Introduction: Sleep is important for learning, memory and underlying neural plasticity. Studies support that children utilize a dual memory system when acquiring and integrating new vocabulary, and sleep (especially sleep spindles, slow waves sleep and REM sleep) is important for this process. We aimed to describe sleep characteristics in children with diagnosis of specific language impairment because sleep disruption, especially of the microstructure, could have an important role in the development and evolution in these patients.

Materials and methods: Descriptive analysis was performed in children with specific language impairment (from January 2011 to June 2016). The inclusion criteria were diagnosis of specific language impairment with development quotient > 70 in Brunet-Lezine Scale, normal cranial MRI, without epileptiform discharges in EEG, no hearing impairment, no other disorders and with parents in medium-high sociocultural level. Children participated in a polysomnographic (PSG) sleep recording. Sleep disorders like Obstructive Sleep Apnea Pediatric (OSAP), Periodic Limb Movement during Sleep (PLMS) and parasomnias, and sleep characteristics like sleep stages percentage, spindles characteristics, presence of significant alpha rhythm during sleep (alpha-delta sleep), microarousal index, sleep efficiency and awakenings episodes were analyzed.

Results: 30 children (24 boys and 6 girls) with 3-5 years old. We found OSAP only in one patient, and parasomnias in 2 patients. However, it was relevant data about PLMS, because 83.3% present a significant number of them with an average index of 8.01 (6.81±9.28). We found an average of 4.073%±3.41 of stage 1, 40.76±8.89 of stage 2, 25.38±5.91 of stage 3, 25.58±6.91 of stage REM, 89.24±41.93 of body movements, 3.39±1.81 awakening episodes ≥5 min, 82.47±15.62 of sleep efficiency (66.66% presented sleep efficiency < 90%), 39.31±11.53 of microarousal index, 66.7% present significant percentage of alpha rhythm during sleep and 66.7% presented unsuitable spindles.

Conclusions: We observed that although the sleep architecture in terms of the macrostructure, like time spent in the different stage of sleep, appears to be not consistently altered, it is very important the analysis of the microstructure because specific features would be altered in these patients and could be in relation with the problem of language skills. Specific treatment for specific sleep disorder like PLMD and treatment to stabilize sleep structure, could improve the symptomatology in these patients.
Introduction: A few studies indicate that reported sleepiness is lower in older individuals, while reported sleep is shorter and poorer. This paradoxical association needs to be studied with a longitudinal approach. The purpose of the present study was to investigate the intra-individual change in reported sleepiness in relation to objectively recorded sleep.

Materials and methods: The present study used a community-based cohort of 400 women recorded twice with 10 years in between. Sleepiness was rated, and polysomnography (PSG) recorded, twice with 10 years in between. Of the 400 women 127 did not participate in the second recording for reasons of health, having died, having moved, or similar reasons and therefore 273 women remained.

Results: Sleepiness Epworth Sleepiness Scale (ESS) was significantly reduced (9.1±.3 to 7.9±.4, p< .001), as was a one-item score (1-5) for sleepiness (2.7±.1 to 2.4±.1, p< .001) and fatigue (1-5) (2.5±.1 to 2.1±.1, p< .001). Also difficulties concentrating (1-5) was reduced (2.2±.1 to 2.0±.1, p.001). A stepwise multiple regression analysis showed that the change in ESS, sleepiness, or fatigue were not related to change in any PSG data (TST, sleep latency, N3 latency, REM latency, awakenings, or percent of sleep stages). However, the change in difficulties concentrating was predicted by the change in R%, r=-.12 (p< .05), such that increased R% was associated with reduced inability to concentrate.

Conclusions: The results suggest that sleepiness, fatigue and inability to concentrate decrease with 10 years of aging. A link with change in PSG parameters was found only for REM sleep such that decreased REM% was associated with increased inability to concentrate.

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THE POSSIBLE ROLES OF AUTONOMIC DYSREGULATION AND SLEEP PROBLEMS IN THE PATHOGENESIS OF AN ALZHEIMER´S DISEASE MOUSE MODEL

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Introduction: Alzheimer's disease (AD), one of the most common type of dementia, is associated with beta-amyloid accumulation. Several studies have highlighted the frequency of sleep disturbances and autonomic dysfunction in AD. However, whether they contribute to disease onset and progression remains to be fully investigated. The aim of this study is to investigate the possible role of autonomic function and sleep patterns at an early stage in the development of AD in a transgenic mouse model with amyloid plaques, the APP/PS1 mouse.

Materials and methods: 17-week-old male APP/PS1 transgenic mice (n=9) and their wild-type littermates (n=7) had electrodes implanted for polysomnographic recording of electroencephalogram (EEG), electromyogram (EMG) and electrocardiogram (ECG) signals. One week later, 12-hour physiological signals during the light cycle were recorded wirelessly in freely moving mice. EEG and EMG signals were analyzed for sleep patterns. Spectral analysis of heart rate variability (HRV) was derived from ECG signals for autonomic function. After finishing physiological recordings, novel object recognition and water maze as behavioral tests were performed to figure out the cognitive function in mice.

Results: Regarding autonomic functioning, APP/PS1 mice had significantly lower overall autonomic activity as evaluated by total power of HRV and high-frequency power of HRV associated with the parasympathetic activity compared with wild-type mice, especially during sleep. Regarding sleep structure, compared with wild-type mice, APP/PS1 mice spent more time in wakefulness during the light period. Moreover, APP/PS1 mice showed significantly lower delta power (an indicator of sleep depth) and higher beta power of EEG signals in quiet sleep than wild-type mice. In behavioral tests, there were no significant differences in working and spatial memory determined respectively by novel object recognition and water maze tests.

Conclusions: We find out that the APP/PS1 mice have had autonomic dysfunction and sleep problems before cognitive impairments, which in turn, may have important implications for preventive and therapeutic interventions in AD patients.

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Aging and Developmental Issues  
Board #002: P5 - Wednesday  

SLEEP AND CORTICAL MATURATION: SLOW AND FAST SLEEP SPINDLES IN THE FIRST 4 YEARS OF LIFE

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Introduction: From birth up to adulthood, important maturational changes in brain morphology and function involve different cortical areas with different timing, mainly following a posterior-anterior trajectory (Shaw et al., 2008). According to the notion that sleep plays a key role in cortical plasticity, regional changes of cortical activity during sleep seem to mirror the evolution of local cortical maturation. Indeed, a postero-anterior shift of SWA activity maxima has been demonstrated from childhood until late adolescence (Kurth et al., 2010). Moreover, we recently showed a similar postero-anterior maturational pattern for the upper alpha activity (~11 Hz) during NREM across the first four years of life (Novelli et al., 2016). We hypothesized that this finding could correspond to the emergence of slow sleep spindles after the first year of life. Accordingly, we re-analysed the pool of data, specifically assessing the maturational trajectory of slow and fast sleep spindles.

Materials and methods: The sleep spindles were automatically detected from the NREM sleep EEG recordings (12 cortical sites) of 39 healthy, full-term, infants and children aged between 0 and 48 months. The participants were divided in 4 groups according to their age (G1: 0-3 mo.; G2: 4-12 mo.; G3: 13-24 mo.; G4: 25-48 mo.). The density of slow sleep spindles (11-13 Hz) and fast spindles (13-15 Hz) for each scalp location was compared between age groups by one-way ANOVAs. A correlation analysis with age was performed, separately for the two type of spindles.

Results: The analysis of fast and slow spindles reveals different maturational trajectories. The density of slow spindles on frontal areas progressively increases across age groups and it is significantly different between >2 years children and the younger ages, while the density of fast spindles peaks at age 4-12 months over centro-frontal sites, with a significant reduction at older ages. Only the density of slow spindles shows extensive significant and positive correlation with age, with a clear posterior-anterior gradient.

Conclusions: The results confirm that the frontal pattern of the upper alpha activity reported in Novelli et al. (2016) mostly corresponds to the slow spindles. Moreover, our analyses point to different age trajectories for fast and slow spindles, with slow spindles progressively increase across age groups, while fast spindles decrease. Therefore, slow spindles follow a genuine maturation process, while this does not seem confirmed for fast spindles. Since it has been hypothesized that slow oscillations and sleep spindles in infants serve to promote the formation of the thalamocortical network (Jenni et al., 2004), we suggest that the fast spindles detected at the age 4-12 months represent an immature antecedent of spindles, when the thalamocortical circuit is still in development. The emergence of frontal slow spindles could represent the first turning point of the thalamocortical network maturation in infancy, as well as the establishment of classical parietal fast spindles in adolescence are thought to represent its fulfillment.

Acknowledgements: This work was supported by a grant of “Sapienza” University of Rome and by a grant from “Ministero della Salute” (Ministry of Health RF-2009-1528677)
Introduction: The sleep pattern is one of the most frequent complaints by the elderly, due to specific physiological changes of the aging process or diseases that can cause disturbances secondary to sleep. The experience of an unsatisfactory or insufficient sleep has reflexes in the performance, behavior and well-being, reflecting in the activities of daily life. Considering the role of sleep in the life of the elderly and the harmful effects of their changes, an inadequate level of sleep directly influences the quality of life. Thus, the objective of this study was to verify and evaluate the presence of sleep disorders in the elderly assisted in Basic Health Units of Divinópolis, Minas Gerais, Brazil.

Materials and methods: This is an observational and cross-sectional study that assessed 140 elderly recruited from a Basic Health Unit in the city of Divinópolis, Minas Gerais, Brazil. Approval was obtained from the institutional Ethics Committee, and all subjects gave their written informed consent. The evaluation consisted of medical history, vital signs and anthropometry data. The Berlin Questionnaire (BQ), the Pittsburgh Sleep Quality Index (PSQI) questionnaire, the Insomnia Severity Index and the Epworth Sleepiness Scale (ESS) also were administered in elderly.

Results: The mean age was 68.3 ± 6.1 years; 77.8% of the patients were female and mean body mass index was 26.8 ± 2.8 kg/m². Regarding PSQI, 15.7% of the elderly had sleep disorders and 52.1% had poor sleep quality. 38.5% of the elderly had a high risk of obstructive sleep apnea (OSA). The mean ESS score was 8.3 ± 5.1 and 39.2% presented excessive daytime sleepiness (EDS) and 79.2% of the elderly had insomnia, with severe insomnia in 14.2%.

Conclusions: In the preliminary results of our study, the elderly assisted in BHU showed poor sleep quality, presence of sleep disorders, a high risk for OSA, presence of excessive daytime sleepiness and insomnia. Results of studies like this are not only applicable in clinical practice, but also in the planning and implementation of public policies.

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SLEEP DISTURBANCES IN ADULTS SUBJECTS WITH DOWN SYNDROME

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Introduction: Few studies have focused on sleep disturbances in adults with DS, despite the high prevalence of sleep disorders and specially obstructive sleep apnea (OSA) in children with Down Syndrome (DS). The objective of the study is to evaluate the nocturnal sleep and the circadian sleep wake pattern in adults with Down syndrome (DS).

Material and methods: Cross-sectional observational study. We included adults with DS and mild-to- moderate disability. Nocturnal sleep was objectively studied by two polysomnography (NPSG) studies separated within 7 days, and by subjective questionnaires: Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS) and Berlin Questionnaire (BQ) to identify sleep apneas (OSA). Circadian rhythm and sleep/wake patterns were investigated with sleep diaries and actigraphy between both NPSG.

Results: We recruited 54 subjects (29 males, mean age 38 years); Subjective questionnaires did not show any sleep disturbances or detect OSA: median PSQI 3.0 (interquartile range [IQR] 4.0); median ESS 7.0 (IQR 6.0) and median BQ 1.0 (IQR 0.0). Sleep diaries also indicated good sleep quality with the highest values of sleep efficiency (median 95.7, IQR 13.4). Conversely, objective PSG measures showed significant decreases, inter alia, in sleep efficiency (median 69.4, IQR 26.4, p< 0.001), reduced REM sleep and importantly evidenced OSA in 78% of the subjects. Actigraphy data showed important unnoticed sleep during the day (median 73.1, IQR 17.4).

Conclusions: Adult subjects with DS suffer from important sleep disruption that is not detected by current subjective sleep measures. These results evidence an urgency to a change in clinical practice. Given the high prevalence of sleep apneas in DS population, and the important associated comorbidity and mortality of OSA, until we develop new validated scales adapted to DS individuals, objective measures should be indicated to screen this population. Treatment of the sleep related disorders might improve cognition and quality of life in this population.

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ASSOCIATION BETWEEN SLEEP SLOW WAVE ACTIVITY AND BRAIN STRUCTURE DURING ADOLESCENCE

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Introduction: Adolescence is a period of development associated with a dramatic reduction in slow wave sleep, a stage of sleep dominated by slow delta (0.3 to < 4Hz) waves. Concurrently, the brain undergoes a wealth of changes, including reductions in gray matter volume (GMV) and cortical thickness (CT) and growth of white matter (complex fiber connections are made, unnecessary pathways are pruned and myelination occurs), throughout adolescence. Here, we investigated whether age-related differences in brain structure, as assessed by GMV, CT, and mean diffusivity (MD) of white matter pathways, accounted for the typically observed age-related differences in slow wave (delta) activity (SWA) in adolescents.

Materials and methods: 132 participants (59 male, 73 female; age range: 12-22 years) from the National Consortium on Alcohol and NeuroDevelopment in Adolescence (NCANDA) study were included in this cross-sectional analysis of baseline polysomnographic, electroencephalographic (EEG) and magnetic resonance imaging (MRI) data, which were collected at SRI International and the University of Pittsburgh. Diffusion Tensor Imaging (DTI), as part of the MRI protocol, was used to derive MD of selective white matter tracts. MD provides a measure of white matter organization and development within a pathway. High MD reflects greater amounts of freely diffusing water molecules and is associated with 'less organized fiber microstructure'. Mediation models, which controlled for site, sex and supratentorial volume, assessed whether age-related differences in brain structure accounted for the typically observed age-related differences in SWA. We hypothesized that the effect of age on SWA would be mediated in part through age-related reductions in all three brain structure measures (CT, GMV and MD).

Results: Older adolescents had less SWA, smaller GMV, thinner CT and lower MD relative to younger adolescents, as shown previously. The direct effect of age on SWA explained 47% of the variance (p< 0.001). In addition, we identified significant indirect effects (p< 0.01) of age on SWA via CT and GMV for several, predominantly frontal, brain regions, with models explaining 50-54% of the variance. Furthermore, the MD of a number of brainstem projection fibers also predicted SWA, after accounting for age, whereby lower MD was associated with less SWA.

Conclusions: We identified that the significant association between older age and less SWA was partially mediated by age-related differences in brain structure. In addition, the degree of diffusivity, which reflects white matter organization, predicts SWA. As diminishing GMV and CT may be indicative of synaptic pruning, these results suggest that diminished SWA in adolescence may largely be driven by synaptic pruning within a number of cortical brain regions combined with the development of numerous fiber tracts connecting the brainstem and cortex. As these maturational processes likely occur to facilitate increasingly complex fiber connections and more efficient brain networks, it is plausible to suggest that lower SWA during adolescence is a consequence of greater brain efficiency and thus may serve as a key marker of brain development.

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K-COMPLEXES AND SLOW WAVE ACTIVITY DURING NREM SLEEP IN PATIENTS WITH ALZHEIMER’S DISEASE

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Introduction: An association between decreased frontal 0.6-1 Hz slow wave activity (SWA) in NREM sleep, impaired hippocampal memory consolidation and β-amyloid deposition has been recently observed in healthy elderly. This result is apparently in contradiction to the evidence of a slowing (i.e., increased slow frequency activity) of electroencephalographic (EEG) activity in Alzheimer’s disease (AD) during wakefulness and -to a certain degree- sleep. The partial overlap between 0.6-1 Hz EEG activity and K-Complex (KC) may explain the apparent contradiction: KCS have a < 1 Hz frequency and frontal predominance; normal aging is characterized by KCs decrease, more pronounced in the frontal cortex, and preliminary observations suggest that AD patients have a further reduction of KCs. We hypothesize that KCs better discriminate AD from healthy elderly than ≤1 Hz SWA.

Materials and methods: 20 AD patients and 20 healthy elderly controls (HC) underwent a polysomnographic recording (19 scalp derivations) of a night of sleep. Spontaneous KCs were visually identified by a blind scorer during stage 2 NREM sleep on the midline derivations (Fz, Cz, Pz), and KC density (KC number/min Stage 2) was assessed. KC density on Fz was the main dependent variable. The topographical distribution of the EEG power values within the 0.6-1 Hz range (≤1 Hz SWA) during NREM sleep was considered. The Mini-Mental State Examination (MMSE) was used to assess cognitive functioning. KC density, ≤1 Hz SWA and MMSE scores were compared between AD and HC, and the relations between these measures were also assessed.

Results: A significant decrease of KC density in AD patients compared with HC was observed in all of the midline derivations, but it was significantly more pronounced on Fz then on Cz and Pz, allowing a correct classification of 80%. The ≤1 Hz SWA was slightly (not significantly) increased in AD patients, except for frontal sites. MMSE scores were significantly higher in HC than AD, and a significant positive correlation has been found between MMSE scores and frontal KC density (but not ≤1 Hz SWA).

Conclusions: AD patients are characterized by a drastic decrease of KCs, while the general tendency of the ≤1 Hz SWA to increase in AD is not observable in the frontal cortex (where the KCs decrease is more pronounced), probably obscured by the KCs reduction. This result suggests that the finding of an association between β-amyloid deposition and frontal slow wave activity in healthy elderly could be hardly replicated in AD patients, due to the dissociation between increased SWA and decreased KC density. Finally, the frontal KC density decrease is associated to the degree of cognitive decline, supporting other findings pointing to an involvement of the frontal areas in the neurodegenerative process. Future studies should assess the possible relation between KCs, grey matter atrophy and β-amyloid deposition in AD, in order to investigate the neural basis and the functional role of the KC density decrease in these patients.

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**Introduction:** Sleep is widely seen as critical to the restoration of functioning, essential to the preparation required for successful confrontation of the challenges we face, and compromised by the worries and stresses of everyday lives. There is also substantial evidence that poor sleep both increases vulnerability to ill-health, and impairs recovery. It follows from this that those facing greater challenge may sleep worse, or need more sleep. Thus the sleep of children with additional needs should differ depending on whether or not they have co-morbid conditions.

**Materials and methods:** These hypotheses were tested in an on-line survey of over 900 families in which some children additional needs (Autism Spectrum, Attention Deficit, Dyslexia, Learning Difficulty, Dyspraxia, etc). Respondents were the principal carer within a family who were in receipt of support from the Family Fund, the UK’s leading charity providing grants for families raising disabled or seriously ill children and young people. Carers reported on the sleep duration, wake after sleep onset and sleep onset latencies of some 2500 children.

**Results:** Co-morbidity was both extensive and complex. In almost half of the whole child sample (48%) had at least two of the thirteen named conditions, while just under 10% had just one condition. Age controlled analyses revealed that the sleep of children with co-morbidities was almost invariably worse: being shorter overall, having slower sleep latencies and longer times awake after sleep onset than children without additional needs. Without co-morbidity, the sleep of children with and without is more similar, depending on the particular additional needs of the child.

**Conclusion:** Having additional needs poses particular problems for both the child’s sleep, and that of their adult carer. This shows that sleep within families is pressured by the particular challenges a family faces, and sleep challenges increase with degrees of comorbidity. The implications for possible interventions are discussed.

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ANIMAL MODEL FOR STUDYING SLEEP DURING PREGNANCY-POSTPARTUM CONTINUUM

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Introduction: Sleep disruptions during pregnancy and post-partum lactation period is an emerging health concern. To develop an animal model for studies on peri-partum sleep disorders, sleep patterns in female rats during pregnancy, post-partum and after weaning, were assessed and associated adaptive changes in their anxiety were examined.

Materials and methods: Sleep-wakefulness (S-W) was measured objectively taking electroencephalogram (EEG) and electromyogram (EMG). These electrodes were surgically implanted under anaesthesia in nulliparous female Wistar rats maintained in standard laboratory conditions with food and water given ad libitum. After postsurgical recovery, three control recordings of S-W were taken for 24 h before the animals were kept for mating. After confirmation of pregnancy, S-W recordings were acquired during different days of pregnancy, post-partum lactation/nursing days, and also after weaning. Their anxiety levels were tested in the elevated plus maze.

Results: The results showed an increase in sleep during pregnancy, primarily due to an increase in light non-REM sleep (S1) during dark period. After parturition, there was a decrease in sleep, especially during daytime, with an increased number of short duration S1 episodes. It resulted in increased time in waking with fragmentation of sleep and an increase in non-REM sleep delta power. Increased anxiety was observed during third trimester of pregnancy and gradual reversal of it after parturition.

Conclusions: This study provided the first longitudinal comprehensive assessment of S-W during pregnancy, post-partum and after weaning in an animal model, along with concomitant recording of anxiety levels. The new findings include post-partum decrease in daytime sleep, with short duration S1 episodes. It not only resulted in increased time in waking, but also in fragmentation of sleep. Sleep homeostatic drive during post-partum period amidst fragmented sleep is evident from the increase in the delta power which is one of the key finding in this study. Observed increase in sleep during pregnancy in rats also clarifies some of the earlier reports. Simultaneous behavioural recording, which showed increased anxiety during the third trimester of pregnancy and its gradual reversal after parturition, are interesting observations of this study. The study provides an animal model for drug trials and studies on sleep disorders during peri-partum window.

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SLEEP DURATION AND QUALITY ARE ASSOCIATED WITH PERFORMANCE ON A COGNITIVELY TAXING GAIT TASK

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Introduction: Longer completion times on gait tasks—i.e., poorer task performance—is associated with risk for falls. While there is some evidence that sleep apnea is associated with worse performance on gait tasks, the association of sleep duration and quality—independent of sleep apnea—with gait task performance is not well understood. Using subjective and objective measures of sleep duration and quality, we examined cross-sectional associations of sleep quantity and quality with gait function in a subset Wisconsin Sleep Cohort study participants—a randomly selected cohort of middle-aged employed adults followed (regardless of continuing employment status) from 1988 to present.

Materials and methods: 631 subjects (45% female; mean [range] age=65[45-82] years) participated in a protocol to assess gait, including:
1) the Timed Up & Go (TUG) task; and
2) the Timed Up & Go while counting backward by threes and stepping over obstacles (TUG+). Subjects also underwent overnight polysomnography and completed questionnaires regarding usual sleep habits, including napping. Polysomnographically-assessed variables examined for this analysis were sleep efficiency (SEff), percent of sleep in stage N3 (%N3) and REM sleep (%REM). Self-reported usual short sleep duration was defined as < 6 hours of sleep per day and long sleep duration was defined as >=9 hours per day; these were referenced to 7-8 hours sleep duration). Multiple linear regression assessed associations of sleep variables with three gait outcome variables:
1) the TUG (seconds, longer is worse);
2) the TUG+ (seconds, longer is worse); and,
3) the difference between the TUG+ and the TUG (deltaTUG in seconds, a measure of the “cognitive cost” of obstacle avoidance and counting backwards on the TUG; longer is worse).

Models adjusted for age, gender, body mass index, alcohol and caffeine consumption, smoking, cardiovascular disease, diabetes, and the apnea-hypopnea index.

Results: Five sleep predictor variables (short and long sleep duration, SEff, %N3, %REM) were examined for associations with 3 gait outcomes (TUG, TUG+, deltaTUG) - a total of 15 tested associations. With a 2-tailed significance threshold=0.05, under the null hypothesis of no association, ~1 association would be expected to be significant by chance alone. Adjusting for confounders, significant associations (p< 0.05) in “expected directions” found in 5 of the 15 models: poorer TUG performance was associated with lower %REM; worse TUG+ performance was associated with short sleep duration and lower %REM; and higher deltaTUG was associated with short sleep duration and poorer sleep efficiency. Additionally, taking longer naps was associated with longer completion times for the TUG, the TUG+ and deltaTUG (all p< 0.05).

Conclusions: Sleep duration and quality are associated with performance on gait tasks. The difference between the “baseline” TUG completion time and the TUG+, which adds two simultaneous cognitively taxing tasks, was associated with short sleep duration and poorer sleep efficiency, suggesting that sleep deficits may affect cognitive functioning in a way that contributes to poorer physical functioning—and, perhaps, a higher risk for falls and fall injuries in older adulthood.

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Introduction: Prospective memory (PM) refers to the ability to plan and execute future intentions. There is substantial evidence to suggest that PM may be affected by sleep quality. Firstly, PM relies heavily on other cognitive domains affected by sleep i.e., executive function and retrospective memory. Secondly, poor sleep is commonly associated with depressive symptoms which, in turn, are associated with poorer PM. Moreover, disturbed sleep often results in unstable levels of daytime arousal, which can compromise attentional abilities essential for successful PM execution. It therefore seems likely that disturbed sleep may also result in poorer PM, but few studies have explored this hypothesis. An association between disturbed sleep and poorer PM is likely to be especially relevant for older adults, who often have health-related PM demands such as remembering to take medication. Ageing has been associated with greater sleep disturbances as well as overall reductions in slow wave sleep (SWS) and, less consistently, rapid eye movement (REM) sleep. The aim of this study was to investigate if objective measures of sleep quality, including wake after sleep onset (WASO) and time spent in SWS and REM sleep, were related to both time-based and event-based PM performance in healthy older adults. This study also aimed to investigate if PM is affected as a direct result of disrupted sleep, or, if there is an indirect effect via other consequences of poor sleep i.e. impaired executive function, retrospective memory, attention or depressive symptoms.

Materials and methods: Community-dwelling older adults, N=112, aged 55-92 years participated in the study. Sleep was measured by electroencephalogram using ZEO: a wireless system worn as a headband overnight (Shambroom, Fabregas, & Johnstone, 2012). The ZEO stages wake, REM, SWS and light sleep, and provides an estimate of WASO. Participants wore devices at home (3-10, M=5.94 nights) before completing lab-based cognitive assessment. They also completed the PHQ-9 to assess current depressive symptoms. Multiple mediation models, controlling for age and years of education, were used to test for direct and indirect relationships between PM and sleep variables.

Results: Each of the sleep variables predicted depressive symptoms, which in turn predicted poorer time-based, but not event-based, PM performance. WASO: bootstrapped indirect path = -.0012, 95%CI = -.0029 to -.0003 explaining 33.1% of variance in time-based PM accuracy, \( F(7,104) = 7.34, p < .001 \). SWS: bootstrapped indirect path = .0019, 95%CI = .0004 to .0043, explaining 33.4% of variance in time-based PM accuracy, \( F(7,104) = 7.44, p < .001 \). REM: bootstrapped indirect path = .0007, 95%CI =.0000 to.0017, explaining 33.3% of variance in time-based PM accuracy, \( F(7,104) = 7.40, p < .001 \). No other direct or indirect relationships between sleep and PM were observed.

Conclusions: This study adds to the growing evidence suggesting a link between sleep and PM, and contributes to existing knowledge of the role of sleep in mood and cognition. These results may also inform possible opportunities for intervention, indicating the benefits of treating not only sleep problems but also depression, to improve PM in older adults.

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**PREVALENCE OF SLEEP PROBLEMS IN KOREAN ADOLESCENTS**

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**Introduction:** Adolescence is a transitional stage of physical and psychological human development. The aim of this study is to determine prevalence of sleep problems in Korean adolescents.

**Materials and methods:** This study represents a part of a nation-wide project on sleep status and its effect on daily life in adolescents of Korea. Korean students typically, as they graduate 6-year course of elementary, get into middle school at age of 13 to 14. Middle school and high school consist of grades 7-9 and 10-12 respectively. As percentage of school attendance is 97.6% for middle school and 92.4% for high school as of 2010, this project surveyed students in middle and high schools. Based on the school registry of the Ministry of Education, Science, and Technology, 150 schools including 75 middle schools and 75 high schools are randomly selected. The random selection is designed to represent all kinds and their proportions of schools (eg, day school, boarding school, academic school, vocational school, specialized school, etc), administrative districts, and geographical areas (metropolitan, urban, and rural areas). From the selected schools, two classes in each grade were then randomly selected. All of the students in the selected classes were recruited as potential participants. Self-administered questionnaires were used to collect data of various aspects of sleep and daytime activities. Global Sleep Assessment Questionnaire (GSAQ) was used to evaluate participants’ sleep problems.

**Results:** Of ~30,000 students who were expected to participate, 26,395 students finished the online survey. Excluding poorly reliable responses from 1,885 students, a total of 24,540 students were included in the analysis. Mean sleep time was 399.8 ± 80.4 min during weekdays and 550.5 ± 121.2 min during weekends which showed significant difference (\(p < 0.001\)). Subjective sleep time requirement was 517.3 ± 106.5 min which was significantly longer compared to their sleep time even during weekends (\(p < 0.001\)). 11,020 (44.9%) out of 24,540 students had some kind of sleep problems. Problems suggesting insomnia disorder was most prevalent (28.4%). 16.2% had excessive daytime sleepiness. All sleep problems except sleep-disordered breathing were more prevalent in girls. All sleep problems except restless legs syndrome and parasomnia were more prevalent with higher grade. Sleep problems were more related to grades rather than age.

**Conclusions:** Considerable number of Korean adolescents has some kind of sleep problem. Prevalence of sleep problems were significantly related to the school grade. Possible effects to the sleep problems should be considered in academic affairs.
**Introduction:** Sleep quality and patterns gradually change over a lifetime. And it is well known that the prevalence of primary sleep disorders increases with advancing age. Therefore, it is quite challenging to distinguish between "normal" aging versus a separate sleep disorder or pathology. Moreover, gender should be considered with respect to different aging process between men and women. In this study, we investigated the gender differences in subjective and objective sleep parameters in Korean population.

**Materials and methods:** Participants of the present study were part of a larger study, the Korean Genome and Epidemiology Study (KoGES), which is an ongoing, population-based cohort investigation, started in 2001. We analyzed 2,267 subjects (mean 51.94±6.94 years old, range 43-73, 48.6% female) who completed two-time-point sleep behavior questionnaires in 2005-2006 and in follow up visit (mean follow up duration 6.82±1.05 year). We also assessed their sleep objectively by ambulatory polysomnography (PSG) at the follow-up. We excluded 96 subjects who scored less than 73 on the Korean version of Modified Mini-Mental State (K3MS) examination, in addition to 106 subjects with medical history of psychiatric disorder, cerebrovascular disorder, head trauma, brain surgery or dementia at study enroll and during follow-up from the original 2447 participants.

**Results:** Women reported significantly shorter mean time in bed in addition to longer sleep latency both at the baseline and follow-up (p< 0.001). And the longitudinal changes of both parameters were statistically significant only in women (-0.19±1.29 hours, p< 0.001 and -2.80±24.11 min, p< 0.001, respectively). However, the total sleep time measured by PSG at follow up did not exhibit significant gender difference (p=0.495), while the longer sleep latency in women was confirmed objectively (p< 0.001). We assessed each individual's chronotype by MSFsc (Mid-Sleep on Free days Corrected for the Sleep deficits during weekdays, mean 03:01±01:59 AM), which was significantly advanced in women (p=0.016, △12 min) at the baseline. The difference become insignificant at the follow-up (p=0.258), because the statistically significant longitudinal advance of MSFsc was only observed in men (-0.16±2.52, p=0.001 vs. 0.02±2.55, p=0.667). The other sleep questionnaires including Epworth Sleepiness Scale (ESS), subjective sleep satisfaction, and insomnia, showed statistically significant (p< 0.05) more complaints in women. However, PSG report exhibited relative poor sleep quality in male gender; increased Apnea-Hypopnia Index (AHI, p< 0.001, △3.55/hr), increased snoring rate (p< 0.001, △5.28%), increased Wake time After Sleep Onset (WASO, p=0.014, △3.86%), increased arousal index (p< 0.001, △1.46/hr), and decreased sleep efficiency (p< 0.001, △3.21%).

**Conclusions:** Our large group of non-demented elderly manifested significant gender difference on a range of both subjectively and objectively measured sleep parameters. Women consistently have more sleep-related complaints than men, which is not always consistent with objective PSG measures except sleep onset latency. To investigate the reciprocal link between sleep disturbances along with aging, different reference should be considered between genders.

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BELIEFS ABOUT SLEEP AND FAMILY COHESION AS FACTORS OF SUBJECTIVE SLEEP QUALITY IN RUSSIAN FEMALE ADOLESCENTS

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Introduction: An extensive research of psychological factors of insomnia in adults demonstrated an important role of anxiety, depression, dysfunctional beliefs and thoughts in illness perpetuation (Morin, 2010, Harvey, Tang, 2012, Spiegelhalder et al., 2008 etc.). Less is known about the cognitive factors of sleep in children and adolescents where family, developmental as well as pubertal factors may play crucial role (El-Sheikh, Kelly, 2011, Erath, Tu, 2011). This lack of studies is specifically prominent in different cultures (Owens, 2004). In Russia sleep-related dysfunctional beliefs and behavior are wide-spread both in general population and patients with insomnia (Rasskazova, Tkhostov, 2012). However, their role in adolescence remains unclear. The aim of the study is to reveal the specific role of beliefs about sleep in sleep quality of Russian female adolescents after adjusting for family cohesion, depression and anxiety.

Materials and methods: 59 Russian female adolescents 14 to 16 years were interviewed about their typical sleep schedule (time to fall asleep and awake, sleep latency, number and length of awakes) and filled Insomnia Severity Index (ISI, Morin, 1993), Hospital Anxiety and Depression Scale (HADS, Zigmond, Snaith, 1983), Dysfunctional Beliefs About Sleep Scale (DBAS, Morin, 1993) and the Family Adaptability and Cohesion Scale (FACES-IV, Olson, 2011).

Results: Cronbach's alpha for ISI and DBAS were acceptable (.70 and .76, respectively) but lower than in Russian adults. Factor analysis supported 1-factor structure for both scales. Subjective sleep disturbances negatively correlated with family flexibility and cohesion (r=-.31 - -.29, p< .05) and positively - with disengaged and rigid family structure, depression, anxiety and dysfunctional beliefs about sleep (r=.28-.59, p< .05). After adjusting for family adaptability and cohesion anxiety (but not depression) was a significant predictor of poorer sleep quality (R-square change 22.8%, beta=.45, p< .01). Dysfunctional beliefs about sleep had an independent effect on sleep quality predicting further 5.5% of variance (beta=.26, p< .05). Chaotic family structure was the only predictor of subjective sleep latency (beta=.34, p< .05) while the anxiety was the only predictor of the number of awakes at night (beta=.35, p< .05). The length of night awakes was related to poorer family cohesion (beta=.74, p< .01) and after adjusting for family factors - to anxiety (beta=.42, p< .05) but not to dysfunctional beliefs.

Conclusions: In line with previous findings (Erath, Tu, 2011), subjective sleep in adolescents is related to family context and emotional factors. In healthy female adolescents anxiety seem to be stronger predictor of poorer sleep than depression. Dysfunctional beliefs remain an important factor of sleep-related complaints demanding psychological intervention even after family and emotional factors are taken into account. Concrete parameters of sleep (sleep latency and night awakes) seem to depend more on family cohesion and anxiety than on cognitive factors. Russian versions of ISI and DBAS could be used in research in adolescents.

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VALIDATION OF RUSSIAN VERSION OF THE CHILDREN’S SLEEP HABITS QUESTIONNAIRE (CSHQ)

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Introduction: Given the prevalence of sleep problems in young children (Byars et al., 2012) and their negative consequences on the development and psychological adjustment having access to appropriate diagnosis and treatment is crucial. However, in many countries including Russia sleep disorders remains underdiagnosed (Owens et al., 2004) partially due to lack of assessment instruments. The aim of this study was to validate Russian version of the Children’s Sleep Habits Questionnaire (CSHQ) (Owens et al., 2000).

Materials and methods: 125 children, ages 5-13 years old (54 females, mean age 8.34±2.38 years) and their parents participated in the study. Children were interviewed about their sleep quality using Sleep Self-Report (SSR; Owens et al., 2000) while their parents (114 females, age 26-56) completed CSHQ and checklists measuring their child’s sleep vulnerability (12 reasons for their child’s disturbances: “To what degree the sleep of your child is disturbed by... stress, strong emotions etc. ”) and emotional reactivity to the lack of sleep (7 negative emotional reactions: “If slept less than enough my child becomes more... anxious, sad etc.”). Cronbach’s alphas for checklists were .82 and .74.

Results: Russian version of CSHQ demonstrated acceptable to good reliability. Cronbach’s alpha was .78 for the whole questionnaire and varied from .57 for the Night Wakings subscale to .91 for the Sleep Disordered Breathing subscale. Item that measured sleepiness while riding a car (#33) was excluded from the analysis due to inconsistency with the subscale (not as frequent situation for many Russian families as for Americans). As a result, Cronbach’s alpha of the Daytime Sleepiness subscale increased from .65 to .73. Cronbach’s alpha for SSR was .83. Parent-reported bedtime resistance, longer sleep onset, higher sleep anxiety, frequent night awakes, parasomnias and daytime sleepiness correlated with sleep disturbances reported by children (r=.27-.38, p<.01) and further supported validity of CSHQ. Children who didn't like to go to sleep were perceived by parents as having higher bedtime resistance, sleep anxiety and more awakenings during the night. Bedtime resistance, sleep anxiety and night wakings correlated with higher sleep vulnerability and stronger emotional response to insufficient sleep (r=.21-.33, p<.05) while daytime sleepiness and parasomnias correlated with sleep vulnerability (r=.26-.29, p<.05).

Sleep in Russian children was assessed as poorer than in their American counterparts based on most scales, except for parasomnias and sleep disordered breathing (p<.05, eta=.25-.76 with the highest difference in daytime sleepiness). Older children had less sleep problems related to bedtime resistance, sleep anxiety, night wakings, disordered breathing and parasomnias (r=-.32 - -.21, p<.05). No gender differences were found.

Conclusions: Results support the reliability and validity of Russian version of the CSHQ and demonstrate the importance of studying sleep in Russian children due to high prevalence of sleep problems. Further research is needed to explore sleep problems across the various clinical settings, and to evaluate CSHQ's applicability to the assessment and treatment of sleep disorders in Russian population of children and adolescents.

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**Introduction:** Nasopharynx is an important compartment of the upper airway and respiratory system. It is closely associated with the characteristic craniofacial skeletal pattern related to sleep breathing and has gradual changes as age grows. The present study aimed to investigate the development pattern of the nasopharynx during rapid puberty growth period.

**Materials and methods:** The study recruited children aged 8~11 coming for consultant in Department of Orthodontics, School & Hospital of Stomatology Peking University. 30 children with no obvious skeletal deformities finally left in the study after questionnaires, polysomnography (PSG) to rule out sleep disorders (male: female 1:1). PSG, MRI and cephalometry were performed for 2~3 consecutive years in these children to determine the yearly changes of the nasopharynx. Fifty-one final mixed longitudinal samples were consisted of 23 children completed three consecutive follow-ups, and 5 children completed two consecutive follow-ups. The yearly changes of the nasopharynx and craniofacial structures were measured. ANOVA was used to evaluate the yearly growth of the nasopharynx. Correlated analysis was used to explore the potential influencing factors of craniofacial structures.

**Results:** The growth of the nasopharynx was continuous. The rapid growth period of the nasopharynx located in the age range of 8~10 years old, which the transverse dimension of the nasopharynx developed rapidly, and the rapid development of the sagittal dimension of the nasopharynx was around 12~13 years old. The changes in the cross-sectional area of the nasopharynx (⊿CSA) was positively correlated with the changes in distance between mandible (⊿M), anterior pharyngeal (⊿AD) and distance of hyoid to cervical anterior surface (⊿H-CVP) (R=0.363, 0.363, 0.323, all P< 0.05). The changes in the volume of the nasopharynx (⊿V) was positively correlated with the changes in upper facial height (⊿N-ANS), ⊿M, and ⊿AD (R=0.336, 0.413, 0.478, all P< 0.05). The changes in the sagittal dimension of the nasopharynx (⊿S) was negatively correlated with angulation in supramental and anatomical horizontal line (⊿SNB) (R=−0.322, P=0.045). The changes in the transverse dimension of the nasopharynx (⊿T) was negatively correlated with the changes in adenoid (⊿A) (R=−0.411, P=0.009).

**Conclusions:** The growth and development of the nasopharynx was early and continuous, which could be affected by the development of either maxilla or mandible.

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Introduction: Aging may cause some physiological changes, including loss of taste sensitivity, especially for bitter and salty flavors, as well as modifications in sleep architecture, such as increased sleep latency, awakenings at night, reduction in sleep efficiency and greater daytime sleepiness, which may culminate in changes in the sleep quality. Some studies relate the taste sensitivity to sleep disorders, but the researches are still scarce, and the controversial results. In this sense, the aim of the present study was to evaluate the taste sensitivity, the sleep pattern, and verify if was correlation between them, in the older adults population.

Materials and methods: We selected twenty-four older adults (11 men and 13 women) and they were submitted to sleep evaluation (Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale), as well as taste sensitivity (Sensitivity Test for the salty, sweet, bitter and acid flavors).

Results: The results showed that the Pittsburgh score was 5,87 ± 3,12, the sleep latency was 21,75 ± 20,36 minutes, the efficiency was 94,17 ± 22,65 % and the sleepiness score was 7,41 ± 6,28. In relation to taste sensitivity, there were more number of errors for the detection of the more diluted samples, and lower perception for the salty and sweet flavors. In addition, there was a relationship between the Pittsburgh score and the salty samples (concentrations 2 and 4).

Conclusions: In this context, we can suggest that aging can cause alterations in the taste sensitivity, as well as sleep pattern, in the older adults, and that there may be a correlation between these two factors.

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Introduction: It is known that sleep apnea and erectile dysfunction highly prevalent in patients with cardiovascular diseases. But age-association and low testosterone increases risk of cardiovascular diseases. It is important as sleep apnea and hypogonadism are premorbid pathology and occurs at young men. These conditions are risk factors of cardiovascular disease so approach to preventive care CVD include CPAP - therapy and testosterone replacement therapy.

Purpose: Assessment of the effect combined use of CPAP (Constant Positive Airway Pressure) and replacement testosterone therapy (transdermal form - Androgel) on indicators of polysomnography monitoring (PSG) with nocturnal penile tumescences (NPT) and serum testosterone level before and after 2 month therapy.

Materials and methods: We examined 26 men with SOAS and hypogonadism. Mean age - 46,1±8,4 years, BMI - 35,2±4,6 kg/m2 . The total testosterone level was 8,5±1,2 versus 8,2±0,2 nmol/l. All patients were divided into 2 groups: men with therapy only CPAP (n=14); men with combination therapy -CPAP and Androgel (50 mg 1 time a day) (n=12). Selection and conducting CPAP carried out by automatic apparatus: Prisma 20A (Weinemann, Germany) and iSleep 20i (Breas, Sweden). Duration of therapy in both groups was 2 months.

Results: There were no statistically significant differences in the baseline characteristics of the physical examination, the level of total testosterone, PSG and nocturnal penile patterns in both groups of patients. After combination therapy regimen (CPAP and Androgel) in men found increase of total testosterone levels 18,2±3,4 (9,1±1,2 -only CPAP) , p< 0,05 and improvement in indicators of altered nocturnal penile pattern (Tup, Tmax , Tm/R, Tup/R, the total number of NPT (p< 0,05)) compared with similar parameters in men with only CPAP-therapy. Indicators of the objective status were improved, although there were no changes in PSG characteristics in both groups. We had noted considerable decrease in IMT at combination therapy regimen -29,2±0,3 vs 33,4±1,8-only CPAP.

Conclusions: The results of this study indicate greater efficiency of the combined method of treatment (CPAP + Androgel) in patients with SOAS and hypogonadism. Thus, CPAP - therapy and testosterone replacement therapy as prevention of cardiovascular diseases in Midle-Aged Men with sleep apnea and hypogonadism.
AN ACCELERATED TELOMERE SHORTENING IN MALE PATIENTS WITH INSOMNIA TREATED WITH SLEEP MEDICATION

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**Introduction:** Sleep disturbance has been reported to be in relation to higher occurrence of chronic aging-associated diseases. Insomnia also has been associated with accelerated aging evidenced by accompanying somatic telomere shortening. In this study, we compared telomere length of circulating leukocyte of outpatients administered with sleep medication and those without sleep medication, in order to detect telomere length changes related to insomnia with an extent for which the patients need to take sleeping pill(s).

**Materials and methods:** Study population The profiles of study population are as follows:
Sleep medication (+): 16 men administered with sleep medication (68.3±12.6 y.o)
Used hypnotics here were zolpidem, zopiclone, triazolam, brotizolam, and estazolam.
Sleep medication (-): 20 men with no sleep medication (67.4±12.7y.o)

**Telomere length analysis**
A part of genomic DNA sample extracted from peripheral leukocytes was digested with restriction enzyme Msp I and subjected to Southern blot analysis using telomere DNA probe. The smear results were analyzed by photodensitometry to detect the telomere length and the telomere length distribution. Each smear was divided into 3 ranges (>9.4kb, 9.4-4.4kb, and < 4.4kb), and the density of each range was measured.

**Results:**
The mean telomere length (TRF) and its distribution of 'Sleep medication (+) and (-)' are as follows:
mean TRFs were 6.4±1.0kb and 6.4±1.1kb (p=0.926), the percentages of >9.4kb (%>9.4kb) were 27.8±10.3% and 29.0±11.2% (p=0.743), %< 4.4kb were 14.8±8.7kb and 16.4±8.4% (p=0.574). In the simple linear regression analysis of TRF/age, %>9.4kb/age, and %< 4.4kb/age, the inclination of 'Sleep medication (+) and (-)' are -0.0441 and -0.0158, -0.500 and -0.236, and 0.412 and 0.126, respectively. The R-squared of 'Sleep medication (+) and (-)' of TRF/age, %>9.4kb/age, and %< 4.4kb/age are 0.319 (p=0.023) and 0.034 (p=0.433), 0.374 (p=0.012) and 0.071 (p=0.256), and 0.358 (p=0.014) and 0.035 (p=0.429), respectively. The mean TRF and its distribution were not different between Sleep medication (+) and (-). However, 'Sleep medication (+)' represent a significant negative correlation of telomere length and age, but 'Hypnotic (-)' did no clear correlation.

**Conclusions:** Patients suffering from insomnia treated with sleep medication are suggested to bear an accelerated telomere shortening. Insomnia with a severity requiring the administration of sleep medication may be in an accelerated phase of aging.

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THE CORTICAL NEURAL ACTIVITY OF MICE IS RESILIENT TO AGEING, DESPITE MARKED DISRUPTION IN GLOBAL SLEEP

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Introduction: Ageing has been shown to have marked effects on sleep, including on its daily amount and architecture, as well as specific electroencephalogram (EEG) oscillations. Neither the neurophysiological underpinnings, nor the biological significance of these age-dependent changes in sleep or brain activity are understood.

Materials and methods: We performed continuous chronic recordings of EEG, local field potentials (LFP) and extracellular neuronal multiunit activity (MUA) from deep layers of the primary motor cortex of freely moving mice using a 16 channel microwire array. Mice were divided into three age categories: early adulthood (EA, 4.6±0.3 months), late adulthood (LA, 12.1±0.3 months) and older age (OA, 24.6±0.4 months). Offline spike sorting was performed to identify putative single units (EA: 17.4±2.9, LA: 15.6±1.7 and OA: 16.7±2.5). Analysis was performed on a 24-hour baseline day and a sleep deprivation day consisting of a 6-hour sleep deprivation (SD) starting at light onset followed by 6-hours recovery sleep. OFF-periods were defined as synchronous periods of silence across the entire recorded neuronal population.

Results: Consistent with previous studies, the global architecture of waking and sleep was substantially affected by ageing, with the amount of wakefulness during the 12-h dark period found to be decreased by almost three hours in older animals (EA: 9.1±0.3 hours; LA: 8.0±0.5 hours; OA: 6.3±0.2 hours, Welch F test: F(2,17)=29.9, p< 0.0001). In contrast, the LFP and EEG signals during sleep were similar between age groups, and did not show a decrease in amplitude as is well documented in humans. Furthermore, in all three age groups LFP slow waves were consistently associated with a robust decrease of MUA. After SD, a robust increase in EEG and LFP slow-wave activity (0.5-4 Hz SWA) was present in all three age groups, and no age-dependent differences were observed in the incidence of slow waves and OFF periods, or in the duration of OFF periods, which were similarly increased after SD as compared to baseline (Repeated measures ANOVA Factor 'Age'; inc slow waves: F(2,42) =0.185, p=0.832; inc OFF periods: F(2,42)=0.99, p=0.38; duration OFF periods: F(2,42)=2.776, p=0.074). In all three age groups the incidence of both LFP slow waves and OFF periods increased in the initial 2 minutes of individual NREM sleep episodes, but only the increase in LFP slow wave incidence was larger and more rapid in EA mice. However, in OA mice a larger proportion of neurons increased their spiking activity in the first 2 minutes of NREM sleep, as compared to younger animals.

Conclusions: Our results suggest that healthy ageing in mice does not lead to dramatic changes in cortical neural activity, despite marked global changes in the daily amount and distribution of waking and sleep. We conclude that powerful protective or compensatory mechanisms may exist to maintain cortical function across the life span during healthy senescence.

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RAPID EYE MOVEMENTS IN REM SLEEP FEATURES AS BIOMARKER OF MATURITY IN HEALTHY INFANTS

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Introduction: Age is probably the most important factor determining how humans sleep. In the first weeks of life, sleep organization is different than older ages, and REM sleep (also called active sleep) is the predominant stage in this state. Several hypotheses have been proposed to explain the relationship between neurological maturation in the first days of life and REM sleep (macrostructure and microstructure).

Materials and methods: We have studied 62 healthy infants, 30 term infants (TI), and 32 preterm infants (PTI). A diurnal polysomnography after food intake was performed in all cases, whose validity requires the presence of a complete cycle REM-NREM sleep. Duration of REM sleep and rapid eye movements (REMov), defined by its acute morphology, amplitude greater than 30 µV and an initial deflection lasting less than 500 ms, have been analyzed. We have compared in both groups, TI and PTI, total number of REMov, REMov density (percentage of REM sleep with REMov), REMov index (REMov frequency / min), REMov complexity (isolated or clustered) and maximal amplitude of these movements.

Results: In our study, percentage of REM sleep (59.1 ± 41.7, p = 0.001), REMov density (78.4 ± 41.5, p = 0.000) and REMov index (8.6 ± 5.7, p = 0.032) are lower in PTI compared with term. Other REMov or REM sleep characteristics are similar in both groups.

Conclusions: A decrease in REMov is a biomarker of brain damage and probably it reflexes cognitive dysfunction. In this study we have observed that REM sleep percentage is lower in more immature children with a significant REMov reduction, suggesting a relationship between these parameters and brain maturation in the first days of life.
Introduction: The prevalence of obstructive sleep apnea syndrome (OSA) increases with age. We hypothesized that the desaturation variables in patients below 65 and over 65 would differ.

Materials and methods: We analyzed 1373 records of OSA patients (59.13±7.6 yo, 71% male) obtained during nocturnal polysomnography. Data collected included body-mass index (BMI), comorbidities, neck and abdominal circumference, as well as polysomnographic data: oxygen desaturation index and mean oxygen desaturation.

Results: They were divided into two groups based on age as followed: group 1, < 65 yo (85.6%, 1176pts, 70.7% male) and group 2, ≥ 65 yo (14.4%, 197pts, 68.5% male). When we compared the two groups, we found significant differences regarding BMI (33.6±7.34 vs. 31.63±6.74, p< 0.001), neck circumference (43.74±5.82 vs. 42.99±4.38, p< 0.03), desaturation index (24.33±22.54 vs. 28.28±28.57, p=0,035) and AHI (41.21±28.37 vs. 36.07±21.02, p=0.004). Abdominal circumference (117.06±16.89 vs. 115.57±14.38, p=0.23) or mean desaturation (92.20±7.51 vs. 91.94±7.88, p=0.67) did not differ significantly. Comorbidities such as hypertension (HT), coronary artery disease (CAD) or stroke were increased in elderly patients (65% vs. 80.7% for HT, 17.8% vs. 37% for CAD and 2.8% vs. 9.6% for stroke).

Conclusions: In the present study, younger patients are more obese and have a severe OSA with a high desaturation index and AHI as compared with older patients, who instead have a higher rate of comorbidities.
Introduction: The prevalence of obstructive sleep apnea (OSA) increases with age. About 20-50% of community dwelling elderly have sleep apnea. Elderly patients with OSA had a higher incidence of healthcare utilization compared to those without OSA. The aim of this study was to investigate polysomnographic and morphological characteristics in elderly OSA patients.

Materials and methods: Fifty four OSA patients aged 40 to 59 years old (middle-aged) and 46 OSA patients aged 65 years old and more (elderly) enrolled in this study. All patients underwent standard polysomnography, and sleep architecture, apnea/hypopnea index on supine and lateral sleep position, and oxygen desaturation were evaluated. The morphological features, tonsil size, modified Mallampati score and the width of fauces, were assessed by the designated otorhinolaryngologist, and graded according to the published guidelines. Nasal resistance was measured with active anterior rhinomanometry in the seated position.

Results: Lowest oxygen saturation was significantly higher and sleep time spent on oxygen saturation < 90% was significantly lower in elderly than in middle-aged. Lateral sleep position significantly improved apnea/hypopnea index in elderly OSA patients, compared with those in supine sleep position. The prevalence of tonsil size grade 3/4 slightly lower in elderly than middle-aged, but there were no significant differences on pharyngeal morphologic features and nasal resistance between two age groups.

Conclusions: Although significant differences on pharyngeal morphological characteristics were not observed, apnea/hypopnea in the lateral sleep position and oxygen desaturation caused by sleep apnea were milder in elderly OSA patients than middle-aged patients.
Introduction: Slow-wave activity (SWA) and slow-wave sleep decline with age. They are further reduced in patients with amnestic Mild Cognitive Impairment (aMCI), a condition associated with high risk for developing Alzheimer's dementia. A decline in SWA may contribute to hippocampal-based memory impairment in patients with aMCI. Therefore, effective interventions to enhance SWA in aMCI may help improve memory. The aim of the present study was to determine if acoustic stimulation could enhance SWA and improve memory performance in individuals with aMCI.

Materials and methods: Five patients with aMCI (mean age 72.5 years, range 62-86, 2 men) completed one night of acoustic stimulation and one night of sham stimulation in a blinded, randomized cross-over study. The stimulation algorithm automatically activated during sleep when slow waves were detected from the midline frontopolar electroencephalogram. An adaptive phase-locked loop (PLL) algorithm locked on to the endogenous slow-waves in real time. Bursts of pink noise (1/f) were delivered when the PLL system predicted the positive up-state of the slow-wave. Tones occurred in blocks of 5 oscillations ("ON interval") followed by a refractory period of 5 oscillations ("OFF interval"). Stimulation continued until an arousal or change in sleep stage was detected. Participants completed a recall task that provided a measure of declarative memory. The test included 44 moderately related word pairs, and was administered before and after sleep, with to-be-recalled words given as feedback after incorrect recall attempts. Power spectral analysis was used to identify change in SWA (0.5 Hz-4 Hz) in ON and OFF intervals of stimulation and sham. Cognitive performance was measured as a change in word recall from evening to morning. Paired t-tests were used to evaluate differences between stimulation and sham conditions.

Results: Preliminary results indicate a mean increase in SWA in the ON period relative to the OFF period during the stimulation night compared to the sham night [21 (6)% v. -0.3 (1.5)%, p=0.02]. SWA during the ON interval of the stimulation night was 9.2% higher compared to the ON interval of the sham night (p=0.01). Overall SWA across the entire night, sleep macrostructure, and number of arousals were not significantly different (p>0.05). Participants recalled more words following acoustic stimulation compared to sham, but the result did not reach statistical significance [2.4 (2.1) v. -1.4 (1.9), p=0.2] and there was large variability among participants.

Conclusions: Acoustic stimulation delivered during sleep may be an effective method to increase SWA in individuals with aMCI. However, additional participants are needed to verify this result and to determine whether acoustic stimulation can enhance memory in aMCI. A larger sample size will help identify potential sources of variability among participants.

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Sleep duration and quality are associated with cognitive performance in midlife and older adulthood

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Introduction: Habitual inadequate sleep duration and poor sleep quality have far-reaching consequences for health and well-being. Cognitive functioning is especially sensitive to inadequate sleep, particularly in older adulthood. Using both subjective and objective measures of sleep duration and quality, we examine cross-sectional and longitudinal associations of sleep and cognitive functioning in the Wisconsin Sleep Cohort Study—a randomly selected cohort of middle-aged employed adults followed to older age (regardless of continuing employment status) from 1988 to present.

Materials and methods: A subset of Wisconsin Sleep Cohort participants (n=1240; 44% female; mean [range] age=55[30-85] years) participated in one or more (up to 5 for a total of 2828 observations) in-laboratory overnight polysomnography and cognitive test battery protocols at 4-year intervals, and provided self-reported usual sleep duration (short sleep duration was defined as < 6 hours of sleep per day, long sleep duration as >=9 hours; reference category was 7-8 hours). Polysomnography assessed sleep efficiency (SEff), percent of sleep in stage N3 (%N3) and REM sleep (%REM). Cognitive function protocols included the Trails B test (seconds, shorter is better), Symbol-Digit Modalities (seconds, shorter is better), Oral Word Fluency (words identified, more is better), Grooved Pegboard (seconds, shorter is better), Digit Cancellation (more digits is better) and the Auditory Verbal Learning Tests (words recalled, more is better). Mixed-effects linear regression modelling estimated associations—weighted averages of longitudinal and cross-sectional "effects"—between sleep predictors and cognitive outcomes, controlling for age, gender, body mass index, education, sleep apnea treatment, and multiple observations per subjects via a robust variance estimator. Other examined covariates including cardiovascular disease, diabetes, smoking, alcohol use and the apnea-hypopnea index were not found to be confounders and were omitted from final models.

Results: Five sleep predictor variables (short and long sleep, SEff, %N3 and %REM) were examined for associations with 6 cognitive outcomes—a total of 30 tested associations. With a 2-tailed significance threshold=0.05 (under the null hypothesis of no association), 1-2 associations would be expected to be significant by chance alone. Significant associations were found in 17 of the 30 models and in "expected" directions (i.e., short and long sleep, lower SEff, lower %N3 and lower %REM were associated with poorer functioning). Significant associations included: Trails B with short and long sleep, SEff and %REM; Symbol-Digit Modalities with long sleep, SEff and %REM; Oral Word Fluency with SEff and %N3 sleep; Grooved Pegboard with short sleep, SEff and %REM; Digit Cancellation with short and long sleep, SEff and %REM; and the Auditory Verbal Learning Test with %N3 sleep.

Conclusions: In a non-clinical sample, objectively- and subjectively-assessed sleep parameters were independently associated with poorer performance on several cognitive tasks assessing memory, learning, executive function, motor function, attention and other domains. Observed effect sizes were comparable to a few-to-several years of aging (or lesser years educational attainment). Future research should examine how sleep throughout midlife contributes to acceleration of cognitive functioning in older age.

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Objectives: Menopausal transition is associated with increased dissatisfaction with sleep, but the effects on sleep architecture are conflicting. This prospective six-year follow-up study was designed to evaluate the changes in sleep stages and sleep continuity that occur in women during menopausal transition.

Methods: Sixty women (mean age 46.0 years, SD 0.9) participated. All women were premenopausal at baseline, and at the six-year follow-up, women were in different stages of menopausal transition. Polysomnography was used to study sleep architecture at baseline and at follow-up. The effects of aging and menopause (assessed as change in serum follicle stimulating hormone, S-FSH) on sleep architecture were evaluated using linear regression models.

Results: After controlling for body mass index, vasomotor and depressive symptoms, aging of six years resulted in shorter total sleep time [TST, B -37.4, 95%CI -71.5-(-3.3)], lower sleep efficiency [SE, B -6.5, 95%CI -12.7-(-0.2)], as well as in increased transitions from slow wave sleep (SWS) to wakefulness (B 1.0, 95%CI 0.1-1.9), wake after sleep onset (B 37.7, 95%CI 12.5-63.0), awakenings per hour (B 1.8, 95%CI 0.8-2.8) and arousal index (B 2.3, 95%CI 0.1-4.4). Higher S-FSH concentration in menopausal transition was associated with increased SWS (B 0.09, 95%CI 0.01-0.16) after controlling for confounding factors.

Conclusions: A significant deterioration of sleep continuity occurs when women age from 46 to 52 years, but change from premenopausal to menopausal state restores some slow wave sleep.
THE EFFICACY OF PREVENTION PROGRAM FOR SLEEP DISTURBANCES IN THREE MONTHS OLD INFANTS

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Introduction: Sleep disturbances in infants are one of the most common parental concerns. There is obvious need for systematic counselling in young families in order to start the prevention of possible sleep disturbances already at the first months of an infant's life. We present here our first results of the sleep disturbance prevention program for parents implemented in child health centres in Tampere, Finland. The efficacy of the program was evaluated when the infants were three months of age.

Materials and methods: The prevention program was carried out as a substudy of CHILD-SLEEP birth cohort (1667 mothers, 1498 fathers) in which questionnaire data was collected prenatally and when the infants were 3, 8, 18 and 24 months of age. The sleep prevention program was also started prenatally. Four child health centres were chosen for the program (prevention centres=PC) and four centres without prevention program served as controls (control centres=CC). There were 199 participants in PC and 207 participants in CC at the beginning of the study. The health nurse gave the written prevention material for the families in every health centre visit (prenatally, 1, 3, 5, 6, 12 and 24 months postnatally). The families answered to the short sleep questionnaire and filled the 3-day sleep diary before every visit, and that was done also by the families in CC. In CC, the nurses were advised to give the routine counselling to the families. Chi-square test for categorical and t-test for continuous variables were used as statistical methods.

Results: At the three months of age the data consist of 169 (59% girls) families in PC and 176 (50% girls) families in CC groups. There was significant difference in total daytime sleep between the groups. The infants of the CC slept more during the daytime than the infants of the PC (323min vs. 302 min; p=0.03). The infants of the CC have also trend to have more difficulties to settle to sleep than the infants in the PC (52.4% vs. 47.6%; p=0.072).

Conclusions: The prevention program for sleep difficulties in infants seem to have benefits already during the first months of life which period is usually considered rather resistant to extrinsic means of impact.

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CONCERNS ABOUT YOUR BABY’S SLEEP: MATERNAL COGNITIONS AND INFANT SLEEP AT 3 AND 6 MONTHS OF AGE

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Introduction: Sleep problems in infancy are highly prevalent affecting ~20% of all individuals. Previous studies reported associations between the presence of parent-reported sleep problems and maternal perception of infant sleep (maternal cognitions), but objective analysis of specific features of sleep problems are lacking. Furthermore, little is known about the stability of the association of maternal cognitions and sleep problems across development. We examined whether maternal cognitions predicted infant total sleep duration, sleep duration variability and nocturnal wakeings at 3 and 6 months of age.

Materials and methods: Sleep was monitored for 9 days in healthy, breastfed infants at 3 (n = 60, 38 male, 2.81 ± 0.2 months of age at start of measurement) and 6 months of age (n= 37, 24 male, 5.73 ± 0.25 months of age at the start of measurement). Ankle actigraphy data was analyzed by building upon a published algorithm (Sadeh, 1995). The algorithm applied to the actigraphy data showed good agreement with the sleep diary (86.7 resp. 88.3%). For the analysis only days with minimal agreement of 85% were included (3 mo: M = 7.42 ± 2.19, 6 mo: M = 7.74 ± 2.0). Participants with less than 3 days of usable data were excluded (3 mo: n = 10, 6 mo: n = 2). We quantified 24h sleep duration, day-to-day variability of sleep duration and night wakings.

Maternal cognitions were assessed with the Maternal Cognitions about Infant Sleep Questionnaire (MCISQ) using the scales Limit setting, Anger and Doubt. We used a hierarchical linear regression to predict sleep variables using maternal cognitions as independent variables. We controlled for perceived sleep problems, to examine relationships independent of the previously established associations between maternal cognitions and parent-reported sleep problems.

Results: At 3 months of age day-to-day variability of sleep duration was positively associated with maternal feelings of Anger (β = 0.44, p = 0.019) but negatively with feelings of Doubt (β = -0.42, p = 0.028). Maternal cognitions did not predict 24h sleep duration or night wakings. The association between day-to-day variability of sleep duration and Anger (β = 0.43, p = 0.016) persisted at 6 months of age. Additionally, Doubt negatively predicted 24h sleep duration at 6 months of age (β = -0.47, p = 0.036). Again no associations with night wakings were found.

Conclusions: Contrasting associations of day-to-day variability of sleep duration with maternal Anger and Doubt at 3 months of age may show a shift in attribution of infant sleep behavior. While the relationship between day-to-day variability of sleep duration and maternal feelings of Anger remained stable, associations with maternal feelings of Doubt changed throughout infancy. Translating this research to clinical recommendations which also address parental beliefs may help tailor sleep interventions to children's and parents’ needs.

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AGE-RELATED CHANGES IN SLEEP ARE ASSOCIATED WITH POOR INHIBITORY CONTROL IN OLDER ADULTS WITH SUBJECTIVE MEMORY IMPAIRMENT

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Introduction: Normal ageing is associated with reduced sleep duration and slow wave sleep (SWS), and increased sleep fragmentation. These changes are typically exacerbated in unhealthy ageing (i.e., MCI, dementia). Impaired inhibitory control is an early indicator of cognitive impairment. Within sleep research, inhibition is typically measured using the manual Go-No-Go task. This is despite evidence that the anti-saccade task is more sensitive to the effects of ageing and sleep loss. The anti-saccade task is an ocular-motor assessment requiring an individual to look away from a visual stimulus. This requires the inhibition of a reflexive saccade and the generation of a volitional saccade to the mirror opposite location. Increased error rate (failing to inhibit the reflexive saccade) is indicative of impaired inhibitory control and is evident in normal ageing and cognitive decline. The association between age-related changes in sleep and inhibition remains unclear. Therefore, the aim of this study was to examine inhibitory control in older adults with subjective memory impairment (SMI) using the anti-saccade and manual Go-No-Go tasks. Performance on these tasks was explored in relation to sleep outcomes.

Materials and methods: Twenty-four older adults (60-80 years; AHI < 15) with SMI slept overnight in the sleep laboratory. During an 8-hour sleep opportunity, participants had their sleep recorded with polysomnography. Participants completed the Go-No-Go task after three and a half hours of wakefulness, and the anti-saccade task after six hours. Hit rate and response time for correct hits were calculated for the Go-No-Go task. Saccade latency and error rate were calculated for the anti-saccade task.

Results: Age-related changes in sleep were associated with poorer outcomes on the anti-saccade task. Here, the number of errors (lack of inhibition) was significantly correlated with SWS duration, total sleep time (TST) and sleep efficiency (SE%), such that worse performance was strongly associated with less time spent in SWS, lower sleep duration, and poorer SE%. No sleep outcome was associated with performance on the Go-No-Go task (hit rate or response time for correct hits). Spectral analysis is currently underway.

Conclusions: These findings demonstrate the sensitivity of the anti-saccade task to sleep outcomes, over and above common measures of inhibition such as the Go-No-Go task. The association between age-related changes in sleep and poorer inhibitory control has implications for future interventions to reduce cognitive decline. Interventions aimed at improving sleep, specifically enhancing SWS, may benefit inhibitory control and broader cognitive function in older adults.

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Aging and Developmental Issues
Board #014: P2 - Monday

A PILOT STUDY: A PRIORITY ORIENTED TAILORED SLEEP HYGIENE INTERVENTION REDUCED SLEEP DISTURBANCE AND ABSENTEEISM AMONG CORRESPONDENCE HIGH SCHOOL STUDENTS

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Introduction: Sleep problems bring massive effect on adolescent health and school achievement. Absenteeism and subsequent dropout is a serious problem to schools, students, and public health. In Japan, a government survey on this topic suggested that the major reason of dropout is the existence of sleep and rhythm problems. Correspondence high school is the most common academic career after the dropout from ordinary high school. Therefore, there is a possibility that the students in corresponding high school have higher prevalence of sleep disturbance and sleep related absenteeism in school. We developed the method of the sleep hygiene intervention and investigated whether the intervention to the correspondence high school students reduces the sleep disturbance and the absenteeism.

Materials and methods: From Jun. 2015 to Dec. 2015, a sleep survey and a subsequent intervention were performed in a branch campus (Tokyo, Japan) of a national-wide correspondence high school having approximately 6,000 students totally. Firstly, Sleep disturbance was assessed by Pittsburgh Sleep Questionnaire Survey Form (PSQI) for the students. Of total 82 students of the campus, 81 students gave informed consent and complete the questionnaire. PSQI indicated that 60 students had sleep disturbance (PSQI>5.5), of which 20 students applied and participated in the sleep hygiene intervention program. In the session of the intervention, each student was suggested which lifestyles to improve, depending on the type of the sleep problems he or she had. The lifestyles to be improved were weighted and prioritized based on our survey which was carried out in advance of the intervention and revealed the association between multiple lifestyle factors and sleep problems. Each participant received a report on his or her sleep status and a statement describing which actions should be taken in order to improve the lifestyles he or she decided to do so. After one or two weeks from the intervention, they were reminded of the session by the teachers. PSQI score and school attendance were measured after one or two months from the intervention.

Results: Among all cases, any lifestyle which increase the risk of sleep problems such as light exposure in the night especially in electric device use, frequent caffeine intake in the night, and lack of sunlight exposure in the morning was detected. Before the intervention, the sum of attendant days and absent days of the students were 321 days and 539 days. After the intervention, the figures improved to 221 days and 224 days. ($\chi^2=17.88; p<0.01$) As for sleep disturbance, PSQI score was significantly improved from 9.9±2.9 to 6.9±3.3 (Paired T-Test: $p<0.01$).

Conclusions: We employed a sleep hygiene intervention, which prioritized and was tailored for each student. Our analysis demonstrated that the method might reduce sleep disturbance and absenteeism among correspondence course high school students. This study is merely a pilot study, and then sufficiently large sample and multi-center study are needed.
INTRODUCTION: In this study, we investigated long-term changes in upper airway morphology to test the hypothesis that the upper airway can be non-surgically remodeled over time in adult patients diagnosed with obstructive sleep apnea (OSA).

MATERIALS AND METHODS: After obtaining informed consent, we undertook a 3D cone-beam (CBCT) scan of a 56-year-old male patient, who had been diagnosed with OSA by a sleep specialist prior to treatment. The patient was treated using a FDA-cleared, biomimetic oral device (DNA appliance®), which provided midfacial redevelopment in combination with mandibular repositioning. The patient wore the device for about 12-16hrs per day, and the overall treatment time was 18 months approx. During this time, the device was adjusted every 4-6 weeks to maintain its efficacy. Volumetric 3D reconstruction of the upper airway from the CBCT scan was undertaken prior to treatment, and the patient was monitored with a follow up CBCT scan 5.5yrs later, which was analyzed in the same way. All CBCT scan measurements were taken with no device in the patient's mouth during wakefulness.

RESULTS: The CBCT scan analysis revealed that the minimum distance of the inferior turbinate from the nasal septum increased on the right side from 1.1mm to 2.5mm; and on the left side from 1.4mm to 2mm. Similarly, the surface area of the posterior nasal apertures at the level of the posterior nasal spine in the coronal plane increased from 487.5mm² to 569mm². The minimum transpalatal bone width also increased from 37mm to 41.5mm, while the medio-lateral retropalatal airway width increased from 4.5mm to 29mm; and the minimal antero-posterior retropalatal distance increased from 1.5mm to 11mm in the mid-sagittal plane. Therefore, the minimum cross-sectional retropalatal airway area increased from 67mm² to 477.5mm². In addition, the minimum antero-posterior retroglossal distance increased from 6mm to 17mm in the mid-sagittal plane; the minimum medio-lateral retroglossal width increased from 14.5mm to 26.5mm in the coronal plane, and subsequently the minimum retroglossal area in the axial plane at the same level as above increased from 83.5mm² to 423.5mm². Overall, the results showed that the upper airway volume increased from 13.9cm³ to 29.2cm³ over a period of 5.5yrs with no device in the patient's mouth when the measurements were taken.

CONCLUSIONS: This biomimetic device and novel protocol has previously been used to treat OSA in the short term. Specifically, the device has been shown to increase midfacial bone volume and nasal airway volume in adult patients. In fact, it appears to have successfully treated OSA in adults since no appliance was in the mouth when the sleep studies were performed. We conclude that biomimetic oral appliance therapy may be able to non-surgically remodel the upper airway in adult patients diagnosed with OSA, and may represent an anti-aging protocol that might maintain upper airway integrity and functionality as a patient undergoes aging. Further studies are required to corroborate the current findings.
EFFECTS OF SLEEP ARCHITECTURE AND SLEEP APNEA ON ALZHEIMER’S DISEASE BIOMARKERS IN COGNITIVELY NORMAL ELDERLY

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Introduction: Increasing evidence suggests sleep can influence the risk for development of Alzheimer disease (AD), but the precise features of sleep architecture influencing this risk and the role of obstructive sleep apnea (OSA) in contributing to this risk remain only partially characterized. Current models of AD suggest that pathological changes, including the accumulation of proteins beta-amyloid (Aβ) and tau, can occur years to even decades before clinical symptoms of memory impairment become evident. In this study, we examined the impact of OSA severity on longitudinal changes in Aβ measured both in cerebrospinal fluid (CSF) and with brain PET imaging with Pittsburgh compound B (PiB). In subsets of individuals without significant OSA, we examined the impact of features of sleep architecture such as slow wave activity (SWA) and spindles on concentrations CSF Aβ and tau at cross-section.

Materials and Methods: 208 cognitively normal elderly subjects (68 +/- 7 years, CDR score = 0) received medical, neurological, and psychiatric evaluations, home polysomnography (PSG) for OSA severity, structural magnetic resonance imaging (MRI) scans, a lumbar puncture (LP) and/or PiB PET scans. A subset of 109 subjects completed a second LP 2.4 +/- 0.9 years after the first LP, and a subset of 34 subjects completed a second brain PiB PET scan 2.5 +/- 0.4 years after the first. A subset of 50 subjects without significant OSA (AHI4% < 15/hour) completed in-laboratory nocturnal PSG for measurements of sleep architecture. SWA was calculated using the average power density in the 0.5-4.0 Hz range at the F4-lead during full night EEG recordings. Spindles were isolated and quantified using DETOKS in which the EEG from the C3-lead was decomposed into oscillatory and non-oscillatory components. Oscillatory components were further scored for sleep spindles using threshold values in the frequency band of 11-16 Hz and time duration of 0.5 to 3 seconds.

Results: OSA increased amyloid burden over the years, as a significant association was found between longitudinal decreases in CSF Aβ42 and increasing OSA severity indices AHI-all (F1,88 = 4.26, p< .05) and AHI4% (F1,87 = 4.36, p< .05). This was corroborated by a trend toward longitudinal increases in brain PiB PET uptake positively associating with increasing OSA severity by AHI-all (F1,28 = 2.96, p=.09). At cross-section, in those subjects without significant OSA, low frontal SWA was significantly associated with high concentrations of CSF Aβ42 and low sleep spindle counts and density were significantly associated with high levels of total and phosphorylated tau in the CSF.

Conclusions: CSF Aβ is likely to increase in concentration over time before decreasing as Aβ is deposited in brain plaques. OSA appears likely to augment this process as increasing OSA severity predicted lower CSF Aβ42 levels simultaneous with a trend toward increasing brain amyloid deposits. In subjects without OSA, low levels of frontal SWA correlate with high CSF Aβ42 levels, making it more likely to aggregate and form plaques before decreasing. Low spindle count correlated with increased tau levels, revealing another feature of sleep physiology that may impact AD risk.
**Introduction:** Sleep health is one of the most important elements for the development of mental and physical characteristics of children such as emotional stability, concentration, and cognitive function. It is also said that children's sleep problems are associated with higher parenting burden/stress, lower quality of life (QOL) of caregivers, and the risk of child abuse. Appropriate sleep-health literacy is not prevalent among Japanese caregivers, and few experts are familiar with pediatric sleep. Therefore, increasing children’s sleep literacy is an urgent and serious social issue in Japan, and an appropriate method is needed that can provide support to caregivers who do not visit specialized institutions or seminars. In recent years, there have been reports of online interventions to improve children’s sleep problems, which have resulted in the improvement of the mental health of caregivers as well as sleep habits of children. However, it is difficult to apply the same intervention method used in western countries to Japanese caregivers, since there are many differences in sleep culture. In Japan, there are a variety of bedroom environments and sleeping styles due to culture-specific lifestyles, housing situations, and so on. In this research, we aim to improve children’s sleep habits and reduce child-care burden through behavioral change in caregivers via a remote intervention method applicable to Japanese culture.

**Materials and methods:** As an intervention method for improving infants’ sleep habits in Japan, a smartphone application for interaction between caregivers and pediatric sleep experts was developed. To check compliance, evaluate the comfort in using, and identify problems, 10 pairs of caregiver-infant (1-2 years old) used the application for a trial period of two months with actigraphy connected to the application. In the application, 1) sleep literacy education was delivered through animation, 2) caregivers inputted the sleep habits of their infants and themselves for eight days of each month, 3) experts analyzed the information entered and sent multiple individual advices, and 4) caregiver selected one advice as the “advice to try.”

**Results:** 10 out of 10 pairs of caregiver-infant (1-2 years old) completed the trial. One case was excluded from the analysis because of a medication that might have affected sleepiness. After the first intervention, the nighttime sleep duration of infants was extended in the weekends. The bath time and nighttime use of media equipment in the weekends were also ahead of schedule. In addition, infants themselves voluntarily came forward to go to their bedrooms earlier in four cases. The caregivers reported the improvement in ease of parenting post intervention.

**Conclusions:** There were no major problems in both the compliance of and comfort in using the application. Overall, the evaluations for the application from caregivers were fairly good, and improvement in sleep habits was seen even in the trial. We are going to expand the use of this application for long-term regional interventions in Japan.

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ARE SLEEP, BULLYING, AND BREAKFAST AND JUNK FOOD CONSUMPTION RELATED TO ANXIETY, SADNESS AND HEALTH IN LATE CHILDHOOD AND ADOLESCENCE?

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Introduction: Late childhood and early adolescence are important developmental times, where behaviour patterns (e.g. in diet and sleep) that are established often continue into adulthood. Also at this time, mood disruption and mental health issues such as sadness and anxiety become more prevalent. Research has demonstrated relationships between sleep, diet, mood and health. However, many of these studies are in small cohorts, and few have measured diet, sleep, health and other psychosocial factors that may also have an impact, such as experiences of bullying. This study assessed the impact of sleep, diet, and bullying on self-reported sadness, anxiety, and health in a large sample of South Australian children and adolescents.

Materials and methods: 29,501 children and adolescents (9 - 17 y; M = 13.24 y, SD = 1.17 y) from South Australian schools completed the Middle Years Development Instrument in 2015, which consists of 74 questions about demographics (age, SES, sex), sleep (bedtime, frequency of obtaining a good night's sleep), diet (frequency of breakfast; junk food consumption), bullying, health, sadness, and anxiety. Those with missing data on core variables were excluded from analysis, leaving a final sample of 27,025 (M = 12.76 y, SD = 1.22 y).

Results: 21.5% of participants reported obtaining a good night's sleep less than three times a week, 15.7% reported a weeknight bedtime of after 11pm, 18.2% reported eating breakfast less than three times per week, 29.6% reported consuming junk food at least five times per week, and 9.6% reported being bullied many times per week. These factors significantly increased the odds of participants reporting high (compared to low) sadness ($p < 0.004$) and fair to poor (compared to excellent) health ($p < 0.001$), while all except breakfast consumption significantly increased the odds of participants reporting high (compared to low) anxiety ($p < 0.001$), controlling for age, sex, and SES.

Conclusions: Late bedtimes, poor sleep quality, regular junk food consumption, infrequent breakfast consumption and bullying were associated with increases in self-reported sadness, anxiety and impaired health in school students. Interventions to promote the importance of bedtime and morning routines, alongside bullying prevention programs in schools may help to lower sadness and anxiety and to improve health in children and adolescents.
OBSTRUCTIVE SLEEP APNEA AND METABOLIC SYNDROME: IS THERE A CORRELATION?

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**Introduction:** Obstructive sleep apnea (OSA) and metabolic syndrome (MS) are common disorders with an escalating prevalence and systemic consequences. OSA is defined as recurrent episodes of complete or partial upper airway closure during sleeping. MS is a cluster of factors including obesity, hyperglycemia, hypertension, dyslipidemic.

**Materials and methods:** The aim of this study was to evaluate the association between OSA and MS. To this end, we performed a retrospective study of patients who underwent sleep study in Constanta Sleep Disorders Center, between 2010-2016. The patient group consisted of 108 adults (79 male and 29 females). All patients underwent polygraphy, blood sampling and measurement of anthropometric variables. OSA was considered present when AHI >15. MS was defined according to the National Heart, Lung, and Blood Institute (NHLBI) and the American Heart Association (AHA) guidelines.

**Results:** Out of a total of 108 patients with OSA, 62 (57.4%) were found to have MS. All of the separate components of metabolic syndrome were common in our patients, but the diagnosis was made based on three (56.4%) or four or all criteria (43.5%). Furthermore, all the anthropometric variables were associated with MS. The prevalence of MS among OSA patients increased with increasing AHI. Obesity was a strong link to both, in particular visceral obesity for MS and enlargement of soft tissue structure within and surrounding the airway for OSA.

**Conclusions:** OSA and MS are significant cardiovascular risk factors that act synergistically. Thus, this positive association between these two pathologies could disclose a role for OSA screening in patients with metabolic abnormalities.
REM-SLEEP DEPRIVATION PREDISPOSES NEUTROPHILIC LUNG INFLAMMATION IN ALLERGIC MICE

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Introduction: Sleep duration exerts an important influence on host immune system homeostasis. Although different studies associated sleep deprivation with systemic inflammatory changes, the effect of sleep duration on the pathology of allergic chronic diseases is poorly understood. Asthma is a complex chronic disease that affects around 235 million people worldwide. Because asthmatic individuals experience disturbed sleep periods due to breathlessness, nighttime coughing, and wheezing, the disease itself impairs sleep quality. In this work, we took advantage of a mouse model to evaluate the influence of sleep deprivation (SD) on allergen-induced pulmonary inflammation.

Materials and methods: Ovalbumin (OVA)-sensitized C57Bl/6, IL-17RA deficient mice (IL-17RA−/−) were exposed to a first set of intranasal OVA challenge under REM sleep deprivation (SD) or healthy sleep (HS) condition followed by a second set of OVA challenge, one week apart. Analysis of cellular profile in the lungs, spleen and lymph nodes (LNs) was performed by flow cytometry. In addition, mice were subjected to corticoid treatment using dexamethasone.

Results: OVA-sensitized SD mice developed a more severe airway inflammation than the HS allergic group. The analysis of lung parenchyma revealed that the inflammation in SD allergic mice was marked by the influx of neutrophils (mainly) and eosinophils and secretion of IL-6, TNF-α, and IL-17, in contrast to the classic eosinophilic inflammation and IL-4 production observed in HS allergic mice. The same cytokine profile was observed in ex vivo culture of cervical lymph nodes cells and splenocytes, indicating that in allergic mice SD polarized the immune responses towards a pro-inflammatory Th17 profile. This idea is supported by the fact that disruption of IL-17 signaling (IL-17RA−/−) prevented airway neutrophilia in SD allergic mice. Furthermore, SD allergic mice became refractory to corticoid treatment, in contrast to HS allergic group.

Conclusions: Collectively, our data show that sleep duration plays an important role in the progression of allergen-induced mild/moderate asthma-like eosinophilic lung inflammation to moderate/severe corticoid refractory neutrophilic manifestation.
Objective: In autism spectrum disorders (ASD) children sleep is major common concerns. The main objective of this study was to measures sleep pattern that differentiated ASD children with and without parental sleep concerns, and correlated with objective measures by actigraphy. Childhood Autism Rating Scale (CARS) score in subject with autism was used to measure the severity of score.

Methods: The Children’s Sleep Habits Questionnaire (CSHQ) and actigraphy-measured data from 18 children (15 males and 3 females; mean age 5.2 years) with ASD were evaluated.

Results: ASD poor sleepers significantly differed from ASD good sleepers on actigraphic (sleep latency, sleep efficiency, fragmentation) were reported severe behaviors based on CARS score.

Conclusion: This work provides the basis for focused studies to understand sleep in ASD population and targeted interventions to improve it but large scale studies are recommended.
CDKL5 DEFICIENCY ENTAILS SLEEP APNEAS IN MICE

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**Introduction:** A recently-discovered neurodevelopmental disorder caused by the mutation of the cyclin-dependent kinase-like 5 gene (CDKL5) entails complex autistic-like behaviors similar to Rett syndrome, but its impact on physiological functions remains largely unexplored. Sleep-disordered breathing is common and potentially life-threatening in patients with Rett syndrome; however, evidence is limited in children with CDKL5 disorder and is altogether lacking in adults. The aim of this study was to test whether sleep-disordered breathing affects adult Cdkl5 knockout (Cdkl5-KO) mice.

**Materials and methods:** Using whole-body plethysmography (WBP), breathing was non-invasively recorded for 8 hours in 10 adult Cdkl5-KO and 10 adult control mice. Applying a recently validated technique (doi: 10.1038/srep41698), the WBP signal was also used to score mouse wake-sleep states.

**Results:** Apneas occurred more frequently in Cdkl5-KO than in WT mice either during non-REM sleep or when considering the whole sleeping period. Interestingly, the major difference between groups was in the occurrence of spontaneous apneas rather than in post-sigh apneas. A Receiver Operating Characteristic (ROC) analysis significantly discriminated Cdkl5-KO from WT mice based on sleep apnea occurrence.

**Conclusions:** These data demonstrate that sleep apneas are a core feature of CDKL5 disorder and a respiratory biomarker of CDKL5 deficiency in mice suggesting that sleep-disordered breathing should be evaluated routinely in CDKL5 patients.

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MYELIN MODIFICATIONS AFTER CHRONIC SLEEP LOSS IN ADOLESCENT MICE

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Introduction: Previous studies found that sleep loss is associated with a decrease in the expression of genes implicated in myelination and can have adverse effects on oligodendrocyte precursors cells. On the other hand, sleep may favor myelination by promoting the expression of genes involved in its formation and maintenance. Albeit limited, these results suggest that sleep loss can have detrimental effects on the formation and maintenance of myelin. Here we tested this hypothesis by evaluating ultrastructural modifications of myelin in mice exposed to different periods of sleep loss.

Materials and methods: We used Electron Microscopy to measure the fiber and axonal diameters of 17894 axons in two different brain regions (the corpus callosum and the lateral olfactory tract) of four groups of male B6.Cg-Tg(Thy1-YFP)16Jrs/J transgenic mice:
1) sleeping (S) mice (n=4) were sacrificed during the light phase after 6-8 h of undisturbed sleep;
2) sleep deprived (SD) mice (n=2) were kept awake for the first 6-8 h of the day using novel objects;
3) chronically sleep restricted (CSR) mice (n=3) were sleep restricted for 4 ½ days using a combination of methods, including exposure to novel objects and gentle handling during the day and forced locomotion on a slowly rotating platform during the night.
4) Recovery sleep (RS) mice (n=3) were allowed to rest undisturbed for ~32 h after CSR. In addition, using confocal microscopy we measured the internodal length (i.e. the distance between two consecutive nodes of Ranvier) in a separate group of S (n=4), SD (n=4), and CSR (n=7) mice.

Results: We find that the g-ratio - the ratio between the diameter of the axon itself to the outer diameter of the myelinated fiber - increases after chronic sleep loss, and this effect is mediated by a reduction in myelin thickness. In addition, we find that the number of myelinated axons in the lateral olfactory tract is reduced in mice allowed to recover for less than 2 days after CSR. Finally, we find that the internodal length is not affected by sleep loss.

Conclusions: Chronic sleep loss can negatively affect myelin.

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ASSESSMENT OF TOLERANCE TO THE EFFECTS OF METHAMPHETAMINE ON DAYTIME ACTIVITY AND ON SLEEP PARAMETERS EVALUATED WITH ACTIGRAPHY IN RHESUS MONKEYS

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Introduction: Methamphetamine is one of the most largely consumed illicit drugs, and its use is associated with abuse liability and several adverse health effects, such as sleep impairment. Importantly, sleep quality can influence addiction treatment outcomes. Evidence suggests that tolerance can develop to the sleep-disrupting effects of stimulant drugs. The aim of the present study was to investigate the development of tolerance to the actigraphy-based sleep-disrupting and stimulant effects of methamphetamine self-administration in adult rhesus macaques (Macaca mulatta; n = 5).

Materials and methods: Methamphetamine (0.03 mg/kg/inf, i.v.) self-administration was carried out following three different protocols: 14 consecutive days of self-administration, 5 days/week for 3 weeks, with a 2-day interval between 5-day blocks of self-administration, and 3 days/week for 3 weeks, with a 4-day interval between 3-day blocks of self-administration. Daytime activity and activity-based sleep measures were evaluated with Actiwatch monitors a week before (baseline parameters) and throughout each protocol.

Results: Methamphetamine self-administration markedly disrupted sleep-like measures and increased daytime activity. Tolerance developed to those effects with repeated methamphetamine intake exceeding five consecutive days. Inclusion of washout periods (2 or 4 days) between blocks of methamphetamine self-administration attenuated the development of tolerance, with longer breaks from methamphetamine intake being more effective in maintaining the sleep-disrupting and stimulant effects of methamphetamine.

Conclusions: Tolerance can develop to the stimulant and sleep-disrupting effects of methamphetamine self-administration in rhesus monkeys. Interruption of drug intake extends the effects of methamphetamine on sleep-like measures and daytime activity.

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**Basic Research**  
**Board #025: P4 - Tuesday**  

**QUANTIFYING PERIPHERAL SYMPATHETIC ACTIVATION DURING SLEEP BY MEANS OF AN AUTOMATIC METHOD FOR PULSE WAVE AMPLITUDE DROP DETECTION**

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**Introduction:** Drops in pulse wave amplitude (PWA) measured by finger photoplethysmography (PPG) are known to reflect peripheral vasoconstriction resulting from sympathetic activation. Quantifying the amount of sympathetic activation during sleep would be useful to investigate the link between sleep disorders, like sleep apnea, and cardio-vascular morbidity-mortality. However, automatic algorithms allowing for a simple and rapid extraction and characterization of PWA parameters are not readily available. Therefore, in the present study we developed and validated a novel automatic approach to detect and characterize PWA-drops in whole-night polysomnographic (PSG) data.

**Materials and methods:** PSG recordings of 9 patients (52±5yrs, 7F) from the HypnoLaus Sleep Cohort were analyzed. The PPG signal was smoothed and detrended before extraction of the PWA signal, defined at each cardiac cycle as the difference between the peak and nadir values of the corresponding PPG-waveform. The time-courses of PWA variance and first-derivative were then evaluated using a moving-window over 5 heartbeats. Candidate time-points for potential PWA-drops were defined as local peaks in the PWA-variance showing correspondent first-derivative negative values. For each PWA-drop candidate, an observation interval was delimited between the closest previous and subsequent PWA maxima, and the maximum percent decrease (amplitude) was computed with respect to the mean of the previous 5 PWA values extracted from stable signal tracts (low local variance and duration >2sec). Then, PWA-drops with amplitude >30% and duration >4 heartbeats were identified, and their amplitude (%), descending slope (%/s) and total duration (s) were estimated. The PWA-drop index was calculated as the number of drops per hour. The algorithm detections were compared with those of an expert scorer who marked PWA-drops with amplitudes >30% (3min scoring window).

**Results:** With respect to the human scorer, the algorithm achieved a sensitivity of 97.4%, a specificity of 89.5%, and a precision of 49.6%. In spite of the apparently low precision, both visual inspection and a direct comparison between false positive (FP) and true positive (TP) detections showed that the algorithm correctly identified above-threshold drops that were missed by the human scorer (minimum amplitude was 32.1±1.5% for FP, and 37.6±3.7% for TP). Only ~31% of all detected PWA-drops were associated with a (visually scored) EEG-arousal, whereas most EEG-arousals (~72%) showed an association with a PWA-drop. Interestingly, among PWA-drops that were not associated with a scored EEG-arousal, 19-55% (depending on sleep stage) were nevertheless accompanied by a strong increase in high-frequency EEG-power, potentially reflecting a cortical activation not visible to the human eye. Finally, the index, amplitude and duration tended to decrease from light (N1) to deep (N3) NREM sleep (p< 0.05, rmANOVA), while REM sleep showed a significantly higher PWA-drop index compared to NREM stages (53.5±19.3d/h vs. 42.1±18.7d/h in N1).

**Conclusions:** The automatic algorithm allowed to reliably detect PWA-drops occurring in all sleep stages, including events not recognized upon standard visual inspection. This automatic algorithm may represent a simple and useful tool to quantify the degree of peripheral sympathetic activation during sleep and may provide relevant information about associated 'cortical activations' during sleep.
Introduction: Parents of children with ASD commonly report that their children resist going to bed at an appropriate time, have difficulties following asleep, have nightmares and wake up at night for long periods of time. Although cultural differences might impact sleep among children due to different school start times, sleep habits, use of social media, general attitudes towards sleep, yet very little research has been carried out. These cultural differences may explain differences in sleep patterns across countries above and beyond variability in sample characteristics or measurement differences. At present, there are no published studies examining sleep patterns of teenagers with typical development and those with ASD in Saudi Arabia. The current study has three aims (1) to compare the night-time sleep parameters of teens with ASD with that of TD in Saudi Arabia, aged 10 to 19, (2) to examine the influence of cultural and environmental factors – use of social media, co-sleeping has on sleep, and (3) to study the influence sleep has on maternal sleep and mental health.

Materials and methods:
Participants: 70 teens with typical development 30 with ASD, aged from 10 to 18 with average age of 14 years. All teens were born and live in Saudi Arabia of the same ethnic background. Medical questionnaire was used.
The School Sleep Habits Survey: (SSHS; Wolfson & Caskadon, 1998) The SSHS is a 63 items questionnaire designed to measure sleep related behaviour and daytime functioning in high school students. Items on the questionnaire combine to give measures of habitual weekday and weekend sleep profiles, sleepiness, sleep/wake problem behaviours, circadian preference (morningness/eveningness; M/E).
Pittsburgh Sleep Quality Index (PSQI): PSQI assesses sleep quality and sleep disturbances over the past month in adults.
Major Depression Inventory (MDI). The MDI measures severity of depression. Total scores equate to clinical symptoms as follows: ‘mild depression’ (20-24), ‘moderate’ (25-29) or ‘severe’ (30+).
The Epworth Sleepiness Scale (ESS; Johns, 1991) is a frequently used short and simple questionnaire which provides a measure of general daytime sleepiness.

Results: In the TD group, an average sleep time during the school days was 7 hours, whereas in the ASD group was 8 hours. Mean sleep latency was 23 min for TD and 30 min for ASD group. Teens in ASD group had more nighttime wakings. Weekend mean sleep time was 9 hours for both groups. Both groups reported no napping during the day. Data from maternal questionnaires was strongly correlated with sleep of their child.

Conclusions: In line with previous research, adolescents in our study report achieving notably less than the recommended 9-10 hours sleep per night. However most interestingly, teens from ASD group reported longer sleep times in comparison to the TD group. Cultural factors such as early school times and religious observations have been directly correlated with sleep are discussed in this study.
FUNCTIONAL CONSEQUENCES OF BRAIN GLYCOGEN DEFICIENCY ON THE SLEEP-WAKE CYCLE REGULATION IN PTG-KO MICE

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Introduction: In the CNS, glycogen is mainly localized in astrocytes where its levels are linked to neuronal activity. Astrocytic glycogen synthesis is regulated by glycogen synthase (GS) activity that is positively controlled by protein targeting to glycogen (PTG) expression levels. Although the role of glycogen in sleep/wake regulation is still poorly understood, we have previously demonstrated that, following a 6 hour gentle sleep deprivation (GSD), PTG mRNA expression and GS activity increased in the brain in mice while glycogen levels were paradoxically maintained and not affected. In order to gain further insight on the role of PTG in this process, we studied the sleep/wake cycle parameters in PTG knockout (PTG-KO) mice under baseline conditions and after a 6 hour GSD. Glycogen levels as well as mRNAs expression of genes related to energy metabolism were also determined in several brain areas.

Materials and methods: Adult male C57BL/6J (WT) and PTG-KO mice were sleep-recorded under baseline conditions (24h recordings, 12 h light/dark cycle) and following 6 hours GSD from ZT00 to ZT06. Vigilance states were visually scored (4s temporal window). Spectral analysis of the EEG signal was performed using a discrete Fourier transformation. Glycogen measurements and gene expression analysis were assessed using a biochemical assay and quantitative RT-PCR respectively, on separate cohorts in WT vs PTG-KO mice at the end of the 6 hours GSD or in control animals (CTL) in different brain structures.

Results: Quantitative analysis of the sleep/wake cycle under baseline conditions did not reveal major differences between the WT and the PTG-KO mice. However, during the dark period, the PTG-KO mice showed a significant increase in the number of wake and slow wave sleep episodes (respectively +26.5±8% and +26.1±8%; p<0.05) together with a significant shortening in their duration (-21.6±7.2% and -14.3±2.8% ; p< 0.01). No such quantitative changes were observed during paradoxical sleep (PS). However, the spectral analysis of PS indicated that there was a significant increase of the spectral power between 7 and 8.5 Hz in PTG-KO compared to WT mice. As expected, SD did not affect brain glycogen content in WT mice even though a 20 to 90% increase in PTG mRNA expression was measured depending on the brain structure analyzed. PTG KO mice displayed an 80% decrease in brain glycogen content compared to WT under control conditions with no further decrease after GSD.

Conclusions: Although, it is unlikely that PTG contributes to the maintenance of glycogen levels during SD, the deletion of its gene resulted in EEG modifications of the theta band during the PS under baseline conditions and the absence of a significant PS rebound after GSD. The results provide the first evidence for a role of PTG in sleep and wakefulness, specifically in the regulation of PS, which warrants further investigation.

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PREVALENCE OF SNORING AND OBSTRUCTIVE SLEEP APNEA AND THEIR RELATIONS WITH DOCTOR DIAGNOSED NCDS OF AN ADULT URBAN POPULATION IN WEST BENGAL, INDIA: AN INTERIM REPORT

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Introduction: Barrackpore Health Study, a longitudinal study conducted general health including snoring and demographic questionnaire survey 2001 and 2011 of randomly selected 3030 households of Barrackpore, West Bengal, India. Both survey results show increased risk of Doctor Diagnosed (DD) NCDs among Snorers (SN) compared to Non-snorers (NSN), presented in the ASRS Congress 2014 India, abstract 86. Hence the study embarked on for objective evidence of prevalence of:
1. OSA and its relationship with snoring history.
2. Associations of each with DD-NCDs.

Materials and methods: In the ongoing cross-sectional study, 432 adults (18-70 yrs.) were assessed between February 2016 - April 2017. The current report considered Hypertension, Diabetes and Body Mass Index (BMI) as DD-NCDs. For OSA symptoms and sleep health Wisconsin sleep questionnaire was used. Apnea Link Plus used to assess OSA. For OSA gradation International classification of Apnea-Hypopnea Index (AHI) is used.

Results: 46.53% male and 53.47% female. OSA 215 (49.77%), 29% with AHI >=15AHI. Snorers 200 (46.30%), OSA with snorers 135 (31.19%), OSA with non-snorers 80 (18.52%), non-snorers with no OSA 152 (35.19%), snorers with no OSA 65 (15.05%).

About 50% of the male and a little less than 50% of the female participants were snorers. 70% male snorer and 65% female snorer had OSA. 33.83% male mild OSA, 36.17% female with mild OSA. Higher proportion of male had moderate (11.94%) and severe OSA (8.46%) than female. Compare to non-snorers with no OSA, non-snorers with OSA [AOR=2.01, 95% CI: 1.11, 3.62, p=0.0217] were associated with DD-Hypertension. Snorers with OSA ware associated with DD-Hypertension [AOR=2.84, 95% CI: 1.71, 4.71, p=< .0001] and DD-Diabetes [AOR=2.33, 95% CI: 1.20, 4.50, p=0.0123] compare to non-snorers with no OSA. Increasing BMI, both overweight and obese group were associated [Overweight: AOR=4.25, 95% CI: 2.45, 7.35, p< .0001; Obese: AOR=6.18, 95% CI 2.75, 13.99; p< .0001] with snorers with OSA.

Conclusions: Around half of the cohort population has either OSA or snoring. Over two-third with OSA are a snorer, about one out of three non-snorers have OSA. little less than one-third with both OSA and snoring. Little over one third neither OSA nor snoring history. Doctor diagnosed - hypertension, diabetes and BMI are analysed as prevalent NCDs. Numbers and or strength of other NCDs were inadequate. Prevalence of three DD-NCDs: highest among OSA with snoring, lowest among non OSA and non-snorer groups. Other groups prevalence is in-between. Overall, individuals with OSA (AHI≥15) have increased prevalence compared with mild OSA (AHI<15) in all the subgroups. The Present results suggest snoring history isn`t a reliable marker of OSA. Beside one-third non-snorer having OSA, one-third of snorers have no OSA. Snorers with no OSA have increased incident NCDs. Take home: Information from randomized a periodic survey of adequate numbers with validated protocol at acceptable intervals is expected to achieve:
1. The trend of OSA and snoring.
2. The trend of the association between baseline characteristics and incident NCDs including may be temporality.

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PSYCHOMETRIC PROPERTIES OF THE PERSIAN VERSION OF SLEEP HYGIENE INDEX IN THE GENERAL POPULATION

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Introduction: Inadequate sleep hygiene may result in difficulties in daily functioning; therefore, reliable scales for measuring sleep hygiene are important. The purpose of this study was to assess the psychometric properties of the Persian version of the Sleep Hygiene Index (SHI).

Materials and methods: From April 2014 to May 2015, 1280 subjects, who were selected by cluster random sampling in Kermanshah province, filled out the SHI, Pittsburgh sleep quality index (PSQI), Epworth sleepiness scale (ESS), and insomnia severity index (ISI). A subset of the participants (20%) repeated the SHI after a four to six-week interval to measure test-retest reliability. Then, we computed the Pearson product-moment correlation coefficients of SHI against PSQI, ESS and ISI, to demonstrate the construct validity of the SHI. The factor structure of the SHI was evaluated by explanatory factor analysis.

Results: The interclass correlation coefficient was 0.89, and SHI was found to have good test-retest reliability ($r = 0.89, P < 0.01$).

The SHI was positively correlated with the total score of the PSQI ($r = 0.60, P < 0.01$), ESS ($r = 0.62, P < 0.01$) and ISI ($r = 0.60, P < 0.01$). Exploratory factor analysis extracted three factors, namely "sleep-wake cycle behaviors" (four items), "bedroom factors" (three items), and "behaviors that affect sleep" (six items).

Conclusions: The Persian version of the SHI can be considered a reliable tool for evaluating sleep hygiene in the general population.

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Basic Research
Board #003: P3 - Tuesday

ZINC IMPROVES SLEEP QUALITY IN HUMAN AND PROMOTES NON-RAPID EYE MOVEMENT SLEEP IN MICE

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Introduction: Zinc is an essential mineral that plays an important role in the body by acting as a cofactor for more than 300 enzymes and 1000 transcription factors. While zinc is naturally present in food, particularly in meat and oyster, inappropriate or insufficient feeding behavior put more than 25% of the world population at risk of zinc deficiency. The purpose of our study was to examine the effect of zinc-rich food on sleep.

Materials and methods: We conducted a randomized, double-blinded, placebo-controlled parallel group trial of 120 healthy human subjects and recorded their night activity by actigraphy for 12 weeks. These subjects were divided into 4 groups: placebo, zinc-rich food, zinc- and astaxanthin-rich food, and placebo supplemented with zinc-enriched yeast and astaxanthin oil. Furthermore, we examined the sleep-promoting activity of zinc by monitoring locomotor activity and electroencephalogram after oral administration to mice.

Results: Compared with the placebo group, the zinc-rich food group efficiently decreased the time necessary to fall asleep and improved sleep efficiency in humans. Additionally, zinc-containing yeast extract dose dependently increased the total amount of non-rapid eye movement sleep in mice. Zinc-containing yeast extract improved sleep onset latency as well as improved the sleep efficiency in healthy individuals. This is the first evidence that zinc can induce sleep. Our data open the way to new types of food supplements designed to improve sleep.

Conclusions: Actigraphic sleep monitoring demonstrated that eating zinc-rich food improved sleep onset latency as well as improved the sleep efficiency in healthy individuals. This is the first evidence that zinc can induce sleep. Our data open the way to new types of food supplements designed to improve sleep.

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Introduction: Sleep influences fundamental behavioral/cognitive processes, included the capability to perceive seconds-to-minutes events (namely interval timing).

We recently started to discover genetic and epigenetic players that modulate both specific sleep physiological processes and time perception in mice. In particular, we present here new evidence that sleep and timing traits are regulated by parent-of-origin effects, a phenomenon that occurs mainly due to epigenetics regulatory mechanisms (e.g., genomic imprinting). We investigated whether parent-of-origin effects over sleep and timing were accompanied by specific neural activity patterns.

Materials and methods: We used progenies of reciprocal crosses of AKR/J and DBA/2J animals. We selected these two particular inbred strains because of their previously described differences in sleep homeostasis. We analyzed the sleep architecture of both cohorts during baseline condition and immediately after a 6h of total sleep deprivation. To investigate differences in cognitive performance we also tested our experimental groups in a behavioral timed task (i.e., the switch task).

We used matrices of sixteen electrodes, wireless EEG electrodes and automated home-cages to study neuronal activity, sleep states and behavioral responses, respectively. We recorded neuronal activity before sleep deprivation (Baseline) and after it (Recovery).

Results: We found both behavioral and electrophysiological differences between the two experimental groups; F1 mice (DBA/2J x AKR/J, the maternal strain always reported first) significantly anticipate their behavioral responses as a result of sleep deprivation compared to F1r mice (AKR/J x DBA/2J). REM sleep was significantly expressed in the two groups of mice. Moreover, neuronal firing during the first hour of recovery was also different across the two cohorts, indicating a different homeostatic rebound. Preliminary results indicate that parent-of-origin effects influence cell-specific responses to sleep homeostasis.

In addition we explored single nucleotide variants across the two parental strains and we have isolated a list of potential genes that can explain the phenotypic differences. Among them, there are specific regulators of REM sleep.

Conclusions: Overall our study shed a new light on the epigenetic mechanisms of sleep and opens new avenues in the link between sleep and behavior.
Introduction: Dim-Light-at-Night (DLAN) exposure is associated with health problems, such as metabolic disruptions, immunological modulations, oxidative stress, sleep problems, and altered circadian timing. Neurophysiological parameters, including sleep patterns, deteriorate in the course of aging in a similar way.

Materials and methods: In this study, we investigated the effect of chronic (3 months) DLAN (12L:12Dim, 50-100:5 lux) exposure on sleep and sleep electroencephalogram (EEG) as well as rest-activity behavior in young (6-month-old, n=7) and aged (18-24-month-old, n=6) C57BL/6J mice and compared with age-matched controls (n=11, n=9 and n=8, respectively). We recorded the EEG and electromyogram continuously for 48-h and conducted a sleep-deprivation (SD) during the first 6-h of the second day.

Results: A general disturbance of the daily distribution of vigilance states was evident in the young mice in which the effect of chronic DLAN exposure was most pronounced. This was characterized by increased Waking and decreased NREM sleep during the light period and decreased Waking and increased NREM and REM sleep in the first part of the Dim period, compared to age-matched controls (t-tests, p<0.05 after significant ANOVAs). These patterns were very similar to those found in aged DLAN mice. Both aged DLAN groups showed a 2-h delayed response to the transition between Light and Dim periods. Additionally, a second free-running rhythm was noted in 4 young DLAN mice (44%), whereas for the old mice this was not the case. In contrast to young control, slow-wave-energy lost during SD was not totally recovered by mice exposed to chronic DLAN and aged control mice.

Conclusions: Our data show a disruption of sleep patterns and a reduced response to SD under DLAN exposure. DLAN altered the sleep architecture in young mice, towards an aging phenotype, whereas it only mildly changed sleep in the older groups.
**Introduction:** Obesity and sleep disturbances comprise major health problems which are likely interrelated.

**Materials and methods:** In this study, we investigated the effect of chronic (12 weeks) high-caloric diet (HCD, 45% fat) consumption on sleep and the sleep electroencephalogram (EEG) in three age groups (6-months old, n=9; 18-months old, n=8) and compared with age-matched controls that were fed on normal chow (n=11 and n=9, respectively). We recorded EEG and the electromyogram for continuous 48-h and performed a 6-h sleep deprivation at the beginning of the second day.

**Results:** Young HCD fed mice showed an altered sleep homeostasis pattern, characterized by increased likelihood of consecutive NREM-REM sleep cycles, increased REM sleep in the light period, and decreased baseline slow-wave activity levels (SWA, EEG power density between 0.5-4.0 Hz) in NREM sleep, compared to the young controls (t-tests, p< 0.05; after significant ANOVAs). 18-months old HCD treated mice showed increased NREM sleep and decreased waking, compared to age-matched controls, denoting an enhanced aging phenotype. In aged HCD fed mice, compared to young HCD fed mice, an aging effect was still evident, characterized by decreased waking in the dark period, increased NREM sleep at the beginning and end of the light period and decreased REM sleep, as well as increased SWA.

**Conclusions:** Our data suggest that the effect of aging is more pronounced compared to the effect of HCD. At young age HCD has a clear impact on sleep and the sleep EEG, but with increasing age, the influence of the diet on sleep architecture decreases.
THE NATURAL DISC1-DELETION PRESENT IN SEVERAL INBRED MOUSE STRAINS DOES NOT AFFECT SLEEP

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Introduction: The gene Disrupted in Schizophrenia-1 (DISC1) is linked to a range of psychiatric disorders. Two recent transgenic studies suggest DISC1 is also involved in homeostatic sleep regulation. Several strains of inbred mice commonly used for genome manipulation experiments, including several Swiss and likely all 129 substrains, carry a natural deletion mutation of Disc1. This constitutes a potential confound for studying sleep in genetically modified mice. Since disturbed sleep can also influence psychiatric and neurodegenerative disease models, this putative confound might affect a wide range of studies in several fields. Therefore, we asked to what extent the natural Disc1 deletion affects sleep.

Materials and methods: To this end, we first compared sleep and electroencephalogram (EEG) phenotypes of 129S4 mice carrying the Disc1 deletion and C57BL/6N mice carrying the full-length version. We then bred Disc1 from C57BL/6N into the 129S4 background, resulting in S4-Disc1 mice.

Results: The differences between 129S4 and C57BL/6N were not detected in the 129S4 to S4-Disc1 comparison.

Conclusions: We conclude that the mutation has no effect on the measured sleep and EEG characteristics. Thus, it is unlikely the widespread Disc1 deletion has led to spurious results in previous sleep studies or that it alters sleep in mouse models of psychiatric or neurodegenerative diseases.

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**BED REST AND HYPOXIC EXPOSURE AFFECT SLEEP ARCHITECTURE AND BREATHING STABILITY**

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**Introduction:** Despite over 50 years of research on the physiological effects of sustained bed rest, data characterizing its effects on sleep macrostructure and breathing stability in humans are scarce. This study was conducted to determine the effects of continuous exposure to hypoxia and sustained best rest, both individually and combined, on nocturnal sleep and breathing stability.

**Materials and methods:** Eleven participants completed three randomized, counter balanced, 21-days trials of:

1. normoxic bed rest (NBR, PIO2 = 133.1 ± 0.3),
2. hypoxic ambulatory confinement (HAMB, PIO2 = 90.0 ± 0.4) and
3. hypoxic bed rest (HBR, PIO2 = 90.0± 0.4; 4,000m equivalent altitude).

Full objective polysomnography was performed at baseline, on Night 1 and Night 21 in each condition.

**Results:** In NBR Night 1, more time was spent in light sleep (10 ± 2%) compared to baseline (8 ± 2%; p = 0.028); Slow-wave sleep (SWS) was reduced from baseline in the hypoxic-only trial by 18% (HAMB Night 21, p = 0.028) and further reduced by 33% (HBR Night 1, p = 0.010), and 36% (HBR Night 21, p = 0.008) when combined with bed rest. The apnea-hypopnea index doubled from Night 1 to Night 21 in HBR (32-62 events·h\(^{-1}\)) and HAMB (31-59 events·h\(^{-1}\); p = 0.002). Those who experienced greatest breathing instability from Night 1 to Night 21 (NBR) were correlated to unchanged or higher (+1%) night SpO2 concentrations (R\(^2\) = 0.471, p = 0.020).

**Conclusions:** Bed rest negatively affects sleep macrostructure, increases the apnea hypopnea index, and worsens breathing stability, each independently exacerbated by continuous exposure to hypoxia.

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OPTOGENETIC MODULATION OF SLEEP SLOW WAVE AFTER FOCAL ISCHEMIC STROKE

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Introduction: Disturbances of sleep-wake cycle and brain state oscillations are frequent after stroke and are associated to negative outcomes. Experimental studies demonstrated that sleep supports the reorganization of neuronal connections and neuroplasticity during stroke recovery. We hypothesize that stroke causes an increase in sleep-like ‘up’ and ‘down’ states in electroencephalogram and local field potential recordings and that this so-called bistability is critical for stroke recovery. To investigate the role of sleep oscillations on brain plasticity following stroke we directly target the neuronal populations in layer V of forelimb somatosensory cortex by combining cell-type specific optogenetic techniques with in vivo electrophysiology.

Materials and methods: We expressed ChR2 (activation), ArchT (inhibition) or mCherry (control) in inhibitory (VGAT) or excitatory (CamKII) deep layer cortical cells of the peri-infarct area to render them light sensitive. Animals were chronically implanted with optical fibers and multiple tetrodes in ipsi and contralateral cortical layer V. Experimental stroke was induced by Middle Cerebral Artery Occlusion (MCAO).

Results: Indeed stroke caused sleep disturbances. 24h after stroke down state rate was reduced during slow-wave-sleep in the peri-infarct area, while rapid-eye-movement sleep duration was increased. To optogenetically investigate the contribution of excitatory versus inhibitory cortical neurons to altered sleep oscillations we confirmed the presence of transfected cells within the layer V, forelimb somatosensory cortex through immunohistochemistry. Amongst all the stimulation protocols tested, optical silencing of pyramidal cells in layer V of the cortex robustly induced both LFP and single unit spike activity similar to a down-state of the neuronal network.

Conclusions: We successfully targeted layer V neuronal cells of the somatosensory cortex in both transgenic and wild type mice and showed that optogenetical induction of down-state is possible and represents the first step in the modulation of sleep-like oscillations. Comparing stimulation before and after stroke will reveal possible altered susceptibility to down state-induction.

Acknowledgements: This project was funded by Swiss National Science Foundation and supported by the University of Bern and the University Hospital Inselspital
Non-rapid eye movement (non-REM) sleep is a natural behavioral state during which various rhythmical electrical activities develop in the brain. Amongst these, sleep spindles are key constituents of the cortical spontaneous activity and are supposedly important for brain plasticity and memory consolidation. Spindles are generally described as 0.5-1 s oscillatory events in the 8-15Hz frequency range, known to originate from the reticular thalamic nucleus (nRt) through CaV3.3-type Ca2+ channel-dependent bursts (Astori et al., 2011). However, spindles display considerable spatiotemporal heterogeneity across cortical areas, raising controversies about their sources, cortical topology and function.

To overcome this limit, through in vitro and in vivo recording in wild-type and CaV3.3-/- KO mice, we explore the palette of regional activities within the sleep-spindle generator (the nRt) and we examine the local variations of spindles in multiple cortical areas.

First, we found that nRT neurons in vitro show heterogeneous bursting properties, i.e. somatosensory (S1) versus limbic cortical areas (medial prefrontal cortex, mPFC), arising, at least in part, from unequal recruitment of CaV3.3 channels.

We then investigated in vivo local variations of spindle features in head-fixed sleeping mice (wild-type and CaV3.3-/- KO mice) via local field potentials (LFP) from high-impedance (~10-12 MOhm) electrodes chronically implanted in the dorsal hippocampus (dCA1) and in somatosensory (S1 and S2), auditory (AC), piriform (Pir), and mPFC cortices. Behavioral states and typical NREMS activities were assessed through conventional polysomnography (EEG-EcoG/EMG). Our major results in vivo show a functional specification in somatosensory areas mediated by the CaV3.3 channels. Indeed, in CaV3.3-/- KO mice (1) relative spindle power decreased specifically in somatosensory areas (S1 and S2), (2) discrepancies between areas in intra-spindle dominant frequency disappeared and finally (3) spindles tended to be more homogeneously distributed across areas. By computing cross-correlations in the spindle band, we explored the functional organization of the 6 recorded areas. We identified a clustering of spindles in functional areas (group frontal Pi-mPFC, versus group parietal S1-S2-A1) that was lost in the CaV3.3-/-KO and replaced by a global synchronization. Finally, we found that specifically for S1 and S2 the temporal coupling of spindles to the active state of the cortical slow oscillation (<1Hz) was perturbed.

Our study shows that molecular and cellular properties of nRt are critical to shape not only the local specificity of cortical spindles but also their coordination with cortical rhythms. These findings will advance the comprehension of how different spindle types emerge in the cortex and could motivate new research on differential capability of learning in different brain areas.
Introduction: Hibernation is an adaptive strategy characterized by metabolic suppression and a decrease in body temperature (Tb). During hibernation, metabolism is suppressed to 1-2% of resting metabolic rate and Tb approaches ambient temperature (2°C). Previous study in the arctic ground squirrel (AGS) reported the role of A1 adenosine receptor (A1AR) in the generation of torpor. Treatment with N6-cyclohexyladenosine (CHA), an A1AR agonist, promotes the onset of hibernation, but AGS show a seasonal difference in sensitivity to CHA. However, what regulates the seasonal control of the agonist response is still unknown. Seasonal differences in sleep-wake pathways may underlie the difference in agonist response. This research tests the hypothesis that sleep-wake pathways are differentially activated in AGS depending on season.

Material and methods: Using cFos as a neuronal indicator for active neurons, we treated AGS with CHA or vehicle in summer and winter. CHA (0.5mg/kg) was administered intraperitoneally and after 3 hours AGS were perfused with 4% paraformaldehyde and brains removed for immunohistochemical analysis. Brains, cryoprotected through a gradient of sucrose from 5% to 30%, were cut using a cryostat into 40µm sections. Free-floating immunohistochemistry was used to localize active nuclei as indicated by cFos-immunoreactivity in the hypothalamus (mouse anti-cFos 1:20,000, Millipore). Blinded analysis of cFos immunoreactivity in hypothalamic nuclei is in progress. Statistical analysis is performed in R.

Results: CHA produced a hibernation-like response in winter, while in summer CHA produced a slight decrease in Tb and metabolic rate. This slight decrease was followed by return to the initial value of Tb and metabolic rate. Blinded analysis is in progress to identify neuronal pathways associated with the different physiological response to CHA in summer and winter AGS.

Conclusion: These results suggest a seasonal activation of neuronal pathways that prevent the hibernation promoting effect of CHA. Work is in progress to optimize double immunohistochemistry of cFos nuclear staining and phenotypic markers in the Perifornical Nucleus, Preoptic area and Paraventricular nucleus.

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ASSOCIATION OF POLYMORPHISM RS2412646 CLOCK GENE WITH SOME SOCIO-PSYCHOLOGICAL FEATURES AND SLEEP DISORDERS IN MALE POPULATION 25-44 YEARS IN RUSSIA / SIBERIA

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Objective: To study the prevalence and association of rs2412646 gene CLOCK with some components of the socio-psychological characteristics and sleep disorders in the male population 25-44 years in Russia / Siberia (Novosibirsk).

Materials and methods: In 2014-2016 GG It surveyed a random representative sample of the male population 25-44 years, one of the districts of Novosibirsk. Randomly selected 200 men had a mean age of 35.5 years, who underwent psychosocial testing. Testing conducted by questionnaire "4-item Jenkins Sleep Questionnaire». Test anxiety and depression conducted modified questionnaires of the Welsh Depression subscale of the MMPI and Bendig Anxiety subscale of the MMPI, the study of the life of exhaustion conducted questionnaires The Maastricht Questionnaire (MQ). Questionnaire "Awareness and attitude towards their health" was also proposed. The men included in the study, studied the frequency distribution of genotypes of rs2412646 CLOCK gene. Differences in the distribution of genotype frequencies CLOCK gene were evaluated by Chi square (X2) test between groups. The values of p ≤ 0,05 were considered statistically significant.

Results: It was found that the most common genotype in the population was the C / C gene CLOCK -50.3%, C / T met at 42.5% and genotype T / T all at 7.2%. Most of the men were of the opinion, that would be addressed to the doctor only when severe pain or discomfort in the heart, but would not return if the pain or discomfort would be poorly expressed, however, 10.7% of men, the carriers of the genotype C / T, I would not go to a doctor, even when a severe pain or unpleasant sensations in the heart. It is also more likely to have continued to work carriers of genotype C / T - 47.4%. Among the carriers C / T genotype often sounded that their sleep is "satisfactory" or "poor." Media C / T genotype, compared with carriers of other genotypes, most agreed with the statement that oppresses them in a bad mood, and they are much less careful and attentive to detail.

Conclusion: Our results indicate a correlation between the presence of social and psychological factors, and sleep disorders, and polymorphic markers rs2412646 CLOCK gene.
SELF-ASSESSMENT OF OBESITY AMONG SLEEP APNOEA PATIENTS

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Introduction: To assess how obese obstructive sleep apnea (OSA) patients evaluate their body weight. How obesity influences their quality of life. What measures they took or are willing to take to decrease their weight. To compare, if there is any difference between those who agree for bariatric surgery and those who disagree.

Materials and methods: 44 OSA patients (male 75%), mean age 56±11 yrs. were questioned. Mean body mass index (BMI) was 41±8 (male 36, women 49). Average apnea-hypopnea index (AHI) was 44.8. A questionnaire targeted the OSA patients’ perception of overweight and obesity was created. We asked how these patients realize their weight, how it influences their quality of life and how do they fight against obesity. We compared if there was any difference between those who agreed for bariatric surgery as weight loss measure and those who disagreed.

Results: All patients admitted that their weight was abnormal (59 % highly increased, 23 % averagely increased, 18 % slightly increased). Despite the fact that almost half of the patients (46%) claimed that being obese did not disturb their well-being, even 82% stated that they had worse physical capacity, for 55% obesity disturbed their everyday household. Majority of the patients (67 %) tried to decrease their weight by changing their nutritional habits (66%), increasing physical activity (45%), 9 % of the patients tried "over-the-counter" medications. Only 43% (19) of the patients consulted with the dietitian. Although 43% of the patients succeeded to lose weight, only 10% managed to maintain these changes. Only 10 (23%) would agree to undergo bariatric surgery (3 patients choosed liposuction, 3 gastric bypass surgery, 2 - gastric banding, others didn`t specify). There was significantly higher BMI in this group (48 vs. 39 kg/m2, p=0.04). Also, only 40% of them were referred to consult with a dietitian, comparing with 59% of patients, who wouldn`t undergo bariatric surgery. Many patients in surgery group succeeded to lose some weight (67%), but none of them managed to maintain these changes.

Conclusions: Majority of OSA patients understand that their weight is increased. Obesity is a major everyday life problem for them. Despite that, less than half of them seek professional help from dietitian. Being severe obese and inability to lose and successfully maintain positive weight changes is the main reason for choosing bariatric surgery.
Introduction: Mammalian midline thalamus consists of five nuclei of ambiguous function whose integrity is obligatory for maintenance of consciousness, cognition and sleep. Each of these functions relies on a tightly regulated UP-DOWN-states of thalamo-cortical networks. Here, we investigated the role of the midline thalamus on control of local and global cortical states during sleep.

Materials and methods: We recorded thalamic and cortical LFPs and single units in freely behaving mice during spontaneous sleep-wake cycles. Optogenetic activation (ChR2) and inhibition (ArchT) was employed to perturb thalamic nuclei to interrogate the circuitry.

Results: We found that CMT spiking activity is modulated across sleep states. CMT local field potentials show a phase-advancement over other midline-thalamic nuclei and cingulate cortex during the UP state of spontaneous NREM slow waves, which is consistent with a CMT-Cingulate monosynaptic pathway. We further found that optogenetic activation of CMT entrains cortical spiking activity in cingulate, parietal and occipital cortex and was accompanied by wakefulness. Interestingly, parietal and occipital entrainment occurred simultaneously, lagging behind responses observed in the cingulate. Using dual activation-silencing stimuli, we showed that spike and LFP transfer to parietal an occipital cortex, as well as wakefulness, is dependent on the dorsal thalamus. In contrast, stimulation of VB did not result in wakefulness.

Conclusions: Collectively these results implicate the CMT as the main driver of local cortical UP-states via monosynaptic input to the cingulate. However, changes in global cortical state and wakefulness, are dependent on a functional relay located in the dorsal thalamus. These results support both a correlative and causal role of midline and dorsal thalamus in control of frontal and global cortical states during sleep.

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SLEEP RESTRICTION INCREASES TELOMERE LENGTH IN SKIN OF RATS

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Introduction: Telomere length is described as a potential biomarker of tumorigenesis. Considering skin, it has been demonstrated that a longer telomere length is associated with an increased risk of cutaneous melanoma. Studies have shown that telomeres length can be affected by sleep disturbances, which in turn has been associated with a higher incidence of skin cancer. However, the literature is still controversial regarding the effects of poor sleep on telomere length and associated pathways. The aim of the present study was to evaluate the effect of sleep restriction on skin telomere length and its correlation with serum cytokines and plasma corticosterone in rats.

Materials and methods: 17 male rats with 3 months of age were distributed into the following groups: control (n=8) and sleep restriction (n=9). Animals from sleep restriction group underwent the modified multiple platform method for 21 days (sleep opportunity from 10a.m.-2p.m.). After euthanasia, skin from the footpad and blood were collected for analysis. Plasma corticosterone was assessed by high-performance liquid chromatography, and serum cytokines were assessed by MILLIPLEX® Multiplex Assays Using Luminex®. For telomere length, DNA was extracted from skin samples and monochrome multiplex quantitative real-time polymerase chain reaction were conducted to assess the T/S ratio, obtained from the amplification of telomeric region (T) and single-gene region (S), which is the indirect measure of telomere length.

Results: We found that sleep restricted rats presented a higher T/S ratio (3.63±0.64) when compared to controls (2.90±0.64), OR=2.1 (1.12-3.83). Additionally, T/S ratio did not correlate significantly with the other parameters. No significant differences in corticosterone, IL-6, IL-10, IL-1ß, TNF-α and IL-17 concentrations were found between the groups.

Conclusions: Sleep restriction increased telomere length independently from serum cytokines and stress.

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Introduction: Participation of nucleus caudatus (NC), one of the largest structures of the basal ganglia in regulation of sleep is not yet completely defined. Although in the science literature there are some data according relationship of this structure to human insomnia, especially in producing of hyper-arousal in case of insufficient activity of NC. Furthermore in some animal studies it was shown that stimulation or lesions of NC may induce EEG and sleep patterns changes. In this report we discuss the effects of electrical stimulation by low and high frequency of the head of the NC and the cortical and hippocampal EEG and post stimulation sleep-wakefulness cycle (SWC).

Materials and methods: Experiments were performed on the adult cats (n=10) in the chronic conditions. The following methods used: 1. Stereotaxic, for implantation of electrodes in the sensory motor area, dorsal hippocampus oculomotor and cervical muscles, using stereotaxic atlas of Jasper and Ajmone-Marsan; 2. Polygraph registration of the SWC, using EEG firm Sane'i; 3. Electrical stimulation of the head of NC, using of rectangular impulses from the generator with high-frequency output; 4. The obtained date treated statistically and significance of the observed changes evaluated according to the Student’s t-criterion.

Results: 
1. Electrical stimulation of the head of NC during calm wakefulness (parameters of single stimulation - 1.5v, 200 Hz, 0.1 m.sec.) induced synchronization of electrical activity of sensory-motor area and hippocampus in the range of alpha and theta rhythms. Behavioral effect of stimulation manifested in the form of a drowsy. Prolonged stimulation could cause sleep, which was ended after ceasing of stimulation. The heart rate was decreased.
2. Increasing of intensity of stimulation (2-2.5v) induced opposite effect - desynchronization of cortical electrical activity and increasing of hippocampal theta rhythm, with simultaneous signs of anxiety. Instability of the heart rhythm was noted.
3. Greater intensification of stimulation (3-5v) simultaneously with the development of manifestation of maneuvering motion of the animals induced activation of hippocampal theta rhythm. Instability of the heart rhythm was noted as well.
4. Low-frequency electrical stimulation of the head of NC during calm wakefulness (parameters of single stimulation 4v, 0.8 Hz, 0.1 m.sec) induced rhythmic oscillation in electrical activity of the sensory-motor area. Prolonged stimulation produced spindle activity in the same area. Behaviorally it was expressed in drowsy.
5. 2-h periodic high frequency stimulation resulting in EEG desynchronization induced increasing of volume percentage of and slow wave sleep and decreasing paradoxical sleep.
6. 2-h periodic low frequency stimulation resulting in EEG synchronization and drowsiness induced decreasing of volume percentage of and slow wave sleep, and significant increasing of volume percentage of wakefulness and paradoxical sleep.

Conclusions: Obtained results allow us to conclude that different patterns of preliminary stimulation inducing desynchronization versus synchronization of EEG expressed in different kind effects on the architecture of SWC in the post-stimulation period. Although the question posed by J.Villablanca “Why do we have a caudate nucleus?” (2010), especially in reference to sleep, still remains unclear.

Acknowledgements: The report is dedicated to professor T.Oniani’ memory.
SLEEP DISORDERS AND THE MEMORY PROCESSING AT ETHANOL ADMINISTRATION

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Introduction: The sleep wakefulness cycle (SWC) generally is sensitive to a variety of pharmacological and non-pharmacological impact, therefore, can be considered as valid model to study the effects of various substances, including ethanol (ET). The animal models are important to study of alcohol effects because they allow researchers to use methods that cannot be used with human subjects. ET, in various doses, may change excitability of nervous circles, which are involved in regulation of sleep-wakefulness cycle and learning and memory trace consolidation. The aim of the present study was to investigate effects of the various doses of 25% ET solution on the acquisition of the active avoidance reaction, memory trace processing and the sleep wakefulness cycle (SWC) in rats and to make correlation between memory processing and alteration of the SWC evoked by administration of ET. Despite alcohol being extensively studied and widely used, the biological processes underlying its beneficial effects on memory particularly in connection with sleep disorders remain unclear.

Materials and methods: Experiments conducted on inbred adult rats (weight 180-250 gr. N=50). The following methods used: 1. Stereotaxic, for implantation of electrodes in the brain, oculomotor and cervical muscles; 2. Polygraph registration of the SWC; 3. Passive avoidance test used for study of possibility of memory consolidation; 4. Active avoidance test for study of possibility learning processes (daily 20 trials during 20 days until achievement the learning criterion). 5. Animals were injected intraperitonealy of 25% ET (1 ml/kg, 2 ml/kg, 4.5 ml/kg) solution during 20 days. 6. The obtained data treated statistically and significance of the observed changes evaluated according to the Student’s t-criterion.

Results:
· Low doses of ET (0.5-1 ml/kg), facilitated elaboration of the avoidance reaction on the light compared with control intact group (p< 0.03). · Middle doses (2-2.5 ml/kg) inhibited the acquisition of the avoidance.
· High doses (3-4.5 ml/kg) of ET completely blocked implementation of the elaborated reaction of avoidance (p< 0.03).
· Consolidation of memory trace was not disturbed at administration of the low doses of ET.
· High doses (3-4.5 ml/kg) of ET blocked normal course of the phases and stages of SWC.
· The EEG wave's amplitude noticeably depressed.
· Recovery of the SWC structure observed after several days.

Conclusions: Obtained results allow to suggest that the main reason of the deficit learning and memory during alcoholization with high doses of ethanol solution depends on disorder of SWC structure and probably of slow wave sleep duration decreasing.
THE RELATION BETWEEN SLEEP AND GRAVITY

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**Introduction:** Gravity affects all living creatures, from cells to humans; at the same time, all creatures on Earth undergo alternative wake and sleep periods. This unalterable cycle raises the question "why do we sleep?" Scientists have developed several theories that partly explain why part of life is devoted to sleep. As gravity is a parameter of our environment that is elusive, pervasive and difficult to apprehend and understand, it has almost never been held accountable for unique traits of our behavior, except for the most obvious.

**Materials and methods:** Direct evidence supporting this hypothesis is based on an extensive and attentive review of the results of scientific studies on sleep, performed either on the ground, in water or in space. Although the "medical" aspects of sleep have received an enormous amount of attention, the effects of gravity on sleep has rarely been studied.

**Results:** Careful analysis of previous research on sleep, on Earth, in space and in water, shows that gravity differs in these three situations, and sleep also varies, at least in its duration. On Earth, Rapid Eye Movement sleep is conditioned by gravity. As the brain receives reduced signals from the external world, light, sound, contact and gravity, the REM sleep phase starts.
In space, ten years of data show that astronauts normally do not get enough sleep, even though most take sleep medications during space missions: astronauts have a shorter sleep duration, 6 hours instead of 8.
Another approach to compensate for gravity, which was used many years ago by the United States Air Force (USAF), was to immerse a subject completely into water for a week. The surprising result was that the subject needed only 3 hours of sleep per 24 h.

**Conclusions:** Evidence has shown that sleep depends on the way gravity acts on the body. In water, or in space where gravity is compensated, sleep is affected. There are no tools to suppress gravity, and it is therefore difficult to carry out a long-duration experiment, over generations, to confirm that sleep is due to gravity. So on Earth, there is no way to escape gravity and as a consequence sleep is unavoidable and necessary.

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Basic Research
Board #049: P5 - Wednesday
AGE, OBESITY AND SLEEP

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It is probable that all living creatures spend their lives alternating wakefulness and sleep. Sleep fulfils the important function of giving rest to the body and the brain. Its duration depends on the way muscles support the weight of the body.

Methods: Scientific papers reporting sleep durations show that elderly or obese people have a reduced sleep duration. Although the comparison may not be obvious their muscular systems provide less effort than what the weight of their body would need. This is due to an unexpected degradation of their appreciation of weight.

Results: The posture of humans is dependent among others, on the tonus of the skeletal muscles. Sleep is a period for the brain and the muscles which are under tension to maintain our equilibrium, to rest. When the work produced by the anti-gravity muscles, is not sufficient to maintain a stable posture, sleep is affected and its duration differs from recommended values. In the two populations, there is a deficit in the contribution of proprioceptive feedback as the gravity sensors may not solicit the muscles in a normal way: the muscles do not provide the same amount of work as would be needed in a normal subject.

As a result, paradoxically, the muscles do not need a longer rest phase, that is sleep.

Conclusion: More studies are needed which may lead to advances in the prevention of the sensorimotor deficits typically associated with the aging process or obesity.
SIMULATION OF SLEEP IN A MOUSE: QUANTITATIVE ANALYSIS OF THE REGION-SPECIFIC AND WAKE BEHAVIOUR-DEPENDENT DYNAMICS OF SLEEP HOMEOSTASIS

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Introduction: The two-process model of sleep describes the interaction between a sleep/wake dependent 'Process S' and a circadian 'Process C' regulating the timing, duration and intensity of sleep episodes. The dynamics of Process S are traditionally inferred from the distribution of sleep and waking over 24h periods, and empirical values of electroencephalogram (EEG) slow-wave activity (SWA, 0.5-4 Hz) are used to estimate the time constants of Process S. The aim of the present study was to adapt, for the first time in mice, an elaborated version of the two-process model to estimate the influence of the brain region and of varying waking behaviours on the dynamics of Process S.

Materials and methods: The vigilance states from undisturbed 48h EEG recordings performed in adult male C57BL/6J mice were annotated. EEG electrodes were implanted in the occipital and frontal regions of the neocortex. To investigate the impact of waking behaviour on the performance of the model, 3 conditions were used: regular-wheel (RW) - 48h with free access to a standard running wheel; complex-wheel (CW) - 24h as in RW and 24h with access to a complex wheel; sleep deprivation (SD): 24h as in RW followed by 6h of SD and 18h of recovery. All analyses were based on 4s epochs.

Results: The time course of SWA was successfully simulated on a time-scale of 24 hours, but also within individual episodes of non-rapid eye movement sleep; this was confirmed by the close fit obtained between empirical and simulated SWA levels. The decay rate of Process S was significantly different between derivations, attaining higher values in the frontal region (Frontal: 9.6±0.7x10^-4 epoch^-1, Occipital: 6.4±1.3x10^-4 epoch^-1, p=0.031, mean±SEM). The upper asymptote of Process S was also significantly higher in the frontal area (Frontal: 469±25 % mean SWA, Occipital: 270±22 % mean SWA, p=0.016, mean±SEM). The model's performance was satisfactory across conditions (RW, CW & SD), and neither waking experience nor time of day were found to have a statistically significant influence on the fit between data and simulation.

Conclusions: Overall, the results suggest regional inhomogeneity in the dissipation and build-up of sleep pressure across the brain, which supports the notion of local sleep regulation. The model was also robust to specific waking behaviours and time of day, suggesting the factors regulating the global 24h architecture of sleep are separate from those involved in sleep homeostasis.

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SLEEP DEPRIVATION INDUCED MEMORY DEFICIT ARE ATTRIBUTED TO DISRUPTED COMMUNICATIONS BETWEEN AMYGDALA AND HIPPOCAMPUS

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Introduction: Sleep, which is essential for proper functioning of the brain, is classified into non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. Theta waves and are characteristic features of REM sleep, in addition to desynchronized EEG, muscle atonia, rapid eye movements, ponto-geniculo-occipital waves and many other physiological changes. It is well recognized that loss of sleep leads to lapses in learning and memory. The brain regions including hippocampus, amygdala and the prefrontal cortex are associated with memory processes. However, effects of sleep deprivation on theta coherence among these brain areas not known.

Materials and methods: The study was conducted on six adult male Wistar rats (body weight 250-280 g) maintained at controlled temperature (26±1°C) and light-dark schedule of 12 h (lights on at 06:00 h). These rats were kept individually in the polystyrene cages with ad libitum supply of food and water. To evaluate the S-W, and for recording local field potentials from Amyg, HC, and PFC, the different electrodes were chronically implanted under Ketamine (50 mg/kg bwt, im) and Xylazine (5 mg/kg bwt, im) anesthesia using coordinates from the Paxinos and Watson atlas {HC (A -3 mm, L 2 mm, H 3 mm), Amyg (A -3 mm, L 5 mm, H 8.5 mm), PFC (A 4.5 mm, L 1 mm, H 2.4 mm)}. In this study, changes in theta coherence among the hippocampus, amygdala and the prefrontal cortex, were studied before and after exposing the animals to total sleep deprivation of 24 h. Changes in reference and working memory were evaluated after sleep deprivation using radial arm maze(8 arm).

Results: Concomitant with a rebound increase in non-REM sleep after total sleep deprivation, there was a decrease in the coherence of theta waves between all the studied areas, especially between hippocampus and amygdala. There was a decrease in 'correct memory performance' after sleep deprivation. This study showed that after sleep deprivation, there was a correlation in the cognitive deficits and decrease in the coherence of theta waves.

Conclusions: Impairments in brain function, especially cognition, after sleep loss could be attributed to changes in functional connectivity between these neural networks. This study highlighted important functions of sleep in maintaining an appropriate synchrony between various neuronal networks during REM sleep.

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MULTITASKING NETWORKS IN THE LATERAL HYPOTHALAMUS: THE ROLE INHIBITORY NEURONS IN SLEEP AND METABOLISM

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Introduction: The sleep-wake cycle is a highly-conserved physiological process across all vertebrates that result from a complex, yet undefined, inhibitory/excitatory balance between neural circuits distributed throughout the brain. Subpopulations of Lateral-hypothalamic (LH)-GABA neurons are active during wake or REM sleep states, as well as food-directed behavior, suggesting the existence of anatomically distinct circuits enabling multi-tasking in hypothalamus functions.

Materials and methods: Here, we targeted the expression of channelrhodopsin-2 opsin (ChETA) or archeorhodopsin (ArchT) to the LH_GABA cells of VGAT::Cre mice for activation or silencing, respectively. We use anterograde and retrograde labeling to study the anatomical connectivity between the LH and other brain areas and confirm their monosynaptic pathways using in vitro and in vivo techniques including patch-clamp recording and high-density electrophysiology/EEG/EMG. We used and stage-dependent optical stimulations to screen for modulation of the sleep-wake cycle architecture and emergence from anaesthesia. For food-directed behavior experiments, inhibition during REM sleep was carried out on every REM episode during ZT 8-12 and food intake was measure at the end of ZT 15.

Results: We first showed that optogenetic activation of LH_GABA cells induced a rapid switch from sleep to wakefulness (< 2 s) during NREM and significantly increases wakefulness duration during chronic stimulation in ChETA compare to control animals. This was not observed when LH_GABA cells were optogenetically activated during REM sleep. Importantly, we identified a monosynaptic GABAergic connection between the LH and the TRN (LH_GABA-TRN_GABA) that exerts a strong inhibitory control over TRN neurons. We found that optogenetic activation of this circuit reiterated state-dependent LH_GABA activation (inducing a rapid arousal during NREM, but not REM sleep). Furthermore, during deep anesthesia, activation of this circuit induced sustained cortical arousal. In contrast, optogenetic silencing of LH_GABA-TRN_GABA transmission during NREM increased the duration of NREM sleep and amplitude of delta (1-4 Hz) oscillations. Consistent with previous studies¹, optogenetic activation of LH_GABA cells causes an increase in food intake. Since these cells are also active during REM sleep, we tested whether perturbation of their activity during REM sleep affect future food-related behaviors. Remarkably, we found that silencing of LH_GABA cells during every episode of REM (4 hours before the light onset) causes a significant decrease of food intake in ArchT compared to control (YFP) animals.

Conclusions: Collectively, these results demonstrate that TRN cells integrate subcortical arousal inputs selectively during NREM sleep and may participate in sleep intensity. Further, our results suggest that reactivation of food-directed neurons during REM sleep is essential to maintain feeding and expand the role of REM sleep to the stability of innate behaviour.
THE SLEEP-WAKE DISTRIBUTION IS A MAJOR DETERMINANT OF CHANGES IN CORTEX TEMPERATURE IN MICE

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**Introduction:** The daily changes in brain and body temperature are considered as a direct output of the circadian clock. However, it is also known that waking and locomotor activity (LMA) affect temperature. Here, we quantify the contribution of waking and LMA to changes in cortex temperature (Tcx) in the mouse.

**Materials and methods:** EEG/EMG based sleep-wake state, LMA, and Tcx were recorded in male C57BL/6J mice (n=6) during two baseline days, 6h of sleep deprivation starting at light onset, and two recovery days. LMA was measured with passive infrared detectors.

**Results:** Tcx, waking, and LMA are high during the dark phase and low during the light phase. Sleep deprivation keeps Tcx at high levels. Tcx increases after transitioning into waking and REM sleep, and decreases upon entering NREM sleep. Both time-spent-awake and LMA highly correlate with Tcx but waking explains significantly more of its variance ($R^2 = 0.84$ and 0.71, respectively; $p<0.0001$; t-test on Fisher Z-transformed individual r-values; $p=0.03$). Wakefulness remains strongly correlated to Tcx even after controlling for the influence of LMA (partial $R^2 = 0.47$; $p<0.0001$), while the correlation between LMA and Tcx after correcting for waking reaches significance only in half of the mice (partial $R^2: 0.06$, p-range: $0.87>p>5.1*10^{-6}$; t-test on Fisher Z-transformed individual partial r-values; $p=0.0002$). However, the interaction between waking and LMA improves the predictive power in a linear mixed model, compared to the additive effect of waking and LMA alone ($X^2 (7) =101.99$; $p<0.0001$).

**Conclusions:** Waking, and not LMA, is the major driving force in Tcx variance, although LMA’s interaction with waking contributes as well. Our findings regarding the role of LMA in Tcx determination, however, might not be applicable in case of heavy exercise. The small residual variance in Tcx that could not be accounted for could be attributed to circadian and/or light effects.
Differential Effects of Intermittent Hypoxia on Phenotypic and Metabolic Features of Airway Muscles in Weaning- and Adolescent-Aged Rats

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Introduction: Repetitive episodes of hypoxia during sleep is a pathology of obstructive sleep apnea (OSA). Comparative studies between humans (children & adolescents), and rodents (rats) have suggested differential hypoxic responses to metabolic morbidities due to functionally immature neurotransmitters. In adolescents, intermittent hypoxia (IH) systemically and locally induces pro-inflammatory cytokines, which leads to progressive atrophic alterations in skeletal muscles. However, there are no comparative studies to verify the metabolic changes in airway muscles exposed to IH at different growth periods. Thus, the aim of this study was to clarify the effects of IH on phenotypic and metabolic features of the geniohyoid (GH) and diaphragm (DIA) muscles in weaning- and adolescent-aged rats.

Materials and methods: The three-week old (weaning-aged), and seven-week old (adolescent-aged) male Sprague-Dawley rats used in this study, were categorized into 2 groups based on their growth periods and the intervention. The experimental group was exposed to IH at the rate of 20 cycles/h (nadir of 4% O₂ to peak of 21% O₂ with 0% CO₂), while the control group received normal room air breathing alone for 8 h/d. After 3-weeks, all the rats were sacrificed and samples of their GH and DIA muscles were collected. Real-time PCR and western blot analysis were performed to evaluate the gene and protein expressions for pro-inflammatory and muscular metabolic factors in the respiratory muscles. Statistical analysis of the normoxic and IH groups was performed using unpaired t-test (p < 0.05).

Results: Western blot analysis for muscular phenotypic and metabolic features showed that in the adolescent-aged rats, IH exposure significantly increased the protein levels of the fast-twitch isoform, sarcoplasmic reticulum Ca(2+)-ATPase (SERCA1) in the DIA muscle (1.77-fold change vs. control), as well as decreased the protein levels of the slow-twitch isoform, (SERCA2a) in the GH muscle (0.50-fold change vs. control). In the weaning-aged rats exposed to IH, SERCA1 significantly decreased (GH: 0.48-fold change vs. control; DIA: 0.48-fold change vs. control), while SERCA2a was comparable in both muscles. PCG-1α protein was significantly decreased in the GH and DIA muscles of the adolescent-aged rats exposed to IH. qPCR showed that exposure to IH significantly elevated mRNA levels of pro-inflammatory cytokines; (IL-1β: 3.3-fold change vs. control), and TNF-α (1.9-fold change vs. control) in the GH muscle of the adolescent-aged rats, whereas they were significantly decreased in the weaning-aged rats (IL-1β: 0.62-fold change vs. control; TNF-α: 0.65-fold change vs. control). The mRNA levels of iNOS significantly increased in the GH muscle of the adolescent-aged rats (2.5-fold change vs. control) compared to those of the weaning-aged rats.

Conclusions: IH increased pro-inflammatory gene levels with change in muscular isoforms from the fast- to the slow-twitch types in the GH muscle of the adolescent-aged rats, whereas IH decreased SERCA1 with a downregulation of pro-inflammatory genes in the weaning-aged rats. However, these findings suggest that phenotypic and metabolic alterations and/or features of airway muscles, depend on the developmental stages of the rats exposed to IH.

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Introduction: Sleep is a reversible state of consciousness associated with reduction of awareness, response to external stimuli, and appearance of behavioral and physiological changes. The perception of sleep, by definition, is measured by subjective report. Previous study has shown that perception of sleep is associated of loss of thinking process, as well as decreased experience of sensation and perception (Yang, Han, Yang, Su, & Lane, 2010). However, the neurophysiological mechanism underlying sleep perception remains uncertain. The aim of this study is to use EEG and fMRI to compare the difference in brain activities before awakenings with and without perception of sleep.

Materials and methods: Forty-eight healthy adults (20-35 years old, 31 females and 17 males) were recruited to participate in the study. Simultaneous EEG and fMRI recordings were conducted while they were lying in fMRI scanner and trying to fall asleep. They were awakened at N1 or N2 stages of sleep. They were then interviewed concerning the status of their subjective experience immediately prior to the awakening. The content of the interview included perceptual experiences, thought content and processes, emotional experiences, engagement with reality, and orientation toward time and place. Their metabolism and functional connectivity within prefrontal cortex and the thalamo-cortical system were analyzed.

Results: Forty-one interviews were included in the analyses, twenty of them were awakened from stage N2 sleep, five were awakened from stage N1 sleep, and sixteen were from waking state. EEG results showed that absolute delta activities were higher in awakenings with sleep perception than those without sleep perception at F4, P3, P4 and PZ. Absolute alpha activities were also found be lower in awakenings with sleep perception than those without sleep perception at F7, Cz, P3, P4, T7, P7, P8, Pz, Oz and CP1. fMRI data showed higher functional connectivities between dACC and left precuneus in awakenings with perception of sleep, comparing to those without sleep perception.

Conclusions: The study provided EEG-based evidence that perception of sleep is associated with decreased activation in frontoparietal network. Besides, fMRI showed association between sleep perception and stronger connectivity between regions that have been shown to be related to self-referential processing. The finding suggests that an increase of internal focus instead of attending to external stimuli might play a key role in the perception of sleep.

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Introduction: Insomnia is the most prevalent sleep disorder in the general population and is considered to be a disorder of hyperarousal. The aim of this study was to measure the psychophysiological responses in insomnia patients using a biofeedback system, and to compare them with results from normal healthy subjects.

Materials and methods: Eighty patients with primary insomnia (35 males and 45 females, average age 49.71 ± 12.91 years) and 101 normal healthy controls (64 males and 37 females, average age 27.65 ± 2.77) participated in this study. Electromyography (EMG), heart rate (HR), skin conductance (SC), skin temperature (ST), and respiratory rate (RR) were recorded using a biofeedback system during 5 phases (baseline, stress 1, recovery 1, stress 2, recovery 2) of a stress reactivity test, and average values were calculated. Difference in values between the two groups in each corresponding phase was analyzed with independent t-test, and change in values across phases of the stress reactivity test was analyzed with paired t-test (all two-tailed, p < 0.05).

Results: Compared to normal controls, insomnia patients had higher EMG in all 5 phases (baseline: 7.72 ± 3.88 µV vs. 4.89 ± 1.73 µV, t = -6.06, p < 0.001; stress 1: 10.29 ± 5.16 µV vs. 6.63 ± 2.48 µV, t = -5.84, p < 0.001; recovery 1: 7.87 ± 3.86 µV vs. 5.17 ± 2.17 µV, t = -5.61, p < 0.001; stress 2: 10.22 ± 6.07 µV vs. 6.98 ± 2.98 µV, t = -4.37, p < 0.001; recovery 2: 7.88 ± 4.25 µV vs. 5.17 ± 1.99 µV, t = -5.27, p < 0.001). Change in heart rate across phases of the stress reactivity test were higher in normal controls than in insomnia patients (stress 1-baseline: 6.48 ± 0.59 vs. 3.77 ± 0.59, t = 3.22, p = 0.002; recovery 1- stress 1: -5.36 ± 0.59 vs. -3.16 ± 0.47, t = 2.91, p = 0.004; stress 2-recovery 1: 8.45 ± 0.61 vs. 4.03 ± 0.47, t = 5.72, p < 0.001; recovery 2-stress 2: -8.56 ± 0.65 vs. 4.02 ± 0.51, t = -5.31, p < 0.001).

Conclusions: Psychophysiological profiles of insomnia patients in a stress reactivity test were different from those of normal healthy controls. These results suggest that the sympathetic nervous system is more highly activated in insomnia patients.

Acknowledgements: none
**Introduction:** It is known that sleep is not a passive but an active process and it has dynamic changes in itself. One of the biggest problems is being unable to assign a task to individuals during sleep. For this reason, simple evoked potentials are preferred in sleep research. The main purpose of this study is to investigate the brain responsiveness to non-painful tactile stimuli during two-hours section of sleep.

**Materials and methods:** 19 healthy subjects (10 male, mean age±SD: 23.02±1.04) has participated in this study. 40 channel polysomnography recording system, Embedded Microcontroller Stimulation Unit, pneumatic stimulation unit were used for recordings. Tactile stimuli with constant pressure were applied to the right index and middle fingers of the subjects. Following the sleep recordings, sleep stages were scored according to AASM scoring systems. Total sleep duration was divided into four equal sections for each subject, and brain responsiveness to non-painful tactile stimuli during NREM sleep was investigated primarily in CZ electrode.

**Results:** During NREM sleep; P50, N100, P200, N300, P450, N550, P900 and N_late responses of brain responsiveness to tactile stimuli were recorded in all these four sections. While in the first section of sleep the average amplitudes of P50 components were $1.41±1.29 \mu V$, N100 component were $-0.24±1.22 \mu V$, P200 components were $2.44±1.51 \mu V$, N300 components were $-5.39±2.67 \mu V$, P450 components were $1.93±2.26 \mu V$, N550 components were $-0.33±2.07 \mu V$, P900 components were $2.93±1.81 \mu V$ and, N_Late components were $-2.31±1.48 \mu V$, in the second part of sleep P50 components were $0.80±0.88 \mu V$, N100 components were $-0.72±0.93 \mu V$, P200 components were $1.34±1.16 \mu V$, N300 components were $-4.15±2.76 \mu V$, P450 components were $1.73±1.91 \mu V$, N550 components were $-0.06±1.14 \mu V$, P900 components were $2.91±2.24 \mu V$ and, N_Late components were $2.74±1.31 \mu V$. In the third part of sleep P50 components were $1.14±1.00 \mu V$, N100 components were $-0.32±1.18 \mu V$, P200 components were $1.61±1.31 \mu V$, N300 components were $-3.87±2.48 \mu V$, P450 components were $2.24±2.02 \mu V$, N550 components were $-0.27±0.93 \mu V$, P900 components were $2.16±1.39 \mu V$ and, N_Late components were $-2.53±1.37 \mu V$ whereas in the fourth part of sleep P50 components were $0.92±0.78 \mu V$, N100 components were $-0.54±0.93 \mu V$, P200 components were $0.82±1.70 \mu V$, N300 components were $-3.24±3.08 \mu V$, P450 components were $2.06±1.92 \mu V$, N550 components were $0.13±1.19 \mu V$, P900 components were $1.99±1.42 \mu V$ and, N_Late components were $-2.06±1.37 \mu V$. The amplitudes of N300 and N_Late components were statistically decreased as sleep process proceeds.

**Conclusions:** In this study tactile evoked potentials were only investigated during NREM sleep and it has been found that N300 and N_Late response components varies during dynamic sleep process. It is known that sleep has different stages. In the related sleep literature, generally stage-based researches are conducted. But in the light of our findings, it has been found that response components of brain changes not only due to sleep stages but also due to time spent within this process. In this context; in the research of sleep's unknown, it is necessary to investigate different variables such as responsiveness in addition to sleep stages.
Introduction: Down syndrome (DS) is the most common congenital condition in Canada; however, an overview of access to healthcare is lacking. We conducted a survey to investigate access to healthcare and comorbidities in a Canadian population of individuals with DS to understand the main met/unmet needs.

Methods: An anonymous online REDCap survey for parents/caregivers of individuals with DS was conducted in 2015. The survey comprised 80 questions in 5 parts:
(i) demographics,
(ii) diagnoses, medications and supplements,
(iii) development, (iv) sleep/wake-behaviours, and
(v) feedback/testimonials.

Results: 349 responses were received. General practitioners and paediatricians were identified as the primary physician for 97% of individuals with DS. The most frequent comorbidities included: ophthalmic (141/46%); ENT & respiratory (124/40%); cardiovascular (109/35%); dermatological conditions (104/34%); endocrine (80/26%); gastrointestinal (64/21%); orthopaedic (67/18%); mental health conditions (40/13%); haematological (19/6%); and, immunological (17/6%). 311/346 responded to the sleep sections specifically and 22% reporting sleep problems; however, there was a 3-4 times fold discrepancy between categorical diagnosis versus descriptive symptoms for sleep disordered breathing and even insomnia and parasomnias.

Conclusions: Individuals with DS have multiple comorbidities that require specialized care. General practitioners and paediatricians were identified as the primary health care provider by the majority of study respondents; this suggests that these physicians are integral. As these physicians are continuously confronted with changing guidelines, a standardized approach is needed for knowledge dissemination. We are developing a Down syndrome medical care app for parents to enable them (i) the gathering of core descriptive symptoms and (ii) to optimize clinical care management by standardizing recommended healthcare investigations and connect professionals across sub-specialties and multi-professional teams.
SLEEP PROBLEMS IN CHILDREN WITH DOWN SYNDROME

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Introduction: Individuals with Down syndrome (DS) commonly experience sleep problems, including sleep disordered breathing (SDB), parasomnias, and insomnia. We investigated sleep problems in individuals residing in British Columbia (BC), Alberta (AB) and Ontario (ON).

Patients and methods: An anonymous online REDCap survey for parents/caregivers of individuals with DS was conducted in 2015. The survey was comprised of 80 questions in 5 parts:
(i) demographics,
(ii) diagnoses, medications and supplements,
(iii) development, (iv) sleep/wake-behaviours, and
(v) feedback/testimonials.

We analyzed the sleep/wake-behaviour results with a focus on the associated categorical diagnoses provided by professionals versus descriptive symptoms reported by caregivers.

Results: 346 responses from BC, AB, and ON were received; 311/346 responded to the sleep sections specifically and 22% reporting sleep problems (BC: 19%; AB: 36%; ON: 21%). Percentages of categorical diagnoses and descriptive symptoms (2+,3+,4+) for SDB: BC 16/(66,43,21); AB 31/(71,51,22); ON 17/(56,41,11); parasomnias: BC 4/(17,5,0), AB 2/(11,2,2), ON 3/(7,4,0); and insomnia (1+,2): BC 15/(53,18); AB 22/(56,13); ON 7/(41,4).

Conclusions: Across the three provinces, the number of reported symptoms was significantly higher than the frequency of diagnosed sleep disorders among individuals with DS. While SDB requires a formal sleep study for diagnosis, the diagnoses of insomnia and parasomnias are both based on capturing descriptive symptoms. These results underline the necessity to bridge information gaps regarding sleep problems in the healthcare system in order to overcome under-diagnosis. We suggest bridging the gaps by enabling parents to share observation-based symptoms in a structured way with involved professionals using a DS medical care app.
EXAMINATION OF THE METHOD THAT IS MOST SUITABLE FOR THE INFLUENCE ON SLEEP IN THE TRANSPLANT OF THE MESENCHYMA SYSTEM STEM CELL AND COGNITIVE FUNCTION AND QOL EVALUATION

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Introduction: There are many examples that studied about quality of life (QOL) for the patient in hematopoietic stem cells transplant for the leukemia. However, there are many unclear points about the QOL of patients receiving mesenchymal stem cell transplantation, in particular the effects on sleep and cognitive functions.

Materials and methods: In this study, the influence on sleep and recognition function of the patient and QOL evaluation method were considered using clinical data before and after transplant for Asian patients (Japanese, Vietnamese and Chinese) that underwent the transplant of the mesenchymal stem cell. The influence of sleep and the cognitive function was analyzed using a One-way layout analysis of variance (ANOVA). The evaluation of the QOL was used by correlation and cause and effect analysis. Coefficient of correlation was calculated with the consideration of outlier by the statistical (Smirnov-Grubbs test) and was made an as needed linear and non-linear regression analysis.

Results: The sleep of the patient who underwent transplant was below the average. As a characteristic of the patients, a decrease in sex function, the loss of the hair, the flexible loss of the skin, a lot of symptoms such as the loss of the appetite were observed. In particular, negative correlation was caught for lifestyle score when they had a chronic disease and a hospitalization career.

Conclusions: In this study, it is hoped that it becomes effective for improvement of the physical happiness of the patient whom this intervention underwent or go the transplant and the emotion. In addition, the clinician engaged in treatment screens the symptom of the patient after transplant regularly and may raise an effect of the transplant by dealing with a treatment-related obstacle effectively. Furthermore, this intervention will satisfy the care needs that I did including the sleep of the patient and a cognitive function. And this study suggests that it is extremely important in developing a strategy for a clinician to improve the quality of life of the patient.
NEUROCHEMICAL PATHWAYS IN THE BRAINSTEM INVOLVED IN A₁ ADENOSINE RECEPTOR AGONIST-INDUCED HIBERNATION IN THE ARCTIC GROUND SQUIRREL (UROCITELLUS PARYII)

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Introduction: Hibernation is a phenomenon brought on by seasonal changes in phenotype. In the arctic ground squirrels (AGS), the effect of these seasonal changes is very evident. In late fall AGS decrease their metabolic demand which is followed by the entry into hibernation in winter. Previously in the lab it has been shown that N⁶-cyclohexyladenosine (CHA), an A₁ adenosine receptor agonist, induces hibernation in AGS in a seasonally dependent manner. AGS treated with CHA in winter experience a decrease in metabolic demand and temperature as seen during natural hibernation during winter. However, in summer CHA triggers a brief and transient metabolic suppression that does not lead to hibernation onset. How CHA acts within the brainstem and which pathways are activated to induce hibernation is currently unknown. The nucleus tractus solitarius (NTS) is characterized by a population of adenosine receptors. A preliminary study suggests that NTS is activated after CHA treatment in winter AGS. By contrast, NTS does not show cFos immunoreactivity after CHA in summer AGS. Our research tests the hypothesis that CHA disinhibition of neuronal activity within the NTS is associated with seasonal onset of hibernation.

Materials and methods: To assess how season affects CHA disinhibition of NTS neurons, AGS in summer and winter were treated with CHA or vehicle (0.5mg/kg, IP). We used whole animal oxygen consumption as a measure of the hibernation-like response and fixed tissue by intracardial perfusion with 4% paraformaldehyde 3hr after injection. Brains were dissected and cryoprotected in 5%, 10%, 15%, 20%, 30% sucrose. We performed free-floating immunohistochemistry on 40µm brain slices in four experimental groups: winter CHA, winter control, summer CHA and summer control. We sectioned brains from eight AGS per group for a total of 32 animals and identified active nuclei with cFos immunoreactivity (mouse anti-cFos 1:20,000, Millipore). Blinded analysis of the number of cFos immunoreactive neurons in the NTS and the raphe pallidus is in progress using bright field microscopy and Metamorph software.

Results: CHA produced a hibernation-like response in AGS during the winter season, but not in the summer season. Blinded analysis precludes preliminary analysis of ongoing neuronal counts.

Conclusions: NTS activation is likely involved in hibernation. Work is in progress to define the phenotype of the neurons within the NTS that show seasonal sensitivity to CHA.

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Introduction: Sleep quality is worsened in many health disorders including chronic pain. The Pittsburgh Sleep Quality Index (PSQI) is a validated measure of sleep quality, a phenotype with considerable heritability (37%). In this study, we present results of a genome-wide association study (GWAS) of sleep quality measured by the PSQI.

Materials and methods: Subjects were 18-44 years old from a U.S. community-based case-control study of 1,082 chronic temporomandibular pain disorder (TMD) cases and 2,144 TMD-free controls enrolled in the OPPERA (Orofacial Pain: Prospective Evaluation and Risk Assessment) study. Participants provided a blood sample for genotyping and completed the PSQI. The Omni2.5M platform was used for genotyping. Quality control filters were applied for samples and genotyping. SNPs were analyzed for association with the PSQI global score using linear regression with adjustment for recruitment site, age, gender, three racial eigenvectors, and TMD case status. SNPs that passed the genome-wide threshold of significance (p< 5E-08) were tested for replication in independent cohorts: the UK biobank (n=152,000 subjects); the Northern Finnish Birth Cohort (n=1000); the Hispanic/Sol cohort (n=8,000); the motor vehicle crash cohort (n=2000) and the Post Mastectomy Pain syndrome cohort (n=1000). Gene enrichment analysis was performed using the biological process gene ontology in the attempt to shed light on the functional impact of genetic variants potentially contributing to sleep complaints. Genes associated with sleep were then tested in a knockdown drosophila melanogaster model for validation.

Results: We identified three genome-wide significant loci associated with PSQI global scores in the OPPERA cohort. The top two associations were rs11976703; (p=3.8E-08) and rs73284230; (p=4.8E-08) on chromosome 7, situated downstream of MPP6 (membrane palmitoylated protein 6) gene. The third SNP, rs60869707; (p=5.0E-08) was located on chromosome 2 downstream of the ATOH8 (atonal bHLH transcription factor8) gene. In all three SNPs, minor alleles were associated with better sleep quality. Of those three SNPs, rs73284230 was replicated in more than 200,000 individuals with various sleep phenotypes in the same protective direction (p-value 0.028). In a drosophila melanogaster model with MPP6 knockdown, better sleep and less fragmentation were found. Pathway analysis revealed that there is enrichment for genes associated with sleep disturbances in the neuronal action potential pathway.

Conclusions: We identified two genetic loci located on chromosomes 2 and 7 in which the minor alleles were associated with better sleep quality. SNP on chromosome 7, located near MPP6, were also associated with better sleep in independent cohorts. MPP6 was validated in a Drosophila Melanogaster model and was shown to play a protective role in depression and anxiety. In conclusion, we identified and validated a new genetic marker for sleep quality, MPP6.

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THE RELATIONSHIP BETWEEN SLEEP DISORDERS AND THE RISK OF CARDIOVASCULAR DISEASES

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**Introduction:** Sleep disorder is common disease and is highly comorbid with a number of cardiovascular diseases (CVD). Purposed mechanisms likely relate to increase in cortisol levels, decreased immunity, and increased markers of sympathetic activity. Despite the well-known association between sleep disorder and CVD, to our knowledge, no large population-based cohort study on this subject has been reported so far. In this study, we investigated the prospective risk of CVD disorder development in sleep disorder patients using nationwide representative cohort sample from 2002 to 2013.

**Materials and methods:** National Health Insurance Service (NHIS) sample cohort data from 2002-2013 in South Korea were used. Sociodemographic and clinical data were collected simultaneously. A total of One million patients with sleep disorders were analyzed. The sleep disorder group included only the patients who were first treated for sleep disorders from 2004 to 2009, among these subjects, excluded patients who existed CVD before sleep disorder. A five-year observation period was established from the time when sleep disorder was started to be treated. To distinguish the severity of sleep disturbance, the patients were divided into two groups: The patients treated within 1 year were classified as mild, while the patients treated for 1 year or more were classified as severe. Logistic regression was used for analysis and Odds ratio (OR) and 95% confidence interval (CI) were calculated via both univariate and multivariate method.

**Results:** After adjusting for age, gender, household income, residential area, type of insurance subscription, Odds ratios of CVD were high in patients with severe sleep disorders (OR:1.467; 95% CI for Hypertension, OR:1.425; 95% CI for ischemic heart disease, and OR: 1.356; 95% CI for heart failure). In terms of sociodemographic factors, increasing age and male were significantly associated with development of CVD.

**Conclusions:** In this large population-based cohort study, patients the patients treated for 1 year or more were significant association with the development of cardiovascular disease. Particular attention and screening of sleep health may be an important part of the management of those with cardiovascular disease.

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URINARY PROTEINS AS POTENTIAL BIOMARKERS FOR ADULT PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: Obstructive sleep apnea (OSA) is an emerging major public health problem in both developing and developed countries and is associated with several adverse health consequences. In India, it was found to have a prevalence of 19-13% in males and 5-7% in adult females. In-hospital polysomnography is an onerous and expensive diagnostic modality for the patient; therefore, there is a need for a disease related biomarker for screening patients with OSA. Repetitive hypoxia and re-oxygenation during sleep in OSA patients result in endothelial dysfunction in patients with OSA and this may cause some intracellular proteins to leak out in the blood and urine of these patients. The aim of the study was to identify differentially expressed disease related proteins in blood and urine samples of OSA patients with respect to overweight subjects without OSA.

Materials and methods: Early morning blood and urine samples were collected from subjects confirmed to be OSA or non-OSA subjects by polysomnography. The study was carried out using proteomics approach in three phases; i) identification phase; ii) verification phase and iii) validation phase. In the identification and verification phase, patients with no co-morbidity were recruited. In validation phase, patients were recruited irrespective of co-morbidities. iTRAQ based proteomics approach was used in the identification phase which is a robust method for protein profiling. For verification and validation of proteins, ELISA was used.

Results: From identification phase, 17 differentially expressed proteins were selected and were verified using ELISA. From the verification phase, 5 proteins (2 from plasma and 3 from urine) were selected for validation in plasma (controls- 42; cases-198) and urine samples (controls- 46; cases-197). Validation of these proteins ensured optimal diagnostic utility the two urinary proteins was exemplary with high sensitivity and specificity of 94% and 91% respectively in combination for severe OSA cases.

Conclusions: Urinary proteins emerged out as potential novel biomarkers for screening of OSA and have exemplary diagnostic performance in diagnosing patients with severe OSA, who need immediate treatment intervention. These proteins after being validated in further studies from different populations can be of great significance and might act as a non-invasive screening or diagnostic modality for OSA.

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MIR-709: A MICRO REGULATOR OF LARGE AMPLITUDE EEG SLOW WAVES

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Introduction: MicroRNAs, 18-25 nucleotide long non-coding RNAs, fine-tune a plethora of neuronal processes and pathologies. Their role in sleep regulation remains, however, understudied. Here, we first assessed whether microRNA expression levels are affected by sleep deprivation (SD) in mice. We then tested the functional involvement of the top microRNA candidate, miR-709, in sleep regulation.

Materials and methods: We sleep deprived male C57BL6 mice (n=6) for 6h and performed a microRNA microarray analysis to determine which microRNAs are affected by sleep loss. Validation of miR-709 expression levels was performed by in situ hybridization (Exiqon, Denmark). The functional involvement of miR-709 in sleep homeostasis was assessed by in vivo knockdown using miR-709 LNA inhibitors (Exiqon, Denmark). Mice were implanted with EEG/EMG electrodes and injected intracerebroventricularly (ICV) with either a) the miRNA-709 inhibitor (imiR-709, n=7), b) a non-functional “scrambled” control (scr, n=6), or c) artificial cerebrospinal fluid (aCSF, n=5) as vehicle control. The response to a 6h SD relative to baseline was compared among the three groups. Predicted targets of miR-709 were explored using TargetscanMouse 7.1 algorithm.

Results: Sleep deprivation altered the expression of several microRNAs in both cortex and hippocampus. Among those, miR-709 exhibited the most prominent changes, increasing its levels in both tissues. Upregulation of miR-709 was confirmed by in situ hybridization. ICV injection of imiR-709 resulted in a higher increase in EEG delta power after periods of prolonged wakefulness, as compared to the controls. This higher increase was specific to the slow delta frequencies (0.75-2.25 Hz). Interestingly, top predicted gene targets of miR-709 in the brain are involved in axon guidance and synaptic connectivity.

Conclusions: miR-709, a microRNA previously associated with epileptic models and stress, both affects and is affected by sleep processes. Moreover, miR-709 has been found to be upregulated after activation of metabotropic glutamate receptors (mGluRs), which are directly involved in sleep homeostasis. miR-709 might therefore functionally link neuronal excitation during extended wakefulness to the recovery process occurring during sleep.
THE ROLE OF Ca\textsuperscript{2+}-DEPENDENT HYPERPOLARIZATION PATHWAY IN SLEEP DURATION

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Introduction: During NREM sleep, an EEG mostly displays high-amplitude low-frequency fluctuations, which are generated by synchronized slow oscillations of the cortical neuron membrane potential; during waking, an EEG exhibits low-amplitude high-frequency fluctuations, which are generated by the irregular firings of cortical neurons. These two states are mutually exclusive in a normal brain, and their ratio is homeostatically regulated. However, the important components contributing to change of these two states and hence the detailed molecular mechanisms underlying the regulation of sleep duration remain unknown.

Materials and methods:
Simulations: To reproduce the firing patterns of cortical neurons during slow-wave sleep (SWS), we constructed a computational neuron-network model by mean-field approximations of a population of neurons. To investigate the components generating the SWS firing patterns, we performed a bifurcation analysis of the conductance of each intrinsic and extrinsic current and of the Ca\textsuperscript{2+} efflux rate.

Animals and Sleep Phenotyping: CRISPR-KO mice were generated by one-cell embryo microinjection of synthesized Cas9 mRNA and gRNAs to C57BL/6N fertilized eggs. To obtain biallelic KO mice in one-generation, we used the Triple-CRISPR methods which achieved almost perfect KO efficiency. Sleep phenotyping of KO mice was conducted using the respiration-based non-invasive sleep phenotyping system named the Snappy Sleep Stager (SSS) and the basal EEG/EMG recording.

Pharmacological Administration: C57BL/6N mice received an i.p. injection of MK-801 in 0.2, 2 or 20 mg/kg at ZT2. For the EEG/EMG recording, 2 mg/kg of MK-801 was injected i.p. to C57BL/6N mice at ZT2.

Results: The simple computational model recapitulated SWS firing patterns and comprehensive bifurcation analysis predicted that a Ca\textsuperscript{2+}-dependent hyperpolarization pathway may play a role in SWS and hence in the regulation of sleep duration.

To experimentally validate the prediction, we comprehensively generated and analyzed KO mice by SSS to screen for important genes for sleep duration. We found that impaired Ca\textsuperscript{2+}-dependent K\textsuperscript{+} channels (Kcnn2 and Kcnn3), voltage-gated Ca\textsuperscript{2+} channels (Cacna1g and Cacna1h), or the NMDA receptor (Nr3a) decrease sleep duration, while impaired plasma membrane Ca\textsuperscript{2+} ATPase (Atp2b3) increases sleep duration. To analyze the detailed sleep phenotype of KO mice, we conducted the basal EEG/EMG recording of each KO mouse. As a result, the observed sleep phenotype of KO mice was largely attributed to the significant change of NREM sleep (SWS) duration. In addition, pharmacological impaired NMDA receptors reduced sleep duration. Interestingly, we also found that impaired Ca\textsuperscript{2+}/calmodulin-dependent kinases (Camk2a and Camk2b) decrease NREM sleep and total sleep duration.

Conclusions: Based on these results, we propose a hypothesis that the Ca\textsuperscript{2+}-dependent hyperpolarization pathway might regulate sleep duration by the active-dependent modification (e.g., phosphorylation) of its components.

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Introduction: Heart Rate Variability (HRV) is a measure of sympato-vagal balance and is considered an indicator of autonomic function. The aim of this study was to assess the influence of age, body habitus, gender, sleep cycle and circadian changes on HRV in children.

Materials and methods: Six minutes sections of interrupted electrocardiography recorded during polysomnography from 135 healthy children (3-15 y), were sampled during progressive cycles of slow wave sleep (SWS1, SWS2, SWS3). Three minute samples of uninterrupted rapid eye movement sleep (REM) were assessed, with REM1 marked at the last REM period before awakening. HRV variables include, meanNN (average RR intervals), SDNN (Standard Deviation of RR intervals), LF (sympathetic and baroreflex rhythms), HF (vagal influence), HF/LF (sympatho-vagal balance) RMSSD (vagal activity).

Results: Repeated measure ANOVA showed a significant difference between sleep cycles and stages. Pairwise analysis of each cycle (time of night 1, 2, 3) and stage (SWS or REM) revealed that the first meanNN (heart rate) during SWS (SWS1) was similar to all REM periods and significantly higher than SWS2 and SWS3 and hence meanNN SWS 2&3 were also lower compared to all REM periods (1, 2, 3). SDNN was significantly higher in REM 1 compared to SWS1. LF during REM periods was similar in all REM cycles, but significantly higher than all SWS cycles. LF was similar for all SWS cycles. We report a moderate correlation with meanNN for all REM cycles and SWS1 and age, height and weight, p < 0.001. SDNN, LF correlated with age only during REM sleep. LF during REM 1 (just before waking up) correlated with age, height and weight. During the SWS1 only, LF and HF/LF were positively related while HF was inversely correlated to age, height and weight. Group comparisons showed that males had increased meanNN in all sleep stages and cycles compared to females. SDNN, SD1, HF and RMSSD where all increased in males compared to females, only during REM sleep cycles.

Conclusions: There are considerable changes in the spectral analysis of cardiac function occurring during different sleep stages and across the night. Children demonstrate a circadian reduction in cardiac modulation during SWS, however the circadian effect is less evident during REM sleep. Cardiac timing during the first SWS period is similar to pre-wake REM timing. Our data suggests that cardiac modulation during REM sleep is regulated by changes in sympato-vagal balance, while changes observed during SWS are not as there were no difference in frequency domain HRV variables between SWS cycles. Our results may reflect the pre-sleep (9.00pm) peak in body temperature reported in the circadian cycle and may demonstrate the high concentration of cardiovascular modifiers (melatonin, catecholamine, etc.) accumulated while awake, which dissipate as body temperature drops during sleep and vagal dominance prevails. In children, these changes are also influence by age, size and gender. Our results suggest that there are significant differences in cardiac autonomic modulation through sleep between the sexes possibly arising from differences in circulation hormones.

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**Introduction:** Over the last years there has been great interest to establish a causal relationship between slow-wave sleep and overnight memory consolidation. Auditory stimulation locked to the slow wave (SW) up-phase (closed-loop auditory stimulation) is a novel promising approach to boost the consolidation of declarative memory. In addition to SW enhancement, closed-loop auditory stimulation increased theta and fast spindle activity, which might be important for subsequent stabilization of the reactivated memory. However, the neural underpinnings of theta and fast spindles enhancement following auditory stimulation and its temporal dynamics remains unclarified.

**Materials and methods:** High-density sleep EEG was collected for 4 right handed subjects (mean age 23.17 ± 2.71 years; three men) in three conditions carried out in different nights: (1) non-stimulation (baseline sleep, BS), closed-loop auditory stimulation in (2) the up-phase (up-STIM) or (3) the down-phase (down-STIM) of real-time detected SW. The data were pre-processed in 2.5 sec epochs and up-STIM/up-BS and down-STIM/down-BS conditions were contrasted in the theta (4-8 Hz) and fast spindles (13-15 Hz) frequency bands. Source localization was computed by dynamic imaging of coherent sources (DICS) based on the FEM head model. We compared STIM and BS epochs in sensor and source space (cluster-based correction), including a random subject effect.

**Results:** In the sensors space, we observed a significant enhancement for theta and fast spindle power (cluster corrected p < 0.05) for STIM vs BS. For both frequency bands, this effect was most prominent and persistent in the left fronto-central and right centro-parietal electrodes. While the generalized enhancement in theta power occurred from ~100 to ~800ms (e.g., left fronto-central electrode E29, main effect of Stimulation: F(1,3)=25.36, p=0.015, η²=0.894), the enhancement in fast spindles power occurred from ~800 to ~1500ms (e.g., E29, main effect of Stimulation: F(1,3)=37.64, p=0.009, η²=0.926).

Source estimates of the differences between the STIM and BS in the theta range revealed involvement of the left temporal lobe (Insula and Heschl´s gyrus) as well as the right frontal and right superior parietal lobule (cluster corrected p<0.01, 2-fold increase for up-STIM and 1.5-fold for down-STIM). A similar source pattern was identified for the fast spindle range, with the maximum located in the left temporal lobe extending to the left frontal gyrus (cluster corrected p<0.01, 2-fold increase for up-STIM and 1.5-fold for down-STIM).

**Conclusion:** Closed-loop auditory stimulation enhanced activity in theta and fast spindles bands and these changes seemed to be more pronounced when stimuli were locked to the up phase of SW. While theta and fast spindle enhancements showed a similar spatial distribution, they followed distinct temporal dynamics. This observation suggests the presence of different phases of the acoustically induced response, which arises from the same functional network. Regions recruited during the enhancement of theta and fast spindles largely overlap with the major connectional backbone of the cortex, which contributes to the default mode network.

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**Introduction:** Slow oscillations in the sleep EEG propagate across the scalp and are a marker of neuronal connectivity. In adults, this marker undergoes fluctuations during sleep, as shown by an across-night decrease of cortical involvement. For translating slow oscillation propagation patterns toward clinical pediatric use two crucial knowledge gaps remain:

1. Characterization of maturational changes throughout periods of rapid development and
2. Examination of across-night fluctuations in children.

**Materials and methods:** 29 healthy children (2-16y) underwent high-density EEG recordings (128 channels) during whole-night sleep scheduled to habitual bedtimes. Slow oscillatory propagation characteristics (i.e., distance, traveling speed, cortical involvement) were examined in five quintiles to assess across-night trajectories. In a subset of subjects (n=23, 2-13y) mcDESPOT-MRI was obtained to measure white matter myelin microstructure (myelin water fraction, MWF). Age was first included linearly and subsequently as a grouping variable for preschool-age (2.0-4.6y, n=11), school-age (5.1-8.9y, n=9) or young adolescence (9.0-16.4y, n=9). Linear mixed-effects models were used to assess across-night fluctuations, the effect of age and their interaction.

**Results:** With increasing age, slow oscillations propagated across longer distances (overall growth 0.2 cm/ year; \(R(21)=0.50, p<0.05\); age group effect \(p<0.05\)), while traveling speed and cortical involvement showed less pronounced maturation (\(p=\text{n.s. for correlation; age group effects} p=0.05\)). Cortical involvement (\(R(20)=0.44\) and slow oscillation speed (\(R(20)=-0.47\), both \(p<0.05\), corrected for age) were associated with intra-hemispheric MWF in the *superior longitudinal fascicle*, the largest anterior-posterior, white matter tract. Furthermore, slow oscillation distance was moderately associated with whole-brain (\(R(21)=0.46, p<0.05\) and inter-hemispheric *callosal MWF* (\(R(21)=0.54, p<0.01\), uncorrected). Across a night of sleep slow oscillation distance decreased by 11.9% in preschool-age children (Wilcoxon signed-rank test, \(p<0.05\)), but not in school-age children or adolescents. Cortical involvement decreased across sleep, regardless of age. No across-night changes were observed in slow oscillation speed.

**Conclusions:** We demonstrate maturational changes in slow oscillation propagation distance, as well as regional associations with white matter microstructure. Furthermore, signatures of brain connectivity undergo across-night fluctuations specific to maturational periods. The fluctuations in slow oscillation distance specific to preschool-age might be a marker for a period of heightened plasticity in underlying neuronal networks. Findings make an important contribution to quantifying natural fluctuations of the brain connectome during human development.

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Introduction: Research suggests an association between schizophrenia and a decrease in sleep spindle activity. Changes in sleep architecture are typically also present in schizophrenia and psychotic disorders. It is unknown how the continuum of psychotic symptoms relates to different features in sleep EEG. We set out to examine how sleep architecture and spindle activity are associated with schizotypal traits in a healthy adolescent population.

Materials and methods: Participants (n=176, 61% girls) came from a community-based cohort. Schizotypal traits were evaluated using The Schizotypal Personality Scale (STA) in early adolescence (mean age 12.3 years, SD=0.5) and the participants underwent ambulatory overnight polysomnography at mean age 16.9 years (SD=0.1). Sleep was scored in 30-sec epochs into stages 1, 2, 3, and rapid eye movement (REM) sleep. Spindles were detected using an automated algorithm. Spindle analyses from Central and Frontal derivations included spindle duration and density for slow (10-13 Hz) and fast (13-16 Hz) ranges. Covariates included sex and age.

Results: Regarding sleep stage portions, we found a difference in REM percentage according to STA tertile: those with highest scores had higher percentage of REM (B=2.07 [95% CI 0.17, 4.0]; p=0.03) than those with lowest scores. In sleep spindle analyses, we found a difference in duration: those with highest scores had shorter spindle duration as derived from the frontal regions, slow oscillation range (B=-0.04 [95% CI -0.07, -0.01]; p=0.023) than those with lowest scores.

Conclusions: High levels of schizotypy characteristics measured in early adolescence may associate with distinguished features of sleep architecture, namely with spindle morphology and higher proportion of REM sleep.
Background: Little is known about the structure of causes lowering cardiorespiratory fitness, a powerful predictor of mortality. Based on previous reports, we hypothesize that obesity, sedentary lifestyle, lung dysfunction, sleep disturbance, and the interactions among these variables would negatively affect cardiorespiratory fitness.

Methods: In this cross-sectional community cohort study of 521 male workers (46.6 ± 7.5 years of age), measures of anthropometry, pulmonary function, overnight sleep polysomnography, and an incremental cardiopulmonary exercise test were processed in a stepwise manner using Structural Equation Modeling (SEM).

Results: By first using a uni-variant correlation analysis, Obesity (body-mass index, waist-to-hip ratio), Non-regular Exercise, Impaired Lung Function (predicted values of forced expiratory volume in the first second, forced ventilatory capacity, maximal ventilatory volume, and lung diffusion capacity for carbon monoxide), Superficial Sleep (total sleep time, percentage of slow wave sleep, sleep efficiency) and sleep-disordered breathing (apnea-hypopnea index, lowest oxygen saturation, percentage of total period of oxygen saturation < 90%) were found as eligible latent variables (with corresponding manifest factors in parentheses) for Low Exercise Capacity. Advanced SEM analysis further produced a well-fitted final confirmatory model that group of Obesity (p< 0.001), Non-regular Exercise (p< 0.001), and Impaired Lung Function (p< 0.001) (these three latent variables have mutual interactions), as well as Superficial Sleep (p= 0.001) (independent latent variable not interact with other factors) cause Low Exercise Capacity. In contrast, sleep-disordered breathing was strongly correlated with Obesity (p< 0.001). Further, sleep-disordered breathing related to Low Exercise Capacity indirectly via (modulated by) Obesity.

Conclusions: Low exercise capacity may be directly caused by obesity, sedentary lifestyle, impaired lung function, and insomnia symptomology. Superficial sleep is a notable factor to associate with exercise capacity, as its effect is likely underestimated. Conversely, sleep-disordered breathing may indirectly link to low exercise capacity via Obesity.

Keywords: cardiorespiratory fitness, insomnia, lung function, physical activity
HEARTBEAT-RELATED ACTIVITY OF CORTICAL NEURONS IN THE SLEEP-WAKE CYCLE IN CATS

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Introduction: As it was proposed by the visceral theory of sleep (Pigarev, 2013), the brain cortical areas switch to the analysis of interoceptive information coming from various visceral organs during sleep. This theory was first confirmed in the studies of gastrointestinal tract, when cortical responses related to its activity were actually detected in visual cortical areas. In our previous study the heartbeat-evoked responses were found on EEG and local field potentials (LFPs) during sleep in fronto-parietal cortical areas of cats. The aim of this work was to investigate heartbeat-related activitation of single neurons in cortical areas in sleep-wake cycle.

Materials and methods: In two adult cats, LFP and neuronal activity were recorded with transcranial bipolar microelectrodes from fronto-parietal and insular cortical regions. Electrodes’ placement was selected according to pre-existing assumptions about the possible whereabouts of cortical areas related to the heart activity (Chernigovsky, Musyaschikova, 1973; Bykov, 1947). ECG was recorded from the electrodes located in the stomach and on the cat’s head. Additionally, general EEG, breath rhythm and eye movements were recorded, in order to divide sleep phases. The analysis included 2-5 hours records, with periods of wake, NREM and REM sleep. The processing and statistical analysis were made using Spike2 CED.

Results: In 20 records, we marked out over 140 single neurons. Heartbeat-related changes of neuronal firing were found in fronto-parietal area and insular cortex, both in right and left hemispheres. This connection between heartbeat and cardiac activity was predominantly observed during sleep but not during wakefulness.

Conclusions: The study shows that information related to cardiac activity reaches cerebral cortex during sleep indeed, as well as it was previously demonstrated for gastrointestinal activity. These results confirm the thesis that cerebral cortex becomes visceral-analyzing during sleep, and that the cortical activity in sleep works on the recondition of body functionality.

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Introduction: Brain function is modulated by circadian rhythmicity and this effect has been reported to differ between the sexes. Here we investigated whether multichannel EEG global field synchronisation (GFS), a measure of global cortical connectivity manifesting as phase synchronization between all derivations, is affected by circadian, sleep-dependent processes and sex. GFS reveals pronounced in-phase oscillations in REM sleep and has been previously used as indicator of cognitive decline or impairment in patients with dementia.

Materials and methods: In total 231 sleep periods of 34 young healthy men (N=16) and women (N=18) scheduled across the circadian cycle in a 10 day long forced desynchrony protocol were analysed with respect to global field synchronization across 12 EEG derivations separately for NREM and REM sleep.

Results: GFS presented two major peaks, one in the low delta (0.5-2 Hz) and one in the alpha-low sigma range (7.5-13 Hz), respectively, across all sleep stages and sleep episodes. The peak frequency of GFS in the broader alpha range was considerably slower in NREM sleep compared to REM sleep. At baseline GFS was higher in REM sleep than NREM sleep in all studied frequency ranges except the low delta (0.5-2 Hz), and fast sigma (13-15 Hz) bands. In these frequency bands synchronization was relatively high across all sleep stages, and this was observed in both men and women, with no major differences between the sexes. The vigilance state dependent differences in GFS persisted when participants slept at other than habitual circadian phases. In REM sleep, GFS was modulated by circadian phase in both sexes in particular in the 8-12 Hz range such that maximal GFS were observed during the wake-maintenance zone and the nadir 12 h later. In women the robust REM dependent circadian modulation of alpha extended to the sigma frequency range (11-15 Hz) whereas this effect was not observed in men. GFS in REM sleep was also affected by time asleep in all studied frequency bands except the delta and theta ranges (0.5-7.5 Hz) such that it diminished in the course of sleep. In N2 and SWS circadian modulation of GFS was not observed but prominent sleep-dependent reduction was observed across all studied frequency bands except the theta (4.5-7.5 Hz) and the sigma (11-15 Hz) bands, respectively.

Conclusions: These data demonstrate that the global brain neural connectivity as measured by GFS is modulated by circadian rhythmicity and sleep history in a frequency and vigilance state dependent manner with some differences between men and women.

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INFRASLOW OSCILLATIONS IN SIGMA AND SLEEP SPINDLE ACTIVITY IN HUMANS: EFFECT OF FREQUENCY AND TOPOGRAPHY

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Introduction: Brain activity is characterized by a multitude of time scales. Traditionally, the relevant time scales of brain activity range from tens of milliseconds up to hours (e.g. ultradian and circadian modulation). Phasic events such as sleep spindles, automatically introduce two intermediate characteristic time periods, that of the duration of a spindle (~1 sec) and their inter event interval (~15 sec). The latter is inversely proportional to the incidence and as such is known to be closely related to sigma activity. It has recently been reported in both mice and humans that activity in most frequency bands, but primarily in the sigma band, is modulated at a frequency of 0.02Hz (i.e. 20 mHz which corresponds to a period of 50 sec). This infraslow oscillation (ISO), most pronounced in the parietal region, is reported to be connected to memory consolidation and sleep fragility.

Materials and methods: Recordings from twelve EEG derivations from 231 sleep periods across the circadian cycle were analyzed for 34 young healthy men and women. We used two different approaches to quantify ISO. In the first approach we performed spectral analysis of the spectrogram focusing on the sigma band. In the second approach, we studied the temporal aspects of individually detected spindle events.

Results: We confirmed topographic dependence of the absolute infra spectrum, i.e., the ISO landscape was dominated by well-defined peaks positioned at infra frequencies in the 11-13mHz region and at sigma frequencies that increase along the fronto-occipital axis. When looking at the relative infra spectrum of the power density separately for all frequencies in the sigma band we observed an almost linear dependence of the infra-slow frequency on the sigma frequency, i.e., higher frequency sigma amplitudes oscillated at higher infra-slow rate. This effect was most apparent in the frontal and central brain regions. We also observed that sigma power undergoes a two component ISO. The evolution of both the peak frequency (position of the local maximum) and peak value (power density) exhibited clear periodicity. While the temporal structures of the infra activity showed extensive variations in time, across individuals and brain regions, there are strong indications that the multi-peaked infra spectrum might be due to periodic but nonharmonic oscillations in the sigma activity.

In the next step, we looked at spectral properties of the “spindle” signal. In the original signal only those short, 0.5-3 sec long, segments were considered - signal level taken as unity - where spindle activity was detected. In inter-spindle segments signal level was considered zero. The power spectrum of this square signal exhibited a peak at around 12mHz. The infra peak monotonously increased along the fronto-occipital axis.

Conclusion: Our analyses confirmed the existence of ISOs and their topographical dependence. In addition we found that the frequency of the ISOs span a rather wide interval from less than 10mHz to beyond 30mHz with a strong preference for the 11-15mHz region.

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THE EFFECTS OF ENERGY SUBSTITUTION DURING SLEEP DEPRIVATION ON THE FOLLOWING REBOUND SLEEP

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Introduction: Cholinergic basal forebrain (BF) neurons are implicated in cortical activation and the induction of recovery sleep (RS). The mechanisms participate in maintaining the homeostasis of these neurons may also be involved in the induction of RS. Wake (W) associated increase in the activity of these cells results in a subsequent decrease in activity which contributes to the induction of RS. It was speculated that the suppression of energy reserves in BF neurons due to the increased activity during W may be an important factor in this mechanism. To test this hypothesis we compensated the suppression of energy reserves by the administration energy sources, glucose (GLU), lactate (LAC) and pyruvate (PYR), locally into the BF during sleep deprivation (SD) and studied how this energy substitution influences the following RS.

Materials and methods: The experiments were carried out in 8 male Han-Wistar rats with implanted EEG/EMG electrodes and guide cannulae for microdialysis probes. On the baseline day, a microdialysis probe targeted into the BF was perfused (1µl/min) with artificial cerebrospinal fluid (CSF), on the following 3 SD days rats were sleep deprived for 3 h and during SD, the microdialysis probe was perfused with CSF or with a solution containing 20 mM GLU and 10 mM LAC or 20 mM GLU, 10 mM LAC and 20 mM PYR. The order of the SD days with various perfusions during SD varied in the different animals and there was minimum 1 day off between 2 SD days. Sleep was recorded for 24 h on the baseline and SD days.

Results: The GLU-LAC-PYR solution suppressed non-REM sleep (NREMS; SD-CSF: 121.6±2.7%, SD-GLU-LAC-PYR: 102.6±5.3% of the baseline day value) and resulted in a tendency to increase REM sleep (REMS) during RS. The GLU-LAC solution resulted only in a tendency to decrease NREMS and increase REMS.

Conclusions: Suppression of energy reserves in BF neurons during SD may contribute to the induction of the subsequent NREMS rebound.
Introduction: Before 2000 "The Yellow Emperor’s Classic of Internal Medicine" recorded "Courage Determining Judgment and Response", and in TCM theory, if this function is abnormal, it will cause disease. According to this, we can speculate that there is also a close relationship between insomnia and "Courage Determining Judgment and Response".

Materials and methods: On the basis of previous studies (including China and the international), our team explored the relationship between "Courage Determining Judgment and Response".

Results: Timidity can cause judgment aberration, and the aberration can make a miscalculate the threat. They will judge security situation as dangerous. In addition to sleep fear and anxiety, the patient will also take the sleep-related wrong behavioral response. The negative emotions make patients to be excited when they should be asleep, and are more sensitive. Improper behavior can weaken the conditioned stimulus of sleep. Not only that, the insomnia experience as a negative thing, each day is aggravating the patient’s fear. The patient’s decision disorder increases the uncertainty. Patients are more unable to determine the objectivity of their insomnia related judgment. Therefore, timidity is a key link in patients’ insomnia, judgment aberration is the direct factor. The main performance of judgment disorder which is caused by timidity is the subjective and objective does not conform to. This produce a series of negative emotion and improper behavior, and cause insomnia, continuous and aggravating, and become complicated and difficult to cure.

Conclusions: There is a close relationship between insomnia and "Courage Determining Judgment and Response". In spite of this, further research remains to be done.

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BIDIRECTIONAL AND CONTEXT-DEPENDENT CHANGES IN THETA AND GAMMA OSCILLATORY BRAIN ACTIVITY IN NORADRENERGIC CELL-SPECIFIC HCRTR1 KO MICE

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Introduction: Noradrenaline (NA) and hypocretins (Hcrt) and their cognate receptors modulate the electrical properties of brain circuits that dynamically sculpt wakefulness and define mnesic traces. Locus coeruleus NA cells (LC-NA) respond to salient environmental changes, and, through widespread NA release, ‘reset’ networks to mediate behavioral adaptation. Among other inputs, they receive dense projections from hypothalamic Hcrt neurons. The range of behaviors that the Hcrt-to-LC-NA neuronal connection implements, remains incompletely defined.

Materials and Methods: We generated a conditional KO allele of Hcrtr1 and used a Dbh-Cre transgene to create mice deficient in HCRTR1 in noradrenergic cell soma and nerve terminals (Hcrtr1^Dbh-CKO mice). Electrocortical activity (ECoG) of these mice was analyzed in distinct behavioral contexts and contrasted to Cre-less littermates.

Results: While baseline wake shows enhanced slow- Δ activity, exposure to a novel environment induced further ECoG slowing with increased Δ and inter-Δ/Θ band activity, blunting of the Θ rhythm and fast-γ power, while β/slow-γ activity increased. Under sleep deprivation (SD), locomotor and Θ-rhythm responses were markedly impaired. Surprisingly, while gentle handling and cage change (CC) induced similar ECoG deficits, late dark phase nest-building activity preceding sleep correlated with enhanced Θ and fast-γ power. Hence the Hcrt-to-NA cell connectivity may fine-tune arousal level, both up in alarming conditions, and down during hyperarousal. Finally, slow-wave-sleep following SD and CC both featured profound slow-Δ wave deficit, suggesting that Hcrt-to-NA signalling is critical to induce the homeostatic slow-Δ rebound characteristic of post-stress sleep.

Conclusion: Hcrtr1^Dbh-CKO mice show strain-specific deficits in adapting electrocortical activity to changing behavioral contexts.
ACCUMBAL DOPAMINE D₁ RECEPTOR NEURONS CONTROL WAKEFULNESS BY MIDBRAIN AND LATERAL HYPOTHALAMUS PATHWAYS

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Introduction: The nucleus accumbens (NAc) is the major component of the ventral striatum and has long been studied as a key structure in mediating a variety of neurobiological behaviors including motivation, reward, feeding, learning, and cognition. These higher brain functions operate based on wakefulness. However, whether the NAc is involved in modulating wakefulness remains to be elucidated.

Materials and methods: In the present study, in vivo fiber photometry was employed to investigate the activity of NAc dopamine D₁ receptor-expressing medium spiny neurons (D₁R-MSNs) during spontaneous wakefulness, NREM, and REM sleep using. Chemogenetic and optogenetic approaches to manipulate activity of NAc D₁R-MSNs with electroencephalogram (EEG)/electromyogram (EMG) recordings were used in freely behaving mice to investigate the necessity of NAc D₁R-MSNs in behavioral wakefulness under basal conditions. Channelrhodopsin-2 (ChR2) was combined with patch clamp to assess functional connectivity between NAc D₁R-MSNs and neurons in the midbrain in vitro, and electron microscopy was used to examine ultrastructure of synaptic contacts. To further compare the connections between NAc D₁R-MSNs and midbrain and lateral hypothalamus (LH) neurons, we combined retrograde tracing using injections of cholera-toxin subunit (CTB) into the ventral and dorsal striatum with optogenetic-assisted mapping.

Results: We provide direct evidence for arousal control of NAc D₁R-MSNs:

i) Using in vivo fiber photometry, we found arousal-dependent increases in population activity of NAc D₁R-MSNs.
ii) Optogenetic activation of NAc D₁R-MSNs induced immediate stage transitions from NREM sleep to wakefulness, and chemogenetic stimulation prolonged arousal, with a decrease in food intake.
iii) Patch-clamp, tracing, immunohistochemistry, and electron microscopy revealed that NAc D₁R-MSNs projected to the midbrain and lateral hypothalamus, while they preferably innervated and inhibited non-dopaminergic neurons in the midbrain.
iv) Photoactivation of terminals in the midbrain and lateral hypothalamus was sufficient to induce wakefulness.
v) Chemogenetic silencing of NAc D₁R-MSNs suppressed arousal.

Conclusions: We found that NAc D₁R-MSNs are essential in controlling wakefulness and are involved in physiological arousal via the LH and midbrain circuits.

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CURRENT STATE OF CLINICAL PRACTICE ON INSOMNIA AMONG KOREAN TRADITIONAL MEDICAL DOCTOR IN SOUTH KOREA

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Introduction: Insomnia is a prevalent and costly disorder and when left untreated, has may negative health consequences. Effective pharmacological and non-pharmacological treatments for insomnia are available, their effectiveness are limited due to adverse effects and difficulties to implement. Because of these limitations, insomnia patients have been interest in and using traditional medical remedies. In South Korea, Korean traditional medicine is legitimately recognized as conventional medicine in health care system, and has introduced specialist qualification since 2000 in eight subfields including neuropsychiatry. Many people with sleep disturbance in South Korea seek medical help from Korean traditional medical doctors (KMD). However, the studies are limited on how KMD managed insomnia in their medical practice setting and what the difference is between Korean traditional medical general practitioners (KMGP) and Korean traditional medical neuropsychiatry specialists (KMNS) with respect to care and management for insomnia. Therefore, the aim of this study was to explore how insomnia is currently diagnosed and treated in Korean medical care setting among two KMD groups.

Materials and methods: We distributed personally and emailed the questionnaire the 1017 KMGP registered members of the Pusan association of Korean Medicine. We also offered questionnaire via email to 165 KMNSs identified from The Korean Society of Oriental Neuropsychiatry. We collected response from 2nd of Nov. 2016 to 18th of Nov. 2016. 305 (30.00%) KMGP, and 53 (32.12%) KMNS responded. Comparisons between KMGP and KMNS were made by Chi-Square test.

Results: Of 358 KMDs, males were 74%, females were 26.0% and middle-aged 30-49 were 86.5%. Most of responders worked at their own clinic (74.6%), clinical career period was 10-20 years (42.7%), 5-10 years (25.4%). In number of patients coming to clinics to treat insomnia, most responded less than 10 patients per month (78.2%). The results of this study showed that there was no difference between KMNSs and KMGP in traditional Korean medical diagnosis insomnia. But, KMNSs had more diversity of methods to diagnose, evaluate and treat insomnia than KMGP. For evaluation, KMNSs used questionnaire, HRV, EEG more than KMGP. On treatment method, KMNSs used electroacupuncture, auricular acupuncture, manipulation (Chuna), herbal medicine (Health Insurance Coverage), herbal medicine, cupping therapy, meditation, aroma, psychotherapy, biofeedback more than KMGP. On percentage of treatment method, KMGP used acupuncture at higher rate than KMNS. On total treatment duration, there was no difference but the number of treatments per week of KMGP was higher than that of KMNS. On the patient educations, KMNSs performed sleep hygiene education more than KMGP.

Conclusions: Through this survey, we found out how insomnia is currently diagnosed and treated by KMD groups. Also we identified some difference between KMNSs and KMGP. More researches are required to explore the underlying reasons for these discrepancies among KMD and the way to improve the quality of Korean medical clinical practice on insomnia.

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ACTIVATION DURING SLEEP AND WAKING OF THE SUPRAMAMILLARY NUCLEUS-DENTATE GYRUS PATHWAY BY OPTOGENETIC INDUCES AN INCREASE IN THETA AND GAMMA POWER

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Introduction: Recent studies strongly support a role of the two states of sleep, slow wave (SWS) and paradoxical sleep (PS) in learning and memory consolidation. However, the mechanisms underlying the beneficial effect of both states of sleep in learning and memory have not yet been identified. To this aim, we recently identified at cellular level the populations of cortical neurons activated and displaying plasticity during PS hypersonmia by means of functional neuroanatomy. Such mapping clearly showed for the first time that only a small number of limbic structures are activated during PS in contrast to waking. Among them, the dentate gyrus (DG) is the only cortical region that display more activated neurons during PS hypersonmia than during waking (Renouard et al., 2015). Further, combining retrograde tracing, neurotoxic lesion and FOS immunostaining, we showed that neurons from the lateral part of the supramammillary nucleus (SuML) projecting to the DG, are responsible for the activation of DG granule cells during PS. These surprising results pointed out for the first time that the SuML/DG pathway activates DG granule cells specifically during PS.

Materials and methods: To further study this pathway, we transfected channelrhodopsin or Halorhodopsin in the glutamatergic neurons of the SumL in vGlut2Cre mice using Cre dependent AAVs. Control vGLUT2-Cre mice received the viral vector containing only the fluorescent reporter EYFP. Mice were implanted with EEG and EMG electrodes and a custom made optrode was placed unilaterally in the dorsal DG. Optical stimulations were applied at 20hz during 10s during waking, SWS and PS. The last day, the mice were stimulated 15 min and perfused 90 min later.

Results: Optogenetic stimulation during SWS but not PS induced waking in ChR2 but not in control mice. Optogenetic stimulations during SWS and waking induced an increase in muscle activity only in ChR2 mice. Stimulations during the three states induced a significant increase in the theta/delta power ratio and in gamma power in the DG LFP. Stimulation during PS induced an increase of the theta peak frequency. Stimulation before perfusion induced a strong and significant increase in the number of Fos-labeled neurons in the DG region ventral to optic fiber only in ChR2mice. Inhibition of DG fibers in mice using halorhodopsin induced no effect on the state of the animal nor on the LFP.

Conclusions: Our results indicate that the SumL/DG pathway increases theta power and frequency. Since our previous results indicate that the pathway is mainly active during PS, it suggests that it would be responsible for the increase in theta and gamma power occurring specifically in the DG during PS reported previously (Montgomery et al., 2008). Additional experiments are now necessary to determine the function of the activation of the SumL/DG during PS in particular with regard to learning and memory.
LASTING EFFECTS OF EARLY POSTNATAL USE OF CLOMIPRAMINE ON SLEEP-WAKEFULNESS CYCLE ARE AMELIORATED BY ICV MICROINJECTION OF OREXIN-A (HYPOCRETIN-1) AND OREXIN-B (HYPOCRETIN-2)

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Introduction: The main goal of present study was to consider hypothalamic Orexin (Hypocretin) producing neurons as the neurochemically identified cell population functional over-activation of which will contribute to the normalization of sleep-wakefulness disturbances produced in adult rats by their early postnatal exposure to Clomipramine. Pre-clinical studies have shown before that early postnatal exposure of rat pups to Clomipramine have lasting effects manifested in adult age in behavioral and sleep disturbances alike to disorders characteristic for major depressive disease (MDD). Effects of ICV Microinjection of OrexinA (Hypocretin-1) and OrexinB (Hypocretin-2) on sleep-wakefulness ultradian structure in rats with early postnatal exposure to Clomipramine were studied by us for the first time. Lasting effects of this procedure on CSF content of orexin-A in adult age rats was also examined in addition.

Materials and methods: Pups of wild white rats were subjected postnatally to subcutaneous injection of Clomipramine (20 mg/kg) two times daily during three weeks, at P7 until P28. Afterwards they were maintained in home cages under special care until adult age and then they were included in experimental groups (n=10 in each). Control group consisted from rats receiving postnatally Saline in the same dose and schedule as Clomipramine in experimental animals. Experiments were started in adult age, 8-12 weeks after the end of the Clomipramine and/or Saline injections. Surgery and implantation of stainless steel screws for EEG registration was made under general anesthesia. Three consecutive continuous (from 10:00 a.m. to 16:00 p.m.) baseline recordings of sleep wakefulness structure were made on each rats. Various doses of orexin-A was injected in the first experimental and orexin-B in the second experimental groups in the lateral ventricle by means of special cannulas and Hamilton Syringe. Microinjections started at 10 o’clock with immediate EEG registration of sleep-wakefulness structure from 10:00 a.m. to 16:00 p.m. Two consecutive recovery EEG recordings, with the same duration, were made thereafter.

CSF content of orexin-A was measured by the method of ELISA. Statistical processing was made by Student’s t-test.

Results: Early postnatal exposure of rat pups to Clomipramine leads to the reduction of the content of orexin-A in CSF and disturbances of sleep-wakefulness cycle structure in adult age. Non-REM sleep becomes fragmented and superficial. Number of awakenings from non-REM sleep raises considerably, incidence of delta waves in frequencies of 1-1.5 c/sec become lower. REM sleep latency becomes shorter than in controls and the number of REM sleep episodes during whole period of EEG registration rises significantly therefore total time of REM sleep increases due to increased REM sleep incidence. ICV microinjection of Orexin-A and/or orexin-B dose-dependently consolidates wakefulness and ameliorates described disturbances in REM sleep indices showing thereby significant antidepressant effect that is especially expressed after ICV microinjection of orexin-A.

Conclusions: Early postnatal use of Clomipramine leads to the reduction of CSF orexin-A in adult age. ICV Orexins significantly ameliorate lasting disturbing effects of early postnatal use of Clomipramine on sleep-wakefulness cycle.

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ON THE EFFECTS OF TWO VERSIONS OF SLOW WAVE SLEEP DEPRIVATION IN THE RELATION TO REM SLEEP

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Introduction: Although a number of interesting articles have been published about rapid eye movement (REM) -sleep regulation considering the results of total sleep deprivation or REM-sleep deprivation, the idea that REM-sleep propensity accumulates during waking or non-rapid eye movement sleep, slow wave sleep (SWS), in particular, is still debatable. This study was aimed to analyze the changes in sleep-wake architecture occurred during SWS deprivation and recovery periods.

Materials and methods: Mature cats (n=8) chronically implanted with electrodes in different brain structures were registered for 24-h baseline sleep-wake cycle following habituation to the recording environment. The animals then underwent different 24-hr SWS restriction conditions. In one experimental session (SD), four cats were awakened at the inception of first EEG signs of SWS through the using of sound stimuli or electrical stimulation of posterior hypothalamus. In second session (WSD), following forced SWS restriction, other four cats were not allowed to fall asleep for 8 min during which the active waking state was strongly maintained through the repeated stimulation if required. Each SWS deprivation session, SD or WSD, was followed by corresponding 24-hr recovery (R) period, RS or WR. The latency of sleep stages, duration and amount of individual episodes of sleep-wake cycle, and their percent ratio in sleep-wakefulness cycle were calculated in both SWS deprivation (SD and WSD) and post-deprivation (RS and WR) periods, and were compared with corresponding baseline data.

Results: The recordings of 24-hr sleep-wake cycle during two different sessions of SWS deprivation period showed that neither REM-sleep entrances nor any REM-sleep signs appeared in SD or WSD sessions. The number of forced awakenings required for the SWS restriction was less in WSD than in SD. The latency of SWS decreased significantly in SD than in WSD relative to the baseline. Total waking time increased but SWS decreased in both deprivation periods though considerable increase of waking state was observed in WSD session as compared to baseline data. The cessation of deprivation sessions was followed by SWS rebound in the RS or WR; however, an increase in SWS amount and intensity was more prominent in the RS, particularly in 6-8-hr post-deprivation sleep-wake cycle. The REM sleep latency decreased in RS whereas in WR it did not differ from baseline. The difference between WR and baseline concerning the frequency of rapid-eye-movements in REM-sleep episodes was not significant. REM-sleep rebound was more intense in RS. Although REM-sleep amount increased in WR, considerable alteration in REM-sleep quality and intensity was not identified relative to the baseline.

Conclusions: This study supports the opinion on the accumulation of REM-sleep propensity in SWS. Taking into account our previous and recent findings, we propose that waking state is able to prevent REM-sleep through the satisfaction the need for this unique sleep stage which we consider as 'intrinsic wakefulness'. It is suggested that defined SWS amount/intensity is needed for the REM-sleep appearance in the sleep-wakefulness cycle.

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THE RELATIONSHIP BETWEEN SLOW WAVE ACTIVITY INCREASE ACROSS ACUTE AND CHRONIC SLEEP LOSS AND VIGILANCE IMPAIRMENTS

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Introduction: Individuals vary in the extent of sleep loss induced deterioration of neurobehavioral functioning. Such individual vulnerabilities have been shown to be comparable across acute and chronic sleep loss paradigms. The homeostatic increase in slow wave activity (SWA) during initial parts of sleep reflects elevated sleep pressure in the sleep electroencephalogram (EEG). We aimed at assessing
1) whether there is an individual homeostatic response, as measured by a SWA increase, that is related across conditions of acute sleep deprivation (ASD) and chronic sleep restriction (CSR) and
2) whether such an individual homeostatic response in SWA is related to sleep loss induced deterioration of neurobehavioral functioning, such as vigilance.

Materials and methods: Nine healthy, male subjects (18 - 26 y) underwent 40 hours of ASD and 7 nights of CSR (5 hours in bed per night). We assessed SWA (1 - 4.5 Hz) during the initial SWA build-up period, i.e., up to the maximal level of SWA reached by each subject during the recovery night following ASD and following the 7 nights of CSR relative to a baseline night by high-density EEG (128 electrodes). Lapses of vigilance in the psychomotor vigilance task (PVT) were assessed during ASD and the last day of CSR relative to baseline. To control for multiple comparisons, we performed non-parametric statistical mapping (SnPM) with suprathreshold cluster testing.

Results: The increase of initial SWA was larger after ASD than CSR in all electrodes (mean over all electrodes: +38.48 ± 4.6%, P < 0.01, SnPM). In most electrodes we found the increase to be significantly related across the two conditions (average correlation coefficient across these 90 electrodes: 0.83 ± 0.02, P < 0.05, SnPM). In the majority of electrodes there was further a positive association between the increase in initial SWA and the increase in PVT lapses across both conditions together (average correlation coefficient across these 76 electrodes: 0.62 ± 0.02, cluster size: P < 0.05, SnPM).

Conclusions: The individual homeostatic response in SWA is related across conditions of ASD and CSR. This means that subjects who showed a relatively large increase in the acute sleep loss condition did so in the chronic too, while subjects with a relatively small increase in the acute sleep loss condition also showed a relatively small increase in the chronic condition. The association between the increase in SWA and neurobehavioral impairments across both conditions of sleep loss further suggests that the increase in SWA may serve as an electrophysiological marker for individual differences in cognitive function deterioration after sleep loss.

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EFFECTS OF BODY MASS INDEX ON SLEEP QUALITY AND SLEEP DISTURBANCES

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Introduction: The prevalence of overweight (BMI-25 to 29.9) and obesity (BMI above 30) has increased in recent years. There has been a change in sleeping patterns with the increase in overweight and obese population, but studies are limited.
In the present study we have looked in to sleep quality in overweight and obese subjects using Pittsburgh Sleep Quality Index (PSQI).

Materials and methods: The study included 230 college students from the age groups 18 to 24 years of which 59 were females and 172 were males (Mean ±SD: 18.86±1.23). The subjects were screened for major diseases and psychological problems. Subjects having sleep problems or known sleep disorder were excluded from the study. Obesity was determined by calculating the BMI. Obesity was graded as per WHO criteria. Sleep patterns, latency, duration, habitual sleep efficiency, sleep disturbances and daytime dysfunction was determined and assessed by using a standardized and validated questionnaire: PSQI.

Results: The data was analyzed using STATA (version 14.2) was used. To compare the phenomena of qualitative variables Chi Square test or Fisher exact test were used according to the distribution of data. It was found that 48 students belonged to overweight category with BMI ranging from 25 to 29.9. BMI over 30 are considered obese and 14 students belong to obese category. Among 48 overweight subjects 33 subjects score 1 sleep disturbances and 11 subjects score 2 sleep disturbances. Among obese subjects all 14 score 1 sleep disturbances. There was significant association observed between BMI and sleep disturbances with a p value of 0.001.

Conclusions: Trouble in sleeping and sleep disturbances were observed higher in overweight category (BMI -25 to 29.9) of subjects. Overweight and obesity can lead to sleep disturbances and it can lead to adverse health outcome. Maintenance of normal BMI as early as in youngadulthood may reduce sleep disturbances and improve sleep quality.

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NONRANDOMIZED INTERVENTION STUDY OF THE EFFECTIVENESS OF SLEEP DISTURBANCES DURING PREGNANCY TO IMPROVE SUBJECTIVE WELL-BEING INVENTORY (SUBI) AND QOL AMONGST JAPANESE PREGNANT WOMEN

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Introduction: Sleep disturbances are frequently during pregnancy. However, the support to prevent sleep disturbances for pregnant women in Japan is not found. The purpose of this study was to evaluate the efficacy of sleep disturbances during pregnancy in improving SUBI and QOL during the doing the delivery period.

Materials and Methods:
Design: Nonrandomized intervention study
Participants: The subjects were 46 females of pregnancy who had undergone pregnancy checkups in one obstetric hospital.
Interventions: A sleep program consists of offering the knowledge about the sleep to change by pregnancy, the sleep support of the gestation period, and the practice support from screening results of the sleep-disordered breathing (SDB). There was a pregnant woman with suspected sleep-disordered breathing from screening results to subjects, and it was connected to the practice support.
For SDB assessment, a pulse-oximeter was employed. Pulse-oximeter using a PMP-200GplusX pulse-oximeter, we calculated the peripheral arterial blood oxygen desaturation index (ODI) per hour during sleep at night by dividing the frequency at which the oxygen saturation did not reach the reference value by the duration of the examination.
The intervention effect of the sleep support was treated with SUBI and a questionnaire investigation of QOL.
Results: Of the 46 subjects, 3% ODI was less than 0.5 in 0, 0.5 to 4.9 in 25(54.3%), 5.0 to 14.9 in 16(34.8%), 15.0 to 29.9 in 4(8.7%), and more than 30 in 1(2.2%).
The outcome measures were WHO-SUBI and WHO-QOL26, and this was performed at baseline survey and posttest. Using a generalized estimation equation to baseline survey several confounding variables, the change in a mean environment of WHO-QOL26 was found to be higher in the post-test (P=0.014) than in the baseline survey.
Conclusions: By sleep support during pregnancy, there was an improvement of the quality of life. Therefore, in the self-care at home during pregnancy, the need of the sleep support was suggested. The SDB screening to a pregnant woman without a risk is necessary.

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Introduction: Parkinson's disease (PD) is the second most common neurodegenerative disease in the general population. The hallmarks of the disease include intracellular deposits of aggregated α-synuclein and a staggering loss of dopaminergic neurons in substantia nigra pars compacta. The disease manifests with motor and non-motor symptoms, including sleep-wake disturbances (SWD), which are common in PD patients, and often precede the onset of other symptoms. Some lines of evidence recently suggested that sleep deficits correlate with increased protein burden in neurodegenerative disease and that sleep might alleviate disease severity in animal models, which could prove beneficial in diseases with protein accumulation/aggregation as primary pathology, such as PD. Here, we investigated potential SWD in vesicular monoamine transporter 2 (VMAT2) deficient mouse model of PD and explored whether sleep modulation leading to changes in slow-wave energy has an effect on cortical counts of total and phosphorylated alpha-synuclein in this model.

Materials and methods: We conducted electroencephalogram/electromyogram (EEG/EMG) recordings in VMAT2 deficient (LO) mice (n=6) and wild type (WT) littermates (n=7) at age of 5 months. Afterwards, we investigated pharmacological sleep induction (SI) with sodium oxybate and chronic sleep restriction (SR) in a separate cohort of aged LO mice (14 mo, n=7/group) and its effect on total and phosphorylated synuclein counts in the cortex of these animals.

Results: Our results show that VMAT2 deficient animals present SWD and EEG changes similar to those seen in PD, namely: increased arousal and lower sleep efficiency. What is more, our results suggest that sleep induction with sodium oxybate and subsequent increase in slow-wave energy was associated with reduced synucleinopathy, as compared to the untreated (Placebo; PL) group. Moreover, chronic sleep restriction resulted in increased synuclein burden, suggesting a positive effect of sleep on synucleopathy in VMAT2 deficient mice.

Conclusions: Overall, our results suggest that VMAT2 deficient mice present increased arousal and reduced sleep efficiency and that reversing such sleep traits by pharmacological slow-wave sleep enhancement may have an alleviating effect on the alpha-synuclein pathology present in this murine model of PD.

Acknowledgements: We would like to thank SRS for help with project design and AB for help with treatment.
Introduction: Obstructive sleep apnea (OSA) is a common disease affecting 5-15% of the general population characterized by repetitive occlusions of upper airways during sleep followed by drops in hemoglobin saturation. Based on epidemiological and experimental studies, OSA might represent a causal factor in the development of Type 2 diabetes (T2DM), however, molecular and endocrine mechanisms linking insulin resistance, glucose intolerance and impaired insulin secretion to OSA remain unclear. Among the possible candidates, increased levels of circulating free fatty acids (FFA) was suggested. The aim this study was to investigate the effect of exposure to intermittent hypoxia (IH) on lipolysis in 3T3-L1 adipocytes and FFA uptake in L6 myotubes.

Materials and methods: 3T3-L1 differentiated preadipocytes and L6 myotubes were cultured and differentiated on a gas-permeable fluorocarbon cultureware (enabling exposure of adherent cell to desired levels of pericellular O2 levels) while being exposed for 14 (3T3L1) or 6 days (L6) to intermittent hypoxia (IH) consisting of 5 min alternating cycles 16% and 1% O2 in the pericellular space. Control experiment was performed by exposing cells to 16% O2 using identical setup and gas flow. Spontaneous lipolysis was determined by glycerol release into Krebs Ringer Bicarbonate buffer (with 10 mmol/L HEPES, 2% fatty acid free bovine serum albumin, 6 mmol/L glucose, pH 7.4) normalized to lipid content. FFA uptake in L6 cells was assessed using fluorescently labelled palmitate and normalized to protein content. The effect of 7-day treatment with 2mM metformin on FFA uptake in L6 myotubes was investigated.

Results: Exposure to IH augmented spontaneous lipolytic rate in 3T3-L1 cells by 210% (0.523 ± 0.336 versus 1.653 ± 0.421 umol glycerol/mg lipids/180min, p < 0.05) while fatty acid uptake in L6 cells was reduced by 10% (p < 0.05). Treatment with metformin further decreased FFA uptake in L6 cells by 21% and 17% in control and IH conditions, respectively (both p < 0.05).

Conclusions: OSA might contribute to T2DM development through elevated circulating FFA levels due to increased lipolysis in adipocytes and reduced FFA uptake in myocytes. These effects might be mediated by direct effects of hypoxia on cells. Metformin was unable to prevent the effects of IH.
LASTING EFFECTS OF EARLY POSTNATAL MALFUNCTIONING OF BRAIN MUSCARINIC CHOLINERGIC SYSTEM ARE AMELIORATED BY ICV MICROINJECTION OF OREXIN-A (HYPOCRETIN-1) AND OREXIN-B (HYPOCRETIN-2)

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Introduction: Study aims to answer the significant question - whether Orexin-containing neurons of posterior and perifornical hypothalamus are those cellular targets which can ameliorate sleep-wakefulness disorders in adult rats subjected during early postnatal development to the functional dysregulation of brain muscarinic cholinergic system (MChS). It was shown by us earlier that MChS malfunctioning in early postnatal period has lasting effects manifested in adult age in behavioral and sleep-wakefulness disturbances which are very similar to the disorders characteristic for major depressive disease.

Effects of ICV Microinjection of OrexinA (Hypocretin-1) and OrexinB (Hypocretin-2) on sleep-wakefulness ultradian structure in rats subjected postnatally to the functional dysregulation of MChS were studied by us for the first time. Lasting effects of early postnatal malfunctioning of MChS on CSF content of orexin-A in adult age was also examined for the first time.

Materials and methods: Experiments were carried out on wild white rats (n=10 in each group). MChS malfunctioning was produced by subcutaneous injection of Scopolamine (30 mg/kg) in rat pups two times daily during three weeks, at P7 until P28. Afterwards rat pups were maintained under special care until adult age. Control group consisted from rats receiving Saline in the same dose and schedule as Scopolamine in experimental animals. Experiments started 8-12 weeks after the end of the Scopolamine and/or Saline injections.

Surgery and implantation of stainless steel screws for EEG registration of sleep-wakefulness cycle was made under general anesthesia. Three consecutive continuous (from 10:00 a.m. to 16:00 p.m.) baseline recordings of sleep-wakefulness structure were made on each rats. Various doses of orexin-A was injected in the first experimental and orexin-B in the second experimental groups in the lateral ventricle by means of special cannulas. Microinjections started at 10 o’clock with immediate EEG registration of sleep-wakefulness structure from 10:00 a.m. to 16:00 p.m. Two consecutive recovery EEG recordings, with the same duration, were made thereafter. CSF content of orexin-A was measured by the method of ELISA. Statistical processing was made by Student’s t-test.

Results: Early postnatal malfunctioning of MChS leads to the significant reduction of orexin-A content in CSF and disturbances of sleep-wakefulness cycle structure in adult age. Slow wave sleep becomes fragmented and superficial. Number of awakenings raise considerably, incidence of delta waves in frequencies of 1-1.5 c/sec became very low. REM sleep latency becomes four times shorter and REM sleep incidence three times frequent than in controls. REM total time increases for two times due to increased REM sleep incidence. Elevation of ICV Orexin-A and/or orexin-B dose-dependently consolidates wakefulness and ameliorates described disturbances in REM sleep indices showing thereby significant antidepressant effect that is especially expressed after ICV microinjection of orexin-A.

Conclusion: Early postnatal malfunctioning of MChS leads to the significant reduction of CSF orexin-A in adult age. ICV Orexin-A significantly ameliorates lasting effects of MChS malfunctioning expressed in wakefulness and sleep disorders indicating to the possible involvement of orexinergic system in the pathogenesis of major depressive disease.

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SLEEP QUALITY AND SMALL-WORLD BRAIN FUNCTIONAL NETWORK IN HEALTHY ADULTS: A RESTING-STATE FUNCTIONAL MRI STUDY

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Introduction: Sleep disturbance, which relates to emotional and cognitive dysfunctions, is receiving greater attention as it is increasingly observed in the general population. Previous neuroimaging studies of sleep dysfunction have mostly focused on patients with sleep disorders or healthy individuals who were sleep deprived in experimental settings. However, little is known about the neural mechanisms related to sleep quality in the healthy population. Thus, the current cross-sectional neuroimaging study was aimed to investigate a relationship between sleep quality and topological properties of small-world brain functional network in healthy adults using graph theoretical analysis.

Materials and methods: The study participants include 104 healthy adults without any major medical illnesses including sleep disorders (54 male, 50 female, mean age 24.7 ± 4.3 years). Demographic and clinical data, as well as resting-state functional magnetic resonance images were acquired. The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate perceived sleep functioning including sleep quality. Sixty brain regions-of-interests including the frontal, temporal, and limbic areas were selected as nodes. Small-world brain functional network was constructed from functional connectivity between these nodes. Multiple linear regression analysis was used to examine correlations between global or nodal topological characteristics and the PSQI scores after adjusting for age and sex.

Results: The sleep quality scores of the PSQI showed a negative association with the mean degree (beta = -0.20, p=0.014). In terms of nodal parameters, the total scores of the PSQI revealed positive correlations with the node degrees in the frontal lobes, including the bilateral paracentral lobule (left beta = 0.30, p = 0.002; right beta = 0.31, p = 0.001), the right dorsolateral prefrontal cortex (beta = 0.23, p = 0.015), and the right supplementary motor area (beta = 0.22, p = 0.024). However, the node degrees in the limbic system, including the left amygdala (beta = -0.23, p = 0.013) and the bilateral hippocampus (left beta = -0.20, p = 0.039; right beta = -0.20, p = 0.035), were negatively associated with the total scores of the PSQI.

Conclusions: This study provides a clue for relationships between sleep quality and small-world brain functional network topology in healthy adults. Poor sleep quality was related to reduced global functional connectivity, strengthened nodal connectivity in the frontal areas, and weakened nodal connectivity in the limbic system. Our results may suggest possible links between sleep disturbance and altered network characteristics specifically in the frontal and limbic regions.

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INTRODUCTION: Previous studies have indicated that music can influence human emotions. However, the effect of music prior to napping remains unknown. The present study aimed to investigate the effect of listening to music on endocrine and autonomic nervous system activity prior to napping.

MATERIALS AND METHODS: Thirteen healthy men (age: 20-22 years) participated in a 2-day laboratory study, which consisted of the following:

1. a control condition, in which participants wore headphones without sound input (5 min) before taking a 20-min nap; and
2. a music condition, in which participants listened to music (4 min 30 s) before napping. Participants listened to music chosen for its ability to induce parasympathetic nervous system activity (Clair de Lune, Claude Achille Debussy) using the headphones. All naps were taken at 14:00 h. Participants engaged in computer tasks (Stroop Colour and Word Test) for 10 min before and 20 min after napping. Polysomnography (PSG) was performed during each nap period, and saliva samples were obtained pre-experiment, pre-nap, 0, 20, 30, and 40 min after awakening. Measures of subjective mood (Profile of Mood States) and sleepiness (Visual Analogue Scale) were obtained prior to the experiment and upon awakening.

RESULTS: PSG analysis revealed that the ratio of total sleep time (TST) was significantly higher in the music condition than in the control condition (p < 0.05). Stage 2 latency also tended to be shorter in the music than in the control condition (p < 0.10). DHEA concentration upon awakening (DAR) tended to be higher in the music than control condition (p < 0.10). Moreover, DAR was positively correlated with subjective quality of sleep, suggesting that DAR may be useful as an index of subjective sleep quality. Subjective sleepiness upon awakening was significantly greater (p < 0.01), while response times on computer tasks were significantly slower, in the music condition than in the control condition (p < 0.01-0.05).

CONCLUSIONS: Increased TST/DAR and decreased stage 2 latency in the music condition indicate that brief music stimulation resulted in the enhancement of parasympathetic nervous system activation. However, greater subjective sleepiness and blunted responsiveness were also observed after napping, indicating that participants experienced deeper sleep after listening to music. As this may have resulted in severe sleep inertia, future studies should aim to determine the appropriate nap time based on the conditions of the intervention.
**Introduction:** Studies performed at the macroscopic level indicate a breakdown in cortical effective connectivity during NREM sleep [1]. Far less is known about the neuron-level mechanisms behind this phenomenon. Moreover, recent studies challenge the notion that neuronal communication is homogeneously modulated during NREM sleep (e.g. [2,3]). Here we aimed to understand how information flow between single neurons is modulated across behavioral states as a function of anatomical and functional factors.

**Materials and methods:** Tetrode recordings were simultaneously performed in primary visual and somatosensory cortex, perirhinal cortex and hippocampus of freely moving rats, during both sleep and performance of a sensory discrimination task in a figure-8 maze [2]. Transfer entropy (TE) [4] was computed, separately for active and quiet wakefulness and NREM sleep, between firing rate patterns of neuronal pairs at short and long time scales (STE and LTE, respectively): 2-10 ms (in the range of direct mono/polysynaptic interactions) and 600-900 ms (indicative of firing rate modulations [2]).

**Results:** In line with the expected breakdown of effective connectivity [1], we found fewer yet stronger significant LTE values during NREM sleep. Conversely, an opposite pattern was found for STE. While brain-state dependent changes in LTE were not different for pairs of neurons located in the same or in different brain areas, STE values for within-area neuronal pairs were significantly higher than for inter-areal ones. This result could be expected by taking into account the higher density and strength of local compared to long-range anatomical connections. Conversely, the proportion of significant STE values (comparable during active wakefulness) diverged in NREM sleep for intra- vs. inter-area connections, with the latter significantly increasing and the former decreasing. We next wondered whether functional specialization (i.e., whether the activity of a neuron was modulated or not during task performance) influenced information flows during NREM sleep. During active behavior, LTE showed many weak connections between task-modulated neurons, and few (yet stronger) ones between non-task-modulated cells. Remarkably, during NREM sleep we observed an increase in the strength and proportion of significant LTE values between non-modulated neurons, especially for inter-area connections, while information flow between modulated neurons became sparser. Conversely, during NREM sleep we observed a prominent increase in the inter-areal proportion of significant STE values for task-modulated neurons.

**Conclusions:** These results challenge our understanding of how neurons exchanges information during NREM sleep. Results at long time scales match the expected breakdown in effective connectivity previously reported for NREM sleep, but suggest that this is primarily due to task-modulated neurons. This functionally-specialized group of neurons, conversely, remains interconnected during NREM sleep at short time scales, especially for long-range connections. Overall, we show that distinct communicative architectures coexist in the brain at different time scales, and that functional specialization is a crucial determinant of neuronal dynamics during NREM sleep.

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**References:**
Introduction: Recently there has been a great increase in research investigating how brain works during sleep. In particular, the quantity and variety of methods applied in sleep research contributes a lot to the neuroscience literature. One of the investigation techniques used in sleep research is Bispectral Index System (BIS). Since BIS has a high time resolution and has an electroencephalography domain, it has a wide use potential in sleep research. In this study, it was aimed to investigate the brain responsiveness components to non-painful tactile stimuli during sleep in adults via BIS. The brain responsiveness to evoked potential for non-painful tactile stimuli was investigated during all night sleep according to BIS values. As far as we know, this is the first study investigating brain’s evoked potentials of non-painful tactile stimuli during sleep via BIS.

Materials and methods: 15 volunteers (7 male, mean age±SD: 22.02±1.32 years) participated in this study. A 40 channel electroencephalography (EEG) recording system, embedded interactive stimulation unit, pneumatic stimuli unit (Somatosensory Stimulus Generator 4-D Neuroimaging) and BIS monitoring system was used for recordings. Non-painful tactile stimuli research design was used and 140 kPa pressurized non-painful tactile stimuli was applied to volunteers' right index and middle finger during all night. Randomized stimuli was delivered to volunteers' fingers. The responses of evoked potentials for non-painful tactile stimuli in response to high and low BIS values (60 BIS score was set as threshold) were evaluated in this research. Brain responsiveness components for CZ electrode, prioritized for somatosensory responses, were investigated.

Results: P50, N100, P200, N300, P450, N550, P900 and N_late responses were observed for evoked potentials of non-tactile stimuli applied to right hand in both high and low values of BIS. P50 components' amplitude 0.95±0.67 µV, N100 components' amplitude 0.33±0.87 µV, P200 components' amplitude 1.14±0.81 µV, N300 components' amplitude -3.03±1.60 µV, P450 components' amplitude 1.28±1.22 µV, N550 components' amplitude -0.14±0.64 µV, P900 components' amplitude 1.39±0.94 µV, and N_late components' amplitude -1.49±0.83 µV was measured respectively in High BIS values, where P50 components' amplitude 0.62±0.80 µV, N100 components' amplitude -0.44±1.11 µV, P200 components' amplitude 1.35±1.27 µV, N300 components' amplitude -4.83±2.47 µV, P450 components' amplitude 2.39±1.74 µV, N550 components' amplitude 0.89±1.32 µV, P900 components' amplitude 2.82±1.86 µV, and N_late components' amplitude -2.98±1.61 µV was measured respectively in Low BIS values.

The amplitudes for components to N300, P450, P900 and N_late was found statically higher in low BIS values in comparison to high BIS values.

Conclusions: In this research, sleep processes were investigated in two different stages. Under the light of the obtained results, it was considered that BIS and brain responsiveness can be used as a method that can enlighten the sleep processes and it can be concluded that, our approach can be used as a clarifying method in further sleep research. Since our method is objective and user friendly, it can be used in clinic research as well. In further studies we plan to use this system in investigating micro sleep stages.
Introduction: Activation of subcortical structures, including components of the reticular activating system, has been shown to induce wakefulness and reverse the traits associated with anesthesia. These findings are consistent with the understanding of behavioral arousal as a bottom-up/subcortical-to-cortical phenomenon. However, the role of cortical processes in regulating behavioral arousal is not fully understood and is a subject of current debate. Prefrontal cortex is reciprocally connected with wake-promoting nuclei and increases in local noradrenergic or cholinergic tone have been shown to correlate with behavioral arousal. Therefore, we hypothesized that cholinergic and noradrenergic activation of prefrontal cortex would be sufficient to induce wakefulness and reverse the state of sevoflurane-induced unconsciousness, as defined by the loss of righting reflex.

Methods: Sprague-Dawley rats (male, 300-350g) were surgically instrumented with screw electrodes to record electroencephalogram from frontal, parietal, and occipital cortices. In addition, a microdialysis guide cannula was implanted in the prelimbic region of prefrontal cortex for reverse dialysis delivery of either carbachol (N=11, 5mM) or noradrenaline (N=11, 20mM), and simultaneous collection of microdialysis samples for measurement of changes in local acetylcholine levels. A custom-made air-tight clear round chamber was used for electroencephalographic recordings and microdialysis delivery/sample collection before, during, and after sevoflurane anesthesia (1.9-2.4 %). The changes in acetylcholine levels were quantified using high performance liquid chromatography and mass spectrometry. A pulse oximetry system was used for recording the heart and breath rate before and after carbachol or noradrenaline delivery into the prefrontal cortex under the state of anesthesia.

Results: Reverse dialysis delivery of carbachol into prefrontal cortex produced signs of behavioral arousal (limb, torso, and tail movements) in all rats and four out of eleven rats were able to regain righting reflex with complete mobility while under continuous sevoflurane anesthesia. Carbachol-induced behavioral arousal was accompanied by a profound increase (~26 fold increase compared to sevoflurane, p=0.0001) in local acetylcholine levels. By contrast, noradrenaline in prefrontal cortex did not produce any signs of behavioral arousal and produced only a moderate increase (~2 fold increase compared to sevoflurane, p=0.0002) in local acetylcholine levels. Both carbachol and noradrenaline produced electroencephalographic activation and increase in respiration rate: mean breath rate increased from 63 to 113 breaths per minute for the carbachol group (p=0.002) and from 66 to 94 breaths per minute for the noradrenaline (p=0.003) group. Carbachol also produced an increase in heart rate from 336 to 372 beats per minute (p=0.04).

Conclusion: These results suggest that cholinergic mechanisms in rat prefrontal cortex can play a causal role in behavioral arousal and that cholinergic stimulation of prefrontal cortex is sufficient to reverse the state of anesthetic-induced unconsciousness.

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A PATH TOWARDS BRAIN REJUVENATION: THE EFFECT OF CHRONIC PHYSICAL ACTIVITY ON EEG SLOW-WAVE ACTIVITY IN MICE

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Introduction: Physical activity is beneficial for health. It has been shown to improve brain functioning and cognition, reduce severity of mood disorders as well as promote healthy sleep and healthy aging. We recently found that aged mice have increased absolute electroencephalogram (EEG) slow-wave activity (SWA, EEG power density between 0.75-4.0 Hz) during non-rapid eye movement (NREM) sleep compared to young controls, suggesting changes in brain connectivity in the course of aging.

Materials and methods: To investigate whether exercise can counteract this aging effect, we provided mice of three different ages with running wheels for 1-3 months (6-months old, n=9; 18-months old, n=9; 24-months old, n=8) that were compared with control sedentary mice (n=11, n=8 and n=6, respectively). All animals with a wheel used the wheel daily. One week before the sleep recordings, the wheel was removed. We recorded the EEG and electromyogram during undisturbed 24-h baseline and during and after a 6-h sleep-deprivation.

Results: Increased waking and decreased NREM sleep was found in the first part of the BL dark period in young mice provided with a running wheel compared to controls, (t-tests, p< 0.05 after significant ANOVAs) whereas no differences in the amount of NREM sleep were found in the aged groups. Interestingly, NREM sleep SWA showed a strong increase across age groups and a strong decrease with wheel availability within the age groups. The lowest SWA levels were observed in the young mice that had a wheel (126 µV²/Hz) and the highest in the old mice without a wheel (227 µV²/Hz, p< 0.0001).

Conclusions: Therefore, although we found only a modest effect on sleep architecture in aged mice provided with a wheel, SWA was markedly reduced when a wheel was used daily. The data suggest that moderate regular exercise in aging can alter cortical brain connectivity towards a younger state.
MELANIN-CONCENTRATING HORMONE (MCH) IN THE MEDIAN RAPHE NUCLEUS: FIBERS, RECEPTORS AND CELLULAR EFFECTS

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Introduction: Hypothalamic neurons that utilize melanin-concentrating hormone (MCH) as a neuromodulator project to several regions of the central nervous system including the median raphe nucleus (MnR). The serotonergic neurons of the MnR and the MCH-containing neurons have been involved in the control of REM sleep and mood; in fact, microinjections of MCH into the MnR promote a depressive-like state.

Materials and methods: In the present study we examined in rats and cats the anatomical relationship between the MCH-containing fibers and the MnR neurons, as well as the presence of MCHergic receptors in these neurons. In addition, by means of in vivo unit recording in urethane anesthetized rats we analyzed the effect on MnR neuronal firing of intracerebroventricular (i.c.v.) and juxtacellular administration of MCH, as well as the effect of juxtacellular injection of MCHR-1 antagonist ATC0175.

Results: Our results showed that MCH-containing fibers are present either in the central and paramedian regions of the MnR. MCHergic fibers were in close apposition to serotonergic and non-serotonergic neurons. By means of an indirect approach, we also analyzed the presence of MCHergic receptors; we microinjected MCH conjugated with the fluorophore rhodamine (R-MCH) into the lateral ventricle and R-MCH was internalized into serotonergic and non-serotonergic MnR neurons. Some of these neurons resulted to be GABAergic. We determined that i.c.v. microinjection of MCH results in a significant decrease in the firing rate of 53% of the MnR neurons, while juxtacellular administration of MCH reduced the discharge in 65% of these neurons. Finally, the juxtacellular administration of ATC0175 increased the firing rate in approximately 70% of the MnR neurons. These anatomical and functional data provide strong evidence that MCH reduces the activity of the MnR neurons. Guided by these data, we hypothesized that the MCHergic modulation of the MnR neuronal activity, may be involved in the promotion of REM sleep and in the pathophysiology of depressive disorders.

Conclusions: Our anatomical and functional studies demonstrated that the MCHergic system regulates the activity of the MnR neurons; the main effect is to reduce the neuronal firing rate, including the activity of presumed serotonergic neurons. This inhibitory effect may contribute to the generation and maintenance of REM sleep as well as to the physiopatology of depression if there is an imbalance of the MCHergic system.

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Introduction: In the past, the suppression of the pineal hormone melatonin depending on timing, intensity and wavelength of the applied light has been investigated in several studies, frequently using small samples and only male subjects. Whereas the nocturnal melatonin production is thought to decrease with age, our knowledge about the extent of the light-induced melatonin suppression depending on sex and age is only limited. Our study addressed this issue in more details.

Materials and methods: Subjects for this study were pre-screened for the onset of melatonin production in the evening hours. In total, 92 healthy subjects without medical treatment or sleep disorders (40 men/52 women), aged between 18 and 72 years, were enrolled. All of them had a regular sleep-wake schedule and normal Ostberg-Horne-Östberg morningness-eveningness questionnaire scores (42 and 80). They completed 4 evening laboratory sessions (19:00 - 23:00 h) predominantly in a weekly interval. The light protocol for each session consisted of a 2-h dim light (< 20 lux) condition (20:00 - 22:00 h) followed by 1h light exposure (22:00 - 23:00h). Light was administered using a sphere illuminated with polychromatic LED (color temperature of 2883 K) at 4 different irradiances corresponding to 200, 500, 750 and 1000 lux. Blood samples for the measurement of plasma melatonin were taken at baseline, after 1h and 2h in the dim-light condition and in the interval of 20 min after starting the light exposure.

Results: After 2h of dim-light condition all study participants showed an increase in melatonin production versus baseline of different magnitude. One hour of warm-white light at 500 lx (0.264 W/m²) caused very variable suppression of melatonin with a maximum of 60.6%. In about 19% of the men and 15% of the women, no suppression during the 2h dim-light was observed. The average melatonin suppression over all subjects was about 37% with sex related differences in the frequency of strong suppression. The impact of age on the magnitude of melatonin suppression was found to be different between men and women. Whereas in men with age up to 50 years an increase in suppression seems to be possible, in women no clear relation to age was found.

Conclusions: The obvious individual variability in the sensitivity of melatonin production for artificial light in the evening with possible sex and age related differences could be a critical factor in our understanding of light effects on well-being, vitality, alertness, sleepiness and mood in the working environment of humans.
ULTRA-SLOW (0.0002 HZ) FLUCTUATIONS IN HUMAN INTRACRANIAL RECORDINGS CORRELATE WITH SLEEP CYCLES

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Introduction: Neural activity is organized in rhythms at multiple temporal scales, from the circadian to the ultra-fast oscillations. While the electroencephalography commonly records oscillations in the range of 0.1 to 100 Hz, the presence of very slow fluctuations has been difficult to assess due to the widespread use of hard-pass filters.

Materials and methods: Recordings were acquired with a full-band amplifier in intracranial electrodes implanted for clinical mapping of the epileptogenic zone in patients with intractable epilepsy, continuously over the course of a few days. We measured the difference in DC potentials between neighboring channels belonging to depth electrodes in prefrontal and temporal cortices. This setup prevents the potential confound that our findings are affected by changes in skin conductance that have limited previous DC studies.

Results: We report, for the first time to our knowledge, the existence of fluctuations with a period of 1-2 hours in the human brain. The ultra-slow oscillations were of an amplitude in the order of mV, which is considerably larger than previously reported brain rhythms, and were present during both wakefulness and sleep. Crucially, the cycle of the ultra-slow fluctuations was correlated with the sleep cycle, especially at the beginning of the night. This observation was confirmed by the cross-frequency coupling which was present exclusively during sleep: the phase of the ultra-slow fluctuations entrained the power in the slow wave band (~1 Hz).

Conclusions: This work shows that the human brain generates ultra-slow fluctuations of very large amplitude in the order of 1-2 hours. These ultra-slow fluctuations synchronize the sleep cycle and their phase might indicate the propensity to fall asleep. We speculate that these fluctuations represent a potential correlate of the Basic Rest-Activity Cycle (BRAC), a putative rhythm that organizes the level of vigilance during wakefulness and the sleep cycle during sleep.

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SEEKING A NEW STANDARD: A NOVEL CHARACTERIZATION OF SLEEP SPINDLES THROUGH TIME-FREQUENCY PEAK ANALYSIS

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Introduction: Sleep spindles, a prominent feature visible in the electroencephalogram (EEG) non-REM sleep, are typically defined as transient oscillatory waveforms between 11-16Hz. Accurate identification of spindles is valuable, not only to the identification of the stages of healthy sleep, but also to the characterization of disorders, such as schizophrenia, in which spindle activity and morphology is altered. Neurophysiologically, spindles are thalamocortical oscillations initiated in the thalamic reticular nucleus (TRN). However, because spindle waveforms cannot be definitively linked to these oscillations using EEG alone, spindle detection lacks a ground truth. Instead, the “gold standard” is subjective visual identification by an expert, known to have high inter-scorer variability. Furthermore, automated spindle classifiers are typically optimized based on this expert scoring rather than on a principled analysis of the data. It is thus crucial to develop methods for establishing an objective, data-centric spindle definition, which would greatly facilitate our understanding of sleep dynamics as well as provide biomarkers of disease.

Materials and methods: We develop a novel approach based on the observation that transient oscillatory waveform activity will appear as salient peaks in the time-frequency domain. We use the EEG spectrogram topography to identify all salient time-frequency peaks, the properties of which form the basis of a new feature-space. By analyzing the feature distributions of all identified peaks and those of peaks corresponding to scored spindles, we can develop statistical models, which estimate the probability that any given peak is a spindle. We can also characterize and quantify the inter-scorer/method consistency, as well as adherence to any defined standard.

We applied this approach to a dataset of expert-scored polysomnogram segments to evaluate inter-scorer differences. We also analyzed the feature distributions of all time-frequency peaks, specifically identifying peaks with similar properties to those of expert-scored spindles.

Results: We performed an analysis comparing spindles in the time-domain with their associated time-frequency peaks, which illustrated that clear time-frequency peaks consistent with spindle activity can be obfuscated in the time-domain, and that broadband background activity can falsely appear spindle-like in the time-domain. We then analyzed the feature distributions of peaks corresponding to the spindles scored by each expert. Despite the frequent disagreement between scorers, few feature distributions had significant differences. Individual models of spindles were then created using the peak-feature distributions for each expert, and were used to identify all the peaks statistically similar those selected by the experts. This method identified many more spindle-like peaks than were scored by the experts, yet the inter-scorer variability was significantly decreased.

Conclusions: The results suggest that while there may be large disparity in spindle count, there can still be strong inter-scorer agreement in the properties of the oscillations selected. This is likely due to the difficulties of subjective visual scoring in the time-domain. By moving to an objective analysis of time-frequency peak properties, we establish a data-centric, statistically-principled framework for rigorous quantitative analysis of transient neural activity, which lays the foundation further experimental work linking subcortical activity with EEG observations.

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AN OBJECTIVE DESCRIPTION OF SLEEP: TRACKING CONTINUOUS OSCILLATION DYNAMICS IN THE SLEEP EEG

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Introduction: Sleep is a dynamic, continuous process in every physiological and behavioral system studied thus far. The ability to accurately describe these dynamics is therefore essential to understanding the way in which healthy and pathological brain activity evolves during sleep. Current clinical staging, however, discretizes the continuum of sleep into 30-second epochs through subjectively visual inspection. By representing sleep as a coarsely discretized progression of stages, vital information on the neurophysiological dynamics is lost, and we are unable to properly account for activity that does not fit into a single stage definition. Given the high variability of the sleep EEG, the inability to accurately quantify oscillatory dynamics severely limits our capacity to characterize and phenotype both natural and pathological states.

Fortunately, recent studies have shown that by using principled, time-frequency spectral analysis methods, such as multitaper spectral estimation, the rich dynamics of the sleep electroencephalogram (EEG) are vividly characterized at multiple time scales. These studies have also highlighted why spectral analysis based on canonical frequency bands (e.g. delta, alpha) are prone to “spectral bleeding,” as an oscillation may not always fall within a band or unrelated oscillations may enter. We therefore must seek methods to objectively describe sleep in terms of continuously evolving EEG oscillations, without reliance on subjective stages or fixed frequency bands.

Materials and methods: We develop a novel quantitative approach, which automatically tracks the properties of the different sleep EEG oscillations (e.g. slow, delta, sigma) throughout the night. In doing so, we can objectively describe sleep in terms of the continuous dynamics of multiple, simultaneously-occurring neural oscillations, rather than in terms of discrete, subjective stages.

This statistically-principled approach leverages the fact that the sleep EEG power spectrum is made up of contributions from different oscillations, which appear as peaks in the spectrum at any given time. We fit a parametric model to the spectrum, which characterizes each oscillation peak in terms of its instantaneous frequency, power, and bandwidth. The model then tracks these properties across time, accounting for noise. This allows us to isolate the different oscillations within of sleep EEG spectrogram, which we can analyze separately, without the confounding influence of other oscillations or background activity, or together, in terms of their joint dynamics.

Results: We applied this method to multitaper spectrograms of human sleep EEG. We explicitly modeled the slow, delta, alpha, and sigma oscillations, as well as 60Hz noise and the background activity. The method accurately estimated the time-varying properties of each constituent oscillation, providing a simple continuous parameterization of the complex, dynamic neural activity during sleep. The power estimates for a given oscillation were also able to provide a more accurate estimate of oscillation power than a simple bandpass filter, which is easily corrupted by spectral bleeding.

Conclusions: By characterizing the continuous dynamics of sleep EEG oscillations, we provide a pathway towards an objective, statistically-principled characterization of brain dynamics during sleep, which is essential to characterizing the vast heterogeneity observed across both healthy and pathological populations.

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Introduction: Despite this worldwide problem, sleep in conflict-affected populations subjected to forced
displacement has received little attention. The prevalence of sleep problems and associated psycho-behavioral
difficulties in Internally Displaced (ID) Children are not well studied. The aim of this study was to examine sleep
and psycho-behavioral variables in Georgian Internally Displaced Children and population-based control (non-ID
children).

Materials and methods: 161 children (10.85±0.9) from ID families, escaped from Shida Kartli, Georgia, in
2008, and 161 non-ID children (10.94±0.9) were studied after 7 years of displacement. Children completed Pre-
Sleep Arousal Scale (PSAS), Buss-Perry Aggression Questionnaire (BPAQ), Children's Depression Inventory (CDI)
and Child Trauma Screening Questionnaire (CTSQ); In addition, children's appraisal of family environment have
been assessed with questions specifically designed for this study. Parents reported socio-demographic
information, children's academic excellence, and completed Sleep Disturbance Scale for Children (SDSC), Beck
Depression Inventory (BDI) and Perceived Stress Scale (PSS). Data were analyzed with SPSS21.

Results: Compared with the control group ID children had a lower level of academic excellence and family
environment (p< 0.01) and a higher scores in all SDCS dimensions then controls with the significant difference
for breathing (p< 0.001), hyperhidrosis and SDCS total scores (p< 0.05). Surprisingly, cognitive pre-sleep
arousal was significantly higher in non-ID children (14.58±4.9 vs 16.9±6.13), while there was no difference
between groups in somatic pre-sleep arousal level (14.17±4.43 vs 14.16±4.74). Similarly, all BPAQ component
scores, as well as a total Aggression score, were higher in ID children, but the difference was significant only in
Physical Aggression (p=0.008). Groups did not differ on sleep duration, time occupied by the social networks,
multi media, and/or computer games, CDI and CTSQ scores, although the difference for CDI approached
significance (p=0.057). In addition, mean scores for BDI and PSS were significantly higher in ID parents. Multiple
regression analyses showed that both cognitive and somatic pre-sleep arousal predicted SDCS total score in non-
ID children while cognitive but not somatic arousal was significant predictor in ID children. In separate models,
family environment, CDI and CTSQ (p=0.055) predicted cognitive pre-sleep arousal in ID group. In non-ID
groups CTSQ, aggression, CDI and age were significant predictors.

Conclusions: Sleep and psycho-behavioral variables showed more similarities between groups than expected.
These results suggest that recovery power of children plays a significant role in coping with displacement
associated difficulties. However, the impact of family environment on cognitive aspects of sleep disturbances in
displaced children warrants more attention for their protection.

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Foundation, Georgian Research and Development Foundation # A60770
Introduction: To analyse possible RF-EMF effects on the physiologically measured macrostructure of sleep. Based on the observation that in some individuals GSM 900 MHz (Global System for Mobile Communications) and to a lesser extent also WCDMA/UMTS (Wideband Code Division Multiple Access/Universal Mobile Telecommunications System) exposure leads to a consistent increase in REM sleep in a sample of young male healthy volunteers (Danker-Hopfe et al. 2016) the present study investigates whether similar effects can also be observed with TETRA exposure in young healthy males and with GSM 900 MHz and TETRA (Terrestrial Trunked Radio) exposure in elderly women.

Materials and methods: In three double-blind, randomized, sham-controlled cross-over studies effects of different RF-EMF exposures on sleep were investigated in two samples of young healthy male volunteers (20-30 years) and in one sample of elderly healthy female volunteers (60-80 years; each sample n=30). Exposure was delivered by a head worn antennas, which had been specifically designed for the projects. An adaptation night, which served as screening night for sleep disorders and as an adjustment night to the laboratory environment, was followed by nine study nights in the laboratory (three nights per condition), in which subjects were exposed to three different exposure conditions (SHAM, and two verum exposures) in an individually randomized order. Polysomnography was performed (assessment and evaluation) according to the AASM standard. All nights were scored according to the standard rules and all three nights/condition and subject were used in the analysis of nine individual verum exposure/SHAM comparisons per subject.

Results: The percentage of subjects showing significant variations with exposure as compared to sham in at least one sleep variable varied from 68.8% in healthy young men under TETRA 6.0 W/kg exposure to 96.7% in elderly women also under TETRA 6.0 W/kg exposure. The average number of sleep variables, which showed a significant individual difference between sham and exposure varied from 1.5 in young men (TETRA 6.0W/kg) to 2.8 in elderly women (again TETRA 6.0 W/kg). While in young males stage R sleep tended to be consistently higher in individuals, in which REM sleep was affected at all (see also Danker-Hopfe et al 2016), this trend could not be observed in elderly females. At the individual level elderly females tended to have slightly more deep sleep (stage N3) under RF-EMF exposure.

Conclusions: The data underline that at the individual level there are differences in sleep parameters and that there are differences between young men and elderly women. Whether these effects are gender and/or age related will be answered when the data of a study in elderly men, which is still ongoing, are available. Anyhow, all observed effects are not indicative of a disturbed sleep under RF-EMF exposure.

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EFFECT OF AMBIENT TEMPERATURE ON REM SLEEP AND CATAPLEXY-LIKE EVENTS IN HYPOCRETIN KNOCKOUT MICE

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Introduction: It is well established that Ta warming toward the high end of the thermoneutral zone increases REM sleep across species, whereas Ta cooling decreases REM. The LH plays a major role in behavioral state transitions from non-rapid eye movement (NREM) sleep to either REM sleep or wakefulness. We hypothesized that Hcrt cell loss within the hypothalamus would preferentially increase REM sleep expression during ambient temperature (Ta) warming. The goal of this study was to examine the effects of Hcrt cell loss on REM sleep expression during Ta warming in a mouse model of narcolepsy. Materials and methods: Hypocretin knockout (Hcrt-/-) mice and wild type (WT) littermates (Hcrt+/+) for the control group, were used for the experiment. The mice were implanted for electroencephalographic (EEG) and electromyographic (EMG) recordings to monitor sleep-wake states and housed in a 12:12 h light-dark cycle (7:00-19:00 h). After one week of recovery, the animals were attached with EEG-EMG recording cables and were housed in a temperature-controlled cabinet in their home cages at 23.0 ± 1.0 C with food and water available ad libitum. After another week of habituation, control recordings were performed, followed by habituation to bouts of ambient temperature (Ta) warming according to a temperature protocol. During the light period at two hour intervals (9:00, 11:00, 13:00 and 15:00 h), four bouts of rapid Ta warming to a maximum of 31.7 C were achieved for 30 minutes in the thermostatically controlled cabinet. After at least one week at constant Ta of 23.0 ± 1.0 C, the bouts of temperature warming were performed again during the night (21:00, 23:00, 1:00 and 3:00 h) using the same protocol.

Results: WT mice show significantly higher REM sleep durations during the Ta warming condition as expected and significantly increased compared to the Hcrt-/- mice (p=0.02). Indeed, Hcrt-/- mice showed no significant increases in REM sleep durations in response to Ta warming. Mean NREM sleep duration appeared unaffected by Ta condition in both WT and Hcrt-/- mice. Interestingly, Hcrt-/- mice showed a dissociation between REM sleep and cataplexy events when Ta warming was presented during the night. The peaks of REM events appeared during the temperature warming, whereas the cataplexy events were expressed during the cooling phases.

Conclusions: Contrary to our initial hypothesis, Hcrt-/- mice appeared unable to increase REM sleep expression during ambient temperature (Ta) warming compared to WT (Hcrt+/+) littermate controls. Moreover, a dissociation of REM sleep and cataplexy appeared with increased REM sleep during the warming phases and cataplexy during the cooling phases. Although the anterior hypothalamus is known to contain warm sensitive neurons thought to play a role in sleep expression, these data implicate the lateral hypothalamus hypocretin system in REM sleep expression during ambient temperature warming. The dissociation between REM sleep and cataplexy in hypocretin knockout mice was an unexpected finding and requires further investigation.

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ULTRADIAN RHYTHMICITY IN SLEEP-WAKEFULNESS IS COLOUR-RELATED IN NESTLING BARN OWLS

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Introduction: The possession of a rhythm is usually described as an important adaptation to the regular changing environmental conditions like the dark-light cycle. However, recent studies suggest plasticity in the expression of a rhythm depending on life-history and environmental factors. Barn owl (Tyto alba) nestlings show variation in behaviour and physiology in relation to the size of black feather spots, a trait associated with many behavioural and physiological phenotypes including the circadian expression of corticosterone and the regulation of body mass. This raises the possibility that individual spottiness could be associated with rhythmicity in sleep-wakefulness states.

Materials and methods: We studied sleep in 108 barn owl nestlings (age 27-49 days, 77 nestlings were cross-fostered, 59 broods) in the field using subcutaneous EEG electrodes and a 3D accelerometer attached to a data logger placed on the head (Neurologger 2, www.vyssotski.ch/neurologger2). Bipolar recordings from each hemisphere were recorded at 200 Hz. A 24-hour baseline period was scored for wakefulness, non-REM and REM sleep using 4 s epochs by a scorer blind to all other variables. Time spent in each state calculated for each 5 min period were then analyzed for the intensity of rhythmicity and the period length (τ, tau) of sleep-wakefulness by performing autocorrelations and maximum entropy spectral analyses. The maximal spectral density of the periodograms produced by fast Fourier transformations relates to the variance explained by a single frequency and is a measure of rhythmicity in time series. We used 24h-periods to determine ultradian rhythmicity in each individual. The mean diameter of eumelanin-based black spots on the tip of feathers was measured and used in statistical analyses. The data was collected between May to October 2011 and 2012. We performed linear mixed models to investigate the potential association between rhythmicity and plumage spottiness, with year and the nest of origin as random variables.

Results: Owlets showed ultradian rhythms in sleep-wakefulness with a period length of 4.5 to 4.9 h. The period length of wakefulness and non-REM sleep was shorter in heavily compared to lightly spotted female nestlings, whereas in males the opposite result was found. Furthermore, male and female nestlings displaying small black spots showed strong rhythmicity levels in wakefulness and REM sleep.

Conclusions: Nestling with small black spots might have an advantage in a stable environment with predictable periodic changes in light, temperature or social interactions. Heavily spotted nestlings displayed weak rhythms in wakefulness and REM sleep, which might enable them to be more flexible in reactions to unexpected events like predation or it might be a mechanism to save energy. These results are consistent with previous findings showing that large-spotted nestlings switch more frequently between wakefulness and sleep, resulting in higher levels of vigilance compared to small-spotted conspecifics. Thus, nestlings with larger black feather spots might differently handle the trade-off between wakefulness and sleep, attention and social interactions compared to nestlings with smaller black spots.

Acknowledgements: The research was supported by the Swiss National Science Foundation and the Max Planck Society.
Introduction: Hcrt or orexin neurons are located in the lateral hypothalamus. They have established roles in the regulation of normal vigilance states and also feeding behavior, addiction, reward and stress. Their expression is dysregulated in the brain of narcolepsy patients which results from loss of these cells causing excessive daytime sleepiness and cataplexy. How these neurons are involved in multiple functions and how they function as physiological integrators remain unknown.

Material and methods: The hypothalami of E18 pups from orexin-Cre mice were dissociated and FACS sorted by a method developed in the lab which amplifies the mCherry signal only in the Hcrt cells. RNA sequencing was performed to compare transcriptome content of Hcrt cells with the rest of the hypothalamus. Immune, in situ hybridization and qPCR were used for data validation and in depth analysis.

Results: we have identified 340 genes significantly expressed in Hcrt cells compared to the rest of hypothalamus with fold changes from 2 to 100. Gene ontology analysis identified gene sets with molecular functions involved in different activities like transport, binding, receptor, signal transducer and translation regulation. Thrh gene, which is the top hit in the list with 112 fold change has already been shown to mediate the interaction between Hcrt and thyrotrophin systems. We have identified several transcription factors including Tbx3, Six6, Prrx1 and peg3, for which their role in the biology of Hcrt cells is under investigation. Immunostaining analysis for co-localization of Hcrt with significantly regulated genes identified molecules that play a role in the immune system such as Tlr2 gene. We have also identified molecules which are not co-localized with Hcrt cells but are highly downregulated in Hcrt-ataxin mice among which Qrfp that also showed CD4 reactivity in narcolepsy patients.

Conclusion: We have found specific set of molecules expressed in Hcrt cells which might explain the multi functionality of these cell types and their profound effect in the development of narcolepsy.
THE RELATION WITH A SLEEP GENE AND THE LIFE GENE. ON GENETIC INTERACTION BY THE SYSTEMS BIOLOGICAL ANALYSIS

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Introduction: Quality and the pattern of the sleep are changed remarkably by the aging and stress for inside and outside body. In mammals, the hypothalamus functions as the higher center of aging, the life control. Sirtuin gene (SIRT1) of the dorsomedial hypothalamic nucleus in particular plays an important role. SIRT1 was a dorsomedial nucleus-specific, and, through the gene which emerged, it was found that controlled quality of the sleep without giving change of sleep construction. This result suggests that the molecular mechanism that was common in a hypothalamus controls a physiologic change with quality and the aging of the sleep. It is expected that it is with a key investigating the possibility that it becomes the physiologic factor that sleep prescribes aging to elucidate the physiologic importance of such a hypothalamus at a molecular level. However, it has many difficult points to check the molecular physiologic function in the brain, and there are many parts that it is unknown in a process reaching the genetic expression.

Materials and methods: We arrested genetic essence by analyzing it from relations with the sleep, in addition, examined a factor to influence quality of extension and the sleep by healthy life expectancy for biological life. In this study, We considered a signal transduction system in a gene about sleep between associated cell line. In these examination, we analyzed it using system biological technique, used Cell Designer for analysis and built a model expressed by a differential equation to express biochemistry and a gene adjustment network and made a biological pass way model and arrested the relation with sleep gene and life gene.

Results: We showed an extremely complicated connection when caught the intergenic action that it was thought that was concerned with the rhythm formation of the sleep. In addition, we knew that prices of the pass decreased than the course where a gene affected when considered the action of the factors such as various hormones started from the hypothalamus.

Conclusions: Including circadian rhythm, It is known to arrest all genes fluctuating at a transcription level by microarray analysis in the study that a gene about rhythm formation fluctuates at a transcription level. It is said that there is a gene identified for the formation of the circadian rhythm by this top-down approach more than 1000. Even if there is the element necessary to bring about a period in this, other things "will be genes receiving control" by engine (core regulators) of the period (regulated genes). It is difficult to completely have life in its hand by receiving a specific disease and an additive at table, an allergen, a drug, stress in a surviving process. In addition, it is thought about adversely affecting a sleep in sending a social life. However, the present days, it becomes an important problem for the country which increase healthy life expectancy in life. Sleeping is very important as a function to reset internal fatigue and stress, and it will be necessary in future to improve quality of sleep.
SLEEP CHANGES IN THE MODEL OF PRECLINICAL-STAGE PARKINSON'S DISEASE IN ADULT AND AGED RATS

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Introduction: Sleep disorders are the non-motor symptoms of Parkinson's disease which are observed in the majority of PD patients [French, Muthusamy, 2016]. PD is considered to be incurable principally because its clinical diagnosis rests on motor symptoms which only manifest at the late stages [Braak et al., 2003; Ugrumov et al., 2011]. Therefore, it is crucial to identify the preclinical signs of PD in the appropriate animal models. Since ageing is the main risk factor for PD development, age-related features of PD modelling should also be determined. Here we apply an experimental model of preclinical stage of PD based on lactacystin [Pastukhov et al., 2013; Ekimova et al., 2016] in order to identify sleep changes associated with the early stage of PD development in adult and aged rats.

Materials and methods: Lactacystin was administered intranasally to male Wistar rats aged 7-8 month (adult) or 19-20 month (aged) twice with a week interval. Respective controls received phosphate buffer solution. Using telemetry system (DSI, USA), polysomnographic recordings were performed continuously for 24 hours in freely moving animals by 13, 14, 20, and 21 days after the first administration of lactacystin. Statistical significance accessed by ANOVA following by Tukey HSD test was considered to be present when p< 0.05.

Results: In control conditions aged rats compared to the adults exhibited an increase in drowsiness during the day and a decrease in wakefulness during the dark (active), phase of day. While slow-wave sleep moderately increased during the active phase, REM sleep decreased during the light (inactive) phase of day. In both adult and aged rats at the lactacystin-induced preclinical stage of PD, an increase in the total time and episode duration of drowsiness during the day was found. In adult rats, this was accompanied by a slight decrease in slow-wave sleep during the light phase of day.

Conclusions: In rats, ageing caused the prevalence of drowsiness in the sleep-wake cycle coupled with a decrease of wakefulness during the active phase of day. The model of preclinical stage of PD was characterised by more profound increase of drowsiness: the most pronounced difference was found between aged rats received lactacystin and adult controls. The changes were consistent with those observed in humans with PD and might be regarded as an excessive daytime sleepiness. Unlike the decrease of REM sleep which was associated with ageing rather than with PD development, increasing drowsiness can be considered as a sign of progressing neurodegeneration at early stages of PD.

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Introduction: Sleep disorders are common and associated with multiple metabolic and psychological derangements. Obstructive sleep apnoea (OSA) is among the most common sleep disorders and an inter-relationship between OSA, insulin resistance, obesity, type 2 diabetes (T2DM) and cardiovascular diseases has been established. Prevalence of sleep disorders in Kenyans, particularly in individuals with T2DM is unknown. We thus aimed to determine prevalence of poor quality of sleep (QOS) and high risk for OSA, among persons with T2DM and determine their associations with socio-demographic and anthropometric variables.

Materials and methods: Utilising a Cross-Sectional Descriptive design, QOS and risk for OSA were determined in a randomly selected sample of patients with T2DM (cases) and an age and sex matched comparison group. The validated Pittsburgh Sleep Quality Index (PSQI) and Berlin Questionnaire (BQ) were used to measure QOS and risk for OSA respectively. Associations between poor QOS, high risk for OSA, and socio-demographic and anthropometric variables in cases were evaluated.

Results: From 245 randomly selected persons with T2DM attending outpatient clinics, aged over 18 years, 22 were excluded due to ineligibility thus 223 were included in the analysis; 53.8% were females, mean age was 56.8 (SD 12.2) years and mean BMI was 28.8 kg/m² (SD 4.4). Among them, 119 (53%, CI 95% 46.5-60.2) had poor QOS and 99 (44% CI 95% 37.8-50.9) were at high risk for OSA. Among 112 individuals in comparison group, 33 (29.5%, CI 95% 20.9-38.3) had poor QOS and 9 (8%, CI 95% 3.3-13.4) had high risk for OSA. Cases had a significantly higher probability for poor QOS [OR 2.76 (95% CI 1.7-4.4)] and high risk for OSA [OR 9.1 (95% CI 4.4-19.0)]. Higher waist circumference was independently associated with a high risk for OSA in cases.

Conclusions: We demonstrate a high burden of sleep disturbances in patients with T2DM. Our findings may have implications for clinicians to screen for sleep disorders when assessing patients with T2DM and warranting further attention by practitioners and researchers in this field.

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Sleep inertia is a transitional state of lowered arousal (most of it fading in approximately 30 min) occurring immediately after awakening from sleep and producing a temporary decrement in subsequent performances (Tassi & Muzet 2000, Trotti 2016). The cerebral correlates of sleep inertia have been poorly investigated and are therefore still unclear (Balkin et al. 2002, Marzano et al. 2011). In order to progress in our understanding of sleep inertia we performed a combined EEG-fMRI study to measure sleep inertia both at the behavioral and at the neurophysiological level. 

Methods. A total of 55 participants were included in this study. After a partial sleep deprivation (subjects were allowed to sleep from 5 to 8 am), subjects took a max 45 min nap in the scanner in the early afternoon (1.30-2 pm). They were awakened in N2 sleep (n=14) or N3 sleep (n=20) and measures of sleep inertia / functional connectivity were done before the nap, 5 min and approximately 25 min after awakening. All the eyes open resting states scans were followed by a 2 minutes descending subtraction task (DST). 

Results. Preliminary results show a stage-specific pattern of disrupted functional connectivity, including regions of the default mode and attentional networks.
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Introduction: The two hypocretin (orexin) neuropeptides (abbreviated as ‘Hcrt’) have potent neuromodulatory activity in a variety of neural circuits important for motivated and survival behaviors. They are critical to maintain the stability of behavioral states, although the mechanisms underlying this, and symptoms that emerge in their absence in narcolepsy, are not well understood.

Materials and methods: To tackle the circuits mediating these effects, we performed a detailed analysis of the electrocorticogram (ECoG) of Hcrt-KO mice. Furthermore we generated conditional KO (cKO, ‘floxed’) alleles of the Hcrtr1 and 2 receptor genes and selectively inactivated Hcrt receptors expressed in Noradrenergic (NA) and Dopaminergic (DA) cells by crossing floxed mice with, respectively, Dbh-Cre transgenic and Dat-ires-Cre KI mice.

Results: While Hcrt-KO mice respond to 6-h sleep-deprivation (SD) with a powerful slow-wave-sleep (SWS) ECoG δ oscillatory rebound as WT littermates, spontaneous waking fails to induce a SWS δ power reflecting prior wake duration. This correlates with impaired θ (6.0-9.5 Hz) and fast-γ (55-80 Hz) activity in spontaneous wakefulness. We algorithmically identified a theta-dominated-waking substate (TDW) underlying motivated behaviors, and typically preceding cataplexy in Hcrt-KO mice. KO mice fully implement TDW when waking is enforced, but spontaneous TDW expression is greatly impaired, due mainly to reduced TDW bout duration. A reformulation of the classic sleep homeostasis model, where homeostatic pressure rises exclusively in TDW, rather than in all waking, efficiently predicts δ power dynamics both in KO and WT mice, baseline and recovery SWS. The low homeostatic weight of KO mice' spontaneous waking correlates with decreased cortical expression of neuronal activity-related genes (Bdnf, Egr1/Zif268 and Per2).

Oscillatory activity of NA cell-specific Hcrtr1 cKO (Hcrtr1 Dbh-CKO) mice was examined in distinct behavioral paradigms. While baseline waking ECoG was almost normal, exposure to stress-associated contexts led to increasing spectral alterations, with a slowing of the ECoG, blunting of the θ rhythm and fast-γ activity. Conversely, enhanced arousal during self-motivated goal-driven behaviors showed increased θ/fast-γ power. Stress-associated waking, moreover, led to alterations in SWS quality, with a selective deficit in the slow-δ oscillatory component. Mice lacking the type 2 Hcrt receptor (Hcrtr2) in DA cells (Hcrtr2 Dat-CKO mice), on the other hand, were found to display very different electrocorticographic alterations, with, surprisingly, a baseline wakefulness highly enriched in the TDW substate, with a robust θ rhythm that was uncharacteristically uncoupled from locomotor activity.

Conclusions: Spontaneous TDW stability relies on Hcrt to sustain θ/fast-γ network activity and associated neuronal plasticity, while other arousal circuits sustain TDW during SD. Hence TDW identifies an activity mode which is regulated by context-dependent neuromodulators, and acts as major driver of sleep homeostasis. Hcrt loss causes impaired TDW maintenance in baseline waking, and blunted δ power in SWS, reproducing respectively, narcolepsy excessive daytime sleepiness, and poor sleep quality. Hcrtr1 Dbh-CKO mice and Hcrtr2 Dat-CKO mice show strain-specific deficits in adapting electrocortical activity to changing behavioral contexts. Hcrtr1 Dbh-CKO mice demonstrate the role of Hcrt-to-NA signaling in building an appropriate θ/fast-γ response in stress-associated environments, but also conditions in which Hcrt-to-NA signaling may serve to curb hyperarousal.

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MEASURING SLEEP BY MAGNETOENCEPHALOGRAPHY (MEG) AND POLYSOMNOGRAPHY: RESULTS OF A MEG-EEG COUPLING ANALYSIS

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Introduction: Non-REM sleep, especially deep sleep, is characterized by a synchronized EEG activity, mostly due to thalamocortical circuits. In general, the EEG measures the electric activity of the brain caused by ionic currents of the neurons. At least two electrodes are required to record EEG activity as it measures electrical potential differences between different electrodes (active electrode and reference electrode). The scoring of sleep requires furthermore an electrooculogram and electromyogram. The gold standard for investigating sleep and associated events is the polysomnography (PSG). In contrast to the EEG, the magnetoencephalogram (MEG) is not measuring the electrical activity but the magnetic field. It shows a higher spatial resolution due to the fact, that the magnetic field drops off very rapidly with distance and furthermore, the MEG does not require a reference channel. For these reasons, the magnetic field is strongest in the vicinity of a brain source and a MEG patterns corresponds roughly to anatomical location.

Materials and methods: A MEG laboratory consists of a magnetically shielded room as MEG requires very low ambient magnetic fields in the range of nano Tesla. We investigated 10 healthy sleeping persons during the night simultaneously with 125-chanel-MEG and PSG and the recorded signals were stored in the EDF+ format and imported into clinical PSG scoring software for offline sleep analysis.

Results: Pilot data verified the operability of this PSG setup without interfering with the MEG. Afterwards a MEG-EEG coupling analysis was performed.

Conclusions: To our knowledge this is the first study investigating sleep by a combined PSG-MEG recording and the results help to understand regional brain activity during sleep.
EXPLORING SLEEP STABILITY IN LONG TERM VIPASSANA MEDITATORS AND CONTROLS USING EVENT RELATED POTENTIALS AND TRANSCRANIAL ALTERNATING CURRENT STIMULATION DURING SLEEP

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Introduction: Long-term meditation is believed to improve many parameters of sleep. However, one or two whole-night polysomnographic recording(s) only allow a correlational evaluation on sleep architecture. To causally evaluate sleep stability among meditators, we are examining the changes in brain oscillatory pattern during sleep, following auditory stimulation (event related potentials or ERPs) as well as following transcranial alternating current stimulation (tACS).

Materials and methods: The participants included Vipassana meditators of different meditation proficiency and matched controls. They are part of a large study with 4-night polysomnography evaluation. First night is the baseline sleep, second night is for auditory ERP, and third and fourth nights are for tACS intervention. Electroencephalogram (EEG) from 24 scalp sites were collected using an EEG cap during the polysomnography. 1000Hz pure tone, presented every 10s throughout the sleep, was used for auditory ERP. Short bursts of tACS stimulation was given either at delta frequency during stable non-rapid eye movement (NREM) sleep or at gamma frequency during stable REM sleep, both using bilateral fronto-temporal electrodes on separate nights. Bootstrap statistics was used to compare the pre-stimulus power-spectral changes with that of post-stimulus period within each subject, for the standard frequency bands from all electrodes.

Results: We present our interim findings based on the data of few participants. Auditory ERPs were associated with event related synchronization in theta frequency, which decreased with sleep depth. In general, delta-tACS during NREM sleep produced more alteration in higher frequency bands (theta, alpha and beta), whereas gamma-tACS during REM sleep produced more changes in lower frequency bands (delta and theta). Despite individual variations, meditators showed distinct patterns of sleep stability during both ERP as well as tACS study.

Conclusions: This study would provide a wealth of data showing the stability of brain networks during sleep, evolved as part of meditation proficiency.

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**Introduction:** Several links between sleep and thermoregulation have been well established. Earlier total sleep deprivation (TSD) studies show an initial increase in waking body temperature ($T_b$) followed by a greater decrease as deprivation progressed. Hypothalamic temperature ($T_{th}$) showed a more prolonged initial rise and a smaller late decline than waking body temperature ($T_b$). However, simultaneous changes of hypothalamic temperature ($T_{th}$), cortical temperature ($T_{cort}$) and body temperature ($T_b$) during sleep deprivation (SD) and during recovery is lacking in literature.

**Materials and methods:** Our study was conducted on adult male Wistar rats ($n=10$) with chronically implanted electrodes for EEG, EOG and EMG for recording sleep parameters. $T_b$ was measured by a pre-implanted intraperitoneal radio transmitter (TA10TAF-40, DSI USA). $T_{th}$ and $T_{cort}$ were measured by Fluke thermometers through implanted thermocouples near the hypothalamus and the cortex respectively. $T_b$, $T_{th}$ and $T_{cort}$ were recorded simultaneously in sleep wakefulness and in sleep deprivation and during recovery after 24h sleep deprivation. Gentle handling was used to induce 12h sleep deprivation in rats. To study on recovery period, disk-over-water method was used to induce 24h total sleep deprivation.

**Results:** The $T_{th}$, $T_{cort}$ and $T_b$ showed an increase during 12 h total sleep deprivation, while during recovery period after 24 h TSD, initial 5 h showed an increased temperature, followed by a decrease in subsequent 7 hours.

**Conclusions:** During SD and recovery period $T_b$ were almost maintained, $T_{cort}$ showed slight variation but the $T_{th}$ showed an increase by 0.4 to 0.7 C than $T_{cort}$ and body $T_b$.

**Acknowledgements:** This study was supported by the Indian Council of Medical Research (ICMR) and All India Institute of Medical sciences (AIIMS), New Delhi, India.
Introduction: Molecular and electrophysiological studies suggest that sleep ensures efficient functioning of the brain by maintaining synaptic homeostasis. Changes in the glutamate receptor α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor (AMPA receptor) function is a key mechanism of synaptic plasticity and it was shown that AMPA receptors in the rat brain are high during wakefulness and low after sleep. Further animal studies have shown that glutamate (GLU) levels are reduced during NREM sleep and reduced GLU was positively correlated with levels of sleep slow wave activity (SWA), suggesting that SWA is essential to keep GLU in a homeostatic range.

The first goal of our study was to specifically assess if proton magnetic resonance spectroscopy (1H-MRS), a non-invasive method to investigate biochemical changes in the human brain, is sensitive enough to measure changes in GLU across the sleep wake cycle in healthy young adults. Secondly, we wanted to investigate if potential overnight changes in GLU are related to changes in SWA.

Materials and methods: MRS spectra of 16 healthy young subjects (6 female, 21.3 ± 2.2 years) were measured in a voxel (20 × 20 × 20 mm³) located in the left parietal lobe at two time points using a 3 T MRI scanner. The first scan was performed in the evening about two hours before a night of sleep, the second scan was performed in the subsequent morning, about two hours after sleep. The night between the scans was recorded with high-density (128 electrodes) EEG. Metabolite concentrations were quantified as ratios to creatine with LC Model. Additionally, concentrations were corrected for partial volume contamination of cerebrospinal fluid (CSF). In order to relate potential overnight changes in GLU to SWA, the decrease of SWA during NREM sleep in the course of the night was calculated as percentage reduction from the sleep cycle with maximal SWA to the last sleep cycle.

Results: Comparison of evening and morning metabolite concentrations (after Holm-Bonferroni correction) revealed significant overnight reductions in Glutamate (6.9± 1.6 %, p=.005) and Glutamate + Glutamine (GLX, 7.1 ± 1.6 %, p=.004). No other metabolites showed changes from evening to morning (e.g. N-acetylaspartate or glycerophosphocholine). Further, the reduction in GLX was positively correlated with the mean SWA decrease over all electrodes (r=0.6, p=0.02, Pearson correlation).

Conclusions: Our results show that quantification of changes in brain metabolites across the sleep wake cycle in the human brain is possible by means of 1H-MRS. Similar to animal studies, we found a positive relation between changes in GLX and SWA. Although a causal relationship needs to be elucidated in the future, our results might support an active role of SWA in downregulating the increase in GLU levels that presumably occur during the day.
IMPACT ABOUT THE ENDOGENOUS CANNABINOID RECEPTOR 1 ON BRAIN INJURY OF CHRONIC INTERMITTENT HYPOXIA IN RAT

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Introduction: By observing the production of calcium/calmodulin dependent protein kinase II (CaMKII) and endogenous cannabinoid system (ECs) receptors CB1 in cerebral hippocampus cells, this study was designed to investigate the effect of CaMKII and CB1 during the course of brain injury of chronic intermittent hypoxia (CIH) with rat model.

Materials and methods: 60 healthy male rats were exposed to the different groups: four weeks (4W) and six weeks (6W) rats of the control groups (CG), 4W and 6W rats of intermittent hypoxia groups (IH), 4W and 6W rats of hypoxic intervention groups (HI) which were intraperitoneal injection with CB1 antagonist (rimonabant) by 1.5mg/kg/d (before modeling). Test animals had been performed after four weeks or six weeks. Morphological changes of brain tissue were observed by hematoxylin-eosin staining (HE). The expression of CaMKII and CB1 receptor in cerebral hippocampus cells were detected by immunohistochemistry detection.

Results:
1. HE staining pathological changes in brain cells of rats: The brain cells in IH group four weeks were damaged, cytoplasm sparse, boundaries unclear; six weeks cells were swelling, scarce cytoplasm, nuclear stained.
2. Compared with CG, in IH group the expressions of CaMKII and CB1 receptor in cerebral hippocampus were elevated, and with the duration of hypoxia, their expressions were more remarkable.
3. Compared with IH group, the HI group CB1 expression results were lower.
4. Correlation analysis: IH group expression levels of CaMKII and CB1 receptor were positively correlated significantly.

Conclusions:
1. It was confirmed that the unique pathophysiological process of OSAS would indeed lead to ECS disorder; of
2. CB1 expression might cause a certain extent of brain damage in CIH;
3. CB1 receptor antagonists (rimonabant) would have a protective effect while the brain occur CIH;
4. CaMKII was activated in the rat brain hippocampus and that might be one of the mechanisms of cognitive impairment.

Closing remarks: With the incidence of OSAS are increasing, they cause us more and more attention that brain damage is caused by cognitive disorders and neurological diseases. CB1 expression and effect by OSAS on brain should be gotten to the mechanism, which could help us to discover new drug to improve the quality of life in patients with OSAS.
Introduction: The homeostatic regulation of sleep is reflected in characteristic changes in electroencephalogram (EEG) or local field potential (LFP) slow-wave activity (SWA, 0.5-4 Hz) and the sleep-wake dependent dynamics of neuronal activity in the neocortex. However, it remains unknown whether preceding sleep-wake history directly affects subcortical brain areas, and if both excitatory and inhibitory neurons are affected. We hypothesise that the homeostatic regulation of sleep is a ubiquitous phenomenon, which can also manifest in subcortical brain regions. In this study, we investigated LFP and neuronal firing patterns in the dorsal striatum during sleep, which almost exclusively consists of GABAergic neurons.

Materials and methods: LFPs and neuronal activity were recorded from the dorsal striatum and the motor cortex of freely moving C57BL/6J mice (n = 11, n = 7, respectively) during an undisturbed baseline day and during recovery sleep after 6 hours of sleep deprivation (SD). Spike sorting identified 56 putative single units in the cortex and 142 units in the dorsal striatum, across all mice. LFP slow waves and their associated periods of generalised neuronal silence (OFF periods) were analysed during baseline and after SD. Neuronal OFF periods were defined as a generalised cessation of spiking activity across the entire neuronal population for at least 50 ms. The median duration of OFF periods was 86.1 ms in the cortex and 87.4 ms in the dorsal striatum.

Results: In both areas, average firing rates were lower during NREM sleep as compared to wake and REM sleep, although the firing rates of individual neurons during wake predicted their discharge during sleep. Specifically, in both areas, faster spiking neurons (> 4Hz) fired at a higher rate during wake as compared to NREM sleep, while slower spiking neurons (< 1Hz) discharged at a higher rate during NREM sleep. In both areas, LFP SWA showed a robust increase in the first 2 hour after SD, which was 166.9±6.2% (mean±SEM) above baseline in the cortex and 178.2±8.9% in the dorsal striatum, and the SWA decreased gradually across the first 6 hours recovery sleep. In both the cortex and dorsal striatum, LFP slow waves were associated with a suppression of neuronal activity, and both SWA and the duration of OFF-periods decreased across the baseline recording. Furthermore, the duration of OFF periods was significantly increased after SD by 134.2 % and 132.9 % (p = 0.04; p < 0.001, paired t-test) in the cortex and dorsal striatum, respectively.

Conclusions: Our results provide evidence that both the cortex and dorsal striatum of mice show homeostatic responses to sleep deprivation at the level of LFPs and neuronal activity. This suggests that preceding sleep-wake history likely affects neurons throughout the brain, and regardless of whether the neurons are excitatory or inhibitory cells.
Introduction: Epilepsy is one of the common neurological disorders that affect people of all ages and is often associated with sleep disorders, but the interaction between sleep and epilepsy is still not clear. Interleukin-1 beta (IL-1β) is a sleep regulatory substance (SRS) and participates in many pathological disorders, such as epilepsy and Parkinson's disease. Previous studies have demonstrated that seizure occurred at different zeitgeber times (ZTs) alter sleep differently and IL-1 mediates the sleep alteration induced by the ZT13 epilepsy. There is evidence that N-methyl-D-aspartate (NMDA) receptors play a key role in epileptogenesis. Therefore, we herein study the relationship between IL-1 and NMDA receptors in epileptogenesis and epilepsy-induced sleep disruption.

Materials and methods: All mice were genotyped by polymerase chain reaction (PCR) analysis of genomic DNA with the specific primers for transgene constructs. The spontaneously generalized seizures were induced by intraperitoneal injection of pentylenetetrazol (PTZ), the sleep-wake activity was analyzed, and the seizure threshold was determined in both the wildtype and IL-1R1 KO mice. The expression of subunit proteins of NMDA receptor, NR1 and phosphorylated-NR2B (at Tyr1472) were determined in the frontal cortex, hypothalamus and hippocampus by the Western blotting.

Results: We found that the occurrence of spontaneous seizure was higher in the wildtype treated with PTZ than that in the IL-1R1 KO mice treated with PTZ. Furthermore, non-rapid eye movement (NREM) sleep was decreased in wildtype mice treated with PTZ, but it was not altered in IL-1R1 KO mice. These results indicate the role of IL-1 signal in both epileptogenesis and sleep disturbance. The expression of NR1 subunit protein and the phosphorylation of NR2B at Tyr1472 in the hippocampus and the hypothalamus were significantly lower in the IL-1R1 KO mice when comparing to those in the wildtype mice. In contrast, the expression of NR1 and the phosphorylated-NR2B in the frontal cortex were significantly higher in the IL-1R1 KO mice treated with PTZ when comparing to those in the wildtype mice. These findings suggest that the epileptogenesis is attributed to the up-regulation of NMDA receptors, which is mediated by the IL-1 signal.

Conclusions: Our results indicate that the increase of NMDA receptor activity by the IL-1 signal contributes to the PTZ-induced epileptogenesis and the epilepsy-induced sleep disruption.

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EFFEICT OF COOLING DOWN AFTER STRENUOUS EXERCISE ON THE QUALITY OF SLEEP THE SAME DAY, AND THE LEVEL OF FATIGUE THE FOLLOWING MORNING

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Introduction: In recent times, we have seen that some athletes make use of a recovery stage (the so-called cooling-down period) after training and competition. It is broadly known that this recovery is significant for both the mind and body to relax and cool down. In fact, previous studies have reported that the implementation of a cooling-down period, after intense exercise, facilitates clearance of lactic acid better than when not doing anything. However, recent investigations have shown that lactic acid is not a source of fatigue, but a part of an energy source. Therefore, although implementation of cooling down after exercise is effective for the "lactic acid removal effect," little has been reported on whether it is effective as a means of medium- to long-term fatigue recovery. Therefore, in this research, the primary objective was to examine the effect that cooling down after intense exercise has on recovery indexes, other than lactic acid. Also, simultaneously, we examined the effect of a recovery period on the quality of sleep the same day, and the level of fatigue the following morning; that is, we examined the medium-term fatigue recovery effect related to cooling down.

Materials and methods: Twenty male university students gave their approval to participate in this study. All subjects were healthy volunteers and were not on any prescribed medication. The experiments were conducted in an air-conditioned room, from 08:30 PM to 07:30 AM, for one subject each day. The subject was instructed to sleep at 00:00 AM and was awakened by the experimenters at 07:00 AM, the following morning. There were 3 experimental conditions: (1) a control condition, in which subjects only slept; (2) a cooling down condition, in which subjects performed 30 minutes of exhaustive exercise, measured using an ergometer, with 15 min for cooling down at 40% of their heart rate reserve based on an ergometer-monitored exercise; and (3) a rest condition, in which subjects performed 30 min of exhaustive exercise, as measured using an ergometer, followed by 15 min of rest while sitting. All subjects went through all three conditions in a counterbalanced order (within the experimental design). Polysomnography was performed during the sleep period. We used our proprietary saliva sampling technique, which analyses the kinetics of cortisol and growth hormone secretion during sleep. Saliva sampling was performed 11 times per experiment day: 5 min before bedtime, during sleep (every hour for 7 h), and after awakening (at 0, 15, and 30 min). Saliva sampling before bedtime and after awakening was performed using a straw to collect the naturally secreted saliva over a period of 2 min.

Conclusion: We demonstrated the change in the salivary growth hormone secretion during sleep for the first time as far as we know. On the other hand, it was found that no clear medium-term fatigue recovering effect was observed when cooling down was implemented.
Introduction: Evidence from patients with neurodegenerative disorders and animal experiments strongly suggest that sleep-wake behavior may be regulated by the striatum within which contains plenty of adenosine A$_2$A receptors (A$_2$AR) known as to promote sleep. Therefore, we hypothesized that A$_2$AR neurons of the striatum might be involved in sleep-wake regulation.

Materials and methods: A series of techniques, chemogenetic approach, EEG/electromyogram recording in vivo, patch-clamp technique, optogenetics, and immunoelectron microscopy in vitro, were employed to examine roles of striatal A$_2$A neurons on sleep-wake regulation in A$_2$A-Cre and A$_2$A/parvalbumin-Cre transgenic mice.

Results: Chemogenetic activation of A$_2$A neurons in rostral, centromedial and centrolateral striatum increased non-rapid eye movement sleep at active period, concomitant with reduced wakefulness, while activation of these neurons in caudal striatum didn’t change sleep-wake profiles at all. Three topographical projection patterns of A$_2$A axons was found in external globus pallidus (GPe): the axons of A$_2$A neurons from rostral striatum distributed in rostral GPe with a discoidal region paralleled to the strio-pallidal border; axons from the central striatum distributed not only in rostral GPe but also the caudal GPe with a similar feature as that in rostral, while the axons from caudal striatum just scattered in the caudal GPe. A$_2$A neurons in the rostral striatum formed inhibitory synapses preferentially with parvalbumin (PV)-positive neurons in the rostral GPe, while A$_2$A neurons in caudal striatum formed inhibitory synapses preferentially with PV-negative neurons in caudal GPe, indicating a rostral-caudal variation in striatopallidal connections. Furthermore, lesion of PV neurons in the GPe abolished the increase in NREM sleep caused by activation of A$_2$A neurons in the striatum of the A$_2$A/parvalbumin-Cre mice. In addition, chemogenetic inhibition of striatal A$_2$A neurons led to a significant decrease of NREM sleep at active period.

Conclusions: The present results indicate that A$_2$A neurons in rostral and central striatum regulate sleep-wake behavior via innervating GPe PV neurons. Our finding provides insight into the striatal A$_2$A neuron/GPe PV neuron pathway for sleep regulation and suggests a potential treatment strategy to ameliorate sleep disturbances.

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THE FEASIBILITY OF A SLEEP EXTENSION INTERVENTION TO IMPROVE DIETARY INTAKE AND ENERGY BALANCE IN HABITUALLY SHORT SLEEPERS: A RANDOMISED CONTROLLED TRIAL

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Introduction: Over the past decades, the decline in sleep duration has been paralleled by the rise in obesity and its associated metabolic complications. Today, nearly a third of adults achieve less than the recommended 7-9 hours/night. Previous intervention studies have shown sleep deprivation may induce energy imbalance and metabolic dysregulation. Diet may mediate the link between inadequate sleep and metabolic disruption. However, few studies have investigated the feasibility of sleep extension and its possible effects on diet and energy balance in free-living people. On this basis, our primary aim was to assess the feasibility of extending sleep in healthy free-living adult short sleepers using a sleep hygiene-targeted behavioural approach, and to collect data to plan a fully powered, larger trial (Registration: NCT02787577). We also investigated the effects of sleep extension on dietary intake and energy balance.

Materials and methods: In this 4-week parallel design randomised controlled trial (RCT), normal weight adults aged 18-64 y who were short sleepers (5-< 7 h) were eligible for participation. Participants were screened for risk of low mood and sleep disorders, and randomised to control or intervention matched for age, sex, ethnicity and BMI. The intervention group received a personalised sleep consultation session aiming to extend their time in bed by 1-1.5 hours, by targeting sleep hygiene behaviours using behaviour change techniques. Seven-day wrist-actigraphy measures (MotionWatch8, CamNtech Ltd, Cambridge, UK), 7-day food diaries and 48-hour total energy expenditure measures (Actiheart, CamNtech Ltd, Cambridge, UK) were obtained at baseline and endpoint.

Results: A total of 43 men and women (control n=21, intervention n=22) completed the study. Three participants dropped out of the study during baseline measures, prior to being informed of their allocated treatment group. The intervention group significantly extended their mean time in bed (0:55 h:mm 95%CI 0:37, 1:12), sleep opportunity (0:47 h:mm 95%CI 0:29, 1:05) and sleep duration (0:21 h:mm 95%CI 0:06, 0:36) compared to controls (P< 0.01). Markers of sleep quality decreased in the intervention group in comparison to controls (sleep fragmentation index 4.9 95%CI 1.5, 8.3; sleep efficiency, -4.9% 95%CI -6.9, 1.5, P< 0.05). There was no difference in sleep latency between groups. The intervention group significantly reduced their intake of free sugars from baseline (-9.6 g/d 95%CI -16.0, -0.6) compared to controls (0.8 g/d 95%CI -0.6, 7.2) (P< 0.05). There were no significant differences in other nutrient intakes or total energy expenditure between groups.

Conclusions: A personalised sleep extension intervention that targets sleep hygiene behaviours is feasible in healthy free-living adult who are habitually short sleepers. Moreover, sleep extension resulted in a reduction in reported intakes of free sugars, suggesting diet may contribute to the relationship between short sleep and metabolic disease. Longer term, fully powered sleep extension studies in at-risk populations are needed to study effects of sleep extension on diet and markers of metabolic disease to inform public health messages.

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COGNITIVE EXECUTIVE FUNCTIONS AND SLEEP-WAKE CYCLE (SWC) PATTERNS IN SAMPLE OF CHILEAN ADOLESCENTS

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Introduction: In Chile, obesity has quadrupled their prevalence in childhood and adolescence, becoming the most relevant nutritional disease for this age-range (64.5% of the population) in the last 20 years. Some studies have shown an association between poor cognitive performance—in particular executive functions (EF)—and the risk of being overweight. On the other hand, the relationship between sleep-wake cycle (SWC) patterns and weight gain is well established. However, most studies are not based on objective. The purpose of the study is to assess EF performance and SWC patterns in OW adolescents.

Materials and methods: The participants were adolescents belonging to an infancy cohort. By means of an eye track method the antisaccade reward task was used to assess EF. SWC patterns were established by an automated procedure using motor activity data recorded by an actigraph wore in the non-dominant wrist for a week. Only SWC patterns of the 24-h preceding the morning of EF assessment were used. BMI was calculated \( \text{BMI} = \frac{\text{weight (kg)}}{\text{[height (m)]}^2} \) and nutritional status was classified according to BMI z-score. Main outcomes were: (a) EF: accuracy and latency for correct responses, and b) SWC patterns: bed time, wake-up time, total sleep time, number of nocturnal awakenings and naps number and duration.

Results: 228 participants were assessed (mean age was 16.9±0.20 years and 53% male) and 39% was overweight (OW). Groups presented similar socio-economic and educational data. Compared with normal weight male, OW male showed delayed bedtime (00:51±01:16 am vs. 00:23±01:2 am, p≤0.05) and longer naps (75.9±54.8 min vs. 54.1±51.7 min, p≤0.05). Logistic regression analyses showed that, taking in account all the subjects, longer reaction time for correct response and delayed bedtime were associated to a greater probability to be OW (p< 0.01).

Conclusions: Our results indicate that SWC patterns and lower EF performance in adolescence are associated with OW. Given the consistent evidence that most OW adolescents were already obese at earlier ages, our findings provide further support for the need to include both SWC patterns and EF performance within prevention strategies for obesity prevention in early developmental stages.

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Introduction: Sleep is a basic need for human and animal survival. The difficulty in sleeping, due to different causes, alters the corporal and mental well-being, interfering in the quality of life. Currently, some stimulants are consumed as a way to reduce sleepiness due to sleep deprivation.

Objective: To investigate behavioral and cognitive alterations caused by sleep deprivation in rats under energetic effects.

Materials and methods: 42 Wistar rats, 2 months old, weighing around 225 g, deprived of sleep for 24 h, were used in a multiple platform model. The rats were randomly assigned to receive 6 treatment types (n = 7 animals / group): Control (C), Sleep deprivation (SD), Energy drink consumed 24 hours before experimental tests (ED24h), Energy drink consumed just before (ED24h + SD), Energy drink consumed 1h before the tests (ED1h), Energy drink consumed 1h before the tests in animals that were at 24 hours in sleep deprivation (SD + ED1h). The energy drink administered (Red Bull®) was calculated according to the dose of 1.8 ml / kg and made by gavage. The experimental models used were open field (locomotor activity), elevated plus maze (EPM) (anxiety) and step down inhibitory avoidance (learning / memory).

Results: It was observed that sleep-deprived animals, whether or not they had an energy drink, presented a reduction of the locomotion in the open field and increased entrances and movement in the closed and open arms of the EPM. The consumption of energy drinks added to sleep deprivation increased the time of their stay in the open arms of the labyrinth. This data was observed mainly in the animals of the group SD + ED1h, that in addition to the high dwell time a high number of open arms entries were also observed. Sleep deprivation interfered with animal learning even when using energy drink.

Conclusions: Based on the results obtained, it is suggested that the use of energy can be a good chemical resource aiming to reduce anxiety levels and some indicative parameters of stress observed in locomotion, in a way dependent on the experimental model used. For the memory, the use of energy did not have a significant effect.

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KNOWLEDGE AND ATTITUDES TOWARDS SLEEP HABITS IN BRAZILIAN POPULATION: FINDINGS FROM WORLD SLEEP DAY

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Introduction: We investigated the society knowledge and attitudes towards sleep habits, and the access to information about sleep and sleep disorders in Brazil.

Materials and methods: A transversal survey was conducted during the World Sleep Day event (March 2016). The survey was composed by a questionnaire about sleep quality, sleep habits and the frequency of search for information about sleep. We collected 659 valid questionnaires (subject agreement to use data) in 5 cities: Curitiba (152), Recife (197), Rio de Janeiro (167), Sao Paulo (78) and Teresina (65).

Results: Our data demonstrated an elevated frequency of bad sleep habits in Brazilian population associated with a deficit in knowledge about attitudes that impair sleep. These results were divergent in different regions of the country: 43.9% of respondents reported the use of electronic devices about 1 hour before bedtime, and this behavior was more frequent in Teresina (69.2%) that also had higher frequencies of subjects that consume alcoholic beverage (10.8%) and stayed in bed worrying about unsolved problems (50.8%). 68.4% of respondents watch television before sleep, with a higher frequency in Curitiba (77%). 10.2% consume large meals, 10.3% consume caffeine or nicotine, and 4.6% practice vigorous exercise 1 hour before bedtime. 55.1% of participants did not agree that the use of electronic devices close to bedtime impairs sleep, with a higher frequency of respondents in Curitiba (64.5%). Watch television (58.4%), practice of vigorous exercise (84.1%), eat large meals (63.4%), consume of caffeine or nicotine (68%), consume of alcoholic beverages (75.1%) and stay in bed worrying about unsolved problems (53.6%) were bad sleep habits not recognized by most of participants. In Rio de Janeiro, 82.6% of respondents did not agree that alcoholic beverages impair sleep. Only 9.8% of Brazilians frequently search for information about sleep and sleep disorders, and Sao Paulo had a significant occurrence of frequent access (21.1%). Subjects from Teresina (38.5%) and Curitiba (52.3%) rarely or never search for information, respectively. Internet is the main source of information about sleep and sleep disorders (32%), followed by health professionals (17.5%), newspaper (15.9%), television (14.3%) and friends (9.1%).

Conclusions: The investigation of population knowledge about sleep and the source used to access information are essential to plan strategies to promote sleep awareness and literacy. Science literacy leads to a society with more science-based choices, and better attitudes towards health and well-being.

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SLEEP DISORDERS IN ADOLESCENTS WITH ESSENTIAL HYPERTENSION AND EMOTIONAL-PERSONAL STATUS

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Introduction: It is known that sleep disorders may contribute to increased risks of behavioral problems. The aim of this study was to evaluate the state of emotional and personal status in adolescents with essential hypertension (EH) at different severity of sleep disorders.

Materials and methods: 28 adolescents with EH were recruited for this study. A control group consisted of 12 healthy adolescents. The diagnosis of EH was verified by ambulance blood pressure monitoring (ABPM). All patients underwent a polysomnographia (PSG). Adolescents were divided into 2 groups: a group A - 13 patients with rises of the blood pressure (BP) during a sleep and severe sleep disorders (episodes of obstructive apnea / hypopnea, excessive sleep fragmentation and significant deficiency of deep stages); a group B - 15 patients with elevated BP during a wakefulness and less severe sleep abnormalities such as lengthening of the period of falling a sleep and high percentage of wakefulness after sleep onset. Two instruments to assess emotional-personal status were administered: Ch.D.Spilberg-Yu.L.Hanin's test questionnaire and A. Licko's Diagnostic Questionnaire were performed.

Results: Expressed inclination to not restrained aggressive behavior, higher to manipulative behavior and higher reaction of emancipation, were observed in adolescents from a group A compared to a group B. Higher level of anxiety, increased emotional instability and inclination to depression have patients from a group B.

Conclusions: Hypertensive adolescents with expressed sleep abnormalities such as obstructive breathing sleep disorders have significant changes of personal status, but hypertensive adolescents with less severe sleep abnormalities have emotional disorders.
Introduction: Children with Autism Spectrum Disorder (ASD) have more sleep disturbances than typically developing (TD) children. Common sleep problems in ASD include difficulty in initiating sleep, maintaining sleep and shorter total sleep time. However, previous findings are largely based on Western countries (Australia, Finland, Sweden, United Kingdom and United States). Sleep problems have been associated with day-time attentional difficulties in TD children. For children with ASD, sleep problems can further exacerbate their pre-existing difficulties in shifting attention and sustained attention. Yet, few studies have examined if sleep can impact attention among children with ASD. Use of more objective measures are needed to accurately quantify sleep problems in Asian countries such as Singapore as well as examine cognitive skills in relation to sleep.

Materials and methods: 36 Singaporean children, aged 6 to 13 years participated in the study. 22 children with ASD and 14 TD children. Actigraphy MotionWatch8. Children wore the watch continuously from Sunday night to Thursday night (5 nights). Continuous Performance Attention Task (CPT). The present study's CPT was adapted from previous studies (Ashworth et al., 2015). Children were instructed to press the 'shift' button whenever they saw the target (monkey) on the screen and inhibit response when they saw other distractor animals. Practice sessions included 20 trials. During the experimental run, stimuli were presented for 300ms, followed by a blank white screen for 1250ms. Raven's Colored Progressive Matrices: RCPM is an extensively used cognitive assessment of non-verbal intelligence among children aged 3 to 12.

Results: Independent t-tests showed that Singaporean children with ASD and TD children only differed in sleep duration but not sleep quality. Children with ASD had later get up time, longer time in bed, longer assumed sleep and longer actual sleep than TD children.

Attention
Independent t-tests revealed that TD children had higher percentage of correct hits, less commission error, faster Response time (RT) for error and less variability in RT for hits. No group difference in RT for hits. This indicates that TD children have lower inattention, lower impulsivity, higher inhibition and less inconsistency in response, suggesting higher sustained attention. There was no difference in processing speed. ASD: Longer sleep duration and later get up time predicted more correct hits. TD: Later bedtime predicted lower percentage of correct hits. Shorter actual sleep time predicted slower RT hits.

Conclusions: Children with ASD did not have significant sleep problems compared to TDs. In contrast, Singaporean TDs had shorter sleep duration. Findings suggest that even though sleep problems could have underlying physiological cause, changes in environmental factors can alleviate these difficulties, such as later school start times and different bedtimes. Children with ASD had difficulties in sustained attention. Deficits in sustained attention among children with ASD are likely partly attributed to cognitive developmental delay (lower IQ), rather than primary impairment in sustained attention ability. Sleep might impact attention components differently for children with ASD and TD children.
EVALUATION OF BEHAVIOURAL OUTCOMES IN CHILDREN WITH DOWN SYNDROME AND CO-EXISTING SLEEP PROBLEMS

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Introduction: It is now well recognised that poor sleep has a negative impact on behaviour and cognition in typically developing children (TD). Children with Down syndrome (DS) have an increased risk of sleep disorders compared to typically developing (TD) children. For example, the prevalence of OSA is estimated at 45-79% in children with DS compared to 1-5% in the general paediatric population.

Small cross-sectional studies have found difference in IQ, cognitive function and accomplishment of daily activities in children with DS and comorbid OSA compared to those without OSA. To our knowledge no studies have evaluated the impact of co-existing sleep problems on behaviour in children with DS.

Materials and methods: As part of a larger prospective longitudinal cohort study we examined the behavioural profiles of children with DS aged 3-16yrs attending a tertiary sleep clinic for assessment and management of a sleep complaint. Parents of participants completed the abbreviated Child Sleep Habit's Questionnaire (CSHQ) to provide a measure of sleep difficulties and the Child Behaviour Checklist (CBCL) for behavioural evaluation. This was undertaken at baseline with a plan to repeat at 6 and 12 months and following any specific sleep intervention (e.g. adenotonsillectomy, CPAP commencement).

Results: Preliminary data is available for 15 of the 30 currently recruited patients (Male =9). Mean age of patients was 7.75yr (3.16-16.36yr) and BMI 19.72kg/m² (15.70-26.90kg/m²). CSHQ was indicative of a sleep problem (defined as score>41/110) in all patients with a mean score of 56 (42-72). Mean total CBCL scale raw score was 41.5 (20-72) with mean raw score for internalising problems of 7.1 (2-11) and externalising problems 11 (1-33) respectively. Children scored highest in the subscales of “attention problems”, “aggressive behaviour” and “other problems”.

Conclusions: Our preliminary results suggest that children with DS and co-existing sleep problems score high for problem behaviours assessed through the CBCL parent questionnaire. Van Gameren-Oosterom et al. have published data on a population based sample of eight-year-old children with DS and found a mean CBCL score of 30.08 ±18.06 in this group. They also showed a higher score for externalising problems (mean 8.73 ± 6.84) than internalising problems (4.71 ± 4.55) and showed peak scores in the “attention problems” and “aggressive behaviour” subscales. Although our population is not directly comparable due to a wider age range, our total mean score is 10 points higher, with our subscales showing similar trends. We hypothesise that children with Down syndrome and sleep difficulties will have more behavioural challenges than both their typically developing peers of the same developmental age and their Downs syndrome peers.

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Van Gameren-Oosterom HBM et al. Plos ONE. 2011; 6(7): e21879

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ASSOCIATIONS OF SLEEP EEG WITH COGNITIVE CHANGES DURING SLEEP RESTRICTION AND RECOVERY

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Introduction: Interindividual differences in sleep EEG and cognitive responses to sleep deprivation have been systematically investigated and found to be trait-like. Here, we examined whether interindividual differences in how sleep physiology was altered during multiple nights of partial sleep deprivation, and the recovery period that followed, were associated with cognitive performance.

Materials and methods: The sample consisted of 58 healthy adolescents (aged 15-19 years; 30 males) from two Need for Sleep Studies. Performance in sustained attention, working memory / executive function, and speed of processing tasks, as well as polysomnographic data across 5 or 7 nights of sleep restriction (5-h time-in-bed [TIB]) and 1 recovery night (9-h TIB) were analysed.

Results: Larger reduction in N1 duration and increase in N3 duration over the course of multiple nights of sleep restriction were associated with larger decline in sustained attention as well as speed of processing. However, impairment of working memory / executive function arising from sleep restriction was not correlated with change in sleep macrostructure or slow wave energy. During the recovery period, there were no significant relationships between physiological sleep and cognitive changes after controlling for the effects of prior sleep restriction on sleep EEG and cognition.

Conclusions: Changes in sleep macrostructure induced by partial sleep deprivation may account for the concurrent deterioration in some cognitive functions. However, the features of sleep that determine the extent of post-sleep deprivation recovery in cognitive performance remain to be uncovered.

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EFFECT OF COGNITIVE REAPPRaisal ABILITY ON PRESLEEP EMOTION REGULATION AND SLEEP ONSET

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Introduction: Cognitive reappraisal is generally considered to be an effective emotion-regulation strategy. However, previous studies on the association between cognitive reappraisal and sleep showed inconsistent results. One possible reason for the inconsistent findings is that previous studies used self-reported measure to assess the frequency to use reappraisal, which has been shown not to correlate with the effectiveness of reappraisal. The present study examined the hypothesis that the impact of presleep reappraisal on sleep onset process depends on individual’s cognitive reappraisal ability (CRA).

Materials and methods: 24 normal sleepers were recruited (13 female, aged 22±3.02 years). Participants came to sleep lab for two nights and one daytime session. For two nights, participants did a presleep cognitive task and got two different feedbacks for the two conditions, a baseline condition with neutral feedback and an experimental night with negative feedback to induce emotion. After getting negative feedback in the experimental night, participants were instructed to use cognitive reappraisal to reduce negative emotion. The change of subjective emotion ratings and physiological reaction were measured during the task. Polysomnographic recording and subject experience ratings were conducted for the sleep onset process. For daytime session, the CRA was measured with subjective emotion reactivity to a standard laboratory challenge with anger-inducing films.

Results: At experimental night, participants with better CRA in reducing negative valence of emotion exhibited better emotion regulation outcomes ($r=0.49$, $p=0.01$), less presleep somatic arousal increments ($r=-0.43$, $p=0.04$), lower beta power before falling asleep ($r=-0.47$, $p=0.02$), and less overestimation of their sleep onset latency ($r=-0.48$, $p=0.02$). Besides, participants with better CRA in reducing dominance of emotion exhibited shorter emotion regulation time ($r=-0.5$, $p=0.01$), lower beta power after falling asleep ($r=-0.51$, $p=0.01$), and less sleep onset latency increment ($r=-0.52$, $p=0.009$).

Conclusions: The findings support our hypothesis that CRA could predict whether cognitive reappraisal strategy is effective for presleep emotion regulation in reducing pre-sleep arousal and facilitating sleep onset.
MODERATE, ACUTE SLEEP RESTRICTION HAS DIFFERENTIAL EFFECTS ON COMPONENTS OF ATTENTION

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Introduction: Most adults require 7-8 h of sleep nightly to function optimally, but many do not get this amount, resulting in negative effects on cognition, daytime functioning and performance, including difficulties with attention. A widely accepted current model of attention posits three separate but interacting attentional networks in the brain, each of which is responsible for a different component of attentional abilities: vigilance/alerting, orienting/selection and executive control. The extent to which each of these attentional networks is differentially affected by sleep loss has not been established. We used the Dalhousie Computerized Attention Battery (DalCAB), which is based on this attentional model, to assess the impact of sleep loss on the component systems underlying attentional performance.

Materials and methods: Healthy participants (women aged 19-25 years) completed the DalCAB twice; once after a 9 h overnight sleep opportunity (OSO), and again after either another 9 h OSO (control condition; n=19) or after a 3 h OSO (sleep restriction condition, n=20). Wake time and DalCAB completion time were held constant. Self-ratings of sleepiness and mood were completed in the morning after each of these sleep conditions. Changes in DalCAB performance, mood and sleepiness were compared between treatment groups and between days.

Results: Stanford Sleepiness Scale (p < 0.01) and Profile of Mood State fatigue (p < 0.001) and confusion (p < 0.05) subscale scores showed increased subjective sleepiness in the restricted but not the control group after the second night. Most significant group by session interactions were found for processing speed on tasks related to vigilance (e.g., slowed reaction times [RTs] on choice RT task following restriction, p < 0.05), although sleep restriction also increased reaction times on tests of executive control (e.g., go/no-go, p < 0.001; flanker task, p < 0.05) and working memory (delayed target probe task, p < 0.05).

Conclusions: Moderate, acute sleep loss may have specific effects on vigilance and executive control components of attention, with relatively less impact on orienting/selection. These findings highlight the potential independence of the functioning of the attention networks, and the need to consider specific components in models of how sleep loss affects cognition.

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Behavior, Cognition and Dreaming
Board #004: P4 - Tuesday
PROGRESS IN EXAMINING DREAMS IN SHAKESPEARE'S PLAYS WITH MODERN SCIENTIFIC DREAM THEORIES AND TECHNIQUES

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Introduction: Shakespeare's plays are still widely read and studied. They include many instances of references to dreams, which seem to impact the course of the story. This is a new report on a study examining these dream narratives, using modern scientific analysis and dream formation and function theories. To examine these dreams, the threat simulation theory (Revonsuo & Valli, 2000) was applied; the theory states that from an evolutionary perspective, threats are manifested in oneiric content to allow for practice and eventual mastery of waking-life dangers. In addition, the theory of impactful dream (Kuiken & Sikora, 1993) was also used. This theory states that some dreams have an impact on the dreamer's thoughts, feelings, or both, further suggesting that some dreams may influence one's waking life. Considering the dramatic characteristics inherent to Shakespeare's works, it was expected that his characters' oneiric content would be more negative than that of modern-day Canadians, would contain more threats and of a more severe nature, and would tend to be impactful by default.

Materials and methods: Twenty-nine dreams, drawn from 29 characters in 19 of Shakespeare's plays, were matched by gender and age range to 29 dreams obtained from the University of Ottawa's Canadian norms database. Reports were analyzed using the Hall and Van de Castle scoring system, the Dream Threat Scale (adapted from Revonsuo & Valli, 2000), and the Impactful Dream Scale (adapted from Busink & Kuiken, 1996). Bonferroni corrections for multiple comparison were applied to t-tests.

Results: Contrary to modern dreams, which are skewed towards negative elements, the dreams in Shakespeare's plays contained equal amounts of positive and negative elements (P = 0.537). Dream characters were more often friendly (P < 0.008) and experienced more good fortunes (P < 0.006) in more familiar settings (P < 0.025) than modern Canadians. The number of threats did not differ significantly between Shakespeare's works and modern dream reports; however, there was a trend towards more minor threats in the dreams of modern-day Canadians (U = 322.5, p < .07) for the same number of threats overall. Furthermore, whereas impactful dreams are very rare among Canadians, representing only 36 out of 566 report packages, 26 of 29 dreams from Shakespeare's plays were judged impactful (difference of 6.36% to 89.66%; P < 0.0001). Further analyses are underway to determine if dreams do impact the play's narratives.

Conclusions: The fact that Shakespeare's plays feature characters at the mercy of benevolent and dangerous forces may explain the tendency for more severe threats and more impactful content. Dream narratives are surprisingly more emotionally balanced in Shakespeare's plays than in modern dreams. This may arise from the interplay of good and evil as a narrative motif, but also from the sample of plays' mixed nature of tragedies and comedies. Overall, findings suggest that the objective study of literary dreams may contribute to a better understanding of these masterpieces, and of the role dreams play within them.
COGNITIVE IMPAIRMENT IN SUBJECTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: Obstructive sleep apnea (OSA), which is by far the most common form of sleep-disordered breathing, is associated with many other adverse consequences including daytime sleepiness, cognitive impairment, accidents that are the most frequent complications that disrupt quality of life. Studies on Cognitive Impairment in patients with Sleep Disordered Breathing has been done quite extensively in countries like USA, Japan etc. However, studies from India are lacking Hence this study was undertaken to assess cognitive impairment in patients with sleep disordered breathing and to compare with age and sex matched normal individuals.

Materials and methods: 36 cases (subjects who were diagnosed based on a level 1 polysomnography) and 36 controls (who scored less than 5 on Epworth sleepiness scale) were selected. Both cases and controls were subjected to Mini-mental score (MMSE) and Addenbrooke’s Cognitive Examination (ACE-R) along with a car driving simulator test lasting for 5 minutes to assess average reflex time.

Results: The mean AHI in the cases was 42 per hour. The mean MMSE was 24 in subjects with OSA with a range of 13-30. In controls the range was 25-30. Mean ACE-R was 75 with a range of 40-97 in cases where as in controls the range was narrower (83-92). The reaction time was 0.4 seconds in the cases with a range of 0.28-0.65 where as in controls it was 0.27-0.4. Only MMSE was significantly lower in subjects with proven OSA (P < 0.05) compared to controls. Apnoea Hypopnea Index (AHI) was negatively correlated with ACE-R and MMSE (-0.1).

Conclusions: Cognitive impairment was noted in the study population as measured by MMSE only. Though the mean values of ACE-R and reaction time were not significantly different in both the groups, there was a wide variation in the values in the subjects compared with controls. A better understanding of the cognitive effects of OSA and development of more effective assessment tools for diagnosis, will aid early intervention and improve quality of life of the patient. Further, following up these subjects after using CPAP to look for improvement in the cognitive functions is required.
**Introduction:** Previous work has demonstrated that sleep loss increases negative mood while sleep extension improves mood. Though these studies have assessed multiple dimensions of mood, few have specifically targeted emotional stress. This is the first study to use a high fidelity measure to track acute self-reported stress across three conditions: normal sleep, sleep extension, and sleep deprivation.

**Materials and methods:** Fifteen healthy adults (6 females) ranging from 20 to 39 years of age participated in the study. Self-reported fatigue and stress were assessed using the Karolinska Sleepiness Scale (KSS) and the Stress Visual Analogue Scale (SVAS), respectively. The KSS and SVAS were administered every two hours from 0700 to 2100 during the three sleep conditions:

1) Baseline Sleep: the day following two weeks of normal/baseline sleep,
2) Sleep Extension: the day following 7 consecutive nights of extended sleep (10 hours time in bed), and
3) Sleep Deprivation: the day following one night of total sleep deprivation.

The data were analyzed with a 3 (Sleep Condition) x 8 (Time of Day) mixed linear model. Additionally, KSS and SVAS scores were correlated across baseline, extension, and sleep deprivation days.

**Results:** A main effect of Sleep Condition revealed increased fatigue and stress during sleep deprivation relative to both baseline and sleep extension conditions. Additionally, fatigue and stress scores were significantly correlated across sleep conditions.

**Conclusions:** The present preliminary findings suggest that the SVAS instrument is sensitive to changes in stress levels experienced by individuals under extended sleep vs. sleep deprivation conditions. In addition, there was a significant, positive correlation between self-reported fatigue and stress across the various sleep conditions. These results demonstrate that when individuals report higher levels of fatigue, they will likely also report higher levels of stress. This finding is very relevant to the military, as irregular and long hours are common during continuous operations in the field. It is possible that the combination of fatigue and a subsequent rise in stress could hinder performance.

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Behavior, Cognition and Dreaming
Board #005: P4 - Tuesday

JUDGMENT IMPAIRMENT IN IDIOPATHIC REM SLEEP BEHAVIOR DISORDER

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\textbf{Introduction:} Previous studies showed that idiopathic REM sleep behavior disorder (iRBD) patients are at high risk for mild cognitive impairment (MCI) and dementia, with cognitive impairment being mostly in attention and executive functions. However, no study to date has measured judgment abilities in this population, despite their association with executive measures and their importance in daily life. The aim of this study was to investigate judgment abilities of iRBD patients in association with their cognitive status.

\textbf{Methods:} We recruited 68 iRBD patients confirmed by polysomnography (age: 67.66±7.38 years; education: 14.12±3.38 years), including 17 patients with MCI diagnosed by a comprehensive neuropsychological assessment. We used the Judgment Assessment Tool (JAT), a test validated with adults with and without cognitive impairment, to measure judgment abilities. The JAT is divided in two sections to assess two core aspects of judgment, namely generation of solutions and assessment of options. We calculated demographically adjusted (age and education) z-scores using normative data for the two sections and total score. T-tests were used to compare the JAT total z-scores between iRBD patients with and without MCI. In addition, repeated-measures ANOVA were used to compare the groups for the two sections of the test.

\textbf{Results:} iRBD patients with MCI performed worse on the JAT total z-scores (mean: -0.50±1.16) compared to iRBD patients without MCI (mean: 0.37±1.17), p=0.009. The ANOVA results were statistically significant for between-subjects (F(1,66)=7.57, p=0.008) and within-subjects (F(1,66)=14.72, p< 0.001) comparisons. More specifically, iRBD patients with MCI (mean: 0.19±1.04) did not differ from iRBD patients without MCI (mean: 0.34±1.10) on the generation of solutions (p=.608) but they performed worse on the assessment of options (mean: -1.09±1.32 vs. 0.24±1.27; p=.001).

\textbf{Conclusions:} This study shows that impaired judgment capacities are linked to cognitive impairment in iRBD patients and that the main process involved is related to lower abilities in the assessment of options. Clinicians should be aware that iRBD patients with cognitive impairment could have limited judgment capacities.

\textbf{Acknowledgements:} This study was funded by the Canadian Institutes of Health Research, Fonds de Recherche du Québec - Santé, and W. Garfield Weston Foundation.
Introduction: Spindles are one of the only known electrophysiological oscillations identified as a biological marker of cognitive abilities typically assessed by intelligence tests. Spindles are highly correlated to trait-like "Reasoning", but not "Verbal" abilities. Our recent work has shown that this relationship is independent of sleep quality and circadian-related factors (e.g., chronotype). Simultaneous electroencephalography and functional magnetic resonance imaging (EEG-fMRI) have revealed brain activations which occur during spindles, including thalami, paralimbic, striatal and motor cortical areas. Interestingly, these regions are known to support Reasoning abilities. However, the neural correlates of the relationship between spindles and cognitive abilities are unknown. Using simultaneous EEG-fMRI during sleep, we seek to identify, for the first time, the neural activation patterns time-locked to spindles that are related to cognitive abilities. This will provide insight into the neural basis of the functional significance of spindles.

Materials and methods: A total of 29 healthy adults (17 females; age=24±3.9) completed the Cambridge Brain Sciences (CBS) Trials online prior to the experimental session (21h00-23h00) where simultaneous EEG-fMRI was recorded while subjects slept in the MRI scanner. CBS Trials yields: 1) a Reasoning subscale (i.e., cognitive abilities which support "fluid intelligence"; such as the capacity to identify complex patterns and relationships, and the use of logic to solve novel problems), 2) a Verbal subscale (i.e., cognitive abilities which support "crystallized intelligence"; accumulated knowledge and experience), and, 3) a Short Term Memory subscale (STM; i.e., the capacity to briefly maintain information in an available state).

Results: 1) Similar to previous studies, spindles detected at Cz (11-16Hz) in non-rapid eye movement sleep were related to Reasoning but not Verbal or STM abilities, and, 2) activations time-locked to spindles were observed in the thalamus, bilateral striatum, middle cingulate cortex, and cerebellum. 3) Importantly, Reasoning abilities were correlated with spindle-related activation in a subset of these regions including the thalamus, bilateral striatum, medial frontal gyrus, middle cingulate cortex, and precuneus. Importantly, No spindle-related activations were correlated to Verbal abilities or STM.

Conclusions: Our results show for the first time, that brain areas known to support Reasoning abilities were activated time-locked to spindles, and were related to interindividual differences in Reasoning but not Verbal, or STM abilities. These results may help elucidate the physiological mechanisms which support the function of sleep for the capacity for reasoning. A better understanding of the neural basis of the relationship between spindles and cognitive abilities may ultimately help to better understand the significance sleep to a variety of normal and abnormal cognitive functioning in healthy individuals and in neurological conditions where spindle activity is abnormal or deficient (e.g., learning disabilities, below normal cognitive functioning, normal healthy aging, developmental disorders and in schizophrenia).

Acknowledgements: Research support provided by a Canada Excellence Research Chair (CERC) grant to author AMO.
Introduction: A good night’s sleep is vital for cognitive functioning and optimal performance in everyday tasks. Using behavioural and electrophysiological techniques, previous research has identified that sleep deprivation, sleep restriction and sleep fragmentation in adults adversely affects executive functioning. Performance monitoring, which involves the detection of errors and subsequent adjustment of behaviour, is one aspect of executive functioning that has been found to be impaired following sleep deprivation. The error-related negativity (ERN) and error positivity (Pe), which are electrophysiological indices of performance monitoring, are often found to be reduced in amplitude following one night of sleep deprivation, suggesting that there are changes at the neural level in error detection and error evaluation processes following poor sleep. Whilst there is a plethora of research exploring cognitive deficits associated with experimentally manipulated sleep in adults, there is little research exploring whether variations in natural sleeping patterns are associated with impairments in performance monitoring. Therefore, our study aimed to explore if differences in sleep duration and sleep efficiency are associated with electrophysiological indices of performance monitoring.

Materials and methods: Sixty (17 male) undergraduate students ($M_{age} = 22.78$, $SD = 3.10$) were recruited for this study. Participants wore an Actigraphy wActiSleep+ device on their non-dominant wrist for seven consecutive nights. Following the last night of Actigraphy participants completed a hybrid Flanker/NoGo task whilst continuous EEG data were recorded. Total sleep time and sleep efficiency were based on a minimum of 5 nights of averaged data (6 participants were excluded due to insufficient data). Participants were then allocated into high or low sleep efficiency and short or long sleep duration groups. Groups did not differ based on IQ, age or gender.

Results: A series of independent sample t-tests were conducted to explore if ERN and Pe amplitude differed between groups. Individuals with shorter sleep duration were found to have significantly reduced ERN amplitude in comparison to those with longer sleep duration, however, no differences were noted in Pe amplitude. No difference in ERN or Pe amplitude was found between individuals with low versus high sleep efficiency.

Conclusions: These results suggest that neural indices associated with error detection (ERN), but not error evaluation (Pe) are associated with sleep duration. Consistent with sleep deprivation studies, these results suggest that individuals who experience sleep loss have smaller ERNs, which may reflect inefficient or impaired error detection mechanisms. Furthermore, as no difference was noted in sleep efficiency, it suggests that sleep duration may play a more important role in optimising daytime functioning and also highlights the need for young adults to have sufficient sleep.
SLOWER REACTION TIMES IN A VISUAL SEARCH TASK IN INSOMNIA AND OBSTRUCTIVE SLEEP APNOEA PATIENTS ARE INDEPENDENT FROM AGE

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Introduction: It is well known that reaction times (RT) increase with age. However, it is possible that strong effects like that of age on response latencies can be overcome by the effect of neurological pathologies. In this study we test the temporal aspects of perceptual processing in two sleep disorders, by employing a visual search paradigm.

Materials and methods: A group of 23 insomnia disorder (ID) and a group of 19 obstructive sleep apnoea (OSA) patients were compared with 19 age-matched healthy controls (HC). All the participants performed a visual search task in which they had to detect the presence/absence of a target (letter T) embedded in the 50% of trials into a set of distractors (letters Os, Xs, or Ls). Target’s salience and distractors’ numerosity were manipulated as independent variables, whereas accuracy and RT were recorded as dependent variables.

Results: Data generally confirmed the typical effects of visual search. Moreover, both ID and OSA patients reported significantly slower RT in comparison with HC. Interestingly, RT increased as expected with age in HC, whereas no correlation between age and RT was found for both ID and OSA patients.

Conclusions: Our results demonstrate the existence of a perceptual deficit occurring in both ID and OSA patients, consisting in a harder extraction of relevant visual information from noise. Noteworthy, for both clinical groups the effect of age is hidden by the overwhelming effect of the disorder, indicating that the delay in RT is ascribable to the effect of the pathology per se.
Introduction: Smartphone use has increased rapidly, especially in adolescents. Many studies have demonstrated that smartphone use before bedtime affects sleep, but few have analyzed the effects of its use during sleep time. The objective of this study was to determine the smartphone use pattern during sleep time, and to analyze its possible effects on the sleep-wake cycle in Mexican adolescents.

Materials and methods: Participants were 114 adolescents, age 12.87±0.90 years, 74 (64.91%) female, attending a secondary school from 07:30-12:30 h, in Monterrey, Mexico. They responded a smartphone use questionnaire and a sleep timing questionnaire.

Results: Ninety three adolescents (81.58%) reported to own a smartphone. During sleep time, 50.54% kept access to internet, 47.31% left sound, 16.13% light, and 37.63% vibrate functions on, ready to receive messages or calls. Only 27.96% used the no disturb function. Furthermore, during sleep time, 84.95% received, 87.10% read, and 36.56% answered messages. A 20.43% used social networks after responding a message. A 29.03% declared that the smartphone interrupts their sleep and required 7.63±14.47 min to go back to sleep, and 25.81% had difficulty sleeping after using their smartphone. Adolescents who own a smartphone reported shorter sleep duration during school days (no smartphone=7.92±1.03 h; smartphone=7.39±0.96 h; t=-2.09; p< 0.05). In addition, those responding messages during sleep went to bed later during weekends (no responding=01.98±2.06 h; responding=02.88±2.33 h; t=2.09; p< 0.05).

Conclusion: Using a smartphone during sleep time interferes with sleep, aggravating the well-known sleep reduction that already occurs during adolescence.

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**EMOTIONAL WORKING MEMORY IN OLDER ADULTS AFTER TOTAL SLEEP DEPRIVATION**

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**Introduction:** Even though the occurrence of sleep problems increases with age, few studies have focused on the cognitive effects of acute sleep deprivation in elderly. Most previous research indicate that, compared to young, older adults show less impairment in e.g. attention after sleep deprivation. However, little is known of whether the same pattern holds for higher cognitive functions. In addition, while old age is usually related to a general decrease in working memory abilities, performance on working memory tasks may differ depending on the emotional valence of the stimuli, where positive stimuli seem to be beneficial for working memory performance in older adults. The aim of the present study was to investigate the effect of sleep deprivation on emotional working memory in older adults using two levels of working memory load.

**Materials and methods:** A healthy sample of 48 old adults (M\_age=66.69 years, SD\_age=3.44 years) was randomized into a total sleep deprivation group (TSD; n=24) or a sleep control group (SC; n=24). They performed a working memory task (n-back) containing positive, negative and neutral pictures in a low (1-back) and a high (3-back) working memory load condition. Performance was measured as Accuracy (d’), Omissions and Reaction Time (RT).

**Results:** For the d’ and Omissions we performed two separate 2x2x3 (sleep, working memory load, valence) repeated measures analyses of variance (rmANOVA). For the RTs, we applied a mixed-effects model. For both d’ and RT we found no effect of sleep deprivation (Ps > .05). For valence, we found main effects on both d’ (F\(_{1,46} = 5.56, P = .005\)) and RT (F\(_{1,95.7} = 4.84, P = .01\)). d’ did not differ for positive and neutral pictures, but was in both cases significantly better than for negative pictures. RTs were significantly faster for positive pictures. However, a working memory load*valence interaction (F\(_{1,95.7} = 4.50, P = .01\)) further revealed an effect of valence in the low, but not in the high load condition. In the low load condition, RTs were faster for positive than for neutral pictures and faster for neutral than for negative pictures. There was no significant effect of Omissions.

**Conclusions:** Our results showed that emotional working memory performance was not significantly affected by one night of sleep deprivation in older adults, which contrast what we found in a sample of young adults from the same project. In line with previous research, our results indicate a beneficial effect of positive stimuli on working memory in older adults. This effect was present in both groups and most pronounced for reaction times in the condition with a lower cognitive demand. We can conclude that, among older adults, the working memory performance is not impaired by sleep deprivation and that the benefits of positive stimuli on working memory seem intact. These findings contribute to a better understanding of older adults’ cognitive functioning after sleep deprivation.

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DIFFERENT MARKERS IN IDIOPATHIC RAPID EYE MOVEMENT (REM) SLEEP BEHAVIOR DISORDER (RBD), POSSIBLE PREDICTORS OF CONVERSION TO DIFFERENT TYPES OF ALPHA-SINUCLEINOPATHIES

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Introduction: Rapid eye movement (REM) sleep behaviour disorder (RBD) is characterized by abnormal behaviors emerging during REM sleep that may cause injury or sleep disruption. The most important implication about RBD is that patients with idiopathic RBD (iRBD) are at very high risk of developing synucleinopathies such Parkinson disease (PD), Dementia with Lewy Bodies (DLB) and Multiple System Atrophy (MSA).

There are a lot of studies about RBD, but there are not consistent data about predictive markers of conversion to each type of these alpha-synucleopathies. This study aimed to analyze and compare the characteristics of patients who, after diagnosis of iRBD, have developed neurodegenerative disease, as well as to determine which biomarkers may be useful to predict conversion different types of alpha-sinucleidopathy.

Materials and methods: A descriptive analysis was performed in 31 patients with iRBD who developed neurodegenerative disease such PD (n=16), DBL (n=11) or MSA (n=4). The mean follow-up time was 10,2 years. The age at onset of RBD symptoms, the first symptom of disease and the characteristics of dreams were analyzed, as well as sleep structure in PSG, muscular activity and characteristics of the episodes of RBD. In the other hand, we have reviewed the results of the neuroimaging test (DAT-SCAN).

All these data have been analyzed related to the evolution of different neurodegenerative diseases.

Results: The most relevant group differences were observed between PD and DLB patients in muscular activity during the night (p< 0,05). Phasic and tonic muscular activity was increased in DLC patients, who presented more vocalitations and continuous dreams behaviours with no need of being aggressive. Cognitive impairment was the first symptom in patients of DBL group (81%) whereas if there were motor symptoms appearing in first place, they were diagnosed in most case of EP (87,7%). No differences between DP and DLB patients were observed in DAT-SCAN. Bilateral and left affection predominated in both groups (80% PD, 75% DLB), fact that could make a difference between iRBD patients in order o develope or not a neurodegenerative disease.

Conclusions: This study provides biomarkers that could be predictors of conversion to a determinate type of alpha-sinucleinopathy in patients with iRBD. All these data may be useful to make an early diagnosis and predict not only the conversion to an alpha-sinucleinopathy but also what type of them. An enlargement of the sample size and more studies are needed to replicate these findings.

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SLEEP DEPRIVATION PREDICTS BOTH IMPAIRED AND IMPROVED PERFORMANCE IN A
VERBALLY FOCUSED COLLABORATION TASK

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Introduction: There is considerable overlap between abilities required for communication and those impaired by sleep loss. However, the effect of sleep deprivation on person-to-person verbal communication is poorly understood. This study aimed to investigate how a night of sleep deprivation affected the efficiency of verbal communication while performing a collaborative task.

Method: 182 individuals (104 female, ages 18-45) were randomised into either one night of total sleep deprivation or normal sleep (8-9 hours in bed). The following day, pairs of participants completed a block-building exercise to assess verbal communication ability. The pairs were comprised of two sleep-deprived participants, two control participants, or a mixture of both. Within each pair, participants were randomly assigned to be either a 'describer' or a 'builder'. The describer was given an abstract model built from Lego and had 10 minutes to verbally instruct their partner how to build an identical model. The main outcome variables were the accuracy of instruction (amount of bricks correctly placed out of 9) and the time taken to complete the task.

Results: Bayesian linear models found that sleep deprivation in builders was associated with a 12% decrease in task performance (effect estimate = -1.10; CI = -1.88, -0.32). Sleep deprivation in the describer was associated with a 10% increase in task performance (effect estimate = 0.93; CI = 0.19, 1.70). Sleep deprivation did not predict time taken to complete the task for either the builder (effect estimate = 13.22; CI = -25.08, 50.23) or the describer (effect estimate = -1.16; CI = -37.42, 35.98).

Conclusion: We show that sleep deprivation leads to both impairments and improvements in performance during a collaborative task with a verbal focus. The impairment in the builders suggests that sleep-deprived individuals are worse at understanding verbal instructions given by others. However, sleep deprivation also appears to promote effectiveness in providing information to others. These findings therefore indicate both drawbacks and potential benefits of sleep deprivation on verbal communication.
THE RELATIVE PRIORITY OF SLEEP AMONG DAILY LIFE ACTIVITIES: ATTITUDE VERSUS PRACTICE

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Introduction: Over the past decades, the impositions of modern life have led to chronic sleep reduction in the society. With the endeavor of sleep researchers, the importance of sleep for physiological and psychological health has been increasingly recognized by general publics. However, it is not clear whether these efforts have led to increased priority of sleep over other daily life activities. Also, the change in attitude does not necessarily lead to change in behavioral practice. The current study therefore aims to survey the relative priority of sleep among daily life activities and the consistency between sleep attitude and behavioral practice.

Materials and methods: Participants included 443 full-time employees (225 males and 218 females), from age 25 to 64 (Mean=43.12, SD=10.21), recruited via an online survey program. A package of questionnaires was administered through the online survey program. Participants were asked to list the priority of their daily life activities, including sleep, work-related activities, family activities, leisure activities, social activities and exercise, to assess their attitude about the importance of sleep. Furthermore, they were required to recall their actual actions the last time when sleep conflicting with one of the other daily life activities (work, family activities, leisure activities, social activities and exercise) to assess their behavioral practice.

Results: When asking to list the priority, 22.1% of the participants made sleep the first priority among daily life activities, 34.8% made sleep the second priority, 24.8% made sleep the third priority, 11.5% made sleep the fourth priority, 1.8% made sleep the fifth priority, and 5.0% of them put sleep the last priority among the daily activities. The results indicated that there is a high percentage of the participants gave high priority to sleep. However, when asking to recall their actual practice last time when there was a conflict in time between sleep and other events, 63.4% of the participants sacrificed their sleep for work. Similarly, 63.2% of them sacrificed sleep for family activities. Relatively less proportion of participants made leisure activities (35.4%), social activities (23.7%) and exercise (23.9%) a priority over sleep. Only one-fourty of participants (25.5%) showed consistent priority of sleep in their attitude and behavioral practices.

Conclusions: While most people recognize that sleep is important and make it a high priority over other activities, it is very common for them to sacrifice sleep over other activities, especially work-related and family activities. Sleep education should not only focus on the importance of sleep, but also provide time management techniques to help the general publics to gain a balance among work, family life and sleep.
SLEEP RELATED COGNITIVE FUNCTIONING IN YOUNG WOMEN WITH EATING DISORDERS

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**Introduction:** While it is now widely recognised that sleep is fundamental to health and learning, very little is known about sleep issues and cognitive functioning in people with Eating Disorders. Eating disorders are a serious ailment and severe illness resulting in poor eating behaviours of the individual (Buysse, 2014). Eating Disorders (ED) that are sleep related associate different aspects of disorders of sleep and eating. Irregular and partial awakenings from sleep trailed with food ingestion pose a negative impact on the entire metabolism. ED are a major reason that result in physical and psychosocial morbidity in adolescent girls and young adult women.

**Materials and methods:** A total of 20 participants diagnosed with Anorexia and 20 with Obesity were tested in London and Jeddah, Saudi Arabia. This is a first cross-cultural study within the area of sleep and ED.. All participants were young women between 18-25 years old. Each participant completed a sleep diary for two weeks. Cognitive functioning was tested by conducting the Fluency test, Digits Test and Ravens Progressive matrices. A non-verbal adult version of the Simons Task which measures attention control was conducted to examine if there was a relationship between total sleep times and performance on the task.

**Results:** The data of the current study showed that participants in both groups suffered from sleep loss of an average of 4 hours per night. This, in turn, had a significant impact on poorer performance on the Simon Task and the results showed a strong correlation with between sleep quantity and performance scores on the Simon test.

**Conclusions:** Our results support evidence that sleep problems in women with ED are associated with poorer cognitive functioning, namely attentional problems based on the Simon task. Short sleep duration, of around 4 hours per night, found in the current sample may lead to increased emotional problems and other health problems. Hence, women with ED should thus be screened for sleep problems since these appear to be severe and are sufficient to negatively influence cognitive functioning. Targeting sleep restoration in ED may ameliorate cognitive responses and associated behavioral outcomes. Eating Disorders (ED) are grave psychiatric pathologies. ED are linked with high anxiety levels that are related to the shape and weight of the body. Although several treatments have been under development, yet sleep is yet to be targeted.Future studies are required to use objective sleep methodology and extensive cognitive and behavioural testing.
SUSTAINED ATTENTION PERFORMANCE DURING SLEEP DEPRIVATION AND FOLLOWING NAP: ASSOCIATED WITH TRAIT-LIKE VULNERABILITY

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Introduction: Sleep deprivation (SD) is known to be associated with cognitive performance deficit. Especially, vigilant attention is consistently and robustly affected by total SD. We tried to identify patterns of sustained attention performance degradation during total SD and whether napping opportunity following SD could improve psychomotor performance. In addition, we examined individual differences in vulnerability to SD using psychomotor vigilance task (PVT).

Materials and methods: Thirty healthy adults (aged 19-25y; 16 females) participated in a 2-day laboratory study. Participants underwent 24-hr (6:00-6:00) total SD under constant environmental conditions and performed the 3-min PVT (PVT-B) for objective vigilant attention, the Stanford Sleepiness Scale (SSS) and visual analogue scale (VAS) for subjective sleepiness at 3-hr intervals. After 24-hr SD, subjects were randomly assigned to one of three conditions: no nap (No-NAP; n=10), a 30-min nap (30-NAP; n=10) and a 90-min nap (90-NAP; n=10). After taking a nap, the PVT-B, SSS and VAS were undertaken at 1-hr intervals. Stress-related hormonal responses (blood concentrations of cortisol, epinephrine, and norepinephrine) were also measured at baseline, pre- and post-nap.

Results: Taking a nap, irrespective of nap length, improved the subjective sleepiness (SSS: P=0.035, VAS: P=0.003), but, did not affect the sustained attention performance task assessed using mRT (mean reaction time) and lapse (number of reaction time>500ms) by the PVT-B. Subsequently, we categorized all subjects as vulnerable or resilient, based on median split of averaged PVT lapse during 24-hr sleep deprivation. In both vulnerable and resilient groups, mRT and lapse increased near habitual bedtime, and there were marked differences between two groups in the magnitude of sustained attention performance (mRT: P=0.006, lapse: P=0.038). However, there were no differences between vulnerable and resilient groups in self-related sleepiness assessed using SSS and VAS for sleepiness. There was also no significant difference in blood concentrations of cortisol, epinephrine, and norepinephrine.

Conclusions: Total SD led to worsening in subjective sleepiness and sustained attention performance. Taking a nap after SD cannot mitigate an impairment of vigilant attention performance, but subjective sleepiness. Degraded sustained attention performance showed marked trait-like individual differences in vulnerability to SD. Small individual differences in sustained attention at baseline are amplified during prolonged wakefulness, especially in habitual bed time.

Acknowledgements: This study was performed at Kyunghee university hospital at Gangdong. YJ Jung and WC Shin had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Introduction: Sleep inertia, experienced as grogginess felt upon awakening, results in cognitive performance impairments that dissipate with increasing time awake. It is unknown, however, how chronic sleep restriction (CSR, insufficient sleep duration over consecutive days) and prior sleep duration influence cognitive performance during sleep inertia. We therefore tested the hypothesis that experiencing CSR (3.3:1 wake:sleep) with short (4.67h) or long (10.0h) sleep episodes would induce significantly greater sleep inertia during the first 1.5h after awakening as compared to Control (2:1 wake:sleep) conditions.

Materials and methods: Data are from two protocols in which healthy participants lived in dim light (< 4 lux) in an inpatient environment free of time cues after 3 weeks of a consistent nightly 10h sleep episode: (i) Seventeen (7 male) participants had 24 cycles of a 20h forced desynchrony (FD) protocol; (ii) Nine (5 male) healthy participants from a prior study that differed only in that the 12 FD cycles were 42.85h with 10h scheduled sleep (CSR_long). Participants in the 20h FD were randomized to CSR_short (4.67h sleep, equivalent to 5.6h per 24h, n=9) or Control (6.67h sleep, 8h per 24h, n=8) FD conditions. In both studies, upon each scheduled awakening, the participant’s bed was elevated to a semi-recumbent posture (~45°) and DSST performance was assessed within 1-min of scheduled awakening and every 10-min thereafter for 1.5h. The number of correct responses on the DSST was analyzed using mixed-effect model techniques. Only data from when the participant was asleep (by PSG criteria) at scheduled wake onset were used.

Results: There was no significant condition effect in baseline performance (p=0.62). Performance on the first test immediately upon awakening was lower by ~7% (SD 6%) than baseline in the Control condition and by ~18% (8%) and 16% (15%) in the CSR_short and CSR_long conditions, respectively (p< 0.05). The two CSR conditions did not differ (p=0.71).

Performance across the dissipation of sleep inertia (average of performance between 10-70 minutes after awakening) was similar in both CSR conditions (p=0.64), was significantly impaired in the CSR_short condition compared to the Control condition (p< 0.05), and exhibited a non-significant trend in the CSR_long condition compared to Control (p=0.06).

Due to expected learning effects, post-sleep inertia test levels were higher than baseline levels, and significantly higher (by 11 responses in 2 minutes) for Control than for both CSR conditions (p< 0.05). Performance reached 95% (4%) of post-sleep inertia levels for Control (p< 0.001), 93% (6%) for CSR_short (p< 0.001) and 96% (7%) for CSR_long p< 0.05) at 70 minutes after awakening.

Conclusions: These data suggest that CSR, commonplace in millions of individuals, can worsen the already reduced cognitive performance immediately upon awakening, with effects persisting for at least one hour. The magnitude of the additional decline is comparable to the performance decrement induced by alcohol intoxication. These findings are important for individuals needing to perform tasks quickly upon awakening and who do not regularly obtain sufficient sleep.

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Introduction: Children experiencing sleep disrupted behaviour (SDB) are at risk of daytime sleepiness and loss of academic attainment. Previous data suggested that executive function was worse in older children with sickle cell disease (SCD) and low mean overnight oxygen saturation. This study assesses SDB (e.g. habitual snoring) and resulting hypoxemia as a potential factor contributing to developmental problems in cognition in patients with SCD.

Materials and methods: We have followed up children and adolescents in the Sleep Asthma cohort (N= 31; mean age = 17.42) who underwent Polysomnography at 2006-2009 and 2011-2014 and compared the sleep data with subsequent neuropsychological assessment (e.g., Processing Speed Index (PSI), Executive Functioning, as measured with Delis-Kaplan Tower, and Coding, subtest of PSI requiring neuropsychological processes of sustained and selective attention).

Result: Patients with SCD achieved lower scores on measure of general intelligence (i.e., Full Scale IQ; effect size: $d = -0.80, p< 0.05$) and processing speed (i.e.; PSI; $d = -0.94, p< 0.01$) compared to sibling controls (N=16). Habitual snoring was significantly associated with decrease in Tower performance ($\eta^2 = 0.34, p< 0.01$), as were shorter sleep duration ($r = 0.42, p< 0.05$). Shorter sleep duration was also associated with decrease in Coding ($r = 0.44, p< 0.05$) and PSI ($r = 0.36, p=0.058$). Additionally, participants who showed a worsening of their SDB symptoms (i.e., AHI >3%: Apnoeas and hypopnoeas with more than $\geq 3\%$ desaturation), in their second sleep study, had lower Tower scores (i.e., executive function, $p< 0.05$). Daytime sleepiness, as measured with the Epworth Sleepiness Scale, and lower mean oxygen overnight showed trends for an association with lower PSI ($\eta^2 = 0.14, p=0.08$). Low Caregiver education could also contribute to lower performance on the Tower test in participants ($\eta^2 = 0.14, p=0.07$).

Conclusions: SDB could contribute to neuropsychological deficits observed in patients with SCD. Sleep disrupted breathing (i.e., habitual snoring and mean oxygen saturation) and parenting (i.e., caregiver educational level) could be potential mediators improving sleep and cognition in this cohort.

Acknowledgements: We thank the patients and families for their participation and the National Institutes of Health and Great Ormond Street Hospital Children's Charity for funding.
**Introduction:** Cognitive impairments and OSA were common in type 2 diabetes mellitus. Both of these conditions can cause difficulties in blood glucose regulation, and will increase the morbidity and mortality. However, the screening of these conditions were still uncommon in worldwide as well as in Indonesia. This study to identify the cognition differences between the type 2 diabetes patient accompanied with Obstructive Sleep Apnea (OSA) risk in Hasan Sadikin Hospital Bandung.

**Materials and methods:** Observational descriptive study, cross sectional was conducted in patients with type 2 diabetes mellitus in Endocrine Clinic Hasan Sadikin Hospital Bandung on September to November 2016. All subjects which fulfill the inclusion criteria will be ask to fill the STOP BANG questionnaire, then cognitive impairment examined with Indonesian version of Montreal Cognitive Assessment (MoCA-Ina).

**Results:** 58 subjects are fulfilled the inclusion criteria, consist of 32 male and 26 female. There was 35 subjects (60,3%) with high risk of obstructive sleep apnea (OSA), 23 subjects (39,7%) with low risk of OSA. From this study, there was 28 subjects (48,3%) with abnormal score of Indonesian version Montreal Cognitive Assessment (MoCA-Ina) and 30 subjects (51,7%) with normal MoCA-Ina score. Type 2 diabetes patients with risk of OSA had risk of cognitive impairment, with adjusted odds ratio 10.364 (95% CI 2.844-37.762).

**Conclusions:** Type 2 diabetes patients who have high risk of OSA have ten times higher risk of having cognitive impairment compared with the low risk OSA group.

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IMPACT OF HABITUAL SHORT SLEEP AND PERCEIVED SLEEP NEED ON RISK-TAKING IN YOUNG PEOPLE

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Introduction: Acute sleep deprivation has been reported to increase risk taking; however, less known about how the common condition of chronic sleep restriction affects willingness to take risks. Given the increasing prevalence of short sleep duration, we investigated the prospective relationship of habitual short sleep in young people to their performance on a laboratory task that assesses willingness to take risks.

Materials and methods: Participants (n=166, aged 17-25, 63% female) completed a 7-day protocol at two time points, separated by 12 months in which they wore actigraphs and completed a sleep diary for 5 days at Time 1 (T1) and 6 days at Time 2 (T2). On the following day at each time point, they came to the laboratory to complete the Risky Gains Task as an assessment of risk-related decision-making. In this task, participants can make an immediate choice that provides a guaranteed low payout (safe choice) or wait to select one of two higher payout options, which also carry a significant risk of instead producing a loss (risky choice). Sleep measures assessed from actigraphy and diary included average and variability of total sleep time, sleep efficiency and timing of mid-sleep. Based on the National Sleep Foundation's recommended sleep time, those with average sleep durations of < 6 h were classified as short sleepers. We measured participants' perceived sleep need by asking them how many hours of sleep they think they need. Overall number of risky choices and the number of safe choices following punishment were used as outcome variables of risk-taking behaviors.

Results: Perceived sleep need among short sleepers (7.8 ±1.4 h) was significantly shorter than among normal sleepers (8.3 ±1.5 h; F1,167=4.043, p=.046). After controlling for demographic factors (age, sex, body mass index, family income) and risk-taking tendency at T1, there was a significant interaction between habitual short sleep measured by actigraphy and perceived sleep need at T1 in predicting the number of risky choices at T2 (F8,139=9.575, adjusted R²=.431, p<.001). There were also significant interactions between both actigraphy-measured (F8,139=28.507, adjusted R²=.673, p<.001), and sleep diary-measured (F8,139=3.974, adjusted R²=.170, p<.001) short sleep at T1 with perceived sleep need in predicting number of safe-choices after loss trials at T2. Among short sleepers, higher perceived sleep need was associated with increased numbers of risky choices and decreased safe choices after loss, while normal sleepers showed the inverse relationship between sleep need and risk-taking in that higher perceived sleep need corresponded to decreased numbers of risky choices.

Conclusions: Our longitudinal data show that the effects of habitual short sleep on risk-taking tendency depend on an individual's perceived sleep need. Short sleepers with greater sleep need seem to be most vulnerable in making risky decisions. Our findings highlight the importance of evaluating individual differences in perception of sleep need in understanding the impact of short sleep duration in both clinical and research settings.

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Influence of chronic short sleep and a daytime nap opportunity on emotion-related inhibitory control in young adults

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Introduction: Rapid Eye Movement (REM) sleep has been proposed to affect fronto-limbic circuitry involved in behavioural inhibition and emotion regulation. We investigated the effect of a daytime nap opportunity in chronic short sleepers and normal sleepers on the ability to inhibit responses to visual stimuli that varied in emotional valence.

Materials and methods: 200 young adults (aged 17-25 years, 63% female) wore actigraphs for 5 days. Those averaging < 6 h nightly were classified as Short sleepers. On the following day, performance was assessed using an Affective Go/No Go (AGNG) task at 13:00 (Test 1) and 17:30 (Test 2). Half of the participants were randomly assigned to stay awake between tests (Wake) and half were given a 90-min nap opportunity (Nap), during which EEG recordings were made for sleep staging. Faces with neutral, positive and negative emotional expressions were used as stimuli signaling Go and No Go responses. Signal detection theory was used to calculate participants’ discrimination index (d') in responding to face stimuli. Performance change was assessed by subtracting Test 2 d' from Test 1 d': a positive difference indicated deterioration of performance across sessions.

Results: The Nap and Wake groups did not differ significantly on demographic features (age, sex, body mass index, household income), habitual sleep patterns (5-day average total sleep time, sleep efficiency, mid-sleep time) and Test 1 performance on the AGNG (ps >.05).

Analysis of d’ involving 2 between-group factors (Nap/Wake; Short/Normal Sleep) and 1 within-group factor (Test Session) showed a significant 3-way interaction, indicating effects on d’ for neutral (F1, 162=9.084, p=.003, η²=.053) and negative faces (F1, 162=5.635, p=.019, η²=.034), but not for positive faces (F1, 162=.305, p=.581, η²=.002).

Follow-up analyses for neutral faces showed that among Short sleepers, those in the Wake condition showed more deterioration of performance than those in the Nap condition (mean difference=1.66, p=.004), and more deterioration than Normal sleepers in the Wake (mean difference=1.67, p=.004) and Nap conditions (mean difference=1.41, p=.010). Greater deterioration of d’ across Tests correlated positively with higher self-reported sleep need among Short sleepers in the Wake condition (r(7)=.826, p=.022).

For negative faces, Short sleepers in the Nap condition showed less deterioration of performance across Tests than those in the Wake condition (mean difference=-2.03, p=.010) and Normal sleepers with a Nap (mean difference=-.84 p=.024) and (F3, 162=.308, p=.029, η²=.214). The change in d’ among Short sleepers with a Nap correlated negatively with amount of REM sleep in the nap, r(36)=-.406, p=.014 and with baseline 5-day average total sleep (r(37)= -.405, p=.013).

Conclusions: Habitual Short sleepers showed more deterioration in their ability to inhibit responses to neutral or negative stimuli than normal sleepers or those given a nap opportunity. These effects were modulated by the emotional valence of stimuli signaling response inhibition. The length of REM sleep during the nap was related to the amount of benefit for performance, suggesting that REM sleep is involved in modifying responsiveness to emotional stimuli.

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Introduction: Adolescence is often linked to sleep deprivation and increased impulsivity and risk behaviours. Whilst previous research has found that sleep deprivation is associated with increased impulsivity and risk-taking, most of previous studies adopted an experimentally induced sleep deprivation paradigm for a certain period of time. There has been limited research on the effects of habitual chronic sleep restriction on behavioural consequences. The current study aimed to examine the influence of habitual chronic sleep restriction on decision making among youth.

Materials and methods: A total of 197 participants (males: 23%, age = 12-23 years) completed a set of questionnaires and the lab assessment. Chronic sleep restriction was measured by the chronic sleep reduction questionnaire (CSRQ). Weekday and weekend sleep duration were measured by Sleep Timing Questionnaire (STQ). Decision-making behaviors were assessed by Balloon Analogue Risk Task (BART) and experimental discounting task. Temporal and effort discounting preferences were reflected by the area under the curve (AUC), in which higher scores suggested lower discount rates (i.e., a preference for larger but later reward). Chronotype was measured by reduced Morniness-Eveningness Questionnaire (rMEQ) and mood disturbance was measured by Depression Anxiety Stress Scale (DASS-21). Linear regression analysis was applied to examine the relationship between decision-making (dependent variables) and chronic sleep restriction (independent variables), whilst age, gender, chronotype and mood disturbance (DASS) were entered as covariates.

Results: The average weekday and weekend reported sleep duration of the overall study participants were 7.08 ±1.14 hours and 9.26 ± 1.46 hours, respectively. Participants with higher CSRQ score, suggesting more chronic sleep restriction, had increased temporal discounting (i.e., a preference for smaller but immediate reward, β=-0.18, p = 0.032). However, neither weekday nor weekend reported sleep duration was related with risk behaviors as measured by BART. In addition, chronic sleep restriction was not found to be associated with either effort discounting or BART performance.

Conclusions: Our findings suggest that chronic sleep restriction affects delay discounting behavior, which may contribute to the emerging understanding of how chronic sleep restriction affects decision making in adolescents. In addition, this study highlights the impact of sleep debt, which may be better reflected by symptoms associated with sleep loss, on neurobehavioural functioning.

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BELIEFS AND ATTITUDES ON SLEEP AND RELATED FACTORS IN INSOMNIA PATIENTS COMORBID WITH BIPOLAR DISORDER

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Background: Disturbances in sleep are prominent features of bipolar disorder, even during interepisode periods. Sleep disturbance is the most common prodrome of mania and the sixth most common prodrome of bipolar depression. A few studies suggest that cognitive behavior therapy for insomnia has the potential to enhance interventions for bipolar disorder patients by providing a specific emphasis on sleep. There is little known about beliefs and attitudes on sleep in comorbid insomnia patients with bipolar disorder.

Objective: To investigate beliefs and attitudes on sleep in bipolar disorder patients comorbid with insomnia and the related factors; to analyze the differences in beliefs and attitudes about sleep among the different stages of bipolar disorder, primary insomnia and good sleepers.

Methods: 166 patients with bipolar disorder comorbid with insomnia (59 in the depressed phase, 53 in the manic phase and 54 in the euthymic phase), 62 patients with primary insomnia and 64 good sleepers were recruited. The five groups were measured by Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS) and Pittsburgh Sleep Quality Index (PSQI). The bipolar disorder group were also measured by the Hamilton Depression Scale (HAM-D) and Young mania rating scale (YMRS).

Results: The total and all factor scores of DBAS for the good sleepers were higher than the three bipolar disorder groups and primary insomnia group. In the aspect of "the distorted beliefs about sleep expectation", the scores of the patients with interepisode bipolar disorder were significantly higher than those of the primary insomnia group (p < 0.05). The patients in depressed episodes of bipolar disorder scored lowest in the factor "catastrophic interpretation about the consequences of insomnia" among the three episodes of bipolar disorder (p < 0.05). Correlation analysis showed that the total score of DBAS was significantly correlated with the scores of the factor "sleep quality", "sleep time", "sleep disorder", "daytime function" and the total score of PSQI (p < 0.05). Multiple linear regression analysis of DBAS scores showed that the scores of sleep disorder and daytime function had a significant effect on the attitudes and beliefs about sleep in the patients with interepisode bipolar disorder and primary insomnia. The attitudes and beliefs on sleep of the patients with bipolar depressive episodes were affected by the HAMD and YMRS scores, while the attitudes and beliefs about sleep in patients with bipolar manic episodes was only related to sleep latency.

Conclusions: The bipolar disorder group hold a level of dysfunctional beliefs about sleep that is comparable to that in the insomnia group and significantly higher than that in the good sleeper. The scores of HAMD and YMRS are influencing factors on the beliefs and attitudes of sleep in the patients with bipolar depressive episodes, while sleep latency is the influencing factor in manic episodes of bipolar disorder.
Introduction: Desaturation during sleep is initially associated with poor quality of sleep in short term. However, in long term, due to chronically intermittent hypoxia, some degree of brain structural impairment can be detected using interconnectivity dependence measurements like PDC (partial Directed Coherence) in PSG data during sleep. Our aim is to assess the association between Desaturation among sleep stages and EEG bands with PDC levels in a Brazilian populational Based sample (EPISONO).

Materials and methods: 805 valid PSG were collected in a total populational based sample of Sao Paulo/Brazil City. Spectral analysis was done in EEG full night PSG and the following frequencies were calculated (Alpha 1 and 2, Beta 1 and 2, Delta, Theta and Gamma). The PDC were calculated for each Spectrum in each frequency, yielding data that was correlated with SaO2 findings (max, min and average) levels. GLzM models were used with Age, Sex and BMI as covariates.

Results: Negative associations between PDC and SaO2 levels (amount of time over 90% during PSG recording) during REM sleep for Alpha ($p < 0.0016$) and Delta frequencies were described ($p < 0.003$).

Conclusions: The negative association between PDC and SaO2 levels indicates some lack of connectivity during specific parts of sleep which can lead to further cognitive impairments in dwellers without previous history of clinical sleep disorders. Some public health assessments can be implemented according with these findings in order to avoid long term problems associated with saturation during sleep.

Acknowledgements: Sleep Institute, AFIP, FAPESP
Introduction: The rapid development and ubiquitous use of mobile phone in modern society have raised concerns about their potential impacts on sleep quantity and quality and mental distress, especially among youth. Several previous studies have focused on the correlations between overuse of mobile phone and various sleep disturbances or mental distress, but the cross-sectional design limited their ability to interpret the causal relationships. Therefore, our study aimed to determine the associations between long time of mobile phone use (LTMPU) and sleep disturbances and emotional distress in a prospective cohort of youth.

Materials and methods: A total of 4,733 students (mean age 18.3±1.7 years, 19.1% female) from a technical school in Guangzhou, China were recruited in November 2014 at baseline. Among them, 4,333 (91.5%) with valid data were eligible for the follow-up study. Finally, 3,396 (78.4%) participants had a valid response at follow-up in July 2015. Data were collected by a set of questionnaires, including a general questionnaire on socio-demographics, lifestyles, health conditions, length of mobile phone use per day, sleep duration on weekdays and weekends, as well as Insomnia Severity Index (ISI), Epworth Sleepiness Scale (ESS), Morningness-Eveningness Questionnaire-5 (MEQ-5), Beck Depression Inventory (BDI), and Zung Self-Rating Anxiety Scale (SAS). Specifically, LTMPU was defined as using mobile phone ≥ 4 hours/day, short sleep duration was defined as having a sleep < 7 hours/night, and insomnia symptoms, excessive daytime sleepiness, eveningness chronotype, depressive symptoms and anxiety symptoms were defined as having a score of ISI ≥ 10, ESS ≥ 14, MEQ-5 ≤ 11, BDI ≥ 11 and SAS ≥ 50, respectively. Student’s t-test, chi-square test and multivariate logistic regression were performed in data analyses by SPSS.

Results: At baseline, 23.5% (n=1020) of the participants reported using mobile phone ≥ 4 hours/day. There were positive correlations of LTMPU with older age, female gender, urban area, higher paternal education level (university), higher family income (>15,000 yuan/month), overweight, habitual napping, long-time spending on TV or Internet (>3 hours/day), chronic medical conditions, high study stress, low study interest, and higher living expenses (>2,000 yuan/month) at baseline (p < 0.05). In cross-sectional analyses, LTMPU was positively associated with all kinds of sleep disturbances and emotional distress studied (p < 0.001), and these relationships remained significant even after adjusted for socio-demographics, lifestyles and health conditions in multivariate analyses (p < 0.05). In prospective analyses, LTMPU at baseline was positively associated with new incidences of most of these problems at follow-up (p < 0.01), even after adjusted for socio-demographics at baseline (p < 0.05). In contrast, after excluding participants without sleep disturbances or emotional distress at baseline, there was no significant correlation between LTMPU at baseline and persistence of all these problems studied at follow-up (p > 0.05).

Conclusions: LTMPU is quite prevalent among youth, which was not only cross-sectionally associated with various sleep disturbances and emotional distress, but also prospectively associated with the new incidences of most of these problems, even after controlling for the potential confounding factors. On the contrary, LTMPU was not associated with the persistence of these problems. These findings suggested that interventions on LTMPU may be beneficial to prevent but not to improve these problems.
THE EFFECT OF OLFACTORY STIMULATION ON AFFECTIVE VALENCE OF DREAMS AND AFFECTIVE STATE UPON WAKING: PRELIMINARY RESULTS OF A PILOT STUDY

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Introduction: Research suggests that the sleeping brain is able to process chemosensory information on the cortical level and that odors can influence content and affective valence of dreams. The focus of the presented project are effects of odor exposure during sleep on affective valence of dreams and affective state upon waking. In the pilot study to this project, effects of two “pure olfactory” stimuli, vanillin and thioglycolic acid, which are generally perceived as pleasant and unpleasant, respectively, are investigated.

Materials and Methods: In weekly intervals, participants spend three nights in the sleep laboratory, to adapt to the research settings on the first one and receive olfactory stimulation (vanillin or thioglycolic acid) on the second or third one in a randomized design. On each night, nocturnal polysomnography (10 p.m. to circa 8 a.m.) is recorded and participants are woken up five minutes into the first REM phase that occurs after 4 a.m. Immediately after waking, they are asked to complete questionnaires on dream characteristics (e.g. pleasantness, presence of specific emotions and sensory modalities), affective state (core affect measure), and awareness of odor and its perceptual characteristics. They complete the same measures once again upon waking in the morning.

Results: Preliminary results in 31 participants show that those receiving olfactory stimulation on the second night reported greater dream pleasantness on that night and morning, regardless of odorant used, compared to their first (adaptation) and third (control) night. However, this was not the case with participants exposed to odor on the third night. Further, compared to the other three conditions, participants exposed to thioglycolic acid (but not vanillin) on the third night reported they felt more awake, peppy, and active upon nocturnal waking and more serene, calm, and relaxed in the morning. All of these effects were independent of whether the participant was aware of the presence of an olfactory stimulus and his or her perceptual ratings of that odor.

Conclusions: Preliminary results indicate that there is a potential for odors to positively influence subjective dream pleasantness and modulate the affective state upon waking that is worth further exploration. The project may help to prepare ground for utilization of olfactory stimulation for instance in individuals suffering from sleep disorders.

Acknowledgements: This pilot study is a result of research funded by the Czech Science Foundation (GA17-14534S) and project LO1611 with financial support from the Ministry of Education, Youth, and Sports (MEYS) under the NPU I program.
**Introduction:** Vigilance performance is experienced as effortful and relies on limited cognitive resources. Recent theories propose that effort allocation is regulated through a continuous cost-benefit analysis, in which effort is considered a cost that is weighed against potential benefits (e.g. monetary reward). The willingness to exert effort is higher when expected benefits are larger. Conversely, rewards are considered less attractive if more effort is required to obtain them (effort discounting). As vigilance performance is heavily affected by sleep deprivation (SD), it is important to examine how SD impacts on this cost-benefit weighting of effortful attention.

**Methods:** Two methodological approaches were used to investigate this matter. First, we tested whether incentives improved vigilance performance, and whether this was altered after a night of SD. Participants (N=26) performed the Psychomotor Vigilance Task (PVT) under different incentive conditions (1, 5, or 15 cent/fast response [individually defined]). Subsequently, reward devaluation was measured using a discounting task in which participants indicated their preference for rewards that were available upon performance of different durations of PVT (1, 5, 10, 20 or 30 min). All tasks were performed once after a night of sleep, and once after SD (in counterbalanced order). During PVT performance, pupil diameter was monitored as a measure of attentional effort and arousal.

**Results:** Overall, PVT performance improved in higher reward runs. This effect was accompanied by increased pupil size, indicating higher attentional effort. Although performance was poorer during SD for all runs, this SD-effect was most pronounced when rewards were low. Results form the discounting task showed that participants clearly devalued rewards that were contingent on longer task performance. Importantly, this discounting effect was steeper after SD.

**Conclusion:** Findings from both tasks confirm that the allocation of attentional effort in vigilance performance is subject to a cost-benefit analysis, and that the subjective costs of vigilance are increased after SD.

**Acknowledgements:** This work was supported by a by a grant awarded to Michael Chee from the National Medical Research Council Singapore (NMRC/STaR/0015/2013) and the Far East Organization.
Introduction: In today’s society, daily household routines are ever changing given family member obligations, parent job schedules, school start times, and weekend activities. Children and parents may perceive aspects of their home environment differently, such as constantly running late or calmness of the home atmosphere. Chaotic households, characterized by disrupted routines, disorganization, and limited regularity, have been linked to poorer sleep among children and adolescents. The 2014 National Sleep Foundation survey found that youth with daily routines (e.g., evening meal times, bedtimes, wake-times) and household sleep rules (e.g., bedtime, technology in bedroom) had sufficient sleep quantity and adequate sleep quality, compared to those without well-established household routines. In adults, poorer sleep is associated with higher levels of C-reactive protein (CRP), a biomarker of chronic, low-grade systemic inflammation linked to cardiovascular risk. Experimental sleep-restriction studies demonstrate shorter sleep duration is causally related to greater inflammation; cross-sectional studies suggest increased sleep fragmentation is related to higher CRP levels. Emerging evidence with youth suggests shorter sleep duration is associated with increased inflammation. The aim of the present study was to investigate pathway models that best fit the relations between household chaos, school start time, sleep dimensions, and inflammation among children and adolescents.

Materials and methods: Children and adolescents ($N=197; M_{age}=13.3\text{ years}$) participated in the larger Healthy Heart Project in Montreal, Quebec. Youth wore a piezoelectric accelerometer (Actiwatch2, Philips Respironics) on their non-dominant wrist for two weeks. Trained technicians manually scored the start and end time of daily rest intervals using a standardized protocol. Actiware software (version 6.0.1) was used to derive sleep duration, wake-time, wake-time variability, bedtime, bedtime variability, and sleep fragmentation. Fasting serum blood samples were assayed using a high-sensitivity, immunoturbidimetric method (Gamma-Dynacare Laboratories) to yield high-sensitivity C-reactive protein. (No participants had concentrations greater than 10mg/L, which would indicate ongoing infection.) Youth and parents rated household disorganization using the 15-item Confusion, Hubbub, and Order Scale (CHAOS). School start time was obtained via self-report and validated with direct follow-up with schools.

Results: Pathway models, using linear regression and structural equation modeling, were tested separately for children and adolescents. For children, earlier school start time and greater household chaos (both child and parent perceived) were linked to later weekend wake-times, greater wake-time variability, and shorter sleep duration, which in turn were associated with higher CRP. Parent perception of household chaos was also directly linked to higher CRP in the child models. For adolescents, earlier school start times and greater household chaos (adolescent perceived only) were linked to earlier waketimes and greater sleep fragmentation, which in turn were associated with higher CRP.

Conclusions: Findings suggest disorganized household routines and early school start times exacerbated sleep parameters differentially among children and adolescents. In turn, poorer sleep had a direct impact on chronic, low-grade inflammation. Future research should consider prospective, longitudinal investigations combined with time-series analyses to establish causal relations between household routine, school start times, sleep, and inflammation.

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IMPLICIT WANTING FOR SLEEP IN GOOD AND POOR SLEEPERS

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Introduction: Good sleepers seem to experience a natural 'wanting' for sleep before going to bed reflecting the activation of an underlying sleep drive. This normal sleep initiation process occurs largely automatic, but can be undermined by hyperarousal, which has been shown to be a key characteristic of poor sleepers. We therefore hypothesized that good sleepers show an increase of drive-related, implicit 'wanting' for sleep before going to bed compared to a wakeful state, while poor sleepers' implicit 'wanting' for sleep should be unaffected by current sleepiness. In contrast, the evaluation ("liking") of sleep should increase in the evening in both good and poor sleepers due to normative concepts and society's positive evaluation of night sleep.

Materials and methods: Forty-five participants were instructed to enter the lab twice. According to their subjective sense of fatigue they were supposed to come during a moment of extreme low (typically during the morning) and high (typically shortly before bedtime) fatigue. In both conditions, we measured implicit 'wanting' for sleep with the Wanting-Implicit-Association-Test (W-IAT), a response-time based measure for assessing the strength of situationally activated wanting motivation. Automatic evaluation ('liking') of sleep was measured with a standard Liking-IAT (L-IAT). The explicit desire to sleep, current state sleepiness (Stanford Sleepiness Scale, SSS), and sleep quality (Pittsburgh Sleep Quality Index, PSQI) were addressed.

Results: Our sample (mean age = 20.02, SD = 1.90), was divided into 'good sleepers' (PSQI-score ≤ 5, n=26) and 'poor sleepers' (PSQI-score > 5, n=19) based on their global PSQI-scores. As hypothesized, results revealed that only good sleepers exhibited greater Wanting-IAT scores in the tired as compared to the wakeful condition, indicating an increase in implicit 'wanting' for sleep before going to bed (p< .001), while poor sleepers' 'wanting' for sleep was unaffected by fatigue condition (p=.353). In contrast, a concurrent increase in implicit 'liking' for sleep was observed for both groups (ps< .05). Importantly, good and poor sleepers did not differ with respect to their explicit desire to sleep, as well as their subjective state sleepiness (SSS) in both conditions (all ps>.05), on which measures both participant groups exhibited equally increased scores in the high as compared to the low fatigue condition.

Conclusions: Results suggest that poor sleepers did not exhibit greater 'wanting' for sleep before going to bed, while good sleepers' 'wanting' for sleep increased shortly before bedtime. The affective component, the increase of 'liking' for sleep before bedtime, was unaffected by sleep quality and might represent normative concepts towards sleep. Lacking 'wanting' for sleep in poor sleepers could reflect the absence of sleep drive, for instance due to the counteractive influence of hyperarousal. The link between hyperarousal and lack of implicit 'wanting' for sleep should be examined in further research since it could be a potential pathomechanism of poor sleep.
Introduction: Fetal Alcohol Spectrum Disorders (FASD) is a spectrum of neurodevelopmental disorders, the result of ethanol exposure to a developing fetus. It is thought to be present in between 2.4 - 4.8% of live births in the West. It is characterised by a complex series of physiological and behavioural patterns including learning difficulties, poor executive functioning, and deficiencies in social perception, memory and higher level language abilities. Additionally, a number of physical features may - or may not - be present, including craniofacial characteristics and low birth weight and height. Children with FASD might often appear to understand words but have difficulties in linking their meanings, order and sentences. They frequently have behavioural and executive functioning issues that are misdiagnosed as Attention Deficit Hyperactivity Disorder or Autism Spectrum Disorders. Prenatal alcohol exposure is often confounded with other environmental disturbances, such as chaotic home environment, living in foster or adoptive care, maternal drug use, and low socioeconomic backgrounds. Up to 90% of caregivers have reported sleep disturbances in children with FASD and since we know from other clinical populations these can be correlated with behaviour and language, this study set out to look at whether language acquisition.

Materials and methods: Sleep characteristics, maladaptive behaviour, and language acquisition was measured in a group of 16 children aged between 3-7 years old with FASD through the following parental reports: The Brief Infant Sleep Questionnaire (BISQ); Infant Sleep Vignettes Interpretation Scale (ISVIS); Pittsburgh Sleep Quality Index of Parents (PSQIP); Child Behaviour Checklist (CBCL); MacArthur Communicative Development Inventory for Infants - Words and Gestures (MCDI).

Results: Compared to typically developing children, those with FASD had shorter night sleep duration, higher numbers of night wakings, night wakefulness and settling duration. They were more likely to sleep with a parent, and fall asleep only when a parent is present. In comparison to control parents, parents of FASD children were more likely to describe their child’s sleep as problematic, and had higher involvement with their children during bedtime routines. Regression analysis revealed that a proportion of the variance in both language development and behavioural scores in children with FASD could be attributed to night sleep duration.

Conclusions: This pilot study found a correlation between sleep quality and maladaptive behaviour in children with FASD; This pilot study found a correlation between sleep quality and language acquisition in children with FASD. Further investigations through actigraphy and polysomnography are currently being tested in a larger, older population. This includes looking at the adolescent behavioural markers for antisocial behaviour and psychosis. The possible negative effects on mood, the efficacy of sleep interventions, and the longitudinal effects of sleep deficiency are areas of much needed further investigation in this clinical population.

Acknowledgements: All families living with the consequences of FASD. The Tavistock and Portman Clinic, London; Dr Dagmara Dimitriou; Professor Chloe Marshall.
THE RELATIONSHIP BETWEEN SLEEP, SOCIAL MEDIA AND WELL-BEING OF FEMALE ADOLESCENTS

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Introduction: Intense social media use, anxiety symptoms and poorer sleep have all been found to be prevalent in female adolescents. Several studies have found that social media use reduced overall sleep duration and increased night time wakings. This study sets out to explore the relationship between female adolescents' social media use and their wellbeing.

Materials and methods: A sample of 41 female adolescents (16-19 years old) participated in an online questionnaire about social media use and wellbeing. The Social Media Disorder Scale and a self-reported questionnaire measured intensity and number of social media platforms used. Sleep was measured using Pittsburgh Sleep Quality Index and self reported seven-day sleep diaries. Anxiety and loneliness were measured using Beck Anxiety Inventory Trait and Hughes et al.'s three-point loneliness scale.

Results: All participants belonged to at least two social media platforms. Snapchat was the platform accessed most often and also the platform which respondents posted material on most often. Based on the Social Media Disorder Scale, 27% of the participants were classed as “disordered” social media users. These disordered users were found to sleep on average almost one hour less per night than non disordered users. Disordered users were also more likely to feel lonely. An increase in social media disorder criteria met correlated significantly with an increase in anxiety symptoms experienced by participants. No association was found in respect to PSQI although 76% of the participants were classed as poor sleepers.

Conclusions: In contrast to previous studies, which suggest 10-13% of adolescents have disordered social media use, the current study shows a much higher score of 27%. Hence, findings from this novel study focusing on 16-19 year old females suggest that social media disorder may be more prevalent than previously thought, especially so within adolescent females. These “disordered” social media users have shown to have poorer wellbeing in respect to their sleep duration and loneliness than non-disordered users. Further investigation is necessary to fully understand the affect social media disorder may have on adolescent wellbeing.
CHAOTIC DYNAMICS OF SLEEP ONSET: PROOF OF INVERTED CONSCIOUSNESS

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Introduction: The hallmark of sleep is partial disconnection from environment that parallels the inverted sensory and mental activities. Our goal was to demonstrate that the re-focusing of consciousness from the outside world to Internal Model of the World (IMW) is a non-linear process that may be evaluated with dynamical analysis of eye and limb movements in order to recreate a topological equivalent picture of the original behavior of pertinent complex neuronal network. In addition, we intended to show similarity in the mode of access to IMW in sleep and wakefulness.

Materials and methods: To define state consistently with changes in consciousness, 10 subjects, 10 asymptomatic patients and 4 patients with narcolepsy were instructed to squeeze a bulb connected with pressure sensor (eyes closed). 35-channel polysomnogram was digitally recorded, and 30 data files were created from the tracing of eye movement (EM) and bulb pressure (BP) using EDF to ASCII converter (stationary time series of 7,500 - 15,000 /EM) and 25,000 - 142,000 /BP/ data points, no filters). We used Visual Recurrence Analysis software (VRA; Kononov, 2011) to compute embedding dimensions and time delays employing the False Nearest Neighbors method and Average Mutual Information methods, respectively. The recurrence plots, correlation dimensions (CD) and phase-space charts were produced and analyzed in context of dynamics of EEG and subjective experience.

Results: Mind-wandering and dreaming associated with alteration of motor and eye movement activities that was consistent with low dimensional chaotic dynamics across the continuum of drowsiness and light NREM sleep. Unexpectedly, in REM sleep our patients with narcolepsy also were able to squeeze the bulb that permitted determination of chaotic dynamic with CD 1.15 ± 0.129. The striking similarity was found with dynamics of Necker cube interpretation (CD 1.16 ± 0.12) when the same subjects squeezed a bulb in response of subjective changes of position of the cube. The most frequent dynamic counterpart of alertness was quasi-periodic mode as in the Van der Pol oscillator with sinusoidal forcing. Different strange attractors were detectable in drowsiness with microsleep, light NREM sleep and in REM sleep. Rapid eye movements in wakefulness and REM sleep as well as rolling eye movements in drowsiness and NREM sleep had chaotic dynamics with periodic trend and variable CD (2.9 - 4.5). Among the significant results of this study was the demonstration of intrinsic unpredictability of drifting to sleep that can be explained by extreme sensitivity to initial conditions of chaotic dynamics.

Conclusions: Our results support the concept of inverted consciousness in sleep and make clear nonlinear dynamics of directional changes of consciousness with emergence of diverse subjective experience.
EXPERIENCING FEAR IN DREAMS RELATES TO BRAIN RESPONSES TO AVERSIVE STIMULI DURING WAKEFULNESS

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Introduction: It has been suggested that sleep and dreaming contribute to emotion regulation processes by fostering adapted emotional responses during waking life. The aim of this study is to elucidate the neural correlates of emotional dreams and their impact on waking behavior.

Materials and methods: In the first experiment, we performed serial awakenings of 12 healthy subjects recorded throughout the night with high-density EEG (256 channels) and asked them if there was any fear/anxiety in their dream experience or not. In the second experiment, 127 healthy volunteers performed an emotional task at wake while fMRI data were recorded. Dreams of these subjects were also collected and ICA analysis on the emotional content was performed to extract the main emotional categories of dreams.

Results: The results show that experiences characterized by fear/anxiety in dreams were associated with the activation of the insula bilaterally, similarly to wakefulness. In addition, we found that subjects reporting high incidence of fear/anxiety in their dreams had less activation in the insula, amygdala and cingulate cortex and more mPFC activation when presented with negative stimuli in wake than those with lower incidence of fear/anxiety in their dreams.

Conclusions: This result provides a first support for a link between emotional processes occurring during sleep and emotional brain functions during wakefulness, and is consistent with the hypothesis that dreams may relate to emotion regulation processes.

Acknowledgements: VS and LP contributed equally to this work.
COMORBID INSOMNIA AND SLEEP APNEA IS ASSOCIATED WITH GREATER NEUROCOGNITIVE IMPAIRMENT COMPARED WITH OSA ALONE

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Introduction: Comorbid insomnia with sleep apnoea (COMISA) affects as many as 30% of patients with obstructive sleep apnoea (OSA) and may compound the negative health consequences associated with both conditions. The aim of this study was to compare neurocognitive function between patients with COMISA to patients with OSA alone.

Materials and methods: 61 patients with snoring and suspected OSA underwent an in-laboratory overnight polysomnography (PSG). Prior to the PSG, patients completed the insomnia severity index and Epworth sleepiness scale and performed the psychomotor vigilance test (PVT) and a choice reaction time (CRT) test, starting at 7.30 pm. These tests were repeated after the patient woke up the next morning, starting at 7 am. Based on the questionnaires, patients were classified as suffering either COMISA (n=18) or only OSA (n=43). Other outcomes were compared between groups using independent samples t-tests.

Results: Compared to the OSA group, COMISA patients were similar in age (mean±SEM 49±2.7 vs 50±2 yrs) but had higher BMI (mean±SEM) (34.6±1.8 vs 29.2±0.8 kg/m², p=0.014), AHI (32.3±8.1 vs 17.1±2, p=0.084) and ESS scores (9.2±1.14 vs 6.1±0.5, p=0.02) and spent more time in N2 sleep (57.2±2.23% vs 49.8±1.87%, p=0.016). There was no significant difference in performance between groups in the evening test session, but in the morning session COMISA patients showed more lapses during both the CRT test (p=0.001) and PVT (p=0.01).

Conclusions: Patients with COMISA appear to show greater neurocognitive impairment when compared to patients with OSA alone, at least in the morning. Further research is warranted but these results suggest that it may be useful to assess the presence of insomnia symptoms more routinely in sleep clinic patients.

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DECREASED TIME IN BED PREDICTS RISKY DRIVING IN YOUNG ADULTS: A PROSPECTIVE, NATURALISTIC STUDY

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Introduction: Road crashes are the number one killer of young people (18-25 years) across the globe. Young drivers are over-represented in sleepiness-related crashes, when compared to older drivers. Sleep loss is commonly experienced by young adults due to a range of biological and environmental factors; however, prospective evidence for the role of habitual sleep in day-to-day driving is lacking. High g-force events captured by in-vehicle accelerometers are a useful proxy measure of high risk driving, and are associated with increased crash risk in young drivers. This study employed a prospective, naturalistic mixed methods approach using in-vehicle acceleration data to assess the effects of sleep (quantity, quality, timing, and regularity) on objective daily driving performance in young adults.

Materials and methods: A total sample of 83 young adult (18-25) drivers took part in this study. Naturalistic 24-hour ambulatory assessment of sleep (actigraphy) and driving (accelerometry and GPS trackers) was conducted across 7 days alongside diary-report of sleep and driving. Questionnaires were used to assess other aspects of participant sleep, risk taking and driving attitudes.

Results: The majority of participants met current National Sleep Foundation guidelines of 7-9 hours of sleep per night for their age group (diary and actigraphy reports), and rated their sleep quality as 'fair' across the week. Preliminary analyses based on subjective sleep data suggested significant associations between sleep duration and risky driving (high g-force events) (r = -.20, p = .05) and time in bed and risky driving (r = -.30, p< .05), but no other sleep (sleep midpoint, sleep quality, weekend-weekday bedtime difference) or personality/experience related variables. A series of hierarchical linear regression analyses revealed that gender, age (driving experience), caffeine, sensation seeking and driving exposure accounted for a significant 27% of variance in driving behaviour F(5, 65) = 4.96, p < .001, although only driving exposure was a significant independent predictor. Adding diary calculated time in bed explained an additional 5% of variance F(1, 64) = 4.51, p < .05 in risky driving behaviour.

Conclusions: This study was the first of a kind in young drivers as it combined continuous naturalistic sleep and driving assessment to address the problem of risky driving in this age group. Results suggest that drivers who spend less time in bed may be driving more dangerously. Hence increased time in bed (combined sleep and rest time) may be a protective factor against risky driving. There may be differences in the way in which different dimensions of sleep impact on objective driving behaviour (i.e. duration vs sleep quality). Previous cross-sectional research suggests age, experience and personality factors such as sensation seeking may increase the propensity for risky driving however this was not evident in the current data. Collecting objective and naturalistic driving data when attempting to understand the real-time risky driving profile of young adults may be important when beginning to plan interventions aimed at improving young adult sleep health and reducing young driver crashes.

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INTRODUCTION: Cognitive impairment and specifically frontal dysfunction could be related to dream content alteration. However, only a few studies have investigated the link between dream content and cognitive abilities in Parkinson’s Disease (PD). We aimed to assess whether dream characteristics in PD-patients with Mild Cognitive Impairment (MCI) differ from those without MCI.

MATERIALS AND METHODS: 19 non-demented PD patients with a diagnosis of MCI (mean age: 65.7±8.6yrs), according to Litvan et al. (2011) criteria, were matched by sex and age with 20 PD patients without MCI (mean age: 63.7±7.4yrs). All subjects underwent a complete neuropsychological evaluation and a full-night-in-lab video-polysomnography. The proportion of REM Sleep Behavior Disorder (RBD) patients was similar in both groups (14/19 for PD-MCI+ vs. 14/20 for PD-MCI- ; X² = 0.01; p=0.90). All subjects fulfilled a 3-weeks dream log. Dreams were analyzed according to Hall & Van De Castle method and Revonsuo threat rating scale. Multivariate analysis was performed in order to control for confounding factors such as duration and severity of PD, presence of RBD, dopaminergic dose and antidepressant drugs.

RESULTS: A total of 320 dreams (160 dreams from MCI patients and 160 from non MCI) were collected and analyzed. PD-patients with MCI showed a higher percentage of Dreams With At Least One aggression (DWALO-aggression: 42% vs. 23%; p< .001) and a higher number of threatening events (59 vs.32; p=0.017) compared to subjects without MCI. In the whole sample, DWALO-agression correlated with executive dysfunctions (r=0.409, p=0.009), while threatening events in dreams were inversely correlated with limbic performances, such as the ability to recognize facial emotions (r=-.520; p=0.001).

CONCLUSIONS: Dreams in PD-patients with MCI are characterized by a higher proportion of aggressive content compared to PD-patients without MCI, even after controlling for the presence of RBD. This study supports the notion that cognitive impairment, particularly in executive and limbic functions, might be involved in altered dream mentation in PD.
Introduction: During childhood and adolescence, sleep undergoes very significant evolutionary changes that include variations in the quantity, distribution, and characteristics of sleep architecture and microstructure (Ohayon, Carskadon, Guilleminault, & Vitiello, 2004). When problems occur in some of these elements, sleep disorders may appear, more so if there is psychiatric comorbidity of any kind and, especially in ADHD (Tomás et al., 2008). In studies based on subjective assessment of sleep problems (parents report on their children’s problems), there is widespread agreement about the existence of more problems in these children (Choi, Yoon, Kim, Chung, & Yoo, 2010); while in studies using objective measures (polysomnography, actigraphy), these differences seem more subtle (Cortese, Konofal, Yateman, Mouren, & Lecendreux, 2006). In addition, the exact role of sleep problems in worsening ADHD symptoms, including cognitive and school performance, is still unknown. One of the best tools used to measure sleep is Polysomnography (PSG), as it provides superior information on the structure (phase differentiation) and depth of sleep (Keenan & Hirshkowitz, 2011). In this technique it is possible to obtain data such as brain activity (electroencephalogram), ocular movements (electrooculogram), muscular activity (electromyogram) and cardiac activity (electrocardiogram). The main objective of the present study was to examine the relationship between objective and subjective measures of sleep and the cognitive performance of 30 children diagnosed with ADHD.

Materials and methods: 30 children with ADHD of combined subtype were evaluated by PSG. In addition, a sleep diary was compiled in which the parents of the participants recorded the start and end time of all sleep periods (e.g. nighttime sleep, daytime napping). A family interview was used with questions regarding subjective sleep quality. For the evaluation of cognitive performance, The Wechsler Intelligence Scale for Children-Revised (WISC IV-R) was used.

Results: Objective and subjective sleep quality data will be presented in children with ADHD, in addition to their relation to cognitive performance.

Conclusions: In light of the results obtained, it is confirmed the need to evaluate sleep quality through objective and subjective techniques for a better understanding of possible alterations in the sleep of children. In addition, it is concluded that some areas of cognitive performance of these children are affected.

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Behavior, Cognition and Dreaming  
Board #017: P4 - Tuesday  
AGING AND DREAMING: EEG OSCILLATIONS PREDICT DREAM RECALL

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Introduction: Neural correlates of dreaming in elderly people are still largely unknown. Several studies showed that electrophysiological (EEG) background during sleep may predict the subsequent presence/absence of dream recall (DR). For instance, it has been demonstrated a relationship between high-frequency (20/25-50 Hz) and DR in young subjects (Siclari et al., 2017), consistently with the “Activation Models” (e.g., Antrobus, 1991). Other studies found that DR is related to frontal theta activity (5-7 Hz) during REM sleep, underlying the presence of shared mechanisms in the retrieval of episodic memory across different states of consciousness (Marzano et al., 2011; Scarpelli et al., 2015). Bearing in mind this scientific background on young healthy subjects, our study aimed to understand whether the presence/absence of DR could be related to specific topographical features of the sleep EEG in elderly.

Materials and methods: Forty healthy older volunteers (mean age=68.4±1.02) were recorded with polysomnography (19 derivations). Twenty subjects were awakened from REM sleep and twenty subjects from stage 2 NREM sleep. Dreams were collected upon morning awakening from both stages. EEG power spectra of the total sleep and of the last 5 min were calculated by Fast Fourier Transform (FFT). The Better OSCillation (BOSC) detection method was used to detect oscillatory activity within EEG signals of the last sleep segment.

Results: In both sub-groups (REM awakenings, NREM awakenings) the 45% of subjects reported DR. Statistical comparisons (unpaired t-test) between recallers (REC) and non-recallers (NREC) revealed that DR from NREM sleep is related to higher beta activity (16-24.75 Hz) over temporal areas during the total sleep. Moreover, DR from REM sleep is related to a general increased of alpha activity (8-11.75 Hz) during the whole-night sleep. BOSC analysis showed that in the last 5 min of REM sleep higher alpha oscillations predict DR. No differences were found in the oscillatory activity during the last segment of stage 2.

Conclusions: According to the idea that an EEG milieu characterized by a less synchronized cortical activity is a prerequisite for DR (Activation Models), these results showed that DR is facilitated by higher cortical activation in both in REM and NREM sleep. In fact, EEG alpha and beta activity, respectively found during REM and NREM sleep, could be considered as an expression of relative cortical arousal. Considering that the differences between REC and NREC, obtained by a FFT analysis, were significant only for entire sleep using a between-subject design, we can hypothesize that these EEG correlates of DR may be partially explained by trait-like factors. Finally, it should be noted that the differences between REC and NREC during REM sleep are larger when alpha oscillations are specifically detected, suggesting that the predictive relationship between EEG pattern and DR upon awakenings from REM sleep mostly depends on the oscillatory activity, more than on tonic - non rhythmic activity.

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AGE-DEPENDENT EFFECTS OF SLEEP DEPRIVATION ON TASK PERFORMANCE AND MIND WANDERING

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Introduction: Mind wandering, the drift of attention from the current task at hand to self-generated thought is commonly associated with poorer performance, and could be a potential pathway through which sleep deprivation affects performance. Little is known about this, however. Therefore, the aim of the present study was to address the effect of sleep deprivation on mind wandering and performance in a sustained attention task. In addition, we studied age as moderating factor, since older individuals are generally less prone to mind wandering.

Materials and methods: Healthy young (18-30 years) and older (60-72 years) subjects participated in either a normal night sleep (NSD) or a total sleep deprivation (SD) condition, i.e. 4 conditions: NSD (n=31), SD (n=30), NSDold (n=24), SDold (n=24). Performance was measured using the Sustained Attention to Response Task, during which 10 thought probes were included that prompted the subjects to answer a question on what they were you just thinking about, using predefined answer alternatives. Mind wandering was quantified as occurrence of task-unrelated thoughts.

Results: Applying a 2 (age) X 2 (sleep deprivation) ANOVA, significant main effects for sleep deprivation and age were observed for omissions, indicating worse performance after sleep deprivation and in young participants (p's < .05). These main effects were dominated by an age*sleep deprivation interaction (p = .04), which was due to sleep deprivation causing significantly more omission errors in young subjects (Mean ±SEM; NSD: 2.3 ±0.9; SD: 13.1 ±4.1) but not in older subjects (NSDold: 1.9 ±0.4; SDold: 2.8 ±0.9). Likewise, main and interaction effects for age and sleep deprivation were significant for task-unrelated thoughts (p's < 0.01). Task unrelated thoughts were significantly more frequent after sleep loss in young (NSD: 1.5 ±0.2; SD: 4.3 ±0.6), but not older subjects (NSDold: 0.3 ±0.2; SDold: 0.5 ±0.2) (interaction age*sleep deprivation p < .01). Young subjects had significantly more task-unrelated thoughts than older, regardless of sleep condition. Task-unrelated thoughts correlated with errors of omission (r = 0.65, p < .001). Also, including task unrelated thoughts as covariate in the age * sleep deprivation ANOVA, main and interactions effect of age and sleep deprivation were no longer significant.

Reaction time was significantly slower in older adults, but no main or interaction effect of sleep deprivation occurred. Errors of commission were not affected by condition.

Conclusions: The results show that sleep deprivation caused both mind wandering and poorer task performance in young but not older participants. In addition, mind wandering rates correlated with errors of omission, which may indicate that a diminished ability to shut down off-task thoughts after sleep deprivation could be an important pathway to performance decrements after sleep loss. In line with previous research, mind wandering appears to occur less frequently in older individuals compared with younger. This lower occurrence of mind wandering in older subjects may potentially enable them to better maintain performance after sleep deprivation and partially explain the higher resilience of older adults to sleep deprivation.

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Introduction: Coca paste (CP) is an illicit drug of abuse defined as a smoked form of cocaine widely consumed in several South American countries. CP is an intermediate product of the cocaine alkaloid extraction process. CP contains variable concentration of cocaine base, and caffeine is one of the major adulterants. In the present report we study the effects of a representative sample of CP normally obtained by street consumers (CP1) adulterated with caffeine on the sleep-wake cycle of the rat. The sample was obtained from local police seizures. The results were compared with saline, with equivalent doses of cocaine (pure) and with CP without caffeine (CP2).

Materials and methods: Twenty four Wistar rats chronically implanted for polysomnography were recorded during 6 hours per session, during the light phase. The acute effects of systemic (i.p) administration of CP or cocaine at 2.5 and 5 mg/kg on wakefulness (W) and sleep variables were analyzed. CP1 contained 20.7% of cocaine base and 10.3% of caffeine. CP2 contained 50.2% and 1% respectively.

Results: Compared to saline administration, acute i.p administration of CP1 induced a dose dependent increase in W, and a decrease in light (LS) and slow wave sleep (SWS). In addition, there was an increase in LS; SWS and REM sleep latency. CP1, in comparison to equimolar doses of cocaine (pure), or CP2, produced a larger effect on W time. Interestingly, combined treatment of cocaine and caffeine, as surrogate of CP1 sample, mimicked its stimulant effect.

Conclusions: When caffeine is present in the CP sample, produces an important potentiation of the W-promoting effect of cocaine. These differences may be the foundation for the distinct cognitive effects induced by drugs adulterated with caffeine in human consumers.

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Introduction: There is now a well-established link between poor sleep outcomes in adolescence and heavy social media use, particularly around bedtime. However, little is known about what drives adolescents’ social media habits, including late night social media engagement, despite negative consequences for sleep. The purpose of this study was to gain an in-depth understanding of the motivating factors for adolescents’ social media use and how these impact on bedtime behaviours and sleep.

Materials and methods: 24 adolescents (age range: 11-17) participated in focus groups. Semi-structured discussions focussed on motivators for social media use and perceived impact on bedtime behaviours and sleep. Thematic analysis was used to identify themes across focus groups.

Results: Participants reported using social media past their intended bedtime, losing track of time while online and experiencing anxiety when disconnected. Fear of missing out and social expectations were identified as the primary drivers for bedtime social media engagement. Participants felt pressure to use social media to avoid offline peer exclusion (as a result of missing out online) and to meet peer expectations of online availability. Being offline was experienced as a state of threat, with difficulties disengaging from social media resulting in delayed bedtimes. Participants also experienced anxiety, intrusive thoughts and rumination when offline at bedtime. Results highlighted powerful underlying motivations for late night social media use, with clear consequences for bedtime behaviours and sleep outcomes.

Conclusions: This study provides novel in-depth understanding of adolescents’ motivations for bedtime social media engagement. Our findings highlight possible barriers to encouraging healthier social media habits for sleep. Interventions aimed at improving adolescent sleep by targeting social media use therefore need to address not only behaviours but also underlying motivations. These results provide the basis for our ongoing development of a targeted intervention at both a behavioural and cognitive level.

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Behavior, Cognition and Dreaming
Board #019: P4 - Tuesday

HABITUAL PHYSICAL ACTIVITY PROMOTES SLEEP QUALITY IN THE ELDERLY? A MULTILEVEL ANALYSIS OF THE WITHIN-PERSON RELATIONSHIP

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Introduction: Previous studies showed that physical activities (PA) such as locomotive and household activities were linked to sleep. The purpose of this study was to examine the within-person and between-person effects of kind of PA on sleep quality in the elderly.

Materials and methods: The subjects were seventy-six community-dwelling older Japanese adults (71.3±4.5 yrs). The PA were monitored using the 3-axis accelerometer (HJA-750C IT, Omron) for a week. We measured the intensity of PA (light-intensity locomotive PA (LLPA), light-intensity household PA (LHPA), moderate-to-vigorous locomotive PA (MLPA), moderate-to-vigorous household PA (MHPA)), and objective sleep parameters using an ActiGraph accelerometry for a week. In this study, LLPA, LHPA, MLPA and MHPA were 2.3±3.1, 267.5±70.71, 13.7±16.1, 3.9±5.2 min, respectively. The individual and relative roles of these kinds of PA as well as objective sleep parameters were examined in the multilevel models that took account of variations in relationships at the within-person (Day) and between-person (Participant) levels.

Results: After adjusting confounding factors, the multilevel models showed that LLPA was unfavorably associated with sleep efficiency ($\beta = -.161, P = 0.003$) and wake after sleep onset ($\beta = .146, P = 0.007$) in within-person level. In contrast, LHPA was favorably associated with sleep latency ($\beta = -.298, P = 0.042$) and sleep efficiency ($\beta = .229, P = 0.017$) in between-person level. However, there was no significant difference in MLPA and MHPA.

Conclusion: LHPA may be beneficial to sleep in older adults, especially habitually in their lifestyle. Considering acute-exercise experiment in laboratory, we should monitor their habitual physical activity.

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Introduction: The organization of sleep and wake states can influence behavioral development throughout childhood, especially in neonates considered to be at high risk in a neonatal intensive or semi-intensive care setting. In this sense, nesting is a strategy of developmental care that can favor this organization. The aim of this study was to compare the effects of nest positioning on the ventral decubitus (VD) and right lateral decubitus (DLD) in relation to the regulation of sleep and wake states in preterm infants.

Method: It is a randomized, controlled, and cross-over trial. The sample consisted of 37 healthy preterm infants, with a post-conceptional age $\geq 32$ weeks and postnatal age $> 24$ hours on the day of the intervention, of both sexes, hospitalized in the Neonatal Intermediate Care Unit of Hospital das Clínicas of the Medical School of Ribeirão Preto, University of São Paulo, São Paulo, Brazil. The intervention was performed by positioning the babies in the ventral and lateral decubitus, and were randomized, by lot, to two groups, according to the order of positioning in the decubitus. The infants remained for 30 minutes in each posture and during this period the sleep and wake states were collected, and these were measured on an ordinal scale of increasing stage of bio-behavioral activation and assigned the following values for the different states: Deep sleep = 1; Active sleep = 2; Drowsiness = 3; Inactive alert = 4; Active alert = 5; Cry = 6.

To compare the intervention with the placements in the VD and DLD, the period effects on the studied variables, both in an intragroup analysis, and to compare the effects of the order of the placements between the groups, were analyzed using variance ANOVA 2 X 2 for models of cross-over studies. In addition, the Omnibus test was applied as a measure of separability between the effects of the intervention and the carry-over effects. The $p$ value was less than or equal to 0.05 and 95% confidence intervals were calculated.

Results: The results showed that VD in relation to DLD favored the stay in sleep states and maintenance in the uninterrupted state of sleep Deep. On the other hand, DLD in relation to VD favored the stay in alert states and the uninterrupted maintenance of inactive alert status. There was a significant effect of period and sequence on the variables maintenance in sleep states and uninterrupted maintenance in the inactive alert state. The carry-over effect showed that 30% of the results can be attributed only to the intervention effect independent of period and sequence effects.

Conclusion: Ventral positioning was essential to promote sleep in this sample of preterm infants, as well as positioning in DLD was important for the interaction of the baby with his environment, therefore both decubitus were effective for the organization of the states Sleep and wakefulness since none of them predisposed to crying.

Acknowledgements: Coordination of Improvement of Higher Education Personnel (CAPES) and National Council for Scientific and Technological Development (CNPq)
Introduction: Since the discovery of a novel photoreceptor cell, ipRGC in the retina, it began to emerge that the eye performs a dual role in detecting light for a range of behavioral and physiological (non-image forming, NIF) responses that are distinct from the classical image-forming function mediated by rods and cones. The ipRGCs consist of different subpopulations that target different brain regions, also those outside of SCN. These responses to light are initially observed in alertness-related subcortical structures and limbic areas, followed by modulations of activity in cortical areas, which can ultimately affect behavior. Studies converge to show that blue-enriched light is more efficient in increasing performance and decreasing sleepiness.

Materials and methods: 12 participants (8 women, 4 men, mean age 27.3 ± 2.4 years) took part in the experiment, which consisted of 3 different sessions and was conducted on 3 separate days, with a week between sessions. On each day of experiment, the subjects were in a randomized order exposed to a light of different wavelengths. Experimental sessions consisted of a 10 minute red light adaptation phase to reach a sensitivity baseline for ipRGCs and a 10 minute dark condition for the adaptation of rods and cones followed by measurements of resting EEG activity and EEG under cognitive load, as well as auditive oddball tasks for the later analysis of P300 component. Subjects also performed a PVT task and rated their levels of subjective sleepiness using the adapted version of Karolinska Sleepiness Scale at 7 different timepoints during each session. Monochromatic light was emitted from a custom-made lightbox placed 30cm away from the subject's cornea, using 3 different light color LED sources: blue (455nm), red (629nm) and green (508nm) with the irradiance level at 14µW/cm² for all conditions. A total darkness was used as a baseline measurement. Analyses were carried out for the following parameters using BrainVision Analyser, IBM SPSS Statistica, MATLAB and LORETA-KEY software: subjective sleepiness, PVT reaction time, spectral analysis of EEG activity during cognitive load, P300 latency and AUC (area under curve) and electric neuronal activity distribution as measured by sLORETA.

Results: Blue light condition was found to be statistically superior in terms of its procognitive effects for the following variables: subjective sleepiness, absolute power in higher beta (24-34Hz) and gamma (35-50Hz) range, shorter latency and larger AUC of P300 response and higher beta activity of visual attention network structures (precuneus, superior temporal gyrus and anterior cingulate gyrus) as measured by sLORETA.

Conclusions: Our results are in line with other studies that show significant alerting effects of short-wavelength light in comparison to lights of longer wavelengths. We were able to show that blue light increases cortical activation of specific brain regions related to visuospatial attention during cognitive load.

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Behavior, Cognition and Dreaming
O12: Behavior, cognition and dreaming and neurological sleep disorders affecting sleep oral abstract presentations

SLEEP SPINDLE ACTIVITY SIGNIFICANTLY CORRELATES WITH IMPLICIT STATISTICAL LEARNING CONSOLIDATION IN OBSTUCITIVE SLEEP APNEA PATIENTS

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Introduction: Statistical learning (SL) is the implicit learning of statistical regularities with a stimulus and is considered to underpin many ‘basic’ cognitive processes. Studies in healthy participants show sleep consolidates the information acquired in SL, with increased slow wave sleep (SWS) positively correlating with improved SL performance. SL does not appear to be impaired in patients with OSA when compared to controls, however data is sparse. Sleep spindles and slow wave activity (SWA) in NREM sleep assist encoding of explicitly learnt information. Deficits in sleep spindles and SWA have been reported in electroencephalogram (EEG) recordings of untreated patients with OSA. To our knowledge no study has examined the relationship between sleep structure or sleep EEG microarchitecture and SL. Thus, this study sought examine whether sleep macroarchitecture and EEG microarchitecture from overnight PSG were associated with SL performance in patients with moderate to severe OSA.

Materials and methods: Patients underwent overnight PSG in the sleep laboratory. EEG signals recorded at 10 electrodes sites F3-M2, F4-M1, C3-M2, C4-M1, O1-M2, O2-M1 and midline channels at Fz-M2, Cz-M1, Pz-M2, and Oz-M1 from all-night recordings were quantitatively analysed following automated artefact removal. Power spectral analysis was performed to derive SWA (delta EEG power, 0.5-4.5Hz) and sleep spindle frequency activity, specifically slow (11-13Hz) and fast (13-16Hz) activity in NREM sleep.

SL was assessed by exposing participants to a reaction time ‘cover task’ at 7pm before the PSG. Cartoon alien pictures would flash on the screen, and participants would be asked to respond to a repeated picture. Unbeknownst to participants, the pictures always appeared in groups of three. 24 hours later, and after sleep, participants were asked to judge which aliens they thought were in the triplet. Associations between sleep measures and SL performance were conducted using Spearman’s correlation coefficients.

Results: 47 participants were studied (age 49±9, BMI 30.0±4.2, AHI 35.5±22.9). Average SL performance was 55.4%, which was significantly above chance level (t46 = 2.45, p = .018, r = .34). No standard PSG measures were correlated with SL performances. Similarly, SWA in NREM sleep was not correlated with SL performance. Lower slow and fast spindle activity at frontal (F3, Fz, and F4) and central (C3 and C4) brain regions were significantly correlated with worse SL performance (e.g., F3-M2: slow spindle activity vs. SL, r=0.37, p=0.013 & fast spindle activity: r=0.30, p=0.047; F4-M1: slow spindle activity: r=0.35, p=0.022 & fast spindle activity: r=0.34, p=0.023).

Conclusions: This is the first study to comprehensively examine the relationship between sleep and implicit SL performance in OSA. The association between lower spindle activity and worse SL performance highlights the important role spindles play in implicit, learning encoding. Exploring links between spindle deficits and impaired SL learning may explain how altered sleep neurophysiology contributes to the inter-individual variability in overnight learning processes in OSA.

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Resting-State Functional Connectivity of the Default Mode Network in Female Nightmare Disorder Patients with Trauma History Compared to Healthy Controls

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Introduction: The default mode network (DMN) is a network of brain regions that display increased activity at wakeful rest in the absence of cognitively demanding tasks, and has been associated with psychopathology as well as sleep disorders. The main purpose of the study was to investigate differences in resting-state functional connectivity of the DMN in nightmare disorder patients compared to healthy controls.

Materials and methods: Nine female nightmare disorder patients with trauma history (7 sexual assault, 2 physically assault) were selected using a semi-structured interview based on the DSM-5 criteria for nightmare disorder. Additionally, the Structured Clinical Interview for DSM disorders was used to exclude participants who had current/history of serious psychiatric or medical conditions, or a history of loss of consciousness. The Nightmare group (NG) was age- and sex-matched to 5 healthy controls (HC) in the study (mean age 29.93 ± 9.68 years). All participants underwent resting-state functional magnetic resonance imaging (3T) and completed questionnaires about nightmares (Disturbing Dream and Nightmare Severity Index), depression (Beck Depression Inventory), post-traumatic stress disorder symptoms (PTSD Checklist for DSM-5), insomnia (Insomnia Severity Index), suicidal ideation (Depression Symptom Inventory-Suicidality Subscale) and 7-day sleep diaries. FMRI data were head motion corrected, band-pass filtered (0.009-0.08 Hz), spatially smoothed (5-mm FWHM), and several sources of spurious variance were removed (six head motion, signal from CSF, and signal from WM). Functional connectivity maps were created by computing the Pearson's correlation coefficients for the posterior cingulate cortex (PCC) to regions of interest to examine DMN connectivity differences between groups. Non-parametric tests were conducted to analyze group differences for self-report questionnaires.

Results: Based on the DDNSI, the NG reported an average of 3.88 times per week. Compared to the HC, the NG reported significantly higher levels of nightmares, depression, PTSD, insomnia, and suicidal ideation (ps< .01) on self-report questionnaires. Sleep diaries revealed longer wake after sleep onset for NG compared to HC (26.79 vs. 4.64 minutes, respectively) and higher number of awakenings (ps< .05). Compared to the HC, NG had decreased functional connectivity in the right middle cingulate cortex, medial frontal gyrus, and left medial frontal gyrus, and increased connectivity in the right inferior frontal gyrus, left cerebellum, and culmen (p< .005, uncorrected).

Conclusions: These preliminary results indicate that nightmare disorder female patients with trauma history have altered functional connectivity in the DMN.

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INTRODUCTION: Sleep deprivation impairs cognitive performance. A low stimulation condition supposedly increases the cognitive impairment produced by sleep deprivation, but few studies have assessed this effect. The objective of this study was to measure sleep deprivation effects on cognitive performance in a low stimulation condition.

MATERIALS AND METHODS: Participants were 22 undergraduate students, age 19.05±2.21 years, 16 females. They were recorded in the laboratory at 14:00 h without sleep deprivation and after 24 h of sleep deprivation. On each recording, they responded a visual CPT (Continuous Performance Task) and an auditory CPT, to assess attention and its components (tonic alertness, phasic alertness, selective attention and sustained attention). The duration of each task was 11.7 minutes. Participants responded the visual CPT in a moderate stimulation condition, seated in a chair with the lights on; and the auditory CPT in a low stimulation condition, lying down on a bed in total darkness.

RESULTS: After sleep deprivation, the participants showed a small reduction in attention and its components in moderate stimulation (visual CPT general correct responses control=92.80±3.62%, sleep deprivation=83.27±10.99%, t=4.40, p<0.001, d=1.05). But attention and all its components declined to very low levels during the low stimulation condition (auditory CPT general correct responses control=87.04±11.17%, sleep deprivation=38.83±24.86%, t=9.45, p<0.0001, d=2.37). After sleep deprivation, participants were able to sustain acceptable levels of cognitive performance for 6.99±4.76 minutes while seated, but in the low stimulation condition acceptable levels of performance were maintained for only 3.58±2.80 minutes, they continue responding at inefficient levels for another 4.90±2.51 minutes, until they stop responding at 8:49±3.27 minutes from the beginning of the low stimulation condition.

CONCLUSIONS: People working in a low stimulation condition are incapable to counteract the effects of sleep deprivation.

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EXPERIENTIAL EMOTION REGULATION VERSUS COGNITIVE REAPPRAISAL: EFFECTS ON AFFECT AFTER STRESS AND FOLLOW-UP SLEEP PHYSIOLOGY

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Introduction: The interesting idea that emotion regulation (ER) plays a key role in modulating effects of stress on sleep, however, has received few research attention. Research findings suggest that emotion regulation plays a key role in the precipitating and perpetuating effects of stress on sleep (Vandekerckhove & Cluydts, 2010). In this study, we compared the impact of an induced ‘experiential approach’, defined as stressing the awareness of our feelings by paying attention to our bodily felt parts in an acceptable and welcoming way (Vandekerckhove & Kestemong, 2012), versus a ‘cognitive approach’ by cognitive reappraisal, defined as reinterpreting a situation in order to eliminate or change one’s emotions about it (Gross, 1998), on sleep physiology.

Materials and methods: 43 participants were recruited and randomly assigned to 3 groups: 15, 13, 15 for experiential, reappraisal and neutral non-specific regulation respectively. 20-Item Toronto Alexithymia Scale (TAS) and Emotional Approach Coping Scale are used to address the individual difference. All participants spend 3 nights (adaption, baseline and experimental night) in the sleep lab for 8 hours. An emotional failure induction was used to trigger stress, after which emotion regulation was induced twice (writing task). Subject negative affect was obtained by the Positive and Negative Affect Schedule (PANAS) at different time points: after failure task, after baseline movie, after emotion regulation in the experimental night.

Results: A main effect of Negative affect (NA) at the four moments was found, $F(3, 62.976) = 17.952, p < .001, \eta_p^2 = .391$, whereby NA after the baseline movie differed significantly from NA after the failure task; NA after the baseline movie was significantly different from NA after the second time of ER. Wake percentage depending on ER types, whereby participants in the reappraisal group have a higher wake percentage than the participants in the experiential and neutral group. In addition, number of awakenings depends on the ER type: the reappraisal group showed the highest number of awakenings while the neutral group the lowest. Moreover, sleep efficiency also depends on the ER type, whereby the experiential group has the highest sleep efficiency while the reappraisal group has the lowest. Importantly, we found the reappraisal group encountered the lowest arousal index, the experiential group encountered the highest. Furthermore, the reappraisal group encountered the highest number of rapid eye movements during REM sleep. Finally, we found significant positive correlations between slow wave sleep latency and the two subscales of the TAS.

Conclusion: Our results indicated the difference between ‘experiential approach’ and ‘cognitive approach’ strategy in decreasing the detrimental effect of stress on sleep. Mainly, people using an analytical cognitive reappraisal have more fragmented sleep than people using an experiential accepting approach and a non-specific emotion regulation approach. Also, people using reappraisal has the least dissolvement of emotional stress during REM sleep. In sum, an experiential accepting approach may be more adaptive in dealing with stress before sleep.

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IRREGULAR SLEEP-WAKE RHYTHM DISORDER IN A YOUNG WOMAN WITH TOWNES-BROCKS-SYNDROME

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Introduction: Referral of 22-year-old former psychology-student from oncology unit. Presenting with lack of energy during daily activities, major performance problems with concentration deficits, reporting refreshing sleep with duration of 8-9 hours. Bed times 03:00am-11:00am, naps non-refreshing. ESS(Epworth-Sleepiness-Scale) normal 3/24, ISI(Insomnia-Severity-Index) normal 6/28, FSS(Fatigue-Severity-Scale) pathologic 6/7. Gave up her studies and returned home 3 years before presenting in our sleep clinic. General practitioner assumed personality disorder.

Materials and Methods: Sleep diary and actigraphy showed irregular sleep wake type, subjective sleep time 6,5-14 hours of refreshing sleep, performed indoor activities only (reading, house work), few social contacts. Psychiatric exploration without pathological findings besides social withdrawal. Former macroadenoma of the pituitary gland, adenomectomy 2012, MRI controls for 3 years unremarkable.

Results: Saliva sampling of Melatonin performed at home under dim light conditions showed a DLMO (Dim-Light-Melatonin-Onset) at approx. at 5:00am (4pg/ml). Chronotherapy trial with melatonin retard formula 2mg at 8:30pm and timed light exposure in the morning hours results in massive improvement of daily functioning and circadian rhythm. Follow up history at 3, 6 and 9 months shows stable functioning with bed times between 10:00pm-06:00am, return to studying planned. Further genetic typing reveals Townes-Brocks-Syndrome with heterozygous SALL1 pathogenic variant and chronic renal impairment with persisting microalbuminuria. Slight foot and thumb malformations, no further deformities found, especially no eye anomalies.

Conclusions: Chronotherapy (melatonin retard 2mg and daily bright light exposure) led to massive improvement of irregular rhythm in a case of Townes-Brocks-Syndrome [1], showing also a delayed DLMO (after withdrawal of oral melatonin retard 2mg). Multiple endocrine abnormalities have been reported in cases with proven SALL1 gene mutation so far [2], though no connection to circadian function in normal sighted individuals.

References:
**Introduction:** Sleep patterns have changed continuously worldwide. These patterns may be associated with poor sleep quality and daytime sleepiness. The aim of the study is to investigate the sleep patterns and quality in Omani adults using actigraphy.

**Subjects and methods:** This is a cross sectional study conducted between June 2015 and February 2017. Subjects were randomly selected among young adults and middle aged in the City of Muscat. Subjects were asked to fill-in Epworth sleepiness scale (ESS) and Pittsburgh sleep quality index (PSQI). Actigraphy was used to measure the sleep pattern for one week. Four sleep patterns were identified; monophasic, bi-phasic (post-dawn), bi-phasic (afternoon siesta), and polyphasic.

**Results:** Four hundred subjects agreed to participate in the study (52% male). The mean age of participants was 32.8 ± 11.5 years. The study revealed that 35% of participants have biphasic-siesta sleep pattern, 28% polyphasic, 26% monophasic and 11% biphasic-dawn. The biphasic siesta pattern was found to be associated with younger age group (25-34 years) (P=0.001). Polyphasic sleep was associated with higher ESS score (Mean=10± 4) (P=0.001) but not with poor sleep quality (PSQI mean=5.6±3)(P=0.24). There was no significant difference in night sleep duration among all the sleep patterns (P=0.07) but the polyphasic sleep pattern has higher total 24-hour sleep duration (mean=7.8 ±1.8 hours) (P=0.03). 90% of participants practiced afternoon siesta with mean duration of 45±43 minutes.

**Conclusion:** In this study, the predominant sleep pattern among Omanis was biphasic-siesta and vast majority of people practiced afternoon siesta. Polyphasic sleep pattern is associated with daytimes sleepiness.

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PILOT STUDY TO EVALUATE GENE EXPRESSION PROFILES OF CIRCULATING CELLS IN SHIFT WORKERS WITH AND WITHOUT BREAST CANCER

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Introduction: Breast cancer is the most common cancer in women that account for approximately 23% of all cancer diagnoses. Early diagnosis of breast cancer can improve the chances of successful treatment and recovery. Determining which patients with localized breast cancer are at risk for disease progression and metastatic spread is one of the current challenges to improve breast cancer prognosis.

Materials and methods: In 2007, the International Agency for Research on Cancer (IARC) concluded that shift workers are at a higher risk of developing breast cancer. One existing method for estimating breast-cancer risk is based on personal health history, family health history, and analysis of the presence of BRCA1 or BRCA2 mutations. However, this approach and mammographic screening often fail to obtain an estimated risk that is tailored to each individual. Liquid biopsy that evaluate circulating tumor cells gene expression profiles has recently emerged as a powerful technique for cases of metastatic breast cancer and some evidences highlight that circulating tumor cells could be an avatar of the solid tumor. Therefore, we hypothesize that gene expression profiles changes in peripheral blood mononuclear cells could correlate with breast cancer presence and severity in rotating shift workers. Thus, in order to identify a panel of genes that could reflect in blood what happens in breast we started a pilot study to investigate the expression of a panel of 624 genes in a small group of shift workers with breast cancer compared to rotating shift workers without. For this study we collected peripheral blood mononuclear cells that we used to perform PCR Real-Time OpenArray profiles.

Results: The data obtained from the deepening laboratory and risk stratification in the type of test employed will be crucial in defining an personalized assessment of the occupational risk, with important impacts on a cancer prevention within the work environment by complement to current available screening methods.

Conclusions: Breast cancer is the most common cancer in women with a significant incidence in the general population.. The risk of developing breast cancer increases exponentially with age, particularly because of the accumulation of epigenetic alterations resulting in imbalance in the expression of oncogenes and oncosuppressor genes. This phenomenon is particularly important in the business world where, in recent decades, we have seen a progressive ageing of the working population.

This study could help manage the occupational risk management, in health care and not, with important consequences on

1) primary prevention;
2) early diagnosis and monitoring extended to hyper-susceptible subjects (secondary prevention);
3) the reintegration of individuals with diagnosis of breast cancer (tertiary prevention). 

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Introduction: Patterns of light exposure across the day have implications for sleep and health. A large proportion of the adult population spend their waking hours at work, and workplace lighting could therefore play a role in supporting circadian function and sleep. A handful of previous studies have found relationships between characteristics of daytime light exposure and sleep in day-shift workers.

Materials and methods: Twenty-one office workers occupying a green building in a subtropical environment wore a wrist-based actigraph measuring triaxial accelerometry and ambient light exposure for up to one week in late spring/early summer. Sleep duration and timing was estimated using accelerometry and a daily sleep diary. The number of minutes estimated as spent in light above 1000 lux was calculated for the full day, during morning office hours (8am - 12pm) and afternoon office hours (12pm - 6pm), as was timing of light exposure above 1000 lux across the entire day (mean light timing above threshold). Correlations between bright light exposure and the timing and duration of sleep (duration, bedtime and wake-time) were examined.

Results: On average, participants spent approximately 150 minutes per day exposed to light over 1000 lux (SD = 70min), went to bed at 10:36pm (SD = 52min), and awoke at 5:56am (SD = 1h 4min). Timing of light exposure above 1000 lux was the only light variable significantly associated with a sleep outcome (sleep onset, $r = .52$, $p = .01$), such that those receiving bright light later in the day had later bedtimes. Moderate but non-significant correlations were also observed between overall time exposed to light above 1000 lux and bedtime ($r = -.37$, $p = .10$), and light exposure during morning office hours and bedtime ($r = -.36$, $p = .11$).

Conclusions: This preliminary data suggests that the profile of lighting provided in office buildings could have implications for the timing of sleep in building occupants. Future research will assess how the timing and intensity of light exposure relates to sleep characteristics in a larger sample of office workers across multiple buildings.

Acknowledgements: Funding for this project was provided by an Australian Research Council Linkage grant, Aecom, and Light Naturally.
Introduction: Pineal tumors are rare and lead to the gland destruction by the tumor itself or by the surgical treatment and radiotherapy, frequently with undetectable melatonin levels. Some authors reported sleep complaints, as insomnia or excessive diurnal sleepiness in small case series, as well as, increased REM sleep in one patient. However, a detailed polysomnographic study addressing sleep microstructure has not been performed.

Materials and methods: Four patients (3 male and 1 female, age ranges: 11 to 21 years old), with pineal tumors submitted to surgical resection were evaluated for sleep disturbances. Sleep complaints were addressed with a structured interview, the Pittsburgh Sleep Quality Scale and Epworth Somnolence Scale. Polysomnography was performed during two consecutive nights and evaluated by two different specialists. Spectral analysis of frequencies was performed for the whole night.

Results: All patients reported diurnal fatigue interfering in daily activities and three also reported fragmented sleep. The youngest patient also reported excessive diurnal sleepiness. The polysomnographic analysis revealed reduced sleep efficiency for all patients and increased REM sleep in one of them. However, the main finding was the presence of increased theta rhythm in comparison to a control patient, as well as, a monomorphic sigma rhythm around 14Hz present in all sleep phases, being more pronounced for the youngest patient.

Conclusions: The destruction of the pineal gland and, maybe, melatonin absence, lead to disturbances in sleep regulation with a peculiar electroencephalographic pattern during sleep, which may be related to sleep complaints reported by these patients.

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NEUROBEHAVIORAL ALTERATIONS IN MOUSE MODEL OF SHIFT WORK DISORDER

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Introduction: To explore the effects of shift work disorder, with particular focus on elucidating possible neurobehavioral alterations.

Materials and methods: To fully investigate the neurobehavioral alterations we designed a chronic protocol of nine weeks, employing modified multiple platform model to induce sleep alterations for 8 hrs from Monday to Friday with unaltered sleep at weekend. Female laca mice of age 2-3 months (n = 20) were used after the approval from institutional animal ethic committee (IAEC). Assessments of neurobehavioral changes were done using open field test, actophotometer, zero maze, hyperactivity scoring, nesting behavior, sucrose preference test, porso1t swim test, morris water maze, novel object recognition, prospective physiological assessment include body weight, body temperature.

Results: Neurobehavioral measures of shift work disorder demonstrated alterations at open field test, hyperactivity scoring, actophotometer, zero maze, body weight and body temperature after the animals were exposed to nine weeks shift work protocol. Laca mice demonstrated hyperactivity response denoted by significant increase in ambulatory movements in actophotometer, open field test, zero maze and stereotypic behavior. Mice also showed loss in body weight along with increase in body temperature. No changes were observed in mean escape latency assessed by Morris water maze, preference index in novel object recognition, immobility period in Porsolt’s swim test, percentage preference to sucrose in sucrose preference test.

Conclusions: This work has important implications for shift workers, particularly concerning awareness of possible ‘hyperactivity syndrome’ and likely implementation/adherence challenges. Findings also pave the way for testable hypotheses concerning possible mechanisms of action involved in hyperactivity induced by shift work disorder.

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University Institute of Pharmaceutical sciences, Panjab University, Chandigarh
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**FUNCTIONAL CONNECTIVITY DIFFERENCES BETWEEN EARLY AND LATE CIRCADIAN PHENOTYPES PREDICT COGNITIVE PERFORMANCE AND DAYTIME SLEEPINESS**

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**Introduction:** Brain function, and consequently behaviour, relies on interactions within and between distributed brain networks. This can be examined using functional MRI, with time series correlation between regions defining functional connectivity (FC). FC is altered during sleep, during wakefulness according to prior sleep habits, and in a range of neurological and psychiatric disorders. However, there is limited research on the impact of circadian phenotype or time of day on waking FC. The aim of this study was to investigate waking FC associated with the default mode network (DMN) in Early and Late circadian phenotypes (ECP/LCP).

**Materials and methods:** Thirty eight participants took part (N = 38, 14 male, age 22.7±0.7y), categorized into two groups by the Munich Chronotype Questionnaire (ECP n=16, LCP n=22). After completing sleep related questionnaires, physiological sampling (melatonin and cortisol) and actigraphy, participants were tested at 14.00h, 20.00h and 08.00h (GMT). Testing consisted of a resting state functional MRI scan (TR=2s, 3x3x4mm voxels) and a structural T1 MRI scan (1mm isotropic) in a 3T Philips Achieva scanner with a 32 channel head coil, and was followed by cognitive and physical performance testing at the same facility. Seed based FC analysis from the mesial prefrontal (mPFC) and posterior cingulate (PCC) nodes of the DMN was performed using MATLAB with UF2C and SPM12. To investigate whether FC differences between ECP and LCP were predictive of differences in cognitive performance and daytime sleepiness, generalized estimating equations were used.

**Results:** At the group level, ECPs had higher FC compared to LCPs in seven regions from the mPFC seed, and eight regions from the PCC seed (FWE corrected at p< 0.05), while LCPs had higher FC than ECPs in two and one region, respectively. For both seeds, the regions identified as different between the circadian phenotypes were primarily within the DMN. Time of day did not significantly modulate FC from either seed, and there was no interaction between circadian phenotype and time of day. For both mPFC and PCC seeds, regions with higher FC in ECPs were predictive of improved cognitive performance and daytime sleepiness. FC of regions higher in LCPs did not predict cognitive performance or daytime sleepiness.

**Conclusions:** Circadian phenotype is a significant predictor of FC within the DMN in the waking human brain. These differences in the brain's functional architecture at rest are predictive of differences in cognitive performance and daytime sleepiness, and may represent the underlying mechanism by which circadian phenotype affects performance.

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SEASONAL CHANGES IN SOMNOLENCE, CHRONOTYPE, AND PUPILLOGRAPHIC INDICES IN MEDICAL STUDENTS

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**Introduction:** Somnolence has been described among university students. There are several factors that may influence daytime somnolence, among them chronotype and seasonal light exposure.

**Materials and methods:** Ten medical students were followed-up monthly during a 1-year period. All subjects performed the Horne Osterberg questionnaire and the Epworth Sleepiness scale (ESS). In addition, a pupillographic sleepiness test was performed monthly early in the morning. Sun rise time was determined for each measurement. Data at beginning (summer) and end (winter) of the follow-up period were compared.

**Results:** Seventy-five percent of the subjects showed an abnormal ESS Epworth at the beginning vs 56% at the end of the 1 year follow-up (p 0.734). All subjects showed an intermediate chronotype according to Horne-Ostberg test median score 49 (min 42 - max 56). There was no significant variation in the Horne - Östberg test score result at the beginning vs end of the 1-year period: 49 vs 50.78 (p 0.232).

Pupillographic sleepiness test showed 33% of abnormal results. There were significant differences between the pupillary unrest index at the beginning vs the end of the follow-up (p 0.002). Sun rise time showed a significant influence on the pupillary unrest index (0.003).

**Conclusions:** Medical students showed a high daytime sleepiness. Pupillographic sleepiness test, as a marker for objectively measured sleepiness, varied throughout the year and was associated with the sunrise time before each measurement.
Introduction: This longitudinal study looks at differences in weight gain between different shift work-rotations and with respect to cumulative night work exposure.

Materials and methods: This study of Norwegian nurses had follow-up after 4 years. Pregnant nurses at time of body mass index (BMI) measurements were excluded. We identified four different shift groups: Day only (n=65), day and evening (n=300), 3-shift rotation (n=445), and night only (n=43). We also investigated those who changed schedule towards a schedule containing night shifts (n=89), and those who changed away from a schedule containing night shifts (n=302) during the follow up period. Furthermore, nurses’ estimation of number of nights worked last year was recorded yearly from which a composite score was calculated, and average yearly night work load calculated. This continuous parameter was used in the analysis. Data were analyzed with paired t-tests and multiple regression models adjusting for BMI at baseline, sex, age, marital status, and children living at home.

Results: Mean age of the nurses was 32.8 years (SD=8.5) at baseline. Mean BMI was 24.1(SD=4.2) at baseline and 25.2 (SD=4.6) after four years. Prevalences of obesity were 11.6% and 12.9%, respectively. Night workers (mean BMI difference (md)=1.30 (0.70-1.90), p< 0.0001), 3-shift workers (md=0.46 (0.30-0.62), p< 0.0001) and day and evening workers (md=0.48 (0.20-0.75), p< 0.0001), those started working night shifts (md=0.63 (0.20-1.05), p=0.005), and those stopped working night shifts (md=0.57 (0.17-0.84), p< 0.0001) all had significant weight gain during the follow-up period. Day only workers had a non-significant weight gain (md=0.33 (-0.17-0.84), p=0.19). Night workers had significantly larger weight gain compared to day workers (B=0.86 (0.04-1.69), p=0.04). We did not find any significant association between average yearly night work load and BMI.

Conclusions: The data suggest that night work is associated with a larger weight gain than day work.
EFFECT OF BRIGHT LIGHT THERAPY ON SLEEP AND MOOD IN ELDERLY INSTITUTIONALIZED SUBJECTS WITH MILD TO MODERATE COGNITIVE IMPAIRMENT

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Introduction: Some symptoms associated with degenerative diseases can be explained as a consequence of circadian rhythms disruption. The aim of the study was to evaluate the efficacy of bright light therapy in circadian activity-sleep rhythms, mood and health status after one-week exposure in elderly institutionalized subjects with cognitive impairment.

Materials and methods: Subjects: 37 (33 women and 4 men) over 65 (mean 78.51 ± 5.56 years) with light to moderate cognitive impairment institutionalized in a geriatric residence. All of them received complete information about the procedure and signed an informed consent approved by the ethical committee of Balearic Islands (IB / 1409/10 PI).

They were studied for three weeks during springtime. In the first week, reference levels of all variables were established. During the second week, each subject underwent a diary protocol of 60 minutes bright light therapy (BLT). During the third week a reevaluation of all variables was performed.

Light and physiological variables were continuously studied during the three weeks. Intensity of light received was measured using HOBO Light Data Loggers (UA-002-64, Onset Computer, Massachusetts) hanging to the neck of the subjects during the day and over the sleep table during the night. Activity was recorded using actimeters (Hobo Pendant G Acceleration Data Logger, Massachusetts) on the non-dominant wrist. Skin temperature was also recorded using a Thermochron iButton (DS1921H, Dallas).

To study sleep, cognitive function, mood and psychiatric alterations and quality of Life, the following instruments were used: Oviedo sleep questionnaire, a semi structured interview; a sleep agenda performed by caregivers in collaboration with subjects during all the 3 weeks; Mini-Mental State Examination (MMSE); Global Deterioration Scale (GDS); Yesavage Geriatric Depression Scale and Neuropsychiatric Inventory (NPI); European Quality of Life-5 Dimensions Questionnaire.

During the three weeks of study, the elderly were encouraged to maintain their normal lifestyle habits. They were allowed to move freely through the different spaces with the possibility of remaining outdoors. Caregivers were instructed to keep the nighttime darkness as much as possible during the study period.

Results: Mini-Mental State Examination (MMSE): pre bright light therapy (Pre BLT) 22.72±6.53, post bright light therapy (Post BLT) 24±5.92 (P value 0.001); Oviedo sleep questionnaire Insomnia: Pre BLT 21.03±1.54, Post BLT 15.86±7.22 (P 0.001); Global Deterioration Scale (GDS): Pre BLT 3.10±1.26, Post BLT 2.72±5.92 (P 0.001); Yesavage Geriatric Depression Scale: Pre BLT 3.65±2.78, Post BLT 2.65±2.97 (P 0.001); Neuropsychiatric Inventory (NPI): Pre BLT 44.86±54.39, Post BLT 22.75±25.10 (P 0.001); European Quality of Life-5 Dimensions Questionnaire (EuroQ-5D): Pre BLT 8.82±2,12, Post BLT 7.48±1.70 (P 0.001). EuroQ-5D, Health perception: Pre BLT 6.93±1.86, Post BLT 7.82±1.62 (P 0.001).

Conclusions: As it has been repeatedly found, the exposure to bright light during morning time causes significant improvements in mood. In the sample studied of elderly people with mild to moderate dementia institutionalized. cognitive performance, insomnia and quality of live were also improved.
THE EFFECTS OF BRIGHT LIGHT EXPOSURE AT NIGHT ON CIRCADIAN RHYTHMS AND ENERGY METABOLISM

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Introduction: Exposure to light at night (e.g., night-shift workers or use of artificial lighting) is associated with increased body mass, resulting in increased risk of overweight and obesity. However, the association between light exposure at night and metabolic changes has not been fully understood. This study aimed to investigate the impact of light exposure at night on circadian rhythms and energy metabolism in healthy participants. We hypothesized that light exposure at night alters energy metabolism during sleep through disrupting the circadian system.

Materials and methods: Eight healthy young male subjects were randomized to a balanced cross-over design protocol; bright light (BL) (approximately 10,000 lux) and control (under 50 lux) conditions for 3h in the evening. In each session, subjects consumed the experimental meal at 1900 h. Subjects were exposed to BL or control for 3h (2100 h to 0000 h) and slept (0000 h to 0700 h) in a whole-room metabolic chamber to measure energy metabolism. Salivary melatonin levels in the evening were assessed to measure circadian rhythm.

Results: Salivary melatonin levels increased from the baseline (1900 h) at 2300 h and 0000 h for the control condition, although no significant changes were observed in BL condition. Energy expenditures did not differ between BL and control conditions during light exposure and sleep. However, fat oxidation had significantly decreased during light exposure and sleep in BL condition, and carbohydrate oxidation had significantly increased during sleep in BL condition.

Conclusion: We revealed that bright light exposure at night is associated with disruption of circadian rhythm and reduced fat oxidation, suggesting that light exposure at night may increase the risk of weight gain and obesity.

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THE DIFFERENTIAL EFFECTS OF REGULAR SHIFT WORK AND OBSTRUCTIVE SLEEP APNEA ON SLEEPINESS, MOOD, VIGILANCE AND NEUROCOGNITIVE FUNCTION

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Introduction: Shift work and obstructive sleep apnea (OSA) both cause sleep impairment. In shift work, sleep quality and quantity is poor because sleep-wake activity patterns, which are largely determined by shift rostering, are often misaligned with internal circadian rhythms. In OSA, sleep quality is poor because the upper airway collapses repetitively during sleep, which subsequently causes sleep fragmentation and in many individuals intermittent hypoxia. It is unknown whether the poor sleep quality affects shift workers and individuals with OSA equally, or whether the differences in aetiology, cause distinct patterns of impairment. Thus, the aim of this study was to compare the effects of regular shift work and OSA on sleepiness, mood and neurocognitive function.

Materials and methods: Participants comprised 41 (female=14) regular shift workers (who had a ≥ 24 hour break since their last shift), 41 (female=13) untreated individuals with OSA and 40 healthy controls (female=21). Participants commenced a 3.5 hour, in laboratory test battery, at 1pm. The test battery comprised assessments of sleepiness (Epworth Sleepiness Scale [ESS]), mood (Beck Depression Index [BDI]) and neurocognitive function (Psychomotor Vigilance Test [PVT] and a 30 minute AusEd driving simulator [AusEd]). In the evening following the testing the shift workers and healthy controls wore an overnight portable polysomnography (PSG) to measure sleep. The OSA participants had completed a diagnostic PSG at an earlier date. Non-parametric Kruskal-Wallis and paired Dunn's tests were used to determine group differences on each of the measures.

Results: ESS scores (Median, Interquartile ranges) were not significantly different between the shift work (7, 5-11.5) and OSA (11, 6.5-14.5) groups, but both were significantly increased (p< 0.001) relative to the healthy control group (4.5, 3-6.0). BDI differed significantly (p< 0.05) between all groups, with BDI greatest in the OSA group (12, 8-17.5) followed by the shift work group (7, 4-15) and then the control group (4, 2-8.5). PVT lapses were significantly more frequent in the OSA group (3, 2-6) compared to the shift work (2, 0-4) and the healthy control (1, 0-4) groups, with the latter pair not differing significantly. For the AusEd driving simulator there were no differences between groups in respect to lane deviations and breaking reaction time, however the OSA group had significantly greater (p< 0.05) speed deviations (kph) from the target of 60-80kph (1.9, 0.8-3.2), compared to the shift work group (1.0, 0.5-1.7), but not the healthy control group (1.1, 0.7-2.0).

Conclusions: Untreated OSA impairs sleepiness, mood and neurocognitive function. Whilst shift work is reported to cause similar acute impairment, the current study demonstrated that following a recovery period of at least 24 hours since the last shift, neurocognitive function was comparatively normal relative to a healthy control group, but subjective sleepiness and mood were impaired. This suggests that not all functions recover equally following shift work. Therefore shift work employers should focus on the management of sleepiness and mood. Future studies should assess if subjective sleepiness and mood can improve with greater recovery time (e.g. >24 hours) or whether the effects are chronic in nature.
SHORT SLEEP DURATION IS ASSOCIATED WITH POOR DIET AS MEASURED BY THE ADAPTED HEALTHY EATING INDEX: A CROSS-SECTIONAL STUDY WITH BRAZILIAN SHIFT WORKERS

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Introduction: Insufficient sleep has been associated with negative alterations in food intake. However, studies analysing this association in shift workers, as individuals who are known to be predisposed to obesity and present short sleep duration, are in fact scarce in the literature. The present study aims to evaluate the associations between diet quality and sleep duration in 1,215 poultry processor shift workers.

Materials and methods: The diet quality was estimated by the Adapted Healthy Eating Index (AHEI) using a validated food frequency questionnaire validated for Brazilian adults. The bedtime and wake-up time during workdays and days off were obtained, and average sleep duration (hours) was calculated by the equation: sleep duration on workdays × number of workdays plus sleep duration on free days × number of free days /7. We grouped average sleep duration into two categories: > 6 and < 6 hours/day, defined as short sleep. Poisson regression were with robust variance was performed and adjusted for potential confounding variables in order to verify the association between sleep duration and poor diet.

Results: The AHEI median scoring criterion was were 69.2 (Interquartile range - IQR: 60.3-82.3) and 53% (n=644) of the workers with a poor diet quality. An association was found between short sleep duration both in free days as well as weekly average sleep duration, and poor diet quality (Adjusted Prevalence Ratio - APR): 1.12; 95%CI: 1.02, 1.24; p=0.016; APR:1.14; 95%CI: 1.01,1.28; p=0.028, respectively.

Conclusions: Short-sleep workers have a greater prevalence toward the consumption of a poor diet as stipulated by the AHEI. After the confirmation of these findings, it can therefore be suggested that the sleep pattern in shift workers should be taken into consideration in the nutritional approach toward these individuals.

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CHARACTERIZATION OF SLEEPING PATTERNS, BODY TEMPERATURE AND HEART RATES IN PRETERM NEONATES

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Introduction: As a result of postnatal maturation sleeping patterns (SL), body temperature changes (BT) and circadian heart rate oscillations (HR) are different in newborns than in older children and adults, especially in preterm neonates. The goal of this model-based analysis was to characterize and compare SL patterns, BT changes and HR oscillations in preterm neonates during their first 5 days of life.

Materials and methods: SL, BT and HR measurements were available from 67 preterm neonates without sepsis (gestational age 30.6 ± 2.3 weeks, birth weight 1303 ± 326 g). SL, BT and HR were monitored daily during a continuous 3 hour time interval. BT was measured by zero heat flux method where a sensor was placed between the infant's trunk and the mattress, SL was scored based on video recordings as awake, active sleep or quiet sleep, and HR measurements were obtained by surface electromyography. For data analysis the average value from each minute interval was used. As dynamics of SL, BT and HR followed oscillating patterns cosine functions were applied. Non-linear mixed effect modelling was utilized to characterize individual and population behaviour.

Results: Individual SL, BT and HR oscillations could be well described by the applied cosine functions. SL, BT and HR had different population period lengths: 110 mins, 5 hrs, and 3 hrs, respectively. Interestingly, HR showed additional overlying oscillations with period lengths of 5.5 days and 10-20 minutes, indicating that this endpoint is a combination of overlying slow and fast rhythms.

Conclusions: As a result of an immature "internal clock", preterm neonates show SL, BT and HR oscillations that are not yet completely synchronized and have shorter period lengths than those observed in older children and adults. A better understanding of physiological regulatory processes such as oscillation of SL, BT and HR could give further insights in infants at risk for autonomic dysregulation and deterioration.
MELATONIN SECRETION AND POOR SLEEP QUALITY IN PATIENTS WITH TETRAPLEGIA: A PILOT STUDY

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Introduction: We evaluated the secretion of melatonin, the sleep quality and the relation between both in tetraplegics versus paraplegic patients and healthy volunteers.

Materials and methods: This observational non-randomised study was conducted from April 2015 to November 2016 includes tetraplegics versus paraplegics and healthy volunteers. Urinary 6-sulfatoxy-melatonin (U6SM) was measured during 5 period per day (8h-12h; 12h-16h; 16h-20h; 20h-00h; 00h-!H). Sleep quality was evaluated on Pittsburgh Sleep Quality Index and Sleepiness on Epworth Sleepiness Scale. Correlation between U6SM dosage and sleep quality and sleepiness was analyzed.

Results: 22 tetraplegic patients (20 men and 2 women), and 4 paraplegics were included in the study. 15 tetraplegic patients (68,1%) had an absence of melatonin secretion, 6 (27,2%) had a decreased secretion with a shift of melatonin secretion. The melatonin secretion was normal in one C5 AIS A patient (4,5%). The Pittsburgh Sleep Quality Index showed a poor sleep quality in tetraplegics (9,28±4,90) and Epworth Sleepiness Scale showed a moderate sleepiness in tetraplegics (9,14±5,12). We did not observe a significant correlation between melatonin secretion and sleep quality. There was a significant correlation between melatonin secretion and sleepiness. Unlike data on the literature, secretion of melatonin was not strictly normal in paraplegic patients.

Conclusions: Secretion of melatonin is abnormal in patients with tetraplegia. It may partly explain sleep impairment of patients with tetraplegia. Further studies are needed to better understand the impact of this absence of melatonin secretion and to assess the effect of melatonin treatment in this population of patients.

ASSOCIATION BETWEEN PANDAS (PEDIATRIC AUTOIMMUNE NEUROPSYCHIATRIC DISORDER ASSOCIATED WITH STREPTOCOCCI) AND NON 24-HOURS SLEEP WAKE DISORDER

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Introduction: PANDAS is sudden acute and debilitating onset of intense anxiety and mood lability accompanied by Obsessive Compulsive-like issues and/or Tics, in association with a streptococcal-A (GABHS) infection that has occurred immediately prior to the symptoms (Swedo et al. 1998). Non 24-hours sleep-wake disorder (N24SWD) is characterized by symptoms of insomnia or excessive sleepiness that occurs because the intrinsic circadian pacemaker is not entrained to a 24-hour Light/dark cycle. Affected individuals have a sleep-wake cycle of 24.5 hours (Okawa et al. 2007). The disorder is seen in 70% of blind persons; among people with conserved vision it is a rare pathology. Among sighted cases, 80% are young males (Hayakawa et a. 2005) and 28% have a psychiatric disorder (Kokkoris et al. 1978).

Materials and methods: Victor is a 14-year-old boy diagnosed with Pandas in 2015. In conjunction with psychiatric symptoms he presents an irregular sleep pattern that was diagnosed as a non-24-hour sleep-wake disorder, with a 25h sleep/wake cycle, studied using the novel circadian monitoring system Kronowise® (Chronolab, Universidad de Murcia) (Sarabia et al. 2008).

The first treatment approach for Victor was focused on improving symptoms during the acute infection and psychiatric symptoms. Sleep pathology was treated with different treatments such as light therapy and melatonin.

Results: After 8 months and different trials, it was possible to normalize its symptoms and fix its sleep rhythm in a normal schedule (21h-6h).

Conclusions: The association between Pandas and non-24 hours sleep-wake disorder had not been previously reported in the literature. Light therapy and melatonin administration have allowed to stabilize the sleep circadian rhythm of the patient, being a crucial adjuvant to the control of anxiety disorder due to PANDAS.
IS INCREASED BODY MASS INDEX ASSOCIATED WITH LARGER SOCIAL JET-LAG?

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Introduction: The disruption of internal clock due to exogenous (social) time is called social jet-lag. Social jet-lag is a strong indicator of the imbalance of the biological clock and social rhythms and it is associated with increased risk of developing sleep disorders, disorders of circadian rhythms and higher prevalence of lifestyle and chronic diseases. The aim of the project is to describe social jet-lag and BMI in a wider context of adult Czech population, which may have consequences for clinical practice and disease prevention.

Materials and methods: Our sample contained 1786 respondents in total (1368 women and 418 men) using MEQ, MCTQ, BMI. The distribution of chronotype (MEQ score) in our sample corresponds with Gaussian curve. We took age-associated changes of chronotype into consideration, the entire data set was divided into three age categories: 18-25 (n=786), 26-49 (n=834) and 50+ (n=166).

Results: There is no correlation between social jet-lag score and BMI in the whole sample (WS) and no correlation in each age group. But there is a negative correlation between age and scores in jet-lag. We found a negative correlation between MEQ score and score in social jet-lag (in each age group and in WS) and a positive correlation between MCTQ score and score in social jet-lag (in WS and in groups 18-25 and 26-49) meaning that people with higher social jet-lag are more evening chronotype. Surprisingly, there is no correlation between MEQ score and BMI in WS, but in 50+ group we found a weak negative correlation, which could mean that elderly people with higher BMI are more often evening chronotypes. One more interesting finding of BMI and age - strong positive correlation in WS and weaker in groups 18-25 and 26-49, but not in the third one.

Conclusions: We confirmed the relationship between severity of social jet-lag and MEQ score and between severity of social jet-lag and MCTQ score for the whole sample and for the first and second age-groups. This confirms our assumption about evening type having higher severity of social jet-lag than other chronotypes. Based on these facts we can say that in elderly population we can expect higher scores of social jet-lag and higher BMI. It is important to acknowledge several limitations of the study. First, we are aware that the distribution of individuals in the age categories is not uniform and it is equally clear that composition of our data set due to gender is irregular.

It has been shown that social jet-lag is not associated with increased BMI, but it was found that evening type is prone to have a higher severity of social jet-lag. Evening chronotype is more vulnerable to the pathogenesis of many types of health complications. It turns out to be very beneficial to consider individual setting of circadian rhythms in the treatment of many diseases.

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**Introduction:** Most studies of sleep and health/performance outcomes have focused on two dimensions of sleep: average sleep duration and average sleep timing. Recent evidence suggests the importance of a third dimension: day-to-day regularity of sleep patterns. Previous studies have usually quantified aspects of sleep regularity using variance in midsleep timing or using Social Jet Lag (which compares sleep timing between work days and free days). These metrics, however, do not capture changes in sleep duration and temporal distribution.

**Materials and methods:** A previously validated mathematical model of human sleep and circadian rhythms (Skeldon et al., 2017) was used to generate sleep/wake patterns under realistic constraints on sleep timing for a range of chronotypes from extreme early types to extreme late types. We simulated weekly daytime work schedules, permanent nightshift schedules, and rotating shift schedules. For these schedules, we investigated the quantitative relationships among three metrics: (i) Social Jet Lag (SJL): The difference in average midsleep timing between work days and free days. (ii) Sleep Regularity Index (SRI): A recently developed metric (ranging 0-100) that compares the similarity of sleep/wake patterns between consecutive 24-hour time intervals. (iii) Composite Phase Deviation (CPD): A recently developed metric that measures the composite deviation in midsleep timing between consecutive days and relative to chronotype.

**Results:** In general, higher values of SJL are associated with higher values of CPD and lower values of SRI. However, the quantitative relationships between these variables differ depending on the type of work schedule, whether the sleep/wake pattern is entrained, and whether the schedule involves naps.

**Conclusions:** The metrics SJL, SRI, and CPD are all closely related, but capture different and complementary aspects of sleep timing. Further work is required to document the relationship of each of these to health/performance measures.

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Evening Light Exposure from Computer Screens Disrupts Sleep, Biological Rhythms and Attention Abilities

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Introduction: In 2012, the American Medical Association (AMA) issued a resolution stating that light at night constitutes environmental pollution because it disrupts daily biological cycles, including the sleep/wake cycle. Millions of computers, tablets, and smart-phones are bought worldwide every month and usage time of these devices is increasing constantly. As a result, humans are almost continuously exposed to unintentional artificial light at night (ALAN) from these device screens. We explored the independent and combined effects of two aspects screen illumination, wavelength and intensity, on sleep, its biological regulation, and functional outcomes, including sleepiness, mood, and attention abilities.

Materials and methods: A 2x2 repeated measures in-lab design with two independent variables: screen luminance (low- 80 lux, high 350 lux) and light dominant wavelength (short (SWL)- 460nm, long (LWL) 620nm). Nineteen healthy participants (female-11, male-8) mean age 24.3 (±2.8) years, underwent all four experimental light exposures in counterbalanced order. Each exposure lasted for 2 hours (21:00-23:00) during which participants performed onscreen tasks. After each exposure, participants underwent an overnight PSG in the laboratory where oral temperature and urine (for melatonin analysis) samples were collected at multiple time points during the night and morning. Each morning participants filled out mood and sleepiness measures and conducted a computerized attention task.

Results: Irrespective of light intensity, SWL illumination significantly disrupted sleep continuity and architecture. SWL altered biological rhythms, disrupting the normal decline of body temperature and the increase of melatonin secretion at night. Light intensity seemed to independently affect sleep as well but to a lesser degree. Mood, at the morning, was not significantly affected by light intensity or wavelength. When compared to the LWL, SWL exposure led to greater self-reported sleepiness. Attention, was found impaired in the morning after a 2-hours evening exposure to a computer screen. Specifically, SWL exposure seemed to affect accuracy of response, while light intensity slowed reaction times but did not affect performance accuracy.

Conclusions: To the best of our knowledge, this is the first experimental design exploring the independent and combined effects of two main features of electronic screen illumination, wavelength and intensity, on sleep and physiological regulation of the sleep/wake cycle. Moreover, we explored possible functional outcomes of variable illumination conditions, including subjective sleepiness, mood, attention and concentration abilities. Our results show that although intensity of light negatively affects sleep and related physiological variables, light wavelength seems to have a greater influence on these physiological functions and their behavioral consequences. The results of our study suggests the possible existence of a "chain reaction" of physiological changes emerging from exposure to ALAN, i.e. reduced melatonin profiles coupled with subdued body temperature rhythms, and reduced quality and quantity of sleep. These changes may directly or indirectly lead to next morning behavioral and functional deficits, such as greater sleepiness and inattention. As larger and larger segments of the population are exposed to "light pollution" emitted from these devices, effects on our health, cognition, and daily function may be significant and pervasive.

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CHRONIC AND ACUTE ALAN FROM COMPUTER SCREENS DISRUPTS SLEEP, BIOLOGICAL RHYTHMS, MOOD AND ATTENTION ABILITIES

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Introduction: Negative physiological outcomes due to exposure to artificial light at night (ALAN) have been a focus of research in the last two decades. Recent studies have reported a wide range of effects of ALAN on the human circadian clock, such as suppression of melatonin secretion, body thermo-regulation and sleep disorders. Evening exposure to dim light containing dominantly short-wave length (SWL) can disrupt biorhythms and sleep. Nowadays, most screens of digital media devices emit primarily SWL illumination. The use of digital technology in the evening even or only one night has been associated with reduced sleep quality and quantity. However, typical use of digital media is not limited to a single night use; rather an ongoing nightly use pattern is significantly more common today. This study compared the effects of non-exposure to acute and chronic ALAN exposure from digital screens on sleep, biorhythms and functional outcomes.

Materials and methods: Nineteen healthy participants (11 female, 8 male; mean age 28.1±7.2 years) underwent a six-night study with three experimental conditions using a repeated-measures design: baseline (1st night, no light exposure), acute (2nd night, one night of exposure) and chronic ALAN exposure (3rd to 6th nights, five nights of consecutive exposure). Each light exposure lasted 2 hours (21:00-23:00), following which participants underwent an overnight polysomnography. On each experimental night, oral temperature and urine samples (for melatonin analysis) were collected at multiple time points. Each morning, participants filled out questionnaires on mood, sleepiness and conducted a computerized attention task.

Results: Acute and chronic ALAN illumination significantly disrupted sleep continuity and architecture parameters (Total Sleep Time: F(2,36) = 5.92, p< .05; Sleep Efficiency: F(2,36) = 16.75, p< .001; SL F(2,36) = 3.94, p< .05) and led to greater self-reported daytime sleepiness (F(2,36) = 4.40, p< .05) and negative emotion (F(2,36) = 4.57, p< .05). Both acute and chronic ALAN also altered biological rhythms, disrupting the normal nocturnal decline in body temperature (F(2,90) = 4.16, p< .05) and dampening nocturnal melatonin secretion (F(4,72) = 3.16, p< .05). Acute and chronic ALAN negatively affected morning attention abilities (F(2,36) = 3.72, p< .05).

Conclusions: To the best of our knowledge, this is the first study comparing acute and chronic effects of ALAN emerging from electronic screen devices on sleep, biological regulation, and daily functions. The results demonstrate that chronic and acute ALAN exposure leads to disrupted melatonin secretion and thermoregulation abilities as well as distorted sleep. Furthermore, in the morning after exposure, negative emotional state, subjective sleepiness, and reduced attention abilities were observed. Today, over 90% of persons report using of some form of technological device in the bedroom in the hour before trying to fall asleep. This is rather easy, given that digital media devices are widespread and available in a many forms and types (e.g., TVs, computers, tablets, smart-phones). However, is also quite concerning, as chronic use of these devices, particularly in the evening and nighttime, constitutes "light pollution," which may determinately affect our sleep, health, and daily functions.

Acknowledgements: None
Introduction: Our biological circadian clock has a period of approximately 24 hr. The individual differences in the preferred timing of sleep and activity is called chronotype, the endogenous component of circadian clock. The discrepancy between work and free days, between social and biological time, can be defined as 'social jetlag'. We describe the relationship between social jetlag and the influence on the daily living and characteristics on sleep pattern in Korean population.

Materials and methods: Subjects were recruited randomly among the general population adults between 20-82 year old, excluded shift workers and longer sleepers when workdays. 2,585 subjects (1,331 women and 1,254 men) were asked to fill out the questionnaires about their sleep patterns separated by work day and free days and several scales about quality of daily life including sleep quality assessed by Pittsburgh Sleep Quality Index, Goldberg Short screening scale for anxiety and depression, The Epworth Sleepiness Scale, Insomnia Severity Index, Headache Impact Test, BMI, education. We calculated the social jetlag and divided two groups into subjects who have social jetlag exceed 1 hour (above upper quartile) and subjects who have not. We also divide into two groups of relatively early and late chronotype.

Results: Social jetlag exceed 1 hour group was younger in age, less educated, more employed status, night owls, and got more monthly income. They tend to consume more alcohol and cigarettes. More social jetlag (longer time), more depressed mood was demonstrated with proportional relationship although presence of depressed mood and severity was comparable between two groups.

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Acknowledgements: H-J Im and Hy Kim contributed to the analysis and interpretation of data. H-J Im and C-Y Yun conceptualized and designed the study, analyzed and interpreted the data, and revised the manuscript.
TASIMELTEON IMPROVES SLEEP QUALITY AND BEHAVIOR IN INDIVIDUALS WITH SMITH-MAGENIS SYNDROME (SMS) IN AN OPEN-LABEL STUDY

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Introduction: Individuals diagnosed with Smith-Magenis Syndrome (SMS), a rare genetic disorder due to a deletion on chromosome 17, typically exhibit self-injurious and aggressive behaviors and disrupted nighttime sleep (i.e., difficulties falling asleep or frequent, prolonged nighttime awakenings). The associated nighttime sleep disturbances may be related to the observed inappropriate timing of the endogenous melatonin secretion during the daytime in this population.

Materials and methods: There were 12 individuals (7 male) diagnosed with SMS, ages 16-38 years (mean ± SD = 23.7 ± 7.3 years), who were assessed during a ~6-week baseline phase followed by an open-label treatment phase (tasimelteon, 20 mg capsule, nightly 1 h prior to bedtime) for 9-36 weeks. Parents rated their child's nighttime sleep quality (1=Poor to 5= Excellent) every morning and rated their child's behavior using the Aberrant Behavior Checklist-Community (ABC-C), a 58-item checklist with a 4-point rating scale (0= "not at all a problem" to 3= "the problem is severe in degree"), every 3-6 weeks during both phases of the study. A paired Student´s t-test was used to analyze the data.

Results: In comparison to the baseline phase (mean change; p-value), scores of parent-reported sleep quality significantly increased (+0.51; 0.0105) and total score on the ABC-C significantly decreased (-15.89; 0.0006) during treatment phase, including four ABC-C subscales, “Hyperactivity, Noncompliance” (-5.96; 0.0049), “Irritability, Agitation, Crying” (-5.62; 0.0004), “Lethargy” (-2.10; 0.0384) and “Stereotypic Behavior” (-1.24; 0.0049). The remaining ABC-C subscale, “Inappropriate Speech”, exhibited a decreasing trend (-0.96; 0.0754).

Conclusions: Parents of children with SMS reported improvement in sleep quality and decrease in aberrant behaviors during treatment with tasimelteon, as compared to baseline. Although not collected under placebo-controlled conditions, these data suggest that nightly tasimelteon treatment may alleviate the nighttime sleep disruption in individuals diagnosed with SMS and may impact daytime aberrant behaviors.

Acknowledgements: The authors would like to thank the study patients, the patients' parents/guardians and the investigators who participated in Study 2401.
**Introduction:** Circadian physiology has been hypothesized to play a role in the etiology of Major Depression and may affect symptom expression and response to treatment. We have studied markers of circadian physiology in a large cohort of patients with MDD and have identified differences of the expression of the circadian timing system between African Americans and Caucasians.

**Materials and methods:** Patients diagnosed with MDD (DSM-IV), including 94 African Americans (70 female) ages 19-61 years (mean ± SD = 41.0 ± 11.7 years) and 235 Caucasians (158 female) ages 18-65 years (42.9 ± 13.5 years) participated in this study. Patients collected saliva samples at home every hour for 9 hours starting 5 hours prior to their habitual bedtime. Participants recorded date and clock time of each sample and were instructed to avoid bright light and wear amber-lens (blue-light filtering) goggles throughout collection. Samples were frozen until assayed for melatonin. Melatonin onset (MO) was defined as the interpolated clock time between 2 consecutive samples when melatonin concentrations rose above 4 pg/mL. The sample clock times for collections performed during daylight saving time were not adjusted (-1 hour) to standard time. A paired Student’s t-test was used to analyze the data.

**Results:** The mean Melatonin onset (MO) clock time was at 9:04 PM in the African American-MDD population as compared to 9:35 PM in the Caucasian-MDD population. The difference of 31 minutes between the two populations was statistically significant (p-value = 0.0229).

**Conclusions:** The timing of melatonin secretion in an African American-MDD population occurred at an earlier time relative to the Caucasian-MDD population. The role of this observation in the pathophysiology and treatment of MDD would need to be further investigated.

**Acknowledgements:** The authors would like to thank the patients and investigators who participated in the Magellan study (tasimelteon in MDD study).
Introduction: The ageing population has been growing at an unprecedented pace in Japan and the proportion of elderly people aged over 65 years in the total population is the highest in the world. The sleep-related problems accompanying with ageing has also become medical and social problems. Although a shift in phase toward a morning chronotype is thought to be normal physiological ageing process, many elderly people in Japan visit a hospital with misbelief that early-morning awakening is a kind of insomnia. As sleep-related problems of elderly people are often assessed in a hospital or a nursing home, influence of chronotype on daily activities and mental health in dwelling environment is not well understood. The purpose of our study was to elucidate relation between chronotype and quality of life in community-dwelling elderly people.

Materials and methods: We recruited 99 elderly people aged over 65 years (mean age: 71.1 ± 4.5 years, 44 female) who live in the southern region of Kyoto Prefecture, Japan. Cognitive function was screened using the Mini-mental state examination. The Morningness-Eveningness Questionnaire (MEQ), the Pittsburgh Sleep Quality Index (PSQI), the Short Form-8 Health Survey (SF-8) and the Patient Health Questionnaire-9 (PHQ-9) were administered to assess their diurnal preferences, sleeping states, quality of life and presence of depression symptoms.

Results: 70.7% of the participants were classified as definite or moderate morning type according to the MEQ score. Regression analysis showed significant negative correlation between the score of the MEQ and the PHQ-9 (P < 0.01). The MEQ score was positively correlated with the mental component score of SF-8 (P < 0.05), while correlation with physical component score was not significant.

Conclusions: Our results reveal that morning preference is associated with lower incidence for depressive states and related to better mental health-related quality of life in the community-dwelling elderly. Although the shift toward morning chronotype is often regarded as an unfavourable phenomenon, the data suggest that morning preference in old age can be associated with better mental health. The result could be useful in sleep hygiene education for the general population.
ASSOCIATION BETWEEN CHRONOTYPE AND OBSTRUCTIVE SLEEP APNEA SYNDROME IN KOREA

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Introduction: Circadian preferences are classified as chronotypes, including morning-type, evening-type and intermediate. Chronotype is a heterogenous characteristic which was contributed by age, gender, birth season and emerging during childhood. The prevalence of obstructive sleep apnea syndrome (OSAS) is associated with age, and several studies showed chronotype and OSAS exhibit a similar age-related characteristic that could indicate the potential influence of circadian preference in the symptoms of sleep apnea. However, there has been limited research examining the relationship between chronotype and OSAS. The aim of the study was to analyze the association between in obstructive sleep apnea (OSA) patients.

Materials and methods: From February 2015 to February 2017, 1537 patients underwent polysomnography (PSG) in Asan Medical Center. Among them, 442 participants finally included who diagnosed by OSAS from a full-night PSG and completed the questionnaires such as Morningness-Eveningness Questionnaire (MEQ), Epworth Sleepiness Scale (ESS), Beck Depression Inventory (BDI), Pittsburgh Sleep Quality Index (PSQI) and Gastro-esophageal reflux disease Questionnaire (GERDQ). Chronotype was assessed by a Korean version of the Morningness-Eveningness questionnaire (MEQ). Scores range between 16-86, chronotypes were classified as evening-type (16-41), intermediate (42-58) and morning-type (59-86). The severity of OSA was measured by the apnea-hypopnea index (AHI), representing the number of respiratory events per hour of sleep. AHI was calculated as the ratio between the total number of apneas and hypopneas and the total sleep time. And respiratory disturbance index (RDI), Oxygen desaturation index (ODI) and hypnogram was analyzed. Additionally, Demographic, Body mass index (BMI) and medical illness history such as hypertension, diabetes mellitus (DM) and hyperlipidemia were collected. The association factors between chronotype and OSA were analyzed by uni-variable and multi-variable linear regression analyses. A p < 0.05 was accepted ad significant.

Results: Four hundred forty-two participants were included in this study. Intermediate-type individuals represented 249 (56.3%) of the sample, followed by morning-type (115 of 442, 26%) and evening-type (78 of 442, 17.6%) individuals. Among them, 203 (45.9%) diagnosed by severe OSA, 130 (29.4%) shows moderate OSA and 106 (24%) were mild OSA. Univariate analyses showed lower MEQ scores which represented to evening-type, significant associated with younger age (p=0.000), without hypertension (p=0.000), poor sleep quality which was represented by higher PSQI (P=0.002), higher OSA symptoms, higher ESS score and GERD symptoms. Gender, DM, BMI and OSA severity index such as AHI, RDI, ODI were no significant association with MEQ scores. Multivariate analysis showed lower MEQ scores represented by evening-type, significant associated with younger ages (p=0.000) and higher OSA symptoms (p=0.008). In multivariate analysis, hypertension, PSQI scores, ESS scores and GERDQ scores were not show significant correlations.

Conclusions: This study evaluated the distribution of chronotypes in OSA patients in Korea. Younger Age and higher OSA symptoms were impact associating factors with evening-type chronotype in OSA patients. In addition, daytime sleepiness and low blood pressure, poor sleep quality and higher GERD symptoms could associate with evening-type chronotype in OSA patients.

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INTRODUCTION: Up to 40% of hypertensive patients and 70% of poorly controlled ones had sleep disturbances. Sleep disorders such as insomnia, RLS, OSA could aggravated nocturnal blood pressure control. There were few studies that analyzed the effects of antihypertensive drugs on sleep architecture using electroencephalogram (EEG) or polysomnography (PSG). Previous studies reported that losartan caused insomnia. We studied the effects of fimasartan, another angiotensin receptor antagonist, on sleep-wake cycle in hypertensive rats.

MATERIALS AND METHODS: Three Wistar-Kyoto rats (WKY), three spontaneously hypertensive rats (SHR) and three SHR-control rats (SHRW) were used in controlled environments. The EEG electrodes with a bio-potential amplifier were implanted into frontal and parietal cortices, then recorded for eight hours from 09:30 to 17:30. Sleep-wake cycles were scored as wake for 'W', slow-wave sleep for 'S' and paradoxical or rapid eye movement (REM) sleep for 'P', every 10 seconds. Mean epoch duration and number of epochs were measured. Animal dose of Fimasartan solutions 0.6, 1.2 and 2.4mg/kg as diluted by distilled water and 0.9% of sodium chloride normal saline were administered intraperitoneally. After an hour and 24 hours, we measured systolic and diastolic blood pressure noninvasively. EEG power spectral analysis and repeated-measure ANOVA were performed.

RESULTS: SHR group showed significantly elevated systolic and diastolic pressure an hour and 24 hours after fimasartan administration compared to WKY and SHR control group, but significantly reduced systolic and diastolic pressure after an hour fimasartan injection compared to normal saline injection. There were no differences of power spectrum between rat groups and drug administration. SHR and SHR control groups showed significantly increased sleep duration an hour after fimasartan administration. There were no differences of sleep/awake duration between rat groups after normal saline administrations. The epoch numbers of wake and sleep per hour significantly decreased and mean epoch duration of sleep increased in SHR group both an hour and 24 hours after fimasartan administrations, compared to SHR control and WKY groups.

CONCLUSIONS: Although it is unknown whether high blood pressure directly damages the sleep structure, the administration of fimasartan into hypertensive rats had the effect of improving sleep quality by prolonging sleep duration and decreasing the frequency of sleep-wake cycle. As previously reported, treatment of sleep disturbances had a better control of blood pressure in hypertensive patients. In this study, we found that fimasartan treatment can improve sleep quality in hypertensive rats. Further studies of hypertension and sleep quality in human will be needed.

ACKNOWLEDGEMENTS: This study was supported by a grant from Boryung Pharmaceutical.
Introduction: Morningness-Eveningness indicates that an individual has a preference in diurnal performance, sleep-wake cycle for activity and alertness during the day. The purpose of this study was to investigate the effect of morningness-eveningness type and shift work duration on nurses relative to sleep quality, depressive symptoms and occupational stress.

Materials and methods: Data was collected using self-administering questionnaires by 257 three eight-hour randomly rotating shift system nurses at St. Vincent's hospital. Questionnaires were composed of baseline demographic data, Korean version of Morningness-Eveningness Questionnaire, Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, Beck Depression Inventory and Korean Occupational Stress Scale. Kruskal-Wallis H test and analysis of covariance (ANCOVA) were used to identify significant differences in sleep parameters, depressive symptoms and occupational stress according to morningness-eveningness type.

Results: There was significant difference in Subjective Sleep Quality score (p=0.018). Post hoc analysis revealed differences between eveningness vs. morningness (p=0.001) in Subjective Sleep Quality score. There were tendencies in sleep efficiency, PSQI total score and ESS between morningness-eveningness type. However, there were no significant differences in total sleep time, depressive symptoms and occupational stress including eight sub-categories according to morningness-eveningness type. Morningness-Eveningness score revealed negative correlation with Subjective Sleep Quality score and Total score of PSQI and ESS, and positive correlation with sleep efficiency. Shift work duration showed positive correlation with total stress and stress due to job demand.

Conclusions: Eveningness type nurses revealed lower Subjective Sleep Quality and tendency for poor sleep efficiency, poor overall sleep efficiency and more severe daytime sleepiness than other type. Morningness type might have positive effects on sleep quality and daytime sleepiness. However, morningness-eveningness were not decisive factors for total sleep time, depressive symptoms and occupational stress. Longer shift work duration had correlation with higher occupational stress. Short-term medication, workers' chronotypes consideration and naps before night shifts may be helpful in improving mental health and quality of life for shift nurses, especially for evening shifts.

Acknowledgements: No conflicts of interests
Introduction: It has been proposed that chronic circadian misalignment between the endogenous and external rhythms would be associated with the disruption of suprachiasmatic nucleus function and increased risk of insomnia. The light is the most powerful synchronizing agent for the circadian clock, and altered light exposure pattern may lead to circadian disruption and reduced sleep quality, which would be associated with mood disorders and health risks. No study has been reported to examine whether the change in rest-activity rhythm or timing of light exposure are expected in insomnia. We aimed to compare the circadian rhythms of rest-activity and light exposure in insomnia patients, and to investigate the effect of these circadian parameters on nocturnal sleep.

Materials and methods: Participants above 18 years old were recruited from 3 Public Health Centers in a rural area of Korea from 2013 until 2015. The actigraphy (Actiwatch 2; Philips Respironics, Murrysville PA, USA) recording was conducted for seven consecutive days at home. One hundred six patients with insomnia disorder (ID) (62.27±12.29 years) and 80 normal control (NC) subjects (55.64±13.25 years) were included for our analysis. The dim light melatonin onset (DLMO) was defined as the time which the saliva melatonin level was 4 pg/ml. The DLMOs were determined in 60 ID patients (Age 62.15±11.79 years) and 49 NC subjects (Age 55.14±13.47 years). The light data across 24h were log transformed. The amplitudes and acrophases of rest-activity rhythm and light exposure were estimated using cosinor analysis. The phase angle differences (PAD) were evaluated between the DLMO and acrophase of rest-activity rhythm, and between the DLMO and that of light exposure. The derived variables were compared using ANCOVA controlling for age and seasonality.

Results: The ID group showed significantly lower sleep efficiency (SE) and greater WASO than the NC group (p< 0.01). The ID group did not show significant differences in the amplitude and acrophase of rest-activity rhythm and those of light exposure compared to the NC group. The ID group did not show significant differences in the PAD of rest-activity rhythm and PAD of light exposure compared to the NC group. In the combined group, stepwise regression analysis showed that the seasonality(Δβ=-.309) and the acrophase of light exposure (Δβ=-.187) were significant predictors of WASO ($r^2 = 0.119$, p< 0.0001).

Conclusions: Compare to NC subjects, insomnia patients had no difference in the circadian rhythms of rest-activity and light exposure. They did not have the different rest-activity rhythm relative to endogenous circadian phase. The phase angle of entrainment to the light-dark cycle was not different from that of NC subjects either. However, the earlier circadian phase of light exposure predicted the worsening of nocturnal sleep maintenance. Our finding suggests that the alteration in the timing of light exposure may negatively contribute to objective sleep quality in community-dwelling adults.

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Effects of Antidementia Drugs on Sleep-Wake Cycle in Rats

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Introduction: It has been reported up to 24.5% of Alzheimer’s dementia patients have sleep disturbances. Changes in the sleep architecture of the dementia patients include decreased sleep efficiency, decreased rapid eye movement (REM) sleep, increased wake after sleep onset (WASO) and irregular sleep-wake cycle, etc. We thought that one of the causes was anti-dementia drug affecting the sleep-wake cycle. Therefore, we conducted an experimental study to administer rats with galantamine, choline alfoscerate, acetyl-L-carnitine which are widely used in patients with dementia.

Materials and methods: We divided 300-320 grams of Sprague-Dawley male rats (Santaco, Osan, Korea) into a control group and three experimental groups. The EEG electrodes with a bio-potential amplifier were implanted into frontal and parietal cortices, then recorded for 8 hours from 09:30 to 17:30. Sleep-wake cycles were scored as wake for 'W', slow-wave sleep for 'S' and paradoxical or rapid eye movement (REM) sleep for 'P', every 10 seconds. Galantamine (1, 2, 4mg/kg), choline alfoscerate (40, 80, 160mg/kg) and acetyl-L-carnitine (50, 100, 200mg/kg) diluted in normal saline for animal dosing were administered intraperitoneally. Mean epoch duration and number of epoch were measured, comparing an hour before and after the administration. EEG power spectral analysis and one-way ANOVA were performed.

Results: Galantamine injecting rats increased duration of waking significantly compared to controls and decreased delta spectral power, dose-responsively. Choline alfoscerate and acetyl-L-carnitine injecting rats showed no differences in sleep architecture and spectral power activity. Acetyl-L-carnitine in equivalent doses showed decreasing duration, epoch numbers and mean epoch durations of paradoxical sleep compared to the other drugs. Choline alfoscerate in all doses recorded no effects on sleep quality. EEG spectrum in galantamine showed dose-responsive reduction of theta and alpha band power, and delta band showed no statistically differences but decreased tendency according to upper dose. Additionally, sleep latency of high dose (4mg/kg) galantamine was prolonged, compared to controls and other drugs.

Conclusions: In this study, it was found that galantamine affected the sleep-wake cycle of rat, exacerbating sleep quality, and choline alfoscerate had little effect. Comparing with equivalent dose of other drugs, acetyl-L-carnitine reduced paradoxical (or REM) sleep period, showed higher frequency of sleep-wake cycle in rats. Because this result based on normal rats, further studies of animal models of dementia will be needed.

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TO BE A NIGHT OWL? OR NOT TO BE? FIRST STUDY OF CIRCADIAN PREFERENCES IN CASE OF CZECH ADULTS

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Introduction: Circadian preferences can be defined as an individual preferences of timing of psychological, physiological and behaviour variables which are influenced by biochemical (e.g. hormone production) and external changes (e.g. daylight changing). They are closely related to sleep-wake cycle, change by age and play important role in many areas in human life. This study represents a part of results of first big study on this topic in the Czech Republic. The aim of the study is to map a distribution of circadian preferences and their relation to many variables in case of Czech adults and to prove new Czech translation of MEQ is prepared for usage in clinical practice and other studies.

Materials and methods: We used web form for collecting data. Our sample contained 1793 respondents which were divided into three age categories: 18-25 (n=788); 26-49 (n=837) and 50+ (n=168). Participants responded to MEQ and MCTQ and questions on demographic data (age, sex and civil status, place of residence, children and education). We used descriptive statistic for describing the whole sample and statistical analysis (t-test, Mann-Whitney test, correlations, regression analysis, Cronbach’s alpha).

Results: Results show that distribution of circadian preferences in all the three age categories is normal (we took account of sample size and applied the central limit theorem). There is difference between men and women in circadian preferences in two age categories. Women within category of 26-49 years old are more often morning type, while category of 50+ years old shows the opposite. In all three categories men drink beer, alcohol (liquor, whiskey, gin etc.) and beverages with caffeine more than women, otherwise women drink coffee more and in the youngest age category they drink wine more too. MEQ score negatively correlates with MSFsc (midsleep times in free days in MCTQ). Negative correlations were found between MEQ score (Cronbach’s alpha 0,75) and drinking alcohol and beverages with caffeine, MEQ score and smoking in categories of 18-25 and 26-49 age. Affiliation with circadian preferences is predicted by MSFsc in all the three age categories, by place of residence and education in category of 18-25 years old, by sex, civil status and place of residence in category of 26-49 years old and by civil status in category of 50+ years old.

Conclusions: Results indicate that there is normal distribution of circadian preferences in case of Czech adults. Men and women differ in some variables (e.g. drinking coffee, alcohol, beer etc.; women are morning type in the 2nd age category, men are morning type in the 3rd age category often). Affiliation with circadian preferences is predicted by many variables too (e.g. MSFsc, sex and civil status, place of residence). Some results confirm results of other studies, some are different. On the other hand, results show that Czech translation of MEQ is ready to be used.

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REDUCED LIGHT EXPOSURE NEGATIVELY IMPACTS SLEEP QUALITY AND ALERTNESS IN UNDERGROUND-OPERATING SUBWAY WORKERS

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Introduction: Despite of being a survival warranty, sleep is absolutely relevant for many functions of which depend attention, adequate behaviour and alertness. Two main oscillatory components (homeostatic drive and circadian cycle) regulate human sleep-wake cycle. Circadian influence on the maintenance of a synchronised sleep-wake cycle primarily depends on time and intensity of light exposure. Furthermore, light exposure can affect wakefulness and sleepiness. This study aimed to compare underground-operating workers (UOW) with surface workers (SW) of the Lisbon subway company regarding sleep quality and sleepiness.

Methods: Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS) were used to assess sleep quality and sleepiness. For statistics it was applied the Statistical Software Package for the Social Sciences (SPSS, version 22.0). Statistical meaning was assumed for p< 0.05.

Results: 399 otherwise healthy workers were included (262 males): 57,1% UOW versus 42,9% SW. 56,6% of the UOW compared to 43,9% of the SW complained of disturbed sleep. Sleep quality was bad (PSQI>5) in 48,2% of UOW versus 31,0% of SW. Sleepiness (ESS>10) was assumed in 41,2% of UOW versus in 28,7% of SW. Lighting levels were significantly lower for UOW (5 to 40 Lux) compared to SW (334 to 781 Lux).

Conclusion: Underground operating workers are more prone to complain about sleep and to have a lower sleep quality and higher levels of sleepiness compared with surface workers of the same subway company. Reduced light exposure appear to be the main factor explaining this difference.
**Introduction:** Circadian preference, reflected in the circadian timing of sleep onset and awakening times, and nighttime sleep spindle characteristics show marked variation between individuals, but are fairly consistent biological features during adulthood. These both have been associated with similar behavioral phenotypes related to cognitive function and mental health. However, there are no previous explorative studies on whether spindle characteristics would differ by circadian preference.

**Materials and methods:** We analyzed the difference in slow and fast sleep spindle amplitude, density, duration and intensity at frontal and central derivations by circadian preference from 170 adolescents (59% girls; mean age=16.9, SD=0.1 years) that come from a Finnish community cohort born in 1998. Circadian preference was assessed with the shortened 6-item Horne-Östberg Morningness-Eveningness Questionnaire and one overnight sleep EEG recording (SOMNOscreen plus) at the home of the participant was used to assess sleep and spindle characteristics. Statistical analyses were adjusted for age and sex.

**Results:** Our results indicate a significant association between morning preference and lower slow spindle amplitudes and intensities as compared to intermediate or evening preference. These results were seen at both central (for both amplitude and for intensity P< 0.001 respectively) and frontal (for both amplitude and for intensity P< 0.01 respectively) derivations. No significant differences between circadian preference groups were found in spindle durations or densities. Even though significant sex differences in spindle characteristics were observed, sex did not moderate the association between circadian preference and spindle characteristics.

**Conclusions:** Our explorative study is the first to report differences by circadian preference in spindle characteristics suggesting that circadian preference not only provides framework for sleep timing, but is also associated with individual sleep microstructure in relation to spindle phenotypes.
SCREENING FOR GENETIC VARIATIONS ASSOCIATED WITH CIRCADIAN RHYTHM SLEEP-WAKE DISORDERS

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The circadian clock system regulates daily behavioral and physiological rhythms such as sleep/wakefulness, hormone secretion, and cognitive performance. These rhythms are generated by the central circadian oscillator located in the suprachiasmatic nucleus (SCN) of the hypothalamus and are entrained by environmental cues. The molecular mechanism of the circadian clock system involves transcription-translation negative feedback loops of multiple clock genes. Circadian rhythm sleep-wake disorders (CRSWDs) are defined by persistent or recurrent disturbed sleep-wake patterns and consist of several subtypes including advanced sleep-wake phase disorder (ASWPD), delayed sleep-wake phase disorder (DSWPD), and non-24-hour sleep-wake rhythm disorder (N24SWD). CRSWDs are thought to result from impairment of the circadian clock system. In fact, polymorphisms in circadian clock genes have been associated with familial ASWPD, DSWPD, N24SWD and inter-individual differences in daily activity/sleep time known as the diurnal preference/chronotype. We sequenced 76 sleep- and circadian-related genes in 17 individuals with N24SWD and found some potential genetic variations associated with N24SWD. Our findings will expand current understanding of the sleep and circadian system in humans.
THE CIRCADIAN RHYTHMS OF OXIDATIVE STRESS MARKERS AND MELATONIN METABOLITE IN PATIENTS WITH AUTISTIC SPECTRUM DISORDERS

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\textbf{Introduction:} Patients with autistic spectrum disorder (ASD) often have sleep problems, such as having difficulties in falling asleep, awakening frequently during night and waking up early in the morning. The relation between melatonin and sleep problems in ASD patients has been reported. Oxidative stress originates from an imbalance between the production of reactive oxygen species and reactive nitrogen species, and the antioxidant capacities of cells and organs. The relationship between oxidative stress and neurodegenerative disease has been reported. We have reported the circadian rhythm of oxidative stress markers and melatonin metabolite in patients with severely disabled and patients with xeroderma pigmentosum. Herein, we report the circadian rhythms of oxidative stress markers and melatonin metabolite in ASD patients using urine.

\textbf{Materials and methods:} We chose thirteen patients with ASD aged from 6 to 15 years old (6 male and 7 female) and five age-matched controls who do not have neurological problems. The intellectual level of patients with ASD is various. Consent were granted from all parents of patients and controls. We collected the urine from each person four times a day (around midnight, in the morning, at the noon, and in the evening). We measured the values of hexanoyl-lysine (HEL), 8-hydroxy-2\textsuperscript{-deoxyguanosine (8-OHdG), 6-sulfatoxymelatonin (6-MS) and total antioxidant (TAO) in each urine by the commercially available enzyme-linked immunosorbent assay kits.

\textbf{Results:} All the patients and controls did not have problems in sleep. The values of each markers in patients ASD are equal to those of controls. The rhythms of 8-OHdG, 6-MS and TAO of the patients with ASD is similar to those of controls. The values of HEL, an early stage marker of lipid peroxidation, have peak at midnight in patients with ASD, though those in controls have peak in the morning.

\textbf{Conclusions:} The circadian rhythms of melatonin in patients with ASD is maintained. It seems that the collapse of circadian rhythms of lipid oxidation to lipid are related to the pathology of ASD.
**Introduction:** In Bipolar Disorder (BD), both chronobiological rhythms and emotion dysregulation play an important role by negatively influencing its trajectory. In addition, many studies documented an association of negative life events with BD onset and course. The aim was to assess the possible association between early life stress chronotype and emotion regulation in subjects with Bipolar Disorder.

**Method:** Fifty-two patients (39 females, 13 males, mean age of 47.6±13.1 years) with a BD-type I depressive episode with mixed features, according to DSM-5 and 20 healthy controls (15 females, 15 males, mean age of 47.7±12 years) were recruited. Subjects with Bipolar Disorder were evaluated with the SCID-DSM-5 and the Morningness-Eveningness Questionnaire (MEQ), Difficulties in Emotion Regulation Scale (DERS), Beck Depression Inventory (BDI-II), Mania Rating Scale (MRS), and Early Trauma Inventory-Short Form (ETISR-SF). An a priori power analysis has been performed, and correlations were studied with regression and mediation analyses.

**Results:** In Bipolar Disorder patients the MEQ total score was 49.2±7.1, 16 subjects (31%) showed an evening chronotype, and in healthy controls was 58.2±1.5, 3 subjects (15%) showed an evening chronotype (p< 0.05), the BDI-II and MRS scores were respectively 23±11.2 and 8.9±6.0 in BDs, 5.2±1.2 and 3.0±0.1 in healthy subjects (p< 0.001) and the ETISR-SF score was 7.1±04 and 2.1±1 (p< 0.01). In subjects with Bipolar Disorder early life stress significantly correlated with the MEQ score (coeff= -0.16, p=0.03), especially with the evening chronotype (coeff= 1.1 p=0.04), the BDI-II (p=0.01), the MRS (p=0.03) and the DERS scores (coeff= 0.7, p=0.01). Considering depressive and manic symptoms as covariates, in bipolar subjects the early life stress independently predicted the evening chronotype (coeff= 0.14, p=0.04) and the greater emotion dysregulation (coeff= 1.8, p=0.005). In the mediation analyses evening chronotype mediated the association between early life stress and emotion dysregulation (Z=2.7, p=0.03).

**Conclusions:** Early life stress may impact on later psychopathology, especially favoring sleep rhythms and emotion dysregulation. Particularly, if the evening chronotype may contribute to the association between early life stress and emotion dyregulation in Bipolar Disorder, we may hypothesized early life stress having negative consequences at first on chronobiological rhythms. Further studies with longitudinal design are required.
Introduction: In Bipolar Disorder (BD), both chronobiological rhythms and emotion dysregulation play an important role by negatively influencing its trajectory; particularly, impulsivity can contribute to risky behavior including substance abuse, aggressiveness and suicidality. The aim was to assess the possible association between chronobiological rhythms and emotion regulation in subjects with Bipolar Disorder while controlling for disease severity.

Method: Fifty patients (38 females 76%, 12 males, mean age of 46.7±13.7 years) with a BD-type I depressive episode with mixed features, according to DSM-5 criteria and 20 healthy controls (15 females 75%, 15 males, mean age of 47.7±12 years) were recruited. Subjects with BD were evaluated with the SCID-DSM-5 and the Morningness Evenness Questionnaire (MEQ), Difficulties in Emotion Regulation Scale (DERS), Beck Depression Inventory (BDI-II), Mania Rating Scale (MRS). An a priori power analysis has been performed, and correlations were studied with unilinear, multilinear and logistic regression.

Results: In BD patients the MEQ total score was 49.2±7.1, 14 subjects (28%) showed an evening chronotype, and in healthy controls was 58.2±1.5 with 3 subjects (15%) showing an evening type (p< 0.05), the BDI-II and MRS scores were respectively 51±11.2 and 11.1±6.0 in BDs, 5.2±1.2 and 3.0±0.1 in healthy subjects (p< 0.001). The DERS total score was respectively 104.5±21 and 24.1±15 (p< 0.01). In subjects with Bipolar Disorder the greater emotion dysregulation was inversely correlated with the MEQ score (coeff= -1.4, p< 0.001) and positively with MEQ evening chronotype (coeff= 0.07, p=0.02), the BDI-II (coeff= 0.08, p=0.01), and the MRS (coeff= 1.7, p=0.03) scores. Considering depressive and manic symptoms as covariates, in Bipolar subjects the evening chronotype independently predicted the greater emotion dysregulation (coeff= 0.6, p=0.008), particularly the greater impulsivity (coeff= 0.20, p=0.02).

Conclusions: These preliminary data show that the alterations in chronobiological rhythm may play a key role on emotion dysregulation in Bipolar Disorder. Especially the evening chronotype may contribute to emotion dysregulation and increased impulsivity in these subjects. The evaluation of chronobiological sleep rhythms in Bipolar Disorder seems crucial for an appropriate and tailored treatment.
WAKE-UP TIME IN ADOLESCENCE RELATES TO OVERWEIGHT RISK IN EARLY ADULTHOOD

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Introduction: The shift toward later sleep onset and wake-up times in adolescence mismatch with unmodified school start times, resulting in insufficient sleep amount. This context might be related to higher body mass index (BMI). Given the current challenge for identifying variables that might contribute to weight gain, this issue is of relevance. Our main goal was to assess the effect of sleep-wake cycle (SWC) patterns in adolescence on BMI changes in young adulthood.

Materials and methods: Participants were part of a cohort followed since infancy and assessed in adolescence and early adulthood. Motor activity was recorded for a week with actigraphs (Actiwatch-16/64) worn in the non-dominant wrist, allowing identification of sleep and wake episodes through an automated procedure (1). We assessed SWC patterns for the nighttime period of weekdays. Variables of interest were: bedtime (BT), wake-up time (WT), total wake time (TWT), and total sleep time (TST). These were categorized according to the 50th percentile of their distribution. Sex- and age-specific BMI z-scores were calculated and categorized as normal weight (NW, BMI z-score ≥ −2 to < 1) and overweight/obesity (OW, BMI z-score ≥ 1). BMI changes from adolescence to adulthood were classified as:
(a) Good BMI: those who were NW or OW in adolescence and NW in adulthood, and
(b) Poor BMI: those who were NW or OW in adolescence and OW in adulthood.
We used logistic regression to explore the effect of SWC patterns in adolescence on BMI category in adulthood.

Results: 265 participants (50.2% female) were included. In adolescence, mean age was 16.7±0.2 y and 34.0% were OW. Median ± interquartile range was 00:00 am±1.8 h for BT, 7:38 am±2.5 h for WT, 0.2±0.4 h for TWT, and 7.6±1.5 h for TST. In adulthood, mean age was 22.1±0.4 y; 42.6% were OW. Regarding BMI change, 43% were categorized as Poor BMI. Later WT (odds ratio [OR] =0.52; 95% confidence interval [CI] =0.28-0.98; p< .05) and being male (OR =0.47; 95% CI = 0.28-0.77; p< .01) were associated with a decreased likelihood of being Poor BMI.

Conclusions: Our results show that waking-up later during weekdays in adolescence had a decreased likelihood of becoming or remaining OW in early adulthood. These findings provide further support to policy initiatives to delay school start times for teenagers (2).

References:
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SELECTIVE SLOW-WAVE SLEEP SUPPRESSION AFFECTS THE TESTOSTERONE LEVEL AT THE NEXT MORNING

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Introduction: Testosterone (T) and cortisol (C) are major final products of the hypothalamic-pituitary-gonadal system and the hypothalamic-pituitary-adrenal system, respectively. The testosterone/cortisol (T/C) ratio is a marker of anabolic/catabolic physiological processes. The balance of T and C modulates psychologically and physically integrated human responses. The levels of these hormones display circadian variation: the highest T and C concentrations occur at the beginning of the day, while the lowest levels occur in the evening. Sleep disorders may lead to the T level decrease and affect the C secretion: increasing or decreasing the level of C. However, experimental data about the link between these hormones and sleep length and architecture are contradictory, because they were obtained in conditions with partial or total sleep deprivation. Consequently, indirect factors might affect these data, such as, different arousal state and, disturbance of circadian rhythm due to sleep deprivation. In the current study we focused on a selective deprivation of the 3rd stage of sleep or slow-wave sleep (SWS) since this stage is particularly important for body balance control. Moreover, the selective SWS suppression affects the circadian rhythm and sleep architecture less than total sleep deprivation. Thus, we aimed to determine the functional significance of SWS for regulation of T and C secretion.

Materials and methods: 7 subjects (all males, mean age 22.4) took part in the study. Each volunteer participated in two experimental sessions: in Session 1 with selective SWS suppression, and Session 2 as a control condition without sleep disturbance. By using polysomnogram during night we monitored phases and stages of sleep. In sessions with SWS suppression we presented sounds with increased volume when subjects reached the 3rd stage of sleep until the occurrence of more superficial the 2nd stage of sleep. Salivary samples were collected upon awakening and in 45 min after awakening. The samples were analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS).

Results: The SWS suppression resulted in a reduction of its overall length by 45%. In the morning after the sleep with SWS suppression and in the morning after normal sleep dynamics of the T secretion was different (p = 0.014): the level of T after awakening was lower and remained at the same level in 45 min in experiments with SWS suppression while in the control session the T level of T after awakening was higher and then significantly decreased in 45 minutes. Selective SWS suppression did not have any significant effects on the C concentration.

Conclusions: Thus, selective SWS suppression may significantly affect the T level. The effect of SWS length on the C level needs to be validated by increasing the sample size.

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ESTIMATING BURDEN OF DISEASE AMONG BLIND INDIVIDUALS WITH NON 24 HOUR SLEEP WAKE DISORDER

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Introduction: Non 24 Hour Sleep Wake Disorder (N24HSWD) is a circadian rhythm disorder with a significant impact on social and occupational functioning. We utilized longitudinal sleep diary data in order to quantify the burden of disease in blind patients with N24HSWD. Daytime sleep episodes interfere with school work and social activities and therefore Daytime Sleep Free Days (DSFD) can act as a surrogate of healthy days for patients with N24HSWD.

Materials and methods: Daytime sleep diary data were collected and analyzed in a cohort of 178 blind individuals presenting with a sleep complaint, 121 of which had N24HSWD and 57 did not. Data collection extended to approximately 90 days and DSFD was calculated in 30 day units. Sleep duration was analyzed using an ANCOVA model and DSFD analysis was performed by a non-parametric test.

Results: N24HSWD patients had more frequent and longer episodes of daytime sleep as compared to a control group. N24HSWD patients had a duration of daytime sleep of 36 minutes per day, and control patients daytime sleep duration was 23 minutes per day (pvalue = 0.0006). In a categorical analysis N24HSWD patients slept 2 hours or more for 12 out of 30 days, compared with 7 out of 30 days for the control group (pvalue < 0.0001). N24HSWD patients also had significantly fewer healthy days, defined by daytime sleep free days (DSFD), as compared to the control group, 11 versus 17 respectively in a 30 day period (pvalue < 0.0001).

Conclusions: Daytime sleep free days (DSFD) is a useful and specific measure of disease burden in patients with N24HSWD and it is predicted to be correlated with the standardized HRQOL-4, Healthy Days measurement.

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**Introduction:** Individuals with late chronotypes tend to experience more ‘social jetlag’ as they transition between non-work and work days. These people may be predisposed to metabolic diseases, possibly reflecting differences in diet composition. Diet timing and consistency also influence metabolic regulation and may differ according to sleep patterns. To date, however, no observational studies have considered diet timing in relation to chronotype. We therefore studied whether chronotype and social jetlag were associated with diet composition, metabolic outcomes, and physical activity. We also assessed if diet timing relative to chronotype was associated with metabolic health.

**Materials and methods:** Adults completed the Munich Chronotype Questionnaire Test. Adiposity (BMI, waist circumference, and body fat), blood lipids (LDL-cholesterol, HDL-cholesterol, and total cholesterol), and blood pressure were measured at baseline. Participants completed up to 3 x 24 hour online dietary recalls using myfood24, software developed specifically for UK adults that records diet timing. Recalls were separated by roughly 3 weeks. On recall days participants wore accelerometers to measure physical activity. The day after, blood samples were taken to measure uric acid, and indirect calorimetry was used to measure resting energy expenditure (REE). We used linear regression to test whether chronotype and social jetlag were associated with diet (energy, macronutrient, total sugar, fibre, fruit, and vegetable intakes), metabolic health (adiposity, blood lipids, blood pressure, uric acid, and REE), and physical activity (step count and moderate to vigorous physical activity). We also assessed if diet timing relative to chronotype was associated with metabolic outcomes.

**Results:** Participants (n = 72, 54.2% female, age 43.5 ± 16.6 years, BMI 24.8 ± 3.9 kg/m2 (means ± SDs)) slept 7.21 ± 0.85 hours, had a mid-sleep time of 04:04 ± 79 minutes, and experienced 1.01 ± 0.86 hours of social jetlag. Participants consumed their first calories at 08:35 ± 79 minutes and their last at 21:02 ± 94 minutes. By midday participants had accumulated 23.6% of their energy intakes, by 15:00 46.4%, by 18:00 57.5%, and by 21:00 89.4%. After adjustment for age, ethnicity, and sex, participants experienced 17 minutes more social jetlag (95% CI 9 to 26 minutes, p < 0.001) per hour later chronotype. Participants consumed 20 grams less total sugar (95% CI -33 to -6 grams, p = 0.004) per hour greater social jetlag after adjustment for age, chronotype, ethnicity, and sex. Other associations were not significant.

**Conclusions:** Contrary to our hypotheses, chronotype and social jetlag were mostly unrelated to metabolic health, diet, and physical activity. First to study diet timing relative to chronotype in such a study, we did not find clear associations between diet timing and metabolic health. Nevertheless, we provide novel insights into temporal dynamics of sleep and diet in UK adults. Future studies should further test interactions between sleep, metabolism, diet, and activity using methods that measure the timing of behaviours and physiology.

**Acknowledgements:** We thank the participants, Darren Greenwood for his advice on statistics, and the other myfood24 consortium members. JEC is Director of a University spin out company named Dietary Assessment Ltd.
Introduction: The aim of this study was to analyze sleep disorders and sleep-wake cycle in undergraduate students attending morning and afternoon shifts.

Materials and methods: Participants were 330 undergraduate students (age=17.82±1.15y, range=16-21y; 62 males and 268 females). Morning shift students (n=211) started classes at 7:00h, while afternoon shift students (n=119) began school at 14:00h. Students completed a sleep disorders questionnaire and kept a sleep diary for at least 9 days.

Results: There were differences between the shifts in the percentage of sleep disorders. Morning shift students showed a higher percentage of daytime sleepiness (morning shift=56%, afternoon shift=42%, $X^2=5.92$, p<0.05), while afternoon shift students showed a higher percentage of sleep onset insomnia (morning shift=30%, afternoon shift=47%, $X^2=10.15$, p<0.01) and snoring (morning shift=13%, afternoon shift=23%, $X^2=4.69$, p<0.05). During weekdays, morning shift students went to bed earlier (morning shift=23.53 ±1.15h, afternoon shift=24.74 ±1.10h, F=9.8, p< 0.01) and woke up earlier (morning shift=06.05±0.75h, afternoon shift=09.14±1.16h, F=270.27, p< 0.001) and their sleep duration was shorter (morning shift=06. 52±0.89h, afternoon shift=08.39±0.95h, F=169.93, p< 0.001) than afternoon shift students. On weekends, morning shift students went to bed earlier (morning shift=24.47 ±1.37h, afternoon shift=25.34 ±1.35h, F=9.8, p< 0.01) and woke up earlier (morning shift=9.23 ±1.34h, afternoon shift=9.87 ±1.41h, F=270.27, p< 0.001) but their sleep duration was longer (morning shift=8.76 ±1.37h, afternoon shift=8.53 ±1.19h, F=169.93, p< 0.001) compared with afternoon shift students. In addition, during weekdays, morning shift students feel more drowsy and less satisfied with their sleep than afternoon shift students.

Conclusions: Morning shift students showed a higher percentage of daytime sleepiness symptoms, consistent with chronic sleep reduction during weekdays. Although evening shift students sleep an average of 8 h during weekdays and weekends, they had a higher percentage of sleep onset insomnia and snoring.

Acknowledgements: We want to express our recognition and gratitude to the voluntary participants and the student assistants who helped with data collection and analyses.
THE EFFECTS OF DELAYING SCHOOL TIME ON SLEEP DURATION, SCHOOL PERFORMANCE, EMOTION AND SLEEPINESS IN ADOLESCENT BASED ON KOREA YOUTH RISK BEHAVIOR WEB-BASED SURVEY

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Introduction: After introducing the delaying school start time campaign in South Korea in 2014, we analyzed the effects of delaying school start time campaign by 9 a.m. on the adolescents’ on total sleep duration, social jet lags/sleepiness, emotions, and school performance.

Materials and methods: Based on 2013 data, both baseline and follow-up changes in sleep patterns, emotions and academic achievement of adolescents were evaluated by using the 2012-2016 data of the Korea Youth Risk Behavior Web-based Survey (KYRBS) in each three different educational district; Gyeonggi (fully participated in the delaying school start time campaign) Seoul (partially participated), and DGU (never participated), excluding the KYRBS data for 2014 in which the school start time has begun to change and there were various school start time in the same district.

Results: The sleep duration of students in the Gyeonggi district, which most participated in the campaign, temporarily was increased (in 2015). However, because simultaneous delaying bedtime was emerged, it returned to the pre-campaign level (in 2016). Meanwhile, in the other two regions (Seoul, DGU) the sleep duration of adolescents had a tendency to decrease in the same periods. Despite the fact that sleep duration was not increased, the social jet lag of the students in the Gyeonggi substantially decreased. The impact of this campaign on students’ emotion, and school performance could not be confirmed.

Conclusions: This study demonstrates that delaying school start time at 9 am improved the social jet lag with transient increasing the sleep duration in adolescents.
APPLICATION OF MACHINE LEARNING METHODS TO AMBULATORY CIRCADIAN MONITORING (ACM) FOR THE DISCRIMINATION OF SLEEP AND CIRCADIAN DISORDERS

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Introduction: In developed societies many people suffer from sleep disorders due to primary alterations in the circadian system (CS). Moreover, sleep disorders lead to secondary CS disturbances, thus diagnosis and treatment of circadian and sleep disorders should be jointly addressed. Primary insomnia (PI) and Delayed Sleep Phase Disorder (DSPD) are the most common sleep and circadian pathologies, respectively. Moreover, DSPD is likely underestimated as its symptoms commonly overlap with those of onset insomnia. Ambulatory Circadian Monitoring (ACM) methods are useful tools in circadian and sleep medicine, providing information about sleep habits (regularity, fragmentation, phase, duration and quality), thus allowing to identify different sleep and circadian pathologies. We propose an ACM method based on the assessment of wrist temperature (T), motor activity (A), body position (P) and exposure to environmental light (L), for the differential diagnostic of PI and DSPD.

Materials and methods: 19 healthy volunteers and 242 patients (IP = 184; DSPD = 58), attending to Estivill Sleep Clinic (Barcelona, Spain) were included in this study. Their rhythms of T, A, P and L were subjected to ACM during a week through a multichannel device (Kronowise™, Chronolab, UM). Sleep-wake states were inferred from the integrated variable TAP through Kronowizard software (Chronolab, UM). Circadian rhythms and estimated sleep were subjected to non-parametric analyses, yielding indexes of interdaily stability (IS), intradaily variability (IV) and relative amplitude (RA). Circadian robustness was assessed by the circadian function index (CFI) calculated from IS, IV and AR of TAP and estimated sleep. Midsleep and midwake times were estimated, respectively, from the central time of TAP-L5 (5 consecutive hours of lowest values) and TAP-M10 (10 consecutive hours of maximum values). These parameters were submitted to machine learning analyses through Orange-canvas software. The most discriminative variables were selected according to ANOVA, Chi-squared and information gain criteria, and employed to build a decision tree.

Results: The decision tree allowed the differentiation between DSPD, onset insomnia (O-I), maintenance insomnia (Mt-I), mild insomnia (Md-I) and healthy controls (HC). DSPD and O-I were characterized by later TAP-L5 than the other groups, and differed between each other in their TAP-M10 time (later in DSPD). Further, DSPD showed later schedules of environmental light exposure than all the other classes. Mt-I exhibited lower TAP-RA than Md-I and HC, while Md-I showed lower sleep-CFI than HC. Accuracy, sensitivity and AUC of this model were higher than 80%.

Conclusions: The application of machine learning methods to ACM recordings allowed the building of a highly reliable model to distinguish between different subtypes of PI and, further, between DSPD and OI, so easily confounded. Our results showed the tight relationship between the rhythm of light exposure and DSPD. Finally, our discrimination based on rhythmic attributes highlights the importance of assessing circadian rhythms in the field of sleep medicine.

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Introduction: Difficulty to fall asleep and poor sleep quality are common within shift workers. Melatonin could improve around all the mentioned problems.

Materials and methods: We sent Insomnia Severity Index (ISI) and Pittsburgh Sleep Quality Index (PSQI) questionnaires to all rotating shift workers of an industry. Melatonin was given to the subjects with initial insomnia and those whom suffer from poor sleep quality.

Results: Melatonin significantly improved sleep onset latency in comparison with the baseline, lowering from 29 minutes to 21.

Conclusions: Our study showed that Melatonin could improve the difficulty to fall asleep among shift workers.

Acknowledgements: The authors wish to thank the staff of Baharloo Sleep Clinic and Occupational Sleep Research Center for their supports.
Chronobiology/Circadian Disorders
Board #027: P2 - Monday

CHRONOTYPE, SLEEP AND FOOD INTAKE IN VOLLEYBALL PLAYERS

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Introduction: It is known that there is an association between human chronotype and food intake, and that, in turn, sleep is also influenced by athlete's individual preferences in practicing physical activity in the morning/afternoon or at the end of the day. Thus, the objective of this study was to study the type of chronotype, sleep habits and food intake of young volleyball players.

Materials and methods: Thirty-six players were evaluated [18.6±5.7 years; 12.6±1.5 hours of weekly training], from the application of a questionnaire, through which it was possible to collect the following data: sports training, chronotype (from the Portuguese and English versions of the Morningness-Eveningness Questionnaire), sleep (from the Epworth Sleepiness Scale, the Pittsburgh Sleep Quality Index, and sleep duration) and 4 consecutive days of food intake. A descriptive and linear regression analysis was performed using the SPSS program, version 22.0 for Windows. The level of significance was 5%.

Results: Although most of the volleyball players had a good quality of sleep (78.2%), most of them suffered from mild drowsiness (69.4%), due to a tendency for afternoon chronotype (56.3%, P < 0.01). Volleyball players slept more hours on weekends than on weekdays. The energetic intake of night-time chronotype athletes was significantly higher (3842 ± 1421 kcal/day) than those of evening type (3210±1233 kcal/day, P< 0.05).

Conclusions: The chronotype of volleyball players has negatively influenced the sleep pattern and energy intake, which may jeopardize their physical and mental performance in daily and training / competition activities.

Acknowledgements: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed written consent was obtained from all individual participants included in this study.
LIVING IN AN URBAN LIGHTING ENVIRONMENT: SHOULD WE MOVE SCHOOL START TIMES?

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Introduction: A shift to later sleep timing has been seen as a characteristic of adolescence. It has been argued that teenagers are 'programmed' to get up late, and suggested that school start times in some countries are therefore too early. Some schools in the USA have shifted school start times to try to combat adolescent sleepiness in morning lessons. Yet the timing of sleep depends on a complex interplay of physiological, sociological and environmental factors. Using a validated mathematical model, we provide a quantitative theoretical framework to understand how these three factors interact and predict the effect of moving school start times in some particular scenarios.

Materials and methods: The mathematical model used considers the interaction of light with the core sleep/wake regulation processes of circadian rhythmicity and sleep homeostasis. Included in the modelling are social constraints, such as the use of an alarm clock during the week to wake in time for school. A typical simulation takes a light profile and parameters describing individual physiological characteristics such as age and endogenous circadian period as inputs, and produces as output wake and sleep times, circadian phase and sleep homeostasis.

Results: Measured light patterns in an urban environment suggest we receive relatively low levels of light during natural daylight hours and self-selected artificial light for many hours after sunset. In line with several recent sleep studies, the model predicts that this post-industrial light environment results in delays to sleep and circadian rhythmicity. The model suggests that changes in sleep homeostasis during adolescence make older adolescents particularly sensitive to the effects of modern patterns of light exposure, and that the urban light environment is a major contributory factor to the shift to later timing of sleep observed in this age group. The model predicts that whether or not it is beneficial to move school start times for older adolescents depends critically on:
(i) the typical daily pattern of light exposure;
(ii) how early rise times are relative to dawn/dusk and hence on season and location within a time zone, and
(iii) physiological factors such as the endogenous circadian period.

Conclusions: In order to determine whether it is beneficial to change school start time it is important to understand the full range of factors that determine when we sleep. Differences in local light environments such as position in the time zone and seasonal variations will mean that the optimal clock time will be region specific. Our simulations suggest that, at least in the UK where typical school start times are 3-4 hours before solar noon, it is unlikely to be beneficial to move school start times for adolescents: a more effective intervention would be to change light consumption behaviour. In contrast, in regions where the school start times are 4-5 hours before solar noon, moving school start times may be of benefit, but local patterns of light exposure need to be considered.

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COGNITIVE, HEALTH AND PSYCHOSOCIAL EFFECTS OF MELATONIN AND LIGHT THERAPY IN CHILDHOOD INSOMNIA. DOUBLE-BLIND PLACEBO-CONTROLLED STUDY

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Introduction: To examine effects of melatonin and light therapy on cognitive, health and psychosocial outcomes in children with chronic sleep onset insomnia; and to disentangle direct effects from indirect effects through sleep improvement.

Method: A randomized, double-blind placebo-controlled trial was conducted in which 84 children received melatonin treatment, placebo pills, or light therapy for three to four weeks, after a baseline period of one week. Daily sleep measures were obtained through actigraphy, and children completed cognitive tasks (simple reaction time, visuomotor control, working memory and selective attention) and parents and children completed questionnaires concerning health, mood, school functioning, behavioral and attention problems, at baseline and post-treatment. Regression analyses with bootstrapping were carried out to disentangle direct and indirect (i.e. through sleep) effects.

Results: Melatonin treatment improved health and light therapy decreased behavior problems. Although both treatments improved sleep, the treatment effects on health and behavior problems were not mediated by sleep.

Conclusions: Melatonin and light therapy improved chronic sleep onset problems in children, but fewer effects were found on cognitive, health, and psychosocial functioning, and these effects were not mediated by sleep improvement.

Acknowledgements: Pharma Nord sponsored the melatonin and placebo tablets for the study, Physician Engineered Products offered the light devices with discount. Both companies were not involved in the study and report of the results.
Introduction: Chronic sleep onset insomnia with late melatonin onset is prevalent in childhood, and has negative daytime consequences. Melatonin treatment is known to be effective in treating these sleep problems. Bright light therapy might be an alternative treatment, with potential advantages over melatonin treatment. In this study, we compare the effects of melatonin and bright light treatment with a placebo condition in children with chronic sleep onset insomnia and late melatonin onset.

Methods: 84 children (mean age 10.0 years, 61% boys) first entered a baseline week, after which they received melatonin (N=26), light (N=30), or placebo pills (N=28) for three to four weeks. Sleep was measured daily with sleep diaries and actigraphy. Before and after treatment children completed a questionnaire on chronic sleep reduction, and Dim Light Melatonin Onset (DLMO) was measured. Results were analysed with linear mixed model analyses.

Results: Melatonin treatment and light therapy decreased sleep latency (sleep diary) and advanced sleep onset (sleep diary and actigraphy), although for sleep onset the effects of melatonin were stronger. In addition, melatonin treatment advanced DLMO and had positive effects on sleep latency and sleep efficiency (actigraphy data), and sleep time (sleep diary and actigraphy data). However, wake after sleep onset (actigraphy) increased with melatonin treatment. No effects on chronic sleep reduction were found.

Conclusions: We found positive effects of both melatonin and light treatment on various sleep outcomes, but more and stronger effects were found for melatonin treatment.

Acknowledgements: Pharma Nord sponsored the melatonin and placebo tablets for the study, Physician Engineered Products offered the light devices with discount. Both companies were not involved in the study and report of the results.
FATAL MONOTONY: INCREASED DAYTIME SLEEPINESS IN THE DEPLOYED SETTING (THIS STUDY IS PART OF A SPECIAL MILITARY MEDICAL RESEARCH PROJECT)

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Introduction: Intolerance of monotony, i.e. the tendency to make errors or even fall asleep during monotonous activities, can be life threatening in certain occupational settings. This applies, for example, to drivers, pilots and guards. Combined with the usual types of deployment-related stress, deployments to crisis areas with a high potential of conflict lead to increased daytime sleepiness. Non-physiological shift work schedules with sometimes irregular rest periods, temporary accommodations that are associated with further factors adversely affecting sleep (heat, noise, insects, etc.), and personal worries trigger monotony intolerance and can become a problem for the German Armed Forces. The primary objective of this study was to identify mobile tests for diagnosing monotony intolerance with sufficient sensitivity and specificity and for screening military personnel in a deployed setting.

Materials and methods: The study used an experimental design and included a literature search. The vigilance of 30 subjects (night duty nursing staff of the German Armed Forces Hospital in Hamburg) was assessed before and after a night shift using a variety of tests: The Stanford Sleepiness Scale (SSS) is a subjective test for assessing sleepiness. Vigilance was assessed using the vigilance test described by Quatember and Maly (VIGIL®). Visual vigilance was tested using the WAFV, which is a component of the SLEEP® test battery described by Schuhfried. Two objective tests were used for assessing objective daytime sleepiness, i.e. a pupillographic sleepiness test and Schuhfried’s SLEEP® test for measuring tonic and phasic central nervous system activation.

Results:
1) VIGIL® and WAFV - unlike pupillography, the measurement of tonic and phasic alertness, and the SSS - were found to be suitable tests for detecting monotony intolerance with very high levels of sensitivity and specificity.
   - Sensitivity: 37.5% (Pupillary unrest) 95.8% (VIGIL) 100% (WAFV) 12.5% (Tonic) 41.7% (Phasic)
   - Specificity: 100% (Pupillary unrest) 88.9% (VIGIL) 86.1% (WAFV) 94.4% (Tonic) 97.2% (Phasic)
2) Psychometric tests showed that, after night shift work, 60% of the subjects did not have the level of vigilance required to drive a car, for example.

Conclusions: VIGIL® and WAFV are two inexpensive computer-based test systems that are easy to operate by even inexperienced users and showed the highest levels of specificity and sensitivity for measuring monotony intolerance. The tests do not require complex hardware and software components (only a portable computer) or special user training. They are suitable for measurements during deployments abroad.
Introduction: Children and adults with AD(H)D are prone to develop problems with their circadian rhythm such as Delayed Sleep Phase Syndrome (DSPS). Long periods of sleep extending into daytime can lead to skipping of meals and even malnutrition. Standard treatment for circadian rhythm problems is chronotherapy. Counselling on nutrition is not a standard part of chronotherapy. Clocked Timed Nutrition (CTN) is a recently developed method of nutritional counselling used for patients with prediabetes or diabetes. The aim of the case-study was to explore the role of CTN in treating DSPS in a case of ADD. We describe a young man with DSPS in ADD treated successfully with CTN only.

Materials and methods: A 20 year old male diagnosed with ADD and DSPS. He went to bed most of the time after midnight and waking up after 9:00 if he did not go to school. If he had to go to school his average sleep time was about 5 to 5,5 hours. Falling asleep and early awakening was difficult, it took an hour to be fully awake. The DSPS existed from his childhood, but became worse in his adolescence and interfered with his academic and social life. Besides his DSPS he complained of weakness, trembling hands and cheek, a pale skin and psychological dysfunction such as forgetfulness, lack of concentration and postponing tasks. Sleep and medical history were otherwise unremarkable. An actiwatch study according to AASM criteria was performed for two weeks and several questionnaires were used such as ESS, GSS, SCL 90, MVI-20, PSWQ, SHL, MOS and the Münchener Chronotype. CTN was prescribed according a pre set schedule of food intake and timing. It consisted of food diary administered for thirteen days, to map the food times and the amount of minerals and vitamins in the food. Chronotherapy was not implemented except for wearing sunglasses from 22:00 till bed time. After 1 month of CTN the therapy was evaluated by history, actigraphy and selected questionnaires.

Results: After initial especially to take breakfast at a prescribed time, CTN was successfully applied. Subjective improvement occurred in sleep wake schedule and daytime functioning. Actigraphy showed bedtimes all before midnight, get up times all before 8:30 and total sleep time average 7 hours and 26 minutes.

Conclusions: CTN was successfully applied in an ADD patient with DSPS. There was both subjective and objective improvement by using a CTN regimen for 1 month without applying chronotherapy. In comparison to chronotherapy CTN potentially has beneficial nutritional consequences. Further larger clinical studies will be necessary to study the role of CTN in circadian rhythm problems.
TEMPORAL DYNAMICS OF CIRCADIAN PHASE SHIFTING RESPONSE TO CONSECUTIVE NIGHT SHIFTS IN HEALTHCARE WORKERS: ROLE OF LIGHT-DARK EXPOSURE

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Introduction: Night shift work is characterised by circadian misalignment between endogenous circadian timing and the imposed work-rest schedule, with negative consequences for alertness, sleep and health. Prior work shows that night shift workers exhibit variability in the magnitude and direction of circadian adaptation, which we hypothesize is primarily due to individual differences in both the amount and timing of light exposure. This study aimed to examine the relationship between light exposure patterns and circadian response to night shift work.

Materials and methods: Light exposure (lux) was monitored continuously using wrist actigraphy (Actiwatch Spectrum, Philips Respironics, Bend, OR, USA) over 2 or 3 weeks in 25 nurses and medical staff (33.4 ± 8.4 years; 16 females, 21 nurses) while working a rotating shift schedule in a public hospital Intensive Care Unit (ICU). They were studied while transitioning from day shifts to 3 or 4 consecutive night shifts (nurses, 21:00-07:30 h; doctors, 20:00-08:30 h). Circadian phase was measured using the urinary 6-sulphatoxymelatonin (aMT6s) rhythm at baseline (day shifts) and on the 3rd or 4th consecutive night shift. In 21 participants (15 females, 18 nurses) with adequate light data the mean level of light exposure occurring during the phase delay and phase advance portions of the light phase response curve (i.e. 6-h interval before and 6-h interval after estimated core body temperature minimum, respectively) was quantified. Multiple linear regression was used to determine the amount of variability in circadian phase shift explained by the pattern of light exposure and diurnal preference (measured using the Horne-Ostberg Morningness Eveningness Composite Questionnaire).

Results: Large inter-individual variability was observed in the direction and magnitude of phase shifts following multiple consecutive night shifts (mean -1:08 h phase delay; range -3:43 h phase delay to +3:07 h phase advance). The magnitude and direction of phase shift was significantly associated with the relative difference in the amount of phase delaying and phase advancing light exposure at baseline ($r^2 = 0.347$, $p = 0.006$), and across night shifts ($r^2 = 0.358$, $p = 0.004$). The difference in phase delaying and phase advancing light exposure at baseline and across night shifts, when combined with diurnal preference, accounted for 71% of the individual variability in phase shift. A regression model using these variables correctly estimated phase shift to within ±60 minutes in 85% of individuals.

Conclusions: Despite some phase shifting, we found no evidence of complete adaptation to night shifts (defined as aMT6s acrophase within the second half of daytime sleep episode) or partial adaptation (defined as aMT6s acrophase within the first half of daytime sleep episode) following 3 or 4 night shifts. These findings provide strong evidence that the individual light exposure patterns over the night shifts relative to individual circadian phase largely determine the circadian response to shift schedules, and the current 'one size fits all' approach to shiftwork interventions may not be effective for some individuals.

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A NEURAL NETWORK MODEL TO PREDICT CIRCADIAN PHASE IN NORMAL LIVING CONDITIONS

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Introduction:
Practical, non-invasive methods for assessing circadian phase under field conditions are needed. Previous work has demonstrated that melatonin phase in healthy males on a fixed sleep schedule can be predicted from blue light irradiance and skin temperature data from 11 sensors using artificial neural networks approach. The current study aims to test the application of the neural network approach to predict circadian phase in a new dataset of healthy individuals in normal living conditions.

Materials and methods:
15 healthy participants (12 males) were monitored continuously over the last 7 days on 14 day fixed 8:16h sleep-wake schedule prior to a laboratory visit. Blue light irradiance was measured using wrist activity monitor (Actiwatch Spectrum, Philips Respironics, Bend, OR, USA), and skin temperature was measured using small wireless temperature recording devices (DS1922L Thermochron iButtons, accuracy 0.0625°C, Maxim, San Jose, CA, USA), worn on 11 distal and proximal skin sites. Circadian phase was assessed via salivary melatonin measured in the laboratory under constant routine conditions, and via urinary 6-sulphatoxymelatonin (aMT6s) collected over 48 hours prior to the laboratory visit. Blue irradiance and skin temperature were used as inputs to an artificial neural network model with 1 hidden layer of 5 neurons aiming to predict circadian phase.

Results:
The neural network model with inputs of blue irradiance and skin temperature (11 sensors) predicts salivary melatonin with an error of 32 ± 27 minutes (absolute mean ± SD; range 0:09 to 1:32 h), accurately predicting melatonin phase within ± 15, 30, and 60 minutes in 47%, 60% and 80% of participants respectively.

Conclusions:
This neural network model approach demonstrates that blue light irradiance and skin temperature can be used to non-invasively estimate circadian timing, with a high level of accuracy. This study will further examine the applicability of this approach using data from participants on an unfixed sleep schedule. If successful this approach would have broad clinical and research applications, with potential to be developed into a wearable device for ongoing phase monitoring in normal living conditions. We are currently extending this work to use urinary 6-sulphatoxymelatonin as reference circadian phase.

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ASSOCIATION BETWEEN WEEKDAY-WEEKEND SLEEP DISCREPANCY AND ACADEMIC PERFORMANCE: SYSTEMATIC REVIEW AND META-ANALYSIS

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Introduction: Insufficient sleep and variable sleep-wake schedule are common in modern 24/7 society. Whilst the negative impacts of sleep deprivation has been well established, the effects of sleep variability as related to the discrepancies in sleep duration and timing between weekday and weekend, a common phenomenon nowadays, on cognitive functioning remains controversial. This meta-analysis aimed to examine the effects of weekday-weekend sleep discrepancies (in terms of bedtime, rise time, mid-point of sleep and sleep duration) on academic performance in school children and adolescents as well college students.

Materials and methods: A systematic search was conducted through PubMed, EMBASE, PsycINFO and the Cochrane Central Register of Controlled Trials (CENTRAL). Search terms included: (Sleep AND weekend*) OR (Social jetlag OR social jet lag OR social jat-lag) OR (Sleep compensation OR catch-up sleep OR catch up sleep). The inclusion criteria were as follows:
1) reported in English;
2) reported data from an original study;
3) included data for the calculation of weekday-weekend sleep discrepancy;
4) examined the correlations between sleep discrepancy and academic performance.

The exclusion criteria were:
1) study samples involved shift workers;
2) grey literatures (e.g., conference abstract).

Studies included were based on consensus between two independent authors' ratings. Study quality was independently assessed by two authors using a standardized rating scale. Correlation coefficients (or converted r) and sample size were extracted from eligible studies and pooled for analysis using a random-effects model.

Results: Out of 2659 studies identified before January 2017, 17 reported data on the association of weekend bedtime delay (n=7), social jetlag (n=3) and weekend catch-up sleep (n=7) with academic performance. Significant effects of small magnitude were found for weekend bedtime delay (r=-0.15, 95%CI: -0.20, -0.10; p<0.001), social jetlag (r=-0.15, 95%CI: -0.19, -0.11; p<0.001) and weekend catch-up sleep (r=-0.09, 95%CI: -0.14, -0.05; p<0.001) on academic performance. Two studies reported opposite findings on the association between weekend rise time delay and academic performance.

Conclusions: Larger discrepancies in sleep timing as an indicator of circadian misalignment are associated with poorer academic performance. The negative association between weekend catch-up sleep and academic performance might be related to the effect of prolonged sleep restriction during weekdays as well as disrupted circadian rhythm. Our findings underscore the importance of maintaining a regular sleep-wake schedule for student population.

Acknowledgements: n/a
Introduction: Regular sleep-wake pattern is associated with better cognitive functions among elderly, yet little is known about the influences of daily sleep-wake stability on cognitive functioning among youth who are more likely to have a variable sleep schedule due to the social demands and an intrinsic delayed circadian phase. In the current study, we examined

1) the relationship between interdaily sleep stability and executive function;
2) the moderating role of chronotype on this relationship in a community sample of Hong Kong Chinese youths.

Materials and methods: A total of 174 healthy participants (males: 20%, age = 12-23 years) filled out a set of questionnaires and wore an actiwatch (Actiwatch Pro, Philips Respironics, Inc.) for the assessment of 24-hour sleep-wake rhythm for 8 consecutive days before the lab assessment. Executive function was tested by Wisconsin Card Sorting Task (WCST), in which four main indicators were calculated: the number of category completed, the number of trials to complete the first category, the number of failures to maintain set and the number of perseverative errors. Chronotype was measured by the reduced Morningness-Eveningness questionnaire. Interdaily sleep stability (IS) was calculated from the activity counts with at least 3 continues days of actigraphic data, and higher IS indicated for more stable 24-hour rhythm. Participants were separated into two groups (stable vs. instable) by median split according to their 24-hour rhythm (i.e., IS) for analysis. Multivariate analysis of covariance (MANCOVA) was adopted to test the group difference in executive function, in which IS, chronotype and the interaction were entered as independent variables, while age, gender and average weekly sleep duration were entered as covariates.

Results: While having comparable average sleep duration, evening-type participants with instable 24-hour rhythm had a later bedtime and rise time than those evening-type participants with stable rhythm. The main effect of IS was borderline significant (F=2.18, p=0.074; higher IS was related with less categories completed, F=8.66, p=0.004, and more perseverative errors, F=6.17, p=0.015), while the main effect of chronotype was not significant. The interaction between chronotype and IS was significant (F=4.00, p=0.016). Specifically, evening-type participants with instable 24-hour rhythm performed better than non-evening type participants with instable rhythm, while evening-type participants with stable 24-hour rhythm performed worse than non-evening type participants with stable rhythm (i.e., interaction on number of categories completed, F=6.96, p=0.009; interaction on number of perseverative errors, F=11.90, p=0.001).

Conclusions: Our results suggested that instability of 24-hour sleep-wake rhythm might not compromise higher order cognitive processes (executive function) among youth with late chronotype. In contrast, evening-type individuals might benefit from a more flexible sleep schedule that could partly match their internal circadian preference. These data support the importance of the alignment between internal circadian phase and external sleep-wake schedule on cognitive functions, especially in the youth population.

Acknowledgements: HKU seed fund to Dr. S.X. Li.
Introduction: The circadian system coordinates a number of events in a daily schedule to make sure that the body systems are synchronized to environmental time and internal cues. One important behavioral aspect of the circadian system is the chronotype. It is usually assessed through subjective questionnaires, being the Horne-Ostberg Morningness-Eveningness Questionnaire (MEQ) one of the most used. It classifies individuals into three major categories: morning, evening, and intermediate types. Recently, it has been hypothesized the existence of a fourth chronotype, the bimodal type, through an algorithm derived from the MEQ responses. Bimodals answer as morning-types in some questions, and as evening types in others, resulting in an intermediate total score. The possible explanation for this novel chronotype relies on the dual-oscillator model of circadian system. To better characterize this phenotype, the present study aimed to detect and characterize the frequency of the bimodal chronotype in the EPISONO, as well as to verify the association between bimodality and sleep parameters and genetic variation in the PER3 gene.

Materials and methods: We used samples from EPISONO, a large population-based cohort. A total of 1,042 participants completed a set of detailed sleep related questionnaires and underwent a polysomnography (PSG). An algorithm was used to classify bimodal individuals according to the number of morning-type/evening-type answers. Finally, genotyping of the variable number of tandem repeats (VNTR) polymorphism of the PER3 gene was performed by conventional polymerase chain reaction.

Results: Of the 1,042 individuals who participated of the EPISONO, 857 had MEQ filled correctly. We found that 16% of our sample were bimodal types. We observed that bimodal individuals were significantly younger and had lower body mass index. The association between PER3 VNTR genotype and gender with bimodal chronotype was not significant. However, we found an association between bimodality and Epworth Sleepiness Scale (EES) and apnea-hypopnea index (AHI). We did not find a statistically significant difference between bimodals and intermediate non-bimodals for the studied variables. Lastly, it was observed that the most significant predictors for bimodal chronotype were female gender, AHI, and EES.

Conclusions: In conclusion, the present work provides more evidence that the bimodal type might have to be considered when classifying chronotype and its association with young age and sleepiness may be due to the influence of social and environmental factors.

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MODELLING WATCH KEEPER SLEEP AND FATIGUE IN THE MARITIME INDUSTRY

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Introduction: Operating on a 24/7 basis has made the maritime industry invent a wide variety of watch keeping systems over the past centuries. These are either two-watch systems (two teams sharing the work under a 24h period) or three-watch system (three teams sharing it). This study aims to identify which systems are associated with the lowest amount of fatigue risk and the highest amount of sleep that can possibly be obtained.

Materials and methods: Seven two-watch systems and three three-watch systems were modelled using the three process model of alertness regulation (TPMA). Key output variables were % of time on watch with a predicted score ≥ 7 on the Karolinska Sleepiness Scale (KSS), defined as time at risk, and the amount of model predicted daily sleep. Separate predictions were made for morning and evening types

Results: Generally speaking, two-watch systems are associated with more time at risk than three-watch systems and moreover with smaller amounts of daily sleep.

For 2-watch systems, 6on6off is associated with the smallest amounts of predicted sleep, both in morning types (4h51m for those working 0600-1200/1800-0000, 5h42m for those working 0000-0600/1200-1800) as well as evening types (5h17 minutes when working 0600-1200/1800-0000, 5h15 minutes when working 0000-0600/1200-1800). Time at risk for morning types was highest in the 8on8off system (19%) and lowest in an a 7/5/5/7 system (work shifts 0100-0800; 0800-1300; 1300-1800; 1800-0100) with only 3,5%. Evening types were predicted to have the highest risk when working 12on12off (42%), and lowest when working the so called royal navy system (work shifts 0000-0400; 0400-0800; 0800-1200; 1200-1600; 1600-1800; 1800-2000; 2000-0000), with 8% time at risk.

For 3-watch systems, morning types are predicted to have least sleep when working 4on8off (6h09m on average), and most sleep (6h30m) when working the so called five and dime system (work shifts 2200-0200; 0200-0700; 0700-1200; 1200-1700; 1700-2200). Time at risk was highest in the US submarine system (work shifts 2330-0530; 0530-1130; 1130-1730; 1730-2330) for both morning types (16%) and evening types (17%). Lowest risks were predicted under 4on8off for morning types (4,7%) and under five and dime for evening types (0%).

Conclusions: 3-watch systems are to be preferred both from a sleep and a fatigue point of view. However, since these systems requiring 50% higher manning levels compared to 2-watch systems there are potentially less popular among shipping companies. Moreover, it is of special concern that the most popular 2-watch system (i.e., 6on6off) is among the worst ones.

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LIGHT EXPOSURE VIA HEAD-MOUNTED DEVICES SUPPRESSES MELATONIN AND IMPROVES VIGILANT ATTENTION WITHOUT AFFECTING CORTISOL AND COMFORT

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Introduction: We aimed at assessing whether a new generation of head-mounted light therapy devices, enriched in blue wavelengths, was able to suppress melatonin secretion and to improve vigilant attention in the late evening hours. We also assessed whether using such light device is associated with discomfort and physiological stress.

Materials and methods: Seventeen healthy young participants (8 females; 22.8 ± 1.8 years) without sleep complaints followed a regular sleep-wake schedule, verified by actigraphy, the week preceding each of two in-lab experimental conditions. Participants entered the laboratory 7h before usual bedtime. They were kept under dim light conditions for 5h before being exposed in a counterbalanced within subjects design for 2h to a blue-enriched light (1500 lux) or to a "placebo-like" red light (150 lux). Light was delivered using a LED head-mounted portable device (Luminettes® - Lucimed). Participants were kept under dim light for 1.5h following light exposure prior to leaving the lab. On multiple occasions, saliva samples, subjective sleepiness and comfort scores were collected, together with vigilant attention assessments.

Results: A significant light condition*session interaction (F(11,364) = 3.28; p = 0.0003) indicated that while not differing between conditions before light exposure, melatonin levels were significantly reduced during the blue-enriched light, compared to the placebo exposure. For vigilant attention, a significant light condition*session interaction (F(9,302) = 2.3; p = 0.017) revealed that attentional lapses (RTs > 500 ms) were reduced at the end of the blue-, compared to the red-light exposure. Neither cortisol levels nor comfort significantly differed between the two light conditions (all ps > 0.05).

Conclusions: The results suggest that blue-enriched light delivered by a new generation head-mounted device elicits typical non-visual responses to light. These effects were observed in the absence of detectable discomfort and physiological stress assessed through salivary cortisol levels.

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PREVALENCE OF SHIFT WORK DISORDER AMONG HOSPITAL PERSONNEL WITH NIGHT SHIFTS

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Introduction: The International Classification of Sleep Disorders, Third Edition (ICSD-3), defines shift work disorder (SWD) as insomnia and/or excessive sleepiness, accompanied by reduced total sleep time, temporally associated with a recurring work schedule overlapping the usual time for sleep. The aim of this study was to assess the prevalence of SWD according to the ICSD-3 criterion in shift work with night shifts among hospital personnel, and to elucidate how recurrence rate of detrimental work shifts effect on the prevalence of SWD.

Materials and methods: The data was derived from employees of five hospital districts and one Department of Social Services and Health Care in Finland, excluding physicians, as part of the Finnish Public Sector cohort in 2015. The survey data was combined with payroll data on working hours of 91 days prior to answering the questionnaire on background, health, work ability, and SWD. Shift work was determined based on the realized work shifts. Shift workers with night shifts (n = 2916, 88.8% female) with at least 31 work days during the past 91 days were included in the study. SWD was defined by two methods: based on the reported frequency of morning, evening and/or night shifts-specific symptoms of SWD (i.e. insomnia and/or sleepiness) in work shifts that recurred either ≥1 or ≥3 times per month.

Results: Prevalence rate of SWD was 13.2% among shift workers with ≥1 detrimental shift per month and 10.3% among shift workers with ≥3 detrimental shifts per month. SWD associated with poorer general health (p< 0.01), poorer work ability (p< 0.01), and eveningness preference (p< 0.001) with both the methods, and with younger age (p< 0.05) and shorter shift work experience (p< 0.05) with the method that used ≥3 detrimental shifts criterion. SWD did not associate with sex or sleep apnea.

Conclusions: Based on objective data on working hours, prevalence of SWD in this study was relatively low compared to previous research on SWD using ICSD-2 criterion. The difference can be explained by the used ICSD-3 definition requiring reduction of total sleep time in association with SWD. The results of this study show that prevalence of SWD depends on the recurrence rate of detrimental work shifts. In addition, SWD seems to relate with poorer health and eveningness preference.

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CIRCADIAN CLOCK PROTEIN PERIOD3 CONTRIBUTES TO SLEEP HOMEOSTASIS THROUGH HISTAMINE AND GABA SIGNALING IN ZEBRAFISH

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Introduction: The zebrafish (*Danio rerio*) has figured prominently as a vertebrate model for studying circadian clocks and sleep. It is known that both the homeostatic process (S) and the circadian process (C) contribute to regulation of sleep homeostasis. While we have a good understanding of circadian regulation, relatively little is known about molecular mechanisms underlying circadian regulation of sleep homeostasis and/or interaction between the circadian clock system and sleep.

Materials and methods: TALEN, a genome-editing tool, was used to generate a number of zebrafish *per3* mutant lines. Behavioral assays, qRT-PCR, luciferase reporter assays, and RNA-seq were used to characterize zebrafish *period3* (*per3*) null mutants.

Results: Locomotor assays showed that *per3* mutant fish display 0.5-hour shortened period and approximately 3-hour phase advance compared with wild types under constant dark, and are completely arrhythmic under constant light; and also *per1a*, *per1b* and *per2* are down-regulated in *per3* mutant fish; indicating that *per3* is essential for zebrafish circadian regulation. Intriguingly, *per3* mutant fish display less sleep time, reduced arousal threshold and difficulty to restore sleep after sleep deprivation. As shown by ELISA, the GABA level is reduced while the histamine level is increased in *per3* mutant fish at night-time, indicating that the disturbed sleep pattern of *per3* mutant fish may be resulted from altered levels of endogenous GABA and histamine. Deep sequencing-based transcriptome analysis leads us to focus on two candidate genes, GABA A receptor gene *rho2a* and histamine decarboxylase gene *hdc*, both up-regulated in the *per3* mutant fish. Luciferase reporter assays showed that both *rho2a* and *hdc* are circadian clock-controlled genes and Per3 negatively regulates their expression.

Conclusions: Taken together, these results ascertain Per3’s essential roles in the zebrafish circadian system, demonstrate that Per3 acts through both histamine signaling and GABA signaling to contribute to sleep regulation, and provide an ideal sleep disorder vertebrate model for drug screen and pathogenesis analysis.

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In mammals, circadian oscillation depends on the complex transcriptional network comprised of the interaction among core clock genes via E box, RRE, D box and other DNA elements. Wherein, as important clock genes, the nuclear receptor genes Rev-Erbs and RORs participate in clock feedback loop by regulating RRE activity, which is essential for maintaining clock robustness. Recent studies suggested that in addition to Rev-Erbs and RORs, most clock controlled nuclear receptors may also be involved in the regulation of circadian rhythms. We comprehensively investigated the influences of nuclear receptor knockout on circadian rhythms. We found single knockout of nuclear receptor just causes subtle changes in circadian rhythms, while multi-knockout of homologous nuclear receptors response to the same transcriptional element significantly impairs the robustness of circadian clock, for example multi-knockout of Rev-Erbs, RORs, ERs, THRs and PPARs. Multi-knockout of these NRs causes several fold change of clock genes expression in human cells, indicating nuclear receptors participant in clock regulation by interacting with TTFL. Either persistent activation or inhibition of these homologous NRs can impair circadian oscillation significantly, suggesting the inherent rhythmicity of NR element activation are critical for maintaining clock robustness. Our data implicate a multi-circuit nod by nuclear receptor response elements in the stabilization of the core clock and coupling between clock and physiological changes.
Identification of Individual Circadian Rhythms in Fibroblasts from Patients with Idiopathic Hypersomnia

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Introduction: Most of all organisms have adapted to a circadian rhythm of almost 24h that is determined by the cycle of light and darkness. The circadian timeline is based on a molecular genetic network of transcriptional feedback loops of clock genes including transcription factors like Bmal1, Cry1/2 and Per1/2/3. It has been shown that the molecular clock is cell autonomous and the period length calculated from skin fibroblasts represents sleep behavior in test subjects.

Materials and methods: Patients suffering from idiopathic hypersomnia (IH) were screened by polysomnography in our sleep laboratory and diagnosed according to the ICSD3-criteria. In order to gain insight into the molecular mechanism of the disease we collected fibroblast from skin biopsies of IH patients and healthy subjects. Initially, the expression of circadian genes had been analyzed by RT-PCR from RNA obtained from fibroblasts of IH patients.

To get further insights in the regulation of circadian rhythm we determined the period length of the fibroblast cells by lentiviral infection with a construct expressing the luciferase gene under the control of a Bmal1 promoter. Luminescence was detected from fibroblasts after infection and addition of the luciferase substrate luciferin. The period length of the fibroblasts was calculated using the Multicycle software (Actimetrics, USA) with the running average method.

Results: In fibroblasts from patients suffering from idiopathic hypersomnia, clock gene expression exhibited a diminished amplitude of BMAL1 which was significantly reduced by 63% (P=0.004) compared to healthy controls. The amplitude of PER1 was reduced by 45% (P=0.048) compared to the control group. Analysis of the circadian period of the fibroblasts revealed an increase in period length by about 0.5 h from 25.1h (healthy control) to 25.6h (IH).

Conclusions: We found deregulation of the expression of circadian-clock genes in terms of dampening of the amount of mRNA and a shift in the circadian period towards longer periods. Although it is not clear whether this is a consequence or a cause of the sleep behavior disorder of the patients it suggests that the patients might benefit from treatments correcting the circadian period length.

Acknowledgements: We thank Prof. S. A. Brown (Institute of Pharmacology and Toxicology, University of Zurich, Zurich, Switzerland) for generously providing the lentiviral plasmids
INTRODUCTION: We previously demonstrated that a chemopreventive regimen of methylselenocysteine (MSC) prevents N-Nitroso-N-methylurea (NMU)-induced mammary carcinogenesis in Fischer 344 (F344) rats by enhancing and restoring circadian rhythm of intracellular redox cycling, NAD+/NADH. The resulting increase in NAD+-dependent Sirtuin 1 (Sirt1) activity restores diurnal expression of the core circadian gene, Period 2 (Per2), and numerous circadian controlled genes, including hormone receptors, growth regulatory genes and genes involved in DNA damage response and repair (DDRR).

MATERIALS AND METHODS: To determine if strain-specific differences in circadian control play a role in differential susceptibility to mammary carcinogenesis, we compared circadian responses to carcinogen or changing light cycles in the mammary tissue of pubescent female F344 rats, the susceptible strain, to those in the resistant Copenhagen (Cop) strain.

RESULTS: Our studies demonstrated that compared to the resistant (Cop) strain, circadian expression of Per2 is delayed by four hours in mammary glands of the susceptible F344 rats. Consequently, susceptible F344 rats exposed to a carcinogenic dose of NMU fail to increase Sirt1 activity or circadian expression of Per2 and DDRR genes. Exposure of Cop rats to NMU has the opposite effect, enhancing Sirt1 activity and increasing circadian expression of Per2 and DDRR genes. Significantly, a chemopreventive regimen of MSC restored Sirt1 activity and circadian expression of DDRR genes in mammary glands of NMU-treated F344 rats to those seen in NMU-treated Cop rats. These results indicate that Cop rat have an increased capacity to maintain NAD+ levels and NAD+-dependent Sirt1 activity under genotoxic stress. This hypothesis is supported by increased stability of the period and phase of circadian locomotor activity in Cop vs F344 rats exposed to changing light conditions. Significantly, exposure of the Cop strain to chronic jet-lag protocols that increase susceptibility of different rodent strains to mammary carcinogenesis also reduced circadian expression of Per2 and DDRR genes to levels in the Cop strains to those in susceptible F344 rats exposed to NMU.

CONCLUSIONS: Our results suggest that uncoupling of DDRR responses from circadian control increases susceptibility to mammary cancer, possibly by inducing a pro-mutagenic state that drives carcinogenesis. These finding have potentially significant implication for prevention of carcinogenesis in rotating shift workers chronically exposed to light-at-night, and those frequently exposed to jet-lag.

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**LIGHT EFFECTS ON SLEEP-WAKE BEHAVIOR IN MICE**

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**Introduction:** Light affects sleep and alertness by entraining the circadian clock and acutely inducing sleep/alertness, in a manner mediated by intrinsically photosensitive retinal ganglion cells (ipRGCs). Because ipRGCs are minimally sensitive to red light, which is widely used for illumination to reduce the photic disturbance to nocturnal animals during the dark phase. However, the appropriate intensity of the red light is unknown. Moreover, the pathways through which the light affects sleep-wake behavior remain less well understood.

**Materials and Methods:** We recorded polysomnography of freely moving mice to investigate the effects of red light emitted by light-emitting diodes at different intensities and for different durations on the sleep-wake behavior. White light was used as a control. In addition, we explored the neural pathway of light effects on sleep through optogenetics, and patch-clamp in acute brain slices of GAD1-GFP mice.

**Results:** Red light exerted potent sleep-inducing effects and changed the sleep architecture when the intensity was higher than 20 lx. Subsequently, we lowered the light intensity and demonstrated that red light at or below 10 lx did not affect sleep-wake behavior. White light markedly induced sleep and disrupted sleep architecture even at an intensity as low as 10 lx. Furthermore, we demonstrated that the RGCs directly projected to and formed functional connections with GABAergic neurons in the superior colliculus (SC).

**Conclusion:** Our findings highlight the importance of limiting the intensity of red light (≤10 lx) to avoid optical influence in nocturnal behavioral experiments, particularly in the field of sleep and circadian research. We also revealed that RGCs formed monosynaptic connections onto GABAergic neurons in the SC.
Excessive Daytime Sleepiness (not Narcolepsy)
Board #037: P2 - Monday

FUNCTION, WORK PRODUCTIVITY, AND QUALITY OF LIFE MEASURES IN A PHASE 3, RANDOMIZED, PLACEBO-CONTROLLED, DOUBLE-BLIND, MULTICENTER, 12-WEEK STUDY OF THE SAFETY AND EFFICACY OF SOLRIAMFETOL (JZP-110) FOR THE TREATMENT OF EXCESSIVE SLEEPINESS IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: Excessive sleepiness in patients with obstructive sleep apnea (OSA) is associated with reductions in health-related quality-of-life (HRQoL), impaired functioning at work, and negative impact on daily activities. The efficacy of solriamfetol (JZP-110), a selective dopamine norepinephrine reuptake inhibitor with wake-promoting effects, was evaluated in a phase 3 study in patients with excessive sleepiness due to OSA.

Methods: Eligibility criteria: OSA diagnosis per International Classification of Sleep Disorders-3; past or present use of primary OSA therapy; Epworth Sleepiness Scale score ≥10; mean sleep latency < 30 minutes on first 4 trials of a 5-trial, 40-minute Maintenance of Wakefulness Test; and usual nightly sleep time ≥6 hours. Patients were randomized (1:1:2:2:2) to solriamfetol 37.5mg, 75mg, 150mg, or 300mg, or placebo for 12 weeks. The Functional Outcomes of Sleep questionnaire short version (FOSQ-10) was used to evaluate functioning in daily activities. Work productivity impairment among employed patients and overall activity impairment among all patients were assessed using the Work Productivity and Activity Impairment questionnaire for Specific Health Problems (WPAI:SHP); “OSA” was the specified health problem. HRQoL was assessed by the 36-Item Short Form Health Survey version 2 (SF-36v2). These exploratory assessments were administered at baseline and weeks 1, 4, 8, and 12. Safety and tolerability were also evaluated.

Results: A total of 474 patients were randomized and treated: 63% male, 76% white, mean (standard deviation) age 53.9 (10.9); 90.5% were rated ≥ moderately ill on the Clinical Global Impression of Severity scale; 459 patients were evaluated for efficacy in a pre-specified modified intent-to-treat population (mITT). The majority of effects seen with the lower solriamfetol doses (37.5mg and 75mg) were not significant. Statistical analysis for exploratory measures did not control for multiplicity. Least square (LS) mean (SE) change from baseline to week 12 in FOSQ-10 Total score was 1.7 (0.2) for placebo, 3.0 (0.2) for 150mg (P=0.0003), and 3.2 (0.2) for 300mg (P<0.0001). LS mean (SE) change from baseline to week 12 in WPAI:SHP percent overall work impairment due to OSA (n=224 employed patients) was reduced by 8.8% (3.0) for placebo, 20.4% (2.8) for 150mg (P=0.0043), and 20.5% (2.9) for 300mg (P=0.0050). Percent activity impairment (outside of work) was reduced by 11.7% (2.2) for placebo, 22.1% (2.1) for 150mg (P=0.0006), and 22.2% (2.3) for 300mg (P=0.0007). LS mean (SE) change from baseline to week 12 in the SF-36v2 Physical Component Score was 1.4 (0.6) for placebo, 3.5 (0.6) for 150mg (P=0.0140), and 3.3 (0.6) for 300mg (P=0.0269). LS mean (SE) change from baseline to week 12 in the SF-36v2 Mental Component Score was 1.1 (0.7) for placebo, 3.1 (0.7) for 150mg (P=0.0354), and 2.12 (0.7) for 300mg (P=0.2812, NS). The most common AEs (≥ 5% and > placebo) with solriamfetol were headache (10.1%), nausea (7.9%), decreased appetite (7.6%), and anxiety (7.0%); AEs appeared to be dose-dependent.

Conclusions: Solriamfetol 150 mg and 300 mg improved functioning, work productivity, and HRQoL. Safety and tolerability were consistent with previous phase 2 studies of solriamfetol in patients with narcolepsy.

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DROWSY DRIVING: PREVALENCE AND RISK FACTORS IN 954 MOROCCAN DRIVERS

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Introduction: Drowsy driving (DD) is considered one of the main risk factors for road accidents. These are considered as a public health concern worldwide due to the high number of victims and notably in Morocco where the roads are among the deadliest. DD may be due to behavioral reasons such as sleep deprivation, pathological reasons secondary to diseases inducing sleepiness such as obstructive sleep apnea-hypopnea syndrome, or iatrogenic reasons (sedatives). The objective of this work was to assess the prevalence and the main risk factors for DD.

Materials and methods: We conducted a prospective study that included 954 Moroccan drivers who responded to a pre-established questionnaire.

Results: DD was reported in more than the third of the subjects (36.8%) and falling asleep at the wheel in 31.1% with a quarter of cases in the month preceding the study. In multivariate analysis, body mass index greater than 27kg/m², duration of sleep less than seven hours, snoring and sleepiness as a car passenger were found as risk factors for DD.

Conclusions: This study assesses the prevalence of DD that concerned more than a third of the subjects, and it highlights the main risk factors for its occurrence.
Excessive Daytime Sleepiness (not Narcolepsy)

O14: Aging and excessive daytime sleepiness oral abstract presentations

REVISED DIAGNOSTIC CRITERIA FOR IDIOPATHIC HYPERSOMNIA: A 32-HOUR BED-REST PROTOCOL

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Introduction: The diagnosis of idiopathic hypersomnia (IH) is based on a body of clinical and electrophysiological arguments, which have limitations, and no reliable biomarkers were discovered so far. The aim of this study is to assess the diagnostic value of extended sleep duration for the diagnosis of IH on a controlled 32-hour bed-rest protocol, in order to propose more specific diagnostic markers.

Materials and methods: One hundred sixteen patients with primary hypersomnolence (91 women; median age 26.1) and 21 controls (12 women; median age 27.6) were recruited. Thirty-seven patients (28 females; median age 27.29) were diagnosed IH according to stringent multiple sleep latency test (MSLT) criteria, the remaining 79 (63 females; median age 25.33) were classified as non-specified hypersomnolence (NSH). All participants underwent a polysomnography and a modified-MSLT followed by a 32-h bed-rest protocol to obtain the maximum spontaneous amount of sleep. Receiver operating characteristic curves were used to find optimal total sleep time (TST) cut-off values on various periods of the 32-h recording (32 hours, first and last 24 hours, daytime), that discriminate IH to controls. Clinical and polysomnographic characteristics of NSH and whole patients with hypersomnolence were then compared according to best thresholds.

Results: Best cut-off was 19 hours for the 32-h recording (sensitivity 91.9%, specificity 85.7%) and 12 hours for the first 24-h (sensitivity 100%, specificity 85.7%), while 11 hours on the first 24-h showed a sensitivity of 100% and specificity of 57.14%. Patients with hypersomnolence above the 19-h cut-off were significantly overweight, had more sleep inertia and higher TST on all periods of the 32-h recording, compared to patients below this threshold. No clinical differences were found between patients with TST above and below the 12-h cut-off. An inverse correlation was found between the mean sleep latency (MSL) on MSLT and TST during 32-h recording in patients with hypersomnolence, but not in controls. Moreover, patients with MSL below 8 minutes had higher TST during the 32-h recording than patients above this threshold.

Conclusions: In standardized and controlled conditions, the optimal cut-offs best discriminating patients to controls were 19 hours over 32-h and 12 hours over 24-h recording, while the current accepted 11-h cut-off showed a poor specificity. Threshold of 19 hours allowed a better phenotypical characterization. Moreover, sleepier patients on MSLT were also the more severe in terms of extended sleep, that favor a continuum between the forms with and without long sleep time of IH.

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Excessive Daytime Sleepiness (not Narcolepsy)
Board #038: P2 - Monday

METHODS FOR EVALUATING EXCESSIVE DAYTIME SLEEPINESS - THE ROLE FOR ACTIGRAPHY

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Introduction: Excessive daytime sleepiness (EDS) is a frequent symptom in sleep pathology and is sometimes difficult to evaluate and distinguish from fatigue and asthenia. Among available methods for its assessment, the Epworth Sleepiness Scale (ESS) is widely used for subjective evaluation and the multiple sleep latency test (MSLT) the most used for objective evaluation. Actigraphy is simple to use and records long periods of rest/activity. It is used during an individual's daily routine and assesses sleep/wake behavior and is therefore of interest in the study of EDS.

Objectives: To understand which actigraphy data may relate to values obtained through MSLT and ESS and whether it is useful in investigating EDS.

Methods: Retrospective analysis of 31 patients with EDS, who completed the ESS and underwent polysomnography (PSG), MSLT and actigraphy (1 to 2 weeks). This study was conducted at Centro de Medicina do Sono do CHUC-HG (January / 2016 to June / 2017). Actiwatch® (Philips Respironics, Inc.) and Somnostar Viasys® PSG equipment were used. Sleep monitoring and staging followed the American Academy Sleep Medicine manual (AASM, v2.3, 2016).

The patients were divided into groups according to ESS severity: 11-15 (mild to moderate EDS); 16-24 (severe EDS). Actigraphy data (time in bed, TIB; total sleep time, TST; mean sleep latency, MSL; sleep efficiency, SE; awakenings, Awak; wake after sleep onset, WASO) were compared between the two groups.

The patients were further divided into groups according to mean latency to first four naps on MSLT (ML4N): ML4N ≤ 8 minutes and ML4N > 8 minutes. Actigraphy data were compared between these 2 groups.

Statistical analysis was done using the IBM® SPSS® software version 23.

Results: Thirty-one patients; 58% men; median age 37 years (sd 12Y); chronic use of psychoactive drugs by 30.6%.

The mean actigraphy values were: TIB 525 minutes (sd 101.4), TST 410 minutes (sd 80), MSL 19.4 minutes (sd 12.4), SE 74.2% (sd 7.3), Awak 23.7 (sd 9.0) and WASO 49.0 minutes (sd 23.8).

There was a statistically significant difference in the number of actigraphy Awak (p = 0.02) in the ESS groups and tended to be lower in the group with severe EDS.

ML4N ≤ 8 minutes and ML4N > 8 minutes. Actigraphy data were compared between these 2 groups. Statistical analysis was done using the IBM® SPSS® software version 23.

Discussion: The low sleep efficiency and the high number of awakenings, recorded on actigraphy, suggest that there is poor sleep quality and may lead to inaccurate awareness of EDS (regardless of whether or not it is objectified in MSLT). This emphasizes the idea that reporting of EDA is often imprecise.

The lower number of awakenings in patients with severe EDS can be explained by the presence of a greater number of psychiatric disorders and use of psychoactive drugs in this group. These drugs stabilize sleep and may cause increased drowsiness.

Actigraphy is useful as a complementary tool in investigating excessive sleepiness but not as an isolated procedure.
Excessive Daytime Sleepiness (not Narcolepsy)
Board #039: P2 - Monday
DIETARY INTAKE OF CARBOHYDRATES, DAYTIME SLEEPINESS AND OBSTRUCTIVE SLEEP APNOEA IN ADULTS FROM REYKJAVÍK, ICELAND

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Introduction: Dietary carbohydrates (CHOs) might influence sleep quality and sleep patterns through their role on several sleep-related hormones, and their influence on tryptophan metabolism. In a population-based study of adults from Iceland, we investigated the association of CHO intake, obstructive sleep apnoea (OSA) and daytime sleepiness.

Materials and methods: Sample of 400 adult residents in Reykjavík, were invited to enroll in a study to investigate the prevalence of OSA, symptoms of poor sleep, and daytime sleepiness. A whole-night sleep study was performed at the subject's home using a T3 device (Nox Medical, Reykjavik, Iceland), with measures of sleep recorded and scored following the American Academy of Sleep Medicine guidelines. Data were considered eligible if the studies had ≥4 hours of scorable oxygen saturation and three respiratory traces: cannula flow, thorax, and respiratory inductive plethysmography belts. OSA was defined according to the apnoea-hypopnea index (AHI), as mild (AHI ≥5-14.9) moderate (AHI ≥15-29.9) or severe (AHI ≥30). The Epworth Sleepiness Scale (ESS) Questionnaire was also administered to ascertain symptoms of excessive daytime sleepiness (ESS ≥10). Frequent snoring was defined as reporting to snore ≥3 times per week. The internationally validated GA2LEN food frequency questionnaire (FFQ) was used to enquire about usual intake of 250 food items, which included foods rich in various types of CHOs. Intake estimates of simple (sucrose, glucose, and fructose), semi-simple (oligosaccharides), complex (polysaccharides) and total CHOs were derived. The association between sleep outcomes and CHOs (per-tertile increase in intake) was examined using ordinal (OSA) or multiple logistic regressions, adjusting for several potential confounders.

Results: A total of 347 participants (mean age 54.8 ±6.8 y) had valid data on sleep, diet and potential confounders. 38.5% snored frequently, 25% had ESS ≥10, and 41% had mild to moderate OSA. 16% reported feeling moderately (n=35), quite a bit (n=18) or extremely (n=3) sleepy during the day, 30% of participants reported feeling sleepy during the day once or twice a week, 14% 3-5 times/week, and 7% every day or almost every day. A per-tertile increase in the intake of total CHOs was associated with a statistically significantly higher risk of having an ESS ≥10 (adjusted [a] OR 1.59; 95% CI 1.01, 2.51; p-value 0.04). The associations between this outcome and total glucose or fructose were stronger (aOR per-tertile of intake 1.50; 95% CI 1.12, 2.01; p-value 0.006; and aOR 1.46; 95% CI 1.10; 1.93; p-value 0.009; respectively). Higher intakes of starch and of breakfast cereals were associated with less severe OSA (aOR, 0.72; 95% CI 0.53, 0.97; p-value 0.03; and aOR 0.76; 95% CI 0.59, 0.97; p-value 0.03; respectively). There was no evidence of association between measures of AHI and intake of CHOs.

Conclusions: Daytime sleep disturbances in middle-aged adults are highly prevalent. To our knowledge, this is the first population-based study to show that dietary CHOs, particularly refined sugars, were associated with a higher prevalence of symptoms related to daytime sleepiness. Improving the quality of CHO content in the diet might reduce the prevalence of these symptoms.
LONG DAYTIME NAPPING OVER 1 HOUR PER DAY IS ASSOCIATED WITH INCREASED RISK OF DIABETES

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Introduction: Daytime napping or siesta is a prevalent lifestyle practice in many populations. It is thought to be health-promoting, with beneficial effects to improve the working effectiveness, mental health and functioning in daytime. It is also regarded as a way to counteract the effects of sleep disorders (e.g. insomnia and sleep apnea). However, recently published meta-analyses suggested that daytime napping might be deleterious to health. In recent years, sleep pattern has been widely accepted as a modifiable risk factor for the development of diabetes mellitus (DM). Nevertheless, conflicting results were observed across different studies, especially in the association between short daytime napping (i.e. daytime napping less than 1 hour per day) and DM risk. Therefore, in this study, we aimed to perform a systematic review and meta-analysis to synthesize the association of daytime napping and its duration with risk of DM in both cross-sectional and cohort studies.

Materials and methods: The electronic databases of Embase, Medline, Pubmed and Web of Science were searched. Relevant studies were extracted by two reviewers independently. The associations between daytime napping (irrespective of duration), long nap (≥1 hour/day) and short nap (< 1 hour/day), and risk of DM were assessed according to study types. Overall estimates were pooled using either fixed- or random-effect with inverse variance meta-analysis. Heterogeneity of included studies was assessed by the I² test and possible cause of the heterogeneity was examined by meta-regression analyses.

Results: Ten studies (4 cross-sectional and 6 longitudinal cohort) comprising a total of 304,885 individuals and 20,857 cases of DM were included in the systematic review, with an average napping prevalence of 47%. Nappers were found to have increased risk of DM in both cross-sectional and cohort studies. However, significant heterogeneity was present. Long nap (≥1 hour/day) was associated with both prevalent and incident DM; in particular, those with a daily nap over 1 hour had a 31% increased risk of developing DM during follow-up (95% confidence interval: 2-67%). Conversely, no such association was found in individuals with short naps (< 1 hour/day) in cohort studies.

Conclusions: In conclusion, our study added fuel to the ongoing debate on the impact of daytime napping on DM risk. Although our findings suggested that daytime napping over 1 hour per day was associated with a 31% increased DM risk, the heterogeneity of included studies precluded us to make a definite conclusion. Since the nature of the association is not clear, further studies with objective assessment of daytime napping on DM risk, covering participants from more age groups and ethnicities, are needed to confirm the findings. Our study also supports that daytime napping-related measures should be included in sleep studies.
Excessive Daytime Sleepiness (not Narcolepsy)
Board #040: P2 - Monday
POLYSOMNOGRAPHY, MULTIPLE SLEEP LATENCY TEST AND ELECTROENCEPHALOGRAPHY
ACTIVITY IN KLEINE-LEVIN SYNDROME

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Introduction: Kleine-Levin syndrome is included in the group of Central Disorders of Hypersomnolence in the
International Classification of Sleep Disorders (ICSD-3). It has been historically defined as a severe recurrent
hypersomnia that also associates hyperphagia and hypersexuality. However, symptoms such as apathy or
derealization in these patients are increasingly described instead of hyperphagia and hypersexuality. Actually,
there are no criteria that define typical polysomnographic or EEG characteristics in this group of patients.

Clinical case: We present a 14-year-old boy with severe periodic hypersomnia episodes since he was 12. The
first episode started with severe hypersomnia (17 hours sleeping) accompanied by confusion, apathy and
derealization, lasting 5-6 days and repeating at 40 to 75 day interval. Some episodes are accompanied by
hyperphagia and he has gained 15 Kg from the first episode. Hyper sexuality has never occurred and the
amnesia of the episodes is repeated in all of them. Between episodes he is asymptomatic and the day before he
has hypersomnolence he is able to perceive derealization and confusion. In some episodes he has also presented
headache.

Blood test, LCR and MR was normal. SPECT findings were a right fronto-temporal hypoperfusion during
symptomatic episodes.

Polisomnography and Multiple Sleep Latency Test (MSLT) has been performed in different days of different
episodes: first, second and third-fourth day from the onset of the symptoms. Sleep latency was reduced in all
three studies. MSLT mean sleep latency was normal in the study of third-fourth day, whereas in the studies of
the first and the second symptoms day it was short. REM was present in two subtest just in the study of the
second day. The main difference between studies in different days was the EEG activity. Background activity was
7,5-8Hz in three studies. During sleep-wake transition and light sleep occurred high-amplitude low-frequency
waves mainly in the bilateral frontal and frontotemporal areas. This activity was more expressive and persistent
in the study of the second day and very isolated on the first day.

The actual treatment in this patient is lithium. In the last episode, Amantadine was tried on the first symptom
day in order to abort the episode without success.

Conclusions: EEG, Polysomnography and Multiple Sleep Latency Test findings could be a useful tool in the
diagnosis of Kleine-Levin if we correlate it with the clinical course and the day in which it is performed from the
onset of symptoms. We propose the second day from the onset of symptoms as the best suited to find the
findings described in Kleine-levin patients.
Objective: To evaluate an attention test as a discriminative tool to measure neurocognitive impairment in patients with disorders of hypersomnolence.

Introduction: Chronic excessive daytime sleepiness is the main symptom in central disorders of hypersomnolence. For diagnostic purposes and treatment evaluation, reliable assessment of excessive daytime sleepiness is required.

Material and methods: Thirty-six patients with central disorders of hypersomnolence were compared with 20 healthy controls. All participants performed the 'Perception and Attention Functions' (WAF) of the Vienna Test System. Patients underwent polysomnography, Multiple Sleep Latency Test and Maintenance of Wakefulness Test.

Patients were divided into two groups:
(i) patients who met the criteria of disorder of hypersomnolence (objective excessive daytime sleepiness); and
(ii) patients with subjective excessive daytime sleepiness, i.e. with normal Multiple Sleep Latency Test results.

Group 1 consisted of 23 patients with objective excessive daytime sleepiness (11 with idiopathic hypersomnia, nine with narcolepsy type 1, three with narcolepsy type 2); group 2 included 13 patients with subjective excessive daytime sleepiness.

Results: Cognitive impairment was present in patients with objective excessive daytime sleepiness and even in patients with subjective excessive daytime sleepiness. WAF tests identified distinct attention profiles in patients with narcolepsy type 1, idiopathic hypersomnia/ narcolepsy type 2, and patients with subjective excessive daytime sleepiness. WAF test measures correlated with Maintenance of Wakefulness Test and the Epworth Sleepiness Scale, but not with Multiple Sleep Latency Test and the Fatigue Severity Scale.

Conclusion: The multidimensional WAF test battery detects cognitive impairment even in patients that complain of excessive daytime sleepiness but have normal Multiple Sleep Latency Test results. WAF tests offer valuable information that adds to the existing polysomnographic measures in discriminating patients with different types of chronic excessive daytime sleepiness. The results provide new insights into cognitive dysfunction underlying different types of chronic excessive daytime sleepiness.
Excessive Daytime Sleepiness (not Narcolepsy)
Board #042: P2 - Monday
COMPARISON OF SLEEP LATENCY MEASURED BY THE OXFORD SLEEP RESISTANCE TEST AND SIMULTANEOUS EEG IN JAPANESE PATIENTS

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Introduction: Excessive daytime sleepiness (EDS) is observed in various pathological conditions associated with sleep disorders. However, objective methods for the assessment of EDS rely on complex electroencephalographic (EEG) recording and are impractical for use in general clinical practice. To address this issue, the Oxford Sleep Resistance Test (OSLER) has been developed for use in clinical practice overseas, though few studies have examined the reliability of the OSLER test for measuring sleep latency in Japanese patients. Thus, in the present study, we aimed to determine whether sleep latency measured via the OSLER test (SLOSLER) is consistent with that measured via EEG (SLEEG) in Japanese patients with obstructive sleep apnea (OSA).

Materials and methods: Seventeen Japanese men with OSA (mean age: 51.5 ± 9.8 years) underwent simultaneous OSLER and EEG testing a total of four times on the day following polysomnography evaluation. SLOSLER and SLEEG were compared, and the reliability of the former was analyzed using Bland-Altman plots.

Results: Mean SLOSLER and SLEEG for all patients were 26.9 ± 11.6 and 25.7 ± 12.2 minutes, respectively. A significant positive correlation was observed between these measurements (p < 0.0001, r = 0.963). Moreover, the Epworth Sleepiness Scale (ESS) scores were not significantly correlated with either SLOSLER or SLEEG. Bland-Altman plot analysis revealed that 94% of the plotted SLOSLER or SLEEG measurements converged within a range of mean ± 1.96 SD.

Conclusions: Our findings thus demonstrated that SLOSLER is consistent with SLEEG in Japanese patients with OSA.

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Excessive Daytime Sleepiness (not Narcolepsy)
Board #065: P4 - Tuesday

DELAYED HABITUAL SLEEP TIMES IN PATIENTS UNDERGOING MULTIPLE SLEEP LATENCY TESTING SIGNIFICANTLY CONTRIBUTES TO TEST FAILURE

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Introduction: The multiple sleep latency test (MSLT) is an objective assessment of an individual's tendency to fall asleep. It is utilised in the evaluation of hypersomnia, particularly when narcolepsy is suspected. However, test results are influenced by recent sleep, pharmacotherapy, co-morbid medical and psychiatric conditions. Our team undertook a review of pre-MSLT parameters to identify whether any components correlated with MSLT outcomes.

Materials and methods: The study was conducted as a retrospective cohort analysis at a metropolitan tertiary hospital, Melbourne Australia. All patients with a completed MSLT performed between May 2015 and December 2016 were included in the analysis. Patient clinical information, laboratory pathology tests and formalized assessments of sleep were analyzed. The majority of the patients underwent actigraphy for the week prior to their studies.

Results: Narcolepsy was diagnosed in 3.7% (3/82) of patients. Additionally, 6.1% (5/82) of patients were ultimately diagnosed with idiopathic hypersomnia. Of note, 12.2% (10/82) of patients had indeterminate results despite short sleep latency. Mean sleep duration on the preceding night's polysomnography (PSG) in our cohort was 6.4 hours with 40% (33/82) of patients sleeping less than 6 hours. The latter was the most frequent explanation for an indeterminate MSLT outcome. There was a weak association between pre-MSLT PSG and initial PSG total sleep time ($r = 0.36, p = 0.03$) and no significant association between the pre-MSLT PSG and sleep diary or actigraphy total sleep time. Average sleep onset at home according to actigraphy was 00:03 (SD, 88 mins) with a range from 20:38-02:50 and average wake time was 08:21 (SD, 102 mins) with a range from 05:33-12:28. The average TST according to actigraphy was 06:53 hours (74 mins) with a range of 02:25 to 09:04 hours. In total 88% of these patients (53/65) had an actigraphy derived total sleep time of 6hrs or more for the week prior to the MSLT.

Conclusions: In our cohort an invalid MSLT outcome as a result of inadequate total sleep time was a frequent finding. Prior total sleep time on initial PSG, actigraphy or sleep diary was not helpful in predicting which patients would not sleep greater than 6 hours during the pre-MSLT PSG. Most patients had habitual sleep times which were incompatible with standard laboratory sleep times for PSGs, likely contributing to inadequate TST on the night prior to the MSLT.

Acknowledgements: The Royal Melbourne Hospital Respiratory and Sleep Unit
Excessive Daytime Sleepiness (not Narcolepsy)
Board #043: P2 - Monday

BEHAVIOURAL OBSERVATIONS STEP 3: VIGILANCE OF NIGHT-TIME DRIVERS

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Introduction: Changes in vigilance experienced throughout the day depend on the quality of night-time sleep, and are characteristic features of individuals experiencing fatigue. To standardize vigilance assessments, we reviewed videos of night-time drivers with a structured rating system and investigated how untrained research assistants (RAs) rate vigilance.

Methods: Night-time driving videos of 60 adult volunteers recorded between 2 and 4 AM were provided by the Institute for Sleep-Wake-Research (ISWF, Vienna) and the Austrian Automobile Club (OEAMTC). After 30 and 90 minutes of driving, two 4.5-minute videos from 14 out of 60 participants were analyzed.

(A) RAs rated participants using the Karolinska Sleepiness Scale (KSS); these values were compared with drivers' self-ratings.

(B) Open-ended and pictogram-based behavioural descriptions of participants were made. Descriptions were separated into
   (i) task-oriented (i.e. driving);
   (ii) non-task oriented (i.e. non-driving); and (iii) posture-oriented (e.g. stretching) behaviours.

(C) For each participant, RAs predicted which video was recorded earlier.

(D) Four videos were reviewed with a Delphi consensus process, determining to what extent prepared pictograms could support analyses.

Results:

(A) KSS participant and observer ratings for the earlier (median, participants: 3.0, observers: 4.25) and later recordings (median, participants: 6.5, observers: 6.1) were comparable, but not significant (Chi-square: earlier p=0.6; later p=0.4). (B) Open-ended descriptions revealed differences between the three categories of spontaneous behavior in the course of the night: task-oriented (earlier: 42%, later: 36.6%); non-task oriented (earlier: 49.5%, later: 54.8%); and posture-oriented (earlier: 8.7%, later: 8.6%) behaviours. Similar trends were found with pictogram-based descriptions: task-oriented (earlier: 39.2% to later: 31.3%); non-task oriented (earlier: 47.2% to later: 54.5%); and posture-oriented (earlier: 13.6%, later: 14.2%). (C) In 42% of cases, RAs correctly predicted which of the two videos were recorded earlier (Kappa < 0.0). (D) Discussions identified missing icons (e.g. self-stimulation) to inform future design.

Conclusion: Although RA KSS ratings corresponded to KSS self-ratings of the participants, RAs failed to identify correctly early- from late-night video recordings. This misalignment needs further investigations since spontaneous behaviour clearly changes in the course of the night, which could be found in both, open-ended and pictogram-based descriptions. Nevertheless, the pictogram design has to be developed further to support the establishment of “benchmark” behavioural patterns of differing vigilance levels for clinical observation.

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Excessive Daytime Sleepiness (not Narcolepsy)

Board #044: P2 - Monday

THE CLINICAL UTILITY OF SUBJECTIVE VS. OBJECTIVE TESTS OF EXCESSIVE DAYTIME SLEEPINESS IN THE ASSESSMENT OF PATIENTS WITH SLEEP APNEA

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Introduction: Excessive daytime sleepiness (EDS) is highly prevalent in obstructive sleep apnea (OSA). In clinical practice, EDS is assessed subjectively with the Epworth Sleepiness Scale (ESS), whereas Multiple Sleep Latency Test (MSLT) is the standard test for the objective assessment of EDS. Psychomotor vigilance task (PVT) has been suggested as a convenient, simpler method than MSLT to assess EDS. In this study, we examined the association between these three methods and their possible utility as predictors of cardiovascular morbidity by examining their association with preclinical markers of metabolic risk, i.e. the proinflammatory cytokine interleukin-6 (IL-6).

Materials and methods: We studied 58 OSA patients (53.7±7.0y, 63.8% male) who underwent 8-hour in-lab polysomnography for 4 consecutive nights. Four trials of MSLT and PVT were administered on the 4th day every 2 hours. PVT was performed an hour before MSLT. PVT variables included number of lapses, mean reciprocal of the fastest 10% and slowest 10% reaction times (RTs), and median of 1/RT. ESS was assessed on day 1 of the study. Twenty-four-hour profiles of IL-6 levels were assessed on the 4th day.

Results: Lower MSLT values were associated with significantly elevated 24-hour (β=-0.34, p=0.01), daytime (β=-0.30, p=0.02) and nighttime (β=-0.38, p< 0.01) IL-6 levels. Higher ESS scores were significantly associated with greater number of lapses (β=0.34, p=0.021) and lower values of slowest 10% (β=-0.30, p=0.04) and 1/RT (β=-0.36, p=0.01) but not with IL-6 levels. No significant associations were found between PVT performance, and IL-6 levels or PVT and MSLT.

Conclusions: Our findings suggest that in OSA, MSLT is associated with low-grade inflammation whereas ESS is associated with impaired sustained attention/vigilance as measured by PVT. It appears that MSLT is a good predictor for cardiovascular morbidity whereas ESS predicts impaired performance in OSA patients.

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COMPETING DRIVES OF HUNGER AND SLEEP ON PERFORMANCE IN SLEEP-RESTRICTED RATS

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Introduction: Studies assessing the impact of sleep restriction on attention and cognitive performance in rodents often combine functional -behavioural measures with electroencephalographic (EEG) measures of vigilance. Such behavioural tasks commonly utilize food reward to motivate performance, yet it is unclear whether the differing biological drives of hunger and sleep interact to modulate outcome in such studies.

Materials and methods: The effects of feeding status was compared (i.e., ad libitum vs. food restricted (>85% of free feeding weight)) on two appetitive behavioural tasks in sleep-restricted male Sprague-Dawley rats. One cohort was trained on a psychomotor vigilance task (PVT), responding to an imperative cue (i.e., magazine light) following a preparatory cue (i.e., house-light) to gain a food reward. Trial completion, number of omissions and response latencies were measured. Rats performing the PVT were also surgically implanted to record the EEG. A second cohort trained to press a lever for food reward under a progressive ratio (PR) schedule, with breakpoint as a primary measure (i.e., the press component at which a subject stops responding). Both cohorts underwent a previously validated 11-h sleep restriction protocol (McCarthy, Loomis et al. 2016) before performance was assessed.

Results: Analyses of the EEG recordings confirmed that rats fed ad libitum and the food-controlled group underwent a similar amount of sleep loss during sleep restriction. PVT testing revealed significant impairments in ad libitum-fed rats, while food-controlled rats showed no deficits. Ad libitum-fed rats completed significantly less trials, made more omissions and had longer response latencies. EEG analyses showed that ad libitum-fed rats obtained more sleep during the task than food-controlled rats. In contrast, the PR test breakpoint remained unchanged following sleep restriction for both feeding regimes, although it was significantly higher in the food-controlled group at baseline.

Conclusions: In conclusion, the present study cautions that while sleep restriction does not differentially alter motivation for food reward in rats, hunger drive will negate the effects of sleep restriction on appetitive task performance.
IS THERE AN ASSOCIATION BETWEEN PERCEIVED HYPERSOMNOLENCE AND ACADEMIC RESULTS?

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Introduction: It is believed that children with hypersomnolence or excessive daytime sleepiness are often too tired to focus on learning during the school day, and that this is reflected in their academic results. This study aimed to more clearly identify the association between hypersomnolence and poor academic results in school-aged children.

Materials and methods: This school-based community study surveyed all students from a regional primary school, aged 4 through to 12 years, their carers, and their teachers using the Paediatric Daytime Sleepiness Scale (PDSS) and a background information survey completed by a carer. Three of the eight PDSS questions were included on the teacher's questionnaire, with three additional questions that aimed to gain further data on whether each child or their carer had discussed the child’s evening sleep routine with their teacher. Each child therefore had three perspectives/sets of data on the possible presence of hypersomnolence and on their evening sleep routine. Data were also collected on their latest academic results for Maths, English, and Science.

Results: The response rate was 52% of the 727 student and carer surveys, and 67% of the teacher surveys. Four sets of data were analysed: child self-report PDSS score, parent report PDSS score, teacher report PDSS score [PDSS maximum score=32, with a higher score indicative of greater hypersomnolence], and average academic grade [max score 6, with 1=mostly As through to 6=Cs and less]. There were significant associations between teacher report PDSS scores for each student and the academic grades those children received for 7 through to 10 year olds, and a weak relationship for 11-12 year olds. There were some weak but predominantly non-significant relationships between parent PDSS scores of their children’s hypersomnolence and the academic grades received, and also between children's self-reported hypersomnolence and the academic grades they received for 7 through to 12 year olds. All associations indicated greater hypersomnolence was associated with poorer academic grades.

Conclusions: These data support an association between hypersomnolence and academic results, however many of the identified associations did not reach statistical significance. Nevertheless, it is still essential that parents/guardians and teachers are alerted to the negative impact that hypersomnolence or excessive daytime sleepiness may have on children's learning and ability to learn. Hypersomnolence has a number of causes, and may be improved with specific interventions. There is a need to better understand the range of educational, and broader emotional, behavioural, and social impacts hypersomnolence has on children.

Acknowledgements: Thanks to students, parents, and teachers of Rangeville State School, Queensland.
Introduction: When hypersomnolence is suspected, children and their parents are routinely screened using one of a number of available surveys. The vocabulary used in these surveys is sleep-specific and possibly adult-oriented, thus it is questionable whether younger children really do comprehend the intent of the questions. The present study aimed to identify children’s understanding of the terminology utilised in sleep surveys, particularly the Paediatric Daytime Sleepiness Scale (PDSS). The PDSS was originally developed by Drake, Nickel, Burduvali, Roth, Jefferson, and Badia (2003) as a measure of sleepiness for 11-15 year olds. Nixon, Wawruszak, Verginis, and Davey (2006) then evaluated the use of the PDSS in elementary school children (5-12.9 years). Neither study commented on the sleep vocabulary used within the scale nor whether additional explanations of each question were given to the children by adults administering the scale.

Materials and methods: This school-based community study surveyed all students from a regional primary school, aged 4 through to 12 years, their parents/guardians, and their teachers using the Paediatric Daytime Sleepiness Scale (PDSS) and a background information survey completed by a carer. 52 percent of the 727 student and carer surveys distributed were returned; and 67 percent of the teachers responded. Prior to commencing the PDSS, each child was asked the meaning of seven key words used in the questions: drowsy, sleepy, alert, awakened, tired, fatigued, and awake. Their responses were recorded/scribed by their carer on the front page of the child’s questionnaire. This study utilised these qualitative data, i.e. the actual definition of each word tendered by each child.

Results: The final vocabulary sample consisted of word definitions from 325 children. The qualitative data yielded perceptions reflective of the developmental expressive vocabulary ability of each child: younger children gave more literal and concrete definitions, often with an example from their own life, whilst older children were more global in their choice of vocabulary to define each word. Interestingly, the oldest groups (10, 11 and 12 year olds) frequently chose more abstract words when generating their definitions. The word fatigued, for example, was the most challenging for children to define, with only 2% of 4-5 year olds (N=51) through to only 30% of 11-12 year olds (N=40) able to give an approximate definition through inclusion of words such as exhausted, weary, or very tired in their definition. Of the other six words included in this survey, drowsy, alert, and awakened were similarly challenging for the children to define.

Conclusions: Sleepiness surveys are frequently utilised by professionals in various capacities, including in research and prior to clinical sleep studies, to gain insight into a child’s own perception of their hypersomnolence. However, the vocabulary in these surveys is sleep-specific, and in the case of the PDSS as investigated through this study, utilises vocabulary not in general use by children. Giving a brief definition of these key words prior to administering the survey may yield a more accurate reflection of a child’s sleep and daytime behaviours.

Acknowledgements: Thanks to students of Rangeville State School, Queensland.
A GENETIC VARIANT IN CRAT IS ASSOCIATED WITH HLA-DQB1*06:02 NEGATIVE ESSENTIAL HYPERSOMNIA

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Essential hypersomnia (EHS) is characterized by excessive daytime sleepiness features that are indistinguishable from those of narcolepsy such as shorter episodes of irresistible daytime sleepiness, feelings of refreshment after short naps, and the absence of prolonged nocturnal sleep time. However, cataplexy, which is typical in narcolepsy, is not present in EHS. Patients with EHS are classified as having narcolepsy without cataplexy and idiopathic hypersomnia without long sleep time based on the criteria in the International Classification of Sleep Disorders second edition (ICSD-2). EHS can be divided into two broad classes based on the presence or absence of HLA (human leukocyte antigen)-DQB1*06:02 allele. HLA-DQB1*06:02 positive EHS and narcolepsy are associated with the same susceptibility genes. However, there are fewer studies of HLA-DQB1*06:02 negative EHS. Therefore, a genome-wide association study was performed in 119 Japanese patients with HLA-DQB1*06:02 negative EHS and 1,582 Japanese healthy individuals to identify susceptibility genes associated with HLA-DQB1*06:02 negative EHS. A replication study was conducted on 283 Japanese patients with HLA-DQB1*06:02 negative EHS and 433 Japanese healthy individuals as an independent sample set. SNP rs10988217 located in CRAT (carnitine acetyltransferase) was found to be associated with HLA-DQB1*06:02 negative EHS (P< 5×10^-8, OR=2.6). The association reached genome-wide significance. An eQTL (expression quantitative trait locus) analysis showed that rs10988217 was significantly correlated with expression levels of CRAT in various tissue or cell types, including brain tissue (P< 10^-5). CRAT gene encodes the carnitine acetyltransferase protein, which is a key enzyme for metabolic pathways involved with the control of the acyl-CoA/CoA ratio in mitochondria, peroxisomes and endoplasmic reticulum. In addition, the Metabolomics GWAS Server (doi: 10.1038/ng.2982.) revealed that rs10988217 was significantly associated with levels of succinylcarnitine in blood (P< 10^-17). Individual acylcarnitines levels were measured in 36 Japanese patients with HLA-DQB1*06:02 negative EHS and 68 Japanese healthy individuals. Levels of several acylcarnitines showed significant differences between the two groups. The results in the present study suggest that HLA-DQB1*06:02 negative EHS may be associated with an underlying dysfunction in energy metabolic pathways.
SLEEP DEPRIVATION MODIFIES THE USUAL BEHAVIOR OF ALPHA OSCILLATORY ACTIVITY DURING COGNITIVE TASKS

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Introduction: Sleep deprivation (SD) induces excessive day time sleepiness and is responsible of bad
performance and reduced alertness. During sleep deprivation, theta and alpha brain oscillatory activity
undergoes changes. Theta activity is known to be related to memory and attention functions while alpha is
considered to be more related to perception. The goal of the present study was to determine the impact of SD on
auditory attention networks by studying the event related potentials (ERPs) and alpha and theta oscillatory
activity during auditory attention tasks.

Materials and methods: Twenty healthy participants performed auditory cued attention tasks, before and after
a night of SD. Each day, subjects had five sessions separated by intervals of 2 hours. Reaction time (RT) and
accuracy of the responses to the target were recorded in parallel with the EEG signals. EEG was segmented
target-locked, into epochs of 1500ms for ERP analysis and into epochs of 3000ms, for wavelets analysis. Epochs
were averaged per type of response (correct, missing and wrong). Alpha was determined as individual alpha
frequency (IAF) +/-2Hz and theta as IAF -4/-6Hz. SD effects on performance and frequency amplitude were
assessed with parametric and non-parametric statistics.

Results: SD produced, as expected, a decrease of performance and a significant increase of RT (p< 0.001).
Repeated measures ANOVA showed that ERP N100 was not significant for sleep condition while ERP P300 was
significant(p< 0.004).Alpha oscillatory activity after target presentation had in the parietal region a peculiar
pattern behavior. First, alpha activity decreased in amplitude (desynchronization) at a time range of 200-600ms,
thereafter increased in amplitude (synchronization) at 800-2300ms. After SD the amplitude of alpha
desynchronization was reduced (p< 0.017) and the amplitude of alpha synchronization was higher (p< 0.014)
compared to before SD. Furthermore, after SD, the alpha oscillatory activity did not show any desynchronization
for missing and wrong answers while a synchronization was present for correct and wrong answers. Theta power
in frontal regions showed a pattern of high synchronization. However no significant differences were found by
sleep condition in theta power. The amplitude of theta synchronization was higher for correct answers than for
wrong or missing answers.

Conclusions: Early-stage of processing at primary cortical areas are relatively preserved after SD contrasting
with the important changes on late stages of auditory information processing observed with ERPs.Alpha inhibition
theory says that alpha desynchronization is related to neuronal activation and, alpha synchronization is related to
an inhibitory activity. Our results show that SD interferes at two steps of the task processing: during the
processing and executive control of the ongoing task (desynchronization) and during de resetting of neuronal
activity after the task is performed (synchronization). Thus, alpha desynchronization would be related to correct
answers only, while alpha synchronization would be rather related to the executive process. Theta oscillatory
activity is probably related to integration and processing of target stimulus during attention tasks.

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Here is reported a 18 years old male patient admitted with a complaint of long lasting sleeping periods together with masturbation episodes. His complaint began when he was 13 years old with nearly 10 days lasting sleeping period. Three weeks before first attack, he had periorbital headache that is associated with lacrimation, rhinorhea and redness in his eye. The headache continued prior to his first 4 sleeping attacks and then disappeared. At the beginning, his 2 sleeping episodes characterized by sleeping lasting nearly 10 days associated with masturbation. After first two attacks, polyphagia and abnormal behaviors like swearing and shouting were added. Between attacks he was completely normal. He got 13 attacks in a 5-period. He admitted psychiatry and neurology clinics, Carbamazepine was given 800mg/day but it did not work on his symptoms. During the admission to our clinic, he was on the attack and we did 24hours video-polysomnographic monitoring. In that period, he slept 19.75 hours and we monitored 5 masturbation episodes that he did not aware of them. After diagnosis of Kleine-Levin syndrome, Lithium bicarbonate was prescribed 1200mg/day and he had been symptoms free since that time.
Introduction: Road traffic accidents due to hypovigilance are common. Our studies show improved sleep hygiene prior to driving from 199 - 2011 but a reduction in overall sleep time and increased sleepiness at the wheel.

Materials and methods: Comparison between very sleepy drivers (Group 1: N° = 63 drivers Epworth sleepiness scale ESS >14) and non-sleepy drivers (Group 2 : N° 3495 ESS < 15). Drivers responded to questions on usual sleep schedules and sleep schedules just before the trip, sleepiness at the wheel, the Epworth sleepiness scale, Basic Nordic Sleep Questionnaire, and a travel questionnaire. Numerical parameters were compared between those two groups with t test, and qualitative parameters with chi square test.

Results: Total sleep time was lower in Group 1 drivers during the week (p = 0.006) and during the weekend (p = 0.02) than group 2 drivers, and they were more likely to experience a near miss accident during the present trip (p = 002) than group 2 drivers. Group 1 drivers had more variation of sleep schedules (p = 0.003) than group 2 drivers. However sleep was refreshing in both groups. Group 1 drivers were more likely to have possible sleep pathologies with more heavy snorers (p = 0.0005) and more nighttime respiratory pauses reported by sleep partners (p = 0.003)

Conclusions: This study shows that sleep deprivation and snoring to for automobile drivers remains an important concept to address in road safety campaigns.

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Excessive Daytime Sleepiness (not Narcolepsy)
O04: Neurological sleep disorders affecting sleep oral abstract presentations

IMPAIRED CONSCIOUSNESS STATES IN MYOTONIC DYSTROPHY-TYPE 1 MEDIATION BY γ-AMINO BUTYRIC ACID (GABA)

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Introduction: Myotonic dystrophy type 1 (DM1) is caused by expansion of a CTG trinucleotide repeat in the non-coding region of DMPK and negatively impacts CNS function beyond the pathognomonic signs and symptoms of skeletal and smooth muscle dysfunction. “States” of consciousness inclusive of the sleep-wake continuum are compromised in a majority of DM1 patients, often prior to recognition of its myopathic features. This represents a substantial unmet clinical need whose pathophysiology is not understood, and for which there are no efficacious treatments. Excessive daytime sleepiness (EDS), and “brain fog”, impaired cognition, and sleep drunkenness in DM1 patients despite excessive sleep amounts closely mimic the phenotype of idiopathic hypersomnia (IH) familiar to sleep clinicians. As murine models of DM1 are hyper-sensitive to the sedating effects of GABA agonists, the cerebrospinal fluid (CSF) of many IH patients enhance GABAA receptor (GABAAR) function by positive allosteric modulation, and some IH patients realize symptomatic benefit from GABAAR antagonism, we hypothesized that impaired consciousness in DM1 might be mediated by enhancement of GABAAR function.

Materials and methods: We assayed CSF of four (2 females) DM1 subjects aged 25-64 who presented for evaluation of EDS (Epworth Sleepiness Scales = 13-22), exceptionally long (>11/24 hr) habitual sleep times, and sleep drunkenness for endozepine-like activity by in vitro patch-clamp electrophysiological assay. Three of these patients were treated in an un-blinded, open-label fashion with oral clarithromycin (N=1), a macrolide antibiotic which can act as a negative allosteric modulator of the GABAAR, or intravenous, buccal, or transdermal flumazenil (N=2), a competitive antagonist of benzodiazepines at the GABAAR, and assessed with standard subjective and objective tools of wakefulness, vigilance, and cognition. Separately we studied the splicing status of the g subunit of the GABAAR in brain tissue obtained post-mortem from DM1 subjects unique from the treated patients.

Results: The CSF of each of the four DM1 patients was found to contain benzodiazepine-like activity that exceeded that detectable in non-sleepy controls. Furthermore, the g subunit of the GABAa receptor was mis-spliced such that GABAAR in DM1 patients would be hyper-sensitive to exogenous benzodiazepines, and presumably, like natural substances that arise endogenously. Treatment of DM1 subjects with clarithromycin or flumazenil improved their wakefulness, vigilance, and cognition. Both medications were well tolerated with minimal side effects and no adverse events. These data suggest that GABAAR modulators may be an effective treatment for impaired consciousness states in DM1 inclusive of EDS, hypersomnia, and cognitive processing speed.

Conclusions: The GABA axis is perturbed in DM1. Not only are there endogenous benzodiazepines present in CSF, but mis-splicing of the g subunit of the GABAaR subunit also yields GABAaRs that are hypersensitive to benzodiazepines. Use of GABAaR antagonists that specifically modulate binding of benzodiazepines may be a viable symptomatic therapy for some of the CNS dysfunction characteristic of DM1. This preliminary experience is supportive of more ambitious controlled clinical trials after additional discovery work to better define the target population, and optimize diagnostic and outcome measures.

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**Introduction:** Recent research suggests that an endogenous agent in the central nervous system of idiopathic hypersomnia (IH) and narcolepsy type-2 (Na-2) patients acts as a GABA agonist and may be a key driver of debilitation. We assessed the efficacy and safety of BTD-001, a GABA<sub>A</sub> receptor (GABA<sub>A</sub>R) antagonist in IH and Na-2 in a pilot clinical study.

**Materials and methods:** This study enrolled 3 IH and 2 Na-2 patients - one male and four females - whose excessive daytime sleepiness had been: 1) refractory to treatment with conventional wake promoting agents; as well as 2) responsive to previous therapies (clarithromycin (N=4) or flumazenil (N=2)) intended to antagonize GABA<sub>A</sub>Rs into an open label study consisting of three phases. The first was a 7-day washout phase beginning with discontinuation of treatment for IH or Na-2 (GABA antagonist and any concomitant stimulant or wakefulness-promoting agent). This was followed by a 14-day BTD-001 dose escalation phase with low dose BID for 7 days then high dose BID for 7 days. The third phase consisted of a 7-day washout beginning upon discontinuation of treatment for IH or Na-2 (GABA antagonist and any concomitant stimulant or wakefulness-promoting agent). BTD-001 treatment resulted in improvements compared to no treatment in all subjects as reported on the ESS, FOSQ, and SF-36. The Investigator rated all 5 subjects to be improved versus no therapy on both low and high dose BID BTD-001. Median improvement on ESS was 11 points for high dose BID BTD-001 compared to no treatment. One Na-2 subject reported complete relief of symptoms based on ESS while treated with high dose BTD-001. All subjects reported improvement on the FOSQ, SF-36 and MFI. Three of the five subjects reported better outcomes on FOSQ, SF-36 Composite Score 9 (Physical) and MFI and 4 out of 5 on the SF-36 Composite Score 10 (Mental) while receiving high dose BTD-001 as compared to their other GABA antagonist therapy. For the FOSQ, the most consistent benefit was in the domain of vigilance, though individuals reported increases in activity, general productivity, social outcomes and intimate relationships. For the SF-36 the most consistent benefits were on vitality and role limitations due to physical health. BTD-001 at low and high doses twice daily was well tolerated by all 5 subjects.

**Conclusions:** The findings support further investigation of BTD-001 as a potential therapeutic for IH and Na-2.

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Excessive Daytime Sleepiness (not Narcolepsy)
Board #071: P4 - Tuesday

DISRUPTION OF SLEEP-WAKE CONTINUUM IN MYOTONIC DYSTROPHY TYPE I: SLEEP MACROSTRUCTURAL AND MICROSTRUCTURAL FINDINGS

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Introduction: Myotonic dystrophy type I (DM1) is the most common adult onset muscular dystrophy. Sleep disruption and excessive daytime sleepiness (EDS) are well acknowledged symptoms in myotonic dystrophy type I (DM1). Fragmented nocturnal sleep, sleep-disordered breathing (SDB), and periodic limb movements (PLMS) have been implicated, but a central dysfunction of sleep-wake regulation is likely to play a pivotal role. Few studies evaluated sleep macrostructure in DM1, reporting peculiar alterations, but none investigated more refined sleep variables as sleep microstructure.

Materials and methods: We included 8 DM1 (6M; 34.0±10.5 years) and 10 healthy controls (7M; 34.6±15.3 years) that underwent in-lab polysomnographic nocturnal sleep and multiple sleep latency test (MSLT). Sleep stages and polygraphic events were scored according with standard criteria revised in 2007 by American Academy of Sleep Medicine (2007); sleep microstructure was analysed by means of Cyclic Alternating Pattern (CAP).

Results: Although not statistically significant, DM1 patients had decreased TST. DM1 showed a significant increase in REM sleep percentage and decreased N2; N3, although not significantly, was increased. Three patients, but no control, showed SOREM in nocturnal PSG. CAP analysis pointed out increased sleep instability (CAP rate). DM1 patients had significantly shorter mean sleep latency; four of the eight patients had a pathological mean sleep latency. Five patients showed at least one SOREM and, when including also nocturnal PSG, all these patients had at least two SOREM. There were no significant differences among two groups regarding apnea-hypopnea and periodic leg movements index.

Conclusions: The peculiar macrostructural pattern confirms a narcoleptic-like phenotype in DM1 and points, from a pathophysiological point of view to a REM sleep dysregulation (sleep onset REM periods, fragmented REM sleep) that may account for EDS. Higher CAP rate suggests increased sleep instability in DM1 patients. Our data further support a CNS involvement in DM1 pathophysiology and suggest a role for the mechanisms underlying central sleep regulation in disrupting sleep-wake continuum, including sleep instability and EDS, in DM1.
RESULTS OF A RANDOMIZED, PLACEBO-CONTROLLED, DOUBLE-BLIND, 12-WEEK, MULTICENTER STUDY OF SOLRIAMFETOL (JZP-110) FOR THE TREATMENT OF EXCESSIVE SLEEPINESS IN PATIENTS WITH OBRUSTRICIVE SLEEP APNEA

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Introduction: This phase 3 pivotal trial evaluated solriamfetol, a selective dopamine norepinephrine reuptake inhibitor with wake-promoting effects, for the treatment of excessive sleepiness (ES) in patients with obstructive sleep apnea (OSA). ES is a common OSA symptom that can persist and affect activities of daily living despite primary treatment such as continuous positive airway pressure (CPAP) or oral appliances.

Materials and methods: Inclusion criteria: adults ≥18 years with OSA diagnosed per International Classification of Sleep Disorders-3 criteria; current or prior use of primary OSA therapy; Epworth Sleepiness Scale (ESS) score ≥10; mean sleep latency < 30 min on the first 4 trials of a 5-trial, 40-minute Maintenance of Wakefulness Test (MWT); usual nightly sleep time ≥6 hours. Patients were randomized (1:1:2:2:2) to 12 weeks of once-daily oral treatment with solriamfetol 37.5mg, 75mg, 150mg, 300mg, or placebo. Co-primary endpoints were changes from baseline to week 12 in MWT mean sleep latency and ESS score. A key secondary endpoint was percentage of patients reporting improvement (minimal, much, or very much) on the Patient Global Impression of Change scale (PGI-C). Safety and tolerability were evaluated.

Results: A total of 474 patients were randomized and treated: 63% male, 76% white, mean (standard deviation) age 53.9 (10.9) years, BMI 33.3 (5.3) kg/m², and baseline MWT sleep latency and ESS score of 12.6 (7.3) min and 15.2 (3.3), respectively. Of these patients, 404 (85.2%) completed the study and 459 were evaluated for efficacy in a pre-specified, modified intent-to-treat population. At week 12, least square (LS) mean change from baseline in MWT was 0.2 (1.0) min for placebo, and significantly higher with solriamfetol: 4.7 (1.4) min, 9.1 (1.4) min, 11.0 (1.0) min, and 13.0 (1.0) min for 37.5mg (P < .05), 75mg (P < .0001), 150mg (P < .0001), and 300mg (P < .0001), respectively. LS mean (SE) changes in ESS scores were -3.3 (0.5) with placebo, and -5.1 (0.6), -5.0 (0.6), -7.7 (0.4) and -7.9 (0.5) for 37.5mg (P < .05), 75mg (P < .05), 150mg (P < .0001), and 300mg (P < .0001), respectively. Significantly higher percentages of patients reported improvement (minimal, much, or very much) on the Patient Global Impression of Change scale (PGI-C). Safety and tolerability were evaluated.

Conclusions: In this population, treatment with solriamfetol at 75mg, 150mg, and 300mg resulted in dose-dependent and statistically significant increases in objective wakefulness, decreases in subjective sleepiness, and overall improvement, as measured by MWT, ESS, and PGI-C, respectively. The tolerability profile was consistent with prior solriamfetol narcolepsy studies.

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Excessive Daytime Sleepiness (not Narcolepsy)
Board #073: P4 - Tuesday

TREATMENT OF EXCESSIVE SLEEPINESS IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA: EFFICACY AND SAFETY RESULTS OF A 6-WEEK, DOUBLE-BLIND, PLACEBO-CONTROLLED, RANDOMIZED-WITHDRAWAL TRIAL OF SOLRIAMFETOL (JZP-110)

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Introduction: Excessive sleepiness (ES), a common symptom of obstructive sleep apnea (OSA), can persist despite primary treatment. Solriamfetol (JZP-110) is a selective dopamine and norepinephrine reuptake inhibitor with wake-promoting effects. This phase 3, 6-week, randomized-withdrawal trial evaluated the efficacy of solriamfetol for treatment of ES in OSA.

Materials and Methods: Inclusion criteria: adults ≥18 years with a diagnosis of OSA; Epworth Sleepiness Scale (ESS) score ≥10; mean sleep latency < 30 min on the Maintenance of Wakefulness Test (MWT); and current/prior use of a primary OSA therapy (e.g., positive airway pressure, oral appliance, and/or surgical intervention). Patients were initiated on once-daily oral 75mg solriamfetol titrated open-label to a maximum tolerated dose of 75mg, 150mg, or 300mg (weeks 1-2), and remained on the titrated dose for 2 additional weeks. At week 4, participants who reported “much” or “very much” improvement on the Patient Global Impression of Change (PGI-C) scale and demonstrated improvement on MWT and ESS were randomized 1:1 to placebo or to continue solriamfetol for 2 weeks. Co-primary endpoints were the change from weeks 4 to 6 in MWT mean sleep latency and ESS. The percentage of patients who reported any worsening on PGI-C at week 6 was a secondary endpoint. Comparison of solriamfetol with placebo was assessed by ANCOVA for the co-primary endpoints and chi-square test for PGI-C. Safety and tolerability, including adverse events (AEs), were evaluated.

Results: A total of 174 patients were enrolled: 61.5% male, 78.7% white, mean (SD): age 54.8 (10.5) years, BMI 33.3 (5.4) kg/m². Baseline MWT (n=171) and ESS (n=174) scores were 13.2 (7.5) min and 15.4 (3.4), respectively. The primary efficacy analysis population was n=122. In patients randomized to receive solriamfetol or placebo, scores at week 4 were 31.7 (9.2) and 29.0 (9.9) min, respectively, for the MWT, and 6.4 (4.4) and 5.9 (3.8), respectively, for the ESS. At week 6, the least square (LS) mean (SE) change in MWT sleep latency was -1.0 (1.3) min for solriamfetol and -12.1 (1.3) min for placebo (P< .0001), and the change on the ESS was -0.1 (0.7) for solriamfetol and 4.5 (0.7) for placebo (P< .0001). At week 6, 20% of patients on solriamfetol reported worsening on the PGI-C, compared with 50% on placebo (P=.0005). The most common (≥5% across solriamfetol doses) treatment emergent AEs in the titration phase were headache (9.8%), nausea (6.9%), dry mouth (6.9%), dizziness (5.7%), and insomnia (5.7%). There were no serious AEs in the study and no AEs ≥5% across solriamfetol doses in the stable dose or randomized withdrawal periods.

Conclusions: In patients who completed the 4-week open-label treatment period and showed improvement on the PGI-C, MWT, and ESS, treatment withdrawal resulted in a significant loss of efficacy on the MWT, ESS, and PGI-C relative to continued treatment with solriamfetol. Abrupt withdrawal of solriamfetol was not accompanied by discontinuation-related AEs.

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**Excessive Daytime Sleepiness (not Narcolepsy)**

**Board #074: P4 - Tuesday**

**KLEINE LEVIN SYNDROME OF THE PAMPAS: REVIEW OF DIAGNOSED CASES IN BUENOS AIRES**

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**Introduction:** Kleine-Levin syndrome is an uncommon disorder with recurrent episodes of hypersomnia, associated with behavioral abnormalities like binge eating, hypersexuality and abnormal behavior. We aim to report the first cases of the Kleine-Levin syndrome in Buenos Aires, Argentina.

**Materials and methods:** We evaluated 7 patients who had recurrent hypersomnia fulfilling the International Classification of Sleep Disorders (ICSD) criteria for a diagnosis. Psychiatric, physical and neurological symptoms and recurrence intervals and comorbidities were noted. Some patients were investigated with brain magnetic resonance imaging (MRI), Single Photon Emission Computed Tomography (SPECT), electroencephalogram (EEG) and some with polysomnography.

**Results:** 7 patients (2 females, 5 males) ranging in age from 8 to 47 years (median 20.7 years) were included in the study. The median duration of symptoms was 1.5-20 days with a mean of 8.071 days. The range of interval between episodes in months: 2.5-24 months, mean 13.21. 7 patients had a history of hypersomnia (one of them post head injury). 5 patients reported hyperphagia, 2 reduced appetite. Ictal EEG revealed evidence of sleep, while polysomnography showed reduced efficiency of sleep. MRI was performed in 5 patients. It was normal in 4 patients, 1 showed non-specific abnormalities and other diencephalic hematoma.

**Discussion:** Our paper is the first one in Buenos Aires presenting KLS of different ethiologies. The prevalence of this rare disease is difficult to estimate in our country because it may fluctuate since some areas have scarce resources and little diffusion of this syndrome.

**Acknowledgements:** Mrs Alicia Rabinovich
Excessive Daytime Sleepiness (not Narcolepsy)
Board #048: P2 - Monday

CYTOKINES AND SLEEP: EFFECTS ON DAYTIME SLEEPINESS

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Introduction: Sleep disturbances have been associated with chronic inflammation. This study examined the relationship between saliva cytokine concentrations and sleep and daytime sleepiness.

Materials and methods: Healthy young Dutch students were recruited. After a normal night of sleep (without previous day alcohol consumption) previous night sleep quality was assessed using the Groningen Sleep Quality Scale. Daytime sleepiness was assessed with the Karolinska Sleepiness Scale (KSS), and single item ratings (0, absent, to 10, extreme) of sleepiness and being tired. In addition, the Fatigue-Inertia subscale of the Dutch version of the Profile of Mood States (POMS) scale was completed. Saliva was collected to determine cytokine concentrations of GM-CSF, IFN-γ, TNF-α, IL-1β, IL-2, IL-4, IL-5, IL-6, IL-8 and IL-10. Sleepiness related outcomes were associated with cytokine levels using nonparametric Spearman correlations.

Results: N=36 healthy subjects (38.9% men) with a mean (SD) age of 21.1 (1.8) years old participated in the study. Total sleep time correlated significantly with salivary TNF-α, IL-4, IL-5, IL-6, and IL-10 concentrations. No significant correlations were found with previous night’s sleep quality. POMS-SF Fatigue-Inertia scores correlated significantly with IFN-γ and IL-2 concentrations, and KSS sleepiness scores correlated significantly with IFN-γ, IL-2, and TNF-α concentrations. The single item sleepiness and being tired score correlated significantly with IFN-γ and IL-2 concentrations.

Conclusion: A significant positive correlation was found between salivary pro-inflammatory cytokine concentrations and daytime sleepiness. Total sleep time correlated significantly with daytime concentrations of both pro- and anti-inflammatory cytokines.

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HANDHELD MOBILE BIOFEEDBACK OF HEART RATE VARIABILITY IN PATIENTS WITH CHRONIC INSOMNIA DISORDER - A PILOT STUDY

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Introduction: The hyperarousal concept in patients with insomnia has been tested by measuring autonomous variables, including electrocardiogram (ECG)-derived heart rate and heart rate variability. In stress-related insomnia an elevated nocturnal sympathetic activity was found, while parasympathetic activity was reduced. In this Pilot-study we tested the usefulness of a mobile heart-rate-variability (HRV) biofeedback device in outpatients of a specialized sleep clinic.

Materials and methods: Biofeedback of heart rate variability (HRV) was applied to 15 patients with chronic insomnia using a new mobile device named Qiu-Ball allowing regularly recorded self-measurements in the home environment. The pulse rate is measured by optical sensors at the digit of the hand. After detection of the pulse signal, HRV in synchrony with respiration (RSA) respiratory sinus arrhythmia is measured and indicated by the luminescent upper half of the device. Continuously changing colours from red to green are shown, with red light indicating low RSA and green light indicating high RSA. Three exercises of 5 min. per day were recommended.

Results: 15 subjects (5 females, 9 males) aged 25-68 (mean=52, SD=13) performed 1437 single exercise sessions lasting 5min each, practicing at home. Autonomic function was assessed before, at 4 weeks after and at the end of the 3-month training period (mean=104 days, SD=59). Training frequency ranged from 12 to 242 individual sessions (mean=101 sessions, SD=73); subjects with less than 30 sessions were excluded from analysis (4 dropouts).

The most important parameters for analysis were HF mean, RR mean, SDNN, grade of rhythmization GR. 6 patients showed positive trends of HRV parameters, in 3 subjects we found a total negative trend in technical variables, 2 subjects showed unchanged HRV. The clinical outcome did not fully correspond to the development of cardiac parameters.

Conclusions: HRV Biofeedback has been proposed as treatment tool for insomnia beforehand. [1] The used handheld spheric device (Qiu-Ball) provides evidence for good patient compliance and may also be used as a diagnostic screening tool. [2] Further studies with larger samples are needed to assess the benefit on clinical outcomes in insomnia. [3]

References:
INSOMNIA SYMPTOMS ARE RELATED TO A MISPERCEPTION OF WORKING MEMORY DEFICIT

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Introduction: Subjective reports of cognitive impairment are frequent amongst individuals with insomnia. However, objectively, it is unclear whether such impairments exist. Indeed, many studies have failed to provide objective evidence of cognitive impairment in this population, suggesting that insomnia is characterized by a misperception of daytime deficit. To date, a limited number of studies have examined subjective-objective discrepancies in cognitive impairment, providing mixed results relating to attention and psychomotor processing speed. The present study aimed to determine whether, compared to normal-sleepers, individuals displaying insomnia symptoms show a misperception of working memory deficit when assessed subjectively and objectively.

Materials and methods: Fifty individuals completed the experiment. Participants were stratified into normal-sleepers (n=22; 23.91±7.67yrs, 66% female) determined as scoring < 8 on the Insomnia Severity Index (ISI), and individuals displaying insomnia symptoms (n=28; 21.82±3.70yrs, 71% female) determined as scoring ≥ 8 on the ISI. Participants completed the Stanford Sleepiness Scale (SSS) and Working Memory Questionnaire (WMQ) assessing three domains of working memory: attention; storage; and executive control. The total score for each domain was summed to calculate the overall WMQ score. Higher scores indicate greater working memory deficits. Participants also completed three computer based tasks each designed to assess all domains of working memory. First, a corsi-blocks task required remembering and indicating the order in which a series of squares were presented. Following, numeric and alphabetic working memory tasks required stating whether an individually presented number/letter had previously been shown in a sequence participants were required to remember at the beginning of each respective (numeric/alphabetic) task. An overall objective working memory score was calculated by summing the score from each of the three tasks, with lower scores indicating greater working memory deficits. Overall subjective and objective working memory scores were analyzed between groups after controlling for sleepiness.

Results: A multivariate analysis of covariance (MANCOVA) analysis was employed with group membership (normal-sleepers vs. insomnia symptoms) as the factor, sleepiness as a covariate, and assessment type (subjective-objective) as dependant variables. The Wilk’s Lambada multivariate test of overall differences amongst groups was significant (F(3,46)=.88, P=.05). Univariate between-subjects tests demonstrated that the insomnia symptoms group (67.68±13.98) reported greater working memory deficits relative to normal-sleepers (57.55±10.95; F(1,47)=6.32, P=.015), but no differences in objective assessment (F(1,47)=.211, P=.65: INS=197.45±13.24; NS=195.92±11.91).

Conclusions: The current findings add to the body of literature suggesting that insomnia is characterised by a misperception of daytime deficit, specifically in the domain of working memory. From a cognitive perspective, this discrepancy between subjective and objective performance in working memory may be attributed to dysfunctional beliefs, attentional, and interpretive biases in relation to daytime performance. However, further research is required to clarify this standpoint both in the context of working memory and wider daytime impairments.

Acknowledgements: n/a
QUALITY OF SLEEP IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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Introduction: Poor sleep quality and insomnia are associated with metabolic disorders. This study examined the prevalence of insomnia, poor sleep quality and related risk factors among patients diagnosed with type 2 diabetes mellitus (T2DM).

Materials and methods: With a cross sectional design, 163 patients were randomly selected with diagnosis of T2DM. Demographic, anthropometric and metabolic data were used to determine the predictors of poor sleep quality and insomnia. Quality of sleep and insomnia were assessed by the Pittsburgh Sleep Quality Index (PSQI) and Insomnia Severity Index (ISI).

Results: From 163 patients, 59.5% were male. The mean age was 51.5 from 30 to 83 years. Among them 55.2% had insomnia and 65.9% had poor sleep quality. Diabetic patients with insomnia had significantly higher levels of cholesterol and diastolic blood pressure than patients without insomnia. There were no significant differences in other demographic, anthropometric and metabolic variables.

Conclusions: There is a high prevalence of insomnia and poor sleep quality in patients with T2DM, which could be considered in clinical management of these patients.
SLEEP PROBLEMS DRIVE SIMULATOR SICKNESS: RESULTS FROM A REALISTIC DRIVING SCENARIO

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Introduction: Virtual reality and simulation tools enable us to assess daytime functioning in environments that simulate real life as close as possible. Simulator sickness however poses a problem in the application of these tools, and has been related to complexity of the simulation scenario but also to pre-existing health problems. Here we show evidence on how insomnia can greatly contribute to the levels of simulator sickness.

Materials and methods: 23 chronic insomnia patients and 36 age-matched controls, all female, drove in a driving simulator covering realistic city, country and highway scenes. Insomnia was diagnosed based on DSM-V criteria, excluding clinical psychiatric and other health conditions, after which sleep quality (PSQI, ISI) and subclinical depression and anxiety symptoms (BDI, BAI) were assessed. Experiment withdrawal due to excessive simulator sickness was analyzed for both groups through a chi-square test. Simulator Sickness Questionnaire (SSQ) scores were then analyzed in those participants that could finish the experiment and filled in the questionnaire after driving (n=29 controls, n=13 patients) by a two-way analysis of variance with group (insomnia and controls) and session (before and after driving) as factors, for total scores and subscales of nausea and oculomotor symptoms. Analyses were corrected for clinically relevant covariates showing significant group differences. Corrected post-hoc tests were performed to test between-subjects effects per session.

Results: Groups differed on sleep quality and on age, depression and anxiety. 43% of the insomnia patients as opposed to 14% of controls reported excessive simulator sickness leading them to withdraw from the experiment (p = 0.011). Pre-post comparisons in the remaining participants revealed a significant main effect of group (p=0.018), age (p=0.003) and anxiety (p=0.018) on total SSQ, but no significant effect of session (p=0.136) nor an interaction effect of group and session (p=0.754). On the nausea subscale we found a significant main effect of session (p=0.006) but not of group (p=0.785), while for the oculomotor subscale, group (p=0.001) but not session (p=0.773) showed a significant effect. Post hoc analyses showed significant group differences even before driving for total SSQ (p< 0.001) and the oculomotor subscale (p=0.001) but not the nausea subscale (p=0.261). After driving, significant group differences were found for total SSQ (p< 0.001), the nausea (p< 0.001) and the oculomotor subscale (p=0.008).

Conclusions: Insomnia patients suffered dramatically more from simulator sickness than control participants; even in those that could finish the experiment, simulator sickness symptoms after driving were much higher. Before driving, insomnia patients already showed elevated oculomotor symptoms. Age and anxiety, but not depression, further drove simulator sickness symptoms. These results, as well as the realistic simulation paradigm developed, can serve to further investigate how vestibular and oculomotor functions as well as interoceptive functions are affected in insomnia. Importantly, our results have direct implications for both the actual driving experience and the wider context of deploying simulation techniques for common applications.

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Insomnia
Board #059: P5 - Wednesday
ROLE OF CRANIAL ELECTRIC STIMULATION IN TREATMENT-RESISTANT INSOMNIA: CLINICAL VERSUS POLYSOMNOGRAPHIC ASSESSMENT

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Introduction: Refractory insomnia is a term used to describe insomnia that is resistant to conventional treatments. Despite the great advance in sleep psychopharmacology, a good percentage of insomnia patients fail to show satisfactory improvement. The aim of the current study is to assess the efficacy of Cranial Electric Stimulation, as a "non-invasive" simple add-on intervention for such patients.

Materials and methods: 15 patients with treatment-resistant insomnia were enrolled in the study, from those attending the "Sleep Disorders Clinic", in the Institute of Psychiatry, Ain Shams University, Cairo, Egypt. Patients should have, at least, 6 months history of insomnia, and a minimum of two trials of insomnia medications, with a score of 21 or above, on "Pittsburg Insomnia Rating Scale". All patients were assessed, apart from Insomnia Rating Scale, as regards depressive and anxiety symptoms, using Beck Depression Inventory and Taylor Anxiety Scale, with preliminary all-night polysomnography, as an objective evaluation of sleep quality. Patients were instructed to continue on the same medications, without any change. After two weeks of daily Cranial Electric Stimulation, using "Alpha Sim-Aid" device, for 20 minutes a day, patients were re-assessed using Insomnia Rating Scale and all-night polysomnography.

Results: 8 out of the 15 patients reported satisfactory improvement on Insomnia Rating Scale; 3 patients reported some improvement, that is not satisfactory, and 4 patients showed no improvement. Patients with satisfactory improvement showed also, significant improvement in sleep quality on polysomnography, manifested as decrease in sleep latency (SL), increase in sleep efficiency (SE), decreased arousal index (AI), as well as, increase in Slow Wave Sleep (SWS). Significant Correlation between higher basic anxiety levels and improvement in sleep quality, with Cranial Electric Stimulation, has been observed.

Conclusions: Cranial Electric Stimulation is a simple, non-invasive, add-on option, which might be of help in treatment-resistant insomnia, especially in patients, with high anxiety levels.

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EXECUTIVE FUNCTIONS IMPAIRMENTS IN INSOMNIA: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Introduction: Executive functions (EFs) are a family of top-down processes involved in the control of affect and cognition. Influential models assume the presence of three core EFs: inhibitory control, working memory and cognitive flexibility. Research on these three functions in patients with insomnia has yielded mixed results. Therefore, we performed a systematic review of the literature on the three EFs of inhibitory control, working memory and cognitive flexibility in adults with a diagnosis of insomnia in order to clarify the presence and magnitude of EFs impairments in this population.

Materials and methods: PubMed, Scopus, Medline and PsycINFO were searched from inception to 2015. Inclusion criteria were: presence of a group of adult individuals with clinical insomnia, presence of a control group, presence of at least one neuropsychological test assessing inhibitory control and/or working memory and/or cognitive flexibility. Included studies underwent quality assessment. Findings were summarised using combined narrative synthesis and meta-analysis. Cohen's $d$ were calculated at 95% confidence interval as effect sizes of between groups differences. Heterogeneity of effects distribution as well as publication bias were evaluated.

Results: Twenty-four studies met the eligibility criteria and were included. Results showed impaired performance of individuals with insomnia as compared to controls on tasks of inhibitory control with an effect of small to medium magnitude ($d = .31, 95\% CI: .50 - .11$) and homogeneous distribution ($Q = 3.356, df = 8, p = 0.910; I^2 = 0.000$). Visual examination of the funnel plot suggested reasonable symmetry indicating low chance of publication bias. We were limited in performing meta-analyses on working memory and cognitive flexibility due to the small number of studies and high variability of outcome measures.

Conclusions: Using meta-analysis, we showed that individuals with insomnia perform poorer than good sleepers on tasks of inhibitory control. Due to the high variability of outcome measures and small number of studies, we were not able to statistically estimate the magnitude of impairments with respect to working memory and cognitive flexibility tasks. To overcome these limitations and advance knowledge of EFs in insomnia, future studies are warranted adopting comparable outcome measures.

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DRIVING AFTER ALCOHOL CONSUMPTION IS ASSOCIATED WITH INSUFFICIENT SLEEP AND INSOMNIA AMONG STUDENT ATHLETES AND NON-ATHLETES

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Introduction: The proportion of university/college students consuming alcohol is similar to the number of those reporting poor sleep quality, at about 60%. The proportion is even greater in Students Athletes (SA). What still remains to be understood is if sleep difficulties potentiate risky behaviors such as driving under the influence of alcohol.

Aim: The aim of the present study was to examine the association between sleep difficulties, insomnia symptoms and insufficient sleep on the risk of driving under the influence of alcohol in a sample of university/college students. Moreover, a secondary aim was to examine whether these associations were more pertinent in SA than in Student Non-Athletes (SNA).

Materials and methods: Data from the National University/college Health Assessment was used from the years 2011-2014, resulting in data from N=27,774 in 2011, N=28,237 in 2012, N=32,964 in 2013, and N=25,841 in 2014. Questions on the number of drinks consumed and driving after drinking alcohol were then related to answers to questions pertaining to sleep difficulties, insufficient sleep, and insomnia symptoms.

Results: Chi-squares analyses showed that the sample comprised more women than men, $\chi^2(2) = 111.59, p > 0.05$, both groups being composed of more women than men while proportionally more men were SA than SNA. Mean alcohol intake during the last period of socializing was of about 3.2 drinks (SD=3.8); SA consumed significantly more than SNA. Number of binge episodes was also significantly higher among SA, compared to SNA. Chi-square analyses showed that SNA were more likely to report difficulty sleeping and insomnia than SA ($\chi^2$ respectively of 168.70 and 33.49; $p< 0.0001$). Also, SNA were more likely to report insufficient sleep than SA ($t(111,496)=4.90, p < 0.001$). Thus, SA are generally less likely to report sleep disturbances than SNA. However, a reported difficulty sleeping was associated with an increased likelihood of driving after any drinks and after 5 or more drinks in both groups, but the effects were stronger in SA. Moreover, SNA with insomnia were less than 1% more likely to drive after any drinks and 26% more likely to drive after 5 or more drinks, compared to those without insomnia. In comparison, SA with insomnia were 32% more likely to drive after any drinks and 93% more likely to drive after 5 or more drinks, compared to SA without insomnia.

Conclusion: The present study found that a self-reported difficulty sleeping, insomnia symptoms, and insufficient sleep are associated with driving after drinking alcohol. This relationship applied to driving after any alcohol, and driving after binge drinking episodes. This relationship was stronger among SA than it was for non-SA. These results suggest that sleep disturbances are an independent risk factor for the activity of driving after drinking alcohol. Future research should aim to determine whether drink driving could be reduced by improving sleep health.

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Introduction: The Insomnia Severity Index (ISI) is a widely used outcome measure in insomnia treatment studies. An ISI score of less than 8 has been proposed to define insomnia remission. The objective of this study was to explore the association between ISI-defined remission, sleep diary data, clinician report, and patient's perception of sleep status and improvement following treatment.

Materials and methods: This abstract presents secondary analyses combining data from two insomnia treatment studies (study 1: Morin et al. JAMA 2009; study 2: Harvey et al. JCCP 2014). The total sample includes 348 adults with chronic insomnia (mean age = 48.7±11.6 years; 62% women). In study 1, participants were randomized to group cognitive-behavioral therapy for insomnia (CBT-I) for six weekly sessions, either alone (n=80), or combined to nightly zolpidem (n=80); in study 2, participants were randomized to individual behavioral therapy (n=63), cognitive therapy (n=65), or CBT-I (n=60), for eight weekly sessions. Post-treatment assessments included a two-week sleep diary, the ISI (participant and clinician versions), and a treatment evaluation questionnaire (TEQ). Based on the self-reported ISI, participants were classified as being in remission (ISI < 8) or not (ISI ≥ 8). Post-treatment sleep diary parameters (sleep onset latency [SOL], wake after sleep onset [WASO], total sleep time [TST], sleep efficiency [SE]), and selected items of the TEQ were compared for remitted and non-remitted cases across all treatment conditions.

Results: Of the 315 participants who completed the post-treatment ISI, 140 (44%) were considered to be in remission and 175 (56%) were not. Remission rate was higher (60%) based on the clinician ISI; 36% of non-remitters on self-report were classified as remitters on clinician-report, while only 12% of the self-reported remitters were non-remitters based on the clinician ISI. On the TEQ, 17% of remitters considered that they still had insomnia and 12% that they needed additional treatment for insomnia (scores > 5 on 0-to-10 scales). Conversely, 32% of non-remitters considered that they did not have insomnia anymore and 46% that they did not need additional treatment for insomnia (scores < 5 on 0-to-10 scales). According to the sleep diary, 18% of the 140 remitted patients had at least 3 nights per week with a SOL or WASO > 30 minutes, 29% a mean TST of < 6 hours and 13% of < 5.5 hours, and 20% a mean SE < 85%. By contrast, 56% of the 175 non-remitters had less than 3 nights per week with a SOL or WASO > 30 minutes, and 49% had a mean SE ≥ 85%.

Conclusions: These results suggest that while the ISI remission cutoff generally agrees with other outcome measures, some individuals may still be misclassified. Misclassification is more likely for non-remitted than for remitted individuals. It may be that in some instances, responses of participants on the ISI are more indicative of their level of improvement, relative to baseline severity, than of their actual sleep.

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Insomnia
Board #017: P3 - Tuesday
SELF-REPORTED SLEEP CHARACTERISTICS IN A MULTI-ETHNIC ASIAN POPULATION: THE SINGAPORE HEALTH STUDIES

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Objectives: There has been limited data on sleep across ethnicities in Asia. We aimed to estimate the prevalence of poor sleep in Singapore, a multi-ethnic Asian population and examine associations with sociodemographic characteristics, lifestyle factors and comorbidities. We compared prevalence of poor sleep among Chinese, Malays and Indians.

Methods: The Singapore Health 2012 and Singapore Health 2 (conducted in 2014) were two population-based surveys that comprised interviews by trained personnel on medical history together with health screening assessing conditions such as hypertension and diabetes. A sample of 4666 participants aged 18 to 79 years from these two surveys completed the Pittsburgh Sleep Quality Index (PSQI).

Results: The estimated prevalence of poor sleep, defined as PSQI score > 5, was 21.5% and 26.8% in 2012 and 2014, respectively. Malays had the highest percentage of poor sleep (31.8%), followed by Indians (27.8%) and Chinese (25.4%). The oldest age group of ≥ 65 years had the highest percentage of poor sleep (35.6%), followed by the youngest age group of 18-24 years (29.1%). In multivariable logistic regression analysis, Malay ethnicity remained a significant predictor of poor sleep; other significant predictors were chronic joint pain, cancer, arthritis, cardiovascular disease, type 2 diabetes, a low household income and smoking.

Conclusion: Poor sleep is prevalent among Singaporeans and varies by ethnicity. Malays had increased odds for poor sleep compared to Chinese even after adjustment for sociodemographic factors and health status. Sleep could represent a modifiable risk factor for observed ethnic disparities in cardiovascular disease and metabolic disorders.
DIFFERENT STRATEGIES FOR CULTURAL ADAPTATION OF PSYCHOTHERAPY: A RANDOMIZED CONTROLLED TRIAL FOR INSOMNIA

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Introduction: Two main approaches exist for cultural adaptation of psychotherapy: indigenization from within and from without. It is unclear which one is more efficient. The objective of this study is to compare the efficacy on insomnia of a locally developed psychotherapy, Thought Induction Psychotherapy in a lowered resistance state (TIP), to Cognitive Behavioral Therapy (CBT) adapted to local culture.

Materials and methods: Sixty insomniac adults (mean age = 48.31 y, female = 47) were randomly assigned either to eight sessions of TIP or eight sessions of CBT. Participants completed 1-week sleep diaries and several self-report scales at baseline and post-treatment.

Results: Except sleep onset latency in TIP group, every measures improved significantly after treatment compared to baseline in both group. No significant difference was found in insomnia severity, dysfunctional beliefs about sleep, depression, and anxiety measured by self-report scales and total sleep time measured by sleep diaries between the two groups after treatment, but CBT group showed significantly better improvements in sleep onset latency, wake after sleep onset and sleep efficiency.

Conclusion: Both cultural adaptation strategies are efficient to treat insomnia in Chinese insomnia patients, but indigenization from without (i.e. CBT) has a better effect than indigenization from within (i.e. TIP) on sleep quantitative measures.

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Insomnia
Board #018: P3 - Tuesday
THE EFFECTIVENESS OF AN ONLINE INTERACTIVE CBT-I TREATMENT

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Introduction: Insomnia is a common health problem with serious mental and physical consequences as well as increased economical costs. The use of hypnotics in Iceland is immense in spite of cognitive behavioral therapy for insomnia (CBT-I) being recommended as the first choice treatment of chronic insomnia. To meet the needs of more individuals suffering from insomnia, online CBT-I was established. The objective of this research was to evaluate the effectiveness of this internet-based CBT-I.

Materials and methods: One hundred seventy-five users (mean age 46y (18-79y)) started a 6 week online intervention for insomnia. The drop-out rate was 29%, leaving a final sample of 125 users. The intervention is based on well-established face-to-face CBT-I. Sleep diaries were used to determine changes in sleep efficiency, sleep onset latency and wake after sleep onset. Treatment effects were assessed after 6 weeks of treatment and at the 6 week follow-up.

Results: Significant improvement was found in all main sleep variables except for 5% decrease in total sleep time (TST). Effects were sustained at 6 week follow-up and TST increased. The use of hypnotics decreased significantly. This form of treatment seems to suit its users very well and over 94% would recommend the treatment.

Conclusions: Internet interventions for insomnia seem to have good potential. CBT-I will hopefully be offered as the first line treatment for chronic insomnia in Iceland instead of hypnotics as the availability of the CBT-I is growing. Thus, the burden on health care clinics might reduce along with the hypnotics use and the considerable costs of insomnia.
HYPERACTIVITY OF THE OREXIN SYSTEM AND CHRONIC INSOMNIA IN A MOUSE MODEL OF ALCOHOL DEPENDENCE

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Introduction: Chronic insomnia associated with alcohol use disorder (AUD) is an important risk actor for relapse. The neural basis of this type of insomnia are unknown hindering its effective treatment. Worst, there is little empirical evidence whether commonly used animal models of AUD also reproduce the sleep disturbances reported by human alcoholics. Here we study whether a validated mouse model of alcohol dependence, it also shows protracted insomnia. The rodent model of Chronic Intermittent Ethanol Exposure (CIEE) produces an escalation in alcohol consumption and withdrawal symptoms that are hallmarks of AUD in humans. Since insomnia in humans has been explained as an hyperarousal state, we also tested whether blocking orexin receptors would ameliorate insomnia in alcohol dependent mice.

Materials and methods: In five adult male C57BL WT mice, baseline sleep was recorded for a week and then the mice underwent four weekly cycles of CIEE. In each CIEE cycle mice were exposed to ethanol vapors for 16 hr/day for four days. Blood ethanol concentrations (BEC) were measured once in every CIEE cycle. Sleep was continuously recorded across all four cycles of CIEE and for at least two months following the last CIEE cycle. In a separate group of nine mice, a Dual Orexin Antagonist (DORA22; Merck) was given orally in two doses (100 and 200 mg/kg) during the protracted insomnia phase following 4 cycles of CIEE. DORA22 was given prior light onset. Similarly to the first group, sleep was also recorded and BEC measured for the second group of mice. At the end and during the first hours after lights onset (peak of insomnia) the brains of these mice were harvested for assessing a marker of neuronal activity (c-FOS).

Results: BEC averaged 177 mg/dL across the four cycles of CIEE indicating high levels of intoxication. During CIEE, sleep was significantly increased during the night and day. However, as early as the first short withdrawal period, mice showed significant insomnia (34% more wake; P< 0.017) during the lights-on phase. The insomnia was still present two weeks after the end of the last CIEE cycle (+29%; P< 0.025) and reduced both types of sleep. Interestingly insomnia returned following a brief exposure of mice to CIEE cues. DORA22 at dose of 100 and 200 mg p.o. blocked significantly protracted insomnia in alcohol dependent mice. DORA22 also was effective blocking the resurgence of insomnia following CIEE cues. Preliminary data also indicated that insomnia showed by the alcohol dependent mice is associated with increased activity of orexin neurons.

Conclusions: Our data support that chronic exposure to alcohol causes protracted insomnia in mice and that the orexin system may account for this sleep disturbance making orexin receptors antagonists a safer pharmacological alternative to traditional hypnotics.

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Insomnia
Board #019: P3 - Tuesday
PREVALENCE OF INSOMNIA AND ASSOCIATED SOCIO-DEMOGRAPHIC FACTORS IN THE RUSSIAN POPULATION: THE ESSE-RF STUDY

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Introduction: Insomnia is one of the most common sleep disorder associated mostly with psychological and social factors. However insomnia prevalence hasn’t been investigated in the Russian population yet.

Materials and methods: We analyzed data from participants of the cohort study Epidemiology of cardiovascular disease in various regions of the Russian Federation - ESSE-RF (Russian) population aged 25-64 years from 13 regions of the Russian Federation. They were interviewed about sleep complaints during the last month: difficulties falling asleep, maintaining sleep, sleepiness and sleeping pill intake. Responses with complaints occurring at least three times a week were considered as insomnia symptoms. Social and demographics parameters from survey included: age, gender, education, marital status, job/employment, type of housing

Results: Were analyzed for 20359 participants, mean age 49 (25; 65) years, including 7746 males and 12613 females. The prevalence of difficulties initiating sleep was 12,42% for men and 20,21% for women ($\chi^2=468,552$, $p<0,001$), maintaining sleep - 8,58% for men and 16,65% ($\chi^2=708,539$, $p<0,001$), sleepiness for 5,07% for men and 7,02% ($\chi^2=103,119$, $p<0,001$), sleeping pills - 1,46% for men and 3,75% ($\chi^2=390,148$, $p<0,001$). Insomnia symptoms complaints increased with age for difficulties initiating sleep - from 11,39% to 24,74% ($\chi^2=382,794$, $p<0,001$), for difficulties maintaining sleep - from 5,91% to 20,41% ($\chi^2=571,148$, $p<0,001$), for sleeping pills intake - from 1,46% to 4,77% ($\chi^2=382,794$, $p=0,820$). Sleepiness hadn’t so significant changes - from 6,07% to 6,20% ($\chi^2=0,920$, $p<0,001$). Divorced and widowed had the highest rate of difficulties initiating and maintaining sleep - 19,21%/28,37% and 15,47%/24,81%. Retired and disabled had the highest rate of insomnia complaints - 30,15%/33,94% for initiating sleep, 25,10%/30,35% for maintaining sleep, 5,31%/12,22% for sleeping pills intake. Living in communal apartments and other types of housing had highest rate of insomnia complaints - 21,84%/22,14% for initiating sleep, 15,57%/19,56% for maintaining sleep, 9%/9,26% for sleepiness and 4,39%/4,43% for sleeping pills intake.

Conclusions: Prevalence of insomnia complaints is higher for initiating and maintaining sleep, higher women and increase with age. Insomnia complaints are higher for divorced and widowed, retired and disabled, lived in in communal apartments and other types of housing.

Acknowledgements: For investigators of the ESSE-RF study from 13 regions Russia
The work is supported by the grant of the Russian Science Foundation, project #17-75-10099
Insomnia
Board #061: P5 - Wednesday
THE PHARMACOLOGY OF DRUGS WITH HYPNOTIC EFFECT AND THEIR INFLUENCE ON SLEEP ARCHITECTURE

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Introduction: Insomnia is a disease of high global prevalence, multifactorial, with a high risk of transformation in a chronic disease due to improper management: inappropriate medical treatment (not taking into account the etiology of insomnia, the necessary dosages, the timetable and duration of administration) and the disregard of non-pharmacological treatments.

Materials and methods: An analysis of the latest scientific sources has been carried out using the PubMed search engines, "HINARI" and Google Academic with the help of keywords: hypnotics, adverse effects, sleep architecture.

Results: The hypnotics of various groups (benzodiazepines, antihistamines, non-benzodiazepines, antidepressants) have common adverse effects of addiction, tolerance and chronic insomnia. The use of hypnotics in case of apnea is useless because respiratory pauses do not disappear, which keeps the patient in a superficial sleep and only treatment with CPAP would solve the problem. Insomnia resulting from circadian rhythm disorders requires treatment to correct the day-night regimen, and insomnia caused by anxiety and depression can be improved by treating these disorders.

Conclusions: Prolonged use of hypnotics leads to the installation of tolerance and addiction. Insomnia is improved for a short period of time, but prolonged use leads to development of chronic insomnia. For the correct treatment of insomnia it is necessary a complex etiological approach.

Acknowledgements: Rakovskaya Tatiana
Insomnia
Poster 3
PREVALENCE, TYPES, PREDICTORS, AND CO-OCCURRING FACTORS OF SLEEP DISTURBANCES IN CHILDHOOD TRAUMATIC BRAIN INJURY: A SYSTEMATIC REVIEW

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Introduction: Sleep disturbances are common after childhood traumatic brain injury (TBI). This systematic review aimed to assess the prevalence, types, and predictors of sleep disturbances in this population, and to assess the relationship between sleep disturbances, fatigue, depression and quality of life.

Materials and methods: Medline, Pubmed, PsychInfo, Web of Science, and EMBASE databases were searched. Out of the 547 articles assessed, 15 met selection criteria for this review.

Results: Sleep disturbances were common in children and adolescents with TBI, irrespective of injury severity. Excessive daytime sleepiness and insomnia were the most common sleep disturbances reported. Difficulty with sleep maintenance was the most common insomnia symptom in mild TBI, while delayed sleep onset was typical in moderate and severe TBI. Sleep disturbance was predicted by sex, injury severity, pre-existing sleep disturbances, younger age, pain, and high body mass index. Sleep disturbance was related to depression and QoL.

Conclusions: Sleep disturbances are highly prevalent in childhood TBI, regardless of the injury severity. Routine assessment of sleep in survivors of childhood TBI is recommended.

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INTERNET-BASED COGNITIVE BEHAVIOURAL THERAPY FOR INSOMNIA COMORBID WITH CHRONIC PAIN

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Introduction: Both chronic pain and sleep disturbances are common and potentially very disabling problems (Smith and Haythornthwaite, 2004). At least 6 % of the population suffer from chronic insomnia (Ohayon, 2002), and the prevalence of longstanding pain is 19 % (Breivik et al., 2006). However, the prevalence of insomnia among individuals with chronic pain seems to be around 50% (Sivertsen et al., 2009). Cognitive behavioural therapy for insomnia (CBT-I) has been shown effective for both primary and comorbid insomnia (Morgenthaler et al., 2006), among other for people with chronic pain (Tang, 2009). Internet-based CBT-I seems to be an applicable alternative to traditional CBT-I (Zachariae et al., 2015), but the effect on insomnia comorbid with chronic pain has not yet been studied.

Materials and methods: In this on-going study 100 subjects, derived from a university hospital pain clinic, with insomnia comorbid with chronic pain will be randomised to one of two internet-based insomnia treatments: CBT-I (sleep restriction, stimulus control and cognitive restructuring) (Jernelov et al., 2012) or applied relaxation, AR (progressive muscular relaxation) (Ost, 1987). The treatments comprise eight text-based modules delivered over a period of eight weeks, designed to target insomnia alone, not pain. Therapist support is provided via the internet during the whole treatment. Primary outcome measure is subjective sleep problems assessed with the Insomnia severity index, ISI (Bastien et al., 2001). The hypothesis is that the subjects that receive CBT-I, i.e. the experiment group, will show a greater reduction of insomnia symptoms after treatment than the group that receives AR, i.e. the control group.

Results: An initial analysis of the first 30 subjects did not show any significant differences between the two treatment groups over time, $F(1, 28)=1.83, p=.187$. The effect size (within) for the CBT-I group was however to be considered high, $d=0.97$, and the mean ISI score for the experiment group went from 17,9 (clinical insomnia of moderate severity) to 12,9 (subthreshold insomnia). The effect size for the control group (AR) was medium sized, $d=0.60$, and the mean ISI score remained in the "clinical insomnia" range, decreasing from 19.0 to 16.2.

Conclusions: This interim analysis failed to show a statistical significant difference between the two groups, probably due to low power. Nevertheless, the large effect size for the treatment group indicates that internet-based CBT-I for insomnia comorbid with chronic pain may be a promising treatment option. Further analyses when the whole sample of 100 subjects has been treated are needed to clarify any potential benefits of the treatment.
Insomnia
Board #044: P1 - Monday
LACK OF RESILIENCE IS RELATED TO HYPERAROUSAL, EMOTION DYSREGULATION AND INCREASED IMPULSIVITY IN INSOMNIA DISORDER

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Introduction: According to the diathesis-stress model of insomnia, a vulnerability to developing it may lead to insomnia in response to stress. Recently, there has been a paradigm shift in the understanding of resilience in context of stress- risk-vulnerability dimension. Psychological resilience is a psychobiological factor which determines individual’s capacity to adapt successfully to stressful events. Lower level of resilience increases vulnerability for developing mental disorders. Because emotion and arousal regulation is a key factor in insomnia the aim was to explore the level of resilience in subjects with insomnia and its relationship with emotion and arousal regulation.

Methods: The study consisted of 48 subjects with Insomnia disorder according to the DSM-5 and 35 good sleepers. Insomnia Severity Index (ISI), Resilience Scale for Adults (RSA), Difficulties in Emotion Regulation Scale (DERS), Arousal Predisposition Scale (APS) Pre-sleep Arousal Scale (PSAS) were administered while controlling for anxiety and depressive symptoms. Differences in means between groups were assessed using t-test or Mann-Whitney U/Wilcoxon test. Univariate/ multivariate regression analyses and mediation analyses were performed. Results Subjects with Insomnia (F 24, mean age 49 ± 2.1) presented higher ISI, RSA, DERS,APS and PSAS scores than good sleepers (F 22, mean age 47.2 ± 1.2) (ISI: 15.7 ± 5.8 vs 5.1 ± 0.6, p< .01; RSA 96.2 ± 9.5 vs 45 ± 15, p< .01; DERS: 83.1 ± 3.3 vs 24.1 ± 12.1, p< .01; APS:36.6 ± 10.1 vs 24.4± 4.4, PSAS Cognitive 23.3 ± 11 vs 10 ± 0.6, p< .01, PSAS Somatic 16.1 ± 7 vs 10.2 ± 1.2, p< .01). After checking for anxiety/depressive symptoms, low level of resilience correlated to emotion dysregulation (coeff =0.07, p=0.04) especially impulsivity (coeff=0.5, p=0.008), trait and pre-sleep state cognitive hyperarousal (coeff=0.32, p=0.007, coeff=0.42, p=0.003). Low level of resilience mediated the relationship between hyperarousal trait and emotion dysregulation/impulsivity (Z=2.02, SE=0.06, p=0.02), while emotion dysregulation mediated the relationship between low level of resilience and cognitive hyperarousal (Z=2.03, SE=0.08, p=0.04).

Conclusion: Subjects with insomnia show low level of resilience that is considered a mechanism of successful adaptation to stressors. In insomnia, low level of resilience is related to emotional dysregulation and to hyperarousal. In particular, lack of resilience may mediate the relationship between hyperarousal trait and emotion dysregulation which can play a role increasing arousal in the pre sleep period. If resilience helps to minimize the extent of pathogenesis in developmental process an early identification of vulnerable candidates should be useful for preventing insomnia development and maintenance.
DEPRESSIVE SYMPTOMS IN INSOMNIA: LONG-TERM CHANGES AFTER COGNITIVE-BEHAVIORAL THERAPY FOR INSOMNIA (CBT-I)

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Introduction: Literature suggests that insomnia and depressive symptoms often co-exist. The first line treatment for insomnia, Cognitive behavioral therapy (CBT-I), has been demonstrated to be effective also on symptoms of depression. Aim of this study was to evaluate depressive symptom severity at the end of 7-session CBT-I treatment (T1) and at a long-term follow-up of a mean of 7.8±1.6 years (range 4-10 years) (T2).

Materials and methods: Non-randomized retrospective study of 294 sleep clinic patients with chronic insomnia (mean age 40.7±12.3, 38.4% males, 61.6% females). All patients completed 7-session group CBT-I. Based on a cut-off of 14 on the Beck Depression Inventory (BDI) patients were divided in low depression (LD) and high depression (HD) groups.

Results: ISI and BDI scores significantly decreased in both LD and HD groups compared to baseline (T0) at the end of treatment (T1) and at the long-term follow-up (T2) (p< .001). HD group improved more than LD group in both ISI and BDI scores. ISI scores of the LD patients were 15.9±4.3 at T0, 9±3.9 at T1, p< .05 and 8.5±5.2 at T2. BDI was 7.8±3.5 at T0, 4.8±3.6 at T1 p< .05 and 5.7±3.7 at T2. Delta score for ISI at T1 was 7.5±4.8 and 6.5±5.1 at T2 while for BDI 2.8±5.1 at T1 and 0.59±6.1 at T2. HD patient's ISI scores were 19.5±3.7 at T0, 12.7±4.8 at T1 p< .05 and 15.6±6.5 at T2. Delta score for ISI at T1 was 8.8±5 and 8.1±7.1 at T2 while for BDI 9.9±7 at T1 and 6±8.2 at T2.

Conclusions: Our study showed that CBT-I improved not only insomnia severity but also comorbid depressive symptoms at the end of treatment. At the long-term follow-up evaluation improvements were sustained after a mean of 7.8 years after the end of acute treatment. Greater depression symptoms did not lead to poorer response to CBT. Overall, the benefits of CBT-I are sustained long-term, and extend beyond insomnia including a reduction in depressive symptoms severity.
Introduction: Some empirical data and clinical observation suggest that people with chronic insomnia have difficulties in assertiveness. However, the literature on this relationship is very poor. Some studies show that low assertiveness is linked to higher severity of depression. Additionally, several studies support the role of insomnia in predicting the onset of depression. The aim of this exploratory cross-sectional study is to evaluate if assertiveness predicts depression directly and/or indirectly through the mediation of insomnia.

Materials and methods: The sample consisted of 374 young university students aged 19-35 years (M = 20.87 ± 2.02), of whom 75.4% were female. Participants completed different self report questionnaires: the Insomnia Severity Index (ISI); the Beck Depression Inventory-II (BDI-II); the Scale for Interpersonal Behavior (SIB) which allow to distinguish Assertive performance and Distress of assertiveness. Questionnaires were administered in group at the end of academic lessons.

Results: Participants were classified according to their insomnia severity into Subclinical Insomnia (SI): ISI < 11 = 304 and Clinical Insomnia (CI): ISI > 11 = 66. Results of one-way ANOVAs evidenced that the CI group reported higher scores in the Distress of assertiveness scale (M = 66.38 ± 15.54) compared to the SI group (M = 58.03 ± 16.25; F(1,368) = 14.54, p < .001). They also reported less scores in the Assertive performance subscale, despite this difference was only marginally significant (F(1,367) = 3.09, p = .08). A significant difference emerged in the BDI-II scores (F(1,288) = 50.86, p < .001): the CI group reported higher level of depression (M = 16.18 ± 9.50) compared to the SI group (M = 8.33 ± 7.02). The relationship between assertiveness, insomnia and depression were also explored using two mediation models in which the scores of Distress and Performance of the SIB were inserted as independent variable, ISI score ad mediator and BDI-II score as dependent variable. The first model showed that Distress of assertiveness predicts directly (R= .17, p < .001) and indirectly (R= .06, p=.001 and R= .78, p < .001) depression severity, through the median of insomnia. The second model showed that Assertive performance (R= .07, p=.027) and Insomnia (R=.78, p< .001) predict directly and independently depression severity.

Conclusions: Results suggest that the distress associated to assertive or non assertive behaviors predicts the severity of depressive symptoms both directly and indirectly, through the mediation of insomnia. Conversely, behaving assertively (Assertive performance) may have protective effects and reduce depression severity. If confirmed through longitudinal data, these results may have an impact on clinical practice, suggesting the importance of including training to improve assertiveness in the treatment of patients with depression and insomnia.
ASSOCIATION BETWEEN STRESS-INDUCED AROUSAL AND NOCTURNAL SLEEP: A PRELIMINARY STUDY

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Introduction: Stress and hyperarousal contribute to insomnia. Elevated sleep reactivity, characterized by increased sensitivity in physiological stress response and sleep system, might also constitute a vulnerability to future insomnia. The present study examined acute stress-induced arousal and its impacts on subsequent nocturnal sleep in individuals with insomnia and good sleepers with high or low vulnerability to insomnia.

Materials and methods: Participants (26.7±5.3 years; 66.7% female) were adults with insomnia (INS; n=10) and good sleepers (n=20). Based on the Ford Insomnia Response to Stress Test (score of 20), good sleepers were further sub-divided into high vulnerability (HV; n=10) and low vulnerability (LV; n=10) to insomnia groups. Participants underwent two nights of polysomnography. In the evening preceding the second night, the Trier Social Stress Test (TSST) was administered. Physiological arousal variables included salivary cortisol, heart rate (HR), heart rate variability (i.e., HF, LF/HF ratio), and blood pressure (BP). Subjective arousal was assessed with the Pre-Sleep Arousal Scale.

Results: Cortisol, HR, and systolic BP were significantly elevated in response to the TSST in all groups (all ps < .05). The INS group showed greater cortisol response (p < .05) and higher cortisol secretion at bedtime (p < .05), and higher pre-sleep cognitive arousal (p < .01) than the LV group; HV participants did not significantly differ from those in INS or LV groups. After controlling for insomnia, increased cortisol response (r = .33, p= .030) and elevated LF/HF ratio (r = .44, p = .018) were each significantly associated with longer nocturnal awakenings. Heightened BP was significantly associated with longer sleep onset latency (ravg = .40, p< .05), shorter total sleep time (ravg= -.54, p < .01), and reduced sleep efficiency (ravg= - .41, p < .05).

Conclusions: Overall, these findings support the hyperarousal conceptualization of insomnia and indirectly suggest that increased stress reactivity and bedtime hyperarousal might represent a trait-like vulnerability in certain good sleepers. More research is warranted to validate and expand our preliminary findings.

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Introduction: Prioritizing the dissemination of cognitive-behavioral therapy for insomnia (CBT-I) has led to a proliferation of adaptive CBT-I programs intended for a wide patient-reach. Such programs capitalize on the availability of underutilized health personnel and resources. However, many of these interventions are developed and tested in controlled experimental conditions, away from the constraints of practice. This factor may limit the transferability of CBT-I into priority settings such as primary care. Therefore, the aim of this systematic review is to synthesize the current state of adaptive CBT-I programs implemented in primary care settings.

Materials and methods: A literature search was carried out across biomedical databases (i.e., MEDLINE, CINHAL, PsycINFO, PubMed and Scopus) and the Cochrane Central Registry of Controlled Trials. Manual snowballing was used to identify additional studies. Studies meeting inclusion criteria were randomized clinical trials of CBT-I interventions implemented at a primary care setting and published in English up until 2017. Primary care is denoted as a basic health care setting where patients might seek help directly for their insomnia without a referral. The current review adhered to the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) standards.

Results: A total of 804 articles were retrieved from the literature search. The full texts of 156 articles were retrieved. After removing duplicates and including snowballed articles, 109 articles were subjected to further scrutiny against the inclusion criteria. Twelve studies published between 2001 and 2016 were included in this review. In total, there were 1622 participants with a mean age range of 37.5 to 55 years. Study populations included middle-to-late aged adults with insomnia \( (n = 9) \), elderly with insomnia \( (n = 2) \) and insomnia comorbid with osteoarthritis \( (n = 1) \). Practice settings included primary care \( (n = 7) \), rural health clinics \( (n = 2) \), community centers \( (n = 2) \) and a workplace health clinic \( (n = 1) \). Providers included social workers/ counselors \( (n=6) \), psychologists/ psychology students \( (n=2) \), psychological wellbeing practitioners \( (n=1) \), general practitioners \( (n=2) \), pharmacists \( (n=1) \), nurses \( (n= 3) \), occupational health physicians \( (n=1) \) and digital interfaces \( (n=1) \). Interventions utilized different components of CBT-I including stimulus control \( (n=11) \), sleep restriction \( (n = 9) \), relaxation \( (n = 7) \), cognitive therapy \( (n = 6) \) and psycho-education \( (n = 12) \). Timeframes of implementation ranged from 1 day to 3 months. Whilst sleep diaries were commonly used \( (n=10) \), the reporting of quantitative sleep parameters (e.g., sleep efficiency) varied across studies. However, the Insomnia Severity Index \( (n = 8) \) and Pittsburgh Sleep Quality Index \( (n=4) \) were frequently reported primary outcome measures.

Conclusion: These findings highlight the adaptive potential of CBT-I programs to diverse clinical contexts. However, no single outcome measure was used consistently across 12 studies, which perhaps reflects the unique practice constraints when adapting CBT-I programs to the respective settings. Standardization of assessment tools and collection time-points are important areas warranting further development in strengthening the evidence base for adaptive CBT-I programs.

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Insomnia
Board #062: P5 - Wednesday
TRAJECTORIES OF USE OF OVER-THE-COUNTER AND NATURAL PRODUCTS FOR SLEEP: A FIVE YEAR FOLLOW-UP

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Introduction: Over-the-counter (OTC) and natural products (NP) are frequently used to manage insomnia symptoms, albeit with limited evidence on their risks and benefits. Despite high rates of self-prescribed sleep aids, the exact patterns and trajectories of OTC and NP use over an extended period of time have not been studied. Therefore, the aim of this study was to investigate sleep-related self-medicating trends and patterns in a Canadian population-based sample. A secondary aim was to characterize the usage frequency in a sub-sample reporting the use of OTCs and NPs in the past year.

Materials and methods: Data were derived from a longitudinal study of the natural history of insomnia. Participants were 3416 adults (mean age = 49.7 years old ±14.7; 62% women) selected from the general population. Self-reported OTC (e.g., antihistamines) and NP (e.g., melatonin, valerian) usage data were extracted across seven time points over five years. Latent class growth modelling (SAS PROC TRAJ, binary or normally distributed outcome) was used to identify clusters of patients with distinct self-medicating temporal trajectories for OTC/NP usage. Additional analyses on usage frequency (nights/week) were conducted in the sub-sample of OTC (n=606) and NP (n=794) users in the last 12 months. Sampling weights were applied to all analyses to adjust for partial non-response.

Results: Within the total sample, a four latent classes solution showed the best fit for OTC usage: Class 1 (non-users, 71%), Class 2 (gradual increase, 15%), Class 3 (gradual decrease, 8%) and Class 4 (persistent high use, 6%). The usage of NPs also fell into four latent classes: Class 1 (non-users, 78%), Class 2 (increase followed by slow decline, 8%), Class 3 (gradual decrease, 8%) and Class 4 (persistent high use, 6%). Within the sub-sample of users in the last 12 months, a large proportion reported the use of OTC (80%) and NP (70%) in the previous month. Usage frequency for OTCs comprised of four latent classes: Class 1 (sharp increase followed by decline, 17%), Class 2 (persistent infrequent use, 54%), Class 3 (decline followed by sharp increase, 21%) and Class 4 (persistent frequent use, 10%). For NP users, greater variability in usage frequency was observed, giving rise to five latent classes: Class 1 (persistent infrequent use, 30%), Class 2 (persistent moderate use, 37%), Class 3 (wide variability with decreasing trend, 9%), Class 4 (wide variability with increasing trend, 14%) and Class 5 (persistent frequent use, 10%).

Conclusion: Trends observed among OTC/NP users not only suggest chronicity but highlight diverse temporal trajectories of self-medication practices over time. Identifying distinct self-medication patterns among people with sleep complaints may provide important insight for understanding patient help-seeking behaviors.

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SLEEP AND MOOD DISTURBANCES IN SURGICAL MENOPAUSAL WOMEN COMPARED TO NATURAL MENOPAUSAL WOMEN

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Introduction: There is a high prevalence of sleep and mood disturbances among menopausal women. However, few studies have investigated about the differences of sleep behavior and mood in natural and surgical menopausal women.

Materials and methods: This study utilized a subsample from the community-based sample from the Korean Genome and Epidemiology study (KoGES). Participants were 526 post-menopausal women (mean age 60.2 ± 7.64). Each participant completed self-report questionnaires about insomnia symptoms (Insomnia Severity Index), hyperarousal (Hyperarousal Scale), sleep-interfering behaviors (Sleep Behavior Scale), depression (Beck Depression Inventory) and gynecological histories. Analysis of Covariance (ANCOVA) was conducted between women who under natural menopause (NM) or surgical menopause (SM) for sleep and mood variables, controlling for age. Additionally, logistic regression analysis was conducted to determine whether NM or SM groups predicted insomnia using an ISI cut-off score of 10.

Results: Among the sample, 81.6% (n=429) reportedly underwent NM and 18.4% (n=97) reported having underwent SM. Age of menopause was significantly different between the two groups, with SM group being significantly younger (p < 0.001). Moreover, women in the SM group reported significantly higher levels of insomnia (p=0.001), hyperarousal (p=0.012), sleep interfering behavior (p=0.021) and depression (p=0.018) after controlling for age. Regression analysis indicated that individuals in the SM group were 2.32 (CI 1.35 - 3.99) times more likely to have insomnia compared to the NM group after controlling for age (p=.002).

Conclusions: Women who undergo menopause through surgery report higher levels of insomnia, hyperarousal, sleep interfering behavior and depression. While most women find menopause both physically and psychologically difficult, women who go through surgical menopause experience more sleep difficulties, engage in more sleep-interfering behaviors, and report higher levels of depression compared to women who go through natural menopause. Thus, women who undergo surgical menopause may warrant additional clinical attention for sleep difficulties, and may benefit from sleep education for modifying sleep-interfering behaviors.

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IS CORMOBID INSOMNIA IN OBSTRUCTIVE SLEEP APNEA LINKED TO HEART DISEASE?

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Introduction: Obstructive Sleep Apnea (OSA) and chronic insomnia are two the most common sleep disorders. There is still controversy that insomnia and OSA are associated with cardiovascular disease. The aim of this study was to investigate the prevalence of OSA patients with insomnia and to compare the clinical characteristics between patients who suffer from only OSA versus OSA with insomnia.

Materials and methods: We have retrospectively screened the patients who visited two tertiary university hospital sleep centers. A total of 476 adult patients diagnosed with OSA by polysomnography (PSG), were divided into two groups based on their insomnia severity index (ISI) score: OSA with insomnia (ISI ≥15) and OSA without insomnia (ISI < 15). For all of the subjects, subjective symptoms were evaluated using various questionnaires, including the Korean versions of the Pittsburgh Sleep Quality Index (PSQI-K), the Epworth Sleepiness Scale (ESS-K), the Insomnia Severity Index (ISI-K), and the Beck Depression Inventory (BDI-2-K). Demographic and clinical factors were compared between the two groups.

Results: As a result of the total 476 patients diagnosed with OSA, 139 (29.2%) patients had significant insomnia symptoms. The OSA with insomnia group were more likely to be women (35.3% vs 19.6%, p< 0.001) and showed more prevalence of heart disease (19.4% vs 8.6%, p< 0.001) compared to the OSA without insomnia group. In questionnaires, subjects in the OSA with insomnia group had lower quality of life (SF-36) and quality of sleep (PSQI-K) with more excessive daytime sleepiness (ESS-K) and depression (BDI-K). There was no significant difference in the current CPAP users and compliance of CPAP use between the two groups.

Conclusions: The prevalence of OSA patients with insomnia symptoms was 29.2% which is comparable to the results of Western studies. The OSA with insomnia group showed more heart disease which was an interesting result, although we could not determine causality. This study supports the link between co-occurring insomnia with OSA and heart disease, however further investigation is needed regarding the detailed pathophysiology.

Acknowledgements: None.
Introduction: It is usual to take sleeping pills 30 minutes before bedtime, but some cancer patients report dissatisfaction with their sleeping pills. We investigated the association between the sleeping pills administration time and patient subjective satisfaction with these drugs among cancer patients.

Materials and methods: All of 61 cancer patients who are taking sleeping pills (benzodiazepine or Z-drug) for their sleep disturbance were selected. Sleeping pills administration time, bedtime, sleep onset time, and wake up time were obtained from their medical records. Subjects were also categorized into satisfied or dissatisfied groups.

Results: Sleeping pills administration time (p < 0.01) and bedtime (p < 0.01), but not the sleep onset time and wake up time, occurred later in the night in the satisfied group. The duration from taking pills to sleep onset (PTS, 41.9 ± 34.2 minutes) and to wake up time (PTW, 7.3 ± 1.3 hours) were significantly shorter in the satisfied group compared to dissatisfied group (119.3 ± 82.8 minutes vs. 9.5 ± 1.9 hours). Logistic regression analysis revealed that patient subjective satisfaction with sleeping pills could be predicted by a short PTS (odds ratio=0.29; 95% confidence interval [0.1-0.83]) and a short PTW (0.47; [0.26-0.86]), and a short time in bed during 24 hours (0.64; [0.47-0.87]).

Conclusions: Taking sleeping pills at a later time and a shorter interval between taking pills and wake up time may increase a patient subjective satisfaction with sleeping pills among cancer patients. We propose that physicians should ask cancer patients what time they take sleeping pills to increase their satisfaction with sleeping pills.

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SEX DIFFERENCES IN THE SLEEP EEG OF THE ELDERLY ACCORDING TO VISUAL SCORING AND SPECTRAL ANALYSIS

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Introduction: In the elderly, women more complain of subjective sleep disturbances compared to men but women seem to have better sleep quality in objective parameters than men. To investigate and explain sex differences of sleep in the elderly, we performed visual scoring and spectral analysis of the sleep electroencephalogram (EEG).

Materials and methods: A total of 354 participants aged 60 years or older were recruited from the community and underwent nocturnal polysomnography (NPSG). Participants were excluded if they showed periodic limb movement during sleep, sleep apnea syndrome, or lack of any sleep stages. The fast Fourier transform was used for the spectral analysis of the NPSG data. Absolute spectral powers of several frequency bands were obtained, and normalized activities were defined as spectral powers in non-rapid eye movement (NREM) sleep divided by ones in rapid eye movement (REM) sleep.

Results: A total of 75 (women, 51) subjects were finally analyzed. Women reported subjective sleep disturbances comprising higher PSQI, longer sleep latency, sleep inefficiency and daytime dysfunction compared to men (p=0.001; p=0.001). For normalized theta and alpha activities, powers in NREM were higher in women than in men (p=0.034; p=0.028). Women had higher relative beta power than men (p=0.027). Normalized alpha activity was positively partially correlated with PSQI (r=0.323, p=0.005).

Conclusions: In the visual scoring of the sleep EEG, more stabilized sleep was observed in women than men, but women showed more disturbed sleep in the spectral analysis. The result from the spectral analysis may explain subjective sleep complaints in elderly women, and visual scoring of the sleep EEG needs to be complemented with spectral analysis.

Acknowledgements: none
Introduction: To investigate the effect of electrical automatic massage (EAM) at bedtime on sleep quality and fatigue,

Materials and methods: We recruited consecutively 35 adults (23 male, 48.7±8.07 y) who complained of poor sleep (The Pittsburgh Sleep Quality Index ≥ 5) and fatigue (Chalder fatigue scale ≥ 4). Participants were seated in the commercially available massage chair (REX-L®, BODYFRIEND, Korea) under the calm and dim light condition immediately before polysomnography. One session of EAM was applied to whole body according to sleep mode embedded in the chair for 30 minutes. Participants underwent two consecutive sleep studies with or without EAM (cross-over study). The order of EAM were decided by 6-block randomization. Participants reported perceived sleep latency, sleep duration, and fatigue using visual analogue scale following morning.

Results: Polysomnography parameters and subjective reports were compared between sleep with EAM and sleep without EAM. Sleep latency (10.3→5.6 min) and N1 (13.6→10.9%) and N2 sleep (59.3→57.2%) decreased, and N3 sleep increased (3.0→6.4%) significantly after EAM. Arousal index (17.1→13.0/h) and sleep-related respiratory disturbance (apnea-hypopnea index, 9.1→7.0/h) also significantly reduced during sleep after EAM. Sleep efficiency and total sleep time were not changed by EAM. Participants reported more lengthened sleep (306→330 minutes) and more relieved fatigue significantly after EAM.

Conclusions: This study demonstrated that muscle relaxation through EAM at bedtime may improve the sleep and alleviate fatigue. It suggests that EAM may be one of alternatives to promote sleep quality. Further studies in a clinical setting are warranted to support this finding.
Insomnia oral abstract presentations

DATA-DRIVEN TOPIC ANALYSIS OF HIGH DENSITY EEG REVEALS CONCOMITANT SUPERFICIAL SLEEP DURING DEEP SLEEP IN INSOMNIA

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Introduction: An intriguing problem in the evaluation of insomnia is that the subjective feeling of insomnia in many cases does not correlate with what is documented by polysomnography (PSG) as evaluated with standard sleep scoring. Although many resolutions to the misperception of sleep in insomnia have been proposed, only few questioned whether the ‘gold standard’ of sleep staging could be the main obstacle in the search for a robust marker of the disorder. Essentially, the assumptions that sleep staging is discrete and constant for predefined periods do not accommodate pathological brain signals. In current study, we used our previously validated data-driven sleep model (Koch et al. J. Neurosci. Methods 2014:235:130-7) that allows latent brain states (referred to as topics) to occur simultaneously within each epoch, in order to obtain a more realistic description of whether their separation and co-occurrence differ between people with insomnia and controls.

Materials and methods: We applied a validated data-driven topic model on sleep EEG of 55 people with Insomnia Disorder (ID, 14 males/41 females, 47.8±12.9 years) and 64 control subjects (CON, 22 males/42 females, 45.4±14.7 years). In the topic modeling approach, spectral EEG and EOG correlation measures in 1-second windows were calculated and used to define 3-second sleep structures. By counting the presence of the sleep structures, each sleep epoch was expressed as a mixture of probabilities of latent sleep states using a Bayesian topic model (Koch et al. J. Neurosci. Methods 2014:235:130-7). Subsequently, each sleep epoch was described independently as a probability distribution of six topics (topic T1-T6), where the dominant topic in an epoch was related but not equal to a classical sleep stage. Using the topic time series of the entire night, we computed the overall proportion of each topic. We calculated a measure of their temporal separation versus co-occurrence within 30-second epochs as follows: for each set of epochs where the dominant topic was the same for at least three epochs, we calculated the normalized proportion of presence among the remaining topics.

Results: Between-group comparisons revealed no significant differences for the overall proportions of topics, much like the often-reported lack of differences between cases and controls on classical measures like total time of sleep and sleep stages. However, in epochs where T1 (a N3-related topic) was dominant and stable, cases with ID showed a much higher co-occurrence of T4 (a N1-related topic). In these epochs, the mean co-occurrence proportion was 9.16% in ID compared to 4.42% in CON.

Conclusions: As compared to controls, N3 sleep in people with insomnia contains twice as much concurrent N1 sleep-related EEG signatures, suggesting continued hyperarousal even during their deepest sleep. Topic modeling is a powerful approach for analyzing concomitant vigilance states.

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The Paradox of Changing the Sleep Architecture in Administration of Hypnotics

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Introduction: According to unofficial data, in the Republic of Moldova, hypnotics are the first line treatment for insomnia. According to literature data, these drugs alter the normal sleep structure. Thus, hypnotic-induced sleep will have lower latency and it will be longer, but with altered structure. Moreover, hypnotics cause addiction, tolerance and do not treat the causes of insomnia.

Materials and methods: A series of cases have been analyzed. From the database of the Center of Somnology within the Institute of Neurology and Neurosurgery, 11 patients with insomnia were researched with cardiorespiratory polymorphism with neuroport, who had already administered hypnotics from the benzodiazepines group and/or non-benzodiazepines, by the time they addressed.

Results: According to hypograms, sleep efficiency was down to 64% of patients and sleep latency went up to 50%. At the same time, 50% of patients suffered an increase in phases 1 and 2 (NREM), and 91% had the third phase of NREM sleep diminished compared to normal; half of patients recorded a sleep with rapid eye movement (REM) within the normal range. Hypogram analysis revealed changes in the ratio between sleep stages: superficial sleep was increased and the slow wave sleep, diminished. Reduced sleep efficacy and increased sleep latency denote the low efficacy of hypnotics in the treatment of insomnia of the studied cases.

Conclusions: The use of hypnotics for treating the insomnia as a single and first-line method does not produce the desired effect. In addition, they alter the architecture of sleep and induce a superficial, respectively non-qualitative sleep. The treatment of insomnia requires a complex approach: drug treatment should complete the non-medication methods aimed to solve the causes of insomnia.
**Introduction:** Insomnia is a serious public health problem worldwide, and chronic insomnia has considerable personal and social costs associated with greater healthcare utilization, work absenteeism, and severe health condition. Cognitive Behavioral Therapy (CBT) has proved to be effective in treating insomnia and a powerful component is thought to be sleep restriction. The purpose of the present study was to investigate the effects of online sleep restriction therapy on polysomnography (PSG).

**Materials and methods:** Nineteen patients (mean age 46.4 ± 14.4 years, 80% women) with Insomnia Disorder underwent four polysomnographic ambulatory nights during an entire period of ten weeks; before the beginning of the online sleep restriction treatment (pre-treatment), three weeks later (mid-treatment), five weeks later (post-treatment) and ten weeks later (ten week follow up). The Karolinska Sleep Diary (KSD) was completed on the morning after each PSG night, one day before and two days before the PSG night (scale 1-5). The Karolinska Sleepiness Scale (KSS, 1-9) was filled out at several times during the day before and after the PSG night.

**Results:** At the post-treatment, patients showed, higher Sleep Efficiency (Pre= 82.5±2.3%, Post=89.2±1.6%, p< 0.05), shorter wake time after sleep onset (Pre= 66.4±9.1min, Post=34.7±6.5min, p< 0.01), fewer awakenings/h (Pre= 5.5±0.8, Post=3.6±0.4, p< 0.05), and lower N2 (Pre= 53.3±2.0%, Post=49.9±2.0%, p< 0.05). N3% (Pre= 13.5±1.6, Post=14.9±1.6, p>0.05) and REM% (Pre= 21.1±1.4, Post=23.8±1.3, p>0.05) did not differ. Ratings of sleep quality also improved in post-treatment and patients reported lower sleepiness on the KSS (Pre= 6.4±0.4, Post=5.4±0.3, p< 0.05), as well as increased depth of sleep (Pre= 2.5±0.3, Post=3.27±0.2, p=0.05) and less early awakening (Pre= 3.0±0.4, Post=3.6±0.3, p< 0.01). Furthermore, at ten week follow up, not only the previous results remained but also the patients reported it was increased ease of falling asleep (Pre= 3.3±0.4, Post=4.1±0.3, p< 0.05), higher sleep quality (Pre= 2.5±0.3, Post=3.4±0.2, p< 0.05), less disturbed sleep (Pre= 3.1±0.3, Post=4.1±0.3, p< 0.01), and a higher level of sufficient sleep (Pre= 2.27±0.3, Post=3.0±0.3, p< 0.05).

**Conclusions:** Five weeks of online sleep restriction therapy improves sleep continuity and suggests improved physiological, as well as subjective sleep quality, with positive effects being sustained at ten week follow up. The lack of effect on N3% was unexpected, but baseline levels were relatively high, which may have prevented the expected increase.
WHAT DO INSOMNIA PATIENTS EXPECT FROM YOUR PHYSICIANS? RESULTS OF A PATIENT FOCUS GROUP

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Introduction: According to the DAK Health Report 2017 sleep disorders have increased by 48%, but only 1/3 of the patients consulted a doctor and only 10-20% are informed about preventive measures of sleep hygiene and psychotherapy. To elicit information deficiencies in Insomnie-Pat. a study was carried out as part of a focus group design.

Methods: As part of a pilot-project for sleep disorders, a patient group of 18 insomnia patients was kept standardized in the presence of a general practitioner/internist.

Results: All participants (f: 10, m: 8) had the experience that neither the family doctor nor the specialist informed about psychotherapy in sleep disorders, 3 participants were told about bedtime rituals and how to use a sleep log and only 1 participant was briefly informed about Sleep-bed-time-shortening, and a possible presence of a complex sleep disorder (mental and physical). Furthermore, long waiting periods until the appointment and long waiting times at the doctor’s office were criticized, which were not related to the very short consultation period. Overall, the patients did not get enough information about sleep disorders and about possible prevention options. The focus group wanted kindness, respect and the possibilities of a collective decision-making in therapy (Pat./Physician) in the Pat.-physician encounter. Information about the disease, its therapy and preventive measures should be communicated by the doctor. Furthermore, different therapy options should also be discussed with consideration of the entire family situation (especially when children/teenagers with sleep disorders are part of the family).

For informational materials for the treatment of mental and physical sleep disturbances, the participants wished that the course of the disease and the therapeutic possibilities were designed clearly and presented with simple formulations. The brochure should not be used solely for the purpose of providing information (sleep hygiene, stimulus control, bedtime, sleep dysplasia, behavioral therapy for sleep disorders), but also as a therapy guide booklet in which the doctor can register individual therapy options or record personal questions.

Summary: Affected persons with sleep disturbances have concrete ideas and wishes about a doctor-patient relationship, which are often not fulfilled in reality. The desire for more information and collective (physician/patient) therapy decision-making is particularly evident.
IMPACT OF OBJECTIVE SLEEPINESS AND HYPERAROUSAL ON THE DAYTIME PERFORMANCE OF PERSONS WITH INSOMNIA

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Introduction: Physiological hyperarousal that causes sleep difficulty both night and day is thought to be a core feature of many persons with insomnia. Despite their apparent chronic “alertness,” hyperaroused insomnia sufferers typically complain of daytime concentration/attention problems that impair their daytime functioning. The current study was conducted to determine if hyperaroused insomnia sufferers show relative performance deficits on a battery of simple and complex reaction time tasks.

Materials and methods: Thirty-four (Mage = 40.5 yrs; 25 women) insomnia sufferers and 54 (31.5 yrs.; 38 women) normal sleepers were recruited. To be enrolled the insomnia group had to meet DSM-5 criteria for insomnia disorder and have scores > 14 on the Insomnia Severity Index (ISI) and > 29 on the Hyperarousal Scale (HS). Insomnia sufferers were excluded if they had concurrent psychiatric disorders, sleep disruptive medical conditions, additional sleep disorders or used hypnotics to manage their insomnia. The normal sleepers were medically and psychiatrically healthy, did not meet DSM-5 criteria for any sleep disorder, and scored < 8 on the ISI and < 26 on the HS. Each participant completed a 4-trial Multiple Sleep Latency Test (MSLT) with each nap trial being preceded by a 30-minute computer-administered test battery comprised of 3 simple (simple reaction time, choice reaction time, big circle-little circle) and 3 complex (rapid visual information processing, attention switching, spatial working memory) reaction time tests obtained from the CANTAB® battery (Cambridge Cognition). Mean MSLT latencies across trials were computed and used to divide the insomnia and normal groups into “alert” (Mean MSLT latency > 8 minutes) and “sleepy” (Mean MSLT latency ≤ 8 minutes) subgroups. Multivariate analyses were conducted to compare means and standard deviations of response latencies shown by the four subgroups across the 6 reaction time tasks.

Results: Preliminary comparisons showed the mean MSLT latencies of the alert insomnia group (14.1 min.) and alert normal group (12.5 min) were significantly longer than the sleepy insomnia (4.0 min.) and normal (4.7 min) groups. Significant results were found for age-adjusted analyses that compared the 4 subgroups on the reaction time measures obtained from the simple choice reaction time (F [3, 83] = 4.43, p=.006) and complex attention switching (F [3, 83] = 3.99, p = .01) tasks. Sleepy insomnia participants showed significantly higher standard deviations of response latencies, connoting more attentional lapses, than did alert normal sleepers on the choice reaction time task. In contrast the alert insomnia group showed slower mean response latencies and more attentional lapses than did the alert normal group on the complex attention switching task.

Conclusions: Among those with insomnia, objective daytime sleepiness seems to most negatively affect performance on simple, boring tasks. In contrast, insomnia sufferers, who seem highly alert in the daytime, show performance deficits on complex tasks when compared to their alert normal sleeper counterparts. In this latter group, physiological hyperarousal not only reduces sleep propensity but also negatively affects daytime cognitive functioning.

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USE OF BLINDED HYPNOTIC TAPERING PROTOCOLS TO HELP MEDICATION-DEPENDENT INSOMNIA PATIENTS DISCONTINUE THEIR HYPNOTIC USE

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Introduction: Many chronic hypnotic users make repeated unsuccessful attempts to discontinue their hypnotics despite receiving suboptimal benefits from them. A putative mechanism perpetuating hypnotic dependence is enhanced sleep-related performance anxiety when hypnotic users try to sleep on nights they know they have reduced the dosage of their usual medication. Our study is testing 3 blinded tapering protocols (2 active, 1 control -CTRL) to reduce this anxiety and help patients discontinue their hypnotics.

Materials and methods: This study is enrolling users of benzodiazepine (BDZ) and benzodiazepine receptor agonists (BZrA). Enrollees first complete a two week baseline including sleep diaries, actigraphy, and the Insomnia Severity Index (ISI) and Benzodiazepine Withdrawal Questionnaire (BWQ). They then complete four sessions of cognitive behavioral insomnia therapy (CBTI) scheduled over a 6 week period. Subsequently they are randomized to one of three 20-week, double-blinded tapering protocols wherein their medication dosage is either reduced by 25% or 10% every two weeks, or remains unchanged (CTRL). During medication tapering, all enrollees are seen biweekly by the study physician to receive support and guidance. At the end of the 20-week period the study blind is eliminated and those who completed one of the two tapering protocols enter a 3-month follow-up period whereas CTRL participants are offered an open label taper and then complete follow-up up at 3 months. Outcomes reported here include hypnotic use rates at the end of tapering and at follow-up as well as changes in ISI and BWQ across study periods.

Results: To date, a total of 28 (M age = 57.7± 12.8 yrs.; 19 women) hypnotic users have been enrolled and started treatment. Of these, 20 have completed the CBTI phase, 10 have reached the end of the tapering, and 9 have completed the 3 month follow-up. Baseline ISI scores showed that the sample had a mean ± standard error score suggesting moderately severe insomnia complaints (ISI=16.1±0.94) despite nightly hypnotic use. These scores declined to the sub-clinical range by the post CBTI (9.45±0.81) and tapering (8.78±1.05) phases and into the normative range by follow-up (6.71±1.77). BWQ scores remained fairly stable from baseline (3.30±0.65) to post CBTI (3.60±.85) but were reduced by the end of the tapering phase (1.25±0.98). Of the 6 who completed one of the active tapering protocols, 5 (83%) totally discontinued their medication use by the end of the 20-week tapering whereas none in the CTRL group had chosen to do so. At follow-up 3 of 5 (60%) who completed blinded tapering remained medication free whereas 2 of 4 (50%) in the CTRL who underwent open-label tapering remained medication free.

Conclusions: CBTI combined with blinded hypnotic tapering seems a promising treatment approach to help hypnotic users overcome their medication dependence. This treatment seems to achieve medication discontinuance while also reducing insomnia symptoms and medication related side effects.

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Introdução: Um número cada vez maior de pessoas estão indo deitar sem a intenção de dormir. Para eles, a hora de dormir se tornou uma continuação do lazer. Se for assim, medidas comuns de sono não foram ajustadas para esse mudança no costume de dormir, o que pode levar a estimativas incorretas de latência de sono (SOL) e a quantificação de insônia de início de sono (SOL > 30min). Usamos o termo latência de sono antes de ir para o sono (SEL) para tempo gasto acordado antes de ir dormir (Exelmans & Van den Bulck, 2017). Este estudo investiga:
(1) a prevalência, duração e preditores de latência de sono antes de ir dormir,
(2) a associação com sintomas de insônia (qualidade do sono e fadiga), e
(3) as atividades realizadas durante latência de sono.

Materiais e métodos: Uma amostra representativa de 584 adultos (18-96 anos, 51.2% mulheres), estratificada por gênero, idade e nível educacional, participaram no estudo. Com base em dados de censo recente, participantes foram convidados a participar de uma pesquisa online. Avaliaram o tipo diurno com o Escale de Tipo Diurno (Torsvall & Akerstedt, 1980). Os respondentes foram questionados sobre quanto tempo eles estavam acordados na cama antes de decidir ir dormir nos dias de semana (domingo a sexta-feira) e nos fins de semana (sexta-feira e sábado). Os respondentes também foram perguntados quantas vezes eles realizaram uma lista de atividades na cama, categorizadas em atividades não relacionadas a tela, atividades passivas de tela (televisão e computador) e atividades interativas de tela (smartphone, tablet, videogames). Usamos o Índice de Qualidade do sono Pittsburgh (Buysse et al., 1989) e a Escala de Avaliação da Fadiga (Michielsen et al., 2004).

Resultados: Entre os adultos que tentaram dormir imediatamente, 34.9% ficaram acordados por menos de 15 min, 27.6% entre 15 e 30 min. Cerca de 16% dos respondentes ficaram acordados por mais de 30 min nos dias de semana e finais de semana. A idade e os tipos de ciclo forneceram maiores delay latência. Os respondentes com latência de sono antes de ir dormir maior que 30 min, eram mais propensos a relatar insônia (PSQI > 5). Este grupo também relatou usar tanto meios passivos quanto interativos mais frequentemente que os respondentes com latência de sono antes de ir dormir abaixo de 30 min, mas não houve diferença entre os grupos para atividades não relacionadas a tela.

Conclusões: Este estudo mostrou que ir para o sono e decidir ir para o sono são duas decisões separadas em muitos. Se ambas as decisões ocorrerem em pontos de tempo separados, pode ocorrer um novo pedaço de 'me-time' antes de despertar. Isso foi associado a um declínio progressivo na qualidade do sono e fadiga. Até onde sabemos, insônia, latência de sono antes de ir para o sono pode ser mais um sintoma de como o sono está se tornando cada vez mais sob pressão da vida moderna, mas também pode revelar um sintoma de insônia que nunca foi documentado antes.
SLEEP DEPRIVATION HAS LONG TERM EFFECTS ON NEURONAL ACTIVITY IN HYPOTHALAMIC NUCLEI

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Introduction: Electroencephalogram (EEG) slow wave activity (EEG power density between 0.5-4.0 Hz) during NREM sleep is a well characterized marker for the homeostatic regulation of sleep. Whether this EEG marker also reflects homeostatic regulation of deeper brain structures is unknown.

Materials, methods and results: By combining EEG recordings with electrical activity in several hypothalamic nuclei in the rat, we found that cortical SWA does not reflect the changes in electrophysiological activity in these brain structures after sleep deprivation (SD). Following a 6h SD, while cortical SWA recovered to baseline values after 7h, neuronal activity in the Lateral hypothalamus (n=20) was decreased for up to 21h. In the Mammillary bodies (n=6) the decrease in the activity lasted 36h while in the Arcuate nucleus (n=5) a decrease was evident during the first half of the subjective night following SD. In contrast, the Paraventricular nucleus (n=7) showed a sustained increase following SD which lasted 42h.

Conclusions: These results show that SD has long term effects on neuronal activity in hypothalamic structures that regulate several important physiological and behavioural functions (i.e. food intake, sleep, cognitive function and fear). The duration of these effects extends beyond the after-effects of SD observed in the EEG SWA, which is the common marker to define the duration of recovery from SD. Our data provide a possible neuronal mechanisms of the many adverse effects on health associated with SD.
Worry and Rumination Traits Are Associated with Polysomnographic Indices of Disrupted Sleep in Insomnia Disorder

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Introduction: Repetitive thought is a perpetuating and maintaining factor in Insomnia Disorder. Accordingly, one of the primary complaints reported by Insomnia patients is the inability to shut-off or control thoughts. Worry and rumination are the two best-known styles of repetitive thoughts leading to sleep disturbances. Aim of this study was to investigate the effect of these two cognitive processes on nocturnal sleep objectively recorded by polysomnography.

Materials and methods: 27 ID patients (10 M, mean age 50.37 ± 12.33 years) and 20 HC matched for sex and age (7 M, mean age 49.35 ± 12.40 years) underwent a comprehensive assessment of sleep quality, excessive daytime sleepiness, insomnia severity, worry, rumination, depressive and anxious symptomatology. ID patients also underwent a PSG evaluation.

Results: ID patients, compared to HC, showed increased levels of worry and rumination that were significantly associated with objective sleep variables. Heightened worry levels were related to augmented wake after sleep onset and diminished total sleep time, sleep efficiency and percentage of REM sleep; rumination was associated with an increase of sleep latency and a decrement of sleep efficiency.

Conclusions: Our study supports the existence of a significant relationship between daytime levels of repetitive thought and sleep, thus corroborating the hypothesis of an interplay between cognitive and nocturnal electrophysiological activity in insomniacs.
**Introduction:** People with insomnia commonly underestimate total sleep time and overestimate sleep discontinuity relative to objective measures. This so-called 'sleep misperception' may drive daytime impairment and influence cognitive processes involved in the maintenance of insomnia. In the age of the 'quantified self', there has been a sharp increase in the number of people seeking to measure their sleep using wearable devices, despite concerns about accuracy of feedback. This study sought to investigate whether providing false feedback about sleep to individuals with clinically-significant insomnia influences daytime symptom reports, sleep-related attentional bias and psychomotor vigilance.

**Materials and methods:** 63 participants meeting DSM-5 criteria for insomnia disorder were recruited from the community. Following baseline assessments and sleep education, participants were randomised to receive next-day sham feedback on their sleep quality ('positive' [91.4% sleep efficiency] versus ‘negative’ [61.4% sleep efficiency] condition) using an integrated actigraphy-diary watch. Participants subsequently completed symptom reports at multiple time-points across the day, using the experience sampling method, in addition to computerised tests of sleep-related attentional bias (dot-probe task) and vigilance (psychomotor-vigilance task) in the evening.

**Results:** Importantly, groups did not differ on subjective or objective sleep variables for the manipulation night. However, participants given negative feedback (n = 32) exhibited significantly impaired indices of alert cognition ($d = .69$) and sleepiness and fatigue ($d = .96$) from pre-to-post intervention, whereas there was no difference in those given positive feedback (n = 31). Within-day trajectories (12 noon and 3pm versus risetime) revealed lower ratings of positive mood and alert cognition, as well as elevated sleepiness/fatigue following negative versus positive feedback ($ps < .01$). There were no significant differences between groups on measures of sleep-related attentional bias or vigilant attention.

**Conclusions:** This controlled experiment shows that false-feedback about sleep, in the absence of objective sleep differences, biases appraisal of daytime symptoms. This confirms a potential pathway in the development and maintenance of insomnia but also has important implications for wearable devices that claim to measure "objective sleep", yet provide inaccurate data relative to gold-standard measurement.

**Acknowledgements:** Supported by the Sleep and Circadian Neuroscience Institute (SCNi) funded by the Wellcome Trust.
Introduction: There is a lack of evidence-based pharmacological treatments with regulatory approval for children with sleep difficulties in association with neurodevelopmental disorders. Controlled studies to date have not provided the necessary evidence on long term efficacy and safety of any such medication. An innovative paediatric-appropriate prolonged-release melatonin formulation (pedPRM), designed to reproduce the endogenous release profile of the hormone at night, was recently developed. The aim of this study was to assess the short and long term efficacy and safety of pedPRM vs placebo for sleep disorders in children with autism spectrum disorder (ASD) and other neurodevelopmental disorders.

Materials and methods: This was a phase III multicenter randomized, placebo-controlled study in children 2 to 17.5 years of age with 1) confirmed history of ASDs (pervasive developmental disorders) according to either DSM-5/4 or ICD-10 criteria, or 2) disabling neurogenetic disorder. Patients also had to have parent reported sleep impairment (defined as > 3 months of ≤6 hours of continuous sleep and/or ≥0.5 hour sleep latency in 3 out of 5 nights).

125 children who failed to improve on basic sleep hygiene and behavioral intervention who remained eligible following 2 week single blind placebo run-in were randomized in a 1:1 ratio to receive either pedPRM or placebo (2 mg escalated to 5 mg after 3-week double blind period, if needed) in a 13 week double-blind treatment period. The double-blind period was followed by a 13-week open-label period on the final dose, with continued efficacy and safety monitoring. The a priori primary outcome measure was total sleep time as assessed by caregivers’ Sleep and Nap Diary (SND).

Results: Statistically significant and clinically relevant effects of pedPRM vs placebo were observed in caregivers’ SND-reported sleep maintenance and initiation (total sleep time (p=0.034) and sleep latency (p=0.01)). Effects were maintained in the long term period. PedPRM was well tolerated and no unexpected safety issues were reported. Secondary outcomes showed improvements in child’s social functioning and behavior, and caregivers’ well-being (QoL) and satisfaction with their child’s sleep pattern.

Conclusion: PedPRM was effective and safe for the short and long term treatment of sleep disorders in children with ASD and other neurodevelopmental disorders. The formulation was generally well tolerated in a population who may have significant difficulties in swallowing. PedPRM may provide a safe evidence-based pharmacological intervention for children with ASD who suffer from sleep disorders refractory to sleep behavioral interventions.

Acknowledgements: The study was sponsored by Neurim Pharmaceuticals Ltd., Tel Aviv, Israel.
**Insomnia**
**Board #067: P5 - Wednesday**

**INVESTIGATIONAL CLUES ABOUT INSOMNIA IN PATIENTS WITH EPILEPSY**

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**Introduction:** The aim of this study is to review the frequency of insomnia in patients with epilepsy (PWE) and to detect helpful results from investigations.

**Materials and methods:** Forty three patients with epilepsy and 53 healthy controls are included in this prospective case control study. All patients underwent a structured evaluation including a detailed clinical, past, family and treatment history. The questionnaires included Epworth Sleepiness Scale (ESS), Pittsburgh Sleep Quality Index (PSQI), Beck Depression Inventory (BDI).

**Results:** Twenty-four (%55.8) of the patients in epilepsy group were female and 26 (%49.1) of the healthy controls were female. Mean age of the patients was 34.2± 11.37 (16-71), and it was 34.6 ±11.28 (16-77) in healthy controls. There were no differences between the groups in terms of gender, age and body mass index (p>0.05). Patients were also grouped according their epilepsy types as focal and generalized. The onset age of epilepsy was 19.2±14.93 (1-69), 23 (%53.5) of the patients had focal, and 20 (46.5) generalized epilepsy. Comparing focal EEG abnormalities in PWE with controls, sleep duration (P<0.006) and sleep efficacy (P<0.023) were found significantly lower. Comparing generalized EEG abnormalities in PWE with controls, sleep duration (P<0.000) and awake functioning (P<0.03) were found significantly lower. Abnormal MRI findings were significantly higher in PWE (P<0.037) compared to controls. There was no correlation in terms of the last 12-month seizure freedom, nocturnal seizures and good sleeper in three groups. Higher scores of BDI and pathological EEG showed more sleep complaints in multiregression analysis.

**Conclusions:** All sleep problems especially insomnia should be routinely asked in PWE. EEG and MRI investigations as well as questionnaires specifically BDI can shed light.
DIFFERENCES IN TRAUMA-RELATED GUILT IN FEMALE VICTIMS OF SEXUAL VIOLENCE BASED ON INSOMNIA SEVERITY

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Introduction: People who are victims of sexual violence report high percentage of sleep problems, especially, insomnia. Guilt is a common symptom among this group. Some studies have suggested that guilt focuses on actions rather than self-blame, and may help trauma patients cope with trauma and reduce the risk of development and maintenance of posttraumatic stress disorder (PTSD). This study aimed to investigate differences in trauma-related guilt cognition between female victims of sexual violence who either reported high or low symptoms of insomnia.

Materials and methods: Data was collected from 43 female victims who reported having a history of sexual violence (mean age 26.56 ± 7.81). All participants completed questionnaires about insomnia symptoms (Insomnia Severity Index; ISI), PTSD symptoms (PTSD Symptom Scale Self-Report version; PSS), trauma-related guilt (Trauma-related Guilt Inventory; TRGI), depression (Beck Depression Inventory; BDI) and trauma-related information. The TRGI consists of three subscales: global guilt, distress and guilt cognitions. Guilt cognitions can further be divided into Hindsight-Bias/Responsibility, Wrongdoing, and Lack of Justification subscales. This study hypothesized that individuals with insomnia symptoms will show a difference in trauma-related guilt after controlling for depression symptoms compared those without insomnia. Analyses were conducted using Pearson’s correlation coefficient and analysis of covariance (ANCOVA).

Results: All participants were victims of sexual assault, with 84.8% (n=28) of the sample experiencing a single traumatic event and 15.2% experiencing multiple traumatic events. ISI scores were significantly positively associated with PSS scores (\(r=.620, p< .01\)) and the distress subscale of the TGRI (\(r=-.488, p< .01\)), and negatively associated with guilt cognitions (\(r=-.423, p< .01\)). 53.5% (n=23) of the sample met criteria for clinical insomnia using ISI cut-off scores of 15. Participants in the insomnia group scored significantly lower in overall guilt cognitions (\(p< .001\)) and significantly higher in distress (\(p=.004\)) than the non-insomnia group after controlling for depression. Among the subscales of guilt cognitions, hindsight-bias/responsibility was significantly lower in the insomnia group (\(p< .001\)).

Conclusions: Guilt can sometimes be adaptive in trauma patients as it may work as a catalyst in cognitively processing their trauma. Our results indicate that individuals with higher levels of insomnia symptoms report lower guilt cognition, which may interfere with their ability to process the traumatic experience and effectively cope with their situation. Further research is needed to define the reason why insomnia patients report less guilt following a traumatic event.

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Insomnia
Board #068: P5 - Wednesday
SLEEPLESS IN NEWCASTLE KATHERINE HAY ST4, HELEN AUSTIN CT3, JOHN HUGHES CONSULTANT AND MARY JANE TACCHI CONSULTANT

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Introduction: Chronic sleep problems affect 50% to 80% of patients in a typical psychiatric practice, compared with 10% to 18% of adults in the general U.S. population. Traditionally, clinicians treating patients with psychiatric disorders have viewed insomnia and other sleep disorders as symptoms. But studies in both adults and children suggest that sleep problems may raise risk for, and even directly contribute to, the development of some psychiatric disorders. This research has clinical application, because treating a sleep disorder may also help alleviate symptoms of a co-occurring mental health problem. Furthermore, sleep problems are more likely to affect patients with psychiatric disorders than people in the general population.

Given the prevalence of sleep disturbance, its impact on development of mental illness and recovery, we decided it prudent to assess how well the team was performing in the areas of assessment and management of sleep disturbance.

Materials and methods: We undertook an audit of patient records for those receiving home based treatment on 4th January 2017. Those who reported sleep disturbance were identified and we reviewed the assessment and management of sleep disturbance in these people, using both electronic patient records and drug kardexes. We then compared practice to the recommendations provided within the NICE Clinical Knowledge Summary for insomnia.

Results: 31 patients were identified as having sleep disturbance. None of these patients had a formal assessment of the severity of insomnia, nor was the presence of sleep disorders looked for in any case. In 94% of cases, potential causes appeared adequately addressed. The proportion of people being offered sleep hygiene advice was low at 32%. The average duration of treatment with hypnotics is 5.64 weeks, with a range of 0 to 15 weeks. In no case was the use of melatonin appropriately considered.

Conclusions: A large percentage of patient receiving HBT have poor sleep as a prominent symptom. This is documented, but as being either present or absent rather than specific type of disturbance. Without a specific assessment of sleep related symptoms, we are unable to tailor management to the symptoms and appear to be prescribing hypnotics as a blanket approach. Furthermore, once prescribed, the review of these hypnotics falls short of the recommendations.

We conclude that insomnia is seen as a symptom of the overall presentation requiring HBT rather than an entity in itself, which in many cases, may be the case. Our assessment of insomnia is not specific or objective and interventions not targeted for maximum benefit. We propose a prospective study to assess sleep disturbance using objective measures such as the Insomnia Severity Index to allow us to target interventions more accurately and effectively, as well as educational interventions for staff to raise awareness among the team of the importance of accurate assessment and focussed management of sleep disturbance.
INITIAL PSYCHOMETRIC TESTING OF THE SLEEP CONDITION INDICATOR IN A SWEDISH CONTEXT

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Introduction: There are several rating scales for insomnia; however, diagnostic criteria have changed over time. This means that the usefulness and validity of earlier scales may be compromised. The Sleep Condition Indicator (SCI) is a recently designed scale, developed in the UK, based on the DSM-V criteria of insomnia. The aim of this study was to translate and psychometrically evaluate the SCI in a Swedish context, focusing on its dimensionality.

Materials and methods: The SCI consists of eight items with 5 ordered response categories (scored between 0 and 4). A total score between 0 and 32 is calculated; higher score indicates better sleep. The SCI was distributed through a web-questionnaire to university students and 634 completed the questionnaire. First we replicated the methodology used in the original testing of the UK SCI using principal component analysis (PCA) as the extraction method with varimax rotation and Kaiser’s eigenvalue >1 criterion for determination of the number of factors. We then continued with a more appropriate method for ordinal data, an exploratory factor analysis (EFA), using an unweighted least squares (ULS) extraction method based on a polychoric correlation matrix. Parallel analysis was conducted to determine the number of factors. Internal consistency was estimated using an ordinal version of Cronbach's alpha.

Results: The PCA suggested a one factor model, with eigenvalues of 5.0 for the 1st and 0.9 for the 2nd factor, explaining 62% of the variance. Loadings varied between 0.62-0.86. With the EFA (ULS), 70% of the variance was explained by the first factor. Factor loadings varied between 0.66 and 0.92. Eigenvalues for factors 1 and 2 were 5.6 and 0.8, respectively. Corresponding 95th percentile eigenvalues from the parallel analysis were 5.3 (1st factor) and 0.4 (2nd factor). Reliability (ordinal alpha) of the total SCI score was 0.94.

Conclusions: Both models support a unidimensional SCI structure in our sample of university students. This is a prerequisite for the calculation and validity of a total SCI score. In addition, the total score exhibited good reliability. These observations support the psychometric integrity of the Swedish SCI and provide a starting point for further testing.
A PROTON MR SPECTROSCOPY STUDY OF THE BASAL GANGLIA IN CHINESE PATIENTS WITH INSOMNIA DISORDER

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Introduction: Growing evidences suggest the basal ganglia (BG) plays an important role in the sleep-wake regulation. Proton magnetic resonance spectroscopy (¹H-MRS) can non-invasively estimate the relative concentrations of brain neurotransmitters and metabolites from their resonance spectra in stimulated brain areas. The objective of this study was to utilize ¹H-MRS to assess N-acetylaspartate relative to total creatine (NAA/Cr) and choline-containing compound relative to total creatine (Cho/Cr) in the BG in non-medicated individuals with insomnia disorder.

Materials and methods: Twenty-three non-medicated individuals with insomnia disorder (mean age =31.3±8.1 years, 15 females) and 18 well-screened normal sleepers (mean age = 28.2±6.9 years, 10 females) were enrolled in the present study. Polysomnography (PSG), Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), State-Trait Anxiety Inventory (STAI), and Beck Depression Inventory (2nd edition, BDI-II), were recorded in all subjects respectively. ¹H-MRS data of the BG were collected on a GE Discovery 750 3.0T magnetic resonance imaging/spectroscopy scanner under resting state.

Results: Mean NAA/Cr ratios of the right BG were higher in patients with insomnia disorder than in normal sleepers (1.69±0.16 v.s. 1.52±0.15, t=3.463, df=39, \(P=0.001\)). Mean NAA/Cr ratios of the left BG were significantly lower than those of the right BG within patients’ group (1.45±0.17 v.s. 1.69±0.16, t=5.175, df=22, \(P<0.001\)). Sleep latency (\(r=0.311, P=0.048\)) and awake times (\(r=0.388, P=0.012\)) measured by PSGs, PSQI global scores (\(r=0.410, P=0.008\)), ISI global scores (\(r=0.439, P=0.004\)), and TAI global scores (\(r=0.344, P=0.028\)) were positively correlated with NAA/Cr ratios of the right BG respectively. In addition, there was a trend that the duration of insomnia was negatively associated with NAA/Cr ratio of the right BG (\(r=-0.406, P=0.055\)). A receiver operating characteristic (ROC) curve analysis showed that NAA/Cr ratio of the right BG could identify insomnia disorder with 78.3% sensitivity and 61.1% specificity when cut off value was 1.57 (AUC=0.785, \(P=0.002\)).

Conclusions: The present study is the first demonstration of a neurochemical difference in the BG of those non-medicated individuals with insomnia disorder compared to normal sleeping controls. Our preliminary finding demonstrated a disturbance of NAA metabolism in the BG of those with insomnia disorder, and may provide a means to shed further light on the neurobiology of insomnia.

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Insomnia
Board #031: P3 - Tuesday

PHYSIOLOGICAL AROUSAL DURING SLEEP ONSET PERIOD IN PRIMARY INSOMNIA AS MEASURED BY EEG POWER SPECTRUM ANALYSIS

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Introduction: Insomnia is a common healthy complain. The neurocognitive perspective of hyperarousal model of insomnia hypothesized that the sleep difficulties in insomniacs may result from enhanced information processing around sleep onset and during sleep. Supporting evidences were primarily from the findings that insomnia patients have increased high frequency EEG activity and decreased low frequency EEG activity during sleep, indicating insomniacs in general have higher physical arousal and lower sleep homeostasis. This study further aims to explore arousal level and sleep homeostasis during the period of sleep onset by comparing the level and change of EEG spectrum in primary insomnia patients and normal control subjects during the process of sleep onset.

Materials and methods: 30 patients with primary insomnia (20F, mean age=36.7) and 25 normal sleepers (17F, mean age=34.8) underwent one night of PSG recording in a sleep laboratory to screening sleep-related breathing disorders and sleep-related movement disorders. They also completed the Pre-sleep Arousal Scale (PSAS) before bedtime. EEG spectrum analyses were conducted for the EEG data collected during the 5 minutes prior to sleep onset and the 15 minutes after.

Results: Subjective ratings of both pre-sleep cognitive and somatic arousal were significantly higher in insomnia group (F = 23.950, p < .001; F = 64.235, p < .001) than control group. More WASO (F = 5.510, p = .023), less time and percentage of stage 2 sleep (F = 7.088, p = .010; F = 32.616, p < .001), less percentage of REM sleep (F = 4.810, p = .033), and poor sleep efficiency (F = 8.685, p = .005) were showed in PSG. The EEG spectrum during sleep-onset period showed that insomniacs had higher alpha power in the sleep-wake transition, lower delta power after falling asleep, and higher theta and beta power during sleep-onset period. In terms of the slope of EEG spectrum change during the period of sleep onset, insomniacs had slower change than normal sleepers in increasing of sleep homeostasis and decreasing of physical arousal. In addition, the correlations between PSAS score and EEG power, cognitive arousal and delta power after falling asleep and theta power in sleep-onset process showed significant positive correlation. Alpha power in the later part of sleep-onset period and beta power around sleep-wake transition, on the other hand, showed negative correlations with cognitive arousal. Physical arousal only showed positive correlation to theta power in sleep-wake transition.

Conclusions: Patients with primary insomnia showed significantly less and slower increase in sleep homeostatic drive as well as less and slower decrease in EEG arousal during sleep-onset period. Although EEG arousal did showed gradually decreased by time, it still maintained higher than normal sleepers. Sleep homeostasis did also increase, but may be interfered by the hyperarousal. This may explain the complaints in insomnia patients of difficulty falling asleep, difficulty maintaining sleep, and light sleep.
**Introduction:** Various sleep dimensions appear to be associated with dyslipidemia, a key risk factor for cardiovascular disease (CVD). However, prior studies are primarily limited to non-US or majority white populations although sleep disorders and CVD disproportionately affect many racial/ethnic minorities. To determine whether these associations differ by race/ethnicity in the US, we quantified the association between sleep measures (insomnia symptoms, short sleep duration, poor sleep efficiency, and insomnia symptoms plus short sleep duration) and abnormal blood lipids while assessing differences by race/ethnicity.

**Materials and methods:** Data were collected between 2010-2013 from racially/ethnically diverse adults aged 54-93 years in the Multi-Ethnic Study of Atherosclerosis Sleep Cohort. All participants (n=1,364) not taking a lipid lowering medication and whose actigraphy-measured average sleep duration was < 9 hours were included in the analysis. Insomnia was based on a Women's Health Initiative Insomnia Rating Scale score of >9. Actigraphy-measured short sleep duration and low sleep efficiency were defined as an average sleep time < 6 hours and an average sleep efficiency < 85%, respectively. Blood lipids included triglycerides, total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C). To quantify associations between sleep and lipids, we used linear random-effects models that accounted for study site and adjusted for sociodemographic characteristics, cigarette and alcohol use, BMI, waist circumference, diet quality, diabetes, hypertensive status, depressive symptoms, and polysomnography-measured Apnea-Hypopnea Index.

**Results:** Overall, 30% of participants had insomnia symptoms, 37% had short sleep duration, 14% had low sleep efficiency, and 11% had both insomnia symptoms plus short sleep duration. These indices of disturbed/short sleep were statistically significantly associated with lipid parameters, with many associations modified by race/ethnicity (interaction term p-values < 0.05). Among white (n=474), black (n=400), and Chinese (n=185) participants, indices of disturbed/short sleep were associated with better lipid parameters. In whites, having insomnia and short sleep duration was associated with a 15-mg/dl (se=4.2) decrease in TC and a 15-mg/dl (se=3.3) decrease in LDL-C, and poor sleep efficiency was associated with a 16-mg/dL (se=2.6) decrease in triglyceride levels. Among black participants, short sleep duration was associated with a 6-mg/dL (se=2.7) decrease in TC and a 8-mg/dL (se=1.7) decrease in triglyceride levels, as well as a 6-mg/dL increase in HDL-C. In Chinese Americans, those with insomnia symptoms had a 12-mg/dL (se=2.9) decrease in TC and a 10-mg/dL (se=2.5) decrease in LDL-C compared to those without insomnia; those who had short sleep duration plus insomnia symptoms had a 17 mg/dL (se=6.4) decrease in TC and a 14-mg/dL (se=4.4) decrease in LDL-C. In contrast, among Hispanics (n=305), insomnia plus short sleep duration was associated with a 12-mg/dL (se=2.7) increase in TC and a 10-mg/dL (se=2.3) increase in LDL-C, and poor sleep efficiency was associated with a 3-mg/dL (se=1.1) increase in TC. In sensitivity analyses, individuals taking lipid-lowering medications were retained in the analysis and findings remained consistent.

**Conclusions:** Associations between indices of disturbed/short sleep with lipid levels varied by race/ethnicity. These data warrant further investigation of mediating and modulating pathways linking sleep to cardiovascular disease.

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EFFECT OF MELATONIN ON INSOMNIA IN 7-12 YEARS OLD CHILDREN

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Introduction: Insomnia is prevalent in children. Insomnia is a difficulty in initiation, duration, consolidation, maintenance of sleep or early waking in the morning that leads to daytime functional impairment of the child and parents. The aim of this study was to evaluate the effect of treatment with melatonin on insomnia in 7-12 years old children in Qazvin, Iran.

Materials and methods: This double blind randomized clinical trial was conducted on 60 healthy children (7-12 years old) with insomnia that were randomly allocated to intervention and control groups. The intervention group was treated with 3 mg melatonin one hour before nocturnal bed time and the control group was treated with placebo for one month. The children sleep habits questionnaire (CSHQ) was completed for both groups before and after the intervention. Both groups received sleep hygiene education before the intervention. Data were analyzed using T-test and paired T-test.

Results: Mean age was 9.79±2.02 in the intervention group and 9.38±2.05 in the control group (P>0.05). Before the intervention, total sleep disturbance score was 56.57±8.44 in the intervention group and 53.96±4.46 in the control group (P>0.05). After the intervention, total sleep disturbance score was 39.23±7.62 in the intervention group and 49.20±5.53 in the control group. The total score was only significantly decreased in the intervention group (P: 0.001). All subscales scores were also significantly decreased in the intervention group except bedtime resistance and sleep disordered breathing. No side effects were reported in the intervention group.

Conclusions: With regards to the results, melatonin was effective to improve the initiation and maintenance of sleep and most in primary school aged children.

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THE RELATIONSHIP BETWEEN PRE-SLEEP MONITORING BEHAVIOR AND AROUSAL IN PEOPLE WITH DIFFERENT STRESS REACTIVITY AND CHRONIC INSOMNIA

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Introduction: The cognitive model of insomnia elucidated the importance of monitoring for sleep-related threat in fueling insomnia. The AIE Model proposed that there is a shift of attention from stress-related threats toward sleep-related stimulus in the transition from acute to chronic insomnia. This study was aimed to test this hypothesis by comparing the attention bias among good sleepers with different levels of stress reactivity, individuals with transient insomnia, and patients with chronic insomnia.

Materials and methods: Participants (N=59) completed the Ford Insomnia Response to Stress Test (FIRST), Insomnia Severity Index (ISI), Sleep Associated Monitoring Index (SAMI) and the Pre-Sleep Arousal Scale (PSAS). Based on clinical interview and the scores on the ISI, FIRST, they were classified into four groups: normal sleeper with low stress reactivity (LF), normal sleepers with high stress reactivity (HF), individual with transient sleep disturbance (TI) and individuals with chronic insomnia (CI). All participants underwent a pre-sleep physiological recording (eg. peripheral temperature, skin conductance, EEG) and had one night of PSG recording to screen for sleep disorders. One-way analysis of variance (ANOVA) was conducted to compare sleep monitoring behaviors among four groups. Pearson correlation was used to examine relationships between sleep monitoring behaviors and pre-sleep physiological arousal.

Results: There was a significant difference in SAMI between four groups (F=8.675, p<.001). Post-hoc comparisons revealed that LF groups had significantly less sleep monitoring behaviors than the other three groups; there were however no differences among the other three groups. In addition, the SAMI score of CI showed positive correlation with PSAS score (r=.541, p<.025), and the SAMI of HF correlated negatively with delta power at frontal site (r=-.910, p<.016). The rest of the correlations did not show significant findings.

Conclusions: Increased attention toward to sleep-related threats were found to be in participants with acute and chronic insomnia, as well as in normal sleepers with high stress reactivity. It suggests that sleep monitoring behaviors might be an important predisposing factor for insomnia. Moreover, the sleep-related attention might become associated with pre-sleep hyperarousal when the sleep disturbance getting into chronic in course.
**Introduction:** Very little is known about important treatment goals among patients with insomnia disorder. This study aimed at identifying central treatment targets and examining the association of these goals with clinical parameters.

**Materials and methods:** Two-hundred nineteen patients with insomnia disorder rated the importance of 18 various treatment goals [from 0 (not at all important) to 10 (very important)] and completed questions on clinical correlates (insomnia severity, functional impairment, quality of life, sleep medication, psychiatric comorbidity, and somatic comorbidity).

**Results:** Based on a predetermined cutoff (7.5 or higher), eight treatment goals were rated as important: reduced frequency of sleep disturbance, reduced dissatisfaction with sleep, longer total sleep time, improved concentration, memory or attention, reduced wake time after sleep onset, reduced worry about sleep, reduced tiredness during the day and improved functioning in occupational activities. Insomnia severity and functional impairment were the most consistent predictors of the treatment goals with moderate to strong correlations. The remaining predictors were either not significantly related to the goals or were correlated at a lower level.

**Conclusions:** The fact that both night- and daytime symptoms were represented as the most important treatment goals emphasizes the need to view insomnia as a 24-hour problem in clinical and research settings. As several of the important treatment goals are seldom assessed in clinical practice, this calls for developing and using measures that cover the full spectrum of important targets for those with insomnia.

**Acknowledgements:** We thank the Swedish Research Council for funding.
Introduction: Previous evidence suggests that insomnia symptoms are related to elevations in suicide risk. This study aimed at investigating the associations between socio-demographical and clinical parameters with suicide risk in patients with insomnia disorder.

Materials and methods: Two-hundred nineteen patients with insomnia disorder completed questions on socio-demographics (age, gender, civil status, occupational status, and educational status), clinical correlates (insomnia severity, functional impairment, anxiety, depression, quality of life, any medication, sleep medication, psychiatric comorbidity, and somatic comorbidity), and suicide risk (one question from the MADRS-S).

Results: A multivariate linear regression analysis using only the eight significant parameters from univariate analyses demonstrated that gender (male), any medication, elevated anxiety, and lower quality of life were independent predictors of increased suicide risk ($R^2 = .32$; the non-significant variables were insomnia and functional impairment severity, levels of depression, and psychiatric comorbidity).

Conclusions: These findings highlight four potential, unique predictors of suicide risk and emphasize the possibility for improved screening and for targeted treatment to reduce suicide risk in patients with insomnia disorder.

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NON-PHARMACOLOGICAL INTERVENTIONS OF INSOMNIA AMONG SHIFT WORKERS: AN RCT TRIAL IN OCCUPATIONAL HEALTH SETTING

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Introduction: Shift work is a challenge for the screening and treatment of chronic insomnia because of irregular sleep-wake pattern. However, our earlier results showed that a group based cognitive behavioral treatment for insomnia (CBT-I) delivered by trained nurses may be effective also for those who work irregular work hours. The aim of the present study was to compare the implementation and effectiveness of group and self-help based CBT-I and sleep hygiene intervention in a randomized and controlled design (RCT) among employees with different types of shift work. The study was carried out in the occupational health (OH) context.

Materials and methods: Participants were shift workers with insomnia disorder that had lasted at least three months. They were recruited from six OH centers and randomized to
a) group-based CBT-I (6 group sessions),
b) computerized self-help CBT-I (an individual introduction session before and feedback session after the intervention), and
c) sleep hygiene intervention (1 individual session).

The interventions were delivered by trained nurses or psychologists of OH centers. Outcomes were assessed using a sleep diary, questionnaires, actigraphy and cognitive tests. In addition, blood samples were collected for biological analyses. The measurements were conducted at five time points within a two-year period. The recruitment of participants ended in June 2017 in this ongoing study. Preliminary questionnaire (Insomnia Severity Index, Dysfunctional Beliefs and Attitudes about Sleep scale, Beck Depression Index and Generalized Anxiety Disorder) results were analysed.

Results: The pre- and post-intervention data were available on 50 participants, of which, 76% were female and the mean (SD) age was 45 (10.1). Twenty of them received the group-based CBT-I, 14 self-help CBT-I and 16 sleep hygiene intervention. Perceived severity of insomnia, sleep-related dysfunctional beliefs and mood symptoms improved statistically significantly after the interventions but there weren’t significant differences between the interventions.

Conclusions: Preliminary results indicate that not only group-based CBT-I but also self-help based CBT-I and mere sleep hygiene intervention delivered by trained occupational health professionals may reduce insomnia symptoms among shift workers.

Acknowledgements: This study is supported by grants from the Finnish Work Environment Fund and the NordForsk.
Introduction: Insomnia is a prevalent sleep disorder associated with a multitude of health consequences. Particularly, insomnia has been associated with cardiovascular disease and its precursors, such as hypertension and blood pressure non-dipping. The present systematic review aimed to summarize the evidence on the concurrent and prospective associations between insomnia and hypertension and/or blood pressure dipping.

Materials and methods: Using electronic search engines (PUBMED, SCOPUS, and PSYCHINFO), 4,402 articles published between January 1980 to January 2017 were identified, and 72 met the inclusion criteria. Insomnia was assessed via self-report questionnaires, interviews, and with proxies of insomnia (i.e., variables indicative of typical insomnia symptoms). Hypertension was assessed with self-reports or was objectively measured; blood pressure dipping was measured objectively.

Results: The sample size ranged from 5 to 94,194 and the average age of participants ranged from 19.7 ± 1.0 to 80.8 ± 16.6 years (range: 18 to 100 years; 48.3% male). In general, findings indicate that when insomnia is frequent, chronic, and/or accompanied with short sleep duration or with objective markers of arousal (e.g., multiple sleep latency test), there is a strong association with hypertension (ORs range: 1.00 - 5.12). When objective proxies of insomnia derived from polysomnography and/or actigraphy were examined, hypertension and blood pressure non-dipping were associated with reduced sleep efficiency and prolonged sleep onset latency.

Conclusions: Findings generally show that insomnia is related to hypertension and blood pressure non-dipping. Additional research is needed to further examine the relation between insomnia (defined by subjective and objective measures) with these precursors of cardiovascular disease. Relatedly, future research is needed to identify putative underlying pathophysiological mechanisms underlying the link between insomnia and hypertension.

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**Insomnia**  
**Board #034: P3 - Tuesday**  
**BETTER SLEEP IN PSYCHIATRIC CARE; A PILOT STUDY OF A BEHAVIORAL TREATMENT FOR INSOMNIA IN ADHD**

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**Introduction:** Patients with ADD/ADHD often experience significant sleep problems. One of the most common problems is sleep onset insomnia, often combined with delayed sleep phase disorder. Previous studies have evaluated the use of melatonin and other pharmacological treatments for this patient group. However, although cognitive behavioral therapy for insomnia (CBT-I) is considered treatment of choice for insomnia, evaluations of the use of this behavioral intervention for insomnia patients with ADD/ADHD are lacking. Thus, the aim of the present study is to pilot and evaluate a CBT-I group intervention for adult patients with ADD/ADHD and insomnia, in the context of a specialist psychiatric out-patient clinic.

**Materials and methods:** In a within-group design, 22 patients at the Department of ADHD, Northern Stockholm Psychiatry (Stockholm, Sweden) with a diagnosis of ADD or ADHD and self-reported insomnia and Insomnia Severity Index (ISI) score above 10, were given an adjusted version of CBT-I (including sleep time scheduling or sleep compression, stimulus control, mindful relaxation and cognitive interventions, and with specific attention to light exposure and sleep hygiene) as a ten-session group intervention. Additional co-morbidities and medication use were allowed. Outcomes were group session adherence, insomnia severity (ISI), and ADHD-symptoms (Adult ADHD Self-Report Scale (ASRS)), at pre-treatment, post-treatment, and three-month follow-up.

**Results:** Seventeen patients were classified as treatment completers and only five as treatment drop-outs, with an average attendance of 7.8 and 1.2 sessions respectively. Preliminary intent-to-treat analyses show statistically significant improvements on the ISI (pre=15.5, post=11.2, and three-month follow up=9.5), and the ASRS (pre=42, post=40, and three-month follow-up=38). Treatment completers had larger gains than treatment drop-outs in terms of insomnia severity (pre=15.6 and 15.2, post=10 and 15.2 and three-month follow-up=8.4 and 13.6 respectively).

**Conclusions:** Most patients attended an adequate number of group sessions, and to these treatment completers treatment was beneficial in reducing insomnia severity. A small effect was also seen on ADHD-symptoms. To confirm these positive results, a randomized trial is currently conducted at the Department of ADHD, Northern Stockholm Psychiatry (Stockholm, Sweden). However, further studies will be needed to create an evidence base for the use of non-pharmacological alternatives to treat sleep problems, with the potential to greatly improve care and quality of life for this patient group.

**Acknowledgements:** We would like to thank the participants, and Holger Thomas and staff the department of ADHD, Northern Stockholm Psychiatry for fruitful collaboration.
**EFFECT OF BRIGHT LIGHT TREATMENT IN PATIENT WITH POST-STROKE INSOMNIA**

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**Introduction:** Post-stroke insomnia is associated with physical and mental health-related quality of life as well as functional outcomes in stroke patients during rehabilitation. Hypnotics could aggravate sleep apnea or delay neurological recovery in post-stroke insomnia, so non-pharmacologic treatment of insomnia after stroke is needed. Bright light treatment has been regarded as effective non-pharmacologic treatment for insomnia in general population. However, there has been no study using bright light treatment in post-stroke insomnia. The aim of this study is to evaluate the effect of bright light treatment in patients with post-stroke insomnia.

**Materials and methods:** Randomized, double-blind, placebo- and sham-controlled 4-week trial was performed in stroke patients during the early stage of rehabilitation. Data were collected from August 2016 to June 2017. The post-stroke insomnia was confirmed using actiwatch. If the average sleep latency is greater than 30 minutes, the average sleep efficiency is less than 80%, the total sleep time is less than 6 hours, or the wake after sleep onset is greater than 30 minutes being measured more than 2 days in 7 days, post-stroke insomnia was defined. People who were found to have insomnia were randomly assigned to a bright light treatment group and a sham treatment control group and received light treatment for two weeks. After treatment, the effect of treatment was assessed with actiwatch.

**Results:** Of the 67 patients, 33 had insomnia evaluated by actiwatch. A total of 33 stroke patients were randomized to bright light treatment group (n=17) and sham treatment group (n=16). The mean age of the subjects was 67.7 years, and 18 were male. There was no difference in age or the proportion of gender before light treatment. Total sleep time, sleep latency, sleep efficiency, the wake after sleep onset, and the number of wake were not different between treatment group and control group. The bright light treatment was significantly superior to placebo in the improvement of total sleep time and sleep efficiency. There was no significantly difference of sleep latency, the wake after sleep onset, and the number of wake between bright light treatment group and control group.

**Conclusions:** Bright light treatment was effective in the treatment of post-stroke insomnia.
Introduction: Employers are becoming concerned with the costs of presenteeism (showing up for work when one is ill) in addition to the absenteeism (being absent from a workstation) and healthcare costs that have traditionally been explored. The purpose of this study is to analyze associations between absenteeism/presenteeism and sleep debt in a Japanese working population.

Materials and methods: A cross-sectional questionnaire survey was conducted in a rural city in Shiga prefecture, Japan, in November 2016. World Health Organization Health and Performance Questionnaire (WHO-HPQ), Insomnia Severity Index (ISI), Patient Health Questionnaire-9 (PHQ-9) were used to assess absenteeism/presenteeism, insomnia, and depression, respectively. Weekday sleep debt was calculated as the difference in sleep duration between weekdays and weekends.

Results: 1827 city government employees (male 691, age 44.7±12.1) participated this survey (participation rate: 83.4%; 1827/2190). Participants with higher rates of relative absenteeism and relative presenteeism (the lowest tertile of the scores) were significantly associated with weekday sleep debt (OR=1.12, 95% CI: 1.05-1.20, p<0.001 and OR=1.09, 95% CI: 1.02-1.16, p=0.014, respectively), after adjusting for age, gender, BMI, ISI, and PHQ-9.

Conclusions: Weekday sleep debt is a risk factor for relative absenteeism and relative presenteeism.

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Insomnia
Board #065: P5 - Wednesday
PREVALENCE OF INSOMNIA AND ITS CLINICAL PHENOTYPES IN EPILEPSY AND THEIR RELATION TO SEVERITY OF DEPRESSION

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Introduction: Sleep is frequently disturbed in epilepsy. On the other hand, depression is vastly present in many patients with epilepsy (PWE). Various reasons exist, including intrinsic factors and pharmacotherapy. Few studies include clinical assessment of insomnia as a separate clinical co-morbidity in epilepsy. The aim of this study was to assess the prevalence of insomnia and its clinical phenotypes in PWE and their relationship to depression severity.

Materials and method: PWE were enrolled according to proven diagnoses, made at tertiary epilepsy and sleep centers. Insomnia diagnosis was placed based upon complaints obtained during somnological interview. Healthy control (HC) group was enrolled based on random principle from general population. Clinical insomnia phenotype (CIP) was divided into 3 categories: sleep-onset insomnia (SOI), sleep-maintenance insomnia (SMI), mixed-phenotype insomnia (MI). The latter were obtained from Hamilton’s Depression-rating Scale (HAMD), which also served for depression assessment, with severity ranging from mild to moderate to severe. T-test and Chi-square test were used for statistical analysis.

Results: Overall, 169 PWE and 100 HC participated in our study. In PWE group 80 subjects (47.3%) complained of insomnia, compared to 27 (27%) in HC group (p< 0.001). The distribution of insomnia phenotypes among PWE with insomnia was as follows: SOI - 27.5%, SMI - 13.2%, MI - 59.3%. According to HAMD scale 37.3% had no depression, 31.3% - mild, 27.1% - moderate and 4.2% - severe. Using Chi-square analysis we found out the prevalence of various CIPs according to severity of depression subgroups, showing a tendency to have more cases of pure SOI in mild depression and more MI in moderate-to-severe depression (p< 0.001).

Conclusions: Our results show significantly higher prevalence of insomnia in epilepsy. Also we report description of CIP, which are differently distributed according to depression severity with pure SOI tending to occur more in mild while MI in moderate-severe depression.

Acknowledgements: Somnus neurology clinic and Republic epilepsy center staff.
Sleep is an essential aspect of life and a high percentage of children with Autism Spectrum Disorder (ASD) experience sleep problems. It is estimated that 40%-80% of individuals with ASD present with insomnia. Insomnia relates to difficulties initiating and/or maintaining sleep. These may include adhering to bedtime routines, trouble falling asleep, frequent waking during the night, waking earlier in the morning and co-sleeping with parents. Sleep-related problems are distressing for the child with ASD and their families. Despite the high prevalence of insomnia in children with ASD there is little qualitative data on parent's subjective experience of the negative impact that insomnia has on the child and the family unit. The present qualitative study presents findings from a series of 3 focus groups with 15 parents of children with ASD who experience sleep related problems. Focus groups were audio recorded and transcribed using 'intelligent verbatim'. NVivo was used to prepare a content analysis that coded and identified the emerging sub themes and main themes. Several sub themes emerged identifying the negative impact that ASD sleep related issues had on the family. Six main themes emerged from the analysis to include triggers of distressing emotions, dietary intake, bedtime behaviours, social impact, familial implications and daytime/educational consequences. Across focus groups, parents gave similar descriptions of insomnia triggers and challenging behaviours associated with the lack of sleep. Parents indicated that anxiety related to school trips triggered several nights of reduced sleep for their child with ASD and the family, prior to a school event. Social exclusion due to tiredness or challenging behaviours was a theme that occurred across all focus groups and it was further articulated that decreased opportunities for fun activities were often experienced by the family unit. The implications of the findings are discussed in relation to the design of future research to inform the development of best practices for sleep interventions for children with ASD. Qualitative data which considers parents perceptions and experiences of insomnia that is experienced by their child with ASD may help to identify the behaviours to be targeted during a sleep intervention. In addition, the qualitative data may also provide insightful information for the clinicians working with the family.

**Keywords:** insomnia, autism spectrum disorder, parents, social exclusion, anxiety, focus groups, content analysis

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THE IMPACT OF ELECTRONIC MEDIA AND SCHOOL SCHEDULE ON SLEEP OF ADOLESCENTS

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Introduction: Until a few decades ago, sleep was considered to be a totally passive state. Today we know that when we sleep our brain is very active. Many theories have been developed on why we sleep: energy conservation, restoration of the body (muscle growth, tissue repair, protein synthesis) contribution to brain plasticity (structure and organization of the brain) and enhancing of learning and memory (Frank MG, 2006). Lack of sleep affects decision-making, mood, ability to learn and retain information, and increases the risk of accidents and injuries. Sleep deprivation leads to health related problems such as obesity, diabetes, cardiovascular diseases and even premature mortality (Harrison Y, 2000), (Beebe DW, 2011). During the whole of adolescence, there are ongoing changes of sleep patterns and of the circadian timing systems. In addition, during this developmental phase, sleep needs and patterns are not in accordance with psychosocial and behavioural factors modulating sleep habits, resulting in incongruence to sleep phase delay, insufficient sleep and somnolence during the day.

Materials and Methods: We reviewed the literature

Conclusions: Sleep patterns tend to exhibit a phase delay, with bedtime more than two hours later during adolescence compared to childhood; this delayed sleep-wake behaviour pattern was found to be exacerbated by cultural factors. Asian adolescents are the most sleep deprived with later bedtimes and less total sleep time than peers from Europe and North America (Gradisar et al, 2011). Various factors have been implicated with this progressive time delay in adolescents, among them academic requirements, extracurricular activities, late-night entertainment, extended use of electronic devices and social media etc, while early school starting time is the main factor behind chronic sleep loss and sleepiness during the day.

Results: Recent literature mainly focuses on the use of electronic media and school starting time, since these two factors have a strong impact on sleep of adolescents and are modifiable. Aim of this paper is to review the recent literature on these parameters.
Insomnia
Board #036: P3 - Tuesday

ANALYST RELATIONSHIP BETWEEN FIVE-PATTERN PERSONALITY AND PITTSBURGH SLEEP QUALITY INDEX(PSQI) OF INSOMNIA PATIENTS

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Introduction: Analyst relationship between Five-Pattern Personality and Pittsburgh Sleep Quality Index(PSQI) of insomnia patients.

Materials and methods: Recruited totally 240 insomnia patients. The Five-Pattern Personality scales and (PSQI) were used to evaluate the Five-Pattern Personality and observe the sleep index. The correlation was analyzed.

Results: Scores of Taiyin dimension was positively correlated with sleep disturbance and daytime function (P<0.05). Scores of Shaoyang, Shaoyin, YinYang balance dimension negative correlation with daytime function (P<0.05). YinYang balance dimension was negative correlation with PSQI total score.

Conclusion: Five-Pattern Personalities are correlated with PSQI. The result preliminary hint that each kind of personalities can be insomnia. However, Taiyin personality are more likely to suffer from insomnia.

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COMBINED EFFECTS OF CIRCADIAN-BASED EXERCISE AND MASSAGE INTERVENTION ON SLEEP AND FATIGUE IN HEAD AND NECK CANCER PATIENTS UNDERGOING CHEMO-RADIATION THERAPY

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Introduction: Sleep disturbance and fatigue are the most common and significant problems in cancer patients during and after treatment of chemo-radiation therapy. Literature has shown that exercise has effect on fatigue, and massage can improve relaxation and sleep. Combine exercise and massage as a circadian-based intervention may have robust effect on fatigue and sleep in cancer patients during treatments. This study used a randomized control design to compare the effect of circadian-based exercise and massage intervention, exercise only, and massage only on sleep and fatigue in head and neck patients undergoing chemo-radiotherapy.

Materials and methods: Sixty patients with head and neck carcinoma aged 53.5±9.5 years were randomly allocated to exercise group (EG, n=22), massage group (MG, n=17) or exercise and massage group (EMG, n=21). Exercise was performed at 8-10 am and 14-16 pm for 15 minute for 3 consecutive days. Massage was performed by using a massage cushion before bedtime (20-22 pm) for 15 minutes for 3 consecutive evenings after started chemo-radiation therapy. The Taiwan General Fatigue Scale (TGFS) and the Verramn & Snyder-Halpen scale (VSH) were administered to assess fatigue and sleep quality, respectively, before and after therapy starts for 4 days.

Results: All patients in three groups experienced low fatigue level (TGFS score 23.1~31.6±8.8~13.9), moderate sleep quality (VSH score 74.6~101.6±17.7~27.4). During intervention, the fatigue level is linear decreased in EMG group (F=6.826, p=.017), quadratic decreased in the EG group (F=4.851, p=.039), but no changes in ME group (F=2.160, p=.161). There are no significant changes in sleep quality within and among groups (all p > .05).

Conclusions: A circadian-based intervention combined with exercise and massage may have better effect on decreasing the fatigue level than exercise or massage alone in head and neck cancer patients undergoing chemo-radiation therapies.

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Insomnia
Board #037: P3 - Tuesday

BOTH WEIGHT AT AGE 20 AND WEIGHT GAIN HAVE AN IMPACT ON SLEEP DISTURBANCES LATER IN LIFE - RESULTS OF THE EPIHEALTH STUDY

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Introduction: Obesity is often associated with impaired sleep, while the impact of BMI at younger age and previous weight gain on sleep problems remains unknown. The aim of the present study was to analyse the impact of BMI at age 20 and weight gain since then on present sleep problems in a community-based middle-aged and elderly population.

Materials and methods: The present study utilized data from the Swedish EpiHealth cohort study. Participants (45-75 y) were asked to fill out an internet-based questionnaire. Body mass index (BMI, kg/m²) was calculated from both measured data at study time and self-reported data at age twenty from the questionnaire.

Results: A total of 15,845 participants were eligible for the present analysis. Significantly more women reported difficulties initiating (DIS; 10% v.s. 5%) and maintaining (DMS; 11% v.s. 6%) sleep and early morning awakening (EMA, 12% v.s. 10%) than men and these sleep-related symptoms were most common among obese individuals (BMI > 30kg/m²). An association between weight gain and sleep problems was found and those with a low BMI at age 20 were most vulnerable to weight gain when it came to risk of DIS, EMA and snoring, while the highest odds were found in the underweight group.

Conclusions: Sleep problems are related to weight gain and obesity and the impact of weight is most pronounced among those who had a low BMI when young.

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THE EFFECTS OF INSOMNIA SYMPTOMS AND OBJECTIVE SHORT SLEEP DURATION ON MEMORY PERFORMANCE IN ADOLESCENTS AND YOUNG ADULTS

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Introduction: Insufficient sleep and sleep disruption, especially insomnia symptoms, are common problems among adolescents and young adults. While the association between insufficient sleep and poor memory performance is well established, there has been limited research on how insomnia may affect memory performance, especially in adolescents. Recent evidence suggests that insomnia with objective short sleep duration, a more severe insomnia phenotype, is associated with an elevated risk for medical morbidity as well as neurocognitive impairments. The present study examined the effects of insomnia and objective short sleep duration on memory performance among adolescents and young adults.

Materials and methods: One hundred fifty-four participants (Female: 79.2%) aged from 12 to 23 years (M = 17.5, SD = 2.0) completed this study. Insomnia symptoms were defined as an Insomnia Severity Index (ISI) score ≥10, and objective short sleep duration was defined as average total sleep time < 6.18 h (below median) as assessed by 7-day actigraphy. Working memory and episodic memory were assessed objectively by Digit Span Task, N-back Task, and the Chinese version of the Verbal Learning Test. Subjective memory performance was assessed by the Multifactorial Memory Questionnaire (MMQ), which consists of three subscales (memory contentment, MMQ-C; memory ability, MMQ-A; daily memory strategy uses, MMQ-S). Participants also completed the Depression Anxiety and Stress Scale (DASS) for assessing mood symptoms. The effects of insomnia symptoms, short sleep duration, and their interaction on memory measures were tested by MANOVA whilst controlling for age, gender, and mood disturbance.

Results: A significant multivariate effect was revealed for insomnia symptoms (Wilk's λ = .86; F = 2.81; p < .01), but not for short sleep duration (Wilk's λ = .94; F = 1.03; p > .1). The interaction between insomnia symptoms and short sleep duration on all the memory measures was not significant (Wilk's λ = .97; F = .57; p > .1). Participants with insomnia symptoms perceived their memory as less satisfactory (MMQ-C: F = 6.97, p < .01; MMQ-A: F = 5.47, p < .05), and objectively performed worse on the two working memory tasks (Forward digit span: F = 9.88, p < .01; Backward: F = 2.79, p = .097; N-back task, 3-back: F = 5.27, p < .05) than normal sleepers.

Conclusions: Our findings suggested that insomnia symptoms, but not objective short sleep duration, are associated with poorer subjective memory performance as well as objective working memory performance in adolescents and young adults. Future research is needed to further delineate the mechanism underlying the effect of insomnia symptoms with objective short sleep duration on daytime cognitive functioning among adolescents and young adults.

Acknowledgements: The study was supported by HKU Seed Funding Programme for Basic Research.
Introduction: Obstructive Sleep Apnoea Syndrome (OSAS) and insomnia are two prevalent pathologies that frequently co-occur. This association has been shown to be more strongly associated with cardiovascular disease. Women with OSAS are more prone to present with insomnia complaints. Few studies have documented that CPAP (continuous positive airway pressure) use may improve insomnia symptoms. There is no data evaluating the benefit of CPAP in patients with mild/moderate sleep apnea and possible gender differences in response to treatment. The objective of this study was to evaluate the response in insomnia symptoms to CPAP in patients man and women with mild/moderate and severe OSA.

Methods: Retrospective study of all patients identified with OSAS and insomnia from an outpatient sleep clinic from an University Hospital. OSA and Chronic Insomnia Disorder were diagnosed clinically according to the ICSD 3 criteria. The main outcome of the study was clinical improvement of insomnia following CPAP based on clinical impression. OSA was considered mild/moderate OSA was considered for AIH/RDI less than 30. Other variables collected included gender, PSG variables, CPAP compliance, insomnia subtypes, comorbidities and pharmacological treatment.

Results: From a database of total of 827 patient, 95 patients were identified with OSAS and insomnia. Of them, 53,7% were women. Most men (77,3%) and women (80,3%) improved insomnia after CPAP. In women, improvement was similar in both severe (n=10) and mild/moderate OSA (80% and 68,3%, respectively). In patients with severe OSA, men were less likely to improve insomnia symptoms after CPAP (65,0 % did not improve insomnia, p< 0,05). Men with mild/moderate OSA (n=24), showed similar improvement when compared to females (66,7% improved insomnia).

Discussion: In our clinical population, co-morbid insomnia and OSA occurred in similar percentages in men and women. Our study re-inforces that CPAP use improves insomnia, irrespective of insomnia type and in patients with both severe and mild to moderate OSA. It also suggests that insomnia symptoms, in men with severe OSA, may be less responsive to CPAP.
Insomnia
Board #074: P5 - Wednesday
INSOMNIA: RELATIONSHIP WITH SLEEP QUALITY AND PSYCHIATRIC DISORDERS IN PATIENTS WITH IDIOPATHIC PULMONARY FIBROSIS

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Introduction: Insomnia is prevalent in patients with idiopathic pulmonary fibrosis (IPF) and is associated with poor sleep quality, psychiatric disorders like anxiety and depression and increased morbidity and mortality. Patients with IPF have poor sleep and it is necessary to screen them for presence of sleep disorders so that their well-being could be improved. The purpose of the current study was to find out the prevalence of insomnia in patients with IPF and examine its relationship with sleep quality, anxiety, and depression.

Materials and methods: It was a cross sectional study carried out on patients selected from a pulmonary clinic (n=35). Insomnia, sleep quality, and anxiety and depression were assessed through Insomnia Severity Index, Pittsburgh Sleep Quality Index, and Hospital Anxiety and Depression Scale respectively.

Results: Insomnia was present in 14 (40%) of patients with IPF. Patients with insomnia had worse sleep quality and were poor sleepers (PSQI > 5) as compared to the ones without insomnia (p< .01). Anxiety and depression were both prevalent in IPF patients with a percentage of 17% and 23% respectively. Anxiety was present more in patients with severe or progressive IPF and had no significant relationship with insomnia whereas depression was more in ones with insomnia (p< .05). Patients with IPF had overall short sleep duration, frequent night time awakenings, and dissatisfaction with quality of sleep. Poor sleep quality was not associated with age, gender, body mass index, or lung function. However, insomnia was significantly correlated with female gender and depression.

Conclusions: Insomnia is highly prevalent in patients with IPF and contributes to poor sleep quality as well as depression. IPF patients must be screened for sleep disorders and be managed accordingly for better quality of life.
INSOMNIA DUE TO RESTLESS SHOULDER FOLLOWING POSTERIOR INTERNAL CAPSULE INFARCTION

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Introduction: Restless legs syndrome (RLS) is a sensorimotor disorder predominantly affecting the legs, causing insomnia. The isolated involvement of the body parts other than legs has been rarely reported as RLS variants.

Methods: We here report a patient who developed the abnormal sensations restricted to the shoulders following ischemic stroke.

Case report: A 70-year-old woman developed difficulty in speech and weakness of the left upper and lower limb upon awakening. No sensory disturbance was observed. Brain magnetic resonance images showed acute infarction in the right posterior limb of the internal capsule. On the hospital day 1, the patient developed the abnormal sensations restricted to the bilateral shoulders, which resulted in difficulty in initiating sleep. On laboratory data, renal function and serum hemoglobin and ferritin levels were normal. When four essential features of RLS were applied to her shoulders, the patient met RLS criteria. After administration of low dose pramipexole, the abnormal sensation of the shoulders and insomnia significantly improved, supporting the diagnosis of RLS variants.

Conclusion: RLS and its variants should be considered as the cause of insomnia following stroke.
DYSFUNCTIONAL BED-NEGATIVE ASSOCIATIONS IN PATIENTS WITH PRIMARY INSOMNIA

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Introduction: Ruminating about sleep problems and negatively-valenced thinking play a key role in the maintenance of sleep complaints in patients with primary insomnia (PI). Based on associative learning principles, we hypothesized that repeated co-occurrence of negative thoughts (unconditioned stimulus) and the bedroom environment (conditioned stimulus) results in automatic negative evaluative reactions towards bed-related stimuli (bed-negative associations, conditioned response).

Materials and methods: Participants were 22 patients with PI and 22 healthy controls without sleep complaints. Automatic bed-negative associations were assessed with the Single Target Implicit Association Test (ST-IAT), which is a response time based classification task, measuring associations between concepts (here: bed and positive vs. negative evaluations) by contrasting reaction times from two different combined response tasks. Insomnia severity (Insomnia Severity Index, ISI), sleep quality (Pittsburgh Sleep Quality Index, PSQI), depressive and anxiety symptoms (Hospital Anxiety and Depression Scale, HADS) were addressed in all participants.

Results: Data were analyzed for 21 patients (mean age = 58.4, SD = 12.4; 2 male) and 19 healthy controls (mean age = 55.4, SD = 10.7; 5 male). Subjects with PI ranked higher on the PSQI and ISI (p-values < .001) and the HADS (p-values ≤ 0.002). ST-IAT scores were lower in the insomnia group, (M = 0.13, SD = 0.20) compared to healthy controls, (M = 0.29, SD = 0.29), t(38) = 2.10, p = .043, suggesting stronger bed-negative associations in patients with PI. Strength of bed-negative associations was not related to the subjective severity of sleep complaints (ISI, PSQI), anxiety and depression (HADS), p-values > .05.

Conclusions: Results suggest that bed-negative associations are existent in patients with PI. Lacking association between the strength of bed-negative associations and subjective severity of insomnia complaints warrants further clarification but may reflect misperception of sleep maintenance in patients with PI. Future research should also examine how bed-negative associations play a role in the maintenance of the disorder, whether relevant key stimuli can be identified, and whether existing dysfunctional associations can be modified by novel intervention strategies. Considering the modification of bed-negative associations by intervention, the ST-IAT might act as a potential easy to apply measure of therapeutic effects independent of subjective misperception.

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Insomnia
Board #075: P5 - Wednesday
INTROCEPTIVE PERCEPTION AND SLEEP QUALITY IN CHRONIC INSOMNIA

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Introduction: Disturbances of introceptive perception and sensation-related cognitive processes (e.g., catastrophization about symptoms) were initially suggested as possible mechanisms of hypochondria and somatoform disorders (Nakao, Barsky, 2007, Rief et al., 1998 etc.). In functional illnesses poor differentiation of sensations (e.g., alexithymia, Taylor et al., 1997) could manifest in either too few or too many bodily sensations comparing to healthy controls as well as in misclassification of sensations as important, dangerous or caused by their illness (Tkhostov, 2002). Although insomnia was shown to be related to alexithymia (Lundh, Broman, 2006, Engin et al., 2010) and is comorbid to a wide range of mental disorders (Riemann, 2007), less is known about relationship between introceptive perception in insomnia and sleep and whether this relationship is explained by cognitive factors of insomnia (Perlis et al., 2011).

The aim was to reveal the relationship of bodily sensations and symptoms with beliefs about sleep, thoughts before sleep and sleep quality in patients with chronic insomnia.

Materials and methods: 82 patients with primary chronic insomnia (25 males, 16-65 years old) and 105 good sleepers (32 males, 16-60 years old) classified descriptors for bodily sensations from checklist as familiar for them, frequent, related to their sleep, important, dangerous and painful (Classification of descriptors of introceptive sensations, Tkhostov, Elshansky, 2003). Then they filled Bodily Perception Scale (Tkhostov, 2002), Glasgow Content of Thoughts Inventory (Harvey, Espie, 2004), Dysfunctional Beliefs About Sleep Scale and Insomnia Severity Index (Morin, 1993). The sleep of 62 patients was recorded using polysomnography. Subsample didn’t differ from initial sample by age and gender.

Results: Comparing to good sleepers, patients´ scores on the Bodily Perception Scale had bimodal distribution reflecting either too few or too many somatic complaints (p< .01). Comparing to controls, patients also classified either much more or just a few of their bodily sensations as dangerous and painful (p< .05). In clinical sample the number of reported somatic complaints (r=.54, p< .01) as well as the proportion of familiar and proportion of related to sleep sensations (r=.34, p< .05 and r=.57, p< .01, respectively) correlated to subjective insomnia severity. The number of somatic symptoms were marginally related to longer stage 1 and shorter delta-sleep (r=.22 and r=-.22, p< .10) while tendency to report either too few or too many symptoms was associated to shorter REM (r=-.30, p< .05). The number of somatic symptoms (but neither their bimodal pattern nor classification of sensations) was associated to dysfunctional beliefs about sleep and thoughts before sleep (r=.30-.49, p< .01).

Conclusions: While the bimodal pattern of somatic complaints in insomnia was typical for functional illnesses, only exaggerated level of sensations and their subjective referral to sleep were associated with poorer sleep in patients. Unlike the exaggerated level of sensations, their referral to sleep was unrelated to dysfunctional beliefs and thoughts before sleep.

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Illness Representation in Chronic Insomnia: Exploratory Study of Social and Cultural Beliefs in Russia

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Introduction: Chronic insomnia is characterized by specific beliefs about sleep (Morin, 2010) and sleep-related behavior (Perlis et al., 2011) that perpetuate its course. According to common-sense model (Leventhal et al., 2003) social and cultural context is an important source of such beliefs and behavior. However, rare research on insomnia based on this model (Morgan et al., 2003; Jorgensen, 2008) does not concentrate on culture- or country-specific beliefs. In Russia where more than 70% of patients with chronic insomnia continue to have disturbed sleep hygiene (Rasskazova, 2008) such studies are of high importance.

The aim was to reveal beliefs about reasons and ways of coping with insomnia that are widespread in Russia and are related to poorer sleep in patients with insomnia.

Materials and methods: Checklists of reasons and ways of coping with insomnia were created based on analysis of Russian-language popular and scientific publications and media. 82 patients with primary chronic insomnia (25 males, 16–65 years old) and 105 good sleepers (32 males, 16–60 years old) appraised their beliefs by Likert scale and filled Hospital Scale of Anxiety and Depression (Zigmond, Snaith, 1983), Glasgow Content of Thoughts Inventory (Harvey, Espie, 2004), Dysfunctional Beliefs about Sleep Scale and Insomnia Severity Index (Morin, 1993). Objective sleep of the subsample of 62 patients matching initial sample by age and gender was registered using polysomnography.

Results: Factor analysis differed 4 types of reasons for insomnia (psychological, situational, behavioral and secondary) and 4 types of ways of coping (medication, passive ways, active pre-sleep actions and lifestyle changes). In the case of sleep difficulties good sleepers attribute them to psychological and situational but not behavioral factors and prefer passive strategies and actions right before sleep. In chronic insomnia the role of medications increases. In clinical group emphasis on psychological reasons was related to poorer subjective sleep, higher anxiety, depression and dysfunctional beliefs ($r = .27-.45$, $p < .05$). Belief in secondary reasons correlated to pre-sleep cognitive activity and anxiety ($r = .38-.58$, $p < .01$) as well as longer stage 1 ($r = .28$, $p < .05$) and shorter stage 2 ($r = -.30$, $p < .05$). Emphasis on situational reasons correlated to longer delta-sleep ($r = .35$, $p < .01$) and shorter awakenings during night ($r = -.29$, $p < .05$). Belief in behavioral reasons was related to depression only ($r = .39$, $p < .01$). Subjectively effective ways of coping were unrelated to subjective sleep but active actions before sleep and lifestyle changes were associated to shorter stages 1 and 2 and less night awakenings ($r = -.37 - -.27$, $p < .05$). Preference of passive ways of coping correlated to less night awakenings only ($r = -.34$, $p < .05$).

Conclusions: Beliefs in exclusively psychological and situational but not behavioral reasons of insomnia as well as beliefs in the effectiveness of passive and “just before sleep” actions are widespread in Russian population. In insomnia these beliefs could lead to poorer sleep and illness perpetuation distracting attention from the triggers that patients are responsible for and can change while promoting use of passive coping strategies.

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HEART RATE VARIABILITY DURING SLEEP DISTINGUISHES BETWEEN INSOMNIA AND NORMAL SLEEP

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**Introduction:** In primary insomnia subjective complaints of poor sleep often contrast with relatively normal findings in objective sleep EEG assessments. Thus, there is a need for more conclusive biomarkers to objectify insomnia. A promising biomarker for restoring sleep may be heart rate variability (HRV), a correlate of autonomous nervous system (ANS) activity. The aim of this study was to evaluate HRV measures during specific sleep stages in relation to the clinical diagnosis of insomnia.

**Materials and methods:** In a case-control study design 10 adult women (mean age: 49.6±7.5 years) suffering from primary insomnia according to DSM-IV criteria were compared to a control group (N = 10). Severe physical and mental illnesses (e.g. affective disorders) were excluded. Sleep was objectively assessed by polysomnography containing EEG and ECG recordings. HRV was assessed in pure, artefact 5-min segments of specific sleep stages. Sleep EEG and frequency domain measures of HRV were compared between patients and controls.

**Results:** Insomnia and normal sleep did not differ in regard to any of the common measures of sleep EEG. HRV analysis in the first available rapid eye movement (REM) sleep segment and adjacent non-REM sleep revealed significant HRV reduction in insomnia patients. Differences were most prominent for N2 and REM sleep. Furthermore, in early REM sleep there was a shift of HRV frequency power from high frequency to very low frequency.

**Conclusions:** HRV in early nocturnal sleep differentiates between insomnia patients and healthy controls, most prominently in N2 and REM sleep. The pattern of results in REM sleep suggests low vagal activity or increased sympathetic input in insomnia. We conclude that HRV analysis in N2 or REM sleep delivers more sensitive markers for insomnia than common sleep EEG variables.

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IMPACT OF A MINDFULNESS-BASED INTERVENTION IN THE SLEEP QUALITY OF FIBROMYALGIA PATIENTS

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Introduction: Fibromyalgia (FM) is a chronic pain condition characterized by widespread pain for at least 3 months and 11 or more of 18 tender point sites on digital palpation, according to the American College of Rheumatology (Wolfe et al., 1990). Sleep disturbances play an important role in the exacerbation of pain and other troubling symptoms reported by patients with FM. Consistent with this, unrefreshing sleep has been proposed by the ACR (Wolfe et al., 2010) as one of the most important diagnostic variables in FM in addition to widespread pain, cognitive symptoms, fatigue and a number of somatic symptoms. In recent years, several studies have evaluated the usefulness of mindfulness-based interventions in the treatment of insomnia and chronic pain. The results of these works are not conclusive, and studies centred on sleep in FM are absent. The objective of this pilot study was to examine the efficacy of mindfulness-based intervention for improving sleep quality (primary outcome measure), and other clinical manifestations, such as pain, fatigue, daily functioning, self-efficacy, catastrophizing, anxiety and depression (secondary outcome measure) in patients with FM.

Materials and methods: Ten women diagnosed with FM aged between 31 and 62 years old (M=46.50; SD=9.09) participated in the study. Patients were recruited from the Rheumatology Service of Virgen de las Nieves University Hospital, and referred to the Clinical Psychology Unit of the University of Granada, where the psychological assessment and treatment sessions were conducted.

Patients were asked to complete a questionnaire survey at pre and posttreatment including the Pittsburgh Sleep Quality Index, the Chronic Pain Self-Efficacy Scale, the Hospital Anxiety and Depression Scale, the Pain Anxiety Symptoms Scale-20, the Pain Catastrophizing Scale, the Short-form McGill Pain Questionnaire, the Multidimensional Fatigue Inventory, and the Fibromyalgia Impact Questionnaire.

The mindfulness-based intervention was developed during 9 sessions in which the following contents were addressed:
1) Effects of stress on health and benefits of mindfulness training;
2) Attitudinal foundations of mindfulness practice;
3) Meditation of the body exploration;
4) Application of training in mindfulness to insomnia;
5) Acceptance and Emotions;
6) Development of self-compassion;
7) mindfulness of thoughts;
8) Connection with significant life values and
9) Maintenance of achievements and prevention of relapse.

Statistical package SPSS.20 was used for the analysis. In order to examine the possible changes we applied the Wilcoxon signed-rank test.

Results: The participants who received mindfulness showed significant post-treatment improvement in the global PSQI score (z= -2.26; p< 0.05), subjective sleep quality (z= -2.00; p< 0.05), and habitual sleep efficiency (z= -2.00; p< 0.05). There were also significant improvements in pain catastrophizing (z= -2.52; p< 0.05), pain (z= -2.23; p< 0.05), chronic pain self-efficacy (z= -2.49; p< 0.05), and fibromyalgia impact (z= -2.29; p< 0.05).

Conclusions: Although there is some preliminary support for the use of mindfulness-based intervention in sleep quality in FM patients, further research is required before it could be considered an effective intervention for insomnia and other symptom in this population.

Acknowledgements: Study financially supported by the Spanish Ministry of Science and Innovation (PSI-2014-58379-P).
Introduction: Following the launch of a new medication, a more diverse patient population than that studied in the original clinical development program may receive treatment. In Japan there is a regulatory requirement to collect safety and efficacy information in a real world setting after drug approval. Suvorexant is an orexin receptor antagonist for the treatment of insomnia that was approved in Japan on September 26, 2014, at doses of 15 mg and 20 mg. This is an interim report of the drug use-results survey of suvorexant, for the period from July 21, 2015 to August 12, 2016. The survey was implemented in compliance with Good Post-marketing Study Practice (171 of Ministry of Health, Labour and Welfare Ordinance, dated December 20, 2004).

Materials and methods: Survey subjects' registration: Survey subjects comprised insomnia patients who initiated treatment with suvorexant for the first time, at medical institutions where a contract had been concluded on the survey. For inclusion, physicians at the medical institutions had to register subjects to an external data center within 7 days after starting suvorexant to ensure a prospective observation. Procedure for data collection: The observation period was up to 6 months from the start of suvorexant. In cases where treatment with suvorexant was ended for any reason before 6 months, the observation period ended at 30 days after the last dose of suvorexant. Throughout the observation period, information was collected through a physician's standard routine medical interview. Then each physicians calculated sleep latency and total sleep time of subjects, and categorized their improvement into “improved”, “unchanged” or “deteriorated”.

Results: We collected data on 791 survey subjects from 307 medical institutions. A majority of the subjects were female (61.4%), elderly (mean age: 61.5), naïve to hypnotics (58.6%), and were seen at a department of internal medicine (56.8%). As subjects had several concurrent conditions such as depression (17.8% of the survey subjects), respiratory dysfunction (5.8%) and hepatic function disorder (3.9%), the population was more clinically diverse than that in the original clinical development program. With regard to safety, the percentage of subjects with an adverse drug reaction was 8.8% and the most common adverse drug reactions were somnolence (3.0%), insomnia (1.3%) and nightmare (1.1%). With regard to efficacy, the percentage of subjects rated as “improved” by the physicians was 74.0%. The median sleep latency changed from 60.0 minutes at pre-dose to 30.0 minutes at Week 1 and this was subsequently maintained 30.0 minutes through Month 6. The median total sleep time per night changed from 300.0 minutes at pre-dose to 377.5 minutes at Week 1 and was subsequently maintained ≥390.0 minutes through Month 6.

Conclusions: These interim data from a prospective post marketing survey suggest that suvorexant is effective in a more medically diverse population than studied in the clinical development program, with a tolerability profile comparable to the clinical trials and consistent with the product label.
**Insomnia**  
**Board #077: P5 - Wednesday**  
**PATIENTS' PERCEPTIONS OF INSOMNIA AND ITS TREATMENT OPTIONS OVER TIME: WHAT CHANGES BEFORE AND AFTER INTERVENTION?**

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**Introduction:** An estimated 25%-30% of the adult population is affected by insomnia symptoms, and 6%-10% meet criteria for an insomnia disorder. Patients often live with insomnia for prolonged periods of time before seeking treatment, even though effective insomnia therapies are available. This qualitative study explores the perceptions of insomnia and its treatment options in adults, and the extent of changes in those perceptions after receiving psychological or pharmacological treatment. **Materials and methods:** Seventeen adults with chronic insomnia (9 men, 8 women, mean age = 54.2 years old) took part in one pre-intervention focus group (FG) (4-5 participants per group) and nine of them also completed a second post-intervention FG, six weeks apart. Participants were asked to describe their experiences/perceptions of insomnia, help-seeking experiences, and treatment preferences before and after receiving cognitive behavioral therapy or medication therapy. Focus group interviews were digitally recorded, transcribed verbatim, and analyzed using Interpretative Phenomenological Analysis. Inter-rater reliability of the verbatim transcripts from the first pre-intervention FG yielded an overall agreement of 63.4% between coders (k = 0.484. p < .0001), indicating good agreement on the identification of themes, sub-themes and categories. **Results:** Synthesis of qualitative data revealed that three key themes emerged from pre-intervention FG (i.e., "The lived experience of insomnia", "Help, please!", and "What is true about treatments?") and four from post-intervention FG (i.e., "Insomnia, an enigma in the process of resolution", "Finally help, thanks!", "Coping skills" and "Better (in)form and give to others"). The results also indicated that insomnia was perceived as a daily enigma by many participants. There was a high degree of dissatisfaction with current treatment options, a sense of helplessness before therapy, but a more positive and critical perception of insomnia and available therapies after treatment. There was also a strong desire for more individualized/tailored therapies, with the need for more guidance/coaching in implementing treatment recommendations. **Conclusions:** These findings suggest that patients' perception of insomnia and its treatment options may contribute to delay their seeking professional help. Allowing them to express those perceptions and past experiences, as well as matching treatment to patients' needs, could improve treatment adherence and satisfaction with insomnia therapy. **Acknowledgements:** Research supported by NIMH Grant #MH091053.
Introduction: Insomnia disorder is prevalent worldwide. Population-based surveys demonstrate that Chinese herbal medicine (CHM) is commonly used among people with insomnia. Pharmacological studies have revealed the sedative-hypnotic effect of CHM. This systematic review was to evaluate the clinical evidence on CHM for insomnia disorder.

Materials and methods: Nine online literature databases and clinical trial registries were searched to identify the randomised controlled trials investigating oral CHM for the people with insomnia disorder. Meta analyses were performed to estimate the effect size of CHM treatment in terms of sleep quality and quantity, concurrent depressive/anxious symptoms and daytime functional impairments. Risk of bias was assessed applying Cochrane methodology. Evidence certainty was appraised using the GRADE.

Results: Two hundred and sixty-three trials were included to the review. Compared to placebo, oral CHM was more effective at reducing the Pittsburgh Sleep Quality Index (PSQI) scores (mean difference: -3.71 points, 95% CI: -5.80 to -1.63, I²=87%, n=10 studies), shortening sleep onset latency (mean difference: -24.89 minutes, 95%CI: -36.23 to -13.55, I²=63%, n=4), enhancing total sleep duration (mean difference: 1.42 hours, 95%CI: 0.34 to 2.50, I²=95%, n=4), and improving sleep efficiency (mean difference: 9.72%, 95%CI: 6.49 to 12.96, I²=0%, n=2). The GRADE evidence was of moderate quality. The meta analyses also showed CHM alone was more effective than benzodiazepine drugs in terms of PSQI while its effectiveness was not significant different from that of non-benzodiazepine drugs. And CHM offered add-on benefits to active controls at improving sleep quality, relieving concurrent anxious symptoms and reducing daytime functional impairments. Subgroup analysis suggested that individualised syndrome differentiation and treatment of CHM was better at improving sleep quality compared to pharmacotherapy. However, these evidences were in low-quality due to considerable risk of bias, high heterogeneity and the limited clinical meaningfulness of minor changes in outcome measurements.

Conclusions: The best available evidence indicates that oral CHM can improve subjective sleep quality and quantity in the people with insomnia overall. However, the comparative effectiveness between CHM and active controls remains inconclusive. The clinical decision making should incorporate patients' preference and clinicians' expertise when psychotherapy, pharmacotherapy and CHM are all available in the clinical settings.

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A COMPARATIVE STUDY OF QUALITY OF LIFE IN PATIENTS BETWEEN OSA AND INSOMNIA

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Introduction: The obstructive sleep apnea syndrome and insomnia are two of the most common sleep disorders in the general population, and are both associated with considerable healthcare costs. The aims of this study were compare the quality of life (QoL) of patients with OSA and insomnia, and to determine the factors that influence the QoL in these patients.

Materials and methods: This was a study comparing the quality of life of 175 OSA patients and 36 insomnia patients. For all of the subjects, night polysomnography test was performed. The quality of life was evaluated using various questionnaires, including the Korean versions of the Medical Outcome Study Short Form-36 (SF-36), the Pittsburg Sleep Quality Index (PSQI), the Epworth Sleepiness Scale (ESS), and the Beck Depression Inventory-2 (BDI-2).

Results: The mean age of OSA was 47.2±12.3 years and the mean age of insomnia was 52.3±11.6 years. The mean age and the score of PSQI in insomnia patients were significantly higher than those of OSA patients. The physical component summary and total SF-36 of insomnia patients were lower than those of OSA patients (65.9±18.5 vs 56.6±18.1, p=0.006, 69.0±19.2 vs 61.2±18.6, p=0.020, respectively). The sleep latency of polysomnographic parameters in insomnia patients was longer than those of OSA (6.9±9.0 vs 16.6±22.2, p<0.001). The sleep efficiency in insomnia patients was lower, the arousal index, WASO and N1 sleep ratio were higher than those of OSA patients. There was no association between the severity of OSA and SF-36 or BDI-2 scores in OSA patients.

Conclusions: These findings demonstrate that insomnia represents a considerable burden on the QoL, especially subjective physical components. It is necessary to not only manage symptoms, but also apply correction of cognitive structure in insomnia patients.
THE EUROPEAN PORTUGUESE VERSION OF THE INSOMNIA SEVERITY INDEX (ISI): RELIABILITY, VALIDITY AND DIAGNOSTIC ACCURACY

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Introduction: Insomnia, the most relevant complaint in the context of sleep disorders, still remains an underdiagnosed problem. Its prevalence, serious health consequences and its impact on quality of life demand quick and effective assessment tools. The Insomnia Severity Index (ISI) is a brief self-report instrument to measure clinical insomnia and is one of the most commonly used in clinical and research domains, in several countries. The main purpose of this study is to present the psychometric properties of the European Portuguese version of the ISI.

Materials and methods: After the forward-backward translation and pretest application, the Portuguese ISI version (authorized by the author of the original version), was administrated to a total sample of 1274 subjects (439 M, 835 F), ranging from 18 to 95 years-old (Mean=37.52 yrs.; SD=16.82 yrs.), with different academic degrees and occupations: 1024 were individuals from the community (318 M, 706 F), including young and middle-aged adults, and elderly - Community Sample, and 250 were insomniac patients (121 M, 129 F) at a Sleep Medicine Centre - Clinical Sample. Reliability tests were performed and an exploratory factor analysis using oblimin rotation was conducted. To determine the optimal ISI cutoff score for insomnia detection, receiver operator characteristic (ROC) analysis was used within a subsample of insomniacs and controls matched by sex, age and academic degree (N=156).

Results: ISI [Pt] Cronbach’s alpha coefficient was 0.88, indicating a good internal consistency, and all items contributed to the internal consistency. Corrected item-total correlations ranged from 0.56 to 0.83. It was observed a two-factor solution for both Clinical and Community samples, explaining 38.65% and 52.19% of the total variance, respectively. The area under the curve (ROC analysis) was 0.86, and the optimal clinical cut-off point was 14 (82.1% sensitivity, 75.7% specificity), which were similar to the values reported respecting the original version.

Conclusions: The results of the current study support the ISI Portuguese version as a reliable and valid instrument for the assessment of insomnia in clinical and non-clinical population, in various age groups, and for accurately discriminate clinical insomnia.

Acknowledgements: The authors thank all patients and team from Sleep Medicine Centre of CHUC and all community participants who let accomplished this study.
Introduction: Adherence to continuous positive airway pressure (CPAP) therapy for apneic patients is a key issue in treatment efficacy. Iatrogenic symptoms (nose stuffiness, skin irritation, etc...) and mask interfaces (air leaks around the mask, claustrophobic reactions to the mask, etc...) explain part of the variance in CPAP use. In addition, self-perception of the treatment by patients, in particular their propensity to report subjective benefits during the night (reduction of insomnia complaints) and self-efficacy in the use of CPAP, may be a strong predictor to explain the variance in CPAP use. However, no study has investigated simultaneously insomnia complaints and self-efficacy perceived by the patients. The aim of this study was thus to determine the contribution of insomnia complaints and self-efficacy to CPAP adherence.

Materials and methods: 404 subjects with OSAS diagnosed in the sleep clinic of Bordeaux University Hospital treated by continuous positive airway pressure (CPAP) and followed by Vitalaire home care received the Insomnia Severity Index (ISI) questionnaire and the French version of the Self-Efficacy Measure of Sleep Apnea (SEMSA). The subjects were mailed a letter describing the purpose of the study and inviting them to self-administer the questionnaires and to return them in a postage-paid envelope. 270 subjects returned the questionnaires (71% acceptance).

The Body Mass Index (BMI), duration of observance, sleep reported duration, and the Epworth Sleepiness Scale (ESS) were assessed by home care technicians.

Results: The mean age was 63.16±12.73 yrs, 31 % (n=91) were females, the BMI was 30.39±6.31 kg/m2, the initial AHI before CPAP treatment was 34.61±20.71 /h, and the residual AHI 1.93±2.61 /h. The number of years since onset of CPAP treatment was 6.58±6.03 yrs, the mean CPAP compliance duration was 6.19±2.03 h, 16% was below 4 h / night, 24 % below 5 h / night. The mean ISI score was 9.03±6.06, with 19.5 % of subjects reporting moderate to severe insomnia complaints, the mean ESS score was 5±4.0, the mean Dimension A score of the SEMSA (“perceived risk of OSA”) was 19.78±5.54, the mean Dimension B score of the SEMSA (“CPAP outcome expectations”) was 32.23±6.19, the mean Dimension C score of the SEMSA (“treatment self efficacy”) was 28.48±6.07.

Multiple regression analysis showed that ISI score, sleep reported duration, BMI, Dimension C score of the SEMSA, age, initial AHI, and number of years since CPAP installation explained a significant 35.1% of the variance of number of hours of CPAP usage (p < 0.001). Reported sleep duration explained the most variance in CPAP usage, followed by self efficacy (Dimension C of the SEMSA), and insomnia complaints (ISI score).

Conclusions: The results suggest that the severity of insomnia complaints (reported sleep duration and ISI score) and self-efficacy are strong predictors of CPAP adherence. These results highlight the need to develop innovative educational and cognitive behavioral therapeutics focusing on insomnia complaints and self-efficacy to improve CPAP adherence in patients with OSAS.

Acknowledgements: Vitalaire home care company helped our team to collect data on our patients.
EFFECTS OF CHRONIC INSOMNIA ON BALANCE INDICATORS IN PATIENTS WITH MILD COGNITIVE IMPAIRMENTS

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Introduction: Sleep disorders are one of the most frequent problems of elderly patients and their prevalence increases with every decade of life. In some studies sleep deprivation in young people worsens the compensatory possibilities of balance. The aim of our study is to investigate the effect of chronic insomnia on balance indicators in elderly patients.

Materials and Methods: 32 patients (mean age 63.6±4.7 male/female=7/25) with mild cognitive impairments (MCI). The diagnosis of MCI was based on complaints, neuropsychological examination (Montreal Cognitive Assessment scale (MoCA)) and MRI (Fazekas grade 1,2). Participants were divided in two groups: 20 patients with chronic insomnia (based on ICSD-3 criteria) and 12 patients without insomnia. Subjective assessment of sleep was performed using the questionnaire (Insomnia Severity Index (ISI), Pittsburg Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS)). Objective assessment of sleep was performed with actigraphy during two days. Postural functions were measured using the posturography platform.

Results: In patients with insomnia postural sway parameters during Romberg test with closed eyes were significantly increased comparing controls (length of statokineziogramm - 450,7±156,2 mm. against 298,0±83,3 mm. p< 0,005; square of statokineziogramm - 332±252,5 mm² against 169,5±80,0 mm². p< 0,005; center of pressure velocity - 15,0±5,2 mm/sec. against 9,9±2,7 mm/sec. p< 0,005) which indicates insufficiency of compensatory mechanisms. The correlation between anxiety level (STAI score) and increased postural sway parameters (length of statokineziogramm - r = -0,4 p< 0,005; center of pressure velocity - r = -0,4 p< 0,005) was also identified. This could reflect the influence of emotional state on balance.

Conclusions: Chronic insomnia in elderly patients combines with imbalance caused by compensation mechanisms deficit. There was correlation of subjective sleep disorders with imbalance, however objective methods did not confirm this correlation. Anxiety was associated with imbalance in elderly patients.
TREATMENT OF INSOMNIA WITH MELATONIN IN PATIENTS AGED 45-60 YEARS OLD: A RANDOMIZED DOUBLE BLIND PLACEBO-CONTROLLED STUDY

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**Introduction:** Melatonin production declines with age in older people and could lead to poor sleep efficiency. The aim of this study was to examine the efficacy and safety of 3 mg melatonin in insomnia patients aged 45-60 years old.

**Materials and methods:** This was a randomized, double blind, placebo-controlled parallel study with 50 insomnia patients admitted into the 3mg melatonin group and 50 into the placebo group. The treatment period lasted for 1 month. Subjective nocturnal sleep conditions and daytime sleepiness were evaluated by questionnaires including the Pittsburgh sleep quality index (PSQI), the insomnia severity index (ISI) and the Epworth sleepiness scale (ESS). And objective sleep conditions were measured by overnight polysomnography.

**Results:** Of the 100 participants, 19 dropped out during the study (5 in the melatonin group and 14 in the placebo group). Significant differences in favor of melatonin vs. placebo were found in changes of REM sleep percentage and changes of early wake in the morning (4% vs. -0.5%, p=0.019 and -3mins vs. 29mins, p=0.004). While all the changes in subjective parameters between the melatonin and placebo groups showed no differences.

**Conclusions:** Melatonin results in significant improvements in some aspects of sleep quality including increasing the REM sleep percentage and reducing the early wake in the morning.

**Acknowledgements:** None.
MARKERS FOR HYPNOTIC ABUSE LIABILITY: CORTISOL IN INSOMNIA

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Introduction: It is hypothesized that stress increases vulnerability to drug abuse. Some insomniacs show hyperarousal by increased physiological responses to stress, elevated alertness on the Multiple Sleep Latency Test (MSLT) and elevated diurnal NE concurrent with the MSLT elevation. Studies have reported cortisol elevation before sleep in insomnia vs controls. We sought to determine whether cortisol levels, both diurnal and pre-sleep, would vary as a function of MSLT and thus potentially serve as markers for hypnotic abuse liability.

Materials and methods: DSM-IVR diagnosed insomniacs (N=110), aged 32-65 yrs, having no other sleep disorder, unstable medial or psychiatric diseases or drug dependency served as subjects. On a screening MSLT 26 had MSLTs < 10 min (Lo) and 44 >15 min (Hi). Participants took 10mg zolpidem or placebo, double-blind, nightly for 12 months. In months 1, 4, 8 and 12, urine was collected over 24 hrs in 8 hr- aliquots and assayed for cortisol (Ward Laboratories, Ann Arbor, MI). Saliva samples were collected 35 min before bedtime and drug administration in month 1 and 8, analyzed for cortisol levels (Salimetrics, State College, PA), and compared to a non-insomnia group (N=41).

Results: Pre-sleep salivary cortisol was higher in insomniacs than controls (2.23+/−2.12 vs 1.49+/−0.91 ug/L, p< .01), but did not differ as a function of MSLT. Nightly zolpidem reduced pre-sleep cortisol relative to placebo on month1, Zol:1.51+/−0.87 vs Pbo:1.79+/−1.44 and month 8, Zol:1.52+/−0.80 vs Pbo:1.94+/−1.48 ug/L, (p< .02) with no months effects. Daytime (0700-1500 hrs) urinary cortisol was higher overall in the Hi vs Lo MSLT insomniacs (Hi: 18.6+/−10.9 vs Lo: 12.9+/−7.1 ug/L, p< .04), was stable across months, and was not reduced with zolpidem. In self-administration assessments those with Hi MSLT increased the number of capsules (zolpidem or placebo) chosen over the 12 months.

Conclusions: Hyperarousal (MSLT) is associated with higher daytime urinary cortisol levels and increased drug seeking. These data are consistent with our previous research showing daytime hypnotic self-administration among Hi, but not Lo, MSLT insomniacs. This suggests that Hi MSLT and its correlate elevated cortisol may be a potential hypnotic abuse marker among insomniacs.

Acknowledgements: Supported by: NIDA, grant #: R01DA17355 awarded to Dr. Roehrs.
Introduction: To address the question of how representative subjects studied in hypnotic clinical trials are of the broader insomnia population, this report assessed initial contact rates and reasons for inclusion and exclusion during recruitment to a zolpidem efficacy trial conducted in the US and to a safety trial of ramelteon and zopiclone conducted in the Netherlands (NL).

Materials and methods: In both studies otherwise healthy persons meeting DSM-IVR criteria for insomnia were recruited. In the US study, persons 32-65 yrs (n=2886), were invited to a 12 month trial of nightly use of zolpidem or placebo. In the NL study persons 21-64 yrs (n=79) with driver’s licenses were recruited to test the effects of a new hypnotic drug on live on-the-road driving ability. In both studies screening was conducted through an initial telephone interview followed by a clinic visit.

Results: In the US study 75% of 2886 initial contacts and in the NL study 67% of the 79 initial contacts proceeded to the clinic visit. Of those at the clinic screen 18% of US and 38% of NL participants failed to meet additional study insomnia criteria. Mental health exclusions accounted for 28% of US and 32% of NL participants and medical health problems accounted for 21% of US and 9% NL participants. Finally 16% of US and 26% of NL participants were excluded for drug use/abuse histories. In the end 4% of the initial US contacts and 0% of the NL contacts entered the study.

Conclusions: These data suggest persons entering insomnia clinical trials are a highly selected sample that is unlikely to be representative of the broad insomnia population or the population of potential medication users.

Acknowledgements: Supported by US study: NIDA, grant #: R01DA17355 awarded to Dr. Roehrs, NL study: Takeda Global Research and Development Centre, grant # TAK-375 107 awarded to Dr. Verster
**Introduction:** Benzodiazepines are widely prescribed in patients with insomnia. These medications have potential for harm, given their alertness impairing effect. Despite provision of alerts and warnings, many benzodiazepine users continue to ignore safety messages and use benzodiazepines inappropriately. Our study aimed to explore risk perception patterns and medication related beliefs of benzodiazepine users.

**Materials and methods:** This study involved a point of purchase survey with patients obtaining benzodiazepines from selected pharmacies across New South Wales (NSW), Australia. Survey items included questions about patient’s demographic characteristics and their reason for taking benzodiazepines. Validated scales such as the Insomnia Severity Index (ISI), and Beliefs about Medication (BMQ) as well as customised scales assessing risk perception were included in the survey. Data obtained from the surveys was entered into the SPSS package and was then descriptively analysed.

**Results:** 55 participants (64% females) with a median age of 52.8 years (range 23 to 86 years) have been recruited so far. The ISI scores indicated that about 30% of the study population had clinical insomnia at the time of survey completion. For 70% of participants, the benzodiazepine use period was ≥1 year. About 25.5% and 47.3% of the participants perceived that driving a motor vehicle within 3-4 hours and 12 hours of taking benzodiazepines respectively are 'not risky at all'. Responses on the BMQ scale highlighted that 43.6% of the participants agreed that benzodiazepines are necessary for their present health. However, 40% of the participants were concerned about the long-term effects of benzodiazepine and 36.4% were worried about developing dependence. The recruitment process is ongoing.

**Conclusions:** Long-term use of benzodiazepine remains high in the Australian population. Inappropriate risk perceptions, for example, about driving a car after taking benzodiazepines clearly place users at risk. Patients concerns and beliefs about taking benzodiazepines can be used to reduce current chronic consumption. More effective information about the risks of using these readily prescribed medications is necessary along with the need to promote better long term behavioural interventions.

**Acknowledgments:** The Faculty of Pharmacy, University of Sydney is acknowledged for providing infrastructure support for the project. All participating pharmacies who helped recruitment and the survey participants are acknowledged for their time and participation.
GROUP TREATMENT FOR INSOMNIA AND IMPACT ON DAYTIME SYMPTOMATOLOGY ASSOCIATED WITH INSOMNIA: ANALYSES FROM A RANDOMIZED CONTROLLED TRIAL IN PRIMARY CARE

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Introduction: Insomnia is a common sleep disorder, mainly treated in primary care. The characteristics of insomnia is disturbed sleep and an extensive daytime symptomatology, for instance fatigue, mood disturbance, daytime sleepiness, and impaired social, family, occupational, or academic performance. The evidence is strong that cognitive behavioral therapy for insomnia (CBT-I) improve sleep, but less is known whether it also improve the daytime symptomatology. This study analyzed data from a randomized controlled trial of group treatment for insomnia in primary care, focusing on the effects of group treatment on the daytime symptomatology associated with insomnia: fatigue (main outcome), mood (psychological distress and depressive symptoms), health-related quality of life, general daytime functioning, individual daytime symptoms (worry about sleep, daytime bodily tiredness, daytime sleepiness, and difficulty concentrating), and dysfunctional beliefs.

Materials and methods: Patients seeking primary care for insomnia were included in the study. These 165 patients were 20 to 90 years (mean age 54 years, SD 16), and most were women (72.7%). Seven primary care centers participated in the trial. The patients were randomized to a 10-week nurse-led group treatment based on the techniques of CBT-I (intervention, n = 90), or to treatment as usual (control, n = 75). They were asked to complete questionnaires at baseline and post-treatment. Questionnaires were Fatigue Severity Scale, General Health Questionnaire, Montgomery-Åsberg Depression Rating Scale, Short Form Health Survey, Insomnia Severity Index, Uppsala Sleep Inventory scale, and Dysfunctional Beliefs and Attitudes about Sleep scale. The post-treatment drop-out rate was 20%. Data were analyzed in accordance with intention-to-treat principles. Additionally, patients who received group treatment where included in a 1-year post-treatment follow up (n = 72, dropout rate 25%).

Results: Patients who received group treatment (n = 82) improved significantly more in variables on daytime symptomatology, than those who received treatment as usual (n = 71). After group treatment, fatigue decreased. Mood, and health-related quality of life (mental functioning) improved, as did general daytime functioning. The severity of individual daytime symptoms decreased, and dysfunctional beliefs was reduced. All improvements were maintained one year after group treatment (n = 54).

Conclusions: Group treatment for insomnia, led by nurses in primary care, resulted in sustained improvements in several important aspects of the extensive daytime symptomatology associated with insomnia.

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SLEEP PROBLEMS CAUSED BY A GREAT NATURAL DISASTER: A 4-YEAR LONGITUDINAL STUDY AFTER THE GREAT EAST JAPAN EARTHQUAKE IN 2011

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Introduction: The Great East Japan Earthquake, a massive underwater earthquake, occurred in eastern Japan on March 11, 2011. The earthquake and tsunami caused great damage in some prefectures on the Pacific coast of northeastern Honshu island of Japan. Among these, the Miyagi prefecture was the closest to the earthquake epicenter and suffered the most. With regard to the mental health problems following these natural disasters, we have reported more frequent sleep problems during the night, such as difficulties in falling asleep, and experience of treatment for insomnia among the university students who lived in coastal areas in Miyagi prefecture than among those who lived in the other areas. To clarify the duration of these sleep difficulties, we have conducted a questionnaire survey about the mental health status of university students once a year from November 2011 to December 2014.

Materials and methods: Data were collected from undergraduate students enrolled in general psychology and health psychology courses at two universities in Sendai city (the capital of Miyagi prefecture) each year. To compare the influence among areas of residence with different damage severity, participants were divided into two groups according to their residence:
1) the coastal areas of Miyagi, which suffered from both the tsunami floods and the earthquake oscillation;
2) the inland areas of Miyagi, which suffered only from the earthquake.

The final sample consisted of 30, 38, 28, and 34 students who lived in the coastal area of Miyagi prefecture and 143, 111, 96, and 115 students who lived in the inland area of Miyagi prefecture at the time of survey in the years 2011, 2012, 2013, and 2014 respectively. These data were compared with the data from the study conducted in 2005, before the earthquake.

Results: In general, some differences among the areas and problems were observed; some problems were mitigated, while others remained high or got worse. In addition, these tendencies were partly different between the two residential areas. For example, the percentage of students who experienced difficulties in falling asleep increased largely in the coastal but not so much in inland area in the first year, and the percentage decreased in the second year in those in the coastal area. Whereas, the percentage of students who experienced nightmare problems increased in the first year and remained high at least for three years in the coastal area, while the percentage of students experiencing nightmares in the inland area increased after the earthquake, but the amount of the change was smaller than that of students in the coastal area.

Conclusions: After the earthquake, in the students in the coastal area, some sleep problems, including difficulties in falling asleep, were mitigated within the first two years, while other problems, including nightmares, remained high at least for three years. Conversely, in general, the percentages of various kinds of sleep problems were smaller in the inland area than those in the coastal area.
DEVELOPMENT AND EVALUATION OF A 4-WEEK SLEEP-COACHING PROGRAM

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Introduction: The prevalence of disturbed sleep in the German armed forces has been shown to be higher than in the general population. Furthermore, since impaired sleep quality prior to deployment is a risk factor for the development of mental health problems, a good sleep quality is essential for the health of military service members. The results of the evaluation of a short-term sleep-coaching program for the German armed forces are presented.

Materials and methods: The sleep-coaching program comprises four 1.5-hrs sessions, which were applied on a weekly basis. The program was evaluated with a treatment group (TG) and a control group (CG) in a cross-over study design. The CG participated in the sleep coaching program after the TG completed the program. Objective sleep quality was measured by ambulatory polysomnography in both groups in parallel prior to participation of the treatment group in the sleep coaching program (t0 baseline), directly after the end of participation of the treatment group in the program (t1), and after the end of participation of the control group (t2), at two consecutive nights each. Subjective sleep quality was analyzed at the same three points in time and in a 3-month follow-up evaluation (t3) by applying evening- and morning protocols, the Pittsburgh Sleep Quality Index (PSQI), the Insomnia Severity Index (ISI), and the Epworth Sleepiness Scale (ESS). Statistical analyses comprised general linear models for repeated measurements, Friedman tests, Mann-Whitney U-Tests for independent samples and Chi-square tests.

Results: In total 57 members (42 male; mean age: 40.6 ± 10.6 years; range: 18-58 years) of the German armed forces participated in the sleep-coaching program. Complete PSG data for all six nights (t0-t2) was available of 29 participants, complete questionnaire data were available for three points in time (t0-t2) in 51 participants and for all four points (t0-t3) in 39 participants, respectively. The TG and the CG neither differed in age, gender nor in baseline scores of questionnaires. Objective sleep efficiency improved significantly in both groups (p< 0.05). The objective and subjective sleep latencies as well as objective wake after sleep onset time decreased significantly across time (p< 0.05). Both groups showed significant improvements from t0 to t3 in subjective sleep quality (PSQI: p< 0.01; ISI: p< 0.01) and in daytime sleepiness in the TG (ESS: TG: p=0.003; CG: p=0.241). A significant intervention effect was seen in the ISI at t1 (p< 0.026).

Conclusions: The sleep-coaching program is a very efficient method to improve objective and subjective sleep quality in members of the German armed forces. To increase the accessibility of the sleep-coaching program as a preventive tool in occupational health management, the program will be disseminated by trained psychologists of the German armed forces, and an e-learning version of the program will be implemented.

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LONG-TERM EFFECTS OF CBT-I FOR CHILDREN SUFFERING FROM CHRONIC INSOMNIA

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Introduction: This intervention study evaluates the short- and long-term effects of cognitive behavior therapy for insomnia (CBT-I) in groups for school-age children and their parents.

Materials and methods: 112 children with chronic childhood insomnia were randomly assigned to a waitlist (WL) control or treatment condition. Sleep diary, actigraphy and various sleep questionnaires were implemented.

Results: According to subjective measures as well as objective wrist actigraphy, children in the CBT-I condition reported greater improvements in sleep behavior immediately after the treatment compared to the WL-group. Improvements in sleep behavior after CBT-I persisted over the 3-, 6-, and 12-month follow-up assessments.

Conclusions: This randomized controlled trial provides evidence for the long-term effectiveness of CBT-I in treating school-age children with chronic insomnia.
SNORING AND INSOMNIA - NEUROCOGNITIVE CONSEQUENCES IN PROFESSIONAL ATHLETES

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Introduction: Professional athletes often describe sleep maintenance insomnia. Sleep loss can impact daytime performance and cognitive function. Specific neurocognitive domains including executive (pre-frontal cortex), memory and complex task-orientated cognitive functioning are vulnerable to insomnia. We hypothesized sleep breathing-related disorders severity decreases neurocognitive performance.

Materials and methods: This study assessed objective snoring and subjective insomnia complaints obtained by an electrocardiogram recorder and questionnaire, respectively in 30 professional athletes (mean ± SD: age, 26 ± 4 years; height, 185.1 ± 7.2 cm; weight, 102.4 ± 11.1 kg).

Results: Subjectively, athletes reported snoring (90%); sleep maintenance insomnia (77%); early morning awakenings (83%); non-refreshing sleep (93%); feeling always or sometimes tired upon awakening (93%) and dissatisfaction with their sleep quality (93%). Objectively, 97% of the athletes snored. A cutoff of 5 snores/hour of sleep (snore index) was used to categorize snore severity. The mean number of snores above the cutoff was 140.5 snores (± 160.3; n=25; range 42 - 605). The snore index, identified 17% as severe, 55% as moderate and 14% as mild snorers. Comparison of the lowest (n=5; < 80) with greatest (n=5; >200) snore counts showed reduced stable sleep (64.8 ± 7.85 vs. 47.3 ± 14.52 %; p< 0.05), longer times in challenges for off-set conditioning (38.33 ± 7.16 vs. 54.32 ± 6.21 seconds; p< 0.05) and technical events (48.3 ± 6.78 vs. 64.7 ± 12.34 seconds; p< 0.05) in the greater snore count group. Snore count negatively correlated (r = -0.689; p< 0.05) with stable sleep. Player subjective fatigue assessment positively correlate (r = 0.660; p< 0.05) with broad band elevated low frequency coupling, a biomarker of sleep instability. Muscular strength tasks did not differ between groups.

Conclusions: The prevalence of snoring and insomnia complaints was high in these elite athletes. Results indicate an inverse relationship exists between stable sleep, snoring and neurocognitive functioning. Subjective fatigue positively correlates with sleep instability.
Introduction: The first-line treatment for chronic insomnia is Cognitive-Behavioral Therapy (CBT-I). Nevertheless, little evidence on clinical outcomes long-term is available. In particular, to the best of our knowledge, this is the first study investigating the maintenance of CBT-I effects on a follow-up longer than three years.

Materials and methods: 292 consecutive sleep clinic insomnia patients (mean age 40.7±12.3 yrs, 38.4% males, 61.6% females) underwent 7-session group CBT-I and were subsequently evaluated after a mean of 7.8±1.6 years (range 4-10 yrs) after the end of acute treatment. Insomnia Severity Index (ISI) score was the primary outcome; ISI scores were compared between the pre-treatment baseline assessment (T0), end of treatment (T1), and follow-up (T2). Presence of insomnia relapses and how patients dealt with insomnia episode (i.e. use of drugs-D, use of cognitive-behavioral techniques-CBT, use of both-D+CBT) were also evaluated as secondary outcomes.

Results: Due to loss of contact from relocating residence, 11% of patients did not complete ISI at T1 and 46% at T2. There was no significant difference for ISI scores at T0 and T1, age and duration of insomnia between patients with and without follow-up evaluation. A significant effect of treatment emerged for ISI score [F (1.78, 207.38) = 89.09, p < 0.001] across times without effect of the length of follow-up. 90.3% of patients no longer had clinical insomnia (ISI ≤ 14) at T1 (ISI 17±4.5 at T0 vs 9.5±4.2 at T1) and 78% at T2 (ISI score 9.9±6.3 at T2). 89 patients (77%) reported at least one episode of insomnia relapse at T2. To deal with relapse, 29 patients (33%) took D, 38 patients (43%) used CBT and 22 patients (24%) used D+CBT. The lowest ISI score at T2 was found in patients who used only CBT-I techniques when facing relapse. Means ISI score were: D=13±7.2, CBT=9±6.2 (p< 0.05), D+CBT=10.2±5.5.

Conclusions: Our data show that not only CBT-I in group format resulted in clinically meaningful improvement of ISI scores at the end of treatment, but also that the improvements were maintained at a long-term follow-up by most of the patients.
EVALUATION OF THE OUTCOME OF COGNITIVE BEHAVIORAL THERAPY FOR INSOMNIA IN PATIENTS WITH SUBJECTIVE SHORT OR NORMAL TOTAL SLEEP TIME

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Introduction: According to recent proposals, Insomnia Disorder (ID) patients may be classified into two distinct phenotypes with different characteristics based on their objective total sleep time (TST). In particular, objective short TST is suggested to be associated with a scarce response to Cognitive Behavioral Therapy for Insomnia (CBT-I). However, in clinical practice subjective measures are routinely employed instead of objective ones. Aim of this study is to investigate the differences of CBT-I response in two groups of ID patients subdivided according to reported total sleep time.

Materials and methods: By analyzing TST as reported in sleep diaries, 246 ID patients (mean age 41.13 ± 12.44, 147 females and 99 males) were divided into two groups: We defined as “normal sleepers” (NS - n=124, mean age 39.15 ± 12.18, 79 females) patients with a TST equal to or greater than 6 hours, and as “short sleepers” (SS - mean age 43.15 ±12.43, 68 females) those with a TST of less than 6 hours. All patients underwent group CBT-I. Insomnia Severity Index (ISI) and Sleep Efficiency (SE) were the primary outcome measures.

Results: A significant main effect of group (NS vs SS) was found for ISI [F(1,243) = 23.306, p < 0.001], WASO [F(1,227) = 43.718, p < 0.001], TST [F(1,232) = 139.311, p < 0.001], SE [F(1,228) = 106.548, p < 0.001]. The deltas between scores at the beginning as compared to the end of the treatment were significantly higher for SS as compared to NS, for both Insomnia Severity Index as well as Sleep Efficiency.

Conclusions: Both normal sleepers and short sleepers benefited from CBT-I. However, SS showed an even boosted response in comparison to patients with subjective normal total sleep time.
A POTENTIAL PHARMACOLOGICAL TARGET OF INSOMNIA: THE MOLECULES INVOLVED IN THE CA\textsuperscript{2+}-DEPENDENT HYPERPOLARIZATION PATHWAYS PLAY A PIVOTAL ROLE IN THE REGULATION OF SLEEP HOMEOSTASIS

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Introduction: Although we are beginning to understand the neuronal and biochemical nature of sleep regulation, questions remain about how sleep amount is controlled and how sleep is homeostatically regulated. Beyond its importance in basic physiology, understanding sleep in molecular level will provide a new therapeutic target in sleep disorder (e.g. insomnia). The current pharmacological targets of insomnia are mainly neurotransmitters included in the regulation of ascending reticular activating system (ARAS), such as the agonist of GABA receptors or the antagonist of orexin receptors or adrenergic receptors. However, the problem of adverse effects including addiction or somnolence remains unsolved and the discovery of a new pharmacological target from a different aspect is awaited. Since the molecules involved in the regulation of ARAS play a minor role in the regulation of sleep homeostasis, identifying the molecules involved in the regulation of sleep homeostasis may provide a new pharmacological target of insomnia.

Materials and methods: To identify the molecules related to the regulation of sleep homeostasis, we first developed a new mathematical model to predict the molecules which are necessary to realize the electrophysiological characteristics of the slow-wave sleep. Then, to validate the prediction obtained in this mathematical model, we created the knockout (KO) mice of every predicted molecule and analyzed their sleep phenotypes by our new developed methods: the triple-CRISPR, a CRISPR-based KO method, and the snappy sleep stager (SSS), a respiration-based sleep phenotyping method \cite{Sunagawa2016}. We finally conducted EEG/EMG recording and sleep deprivation experiments against the KO mice which exhibited significant sleep changes in SSS to validate the contribution of these molecules to the regulation of sleep homeostasis.

Results: Our mathematical model predicted that a Ca\textsuperscript{2+}-dependent hyperpolarization pathway consisting of ion channels (NMDAR, Ca\textsubscript{v}, and K\textsubscript{Ca} channels) and pumps (PMCA) plays a central role in the regulation of sleep amount, where 1) an impairment of ion channels involved in the Ca\textsuperscript{2+}-dependent hyperpolarization pathway will increase the total wake duration and 2) an impairment of Ca\textsuperscript{2+}-pumps/exchangers will increase the total sleep duration. This model also predicted that sleep could be triggered via Ca\textsuperscript{2+} influx by slowly activating a Ca\textsuperscript{2+}-dependent pathway such as those including calcium/calmodulin-dependent kinase II (CaMKII) family members. The KO mice of Ca\textsuperscript{2+}-dependent K\textsuperscript{+} channels [Kcnn2 and Kcnn3], voltage-gated Ca\textsuperscript{2+} channels [Cacna1g and Cacna1h], NMDAR subunit (Nr3a), or the CaMKII [Camk2a and Camk2b] exhibited a significantly decreased total sleep duration, whereas the KO mouse of plasma membrane Ca\textsuperscript{2+} ATPase (Atp2b3) exhibited a significantly increased total sleep duration. EEG/EMG recording and SD experiments revealed that at least a part of these KO mice exhibited abnormal sleep homeostasis.

Conclusions: We identified seven molecules related to the regulation of sleep homeostasis and proposed a new hypothesis that Ca\textsuperscript{2+}-dependent hyperpolarization pathways play a pivotal role in the regulation of sleep homeostasis. We also proposed that the molecules in the Ca\textsuperscript{2+}-dependent hyperpolarization pathways may be the potential pharmacological target of insomnia.

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Introduction: Sleep is a dynamical state where various electrophysiological changes occurs. These changes are often monitored via EEG to assist the diagnosis of sleep-related disorders. Neurofeedback works on the brain enhancing desired brainwaves, which can allow and regulate sleep, and potentially treat sleep disorders. In this study, we aim to quantify effects of neurofeedback on the brainwaves in insomnia patients.

Methods: A sequence of randomized qEEG sessions (one neurofeedback enhancing theta and sigma, but inhibit beta; one sham, 30 minutes each) was performed to 4 mild insomnia patients (34.8 +- 5.3 yrs; 3 males), registered at a sleep clinic. A standard 10-20 system was used for EEG recordings (20 channels). For each 30 s epoch, spectral power in standard frequency bands (delta, alpha, theta, alpha and beta) and scaling exponent of detrended fluctuation analysis were calculated. These time series of these qEEG measures were further quantified and compared between the neurofeedback and sham sessions.

Results: The relative theta spectral power was reduced significantly during the neurofeedback treatment compared with the sham session (3.40 +- 1.3 vs 2.63 +- 1.36; p = 0.048). The EEG slowness (delta to alpha ratio) enhanced slightly during the treatment session (12.54 +- 9.82 vs 10.80 +- 9.18; p = 0.726). However, no changes were found in other qEEG measures.

Conclusions: The trend of EEG slowness during the neurofeedback session might imply the insomnia patients would feel sleepier during the treatment session, which may be associated with the effectiveness of the neurofeedback. The small size of our pilot data is a limitation of the current study and it requires further validation of the outcomes.
Inhibition
Board #086: P5 - Wednesday
INVESTIGATION ON SLEEP STATUS OF PRESCHOOL TEACHERS
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Introduction: Beijing City, Fengtai District nearly 180 kindergartens, including preschool teacher groups accounted for 8000. Through sampling investigation, understand the quality of preschool teachers’ sleep.

Materials and methods: This project in Beijing city of Fengtai District preschool teachers as the research object, the 4 pilot kindergarten were selected, using PSQI (Pittsburgh sleep quality index) on the questionnaire survey, using logistic regression analysis the related factors of sleep quality of preschool teachers.

Results: The PSQI questionnaire issued 182 copies, 176 were recovered, the recovery rate was 96.7%, complete 171 questionnaires, the complete rate of 97.2%. PSQI score for preschool teachers (4.68 ± 2.779), the poor sleep quality (Pittsburgh sleep quality index more than 8 cent) children and 26 teachers, the ratio of 15.2%.PSQI = 2 is divided into parts said in the composition of poor quality, poor sleep and sleep quality, sleep disorder and sleep time related factors.

Conclusions: Preschool teachers sleep condition is not optimistic, can sleep time and other factors to intervene.

Acknowledgements: Thanks to the leadership of the Fengtai maternal and child health care hospital for this project; thanks to the active cooperation of the four kindergarten teachers in Fengtai District.
**Insomnia**  
**Board #043: P3 - Tuesday**  
**COMPARING INTERNET-DELIVERED COGNITIVE THERAPY AND BEHAVIOR THERAPY FOR INSOMNIA DISORDER: A RANDOMIZED CONTROLLED TRIAL**  

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**Introduction:** Very little is known about the efficacy of the main components in CBT for insomnia disorder, Cognitive Therapy (CT) and Behavior Therapy (BT). In order to better understand their unique contribution in the treatment of insomnia disorder, our aim was to examine the unique and comparative effects of internet-delivered CT and BT with a waitlist (WL) for people diagnosed with insomnia disorder.

**Materials and methods:** One hundred and twelve participants diagnosed with insomnia disorder were randomized to CT (n=37), BT (n=37) or WL (n=34). The mean age was 50.5 years and 69.6% were females. Of these 36.6% reported use of sleeping pills and 25% stated a comorbid somatic disorder. The treatment arms consisted of 10 weekly internet-delivered modules with telephone support 15 minutes per week. At pre- and post-treatment, participants completed the Insomnia Severity Index.

**Results:** Both CT and BT had a significantly larger improvement relative to WL on insomnia severity. There were no significant differences between the two treatment groups on insomnia severity. Within group effect sizes for the three arms were large for CT (2.7) and BT (2.2) and small for the WL (0.7). The proportion of treatment responders was highest in CT (73.0%), but did not significantly differ from BT with (56.8%). Both CT and BT resulted in a significantly larger proportion of responders compared to WL (11.8%). In terms of remission, BT (45.9%) had the highest proportion of remitters, with a somewhat smaller proportion in CT (35.1%) and a very low proportion in WL (2.9%). Both treatment groups had a significant larger proportion of treatment remitters compared to the waitlist. In the poster during the conference, we will also present the efficacy on other outcomes such as sleep diaries, functional impairment, quality of life and psychiatric symptoms (anxiety, depression).

**Conclusions:** There were no significant differences between CT and BT regarding improvements in insomnia severity or regarding the proportion of responders and remitters. Both CT and BT yielded large effect sizes separately and both outperformed WL. Although there were no significant differences regarding insomnia severity between the two treatment groups, differences on other important outcomes have not yet been evaluated. In summarizing it should be acknowledged that these analysis are based on only half of the planned sample.

**Acknowledgements:** We would like to acknowledge the Swedish Research Council for funding the study as well as the participating therapists and patients.
Introduction: Sleep disturbance and insomnia commonly occur in patients with Alzheimer’s disease but evidence for the efficacy of sleep medications in this population is limited, and there are few randomized controlled trials. Furthermore, there is a concern that sleep medications may potentially worsen cognitive impairment/next-day function. Suvorexant, a first-in-class orexin receptor antagonist that enables sleep to occur via competitive antagonism of wake-promoting orexins, was recently approved in the US and Japan for treating elderly and non-elderly adults with insomnia. Its unique profile may help to address an important unmet medical need in Alzheimer’s disease patients with insomnia. We designed a study to evaluate suvorexant for the treatment of insomnia in Alzheimer’s disease patients.

Materials and methods: This randomized, placebo-controlled trial consists of a screening period followed by a double-blind 4-week treatment period (clinicalTrials.gov NCT02750306). Patients are required to meet diagnostic criteria for both Alzheimer’s disease and insomnia and have a qualified trial partner. Eligible patients are randomized to suvorexant 10mg (may be increased to 20mg) or placebo. Assessments include overnight polysomnography visits, an electronic sleep diary (completed by the trial partner), an activity/sleep watch (worn by the patient), and exploratory measures of cognition and neuropsychiatric behavior. The primary hypothesis is that suvorexant is superior to placebo in improving polysomnography-derived total sleep time (TST) at Week-4. The planned sample size of 260 randomized subjects/117 evaluable subjects per treatment group has approximately 80% power to detect a 25-minute difference in change-from-baseline in TST between treatment groups (effect size of 0.4).

Results: Enrollment of the trial started in May 2016 and is ongoing.

Conclusions: This is the largest randomized controlled trial of a sleep medication undertaken in an Alzheimer’s disease population to date. Results from the trial will help establish the utility of suvorexant for treating insomnia in Alzheimer’s disease patients.

Acknowledgements: Support: Merck & Co. Inc., Kenilworth, NJ, USA
Introduction: Orexin receptor antagonists provide a new approach to treating insomnia by blocking orexin-mediated wakefulness. This approach differs from most current insomnia drugs which promote sleep by enhancing GABA inhibitory effects. Suvorexant is a first-in-class orexin receptor antagonist for treating insomnia, currently approved in the US and Japan at doses up to 20mg. Previously-published Phase-3 results showed that suvorexant improves sleep maintenance and onset. We report here on its effects as measured by the Insomnia Severity Index (ISI) which assesses sleep problems and their impact on daytime function.

Materials and methods: The analysis included pooled-data from two similar randomized, double-blind, placebo-controlled, parallel-group, 3-month trials in elderly (≥65y) and non-elderly (18-64y) insomnia patients. Age-adjusted (non-elderly/elderly) dose-regimes of 40/30mg and 20/15mg were evaluated. Fewer patients were assigned to 20/15mg than 40/30mg or placebo. The ISI, a 7-item patient questionnaire, was administered as an exploratory assessment at Months 1 and 3.

Results: 1824 patients were included in the analysis. Compared to placebo, suvorexant improved change-from-baseline in total score at both time points (Month 3: 20/15mg = -6.2, 40/30mg = -6.7, placebo = -4.9, p-values < 0.001) and the percentage of responders (≥6-point improvement from baseline) at both time points (Month 3: 20/15mg = 55.5%, 40/30mg = 54.9%, placebo = 42.2%, p-values < 0.001). Scores for individual items of the ISI showed numerical improvement for both suvorexant dose regimes versus placebo at both timepoints; the “impact of insomnia” component (last 3 items) which assesses the impact of insomnia on daytime function/quality-of-life was also improved by both dose regimes.

Conclusions: Suvorexant 20/15mg and 40/30 mg improve sleep as assessed by the ISI in patients with insomnia. Improvement in sleep onset/maintenance as well as a reduction of the impact of sleep problems on daytime function contribute to the overall improvement observed in ISI total score. Given that the maximum approved dose is 20mg, the 20/15mg data are the most clinically relevant.

Acknowledgements: Support: Merck & Co. Inc., Kenilworth, NJ, USA
**Insomnia**

**002: Insomnia oral abstract presentations**

**YOUNG WOMEN WITH SHORT SLEEP DURATION AND INSOMNIA RUN A HIGH RISK OF DEVELOPING HYPERTENSION AND DIABETES MELLITUS. A 10-YEAR FOLLOW-UP OF THE POPULATION-BASED SHE STUDY**

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**Introduction:** We aimed to study whether sleep duration, and insomnia are risk factors for incident hypertension and diabetes mellitus in women.

**Materials and methods:** At baseline and at 10-year follow-up, a random sample of 4,404 women aged 20-87 years without hypertension or diabetes at baseline answered questionnaires on sleep duration (short; < 6h/night, normal; 6-< 9h/night), insomnia (difficulty inducing sleep (DIS), difficulty maintaining sleep (DMS) or early morning awakening (EMA)), anthropometric measures, lifestyle factors and somatic disease. Outcome was incident hypertension and diabetes at the 10-year follow-up. Age stratified multivariate analysis were adjusted for baseline BMI, smoking, physical activity, and alcohol dependency.

**Results:** The incidence of hypertension and diabetes were lowest in the reference group with normal sleep duration and no insomnia (10.7% and 2.1%, respectively). The highest incidence was seen in women with short sleep duration both with insomnia (hypertension: 16.5%, and diabetes: 4.7%) and without insomnia (hypertension: 21.3%, and diabetes: 4.2%). Women younger than 40 years with short sleep duration alone had the highest risk of incident hypertension with adjusted OR 3.8 (95%CI 1.3-11.5) in the multivariate analysis. Women younger than 40 years with the combination of short sleep duration and insomnia had the highest risk of developing diabetes with adjusted OR 8.1 (2.1-30.9).

**Conclusions:** Short sleep duration and the risk for diabetes and hypertension is age dependent in women. Young women -below 40 years- with short sleep duration and insomnia run a high risk of developing diabetes mellitus, while young women with short sleep duration alone run a high risk to develop hypertension. The different risk combination regarding insomnia, or not, indicate different possible underlying mechanisms when women with short sleep duration develop diabetes and hypertension.

**Acknowledgements:** The SHE study is supported financially by the Swedish Heart Lung Foundation. The authors have no conflicts of interest.
Insomnia
Board #066: P1 - Monday

COMPARISON OF SLEEP CHARACTERISTICS IN CHRONIC INSOMNIA SUBTYPES: EEG CORRELATES OF SLEEP MISPERCEPTION

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Introduction: Many insomnia patients misperceive their sleep. Sleep misperception might occur in patients with normal total sleep time (TST) and also in patients with objectively short TST. Whereas the first group is often included to comparison studies, the second group is not. The first aim of our study is to compare sleep characteristics in different insomnia subtypes, divided by the objective TST and presence of sleep misperception. The second aim is to explore relations between objective and subjective sleep parameters.

Materials and methods: 29 patients with chronic primary insomnia who underwent polysomnography (PSG) were selected from the sleep laboratory database and were divided into three groups: psychophysiological insomnia (PSY-I) with objectively short TST and absence of sleep misperception (n=9), psychophysiological insomnia with sleep misperception (PSY/MIS) (n=9) and paradoxical insomnia (PARA-I) with normal objective TST and sleep misperception (n=11). We also included a control group (GS) (n=9). All participants completed self-reported questionnaires: Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), Beck Depression Inventory-2 (BDI) and Beck Anxiety Inventory (BAI). To quantify sleep misperception, the Misperception Index (MI) was computed. A full-night PSG was made by Brainscope PSG. Absolute power spectral analysis (PSA) was performed on six EEG frequency bands during NREM 2, NREM 3 and REM sleep stages on central sites of the brain.

Results: All insomnia groups reached higher score in the ISI and PSQI compared to GS suggesting a poor sleep quality (p < 0,001). There were significant differences in proportion of NREM 1, NREM 3 and REM sleep stages between all insomnia groups and GS. PSY/MIS showed the lowest proportion of REM sleep compared to other groups (p < 0,001). Absolute PSA revealed significant differences only in NREM 2 sleep. There was a lower amount of delta activity during NREM 2 in PARA-I group compared to other groups. PSY/MIS showed less delta activity than GS (p < 0,01). PARA-I showed also a lower amount of theta activity compared to GS (p =0,05). We found a strong correlation between the proportion of REM sleep and subjective TST in positive direction (r = .733; p < 0,001), and MI in negative direction (r = -.389; p < 0,05). In the case of absolute PSA values, the strongest correlation was found between delta activity in NREM 2 sleep and subjective TST in positive direction (r = .454; p < 0,01), and MI in negative direction (r = -.346; p < 0,05).

Conclusions: All insomnia patients subjectively perceived their sleep as disturbed compared to GS, regardless of whether their TST was objectively short or not. There were significant differences in proportion of sleep stages between all insomnia patients and GS. According to our results, the lower amount of REM sleep and delta activity during NREM 2 sleep might contribute to the experience of sleep misperception.

Acknowledgements: This work was supported by the project „Sustainability for National Institute of Mental Health“ under grant number LO1611, with a financial support from the MEYS, and the project PROGRES Q35.
**Introduction:** Approximately 80% of Canadians have internet access, making internet service delivery (eHealth) a powerful tool to overcome barriers to treatment. To this end, we developed Better Nights, Better Days (BNBD), an innovative, bilingual (English and French language) eHealth program for primary caregivers across Canada, aiming to provide accessible and evidence-based care for insomnia in typically developing children aged 1-10 years. Study recruitment can be challenging, however recent eHealth interventions have suggested that incorporating online recruitment strategies can be both practical and effective. Here we report on the response rate of various recruitment strategies for the English-speaking segment of the randomized controlled trial (RCT), targeting 400 participants.

**Materials and methods:** A comprehensive recruitment campaign was developed including a combination of digital (social media platforms, search engines, online news articles), media (e.g., radio and television interviews), and traditional (e.g., poster advertisements, health care professional referrals) recruitment strategies. As part of the online screening questionnaire, individuals were asked to indicate how they heard about the study. The response rates to four recruitment strategies were computed: digital, media, traditional, and other.

**Results:** The BNBD RCT launched September 2016. Over 2,000 individuals responded within the first three months, and the target number of 400 English speaking primary caregivers had consented, with their study participation currently ongoing. Results from the online screening questionnaire indicated 42% heard about BNBD through digital strategies, 30% through media sources, 5% through traditional strategies, and 23% from other unspecified sources (principally referral from family or friends).

**Conclusions:** The high rate of recruitment likely speaks to both the need for intervention, and the effectiveness of our multi-modal recruitment campaign. Given Canadians have increasing access to the internet, creating a dynamic online presence can help to increase study visibility and be effective in recruiting for eHealth interventions.

**Acknowledgements:** Funded by CIHR (Canadian Institutes of Health Research)
Introduction: Sleep disorders have strong negative effect on many areas of functioning. The aim of this study was to assess the sexual functioning of patients with insomnia or hypersomnia referred to our center for sleep medicine.

Materials and methods: 53 patients (mean age 31.1 ±7.6, 16 females, insomnia n=21, narcolepsy n=23, other hypersomnias n=9) have been investigated. The patients underwent clinical evaluation of sleep disorder and filled in demographic and sexual history questionnaire, Arizona Sexual Experience Scale (ASEX), International Index of Erectile Function Questionnaire or Female Sexual Function Index, Sociosexual Orientation Inventory, Mell-Krat scale and SF-36 quality of life questionnaire. They also rated the impact of sleep disorder on their sexual functioning on 10 point Likert-type scale.

Results: The significant difference between both groups was found only in the frequency of sexual dreams that were reported as frequent by 18 patients with hypersomnia but only by 3 patients with insomnia (55% vs 15%, p< 0.01). Moderate or severe impairment of sexual functioning due to sleep disorder was reported by 8 patients with insomnia and 12 patients with hypersomnia (40% vs 36%, ns). The quality of sexual life was rated as bad or rather bad by 4 patients with insomnia and 5 patients with hypersomnia (20% vs 13%, ns).

Conclusions: The proportion of patients reporting that disturbed sleep negatively impacts their sexual life is high. Substantial part of these patients reports also dissatisfaction with their sexual life quality.
**Introduction:** In primary care, insomnia is widely under recognized and undertreated by medical providers. For patients who suffer from lack of sleep, there can be dramatic effects on their physical and psychological well-being. Therefore, a critical need exists for improved identification and management of patients suffering from insomnia (Rosekind, et al. 2010). Over the years, the prevalence of insomnia in the general population remains 30-35%, but only 17% have sought treatment from their health care provider (Sleep in America, 2014). These statistics are unchanged from 2010. Previous sleep guidelines (ICSD-2) were confusing and of questionable validity. The advent of the ICSD-3 guidelines simplified the classification of insomnia, which can lead to improved clinical diagnosis and treatment of insomnia disorder (ICSD, 2014).

In the United States, primary care providers who are in medicine, nurse practitioners and physician assistants, lack current knowledge about the ICSD-3 guidelines. This lack of knowledge hampers their ability to use appropriate questions that guide diagnosis and management of insomnia. Participants who take part in this session will gain current practical knowledge about insomnia that can apply in the primary care setting.

**Materials and methods:** The session is target for primary care practitioners and will review the streamlined ICSD-3 guidelines. Additionally, treatment guidelines will be emphasized including research for the efficacy and safety of long-term use of appropriate sleep agents for chronic insomnia. Discussion includes the importance of sleep behavior changes and evaluation for concomitant psychological processes. A case study approach from the viewpoint of a seasoned primary nurse practitioner will illustrate the application of the guidelines and management of insomnia.

**Results:** Armed with current knowledge about insomnia, primary care practitioners can positively impact patient health and well-being. The effect of poor or insufficient sleep can cause impairment of work performance, accidents, and impaired quality of life. Understanding the new ICSD-3 guidelines can assist primary care providers to optimize diagnosis and treatment of insomnia by helping to asking the right questions, which leads to the correct treatment and management.

**Conclusions:** Primary care providers are in the perfect position to evaluate patient quantity and quality of sleep. Screening for insomnia and incorporation of the current ICSD guidelines in every patient assists the to help patients improve physical and psychological well-being. The appropriate treatment of insomnia influences public health safety when individuals get the proper amount and type of sleep. Evaluation and management of insomnia are well within the scope of practice for all primary care providers.
DEPRESSION SEVERITY, BUT NOT OBJECTIVE OR SUBJECTIVE SLEEP DISTURBANCE, MEDIATES GLUTAMATE REDUCTIONS IN THE ACC IN MAJOR DEPRESSIVE DISORDER

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Introduction: Insomnia, marked by an inability to initiate or maintain sleep, and Major Depressive Disorder (MDD), in which sleep disturbance is a common feature, exhibit a bidirectional relationship suggesting a shared neurobiological cause. Insomnia and MDD are independently associated with deficiencies in cortical γ-aminobutyric acid (GABA), while reduced glutamate (Glu) has been observed in anterior cortical regions in MDD. However, the link between abnormal cortical Glu and GABA levels and objective or subjective insomnia in MDD remains unclear. We explored this relationship by measuring cortical levels of Glu and GABA with 1H-MRS in MDD with varying degrees of insomnia and healthy, good sleeper controls (HC).

Materials and methods: Fifty-one MDD patients (DSM-IV; HAM-D ≥11 without sleep items; symptom duration ≥ 2 weeks) not taking any CNS medications and 25 age- and sex-matched HC completed two weeks of qualifying actigraphy and sleep-wake dairies and two nights of polysomnographically-recorded sleep. 1H-MRS scanning was conducted at 4T. T1-weighted anatomical images were used to place single voxels (35 x 25 x 20 mm) in the bilateral dorsal anterior-cingulate (ACC) and parieto-occipital (POC) cortices. Proton spectroscopy employed a GABA-optimized MEGAPRESS sequence for optimal measures of GABA (GABA/Cr) using difference-editing as well as measures of glutamate (Glu/Cr) using the 68ms sub-spectrum.

Results: Compared to HC, MDD reported significantly greater levels of depression on the Beck Depression Inventory (BDI) and Hamilton Rating Scale for Depression with sleep items excluded (HAM-D) and significantly worse sleep quality as measured by the Insomnia Severity Index (ISI) and Pittsburgh Sleep Quality Index (PSQI). Compared to HC, MDD subjects had significantly reduced Glu/Cr levels in the ACC (MDD = 0.85 ± 0.20; HC = 1.00 ± 0.20, df = 71, t = 3.22, p=0.002). No significant differences were observed between MDD and HC for GABA/Cr in the ACC or Glu/Cr or GABA/Cr in the POC. In MDD, significant negative correlations were observed between ACC GABA/Cr and HAM-D (r=-0.57, p<0.0001) and BDI scores (r=-0.34, p=0.02), while significant positive correlation were observed between POC GABA/Cr and PSG-recorded WASO (r=0.47, p=0.0006). Regression models were significant for GABA/Cr in the ACC and POC in MDD. In the ACC, the four predictors (HAM-D, ISI, sleep-wake diary sleep quality, and PSG-recorded WASO) accounted for 38% of the variance (R²=0.38, F(4, 44)=6.80, p=0.0002). Based on the partial regression coefficients, the HAM-D significantly predicted GABA/Cr in the ACC in MDD (β=-0.006, p<0.001), but all other predictors were non-significant (all p>0.13). In the POC, the four predictors accounted for 24% of the variance (R²=0.24, F(4, 46)=3.71, p=0.01). PSG-recorded WASO significantly predicted GABA/Cr in the POC in MDD (β=0.0003, p=0.001), but all other predictors were non-significant (all p>0.35).

Conclusions: Subjects with MDD showed significant reductions in Glu/Cr in the ACC compared to HC, which were largely influenced by depression severity, but not objective or subjective poor sleep. These findings suggest that well-documented deficits in Glu in MDD may not be directly linked to insomnia severity.

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DISRUPTED WHITE MATTER INTEGRITY IN INSOMNIA AND MAJOR DEPRESSIVE DISORDER: CORRELATIONS WITH SUBJECTIVE AND OBJECTIVE SLEEP PARAMETERS

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Introduction: White matter integrity can be assessed with fractional anisotropy (FA), a measure of the degree of directionality of cellular structures, derived from diffusion tensor imaging (DTI). Medication-free patients with major depressive disorder (MDD) demonstrate robust FA reductions in multiple white matter tracts. A single study in primary insomnia (PI) also showed reduction in one of these same tracts, the internal capsule. We investigated FA in groups with MDD and PI using DTI.

Materials and methods: Fifty-one MDD subjects (DSM-IV; HAM-D ≥11 without sleep items; symptom duration ≥ 2 weeks), 25 PI subjects (DSM-IV, ISI>14, WASO + SOL>45 minutes) and 25 age- and sex-matched healthy controls (HC) completed two weeks of qualifying actigraphy and sleep-wake diaries and two nights of polysomnographically-recorded sleep. Subjects were free of other medical, psychiatric and sleep disorders, and not taking any CNS medications.

DTI data were collected on a Siemens 3T Tim Trio scanner (TR=6080 ms, TE=94 ms, FOV=224 x 224 mm, voxel dimensions=1.4 x 1.4 x 3.5 mm, b value=1,000 s/mm², 36 directions). All diffusion tensor maps were normalized and interpolated to isotropic 1.4 mm voxels. The Johns Hopkins International Consortium for Brain Mapping (ICBM) FA template was used.

Regions of Interest: the inferior longitudinal fasciculus (ILF), inferior fronto-occipital fasciculus, posterior thalamic radiation, genu and body of the corpus callosum (CC), anterior limb of the internal capsule and superior longitudinal fasciculus (SLF). We conducted multivariate analyses of covariance and computed a Group x Gender x ROI on mean FA values with age as covariate. We then performed pair-wise analyses on significant results, and partial correlations between FA from significant ROIs and clinical measures.

Results: Following significant MANCOVAs, pairwise comparisons revealed that FA was significantly reduced in subjects with PI compared to controls in the genu of the CC (p< 0.001) and SLF (p< 0.001). In MDD, FA was significantly reduced compared to controls in the genu of the CC (p< 0.001), SLF (p< 0.001) and ILF (p=0.001). FA was reduced in subjects with MDD compared to subjects with PI in the genu of the CC (p = 0.027).

In the PI group, FA in the genu of the CC was positively correlated with PSG-derived sleep efficiency (p=0.012) and negatively with PSG-derived wake after sleep onset (WASO) (p=0.004). FA in the ILF was positively correlated with sleep diary-derived sleep quality (p=0.010).

In the MDD group, FA in the genu of the CC was negatively correlated with HAMD (p=0.034). FA in the SLF was negatively correlated with diary-derived sleep quality (p=0.011). FA in the ILF was positively correlated with both PSG-derived (p=0.017) and diary-derived (p=0.020) total sleep time.

Conclusions: Subjects with both PI and MDD had evidence of disrupted integrity in multiple white matter tracts (genu of the CC, SLF, ILF). In PI, severity of disruption was strongly associated with WASO and more weakly with sleep quality. In MDD, this disruption was weakly associated with both depression severity and some sleep measures.

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**Introduction**: Poor sleep quality is widely reported among patients with psychiatric conditions. While sleep problem is mostly treatable by cognitive behavior therapy for insomnia (CBT-I), the access to expert-conducted individual CBT-I sessions remains low. We here investigate the effectiveness of a 2-session CBT-I group treatment ran by trained low-intensity worker under supervision.

**Materials and methods**: Participants (n=49, aged 18-70, 66% female) were all attending routine clinical psychological services for mental health conditions at a community out-patient clinic of a public hospital. They were recruited if they self-reported poor sleep quality, measured by a Pittsburgh Sleep Quality Index (PSQI) global score >5. The CBT-I group was primarily conducted by a trained low-intensity worker, while a clinical psychologist would sit in the treatment session to ensure quality treatment delivery and handle enquiry. There were two 90-120 minute sessions, separated by a week. There were 6-12 participants in each group. Treatment component includes Stimulus control therapy, relaxation training, and psychoeducation regarding homeostatic and circadian factors affecting sleep and wake condition. Participants completed the PSQI and Depression Anxiety Stress Scale at the referral, pre- and post-treatment day for evaluation of treatment impact on sleep quality and negative mood.

**Results**: Results from paired-sample t-tests showed that, compared to baseline performance at the date of referral, after the treatment, participants had significantly improved habitual sleep efficiency, $t(47)=-2.961$, $p=.005$, $d=-.399$ and increased actual sleep time, $t(47)=-2.371$, $p=.022$, $d=-.335$, measured by the PSQI, though there was no significant difference on the PSQI global score, $t(46)=1.678$, $p=.100$. There was also a trend of improvement in depressive symptoms, $t(36)=1.869$, $p=.070$.

**Conclusions**: While our findings inclined to suggest that a 2-session CBT-I group ran by a low-intensity worker had significant positive impact on psychiatric patient's self-reported sleep efficiency and sleep duration, we called for future CBT-I intervention study conducted by low-intensity worker, especially randomized control trials for further verification of the effectiveness and feasibility of this mode of treatment delivery which appears to improve the access to CBT-I.
SANDPLAY THERAPY ON INFANT SLEEP DISORDERS GROUP INTERVENTION STUDY

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Introduction: Study of sandplay therapy for sleep status of teachers group to improve the situation.

Materials and methods: This project in Beijing city of Fengtai District preschool teachers as the research object, the 4 pilot kindergarten were selected, using PSQI (Pittsburgh sleep quality index) conducted a questionnaire survey, using logistic regression analysis the related factors of sleep quality of preschool teachers, and intervene with the experiential group sandplay therapy, once every two weeks, every time time is 1.5-2 hours, a total of 12 weeks after intervention, and then conducted a questionnaire survey on sleep status before and after the intervention of preschool teachers to improve the situation.

Results: Teachers sleep 15.2%, total score of PSQI (4.68 ±2.779), poor sleep is mainly reflected in the quality of sleep, sleep disorder and sleep time. Through the 6 experience intervention group sandplay therapy, sleep situation of preschool teachers is improved, the total number of teachers in poor sleep ratio 12.2%, after intervention decreased by 3%, which is mainly through the improvement of sleep efficiency, sleep quality, sleep time and sleep disorder of these four factors to improve the sleep status.

Conclusions: The sleep status of preschool teachers is not optimistic, the experiential group sandplay therapy intervention can effectively improve the sleep status.

Acknowledgements: Thank the leadership of the Fengtai maternal and child health care hospital for the project support; thanks to the active cooperation of Fengtai District four kindergarten teachers.
EFFICACY OF THOUGHT IMPRINT PSYCHOTHERAPY FOR PRIMARY INSOMNIA IN ADULTS: A RANDOMIZED CONTROLLED TRIAL

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Introduction: Thought Imprint Psychotherapy (TIP) is one of the modern psychotherapy of Traditional Chinese Medicine, which reflects the concept of holism and syndrome differentiation. It developed based on low resistance theory and thought induction theory, and combines the Guidance (Dao Yin) and Qigong therapies of China with suggestion and hypnotherapy of the West. TIP is a treatment that has been used clinically to address sleep disorder for nearly 20 years. This article aims to investigate the efficacy of TIP for primary insomnia in adults.

Materials and methods: A randomized controlled trial was conducted. Sixty-six primary insomnia patients were randomly assigned to receive TIP therapy (n = 33) or cognitive behavioral therapy for insomnia (CBTI) (n = 33) for eight weeks. Both groups were given treatment once a week. Outcomes were assessed with the Pittsburgh Sleep Quality Index (PSQI), Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS), the MOS item short from health survey (SF-36) and polysomnography (PSG) before and after treatment.

Results: Thirty-two patients (age: 50.47±12.98 years) of TIP group and thirty-one patients (age: 48.45±12.46 years) of CBT group have finished the treatment. There were no significant differences between the two groups in age (p=0.46) or proportion of males and females (p=0.59). Results showed that adults in both TIP and CBTI, improved significantly on sleep efficiency, sleep onset latency, wake after sleep onset, and total sleep time at post-test. Most of these improvements were found in both objective and subjective measures. Furthermore, insomnia complaints and symptoms of chronic sleep reduction also decreased significantly in both treatment conditions. Both groups demonstrated significant improvements in the PSQI, DBAS, SF-36 and polysomnography indices after treatment for eight weeks. But there were no significant differences between the two groups in the improvements of PSQI, DBAS, SF-36 and polysomnography.

Conclusion: This study is the RCT provides evidence that TIP is effective for the treatment of adults with primary insomnia. Compared with CBTI, the TIP group had an advantage in patient compliance and perseverance, and was not subject to the objective factors such as patient work shift and so on. A large sample of clinical control study on the more in-depth comparison of the two groups may need in the future.

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WHAT PARENT AND CHILD FACTORS PREDICT PARENTAL HELP-SEEKING FOR PAEDIATRIC SLEEP DISTURBANCE (PSD)?

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Introduction: Parents whose infants experience PSD are likely to consider whether or not to seek professional help and implement a behavioural sleep intervention. Given long-term negative outcomes of PSD it would be useful to understand what factors predict parent advice-seeking. This study examined parent and child factors assessed at initial contact in two groups of families, those who wanted a behavioural infant sleep intervention and those who did not.

Materials and methods: Families with 1-year-old infants with frequent night wakings and/or who took at least 30 minutes to settle to sleep were recruited for an intervention study. Parents provided demographic information and infant sleep history and completed the fussy-difficult subscale of the Infant Characteristics Questionnaire (ICQ), the Maternal Cognitions about Infants’ Sleep Questionnaire (MCISQ) and the Depression Anxiety Stress Scale 21-Item version (DASS-21). The quality of attachment relationship and infant’s cry duration at separation episodes were measured by the Strange Situation Procedure (SSP). A 15 minutes video of parent-infant free play was recorded to measure Parental Sensitivity via Maternal Behavior Q-Sort 25-item video version and Infant Negative Emotionality via 15-seconds interval coding. Data were analyzed, with SPSS version-23, using Independent Samples t-test, Chi-Square, and Cohen’s d. Statistically significant between-group differences were subject to Discriminant Function Analysis (DFA) to determine if any combination of parent and infant variables reliably predicted group membership.

Results: Twenty five families participated in the study. Fifteen families volunteered to receive an intervention (help-seek group, n=15, mean age=13.11±1.41, 47% boys,) and 10 families did not want to receive an intervention (non-help seek group, n=10, mean age= 13.10±1.19, 70% boys). There were no differences between groups in infant age, gender, parity, infant day care attendance; and parental age, maternal working status, SES, relationship status, nighttime breastfeeding and previous experience with sleep interventions. All help-seek parents interchanged crib and co-sleeping as management strategies whereas 60% of non-help seek parents practiced co-sleeping by choice ($\chi^2$=11.842, p=.001). Sixty percent of help-seek infants developed sleep problems after 4 months whereas 90% of non-help-seek infants had sleep problems since birth ($\chi^2$=6.250, p< .05). The groups were not significantly different on infant temperament, observed negative emotionality, attachment patterns, parental sensitivity and mood. Non-help seek infants cried significantly longer at the SSP separation episodes (Cohen's $d=.88$, effect size ($r$) =.40 p < .05) and parents had significantly higher scores on the Difficulty with Limit Setting at Bedtime Subscale of MCISQ (Cohen's $d=1.21$, effect size ($r$) =.51, p < .01). In the DFA, cry duration at separation episodes of SSP (Wilk's $\Lambda=.732, p < .01$) and difficulty with limit setting at bedtime (Wilk's $\Lambda=.732, p < .01$) showed strong predictive accuracy and the DFA correctly classified 8/10 of the non-help seek group and 14/15 of the help-seek group; overall accuracy= 88% (Wilk's $\Lambda=.615, p < .01$, Canonical $r= .620$).

Conclusions: Parents with more difficult and longer-standing infant sleep problems, and whose infants are more distressed at separation are less likely to seek help. Investigation of these parents' attitudes and parenting practices may throw more light on this apparent conundrum.
INSOMNIA AS A SOMATIC REPRESENTATION OF ANXIETY IN THE SYMPTOMATOLOGY OF DEPRESSION

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Introduction: Accumulating evidence from observational studies has suggested that not only insomnia but also somatic anxiety plays an important role in the development and maintenance of major depressive disorder (MDD) (Bekhuis et al., 2016; Dombrovski et al., 2007; Wong et al., 2015). Somatic anxiety refers to inner fear of changes in bodily sensations, which is relevant to both psychophysiological insomnia and somatic symptom disorders that are commonly characterized by increased attention to somatic states and latent health crisis. However, the relationship between insomnia and somatic anxiety remains elusive. We examined the reciprocal roles of insomnia and somatic anxiety in the symptomatology and pharmacotherapy in MDD.

Materials and methods: This cross-sectional study included 72 consecutive outpatients with MDD who were registered to receive a return-to-work intervention (age 41.1 ± 8.6 years, 14 females). Depressive symptomatology was assessed using the 17-item Hamilton Rating Scale for Depression (HRSD) and somatic concerns were defined by the somatic anxiety, hypochondriasis, and general/gastrointestinal somatic symptoms on the HRSD. The daily doses of GABAergic hypnotics being prescribed were determined by the equivalent of 10mg diazepam.

Results: Whereas 68% of patients were considered to have remitted from their major depressive episode (the HRSD total score ≤ 7), 43% of patients exhibited insomnia symptoms and 53% of patients showed somatic concerns. Patients with insomnia symptoms exhibited higher levels of somatic concerns (1.4 vs. 0.6; \( p = .003 \)) and higher HRSD total scores (7.4 vs. 4.4; \( p = .001 \)) than patients without any insomnia symptoms. Meanwhile, patients with somatic concerns exhibited higher insomnia scores (1.1 vs. 0.4; \( p = .006 \)) and higher daily hypnotic doses (6.7 vs. 4.1; \( p = .024 \)), as well as higher HRSD total scores (8.2 vs. 3.0; \( p < .0001 \)) than patients without any somatic concerns. Furthermore, the somatic anxiety score on the HRSD was positively correlated with the daily hypnotic dose (\( r = .25; \ p = .038 \)).

Conclusions: Our results clearly illustrate the intertwined relationship between insomnia and somatic anxiety in the symptomatology of MDD, and also suggest that higher levels of somatic anxiety required greater amounts of GABAergic hypnotics. These findings suggest an additional role of insomnia in representing somatic anxiety in the pathophysiology of MDD, which closely resembles the psychopathological understanding of somatic symptom disorders.
CORRELATING ACTIGRAPHIC PARAMETERS WITH BDNF GENE POLYMORPHISM IN A SAMPLE OF INSOMNIACS: AN EGYPTIAN STUDY

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Introduction: Actigraphy plays an important role in sleep monitoring, diagnosis, and even in the follow-up of treatment effect. A wide range of researches have been published investigating the validity and reliability of actigraphy in various sleep disorders. Additionally, researches about the role of BDNF gene polymorphism have been discussed thoroughly in psychiatric diseases as depression and anxiety but very minimal data exist about its role in insomnia patients. To our knowledge no existing Egyptian actigraphy data has been published before, nor any of the sleep research teams in Egypt have published actigraphy parameters.

Aims: To evaluate the actigraphy parameters and correlate these parameters with the BDNF gene polymorphism, in a sample of Egyptian insomniacs.

Materials and methods: The study subjects consisted of a patient group (n=25) complaining of insomnia. Each subject was clinically interviewed by the Brief Insomnia Questionnaire. The subjects completed the Insomnia Severity Index. A one week actigraphy monitoring was also conducted. Blood samples were collected for BDNF genetic study.

Results: The insomnia patients showed a greater prevalence of hetero-band (A/G) VAL/MET polymorphism. Sleep onset latency (SOL) and total sleep time (TST) were quite low in the studied subjects. There was a correlation between subjects with positive BDNF polymorphism and those with disturbed actigraphic profile.

Conclusions: Actigraphy might be useful in detecting insomnia. Furthermore BDNF polymorphism might be considered a useful indicator of insomnia severity.

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THE EVALUATION OF THE CONSENSUS SLEEP DIARY IN PATIENTS WITH POST-CONCUSSION INSOMNIA

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Introduction: Approximately one-third of patients experience symptoms of chronic insomnia following a mild traumatic brain injury/concussion. Despite the high prevalence of insomnia symptoms, validation of insomnia assessment tools has been lagging in this clinical group. The Consensus Sleep Diary (CSD) was developed to provide a standard sleep log based on patients’ input and expert consensus (Carney, 2012). We have conducted a comprehensive sleep and circadian assessment in a consecutive sample of patients suffering from chronic post-concussion insomnia. As part of this study, we examined the acceptability and psychometric properties of the CSD in this clinical group.

Materials and methods: Individuals reporting ICSD-3 and DSM-5 symptoms of chronic insomnia (N = 50; 64% females; mean age = 39) participated 3-24 months following a concussion. Participants monitored their sleep for two consecutive weeks with the CSD and a Philips Respironics Actiwatch 2, set to record 30 s epochs at medium sensitivity. One night of sleep was recorded and manually scored in the sleep laboratory. Additionally, participants recorded two nights of sleep in their homes using a Compumedics PSG device. Home recordings were scored automatically with NeuroZone software and manually for quality control purposes.

Results: Most (88%) of participants completed the sleep diary and rated this assessment as “3 = acceptable” on a 0-4 scale ranging from “extremely burdensome” to “highly acceptable”. Eighty-eight percent of these individuals had a sleep diary sleep efficiency (SE) < 85%. There were significant correlations between two weeks average sleep diary and actigraphy total sleep time (TST), while correlations between the wake indices and SE were weak and non-significant. CSD and PSG sleep onset latency (SOL) and wake after sleep onset (WASO) were significantly related in the lab nights; however, they shared only 16% of variance and the difference between the CSD and PSG values was significant. The correlations for SOL and WASO were 50% smaller and non-significant during the home nights. CSD and PSG TST and SE had only weak and non-significant correlations both in the laboratory and at home.

Conclusions: The CSD was consistent with the clinical interview in 88% of the sample. Most patients with post-concussion insomnia found the CSD to be an acceptable tool for prospective sleep monitoring. The pattern of correlation with actigraphy was similar to the relationship between these measures in a previous insomnia disorder and good sleeper validation sample but the strength of correlations was weaker for SOL and WASO in the concussion clinical group (Maich, 2016). There was a significant discrepancy between the CSD and PSG indices due to patients’ overestimation of wake time and under-estimation of sleep time. As in other clinical groups, the sleep diary should be treated as a tool that captures subjective sleep perception among individuals with post-concussion insomnia. Although it is a feasible measure for subjective sleep perception, it cannot be used to accurately measure sleep indices at a group level.
THOUGHT CONTROL ABILITY AS A MEDIATOR OF THE RELATIONSHIP BETWEEN INSOMNIA AND DEPRESSIVE AND ANXIETY SYMPTOMS

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Introduction/background: Poor sleep, such as insomnia, is often linked with psychological symptoms including depression and anxiety. Meanwhile, insomnia symptom severity has been found to be positively correlated with thought intrusion, such as worry and aggressive suppression, while negatively correlated with thought control strategy, for instance, cognitive distraction. However, the interplay between insomnia, thought control ability and mood difficulties has scarcely been investigated. The current study aimed to examine the mediating role of thought control ability between insomnia severity and negative emotional states of depression and anxiety.

Methods: Three hundred and thirty-one adolescents and young adults (36% male) aged between 12-26 participated in this cross-sectional study. Sleep was measured by Insomnia Severity Index (ISI), with scores equal to or higher than 9 being classified as insomnia cases. The Thought Control Ability Questionnaire (TCAQ) was used to measure individual’s ability to control unwanted and intrusive thoughts. Negative emotion states were measured by Depression Anxiety Stress Scales (DASS). Statistical analysis of indirect effects of insomnia on emotion states were tested by Sobel test.

Results: In the current sample, 39.0% of participants were classified as insomnia cases. Thought control ability was found to be a statistically significant mediator between insomnia and depression (indirect effect: z=3.35, p< 0.001) as well as anxiety symptoms (indirect effect: z=3.03, p< 0.001). In the unmediated models, insomnia was found to predict higher depressive (B=2.91, β=0.21, p< 0.001) and anxiety symptoms (B=2.66, β=0.23, p< 0.001). Insomnia also predicted thought control ability (B=-9.08, β=-0.36, p< 0.001). In the mediated models, the direct effect of insomnia on depressive and anxiety symptoms was not statistically significant (depression: B=1.35, β=0.10, p=0.213; anxiety: B=1.42, β=0.14, p=0.104) after adding thought control ability as a mediator (depression: B=-0.23, β=-0.46, p< 0.001; anxiety: B=-0.15, β=-0.37, p< 0.001).

Conclusion: The current study showed that thought control ability mediates the impact of insomnia on depressive and anxiety symptoms. Further analysis showed that thought control ability is significantly correlated with cognitive reappraisal, which sheds light on the role of reappraisal on the perceived ability to suppress unwanted thoughts. The findings may have potential therapeutic implications on alleviating depressive and anxiety symptoms associated with insomnia.
INVESTIGATING THE ROLE OF SLEEP IN EMOTIONAL MEMORY PROCESSING; A PILOT STUDY BASED ON ANALYSIS OF INVERSE EFFICIENCY SCORE

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Introduction: In recent years, a large number of studies have demonstrated that the sleep process play a crucial role in emotional memory processing. Most of the studies have been dealt with the issue through recognition rate analysis of emotional and non-emotional stimuli alone, while it seems that the processing speed of target stimuli is as important as the recognition rate. For this purpose, the inverse efficiency score (IES) was employed in this study to provide a speed-accuracy trade-off by combining the percentage of errors and the reaction times.

Materials and methods: Forty healthy subjects (19 females) between the ages of 19 and 30 years participated in the experiment. All participants were randomly assigned to either a nap group or control group (N = 20, in each group). The experiment was designed in two main study sessions: learning and recognition separated from each other with a 4-h interval. Between this two sessions, the participants of nap group obtained a 120-min sleep opportunity, whereas those in the control group remained awake. During learning session, participants learned a total of 96 emotionally negative and neutral stimuli (with equal number of images) selected from the International Affective Picture System (IAPS). At the recognition session, the 96 old pictures of learning session were mixed with 96 new matched pictures and presented to each subject. Physiological signals including EEG, EOG, and EMG were recorded during the nap period with digitized polysomnography (PSG). Sleep stages were scored visually by a blind expert following AASM standard criteria. The sleep stage parameters such as total sleep time (TST), sleep efficiency as well as time, percent and latency of each sleep stages, i.e. N1, N2, N3, and REM, were calculated.

Results: The IES index was calculated for both of emotional and neural stimuli by dividing the mean reaction times of the correct responses by the hit rates. IES is expressed in millisecond. A two-sample Student's t-test was revealed that there was no significant difference between the IES index of the nap and control groups for neutral pictures (p-value > 0.120). In contrast, IES of emotional pictures in the nap group was significantly lower than of the control group (p-value < 0.035). Moreover, the correlation analysis was illustrated that there was a significant positive correlation between the IES of emotional stimuli and the percent of N3 sleep (r = 0.502, p-value < 0.05). Likewise, a negative trend-level correlation was observed between the latency of N3 sleep and IES of emotional stimuli (r = 0.471, p-value < 0.075).

Conclusions: Cognitive psychology tasks usually return two dependent variables: the percentage of errors and the reaction time of the correct responses. IES provides a measure in which the speed and accuracy of target recognition during performing a cognitive task is merged together. It seems that sleep, unlike awakening, can facilitate the processing speed of negative emotional stimuli compared to neutral stimuli. Furthermore, the results also demonstrate that there is an inverse relationship between the N3 stage and the recognition speed of negative emotional stimuli.
NON-INVASIVE VENTILATION EXERTS A NEUROCOGNITIVE IMPACT ON THE GENERALIZATION OF FALSE MEMORIES IN OBSTRUCTIVE SLEEP APNEA PATIENTS

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Introduction: When learning a new verbal material, and then presented later on with never learned but semantically related elements, healthy participants erroneously recognized these new items as previously learned. These commonly observed false memories actually reflect the integration and association of the learned material in the semantic memory system. The specific impact of obstructive sleep apnea (OSA) on cognitive functioning in general, and memory in particular, remains elusive. Likewise, the potential treatment effects of non-invasive ventilation by means of continuous positive airway pressure (CPAP) on memory are barely explored. Using on a standardized DRM paradigm aimed at the induction of false memories, we investigated immediate and delayed CPAP treatment-related effects on verbal memory integration.

Materials and methods: 22 OSA patients underwent CPAP treatment and structured verbal memory testing by means of 10 learned lists, comprising 15 words each. They had then to recognize the learned words in a list of 60 words comprising (a) really studied words, (b) lures, i.e., new words semantically related to the learned lists, and (c) distractors. Additionally, based on the Remember-Know-Guess (R K G) paradigm, patients were asked to specify whether their recognition was based on a controlled recall (R), item familiarity (K) or haphazard (G). The experimental procedure comprised three time points: (1) after a first night of sleep under polysomnographic (PSG) recording, (2) after a consecutive PSG recorded CPAP trial and (3) after a 3-months follow-up period of compliant ambulatory CPAP treatment at home. Verbal memory assessments were combined with questionnaires and psychomotor vigilance tests (PVT) at each time point.

Results: CPAP treatment led to OSA remission and significant improvements of sleep fragmentation, REM sleep proportion, decreased light sleep proportion (N1) and enhanced perceived sleep quality. Subjective sleep quality improvement persisted at 3-months follow-up. Verbal learning and memory performance measures already significantly improved after a single night under CPAP, and effects persisted after 3-months of ambulatory therapy. In particular, persistent effects were found for essential semantic dimensions such as categorization and generalization abilities. Item recognition (R) improved after one night of CPAP treatment and remained stable at 3 months. No treatment-related effects were found on PVT performance.

Conclusions: While our results underline classical and expected improvements of sleep related parameters, our study also evidence strong and specific treatment effects on verbal learning abilities (semantic memory generalization) and cognitive functioning in CPAP-treated OSA patients. Present and similar future findings may contribute to improvements in treatment compliance and adherence to CPAP in OSA patients.
GLUA1 KNOCKOUT MICE SHOW REDUCED EEG SLEEP SPINDEL ACTIVITY WITHOUT PRESENTING LONG-TERM MEMORY DEFICITS

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Introduction: Sleep spindles are field potentials occurring at 10-15 Hz during NREM sleep. Spindles have been implicated in cognitive functions and memory consolidation, and deficits in spindles have been reported in brain disorders including schizophrenia. GWAS have implicated the GRIA1 gene, which codes for the GluA1 AMPA receptor subunit, in schizophrenia, while Gria1\textsuperscript{-/-} mice exhibit a phenotype relevant for neuropsychiatric disorders, such as attentional deficits leading to aberrant salience. Therefore, here we investigated the dynamics of sleep spindles and their relationship with memory performance in Gria1\textsuperscript{-/-} and wild type (WT) mice.

Materials and methods: Chronic electroencephalogram (EEG), from the frontal and occipital cortex, and the electromyogram (EMG) were recorded during spontaneous sleep in n=14 mice. Multichannel recordings of local field potentials (LFP) were also collected in a subset of mice from layer-V somatosensory cortex (SCx), where previous studies in WT mice have identified clear-cut local LFP spindles. EEG and LFP power spectra were calculated with a Fast Fourier Transform using 4-second epochs. For individual spindle event detection, an automated algorithm was applied to the LFP and EEG signals, filtered between 10-15 Hz. The instantaneous amplitude was calculated using a Hilbert transform and spindle amplitude thresholds were obtained for each mouse. Spatial reference memory was assessed in an additional group of mice using a plus maze task, where mice had to learn the location of a fixed-position reward regardless of their start-arm location.

Results: Frontal EEG spectral power during NREM sleep was significantly reduced in the spindle-frequency range (10-15 Hz) in Gria1\textsuperscript{-/-} relative to WT mice. This decrease in EEG spindle frequency power in Gria1\textsuperscript{-/-} mice was especially evident prior to transitions from NREM to REM, when spindle activity is prominent in rodents. EEG spindles were not detected in the occipital derivation in either genotype. Furthermore, individual EEG spindle events were readily detected in WT mice with the automated algorithm, while they were absent in Gria1\textsuperscript{-/-} mice. Interestingly, despite the absence of EEG spindles in Gria1\textsuperscript{-/-} mice, preliminary analyses of LFP signals revealed an occurrence of local spindle events in the SCx in both genotypes.

A repeated measures analysis revealed significant spatial-reference learning across training (main effect of day; \(F_{(6,36)}=17.01, p<0.001\)). However, there was no significant differences between Gria1\textsuperscript{-/-} and WT in memory performance (main effect of genotype and interaction by day; \(F<1; p>0.20\)). This is consistent with previous evidence indicating that long-term memory formation is preserved in Gria1\textsuperscript{-/-} mice.

Conclusions: The deletion of the GluA1 AMPA subunit receptor in mice is associated with a profound reduction of EEG sleep spindling activity; yet local cortical sleep spindles may be preserved. Global EEG spindles do not seem necessary for memory consolidation, although a role for local LFP spindles cannot be excluded. These results have important implications for understanding the biological role of reduced EEG spindles in patients with schizophrenia, and suggest an important role of the GRIA1 gene in mediating the link between sleep and cognitive function.

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ENHANCED ENCODING IN RESPONDERS TO ACOUSTIC STIMULATION DURING A NAP

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Introduction: Acoustic stimulation delivered during the up-state of slow oscillations (< 1 Hz) has been shown to augment these oscillations, and consequently, the consolidation of declarative memories. As these slow oscillations have also been suggested to promote synaptic downscaling of neurons potentiated during wake thereby renewing encoding capacity during subsequent wakefulness, we sought to examine if acoustic stimulation could similarly enhance encoding following a nap.

Materials and methods: 36 healthy undergraduates (M = 22.5 years, SD = 2.4; 17 males) who were partially sleep restricted (4h time-in-bed) underwent two 90-min nap sessions (15:00-16:30): once with acoustic stimulation (STIM), and once without (SHAM) (order counterbalanced). 8-channel EEG, along with EOG and EMG measures were recorded throughout the nap session - for sleep scoring purposes and for real-time detection of the sleep slow oscillation up-state from channel F3. Tones were played in N2 and N3 sleep, locked to the slow oscillation up-state. Following the nap sessions, participants performed a picture encoding task. Participants viewed 80 images of indoor and outdoor scenes (40 of each type) and judged whether these were indoor/outdoor. After a 1h retention period, performance was assessed by means of a recognition task. Participants were presented with 80 old and 80 new images and indicated whether or not they had seen these images before. Hit and false alarm rates were computed as a measure of performance.

Results: There was significant inter-individual variation in response to the auditory tones. To quantify the magnitude of response to these tones, we derived an 'Acoustic Stimulation Response Index' (ASRI) from the absolute difference between mean event-related-potentials in the STIM and SHAM condition. We found that individuals with higher ASRI scores improved more (higher hit rate) on the picture encoding task ($r_{36} = 0.36$, $P = 0.037$) and had greater duration of slow wave sleep (SWS) ($r_{36} = 0.37$, $P = 0.028$) in the STIM compared to the SHAM condition. No relationship was found with false alarms or with the other sleep stages.

Conclusions: The present data extends previous work by providing evidence that encoding of declarative materials could similarly be enhanced using non-invasive acoustic stimulation methods. However, we observed variability in responsiveness to this method, where individuals who displayed greater EEG enhancements demonstrated greater encoding benefits. Whether this is due to individual differences in physiology remain to be explored.

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EFFECT OF ACOUSTIC STIMULATION AFTER SLEEP SPINDLE ACTIVITY

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Introduction: Sleep spindle is a brain wave activity in sigma-frequency band (12-15Hz) during NREM sleep stage 2 and 3. It is well known that sleep spindle is related to memory consolidation and sensory gating during sleep. Even though many studies have been reported on acoustic stimulation during NREM sleep in order to induce K-complex (KC) and slow oscillation (SO), debates on the relationship between SO and spindle still exist. In this study, we tried to investigate an effect of acoustic stimuli right after spindle activity.

Materials and methods: Seven male subjects were recruited for this study. Each subject underwent polysomnographic recording (32 channels of EEG, 2 channels of EOG, ECG and 1 channel of EMG) during three sessions of sleep experiment (1.5 hours of adaptation sleep, stimulation night, and sham night). During the stimulation night, acoustic stimulation (50 dB of pink noise with duration of 50ms through in-ear earphone) was delivered at 250 ms after detection of fast spindle activity. Automatic spindle detector is based on threshold scheme that detects EEG time points where sigma band spectral power exceeds the threshold level for specific time duration. The threshold for automatic spindle detector was estimated based on adaptation sleep EEG data. The performance of psychomotor vigilance task (PVT), word-pair memorization, and motor sequence tapping task were compared between before and after sleep. Questionnaires about subjective sleep quality and emotion were reported before and after sleep. Lastly, power spectral density of slow oscillation (0.5-1Hz), spindle (12-15Hz), and beta (20-30Hz) bands were measured.

Results: The speed increment in motor sequence tapping task after normal sleep (sham night; 24±26ms) disappeared after stimulation night (1±18ms) and it showed statistical significance (p=0.0128) under the unpaired student's t-test. Other performances did not show statistical significance (p>0.05) between conditions, but the difference of the number of memorized word pairs between before and after sleep seemed to be negatively affected by stimulation (-1.42±1.39 words) compared to sham condition (0.42±1.8 words). Questionnaire results from each condition did not show any significant difference (p>0.05). In the SO spectral power time series, the emergence of first peak, which may imply the slow wave sleep (SWS) latency, was postponement during the stimulation night (2401±272s) compared to sham night (1606±530s).

Conclusions: We observed that performance increment of motor sequence tapping task is more likely inhibited during the stimulation night compared to sham night. This result means that pink noise stimulation right after fast spindle activity may hinder procedural memory consolidation. Additionally, the emergence of the first SO spectral power peak during the stimulation night seemed slightly delayed than the sham night. These preliminary results may imply an antagonistic effect between acoustic-evoked SO and fast spindle. However, we have some limitation for understanding these results due to small number of subjects. We will extend this study to figure out the relation between spindle and KC with more sophisticated experiment design.

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Memory
Board #053: P3 - Tuesday
SLEEP RESTRICTION IMPAIRS CONCEPTUAL KNOWLEDGE FORMATION

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Introduction: Accumulation of sleep loss across the school week is common among adolescents, but it remains unclear how this pattern of sleep impacts on the formation of conceptual knowledge, a process that underpins learning in the classroom.

Materials and methods: We restricted 15-18 years olds (n=29) to 5-h time in bed for 4 consecutive nights prior to learning detailed facts about arthropods, and contrasted with a control group (n=30) who had 9-h sleep opportunity every night of the study. Learning took place across a 6-h daytime period that included frequent breaks. Retention was tested at 30-mins, 3-days and 42-days after learning via two-alternative forced-choice questions rated for confidence (Certain, Somewhat Certain, Guess).

Results: Certain memory was significantly impaired in the sleep restricted group relative to controls at all three testing sessions (p< 0.01). Psychomotor vigilance was also significantly degraded after 4 nights of sleep restriction (p< 0.05), but did not correlate significantly with memory in either group (p>0.06). As such, the observed impairment to long-term memory may be more specifically attributed to a degradation of encoding capacity after restricted sleep.

Conclusions: These findings point to deficiencies in the acquisition and long-term retention of knowledge when adolescents fail to obtain the recommended daily amount of sleep, and highlights the importance of keeping good sleep habits in order to optimise learning.

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THE CONSEQUENCES OF SLEEP-DISORDERED BREATHING (SDB) ON THE CONSOLIDATION OF DIFFERENT MEMORY PROCESSES IN CHILDREN AND ADULTS

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Introduction: The role of sleep in memory consolidation is well-described, but remarkably little is known the effect of sleep disorders on different memory processes. Thus, we examined the effect of sleep disorder on declarative and non-declarative memory consolidation by testing children with sleep-disordered breathing (SDB) and adults with obstructive sleep apnea (OSA) compared to healthy control subjects.

Materials and methods: We used story recall to measure declarative memory and Alternating Serial Reaction Time task to measure non-declarative memory. There were two sessions: before sleep (Learning Phase) and after sleep (Testing Phase) for all groups.

Results: In case of children with SDB, we found intact declarative and non-declarative memory consolidation however, the declarative memory performance was generally weaker in children with SDB compared to control group. In case of adult OSA patients, we revealed dissociation between the consolidation of general skill and sequence-specific learning. The control group showed improvement from evening to morning, thus they became faster in the morning, while the OSA group did not. We failed to find differences in the consolidation of sequence-specific knowledge between the OSA and control group.

Conclusions: Sleep disorders has less influence in implicit sequence learning in childhood and the sequence-specific aspects of non-declarative learning in adulthood. These results also give insight into the developmental aspects of the relationship between sleep and memory.

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EFFECT OF INTERICITAL EPILEPTIC SPIKES ON SLEEP SPINDLES IN MEDIAL TEMPORAL REGIONS DURING NREM SLEEP: ARE THERE CONSEQUENCES ON MEMORY LONG-TERM CONSOLIDATION? A SEEG STUDY

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Introduction: Encoding and storage of declarative memory (episodic and semantic memory) depend on hippocampus during early stages of memory consolidation. Later (days, weeks, years), memories are progressively transferred to neocortical regions for long-term memory consolidation. This hippocampal-neocortical transfer of memories is supposed to occur during non-REM (NREM) sleep. Specific brain oscillations or activities, such as sleep spindles, ripples or slow waves, probably play a key role in this process.

Some epileptic patients -generally with a medial temporal lobe epilepsy- may suffer from a specific impairment of long-term memory consolidation, called accelerated long-term forgetting. In this impairment, patients perform normally to memory tests with standard delay of recall or recognition (30min) but forget more than controls when tested with one to few weeks delay.

As epileptic activities (seizures and interictal spikes) are activated during NREM sleep, we aimed to study the effect of epileptic activities on physiological sleep activities, such as sleep spindles, in the hippocampus, and the consequences on long-term memory consolidation (one-week delay) with intracranial EEG recordings.

Materials and methods: We prospectively studied 10 patients with drug-resistant focal epilepsy hospitalized for a presurgical investigation with an intracranial EEG recording (stereoelectroencephalography, SEEG).

All included patients had electrodes in hippocampus (uni or bilaterally) and in other brain regions depending on the supposed localization of seizure onset zone (based on clinical, imaging and scalp EEG data).

Each patient had memory tests 48-72 hours after electrodes implantation. These tests studied standard memory consolidation of words and pictures with immediate and delayed (30 min) recall and recognition. Encoding was reinforced to improve consolidation with a 30 min-delay. Patients were tested one week later to test recall and recognition of pictures and words learnt during the first memory test with a one-week delay to test specifically long-term consolidation processes. Their performance was compared to controls, matched for age, sex and educational background.

We did sleep scoring on the night following the first memory tests (according to AASM recommendations, with scalp EEG, EOG and chin EMG). We studied spike frequency and spindle frequency on contacts localized in hippocampus during the first cycle of NREM sleep.

We studied the localization of the seizure onset zone (SOZ) in each patient to determine if hippocampus belonged to the SOZ or not. We counted all the epileptic seizures occurring during the week following the first session of memory test and we distinguished those occurring during wakefulness and those occurring during sleep.

We studied correlation between spike frequency, sleep spindles during the first NREM cycle in the hippocampus, number of seizures and the performance at the memory test with one-week delay.

Results: As reported in previous works, we found a negative correlation between spike frequency and spindle frequency in hippocampus. We found a significant correlation between spike frequency during NREM cycle and percentage of forgetting at the one-week delay recall and recognition.

Conclusions: Impairment of physiological spindle activity in the hippocampus during NREM sleep by interictal epileptic activities may have negative consequences on long-term memory consolidation.
**Background:** Several factors have been outlined as having a negative impact on cognitive-behavioral functioning of individuals with Autism Spectrum Disorders (ASD). One of them is sleep, the main focus of this project, with which children with ASD are reported to experience severe challenges. Sleep has been found to play an active role in children’s memory consolidation. Specifically, memory is facilitated during intervals of sleep as opposed to wake. To date, research which primarily focuses on children with ASD remains limited and of inadequate nature.

**Aims:** The study had two chief aims: primarily to examine sleep-dependent memory consolidation on children with ASD, and furthermore to provide insights on children's nocturnal sleep habits in relation to their cognitive abilities. Additionally, as Greece is a country in which napping is a common practice, diurnal sleep habits of children were assessed. Participants included, 12 typically developing (TD) children and 12 children with ASD between 5-16 years of age.

**Methods:** Sleep dependent memory consolidation was assessed using the Animal Names task, a recently developed child-friendly and engaging declarative memory task as an alternative to the classic word pairs tasks. Sleep was further assessed using Childhood Sleep Habits Questionnaire (CSHQ), a napping questionnaire and actigraphy.

**Results:** Repeated measures ANOVAs were conducted to assess the changes in performance between the Animal Names task sessions across each group (TD, ASD) and condition (W-S and S-W). TD children had higher scores than the ASD children on all tests. TD children had higher scores on the Animal Names task following intervals of sleep, rather than wake, indicating that during periods of active sleep children's memory traces of the animal's names were strengthened. The new memories the children had made of the non-words improved following periods of sleep irrespective of whether the training had happened in the morning or in the evening. Contrary to expectations, despite the challenges that children with ASD experience during sleep, the positive effects of sleep remained. New memories were not merely protected and strengthened, but were also maintained after a period of 24 hours. Sleep-dependent memory consolidation was possible for children with ASD, regardless of whether the training had occurred in the morning or evening. Correlations, indicated significant difference in Sleep Duration, Night Wakings and Sleep Disordered between the two groups. Moreover, ASD children had higher CSHQ total scores than TD children. Children with ASD had significantly higher sleep onset delay and decreased sleep.

**Conclusions:** The findings suggest that sleep, does in fact play an active role in children with ASD, despite the reported sleep problems which are suggested to characterize them. Due to the scarcity of previous research on the area, the findings of the study emphasize the importance of sleep in children with ASD and stress its role in the process of learning. It is concluded, that sleep had a strengthening and stabilizing effect on the memories of both TD and children with ASD. The complete understanding of the influence of sleep on children is important for the creation of teaching interventions.
THE DEVELOPMENTAL ADVANTAGE OF SLEEP ON MEMORY DECLARATIVE CONSOLIDATION:
A BEHAVIOURAL COMPARISON BETWEEN ADULTS AND CHILDREN

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Introduction: Children exhibit significantly larger amounts of slow waves sleep (SWS) than adults, which may promote a faster pace of memory consolidation during development. Consistent with this hypothesis, we showed that whereas immediate retrieval of new verbal memories involves the hippocampal regions, delayed retrieval after a 90-minute daytime nap in children recruits the neocortical medial prefrontal (mPFC) and bilateral inferior frontal (IFG) areas (Urbain et al. 2016). as similar effects were observed in fMRI studies in adults, but only days to months later, supporting our hypothesis that memory consolidation processes develop more quickly in children.

Materials and methods: The present study aims at testing this hypothesis at the behavioural level. Sleep-dependent memory consolidation performance associated with the retrieval of novel associations between unknown objects and their functions was evaluated in two groups of 15 children (7-12 years old) and 15 adults (20-30 years old). Sleep-dependent declarative memory consolidation was estimated by comparing immediate (evening, session 1, S1) and delayed (morning, session 2, S2) retrieval performance between groups.

Results: A repeated measures ANOVA analysis with within-subject factor SESSION (S1 vs. S2) and between-subject factor GROUP (Children vs. Adults) disclosed no main effect of SESSION (p>0.14) or GROUP (p>0.21). The SESSION X GROUP interaction effect was significant (F (1,24) = 6.42; p< .018). In adults, post-hoc Tukey tests showed significantly poorer retrieval performance after sleep compared immediate retrieval performance the day before (S1>S2; p< .04). In children, retrieval performance was similar between the two sessions (S1=S2; p >.88). Immediate retrieval performance (S1) did not differ between groups (p>.23), indicating that initial learning performance was not responsible for between groups sleep-dependent differences in memory retrieval.

Conclusions: Altogether, our results suggest that consolidation of novel declarative associations is faster, or at least more effective, after one night of sleep in children than adults. We suggest that this effect is due to the potential advantage of more abundant SWS during development on memory consolidation processes.

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Introduction: Slow wave sleep (SWS) is known to play an important role in the off-line consolidation of memory. During SWS some memories are randomly reactivated at neuronal level as a part of consolidation process. Moreover, targeted presentation of memory-associated cues in SWS stage may reactivate declarative and procedural memory and improve its consolidation. As little is known about the effect of sleep at consolidation of sensory memory, we aimed to study an effect of auditory memory reactivation during SWS on explicit auditory discrimination during subsequent wakefulness.

Materials and methods: We asked 34 healthy volunteers to discriminate alternately one of two deviant sounds in two blocks of odd-ball acoustic sequence (80 % Standard, 10 % - Deviant 1, 10 % Deviant 2) before and after 1.5 hour day nap. Deviant 1 was perceived acoustically lower and Deviant 2 was higher than standard sound with the same difference of 5 Hz in the basic frequency. All sounds were difficult for discrimination at the first session (discrimination probability less than 39 %). During SWS the same standard and only one ‘cued’ deviant sound (either Deviant 1 for the first group of 17 participants or Deviant 2 for the second group of 17 participants) were presented together with standard sound in a different paradigm, containing violations of local and global regularity of the sound sequence, which served as a cue for memory about acoustic differences in the previously heard sound sequence in awake state.

Results: Two deviants did not differ in accuracy of discrimination at the first session before sleep. Difference in hit rate before and after sleep for the cued deviant was significantly higher than for the uncued deviant (repeated measures ANOVA: $F(1,33)=4.61; p<0.039$) for both groups. Within subjects of Deviant 1 group, hit rate for the cued deviant was significantly higher after sleep ($F(1,33)=6.66; p<0.020$), than before sleep, with no difference in discrimination accuracy of the uncued deviant. Despite the obvious tendency of increasing discrimination rate after sleep, this increase was not significant for Deviant 2 group, the same as difference in discrimination of both deviants after sleep between the groups.

Conclusions: Our results indicate that re-exposure of the lower deviant sound in SWS in the different sequence, than in the preceding wake stage, leads to improvement of discrimination of this specific deviant. Nevertheless, this improvement was not significant for the higher deviant sound. Further research is needed to validate targeted auditory memory reactivation in SWS.

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SLEEP-DEPENDENT MOTOR SEQUENCE MEMORY CONSOLIDATION IN INDIVIDUALS WITH PERIODIC LIMB MOVEMENTS

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Introduction: Periodic limb movement disorder (PLMD) is a neurodegenerative disease resulting from striatal dopamine deficiency, characterized by periodic limb movements (PLMs), associated with disrupted non-rapid eye movement (NREM) sleep. Motor skill memory consolidation recruits the striatum, and learning-dependent striatal activation is associated with NREM sleep. Therefore, we investigated whether individuals with clinically significant PLMs had learning and sleep-related memory deficits, and if these deficits related to sleep quality and symptom severity.

Materials and methods: Fourteen adults with clinically significant PLMs (PLM condition); fifteen aged-matched controls (CTRL); and fourteen age-matched “disturbed” sleep (via induced leg movements) controls (CTRL-ES) participated. Participants were trained (PM) and retested (AM) on procedural motor sequence learning (MSL) and declarative paired associates memory tasks.

Results: Baseline sleep quality was significantly worse in the PLM vs. CTRLs. Despite the continued presence of PLMs in the PLM condition on the experimental night, remarkably, sleep quality was improved and arousals were reduced vs. baseline, and did not differ from CTRL. MSL was significantly slower in the PLM condition compared to CTRL at training, but surprisingly, did exhibit overnight performance gains; which correlated with reduced arousals. As predicted, CTRL but not CTRL-ES had overnight gains in MSL. Together, suggesting that, in the PLM condition, sleep quality was normalized following MSL, where they derived the same benefit of sleep to procedural memory consolidation as CTRL. Sleep did not benefit declarative memory.

Conclusions: Although preliminary, these results suggest that motor sequence learning in individuals with PLMs may provide a benefit to sleep, which in turn, may benefit memory consolidation.
DYNAMIC OF THE HIPPOCAMPUS ACTIVITY DURING AROUSING REACTION FROM SLEEP: AN INTRACRANIAL EEG STUDY

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Short phasic activations during sleep, characterized notably by an increase of high frequencies in the electroencephalogram (EEG), are considered as transient elevations of the level of vigilance and are called arousals (3 to 15 s) or awakenings (more than 15 s) according to their durations (Silber et al. 2007). As predicted by the arousal-retrieval model (Koulack and Goodenough 1976), we previously found that the average duration of intra-sleep awakenings was a good predictor of dream recall (2 min in average in high dream recognizers and 1 min in low dream recognizers, Eichenlaub et al. 2014, Vallat et al. 2017). Intracranial EEG studies have shown that cortical patterns of activation during short arousals were inconsistent across time and heterogeneous according to brain regions, but none of them had the chance to explore the hippocampus (Nobili et al. 2011, Peter-Derex et al. 2015). The intra- and inter-subject variability of activity in the hippocampus during arousing reactions is a good candidate to explain variation in dream recall given the involvement of this region in memory. In order to better understand the possible role of the hippocampus in dream recall, we investigated its activity during sleep and short arousing reactions lasting from 3 s to 2 min (arousals and short awakenings) using intracranial recordings (S-EEG) in 4 drug-resistant epileptic patients undergoing invasive presurgical investigation. Sleep EEG recordings from the thalamus and hippocampi free of epileptic activity were analysed. Arousing reactions were scored using the EEG signal recorded on thalamic leads (Peter-Derex et al. 2015). The average power in S-EEG hippocampal signal for frequency bands of interest (between 0.5 and 140 Hz) was calculated in 4 time windows: the 10 sec of sleep preceding the arousal (baseline), the first 3 sec of the arousal, the end of the arousal, and 10 sec of quiet wakefulness. Six hundred and seventeen arousal reactions were analysed. Comparisons between hippocampal spectral power in the 4 time windows of interest showed that 1) the power in several frequency bands during the arousals was intermediate between the power during wakefulness and the power in the preceding sleep (delta, theta, alpha for N2 arousals, and theta and alpha for REM sleep arousals), 2) the longer the arousal, the more wake-like the power in these frequency bands, 3) the power in the gamma band was not significantly lower in N2 sleep than in wakefulness, and 4) the power in the delta band was not significantly different in REM sleep and wakefulness. The results show that during short arousals/awakenings: 1) the hippocampus activity changes, 2) the reinstatement of the wakefulness hippocampus activity takes time (several tens of seconds), 3) the timing of the hippocampus reactivation is coherent with the timing of dream recall/forgetting and awareness of wakefulness reinstatement at awakening (Campbell & Webb 1981). The results will be discussed regarding the different role of REM sleep and N2 sleep in sleep-dependant memory consolidation, the functional role of the hippocampal delta power in memory encoding and the link between sleep stage and dream recall.
USE OF OCCLUSAL SPLINT OR MANDIBULAR ADVANCEMENT APPLIANCE BY SLEEP BRUXISM PATIENTS DO NOT NORMALIZE AROUSAL RELATED HEART RATE VARIABILITY

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Introduction: Oral appliance is among first-line therapy for sleep bruxism (SB). However, mechanism of action for SB remains unknown. The aim of study is to assess if changes in heart rate variability (HRV) related to SB arousal could explain their action.

Materials and methods: A retrospective analysis of sleep from 20 SB subjects (25.8 ± 4.6 years) was done on data previously collected in a sleep laboratory (Landry-Schönbeck et al 2009, Landry et al 2006 in Int J Prosthodontic). The inclusion criteria were: frequent tooth-grinding sound reported at least 3 times a week over previous 6 months, tooth grinding-SB confirmed by polygraphic (PSG) recordings with audio/video monitoring. We compared PSG data without oral (no appliance night) vs. PSG with occlusal splint (OS) or mandibular advancement appliances (MAA; at the 75% advancement) after short term use (7 nights). Rhythmic masticatory muscle activity (RMMA) index (event/hr) were compared between no appliance night and OS or MAA PSG night recordings using Friedman test followed by Wilcoxon signed ranks test corrected by Bonferroni. HRV was evaluated in the time domain (RR mean) and the three frequency domains (normalized HF - parasympathetic and LF, LF/HF for sympathetic dominance) during non-REM and REM sleep using autoregressive model analysis (to monitor small fluctuation in HRV) with RemLogic. Three PSG sections were selected for analysis: i) BASELINE (quiet segment removing 8minutes before RMMA onset and 28 minutes after RMMA onset, and other movements), ii) BEFORE RMMA onset (minutes 8 to 0 min before RMMA onset), and iii) AFTER RMMA (onset time 0 up to 8 minutes after). Sleep quality was assessed on a 100 mm VAS on morning.

Results: As expected from our previous publications, both OS and MAA lowered the index of RMMA episodes during both non-REM and REM sleep (P ≤ 0.01). The non-REM parasympathetic activity was significantly reduced (P = 0.036) across three observation nights (for BASELINE segment: 53.6 to 49.9 and 48.6; for BEFORE RMMA: 52.7 to 48 and 51 from no appliance to OS and MAA nights, respectively). However, the changes between each night did not have significantly difference using post-hoc test. During non-REM sleep, for the AFTER RMMA segments, the expected reduction in parasympathetic and rise in sympathetic activities was significantly different (p ≤ 0.001) but comparisons between no appliance and the 2 appliance nights did not revealed any difference. No difference in self report of sleep quality was reported this regardless the use or not of an oral appliance.

Conclusion: During non-REM sleep, short term (7 nights) use of OS of MAA seem to alter parasympathetic cardiac and respiratory nervous system activity suggesting a mild interference on sleep stability not reflected in self reports of sleep quality. The short term efficacy of OS and MAA in reducing RMMA index during sleep do not seem to be associated to autonomic nervous systems changes, i.e., a rise in parasympathetic (calming effect) and the concomitant reduction in sympathetic activity (arousal effect).

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Introduction: Insomnia is a sleep disorder with a prevalence estimated at 10% of the adult population. Part of the insomnia population have at polysomnography periodic limb movements in sleep (PLMS). In our previous study we found that 15% had a combined sleep problem of insomnia and PLMS (PLMI $\geq 15$/h). (These patients have no signs or symptoms of restless legs syndrome (RLS)). The use of dopamine-agonists in this combined group can have an effect on sleep quality. The aim of this study is to investigate whether dopamine agonists decrease the Periodic Limb Movement Index (PLMI) and improve subjective sleep experience.

Materials and methods: Six patients (4 females; median age: 50.5 years, range 28-58) with an unknown etiology of insomnia and a PLMI $\geq 15$/h were included. Patients were treated following the guidelines with a dopamine-agonists (Ropinirole, Pramipexole or Rotigotine) with titration up to the best possible result. All patient received cognitive and behavioral therapy for insomnia (CGTi). The patients were followed over a period of three months. At the end of the follow-up period repeat polysomnography was performed.

Results: Five patients received for three months a dopamine-agonist and CGTi. One patient dropped-out because of side-effects. Patients received monotherapy ranging from Pramipexol 0.25 mg - 0.75 mg or Ropinerol 0.5 - 0.75 mg. One patient switched dopamine-agonist due to side-effects. Subjective results showed in all patients an improvement in better quality of sleep and daytime functioning. The follow-up polysomnography showed a considerable reduction of the PLMI and an increase of sleep efficacy.

Conclusions: Dopamine agonists and combined CGTi is possibly of clinical importance in patients diagnosed with combined insomnia and PLMS. In this study subjective and objective parameters showed improvement. Further studies are necessary. In this small study we demonstrated the effect of Dopamine agonist in the studied population.
THE PREVALENCE OF RESTLESS LEG SYNDROME IN NORTH-WEST OF IRAN

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Introduction: Restless legs syndrome (RLS) is characterized by an irresistible urge to move the legs. The purpose of this study was to investigate the prevalence of RLS in an adult population.

Materials and methods: In this cross-sectional observational study, 1558 participants (>18 yr. old) were recruited in a telephone interview during Jan.-Mar. 2017 in Ardebil (north-western Iran). The prevalence of RLS was estimated with validated questions defined by the International Restless Legs Syndrome Study Group (IRLSSG). Participants with definitive RLS completed RLS severity scale. Data were analyzed using t-test, chi-square, Mann-Whitney and spearman rank correlation tests.

Results: Out of the 1558 participants, 777 (49.9%) were men. Mean age of study population was 36.6 ± 12.1 years. Mean BMI (body mass index) was 25.9±4.4 kg/m². Prevalence of RLS was 4.2% (n=65) with highest frequency in age range of 18-30 years. RLS frequency was not increased in terms of sex (p=0.8). Findings showed no association between BMI and RLS. Mean score on the RLS scale was 9.2±3.6. In 61.5% (n=40) of individuals, the symptom duration was of mild degree (mean 6.9±2.8). Aging was not associated with symptoms' severity but elder men reported more severe symptoms.

Conclusions: RLS was a common disease in studied population with the highest frequency in young age. Elder men reported more severe symptoms. Current findings warrant conducting population-based studies for investigation of RLS prevalence.

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Introduction: Several neurological disorders associated with Basal Ganglia dysfunctioning, like Parkinson's and Huntington's disease, are characterised by seriously debilitating sleep abnormalities. The involvement of Basal Ganglia in sleep modulation has been recently documented. However, the reciprocal modulation of Basal Ganglia activity by sleep-wake dependent processes is unknown.

Materials and methods: We combined electroencephalogram (EEG) with electrical multi-unit activity (MUA) recordings in different subdivisions of both midbrain dopaminergic structures [Substantia nigra lateral (SNL, n=6), Substantia nigra medial (SNM, n=5), Ventral Tegmental area (VTA, n=6)] and striatal structures [Striatum laterodorsal (STR-LD, n=4), Striatum mediodorsal (STR-MD, n=4), Ventral striatum (STR-V, n=4)] under 12h:12h light/dark (LD) and constant dark (DD) conditions. In addition, we investigated the effects of a 6h sleep deprivation (SD) on MUA in these areas.

Results: Both under LD and DD conditions, the MUA showed a vigilance state dependency with the highest firing rates during wakefulness and REM sleep compared to NREM sleep (p< 0.001, t-test). Interestingly, different dopaminergic and striatal subdivisions responded differently to SD.

Conclusions: Our results indicate that circadian and homeostatic processes influence the activity of midbrain dopaminergic and striatal structures. These influences may contribute to behavioural changes observed in neurological disorders related to dysfunctioning in the Basal Ganglia.
**Introduction:** Individuals with mental health and/or neurodevelopmental conditions often display disruptive behaviours characterized as hyperkinesia, hypermotor-restlessness, and hyper/hypo-arousability, all grouped as “H-behaviours”. In 2017, the Video-Working-Group of the International Paediatric Sleep Association developed a standardized framework for analyzing video recordings of H-behaviours. As a first step before assessing the suggested framework’s feasibility and reliability, we investigated Suggested Clinical Immobilization Test (SCIT) snapshots. Our goal was to develop a shared annotation language among research assistants (RAs) that could later be applied in the annotation of video recordings.

**Methods:** Seven RAs without previous formal training in assessing H-behaviours analyzed video recordings of five adult volunteers undergoing a SCIT; a REDCap survey structure was used for data gathering. (A) RAs reviewed 24 SCIT snapshots and made qualitative free-hand observations (e.g. of body movements, facial expressions, etc.). (B) Two days later, the same 24 SCIT snapshots were reviewed in a randomized order. (C) A and B were repeated using prepared pictograms instead of free-hand observations. (D) The categorization of observations in 12 SCIT snapshots was further analyzed. (E) Interobserver variability was assessed.

**Results:** Observations were categorized as (i) descriptive; or (ii) interpretive (predictions or statements influenced by viewer’s “Gestalt”-perception). Median number of descriptions and interpretations per SCIT snapshot for free-hand observations were 6 and 1, respectively. Interobserver consistency was 61.9% for descriptions and 36.6% for interpretations in free-hand observations. After grouping all movement-related pictograms, median number of descriptions and interpretations per SCIT snapshot were 2 and 1, respectively.

**Conclusion:** This exercise provided an introduction to structured behavioural observations of H-behaviours during SCITs. Free-hand observations yielded higher interobserver consistency in descriptions than interpretations. Unexpectedly, we found that the proportion of interpretations increased when annotating using pictograms. This learning experience emphasizes the importance of developing and optimizing neutral descriptors (i.e. pictograms) of body movements and behaviour patterns.

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THE ASSOCIATION BETWEEN NOCTURNAL TRAPEZIUS AND MASSETER MUSCLE ACTIVITY IN TWO FEMALE PATIENTS WITH SHOULDER AND NECK PAIN: A CASE REPORT

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Introduction: Subjects with shoulder and neck pain had more trapezius muscle activity than pain-free subjects during sleep (Mork and Westgaard, 2006). However, the association between trapezius and other muscle activity including masticatory muscle was not clear yet. Sleep bruxism, characterized by nocturnal rhythmic jaw clenching and tooth grinding, was observed the association with transient pain and/or fatigue of masticatory muscle in the morning. The objective of study was to investigate influence on nocturnal trapezius and masseter muscle activity in subjects with shoulder and neck pain.

Materials and methods: Self-report questionnaire and polygraphic data with audio-video monitoring were collected from two young females (30 and 28 years old) with shoulder and neck pain before and after experimental night. They are graduated students and the polygraphic recordings were carried out for two consecutive days avoiding their menstrual period. Their sleep quality was normal range from the Pittsburgh sleep quality index. Electromyographic (EMG) activity was monitored bilaterally from the trapezius and masseter muscle in whole night. The first night recording was habituation to our sleep laboratory environment, and the second night recording was used to analyze. Trapezius muscle activity (TMA) over four-time higher amplitude than baseline was detected. Rhythmic Masticatory Muscle Activity (RMMA) of masseter muscle was scored based on sleep bruxism research diagnostic criteria (Lavigne 1996). The duration of trapezius and masseter muscle activity were calculated. The duration of trapezius muscle activity associated with masseter muscle activity was also calculated.

Results: Two females showed high sleep efficiency (98.2% and 98.1%), they spent comfortable sleep time in our sleep laboratory. Case 1; the percentage of slow wave sleep (SWS) was 43.6% in total sleep time. The duration of TMA was 71.0 sec and recognized 29.0% during SWS. The duration of RMMA was 157.7 sec. The RMMA episode per hour was 5.4 and she had more than two episodes with grinding noise. The TMA with RMMA was 14.4 sec (20.2%). Case 2; the percentage of SWS was 26.4%. The duration of TMA was 261.6 sec and recognized 12.8% during SWS. The duration of RMMA was 48.3 sec. The RMMA episode per hour was 2.1 and she had no episodes with grinding noise. She had more tonic episodes than phasic episodes. The TMA with RMMA was 18.4 sec (7.0%).

Conclusion: Nocturnal muscle relaxation and recovery might play an important role. These two subjects reported shoulder and neck pain before and after sleep. Same symptom was observed but each muscle activity was recognized inverse profiles; one case had more RMMA and another case had more TMA. Shoulder and neck pain after experimental sleep might have possibly different characters. Two different ways for shoulder and neck pain was assumed. 1st case was caused by RMMA and another case was caused by TMA. Future studies with a large sample size are needed to clarify the association between character for shoulder and neck pain and these muscle activities.

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DISTINCT FIRST NIGHT EFFECTS FOR RHYTHMIC AND NON-RHYTHMIC MASTICATORY MUSCLE ACTIVITIES IN YOUNG ADULTS

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Introduction: Sleep bruxism (SB) is characterized by frequent occurrence of rhythmic masticatory muscle activity (RMMA). There is a daily variation in the occurrence of RMMA in SB patients. Although previous studies have shown the association between RMMA and sleep homeostatic factors, it remains to be clarified how the daily variations of RMMA and sleep architecture are associated. This study aimed to investigate the first night effects on sleep architecture and oromotor activities during sleep in young subjects with or without the frequent RMMA.

Materials and methods: Polysomnography (PSG) recordings were performed simultaneously with audio-video in 30 young subjects (F: 15; M: 15, 23.5 ± 0.39 years old, BMI: 20.7 ± 0.32 kg / m²) for two consecutive nights in the university sleep research laboratory. Sleep stages and arousals were scored and calculated according to the AASM scoring rules. RMMA and non-rhythmic, nonspecific activity (NA) were scored based on the PSG traces and audio-video records. The frequency per hour of sleep was estimated for the two oromotor activities (RMMA index and NA index). According to the previous studies, subjects were divided into SB group (15 subjects, RMMA index ≥ 4 /hr) and control (CTL) group (15 subjects, RMMA index < 2) based on the data of the second night. Sleep and oromotor variables were compared between two nights in the two groups.

Results: In the SB group, sleep efficiency (P < 0.01) significantly increased while the percentage of total waking time after sleep onset (P < 0.01), sleep latency (P < 0.01), and stage R latency (P < 0.05) decreased from the first to the second night. RMMA index increased by 18.8% (p < 0.001) and NA index decreased by 17.9% (P < 0.05) from the first to the second night. However, no difference was found for the total number of oromotor activity (i.e., a sum of RMMA and NA) between the two nights. In the CTL group, the percentage of stage R decreased (P < 0.05) but micro-arousal index increased (P < 0.001) from the first to the second night. However, neither RMMA nor NA differed between the two nights.

Conclusions: The first night effect on sleep architecture was more clearly observed in the SB group than the CTL group. In the SB group, the improvement of sleep quality on the second night was associated with the increase of RMMA and with the decrease of NA. The results suggest that the occurrence of rhythmic and non-rhythmic masticatory muscle activities are differently associated with the subtle changes within normal sleep processes between the first and second nights in the SB group.

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**PREVALENCE AND ASSOCIATED FACTORS OF RESTLESS LEGS SYNDROME AND PERIODIC LIMB MOVEMENT IN EPISONO COHORT**

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**Introduction:** Restless legs syndrome (RLS) and periodic limb movement (PLM) are sleep-related movement disorders associated with several medical conditions and a poor quality of life. The aim of the present study was to determine the prevalence of RLS and PLM as well as to establish the associated factors related to each sleep disturbance in a representative sample of general population.

**Materials and methods:** This is a cross-sectional study performed in an adult population-based sample of 1,042 participants from EPISONO cohort (Sao Paulo, Brazil), who underwent polysomnography, answered questionnaires and had their blood collected for quantification of iron, ferritin, and inflammatory markers. RLS was assessed by closed questions addressing the presence of uncomfortable sensations in the legs that were not associated with muscle cramps and positional discomforts. PLM disorder was considered as positive using a cut-off value of PLM index (PLMI) >15/h.

**Results:** Overall, the prevalence of RLS was 7.5% (7.9% women; 7.1% men) and PLMI>15/h was 2.4% (2.4% women; 3.4% men). No association between RLS and PLMI>15/h was found. Serum levels of iron and ferritin did not differ among the groups. Participants with RLS showed an increased frequency of DSM-IV insomnia, anxiety symptoms, and hypertension. Those with PLMI>15/h were older and had a higher waist circumference, apnea-hypopnea index and levels of TNF-alpha and IL-6 compared to PLMI\(_{\leq 15}/h\) group. In logistic regression models, anxiety symptoms (OR=2.71, 95% CI [1.35-5.46]) and hypertension (OR=2.15, 95% CI [1.35-5.46]) were independently associated with RLS. On the other hand, age (OR=1.07, 95% CI [1.04-1.09]) and TNF-\(\alpha\) levels (OR=1.04, 95% CI [1.00-1.08]) were positively and independently associated with PLMI>15/h.

**Conclusions:** RLS and PLM are both prevalent sleep-related movement disorders in Brazilian population. PLM>15/h was associated with increased levels of proinflammatory markers, while hypertension was a predictive factor of RLS. These findings may suggest a possible role of PLM and RLS as mediators of cardiometabolic diseases.

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Introduction: Sleep bruxism is a common sleep-related movement disorder in children. Parental reports have so far been widely used to study pediatric sleep bruxism. However, physiological aspects of sleep bruxism in children have been rarely studied with polysomnography. This study aims to investigate physiological characteristics of rhythmic masticatory muscle activity (RMMA) in Japanese children.

Materials and methods: Twenty children (M/F: 11/9) aged between 6 and 15 years old (10.3 ± 2.9) were recruited from community. An overnight polysomnography with audio-video recording was performed. RMMA was scored according to previous publication in adults as follows: RMMA episodes were consisted of phasic masseter EMG bursts (lasting between 0.25 and 2 seconds) and/or tonic bursts (≥ 2 seconds) separated by < 3 seconds. The number of bursts per episode was counted. RMMA episode duration was the time length of individual episode. Burst index and bruxism time index were calculated as total number of bursts and total RMMA episode duration divided by total sleep time, respectively.

PSG research diagnostic criteria for adult sleep bruxism were used to determine the cutoff between control and PSG-SB groups: PSG-SB was diagnosed when RMMA episode per hour (RMMA index) was > 2. PSG-SB was further classified into low-frequency (RMMA index between 2 and 4) and moderate-to-high-frequency (RMMA index > 4) groups. Burst variables were compared between PSG-SB and control groups using Mann-Whitney tests.

Results: In twenty children, mean RMMA index was 3.7±2.6/hr [0.1-8.8]. RMMA index was significantly correlated with mean RMMA episode duration (Spearman’s coefficient: 0.47, p=0.04) and arousal index (Spearman’s coefficient: 0.50, p=0.03). Approximately 75% of RMMAs were accompanied with arousal. A majority of RMMAs occurred in stage N1 and stage N2 (28.8% and 52.3%, respectively), while a less number of episodes occurred in stage N3 (12.1%) and stage R (6.8%).

Among 20 children, twelve children (60%) were diagnosed to have sleep bruxism by polysomnography: 2 belonged to low-frequency, and 10 were moderate-to-high frequency PSG-SB. RMMA index (SB: 5.3±1.8/hr [2.6-8.8]; CTL: 1.1±0.7/hr [0.1-2.0], p < 0.001), burst index (SB: 31.9±20.8/hr [9.0-88.0]; CTL:4.9±3.3/hr [0-9.0], p < 0.001), and bruxism time index (SB: 9.1±5.9*10^{-3} [2.7-22.6*10^{-3}]; CTL:1.4±0.8*10^{-3} [0.1-2.3*10^{-3}], p < 0.001) were significantly higher in PSG-SB group than those in control group. There was no significant difference in burst per episode (p= 0.12) and mean RMMA episode duration (p= 0.08) between these two groups.

Conclusions: The occurrence of RMMA can be associated with sleep macro- and micro-structures: a majority of RMMA episodes in children occurred transiently with arousal and in light non-REM sleep, which shared common physiological characteristics in adults. In our sample, sixty percent of children were diagnosed to have SB by polysomnography.
A CASE-CONTROL SPECTRAL ANALYSIS OF SLEEP IN FRIEDRICH'S ATAXIA

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Introduction: Friedreich’s Ataxia (FA) is a rare neurodegenerative autosomal recessive disorder. It is characterised by progressive ataxia, impaired sensory function, weakness, dysarthria, loss of vision and hearing, scoliosis, and cardiomyopathy. FA leads to premature death and currently has no cure. Fatigue and sleep complaints are often reported by FA patients, but quantitative analysis of polysomnographic EEG has never been conducted.

Materials and methods: FA patients were recruited from the FA clinic at the Royal Brisbane and Women's Hospital (n=5). Age-matched controls were recruited from the general population (n=5). The study received ethical clearance from relevant committees. Participants underwent one night of home-based polysomnography (PSG) using a portable Somte-V2 PSG based on the international ten-twenty electrode system. Whole night data were collected for EEG derivations C4-A1 and O2-A1 (with C3-A2 and O1-A2 as backup). Eleven 30-second epochs each for stages REM, NREM2 and NREM3 were selected with visual exclusion of artefacts in the same derivations. Fast-Fourier transformation was applied using a 10-second Hamming window, with no overlap, using MatLab R2016b. Integral Mean Power Spectra (IMPS, µV²) were calculated for each frequency band defined by AASM (delta 0.5-4Hz, theta 4-7Hz, alpha 8-13Hz, beta 13-30Hz, gamma 32-50Hz, spindle 11-16Hz). Analyses were also conducted for a 6-8Hz band due to visually identified changes in power spectra. Spindles were identified using Compumedics ProFusion-PSG4, and spindle index calculated as spindle/hour. Sleep data based on AASM PSG analysis were also collected (i.e. arousal index). Non-parametric t-tests were performed using GraphPad Prism7 and data presented as mean±SEM.

Results: Whole night spindles IMPS was lower in FA than in healthy controls (HC) in the central derivation (FA 7.399±1.196, HC 12.75±1.702, P=0.0317). In line with this results, the spindle index was lower in FA compared to HC (FA 31.1±7.31, HC 12.81±2.217, P=0.0159). When looking at the 6-8Hz band, IMPS for the whole night was higher in FA than in HC in the occipital derivation (FA 31.1±7.31, HC 12.81±2.217, P=0.0159). When looking at the 6-8Hz band, IMPS for the whole night was higher in FA than in HC in the occipital derivation and a similar trend was observed in the central derivation (FA 16.96±1.97, HC 6.932±1.263, P=0.0159, and FA 17.42±3.103, HC 9.625±0.4586, P=0.0556). In NREM2, in the central derivation, IMPS for beta was higher in HC compared to FA (FA 4.959±1.025, HC 10.07±0.793, P=0.0317) and IMPS for spindles was higher in HC than in FA (FA 4.908±1.198, HC 12.98±2.108, P=0.0159). The alterations observed in IMPS in FA versus HC are not due to differences in the arousal index (FA 23.32±3.868, HC 21.72±0.8874, P=0.8413).

Conclusions: This study shows that power spectral alterations are present in FA patients when compared to healthy controls. This may have implications for understanding the nature of sleep difficulties in FA, while their role in the progression of disease remains uncertain.
EFFECTS OF DEEP BRAIN STIMULATION (DBS) OF THE PEDUNCULOPONTINE NUCLEUS (PPTg) OF THE RETICULAR ACTIVATING SYSTEM (RAS) IN PARKINSON´S DISEASE (PD): MOTOR AND NON MOTOR BENEFITS

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Introduction: The human pedunculopontine nucleus (PPTg) is located in the ponto-mesencephalic region delimited by three sensitive pathways; PPTg has two main sub-regions: the pars compacta and the pars dissipata. The PPTg presents mainly ACh neurons. Moreover GABAergic and glutamatergic neurons of PPTg receives corticostriatal inputs and projects to structures involved in motor control, such as GPi, SNr and the STN. However, PPTg is not only a locomotor structure and it is a part of RAS. Diffuse ascending cholinergic projections affects rapid-eye-movement and sleep. Recently PPTg was proposed as a target in PD patients (DBS), alone or associated with STN/GPi. We discuss the motor and non motor effects of PPTg DBS.

Materials and methods: We compared six idiopathic PD patients with unilateral PPTg DBS alone and six with simultaneous bilateral implantation of STN and PPTg. All presented severe axial signs; disabling freezing was present in 7. The surgical procedure, stimulation setup was described elsewhere. Briefly, the electrodes are implanted (Medtronic 3389) in PPTg alone unilaterally or bilaterally in PPTg and STN. Each clinical evaluation included the UPDRS-III; gait and posture by dedicated items (27-30) plus optoelectronic 3D gait analysis system. Cognitive evaluations were performed by a neuro-psychologist, in CAPIT. Cognitive functions were assessed by using different tests. Polysomnography recordings were carried out using a dynamic 32-channel system polygraph with standard montage, after surgery, in the test period.

Results: The PPTg implantation was to provide specific benefits on gait respect the ON drug condition. So far, the degree of response obtained are largely variable: a significant amelioration of gait and posture was found in 7. The surgical procedure, stimulation setup was described elsewhere. Briefly, the electrodes are implanted (Medtronic 3389) in PPTg alone unilaterally or bilaterally in PPTg and STN. Each clinical evaluation included the UPDRS-III; gait and posture by dedicated items (27-30) plus optoelectronic 3D gait analysis system. Cognitive evaluations were performed by a neuro-psychologist, in CAPIT. Cognitive functions were assessed by using different tests. Polysomnography recordings were carried out using a dynamic 32-channel system polygraph with standard montage, after surgery, in the test period.

The evidence by which PPTg-DBS helps restoring a more physiological sleep and more brilliant attentive and executive functions, suggests that the stimulation, imposes new activity patterns in otherwise impaired/silent networks. Instead, PPTg exert also a strong influence onto ascending pathways, as if the PPTg and the BG structures are an integrated system. This data indicating PPTg as an active player in "limbic-reward" circuitries and the involvement of non-motor non-dopaminergic brain-stem areas .In the natural history of PD. PPTg - DBS promotes an improvement of sleep efficiency and cognitive performance. REM sleep alterations are related to degenerative processes of non dopaminergic circuitries, unaffected by dopamine-therapy or standard STN DBS.
Introduction: Sleep bruxism (SB) is defined as a repetitive jaw muscle activity characterized by clenching or grinding of the teeth, which is classified as a sleep-related movement disorder according to the American Academy of Sleep Medicine. While laboratory-based video-polysomnographic (vPSG) recording is the gold standard for quantification of SB severity, such recordings are not feasible for dental patients because they require patients to sleep at laboratory. We recently modified a commercially available portable PSG device (Sleep Profiler™; Advanced Brain Monitoring, Inc., USA) in order to record the SB-related masseter EMG muscle activity for multiple nights in the patient’s home environment at minimal expense. The aim of this study was to investigate accuracy of the portable PSG device for scoring SB-related masseter EMG muscle activity in comparison to the vPSG recording.

Materials and methods: Ten SB subjects (7 male and 3 female; mean age 25.6±2.91 years) and 10 control subjects (7 male and 3 female; mean age 24.3±1.06 years) participated in this study after providing informed consent. All of them spent two nights in a sleep laboratory for vPSG recordings. The first night data was used to diagnose SB status according to SB research diagnostic criteria (SB-RDC, Lavigne et al., J Dent Res. 1996). The second night recording was conducted by the regular vPSG setting simultaneously with the portable PSG device and the data obtained by the 2 methods were analyzed according to SB-RDC. SB-related masseter EMG muscle activity was visually scored by one examiner (Y.N.), based on the EMG and audio-video records for the vPSG recordings and on the EMG records only for the portable PSG recording. The SB episodes were regarded as true positive when scored in the vPSG and the portable PSG recordings, while those scored in the portable PSG but not in the vPSG recording were as false positive episodes. The SB episodes scored only from the vPSG recording were regarded as false negative episodes. Using these data, sensitivity and positive-predictive value (PPV) were calculated for each subject. Specificity was not calculated because the true negative episode number could not be obtained.

Results: The averaged total number of SB episodes per night scored using vPSG recording and the portable device were 61.2±13.71 and 78.1±22.3 for the SB group and those for the control group were 24.4±11.6 and 28.2±13.5, respectively. The averaged sensitivity of the portable device for the SB group was 0.86±0.09 and that for the control group was 0.74±0.15. The averaged PPV for the SB group was 0.69±0.11 and that for the control group 0.63±0.17.

Conclusions: Sensitivity and PPV of the newly developed portable PSG device for scoring SB-related masseter EMG muscle activity are judged to be moderate to high, suggesting that the newly developed portable PSG device might have the potential to record SB-related masseter EMG muscle activity in the home environment for the diagnosis of SB.
OPEN YOUR MOUTH! SHOULD THE SOMNOLOGIST CARE MORE ABOUT YOUR TEETH?
RELATIONS BETWEEN SLEEP BRUXISM DISTRIBUTION AND NON-RESTORATIVE SLEEP

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Introduction: Beyond increased and abnormal teeth attrition, Sleep Bruxism (SB) may also directly impact
sleep quality and related symptoms. We aimed at unraveling the existing relationships between nocturnal SB
events (i.e. type, duration and sleep stage incidence) and structured clinical evaluations regarding sleep related
daytime symptoms.

Materials and methods: Within a cross-sectional protocol, we investigated polysomnographic recordings and
assessed clinical symptoms from 22 SB patients in comparison to 12 control subjects. SB was visually analyzed
and categorized by sleep stage, bruxism type (tonic / phasic) and duration. Clinical instruments comprised the
Epworth Sleepiness (ESS), the Fatigue Severity (FSS) and the Hospital Anxiety and Depression Rating (HADRS)
Scales. Perceived sleep quality was measured by means of the Pittsburgh Sleep Quality Index (PSQI).

Results: Control subjects and SB patients presented similar sleep architecture with respect to sleep stage
distributions and proportions. Alongside with a higher AHI, more PLMS, and lowered sleep efficiency, sleep
fragmentation was significantly increased in SB (all p < 0.05). SB patients also presented with higher levels of
sleepiness (p = 0.02), greater fatigue intensity (p = 0.02) and a trend for depression symptoms (p = 0.07).
Total absolute count (p = 0.007), number of tonic SB events (p = 0.012), total SB duration (p = 0.001) and SB
index per hour of sleep (p = 0.012), but not PLMS index or AHI, were significantly correlated to a decrease of
perceived sleep quality (PSQI).

Conclusions: Our results evidence that SB can display degrees of altered sleep (i.e. lower efficiency, increased
fragmentation) and confirm its common associations to comorbid sleep-related respiratory events or limb
movements. SB patients do not only present with higher levels of daytime fatigue or potential sleepiness, but
may also exhibit sleep impairments directly related to the total amount of bruxism occurrences.
**Introduction:** Up to 50% of the patients affected by Parkinson’s disease (PD) experience a transient but clinically relevant improvement of their motor function in the morning after awakening, even before taking their regular antiparkinsonian medications. This phenomenon has been described as “Sleep Benefit” (SB). The role of nocturnal sleep on the occurrence of SB is controversial. Moreover, there is no evidence in the literature on SB being either a “state”, i.e. a transient phenomenon changing over time within subjects, or a “trait”, i.e. a clinical feature characterising a subgroup of PD phenotypes (SB+ patients), yet not others (SB-).

**Material and methods:** In the context of the “Awake & Move” study, 14 patients (12 males, 2 females, mean age: 70.2±9.1 year-old) with mild to moderate PD, medicated, were examined by the Movement Disorders Society Unified Parkinson’s disease rating scale part III (MDS-UPDRS-III). Two assessments were performed: one before bedtime, the other 30 minutes after morning awakening. A in-lab video-polysomnography was performed after an adaptation night. Bedtime and wake time were adapted to the each patient’s routine based on a sleep diary and actigraphy performed during the previous two weeks.

The variation of the MDS-UPDRS-III between evening and morning assessments was calculated for all the subjects (2-tailed paired t test). A sub-analysis was done to explore the motor score variation among SB+ and SB- patients.

**Results:** From evening to morning assessment, the MDS-UPDRS-III motor score decreased in 9 patients, remained unchanged in 1 and increased in the other 4. Overall, no significant difference was observed in the mean value. On the other hand, a mean significant decrease from evening to morning assessment was documented in the SB+ group (n=7), (mean difference in the MDS-UPDRS-III score: -4.3±4.5 points, p=0.044), but not in the SB- group (+0.57 ±4.7 points, p=n.s.). No differences between the SB+ and SB- patients’ group were found as regards nocturnal sleep architecture (total sleep time, sleep efficiency, percentage of REM, N1, N2 and N3 sleep).

**Conclusions:** These preliminary results seem to support the concept of SB as a “trait”. Total sleep time or sleep macrostructure might not act as determining factors of this phenomenon.
Introduction: Meis1, a developmental transcription factor, has previously been identified as the highest-effect gene associated with restless legs syndrome (RLS) in genome-wide association studies. The genetic variants associated with increased risk of RLS have been shown to lead to decreased expression of the Meis1 protein. Therefore, a Meis1 downregulation in mice is the most promising approach to develop a much-needed animal model for RLS. Here we investigated the circadian locomotor activity of Meis1 haploinsufficient mice.

Materials and methods: We raised three cohorts of heterozygous Meis1 knock-out mice and wildtype controls: a discovery cohort of young adult mice (15 animals per sex per genotype), a replication cohort of the same age (15 animals per sex per genotype) and an aged cohort (9-13 animals per sex per genotype, 40-50 weeks old). We screened each cohort for circadian differences in locomotor behavior in PhenoMaster cages. In addition, the aged cohort was screened with voluntary running wheel for circadian changes in running wheel activity.

Results: We did not see a clear genotype effect on circadian locomotor activity in the young adult cohorts. However, the mutant males in the aged cohort showed a hyperactivity phenotype present at several time points during the day but pronounced in the early part of the inactive period (p = 0.038). The phenomenon was not seen in female mutants. In the voluntary running wheel test, we observed a similar finding in the mutant females: their wheel running activity was increased in the early parts of the inactive period compared to wildtype controls (p = 0.014). Male mutants did not show this behavior.

Conclusions: We demonstrated that at an older age, Meis1 deficient animals show an RLS-like phenotype in 24-hour activity screenings. Although not perfectly replicated between sexes and different methods, the results demonstrate the potential of Meis1 knock-out mice as an RLS animal model. In addition, our results indicate that RLS phenotypes should be evaluated at an older age also in other potential mouse lines.
RESTLESS LEGS SYNDROME AND LEG MOTOR RESTLESSNESS IN PATIENTS WITH PARKINSON’S DISEASE: A MULTICENTER CASE-CONTROLLED STUDY

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Introduction: We investigated the prevalence and clinical impact of restless legs syndrome (RLS) and leg motor restlessness (LMR) in patients with Parkinson’s disease (PD) in a multicenter study.

Materials and methods: A total of 436 PD patients and 401 age- and sex-matched controls were included in this study. RLS was diagnosed based on four essential features. LMR was diagnosed when a participant exhibited the urge to move his or her legs but did not meet the four essential features of RLS.

Results: The RLS prevalence did not differ between PD patients and controls (3.4% vs. 2.7%). The LMR prevalence was significantly higher in PD patients than in controls (12.8% vs. 4.5%). PD patients with RLS or LMR had a higher prevalence of excessive daytime sleepiness (EDS), probable REM sleep behavior disorder and PD-related sleep problems than controls with RLS or LMR. PD patients with RLS more frequently had EDS than PD patients without restlessness (80.0% vs. 35.3%). PD patients with LMR had higher PD sleep scale-2 and MDS-Unified PD Rating Scale part II scores than those without restlessness. RLS/LMR preceding PD onset was related to an older age of PD onset.

Conclusions: Our study revealed an increased prevalence of LMR but not RLS in PD patients. LMR could be a manifestation of PD.

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OXYGEN AND CARBON DIOXIDE SHIFTS IN RELATION TO SLEEP BRUXISM - RHYTHMIC MASTICATORY MUSCLE ACTIVITY (RMMA): AN EXPLORATORY CASE SERIES

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Introduction: Jaw movements are often observed before and after apnea-hypopnea events during sleep. Rhythmic masticatory muscle activity (RMMA), a marker of sleep bruxism (SB), can be observed after a sequence of physiological autonomic cardiac and respiratory activation in adults with non-sleep-disordered breathing. Furthermore, it was found that about 1/4 of RMMA events were associated with a mild (1.8%) but significant drop in oxygen (O₂) measured. We hypothesized that mild hypventilation, CO₂ increased (hypercapnia) and secondary decreased O₂ (hypoxia), may contribute to the genesis of RMMA. The aims of this study were:

1) to investigate concurrent fluctuations in O₂ and CO₂ in relation to RMMA onset, and
2) to compare O₂ and CO₂ fluctuations associated with RMMA and leg movements to determine whether the observed activity is specific to RMMA or non-specific to movements during sleep, i.e., normal physiological activity in response to sleep arousal.

Materials and methods: 12 subjects (7 male, 5 female; mean age: 43) were recorded by polysomnography in a hospital sleep laboratory for diagnosis of sleep bruxism and/or sleep apnea. This observational case study was conducted according to institutional human subjects’ policy. RMMA index and apnea-hypopnea index (AHI) were calculated. Oxygen saturation (SpO₂) was measured by finger pulse oximeter and end-tidal CO₂ (EtCO₂) by nasal airflow cannula with capnometry during 20 sec before to 40 sec after RMMA onset and, as a control condition for RMMA specificity, for isolated single leg movements (SpO₂ time scale adjusted for 17-sec delay). Mean SpO₂ and EtCO₂ during -60 to -30 sec from RMMA onset were calculated as baselines. Statistical analyses were performed using mixed models for repeated measures. Per second SpO₂ and EtCO₂ were compared to baseline using Dunnett’s test.

Results: 83% of subjects had RMMA index ≥2/h, 42% had AHI ≥5/h, and 25% had both. SpO₂ levels were significantly lower than baseline (-0.6%; p< 0.05) in the minus 6-4 sec before RMMA onset, but significantly higher in the 6-18 sec after onset (+0.6 to +0.9%; p< 0.05). EtCO₂ before RMMA onset did not differ from baseline but decreased at + 8 and 10 sec after onset (-1.5 to -1.7 mmHg; p< 0.05). Thus, transient mild hypoxia before RMMA onset was observed for a mean of 78.6% of events for each subject, whereas mild hyperoxia and hypocapnia after RMMA onset were observed for a mean of 84.8% and 70.2% of events, respectively. On the other hand, hypoxia was not present before leg movement onset, but hyperoxia (+0.5 to +0.6%; p< 0.05) and hypocapnia (-1.3 mmHg; p< 0.05) were observed after onset.

Conclusions: Transient mild hypoxia preceding RMMA appears to be specific to SB, whereas the ventilation return with RMMA and leg movement is probably part of the natural physiological activity associated with movement-related sleep arousal.

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Introduction: Sleep disorders and sleep-associated symptoms are important in comprehensive management of patients with Parkinson's disease (PD). Insomnia, restless legs syndrome (RLS) and excessive daytime sleepiness (EDS) are among the most frequently reported sleep-related complaints in PD. Better understanding of their role in PD would be important for quality management. The aim of this study was revealing influence of nocturnal symptoms and sleep disorders symptoms on health-related quality of life (HRQOL) in patients with PD.

Materials and methods: PD patients were diagnosed according to UK PDS Brain Bank clinical diagnostic criteria. Patients did not have significant cognitive impairment (MMSE >25) and any other disabling disease that could influence HRQOL. Depression was assessed using Hamilton Depression Scale (HAMD) and anxiety - Hamilton Anxiety Scale (HAMA). Nocturnal symptoms - nocturnal akinesia, tremor, nocturia and vivid dreaming, and insomnia were revealed during interview. EDS was assessed with Epworth Sleepiness Scale (ESS) with cutoff of 9 and above considered EDS. Restless legs syndrome (RLS) was diagnosed according to IRLSSG diagnostic criteria. HRQOL was assessed using disease-specific instrument - PDQ-39 with 8 domains: D1 - Mobility, D2 - Activities of daily living (ADL), D3 - Emotional well-being, D4 - Stigma, D5 - Social support, D6 - Cognition, D7 - Communication, D8 - Bodily discomfort and SI - single index (average score). T-test, Pearson's correlation coefficient and Spearman's rank-order correlation were used for statistical analysis.

Results: Fifty-four patients with PD (F -50%) were enrolled in the study. Mean age of patients was 62.5 years (43-79), mean disease duration - 4.4 years (0.5-19). Enrolled patients had Hoehn&Yahr stage 1-4. There were 9 patients with RLS (16.7%), 31 with insomnia (57.4%) and EDS 17.6%. PD patients with RLS had worse results with D1 (44.5 vs 22.1) and D7 (31.4/5.8) domains (p< 0.05). Insomniac PD patients had higher PDQ-39 scores (worse HRQOL pattern) with D2 (37.2/23.4), D3 (49.7/32.5), D7 (28.8/12.7) and SI (37.3/27.3) (p< 0.05). PD patients with nocturnal akinesia (63%) with D1 (44.5/22.1), D2 (40.4/16), D3 (49.5/30.4), D5 (26/9.2), D7 (31.4/5.8), D8 (45.6/30.4) and SI (39.5/22.1) (p< 0.05) and nocturia (61.1%) - with D2 (37.8/21.2), D6 (34.1/23.2), D8 (46/30.6) and SI (36.6/27.6) (p< 0.05). Nocturnal tremor (46.3%) - with D8 (51/30.5) and SI (38.6/28.3) (p< 0.05). ESS scores positively correlated with D7 (r=0.45, p< 0.01) and HAMD (r=0.37, p< 0.03), not with HAMA (p>0.05). PDQ-39 SI positively correlated with HAMD and HAMA scores (r=0.675 and 0.65 respectively, p< 0.05). Vivid dreaming did not have associations or correlations with any PDQ-39 domain.

Conclusions: Overall, it is obvious, that sleep disorders symptoms and sleep-associated symptoms are highly prevalent in PD. Our data suggest that HRQOL measured by disease-specific instrument PDQ-39 could be essentially dependent on presence of insomnia, RLS, and to a lesser degree on sleepiness, but also PD specific sleep-associated symptoms like nocturnal akinesia, nocturia, night tremor, depression and anxiety play a significant role. Their better correction would lead to improved quality of life.

Acknowledgements: None
INCREASED SERUM CYSTATIN C IN PARKINSON’S DISEASE WITH OBJECTIVE SLEEP DISTURBANCE

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Introduction: Parkinson’s disease (PD) is a common neurodegenerative disease. Sleep disturbance are one of the major non-motor symptoms. Cystatin C (CysC), an inhibitor of cysteine proteases, belongs to the cystatin type 2 super family. Increased gene and protein expression of CysC have been shown in the dopaminergic-depleted rat striatum. Several studies have confirmed an association between CysC and sleep disorders. These suggest that CysC may be associated with sleep disturbance in PD. Thus, we explored the correlations of serum CysC levels and objective sleep disturbances in PD.

Materials and methods: We recruited 162 PD patients and 146 age- and sex- matched controls. All participants underwent comprehensive clinical investigation and video-polysomnography (vPSG) (Sandman Elite, USA and Compumedics-E series, Australia). Sleep architecture, sleep apnea parameters, and the index of periodic leg movements during sleep (PLMSI) were assessed. Serum levels of CysC were measured using an immunoturbidimetry assay (Cystatin C Kit, Shanghai Jingyuan Company, China). Concentrations of serum creatinine, urea, and uric acid were determined using an enzymatic assay and different diagnostic reagents (Kyowa Medex Company, Japan). All laboratory tests were performed with an AU5400 random access analyzer (Olympus Corporation, Japan).

Results: The mean serum level of CysC was significantly higher in patients with PD (1.16 ± 0.17 mg/l), compared to controls (0.98 ± 0.14 mg/l) \((p < 0.001)\). In PD and control groups, correlation analysis showed a significant positive correlation between serum CysC levels and age \((r = 0.424, p < 0.01)\), gender \((r = 0.156, p < 0.01)\), and creatinine levels \((r = 0.397, p < 0.001)\). There were no correlations observed between CysC levels and urea \((r = 0.098, p = 0.107)\) or uric acid \((r = 0.102, p = 0.074)\). Increased Serum CysC levels in PD patients were significantly associated with more awakenings \((r = 0.197, p < 0.05)\), higher index of sleep apnea and hypopnea (AHII) \((r = 0.334, p < 0.01)\) and oxygen desaturation index (ODI) \((r = 0.279, p < 0.05)\), higher PLMSI \((r = 0.407, p < 0.01)\) and PLMS related arousals \((r = 0.192, p < 0.05)\). Serum CysC levels in PD patients were negatively correlated with sleep efficiency (%) \((r = -0.246, p < 0.05)\), proportion of Rapid eye movement sleep \((r = -0.189, p < 0.05)\), nadir SaO2 \((r = -0.299, p < 0.05)\). There were no significant relationships among serum CysC levels and Total sleep time (TST), sleep latency (SL), percentage of non-rapid eye movement (non-REM) sleep stage 1 (NREMS1), non-REM sleep stage 2 (NREMS2), proportion of slow wave sleep, REM sleep latency (REM-SL) \((r = -0.148, 0.160, 0.183, 0.176, -0.179, 0.164, \text{all } p > 0.05)\).

Conclusions: The level of serum CysC was higher in PD patients than in controls. Patients with elevated serum CysC levels had more severe objective sleep disturbances. Therefore, the serum CysC level may be served as a potential biomarker of sleep disturbance in PD patients.

Acknowledgements: The authors declare no conflicts of interest.
**Introduction:** Type 1 Narcolepsy (NT1) is a central hypersomnia due to an autoimmune hypothalamic hypocretin neurons destruction with onset in predisposed subjects carrying the HLA DQB1*06:02 haplotype, mostly during paediatric age. There are few cases of NT1 related to central nervous system (CNS) structural or functional lesions.

**Materials and methods:** The case at issue reports for the first time a patient with secondary narcolepsy associated with anti-Hu antibodies, in the context of paraneoplastic encephalitis. The patient was an 85-year-old male, previous heavy smoker with many cardiovascular risk factors. His history begun with a two-days-lasting episode of aggression and hallucinations, followed by persistent generalized muscular weakness to the extent that in few months he was confined in a wheelchair. He also had brief (seconds) and frequent episodes of facial twitching and grimaces, ptosis, slurred speech and increase of weakness involving mainly the arms, with preserved consciousness, mainly triggered by emotional or stressful conditions. He also displayed continuous tendency to fall asleep and disrupted nocturnal sleep. Episodes were mislabeled as epileptic seizures and he was started on antiepileptic drugs, without benefit.

**Results:** Neurological examination revealed subcontinuous fluctuations in muscle tone with ptosis, facial grimaces, muscle sagging of upper limbs. The 24-hour video-polysomnography documented several sleep episodes with frequent sleep onset in REM periods (SOREMPs) during daytime and nighttime sleep with SOREMP and REM sleep behavior disorder. The multiple sleep latency test showed a pathological mean sleep latency with five SOREMPs. Several and subcontinuous focal and generalized cataplectic episodes were video-documented, leading to a diagnosis of NT1 (figure 1). HLA typing was negative for HLA-DR15-DQB1*0602 antigens and dosage of CSF hcrt-1 level was of 146.83 pg/mL (normal > 200 pg/mL). Due to the atypical age of onset and to the "HLA negativity", the patient was therefore investigated for secondary causes of NT1. Serological and biochemical analyses disclosed positivity for anti-neuronal nuclear antibody, type 1, ANNA 1 (anti Hu) and Total body CT and fluorodeoxyglucose positron emission tomography scans showed a nodular hilar-perhilar lung formation, with features characteristic of malignancy (figure 2). Accordingly, the patient received the diagnosis of secondary NT1 related to anti-Hu antibodies and neoplasm of lung.

**Conclusions:** The atypical age at onset along with the biochemical profile (discrete HLA negativity and the slightly low CSF hcrt-1 levels) may be telltale-signs to suspect a secondary nature of NT1 symptoms and signs and to undergo a prompt and extensive work-up searching for secondary causes. It is likely that Hu-autoantibodies have targeted the lateral hypothalamus, where hypocretinergic neurons are located, along with other structures of the CNS explaining the additional symptoms. Early recognition of paraneoplastic encephalomyelitis and prompt antitumor treatment are indeed pivotal in order to stabilize underlying disease and the related symptoms.
Introduction: Type 1 Narcolepsy (NT1) has been reported to have peculiar clinical features in children. Recently, the occurrence of a severe and peculiar motor disorder during REM sleep in pediatric NT1 has been pointed out (Antelmi et al, 2017). Sodium Oxybate (SO) is used as an off-label treatment in children with NT1, being effective at controlling excessive sleepiness, cataplexy, and disturbed night sleep. Here, we aimed to analyze the effect of this treatment on motor events occurring during nighttime.

Materials and methods: Fifteen children with NT1 (40% females; mean age 12.8±2.86) were followed up after the at least three months of stable treatment with SO. All patients repeated video-PSG and the recordings were then reviewed by two independent experts in the field in order to analyze motor events. These latter were classified as previously reported (Antelmi et al, 2017) in elementary movements, if brief and non-purposeful and complex behaviors, if simulating purposeful behaviors. Baseline and follow-up data were contrasted (within-subjects).

Results: When compared to baseline evaluation, NT1 patients taking SO showed a significant decrease of the pentad of NT1 symptoms, but for sleep paralyses that turned to be instead increased. As far as sleep architecture is concerned, NT1 children treated with SO showed a significant increase of SWS sleep and a significant decrease of stage 1 of NREM sleep and of REM sleep, when compared to PSG at baseline. When analyzing motor patters during nighttime, it emerged that elementary movements emerging from NREM sleep were significantly increased after the start of treatment. Conversely, complex behaviors could be detected in a decreased number of patients and showed also a decrease in frequency. The decrease of motor events during REM sleep was supported by a significantly increase of the values of the atonia index.

Conclusions: Motor events emerging from REM sleep showed to be decreased after the start of treatment with SO. The concordant increase in REM atonia index leads to infer on a direct role of the drug in modulating motor control during REM sleep. The increase of motor events during NREM sleep might also be related to the GABAergic modulation related to this drug. These findings should be confirmed by enlarging the sample of patients and by comparing these data with those recorded in NT1 children at the same disease duration but untreated with SO.

PITOLISANT SAFETY AND EFFICACY IN ADULT NARCOLEPTIC PATIENTS WITH OR WITHOUT CATAPLEXY OR IDIOPATHIC HYPERSOMNIA PATIENTS IN A COMPASSIONATE USE PROGRAM IN FRANCE: AUTORISATION TEMPORAIRE D’UTILISATION DE COHORTE (ATUC)

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Introduction: Before European marketing authorization was obtained, Wakix® (pitolisant) was available in France through a Compassionate Use Program (ATUc): Wakix® was given to adult narcoleptic patients or Idiopathic Hypersomnia (IH) patients in case of usual treatments failures including lack of efficacy, contraindications or undesirable effects. This analysis objective was to assess efficacy and safety for Wakix® treated in ATUc.

Materials and methods: 408 requests were sent by sleep specialists in the framework of ATUc (2014-2016) of whom 43 were refused because of incorrect age or incorrect indication.

Results: The analysis in June 2016 showed that 365 patients were included in 27 centers: 64% females, 59% Wakix® “naïve” patients (WNP) i.e. never treated by Wakix and 41% treated during a previous Compassionate Use Program called ATU nominative. 59.7% patients suffered from narcolepsy (62.4% type 1; 37.6% type 2) and 40.3% from Idiopathic Hypersomnia. The most frequent comorbidities were obesity (n=74), depression (57), High Blood Pressure (22), epilepsy (9), thyroid insufficiency (9), Sleep Apnea Syndrome (8), diabetes (7), migraines (7), Restless Legs Syndrome (7). 167 patients were treated with Wakix alone. At baseline, QTc was notified in 321 patients and was normal in 315 patients. Most frequent usual daily dosages were 36 mg (228 patients), 18 mg (118 patients). Concomitant treatments were: methylphenidate (n=57), modafinil (44), sodium oxybate (37), melatonin (20), selective serotonin receptor inhibitors/serotonin and norepinephrine reuptake inhibitors (32/27).

Tolerance: 43 pharmacovigilance cases were notified for 22 patients; the most frequent were: 8 headaches, 4 depressions, 3 insomnias, 2 anxieties, 2 myalgia.

A follow up was obtained for 58 narcoleptic patients: 29 were WNP including 10 treated with Wakix alone (mean initial Epworth Sleep Score at 16 reduced by 3.4) and 19 treated with Wakix combined with other drugs (mean initial ESS at 15.8 reduced by 2.8). Follow up results for 29 non naïve patients concerned 8 patients with Wakix alone (mean initial Epworth Sleep Score at 16.3 reduced by 2.7) and 21 treated with Wakix combined with other drugs (mean initial ESS at 15 reduced by 1.3).

Conclusion: Pitolisant alone represents a new efficient therapeutic alternative with a good safety profile for the treatment of adult narcoleptic patients with or without cataplexy. Pitolisant can also be used in combination with usual anti-narcoleptic treatments. Apparently, Pitolisant used alone, shows better efficacy and better safety results, possibly because more patients in this group are responders to the treatment or possibly because of a less severe and/or less resistant narcolepsy, suggesting this is to be further investigated.

Acknowledgements: Bioprojet acknowledge all the French Sleep Centers which were involved in the ATUc and particularly Groupe Hospitalier Pitié-Salpêtrière Paris, Hôpital Gui de Chauliac Montpellier, Strasbourg, Lyon, Nantes, Angers, Laval, Lille, Amiens, Grenoble and Bordeaux.
Narcolepsy
Board #092: P5 - Wednesday
EXPLORATION OF CARDIAC AUTONOMIC FUNCTION BY MYOCARDIAL 123-I-MIBG SCINTIGRAPHY IN NARCOLEPSY TYPE 1

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Introduction: Narcolepsy type 1 (NT1) is a rare sleep disease caused by the irreversible destruction of orexin neurons, by a probable autoimmune process. Orexin is implicated in the regulation of sleep, but also has a direct effect on sympathetic and cardiovascular activity, and autonomic abnormalities have been observed in NT1. 123-I-MIBG cardiac scintigraphy is one of the few available methods for objective evaluation of cardiac sympathetic function at a clinical level. The 123-I-MIBG uptake, measured by the delayed heart/mediastinum (H/M) ratio, happens to be reduced in idiopathic REM sleep behaviour disorder (iRBD), a parasomnia preceding the development of synucleinopathies. It indicates a cardiac denervation by aggregation of alpha synuclein. RBD is also reported in NT1, but the clinical phenotype is different from iRBD, and the pathophysiology probably distinct.

The aims of this study were:
(1) to compare the H/M ratio on 123-I-MIBG cardiac scintigraphy between patients with NT1 and control subjects,
(2) to assess clinical, electrophysiological and biological determinants of the cardiac sympathetic function in NT1,
(3) to state whether NT1 patients with RBD could be differentiated from patients with iRBD, based on their cardiac scintigraphy pattern.

Materials and methods: Fifty-six consecutive NT1 patients (38 men (M), median age 38.5 [13-86], 15 under psychostimulant medication), 78 controls without neurological or cardiac diseases (36 M, age 53.5 [13-86]), and 15 patients with iRBD (12M, age 72 [13-86]) had a cardiac 123-I-MIBG scintigraphy. H/M values lower than 1.62 are defined as abnormal. Sociodemographic, clinical, electrophysiological and biological characteristics of the patients were assessed.

Results: iRBD patients had a markedly reduced H/M ratio (1.25 [1.03-1.68]), significantly lower than controls and NT1 patients (p< 0.0001). No difference was found between NT1 and controls, after adjustment on age and sex (H/M=1.77 vs 1.72, p=0.13). We defined RBD, clinically and electrophysiologically, in 34 NT1 patients (60.7%). Those patients had a normal H/M ratio (1.7[1.20-2.29]), different from iRBD patients (p=0.0009), even after adjustment on age. However, 34 % of NT1 patients had an abnormal scintigraphy (H/M< 1.62), and this reduced H/M ratio was not correlated to the presence of RBD (p=0.24), nor to the treated condition (p=0.18). Overweight (BMI: 29.6 vs 26 kg/m2, p=0.02), cardiovascular comorbidities (p=0.03), and increased sleep fragmentation (microarousal index per hour of sleep: 25 vs 15, p=0.02) were correlated to a low H/M ratio, and that remained significant after adjustment on age and sex (p< 0.05). We observed a tendency of low orexin-1 levels in the CSF when the H/M was low (5 vs 16 pg/mL), but the correlation was not statistically significant (p=0.17).

Conclusions: Obesity, cardiovascular diseases, and increased sleep fragmentation were correlated to reduced MIBG uptake in NT1. The cardiac scintigraphy pattern of NT1 patients with RBD was different from iRBD patients. We thus provide for the first time a biomarker able to distinguish iRBD and symptomatic RBD associated to NT1. Our data support a different pathophysiology of this parasomnia in those two conditions, that was suspected but never proven so far.
HYPOCRETIN/OREXIN IN CEREBROSPINAL FLUID: A NEWLY-LAUNCHED LABORATORY ASSESSMENT IN THE CZECH REPUBLIC

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Introduction: Narcolepsy type 1 (NT1) is a rare disease strongly associated with hypocretin/orexin (hcrt) deficiency and HLA DQB1*0602 positivity. The pathophysiology is linked to the damage of hcrt neurons in hypothalamus probably by an auto-immune process. The diagnosis is based mainly on clinical history and polysomnographic findings, including the MSLT test. The PSG/MSLT test fails to prove the diagnosis in some patients. Finding of the low hcrt level in CSF supports the diagnosis of NT1. Based on sensitivity/specificity analysis, the optimal cut-off value of hcrt in CSF for NT1 was set to 110 pg/ml. The laboratory in Ostrava, Czech Republic extends a spectrum of laboratories providing this measurement over the entire world.

Materials and methods: After preliminary testing of pre-selected laboratory kits with quasi-normal CSF samples we chose the RIA kit RK-003-30 (Phoenix Pharmaceuticals, Inc. CA, USA) with measurement range 10-1280 pg/ml. The hcrt levels in 21 quasi-normal samples in these settings were: mean 278.5 pg/ml, SD 35.08 pg/ml, 5-th percentile 198 pg/ml and 95-th percentile 324.2 pg/ml.
Then we analyzed 57 samples of CSF from adult patients in two sessions during 2016 and 2017 (both narcoleptic and non-narcoleptic controls). Each sample was deep frozen to -70C just after collection and the measurement was performed later. The samples were taken in multi-centric manner in several facilities in the Czech Republic. The RIA measurement was performed by the Institute of Laboratory Diagnostics (Dpt. of Clinical Biochemistry) in University Hospital Ostrava, Czech Rep. In 19 patients the final diagnosis was NT1, 7 were diagnosed with NT2 and 31 were classified with other diagnoses (non-narcoleptic controls). We used the generally accepted cut-off value of 110 pg/ml as a limit for low hcrt.

Results: 17 patients with NT1 had low hcrt level, 2 NT1 cases had hcrt in normal range (both are HLA DQB1*0602 negative). We found no non-narcoleptic case with a low hcrt level (so the specificity was 1.0). In the narcoleptic patients (NT1 or NT2) the HLA DQB1*0602 positivity associated with low hcrt was in 70.8%, HLA negativity with low hcrt in 4.2%, HLA positivity with normal hcrt in 4.2% and HLA negativity with normal hcrt in 20.8%. In NT1 only the HLA DQB1*0602 positivity associated with low hcrt was in 88.9%. The analysis in more details is in progress.

Conclusions: Our results are comparable with contemporary state of medical knowledge in terms of reliability and parameters of association with HLA DQB1*0602 haplotype. The laboratory assessment of the Hypocretin/orexin in CSF is a diagnostic test with high specificity for patients under suspicion of the narcolepsy type 1. The Institute of Laboratory Diagnostics of the University Hospital Ostrava now offers this useful laboratory test.
Introduction: In this study, we compare the prevalence and characteristics of nocturnal REM sleep without atonia (RWA) and REM behavior disorder (RBD) among drug-naïve children with narcolepsy compared to those with idiopathic hypersomnias and controls. Furthermore, we determine if the nocturnal RWA index is a valid diagnostic biomarker for pediatric narcolepsy.

Methods: Based on sleep study results and clinical history, we grouped subjects as narcolepsy type 1 (NT1, n=11), narcolepsy type 2 (NT2, n=6), idiopathic hypersomnia (IH, n=12) and controls (C, n=11). The mean age of patients was 13.6 years, and 47.5% were female. RWA and RBD were scored based on American Academy of Sleep Medicine (AASM) specifications. We calculated a nocturnal RWA index for each subject (number of REM epochs with RSWA/total REM epochs). We then performed ANOVA testing to report group differences and assessed its receiver operating characteristics (ROC) for the diagnosis of narcolepsy.

Results: While the median nocturnal RWA index for NT1 group did not differ from the NT2 group (p=0.46), the NT1 group median nocturnal RWA index was 30x greater than the IH group (p=< 0.001) and 15x greater than controls (p< 0.001). Interestingly, 82% of NT1 patients and 50% of NT2 patients were found to have RWA during daytime REM periods captured on the MSLT. The median RWA index on the MSLT was higher among the NT1 group than NT2 patients but results only trended toward significance (p=0.08). Two patients with NT1 and two patients with NT2 demonstrated RBD on the PSG. During the MSLT, the same two NT1 patients and one of the N2 patients who had nocturnal RBD demonstrated similar RBD during daytime REM periods. Across all groups, we found that nocturnal RWA index is inversely correlated with mean sleep latency (r=-0.61, p< 0.001) and is a robust predictor of this mean sleep latency severity even after accounting for age, gender and BMI (p<0.001).

Conclusions: REM sleep dysregulation is a hallmark of hypocretin deficiency, the underlying pathophysiology of narcolepsy. Here we show that the nocturnal RWA index is significantly higher in pediatric narcolepsy cases than non-narcolepsy controls and is a valid sleep biomarker for the diagnosis of pediatric narcolepsy. Additionally, our findings that pediatric narcolepsy patients have high RWA indexes during nighttime and daytime REM periods has practical implications about the potential of erroneous miss scoring of REM periods during sleep study testing which could result in misdiagnoses.
**Narcolepsy**
**Board #079: P4 - Tuesday**

**TYPE-1 AND TYPE-2 NARCOLEPTICS: A 5 YEARS REPEAT TESTING STUDY**

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**Introduction:** There is a controversy on the definition of narcolepsy based on the multiple-sleep-latency-test (MSLT) as 2 sleep-onset-REM-period-SOREMP- may be monitored in non-sleepy individuals, and the dissociation in type-1, type-2 and hypersomniacs has been challenged.

**Methods:** We perform every year for 5 years, study of 157 individuals considered with more than two SOREMP at entry and in need of treatment related to their daytime sleepiness. The protocol was the same every year: subjects must have been drug free for a minimum of 14 days. Each subject had 7 days of actigraphy, filled sleep logs, questionnaires (Epworth Sleepiness Scale/or Pediatric Sleepiness Scale if young teen-ager and SF-36). Subjects were asked to keep a regular sleep schedule and 8 hours in bed before each test-retest. Subjects had a polysomnogram (PSG) and multiple sleep latency tests (MSLT) was based on the recommendation of the AASM. Descriptive statistics and repeat measure tests were used to analyze the data.

**Results:** All type-1 narcoleptics (n=111, 60 male, current mean age=24.51±8.74) presented cataplectic attacks each year. None of the type-2 (n=46, 29 male, current mean age=25.65±8.71) had such clinical presentation. The mean sleep latency showed more severe in type 1 narcoleptics than type 2 in following 5 years (p=0.035; < 0.001; 0.147;0.771;0.026;0.491). But Type 2 had much greater variability of findings. The number of SOREMP also had the similar finding (p=0.087; 0.132; 0.542; 0.344; 0.002; 0.247) between the two groups. Type 1 always showed shorter REM sleep latency than type 2 (p=0.001; 0.191; 0.135; 0.072; 0.864; 0.180). But the variability is much greater in type 2 than type 1 during the following years. PSG results also showed presence of significant differences in AHI and PLM between the 2 groups.

**Conclusion:** When looking at repeated tests performed 5 years in a raw clear differences between patients initially diagnosed as type1 and type2 narcoleptics are noted. Type1 patients have consistently a greater severity of results, while type2 patients present a large variability of results from year to year. However, there is a consistency of complaint of sleepiness despite the variability in test-results.

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THE RELATIONSHIP BETWEEN SYMPTOM SEVERITY, NEUROCOGNITIVE FUNCTION AND QUALITY OF LIFE IN PATIENTS WITH NARCOLEPSY

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**Introduction:** to examine the change of quality of life in patients with narcolepsy within five years, and to investigate the relationship between the symptoms and neurocognitive function on quality of life.

**Materials and methods:**
We recruited 111 type 1 narcolepsy patients and 85 of them completed the 5-year annual follow-up data collection. During the follow-ups, polysomnography (PSG), multiple sleep latency test (MSLT) and human leukocyte antigen (HLA) test were conducted. Computerized neuropsychological tests of Conners’ Continuous Performance Test (CPT-II) and Wisconsin Card Sorting Test (WCST) were also administered to obtain neurocognitive function data. The short from-36 items of health related quality of life (SF-36) was applied to assess quality of life. Visual analogue score (VAS), Epworth Sleepiness Scale (ESS) (15) and Pediatric Daytimes Sleepiness Scale (PDSS) were used to assess symptom severity. Descriptive statistics, repeated measures and hierarchical linear models were applied for data analysis.

**Results:**
No significant difference during the 5-year follow-up was found in all physical domains of SF-36. In psychological domains of SF-36, only "role functioning-emotion" and "social function" showed significantly change in the 3-year follow-up \((p = 0.041; 0.01)\), but declined after 3 years later. The VAS of daytime sleepiness and cataplexy showed significantly difference after treatment during the 5-year follow-up \((p = 0.01; 0.01)\). Both symptoms severity showed decreased after treatment, but relapsed after the 3\textsuperscript{rd} year.

Neurocognitive functions such as CPT showed "attention" can affect domains of SF-36 including "social function\((r=0.169*)\) and role function-emotion (0.270*)"; "vigilance" can affect "role function-physical( 0.284*), general health(0.251*), social function(0.391*), and role function-emotion\((r=0.609*)" in SF-36.

**Conclusions:**
Although quality of life of patients with narcolepsy was improved after treatment, but the "social function and role functioning-emotion domain" declined during follow-up 3 years after. Clinical symptoms and their neurocognitive function also significantly affect their quality of life with the change of time.
LONG-TERM EVALUATION OF SAFETY AND EFFICACY OF PITOLISANT (WAKIX®), AN HISTAMINE H3R ANTAGONIST, IN NARCOLEPSY

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Introduction: Pitolisant, the first potent and highly selective Histamine H3-receptor antagonist/inverse agonist in clinics, demonstrated its efficacy over 7-8 weeks in reducing Excessive Daytime Sleepiness (Lancet Neurol. 2013) and cataplexy attacks (Lancet Neurol. 2017) in adult narcoleptic patients with or without cataplexy. HARMONY III is a phase III naturalistic study assessing long-term safety and efficacy of pitolisant in narcoleptic patients with or without cataplexy over 5 years. The analysis after 1-year treatment is presented here.

Materials and methods: This naturalistic, pragmatic, open label, multicentric study evaluated the effect of pitolisant (18 or 36 mg, once a day) at 12 months, in adult narcoleptic patients with or without cataplexy according to ICSD-2 criteria, with a residual sleepiness (Epworth Sleepiness Scale (ESS) ≥ 12), initially treated or not treated with anti-narcoleptic agents. In the absence of typical cataplexy, a confirmatory diagnosis within the past 5 years was required (overnight polysomnogram, Multiple Sleep Latency Test). After a one-month titration period (from 4.5 to 36 mg/d), oral pitolisant doses were regularly adjusted according to individual benefit/risk ratio. Concomitant psychostimulants and anti-cataplectic agents were allowed. The primary endpoint was safety regularly assessed by an independent Data Safety Monitoring Board. Safety and Efficacy analysis were descriptive. Comparisons were done between de novo and exposed patients, between responders and non-responders and between patients treated with pitolisant alone or associated with other agents.

Results: A total of 104 patients were enrolled in France (n=79) and Hungary (n=25). Among them 102 received the study drug. At inclusion, they were either “naïve” (n=73) or previously treated with pitolisant in ATU, a French compassionate use program (n=16) or previously participated in another pitolisant trial (n=13). At baseline, mean age was 36 years old [18; 69], 44.1% males, ESS was 17.1 ± 3.1 and cataplexy was observed in 73.5% patients. A total of 68 patients completed at least 12 months of treatment. Mean pitolisant exposure time was 260 and 548 days for naïve and previously exposed patients, respectively. Among them, 72% received 36 mg/d pitolisant. During this 12-month period, 56.9% patients reported adverse events: headaches 11.8% of patients, insomnia 8.8%, weight gain 7.8%, anxiety 6.9%, depression 4.9% and nausea 9%. The ESS was reduced by 4.3 pts, as well as other symptoms: partial and total cataplexy attacks (-64% and -75%), hallucinations (-54%), sleep paralysis (-63%). At 12 months, ESS reduction was 4.9 (p< 0.01) in de novo patients and 4.2 in previously treated patients. 43/68 patients were responders (ESS final ≤ 10 and/or ESS baseline - ESS final ≥ 3) and 25/68 patients were normalized (ESS final ≤ 10), their mean ESS decreasing from 15.3 to 6.6. Both safety and efficacy were found higher on patients receiving pitolisant alone compared with patients receiving also another anti-narcoleptic treatment.

Conclusions: This study confirmed the good long term safety and efficacy of pitolisant on EDS, cataplexy attacks and other narcolepsy symptoms, namely when the drug was given alone, suggesting that it may constitute a novel first-line treatment of the disease.

Acknowledgements: HARMONY III study group investigators
**Introduction:** The central disorders of hypersomnolence represent a new application field for noninvasive neuromodulatory techniques of the human brain such as transcranial electrical stimulation (tES). In the case report of Frase et al. (Brain Stimul 8(4), 844-6, 2015), an objective and subjective improvement of vigilance in a patient with organic hypersomnia due to transcranial direct current stimulation (tDCS) is presented. The pilot study targets on the short-term effects of tDCS and transcranial random noise stimulation (tRNS) on wakefulness and vigilance in patients with hypersomnia (α=10%).

**Materials and methods:** 29 patients (27 patients with Narcolepsy (14 Type 1 and 13 Type 2); 2 patients with Idiopathic Hypersomnia) underwent sessions of tES on three consecutive days in a double-blind, placebo-controlled pseudorandomized crossover trial. tES was delivered for 2x13 minutes with an intersession interval of 20 minutes per day. Stimulation modes were: anodal tDCS (FP1/FP2; 1 mA over each stimulation electrode; reference electrodes P3/P4); tRNS (identical setup; 100-640 Hz); placebo stimulation (30 second fade-in /fade-out design). The primary study endpoint was the mean reciprocal response time (mean RRT) measured by the Psychomotor vigilance test (PVT). Secondary endpoints were subjective efficacy parameters (e.g. Epworth Sleepiness Scale; ESS) and further objective PVT outcome metrics.

**Results:** Concerning mean RRT, there were no significant differences between active treatment and placebo stimulation, neither in the whole collective of patients (p=0.49), nor within the diagnostic subgroups. tDCS resulted in an increased number of false starts measured by the PVT (1.15 (±1.16) vs. 2.35 (±2.30); p=0.02), but did not affect overall PVT performance. tRNS decreased the standard deviation of mean RRT (0.63 (±0.10); p=0.06), but lacked from any statistically significant deviations compared to tDCS and placebo (p=0.21). A moderate reduction of ESS scores was observed after the treatment series (15.8 (±3.7) vs. 14.2 (±3.8); p=0.03).

**Conclusions:** There was no evidence for any clinically relevant (Cohen's d > 0.5) short-term effects of tES on objective measures of wakefulness in patients with central disorders of hypersomnolence. The trial's power was 0.8. Subjective improvement of ESS scores can't be differentiated from a placebo response.
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CHILDHOOD NARCOLEPSY IN SLOVENIA

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Introduction: Narcolepsy type 1 is a rare and underdiagnosed disease. With the estimated prevalence of narcolepsy with cataplexy there should be at least 500 narcolepsy patients in Slovenia. However up until now only around 60 patients have been diagnosed with narcolepsy type 1. Among them there are only 5 childhood cases. We present their clinical and neurophysiological characteristics.

Materials and methods: Retrospective study of all childhood narcolepsy patients referred to National Sleep Disorders Centre at University Medical Centre Ljubljana and National Centre for Pediatric Sleep Disorders at General Hospital Celje.

Results: From 2000 to 2017 5 Slovenian children have been diagnosed with narcolepsy type 1. The youngest was 7.5 and the oldest 16 years old. The average duration of the symptoms before the diagnosis was 25 months. All narcolepsy patients had HLA DQB1*0602. We had no vaccination related cases. Three patients were obese, however none had precocious puberty. They all presented with prominent hypersomnolence with an average MSLT of 6. 25 minutes. All but one patient had 4 or 5 SOREM at the MSLT testing. They all reported cataplexy. Three patients were treated with stimulant medication (methylphenidate extended-release or modafinil) and two with sodium oxybate with significant symptoms improvement.

Conclusions: In 17 years period only 5 children had been diagnosed with narcolepsy type 1 in Slovenia confirming that narcolepsy is still un underdiagnosed disease. Considering the fact that the first narcolepsy symptoms often occur around puberty and that in Slovenian children the average time lapse from the onset to the diagnosis was more than two years we should focus more on preventive programs for better detection of childhood narcolepsy among laic and professional population.
WIDESPREAD WHITE MATTER CONNECTIVITY ABNORMALITIES IN NARCOLEPSY TYPE 1 PATIENTS: A DIFFUSION TENSOR IMAGING STUDY

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Introduction: Narcolepsy type 1 is caused by a selective loss of hypocretin-producing neurons in the hypothalamus, resulting in severely disturbed sleep-wake control, sleep paralysis, hypnagogic hallucinations and cataplexy. Hypocretin's neuronal projections are known to be diffusely spread throughout the brain excluding the cerebellum, influencing different narcolepsy-related neural networks. We therefore assessed the extent of microstructural white matter organization and brain-wide connectivity abnormalities in narcolepsy type 1 patients using tract-based spatial statistics (TBSS), more localized regions-of-interest (ROIs), and tract pathways as a possible backbone of their symptoms.

Materials and methods: Twelve drug-naïve ICSD-3 diagnosed narcolepsy type 1 patients and 11 age-, sex- and handedness-matched healthy volunteers underwent diffusion tensor imaging (DTI) twice. Whole brain TBSS was performed on diffusion estimates of the averaged two acquisitions with mean fractional anisotropy (FA) and mean, axial and radial diffusivity (MD, AD, RD) as summary measures of white matter integrity and axon orientation. Quantitative analysis of mean FA and MD measurements was performed in predefined ROIs, including reticular activating system (hypothalamus, ventral diencephalon, thalamus, midbrain, pons), limbic and reward system (hypothalamus, thalamus, ventral diencephalon, anterior cingulate, amygdala, orbitofrontal cortex, midbrain) and corticospinal tract areas (primary motor and somatosensory cortex, ventral diencephalon, midbrain, pons). Tractography analyses were performed in pathways related to the hypothalamus by itself and in connection with the thalamus, amygdala, midbrain and pons. All ROI-based, and tractography analyses were Bonferroni-corrected for multiple comparisons.

Results: Compared with controls, patients had significantly lower FA and higher RD, widely spread throughout the brain, except for the cerebellum. Neither significant abnormalities in MD and AD nor a correlation with disease duration were found. The ROI analyses yielded lower FA in all ROIs for narcolepsy patients. After multiple comparisons correction, the left ventral diencephalon showed a significantly lower FA compared to healthy sleepers. Similarly, lower FA values were found in all tracts originating in the hypothalamus, with only left hypothalamic fibers in connection to the pons being significantly lower. No significant differences were seen in MD.

Conclusions: Based on converging evidence from different analysis strategies (TBSS, ROIs and tractography), microstructural white matter properties as investigated with DTI were found to be abnormal in narcolepsy type 1 patients. The widespread brain abnormalities excluding the cerebellum as well as localized abnormalities in the ventral diencephalon and pons - comprising the hypothalamus and different sleep- and motor-related nuclei - suggest a heretofore underestimated modulatory effect of hypocretin deficiency on microstructural white matter composition in narcolepsy type 1 patients.
SEROTONIN NEURONS IN THE DORSAL RAPHE MEDIATE THE ANTICATAPLECTIC ACTION OF OREXIN NEURONS BY REDUCING AMYGDAŁA ACTIVITY

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Introduction: Although the neurodegeneration of orexin (hypocretin)-producing neurons clearly causes the sleep disorder narcolepsy, the precise neural mechanisms by which orexin neurons prevent narcolepsy remain unclear. We previously demonstrated that orexin neurons inhibit cataplexy-like episodes—cataplexy is a cardinal symptom of narcolepsy, characterized by a sudden weakening of muscle tone—via serotonin neurons in the dorsal raphe nucleus (DRN). We thus used optogenetic and chemogenetic approaches to demonstrate that DRN serotonin neurons suppress cataplexy-like episodes by reducing the activity of the amygdala that plays an important role in emotional processing, as consistent with the fact that strong emotions often trigger cataplexy. We therefore propose that the orexin neuron-DRN serotonin neuron-amygdala pathway is a critical circuit for preventing cataplexy.

Materials and methods: The 12- to 20-wk-old male mice (Orexin-ataxin3, Ox1r−/−Ox2r−/−, and Sert-Cre) were used. Implantation of an EEG/EMG electrode, optic fiber, and stereotaxic injection of AAV vectors were performed as described previously. After completing EEG/EMG recordings, we evaluated the expression by histological study. For optogenetic experiments, mice were given milk chocolate after the recovery period along with their regular chow for 24 h starting at Zeitgeber time (ZT) 12 (dark phase onset; day 1). By the way, CNO or saline was administered to each mouse intraperitoneally at ZT12, and then EEG/EMG was recorded for 12 h (ZT12-0) without chocolate feeding. In electrophysiological recording, we used 3- to 6-wk-old Sert-Cre;orexin-ataxin3 mice which were injected in the DRN with some AAV vector. We also measured the serotonin release in slices by using HPLC.

Results: We aimed to identify the downstream target that mediates the anticataplectic effects of serotonin neurons in the DRN that also send widespread projections throughout the brain. Based on evidence using electrophysiological, neurochemical, genetic, and neuropharmacological approaches, DRN serotonin neurons have long been implicated in promoting wakefulness and suppressing REM sleep. Along with regulating sleep/wakefulness, serotonin in the brain has been implicated in various sensorimotor, affective, and cognitive behaviors. Therefore, identifying the action site of DRN serotonin neurons in preventing CLEs can shed additional light on the multiple functions of the serotonin system.

Conclusions: Our study provides additional support for our previous observations that DRN serotonin neurons mediate the anticataplectic function of orexin neurons (Hasegawa E, et al. 2014). Both studies propose the orexin neuron-DRN serotonin neuron-amygdala pathway as a critical circuit to prevent cataplexy.

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Introduction: The International Classification of Functioning, Disability and Health (ICF) can be used to assess patients' problems and needs, and to determine the rehabilitation potential of the individual. The aim of this study was to use the Comprehensive ICF Core Set for Sleep Disorders (120 categories) to identify aspects of functioning in narcolepsy patients, and to determine whether the Brief ICF Core Set for Sleep Disorders (14 categories) allows a comprehensive assessment of these patients.

Materials and methods: Seventeen patients with narcolepsy type-1 or narcolepsy type-2 (11 females, mean age of 46.6 years, Epworth Sleepiness Scale mean score of 14.5, 16 under treatment) were recruited. Data were collected from patients' records and by means of a face-to-face interview using the Comprehensive ICF Core Set for Sleep Disorders. For the ICF components Body functions, Body structures and Activities and participation (“performance” and “capacity”), the relative frequency of the at least mildly compromised categories was reported. For the categories referred to the Environmental factors, that could be considered either “facilitators”, “barrier” or “neutral”, the relative frequency of categories considered at least a “mild” facilitator or barrier was reported.

Results: With regard to Sleep functions, the Amount of sleep, Maintenance of sleep, Quality of sleep and Onset of sleep were impaired in 71%, 71%, 59% and 18% of patients, respectively. Functions involving the sleep cycle was compromised in 100% of patients. Other Body functions and Body structures frequently impaired were Structure of brain (88%), Attention function (76%), Muscle tone functions (76%), and Memory function (71%). Focusing attention and Reading were the Activity and participation categories more limited in both the “performance” (65% and 65%, respectively) and the “capacity” (65% and 82%, respectively) components; other categories frequently limited were Managing diet and fitness (41% and 41%, respectively) and Driving (29% and 47%, respectively). Finally, Environmental factors considered as facilitators were Individual attitudes of immediate family members (94%), Immediate family (88%), Drugs (76%) and Individual attitudes of health professionals (65%), while those considered as barriers were Transportation services, systems and policies, Legal services, systems and policies, Labour and employment services, systems and policies and Time-related changes (25%).

Conclusions: More frequently compromised functions in patients with narcolepsy were those related to sleep and attention, but restrictions were found also in muscle tone, memory, applying knowledge and managing diet. Immediate family was considered the main facilitator, but also health care professional attitudes and drugs had an important role. The difference between performance and capacity ratings in Reading and Driving categories may indicate the effectiveness of facilitators in helping patients in these activities. At least five important categories (i.e. memory functions, muscle tone functions, reading, diet and drugs) were not included in the Brief ICF Core Set for Sleep Disorders that conversely included some categories (i.e. consciousness functions, structure of pharynx) not relevant for patient with narcolepsy.

A narcolepsy specific Brief ICF Core Set should be developed, alternatively our data recommend the use of the Comprehensive ICF Core Set for Sleep Disorders to adequately assess people with narcolepsy.
MEASUREMENT OF NARCOLEPSY SYMPTOMS: THE NARCOLEPSY SEVERITY SCALE

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Introduction: There is a lack of narcolepsy-specific instruments to monitor symptom severity and their changes following treatment. A variety of subjective and objective tests are available to evaluate the severity of sleepiness and its treatment response. However, these tools focus only on excessive daytime sleepiness and their scores do not necessarily reflect the patient’s functionality and complaints. Other narcoleptic symptoms are often not properly monitored. A brief clinical instrument to measure the severity and consequences of the main narcoleptic symptoms is warranted. This study reports on the development of a new instrument: the Narcolepsy Severity Scale (NSS) in a large well-defined population of patients with narcolepsy type 1 (NT1).

Materials and methods: A 15-item scale was developed to assess the frequency and severity of excessive daytime sleepiness, cataplexy, hypnagogic hallucinations, sleep paralysis and disrupted nighttime sleep, and validated by sleep experts with patients’ feedback. Seventy untreated and 146 treated adult patients with NT1 were evaluated and completed the NSS in one sleep referral center. Forty one patients completed the NSS both before and after sleep therapy (dependent sample) and 29 drug-free and 105 treated patients completed the NSS on one occasion only (independent sample). The NSS psychometric properties, score changes according to treatment status and convergent validity with other clinical parameters were assessed.

Results: The NSS showed good item convergent validity with significant item-total score correlations ranging from 0.50 to 0.72. The factor analysis indicated a three-factor solution with good reliability, expressed by satisfactory Cronbach’s a values for each factor. The NSS total score temporal stability was good (intraclass correlations: 0.75 95%CI=0.20-0.94 in drug-free patients, and 0.85 95%CI=0.67-0.94 in treated patients). Significant NSS score differences were observed between untreated and treated patients, with lower scores in the treated groups in both the dependent and independent samples. Significant correlations were found between NSS total score and daytime sleepiness (Epworth Sleepiness Scale, Mean Sleep Latency Test), depressive symptoms and health-related quality of life.

Conclusions: The NSS can be considered a valid, reliable and informative clinical tool for assessing symptom severity and detecting clinically significant changes following treatment. NSS may be useful to monitor and optimize the management of narcolepsy.

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FUNCTIONAL MRI DURING HUMOUR PROCESSING IN POST-H1N1 VACCINATION NARCOLEPSY TYPE 1

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Introduction: Narcolepsy type 1 (NT1) is a neurological sleep disorder strongly associated with loss of hypothalamic neurons producing the sleep-wake regulating neuropeptide hypocretin. H1N1 mass vaccinations with Pandemrix® in 2009/2010 in several European countries incl. Norway were followed by >10-fold increase in narcolepsy incidence. NT1 patients typically experience cataplexy; muscle atonia triggered by strong emotions, often elicited by humorous stimuli, such as hearing or telling a joke. It is unclear which brain regions are involved in cataplexy, both in eliciting or suppressing attacks. Moreover, no current study has investigated mechanisms for humour processing/cataplexy with functional magnetic resonance imaging (fMRI) in post-H1N1 vaccination narcolepsy patients.

Materials and methods: 41 drug free NT1 patients with cataplexy (30 females/11 males, mean age 22.1 years) were included (39 with confirmed hypocretin deficiency and 2 with unknown hypocretin-status but with typical cataplexy; 37 H1N1-vaccinated, 4 sporadic/unvaccinated). 43 narcolepsy-naïve controls (24 females/19 males, mean age 18 years) were included among the patients 1st degree relatives. All participants completed a multimodal MRI session (3 Tesla GE 750 scanner), including functional MRI while watching 30 short movies (25 were potentially funny and 5 were neutral). FMRIB Software Library (FSL) was used to preprocess the fMRI data. Group comparisons were done using FMRI Expert Analysis Tool (FEAT).

Results: There were no reports of cataplectic attacks during fMRI acquisition. Both NT1 patient and control groups showed significant bilateral activation in the brainstem, hippocampus, visual cortex, thalamus, amygdala, temporal areas and the cerebellum while watching funny movies compared to watching a fixation mark ("fun vs fixation"). Moreover, NT1 patients showed significantly stronger bilateral activations in the temporal areas, brainstem, thalamus, putamen, pallidum, hippocampus, amygdala, frontal pole and the cerebellum compared to controls in "fun vs fixation". When comparing funny movies to neutral movies ("fun vs neutral") both NT1 patients and controls had increased bilateral activation in parts of the visual cortex, postcentral gyrus, parietal operculum cortex, supramarginal gyrus, insular cortex, amygdala and the left thalamus. In "fun vs neutral" NT1 patients showed significantly stronger activations in bilateral parts of the frontal pole, the inferior frontal gyrus and parts of the left insular cortex compared to controls.

Conclusions: Our preliminary results show that both NT1 patients and controls activated areas previously implicated in humour processing. When watching funny movies compared to fixation, NT1 patients had stronger activations compared to controls in several areas, including the amygdala, which is involved in processing of emotional stimuli. When comparing funny and neutral movies, NT1 patients showed stronger activation compared to controls in inferior frontal areas, which we speculate could reflect altered humour processing mechanisms or alternatively reflect mechanisms related to cataplexy/cataplexy inhibition.
Introduction: According to a Mayo Clinic definition, narcolepsy is a chronic sleep disorder characterized by overwhelming daytime drowsiness and sudden attacks of sleep. Its exact cause is unknown. It is sometimes accompanied by a sudden loss of muscle tone (cataplexy) that leads to weakness and loss of muscle control. Diagnosing narcolepsy can be complex and can require several tests. Only 25% of people who have narcolepsy have been diagnosed and are receiving treatment. In this paper, we solely consider narcoleptic subjects without cataplexy, and we present a first, preliminary investigation of the evolution with time of the level of drowsiness (LoD) in such narcoleptic subjects.

Our hypothesis is that the analysis, especially automatic, of the time evolution of LoD could ultimately lead to new diagnostic tools. Additionally, an understanding of this evolution would enable the design and construction of drowsiness monitoring systems specifically tailored to narcoleptic subjects, allowing them to drive more safely and/or to obtain/recover a driving license.

Materials and methods: Since the evolution of the LoD over time, referred to here as "LoD signal", is inherently random, one should definitely treat each such signal as being a realization of an underlying random process (RP). In a previous publication, we showed that the LoD of healthy subjects evolves in time according to a particular RP model called Geometric Brownian Motion (GBM). Our goal here is to determine whether or not the LoD of narcoleptic subjects also evolves according to GBM.

According to a well-established procedure, a given signal can be declared to be GBM if (1) the logarithms of the ratios of successive values are normally distributed, and (2) these ratios are uncorrelated (in time).

For the first check, we applied, to each (LoD) signal, established graphical methods, i.e. the quantile-quantile (QQ) plot and the histogram. For the second, we looked at the scatter plot of "log-ratios" versus time for each signal to see whether there was any (time) correlation between the logarithms of the ratios of successive values.

Results: The LoD signals used here were produced using a drowsiness monitoring system built in our group, consisting of a camera mounted on a pair of eyeglasses and imaging one eye. Using data obtained at 60 Hz, it produced one LoD value every 20 second. A total of 4 distinct subjects performed the following tests at two different states of sleep deprivation over one day: (1) 4 subjects performed psychomotor vigilance tasks (PVTs), leading to 4x2 LoD signals, each having 29 samples, corresponding to a duration of 10 minutes; (2) 3 subjects performed driving tests in a high-fidelity driving simulator, leading to 3x2 LoD signals, each having 49 samples, corresponding to a duration of 16 minutes.

We subjected all 14 LoD signals to the above pair of statistical tests, and concluded that all of them could be well modeled by a GBM RP model.

Conclusions: The preliminary results described here suggest that, similar to a healthy subject, the LoD of a narcoleptic patient evolves according to a GBM.
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NARCOLEPSY AFTER H1N1-VACCINATION IN NORWAY DURING 2009-2017

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Introduction: In autumn/winter 2009, 2.2 million Norwegians were H1N1-vaccinated with Pandemrix® followed by a large increase in narcolepsy incidence.

We here present an update on new Norwegian narcolepsy cases from 2009-2017.

Materials and methods: Since spring 2010 all new Norwegian narcolepsy cases should be centrally reported to our national centre. The present update includes cases with valid information to confirm narcolepsy according to International Classification of Sleep Disorders 3rd edition.

Results: A total of 213 probable narcolepsy cases were identified, of which 72/213 cases were excluded. 11/72 excluded cases were either probable/certain narcolepsy based on symptoms, sleep investigations and/or hypocretin measurements results but lacked sufficient information about final diagnostic results or year of disease onset; 61/72 excluded cases had low hypocretin levels but lacked sufficient symptom description and/or year of disease onset.

126 confirmed H1N1-vaccinated narcolepsy cases were identified (♀:♂ 79:47). 97/123 were < 18 years at disease onset (age range: 3-17 years), 26/123 were ≥18 years at disease onset (age range 18-55 years), age at disease onset was unknown in 3 cases. Median age at disease was 12.0 years. 19/123 had narcolepsy onset in 2009, 78/123 in 2010, 11/123 in 2011, 7/123 in 2012, 7/123 in 2013, 0 in 2014-15, 1/123 in 2016, 0/123 in 2017. Cataplexy was present in 115/120; not present in 5/120; unknown cataplexy-status in 6 cases.

Hypocretin-1 levels were known in 111/126 cases: hypocretin deficiency (hypocretin-1 levels < 150 pg/ml) was found in 109/111, normal hypocretin-1 levels in 2/111 (both had cataplexy), and unknown/not measured hypocretin-1 in 15 cases.

15 non-H1N1-vaccinated confirmed narcolepsy cases were also identified (♀:♂ 7:8). 11/15 were < 18 years at disease onset (age range 3-15 years), 4/15 were ≥ 18 years at disease onset (age range 18-31 years). 12/15 had cataplexy, 3/15 were without cataplexy. Hypocretin-1 levels were known in 13/15 cases (13/13 were hypocretin deficient), 2/15 had no hypocretin-measurent (both with cataplexy). 0/15 had narcolepsy onset in 2009, 2/15 in 2010; 9/15 in 2011, 2/15 in 2012, 0/15 in 2013/14; 2/5 in 2015, 0/15 in 2016-17.

Narcolepsy incidence was significantly increased in the H1N1-vaccinated versus non-H1N1-vaccinated group during autumn/winter 2009, 2010, 2012, and 2013, especially in 2010. In 2012 there no significant difference between the H1N1-vaccinated versus non-H1N1-vaccinated groups, but this was due to an increase of non-H1N1-vaccinated cases. Mean diagnostic delay (year of disease onset to year of diagnosis) was 2.1±1.58 years in the H1N1-vaccinated group, and 1.87±1.17 years in the non-H1N1-vaccinated group. 84/109 (77%) of all H1N1-vaccinated cases which were diagnosed during 2011-2016 actually had disease onset in winter 2009-2010.

Conclusions: Based on cases known by our national centre of expertise for hypersomnias, the Norwegian incidence of H1N1-vaccinated narcolepsy is consistently increased from autumn/winter 2009-2013. In 2011, there was an additional increase in non-H1N1-vaccinated narcolepsy cases.

Considerable diagnostic delay, reporting delay, and many unresolved possible narcolepsy cases, support a higher “true” Norwegian narcolepsy incidence during 2009-2017. Consequently, it is premature to propose final numbers of H1N1-vaccination associated narcolepsy cases in Norway.
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POLYSOMNOGRAPHY DIFFERENCES IN NARCOLEPSY WITH CATAPLEXY AND HEALTHY MEN AGED OVER 55

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Introduction: Narcolepsy with cataplexy (NC) is a life-long disease caused by loss of hypocretine neurons in lateral hypothalamus and characterized by dysregulation of sleep-wake cycle. Majority of patients are examined at the disease onset. We decided to compare sleep stage proportions in older NC men and healthy age matched controls. NC is often accompanied with sleep comorbidities. Therefore we focused on sleep disordered breathing since it is more frequent in older men and in subjects with high BMI, which is also known in NC patients.

Methods: 17 men with NC diagnosis (mean age 66 ±5.3) and 17 healthy (according to interview) control men (HC) (mean age 65 ±6.6) were examined with one night polysomnography (PSG) in our sleep department. We compared sleep stages and latencies, sleep apnea parameters (apnea-hypopnea index [AHI], oxygen desaturation index [ODI], sleep time with saturation < 90% [T90]) and periodic limb movement index (PLMI). For data analysis Student's t-test was used. During the PSG, 2 patients used stimulants, 2 antidepressants, 1 used both and 1 Xyrem. 11 NC and all HC did not take any sleep modulating medication at least two weeks prior to examination.

Results: As for sleep structure, both groups had similar mean proportion of wake (NC=29%, HC=26%, n.s.) and N2 (NC=33%, HC=30%, n.s.) stages. NC group had significantly higher mean proportion of N1 (NC=17%, HC=10%, p=0.01) and lower mean proportion of N3 (NC=8%, HC=26%, p=0.02) and R (NC=12%, HC=19%, p=0.01) stages. Sleep and REM sleep latencies, as well as sleep effectivity, did not significantly differ between the two groups. Sleep disordered breathing seems to be a problem for both groups at given age. Although mean BMI was significantly higher in NC group (NC BMI=32, HC BMI=28, p=0.02), mean AHI (NC=25, HC=23, n.s.), mean ODI (NC=24, HC=21, n.s.) and mean T90 (NC=8%, HC=5%, n.s.) did not differ. Criteria for obstructive sleep apnea (AH1>15) fulfilled 10 subjects (59%) of each group. PLMI was found to be much higher in NC (62 vs. 16, p=0.02).

Conclusions: As expected, we proved the NC sleep to be of less quality than in HCs. NC subjects have surprisingly similar sleep latencies, REM sleep latencies, sleep effectivity and wake at night to HCs. Still, the important slow wave and REM sleep proportions were found to be much shorter than in HCs. However, our findings are quantitative and show little about sleep structure differences. As for breathing we found problems unexpectedly equal in both groups. This finding is even more surprising given that body mass index of NC group is much higher.
Narcolepsy
Board #085: P4 - Tuesday

TOLERANCE AND PHARMACOKINETICS OF PITOLISANT (WAKIX®), A HISTAMINE H3 ANTAGONIST, IN 24 NARCOLEPTIC CHILDREN

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Introduction: Pitolisant has been recently approved in Europe (March 2016) for "treatment of narcolepsy with or without cataplexy", in adults. Due to its good safety profile and its efficacy on both Excessive Daytime Sleepiness and Cataplexy in adult, it was relevant to study pitolisant in pediatric narcoleptic patients. This trial assessed its tolerance and pharmacokinetics in pediatric patients suffering from narcolepsy with and without cataplexy.

Materials and methods: Four subgroups of 6 pediatric patients equally balanced with gender and age (6-11 years (sub-group I) and 12-17 years (sub-group II)) received an 18mg pitolisant single tablet. Blood samples were collected up to 10 hours post-dose and general clinical, cardiovascular, biochemical and hematological tolerance were assessed. Pitolisant and its main metabolites plasma levels were measured by UPLC/MS. First, the pharmacokinetic parameters were analysed and compared by subgroup and gender. Secondly, these pharmacokinetic parameters were compared to data previously obtained in young healthy male and female adult volunteers who received a single 18 mg pitolisant oral dose.

Results: No significant safety signal was recorded. Cmax values in males and females were respectively 60.5 and 48.5 ng/mL in children, 30.86 and 42.07ng/mL in adolescents. Corresponding AUC0-10h values were 332.02 and 293.72 ng.h/mL in children, 156.42 and 207.95 ng.h/mL in adolescents. Mean Cmax and AUC0-10h were 20% and 12% lower, respectively, in female than in male children patients. Corresponding values were 36% and 33% higher in female than in male adolescent patients. There was no statistically significant gender effect in each subgroup. Compared to data previously obtained in young healthy male and female adult volunteers, mean Cmax were 68% and 51% lower while AUC0-10h were 70% and 48% lower than in children and adolescents. Tmax (~2h) were similar. These differences were not explained by any direct age, gender nor BMI effects. The sole direct correlation was with bodyweight.

Conclusion: The 18mg pitolisant single dose tolerability was excellent in narcoleptic pediatric patients. No gender nor age effect on drug exposure was observed. Since body weight impacts drug exposure, and despite the excellent pitolisant safety profile, the daily recommended dose should be 18 mg for patients weighing less than 40 kg.

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EPWORTH SLEEPINESS SCALE ESS : DETERMINATION OF A MINIMUM CLINICALLY RELEVANT DIFFERENCE

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Introduction: Excessive Daytime sleepiness (EDS) constitutes a major complaints in sleep disorders. Among other tools, the Epworth Sleepiness Scale (ESS) measures EDS and is defined of a sum-score of 8 ordinal items producing a score within [0,24]. ESS is a very simple and usual tool, its validation proved satisfactory internal consistency and sensitivity to change. However the minimum clinically relevant difference MCRD in change in time was never identified as yet. This causes difficulties for the sample size determination or the determination of the non inferiority margins in clinical research, but limits ESS use in routine practice to appreciate the actual improvement of a patient.

Material and methods: Three controlled randomized trials and one open label trial assessing the efficacy of pitolisant in narcolepsy provide the largest worldwide data base reporting ESS in narcolepsy. On a total of 531 patients, two ESS values are available at recruitment (W0) and baseline two weeks later (W2), followed by 4 measurements (W4, W6, W9 and W12) under treatment exposure (placebo or pitolisant). For each visit, the patient Clinical Global Impression CGI (measured on a 5-categories ordinal scale).

The estimation of MCRD was determined by four statistical techniques:
1) Cohen's ratio of half the difference between two means and the 95% 1-sided estimate of the standard deviation;
2) 95% 1-sided estimate of the Standard Error Measurement (SEM) through randomized block Repeated Measurement ANOVA on change between W0 and W2,
3) determination of the SEM from Internal consistency Alpha estimate; (4) Polynomial mixed model regression of CGI by ESS calculating the ESS variation corresponding to a unit change of CGI and assessment of the invariance of the MCRD with regard to non specific covariates (gender and age).

Results: The pooled estimate of the standard deviation of ESS across studies and treatment arms was SD = 5.72 95%CI [4.78-6.71], with a resulting Cohen's MRCD 1-sided 95% CI of 3.03. The pooled SEM estimate based on period [W0-W2] was 1.71 (1-tailed 95%CI =2.88). From the estimated internal consistency Alpha=.84, we found SEM ≅ 1.69 confirming previous confidence limit. From the ESS by CGI regression, the mean change associated with a CGI unit was 2.79 95%CI [2.22, 3.14], without main or interaction effect of age or gender. The four results provide very similar values close of MCRD ≅ 3.

Conclusions: Our results based on the largest available data base of ESS in narcolepsy and confirmed through four different statistical techniques, provide evidence that a change of ±3 on ESS scale corresponds to a minimum clinically relevant difference coinciding with the minimum perceived change of the Clinical Global Impression of the patients. In conjunction with the observed reliability, external validity and the determination of its MCRD, ESS may definitely be considered as a recommended scale both for clinical research and routine practice.

Acknowledgements: We are grateful to Bioprojet company for providing raw data needed for this research. We declare no conflicts of interest
Cognitive Performance in Narcolepsy with Cataplexy Patients With and Without Stimulants: A Preliminary Case-Control Study

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**Introduction:** Patients with narcolepsy with cataplexy (NT1) often report cognitive deficits. Several studies showed that the most affected cognitive functions in NT1 patients are attention and information processing. The aim of the study was to compare neuropsychological performance in NT1 patients under stimulant therapy with NT1 patients without treatment and a healthy control group matched by age and gender.

**Materials and methods:** We studied three patients with NT1 diagnosed with ICSD-2 or 3 criteria; two men and a woman (mean age: 39 years) under stimulant monotherapy with Modafinil, five drug-free NT1 patients: four men and a woman (mean age 38 years), and ten healthy controls: six men and four women (mean age: 36.8 years). The five drug-free patients group consist of one recently diagnosed patient and four previously treated with stimulants and Sodium Oxybate that withdrew voluntarily medication for different reasons. All participants responded to questionnaires on sleepiness (Epworth Sleepiness Scale), Sleep Quality Assessment (PSQI) and depression (Beck Depression Inventory-II). The neuropsychological assessment focusing in attention, memory and executive functions were evaluated with the D2 Attention Test, Symbol Digit Modalities (SDMT), the Verbal Paired Associates (VPA) test from the Wechsler Memory Scale (WMS) and the Rule Shift Cards Test from the Behavioural Assessment of the Dysexecutive Syndrome (BADS).

**Results:** The years of the disease progression and the cataplexy severity index (1) were: 1) in the treated group 9.66 years and 4/5; 2) in the NT1 drug-free patients 15.6 years and 5/5. The mean duration of treatment with Modafinil was 7.66 years.

We found significant differences between drug-free NT1 patients and the healthy control group in daytime sleepiness (p< 0.003), depression (p< 0.028) and sleep quality (p< 0.001);

Drug-free NT1 patients performed significantly slower in the D2 test, specifically in total numbers of stimuli processed (p=0.019) and in correct stimuli (p=0.040) compared with healthy control group. In addition, they have significant lower performance in one of the VPA test (p=0.019).

**Conclusions:** Preliminary results showed that drug-free NT1 patients had more daytime somnolence, depression, less sleep quality and subtle selective attention disturbances compared with the healthy control group.


**Acknowledgements:** We are grateful to all the patients and controls who participated in this study. Thanks to Maria-José Domínguez, nurse of the Sleep Unit of University General Hospital Gregorio Marañón. Madrid.
Narcolepsy
Board #060: P6 - Wednesday

INCORPORATING PATIENT INPUT INTO CLINICAL TRIALS

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Introduction: Flamel Ireland/Avadel Ireland is currently recruiting patients for a Phase III clinical trial, "The REST-ON Study" - evaluating the safety and efficacy of Once Nightly formulation of sodium oxybate. Patient engagement in clinical development is in its infancy. Flamel Ireland/Avadel Ireland is committed to utilizing patient feedback in the development of study activities.

Materials and methods: Following an initial consultation with the Narcolepsy Network USA, Flamel Ireland/Avadel Ireland has established a REST-ON Patient Advisory Group (PAG). The established group is comprised of narcolepsy patients and caregivers of narcolepsy patients. The group agreed on serving two key functions at the outset:

1. Advancing alignment of development activities with the direct needs of patients through meaningful patient collaboration predicated on mutual benefit and well defined relationships.
2. The goal is to develop objective measures of success and to identify a unifying construct for the similar future endeavors.

Results: To date the group has influenced a number of development and clinical trial roll-out activities for REST-ON, including; content development of patient facing materials, ePRO study diary device configuration strategies to enhance REST-ON trial awareness and recruitment strategies. PAG members have voiced recognition of the value and benefit of this initiative in promoting greater patient empowerment through direct engagement and information sharing.

Conclusions: This initiative provides a framework for driving more long term and pervasive engagement between industry, academic researchers and patient groups. Flamel Ireland/Avadel Ireland is committed to advancing PAG developments to capture the long-term benefits such collaborative mechanisms can bring to the lives of patients through patient focused research and development. A similar EU REST-ON PAG framework was more recently established.
**A CASE OF TYPE 1 NARCOLEPSY WITH REM SLEEP BEHAVIOR DISORDER**

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**Introduction:** REM (Rapid eye movement) sleep parasomnias include REM sleep behavior disorder (RBD), and they are frequently reported in up to 60% of narcolepsy patients.

**Materials and methods:** The case of type 1 narcolepsy with RBD was first diagnosed on May 2012, and clinical history was carefully reviewed. After the diagnosis, the patient visited the clinic monthly and the progress of the disease has been followed up until December 2016.

**Results:** A 32-year-old Korean male patient diagnosed with type 1 narcolepsy with REM sleep behavior disorder was reviewed. He had an influenza vaccination history, and two years later, the typical symptoms of narcolepsy (excessive daytime sleepiness and cataplexy) began. He was diagnosed with narcolepsy and prescribed medication, but cataplexy was often present and excessive daytime sleepiness was still severe. He started talking and singing as if he were talking to someone during sleep. The multiple sleep latency test (MSLT) results in May 2012 showed a mean sleep latency (MSL) of 0.2 minutes and a SOREMP (Sleep Onset REM Period) of 4 times. In polysomnography (PSG), apnea-hypopnea index (AHI) was 10.7 / h, SOREMP, bruxism and REM sleep without atonia was observed. Despite regular medication and follow up to relieve his symptoms, REM sleep behavior and cataplexy are still present.

**Conclusion:** RBD in patients with narcolepsy is a distinct phenotype with respect to other RBD patients. Moreover, the management of REM sleep behavior disorder in narcolepsy is still challenging.
CHILDHOOD NARCOLEPSY AND AUTISM SPECTRUM DISORDERS - AN UNDERDIAGNOSED NEUROPSYCHIATRIC ASSOCIATION?

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Introduction: Childhood narcolepsy is associated with various emotional, behavioural and cognitive dysfunctions as well as with psychiatric and neurodevelopmental disorders: anxiety, depression, attention deficit hyperactivity disorder and psychosis. A relationship between these conditions is not clear - comorbidity as well as similar pathophysiological mechanisms can be suggested. The aim of our study is to describe four children with narcolepsy type 1 (NT1) and new comorbidity of autism spectrum disorder (ASD) - Asperger syndrome.

Materials and methods: Over the past three years, 9 new childhood cases of NT1 (4 boys, mean age 11.8±1.5, age range 9-13 years) have been observed at the Department of Neurology, 1st Medical Faculty of Charles University in Prague.

Results: In all NT1 cases diagnosis was proved by nocturnal polysomnography and multiple sleep latency test. HLA DQB1*0602 was positive in all cases. Hypocretin level in cerebrospinal fluid was not measured due to the parents’ refusal to perform lumbar puncture. In four of NT1 cases, diagnosis or suspicion of Asperger syndrome was confirmed by detailed psychiatric and psychological examinations including ADOS (Autism Diagnostic Observational Schedule), NEPSY II (Developmental NEuroPSYchological Assessment, Second Edition, part Affect recognition) and WISC-III (Wechsler Intelligence Scale for Children - Third Edition). The both diagnoses were verified in 3 cases almost simultaneously.

Conclusions: ASD, particularly Asperger syndrome, can be a further underdiagnosed psychiatric comorbidity of childhood narcolepsy. An assessment of ASD symptoms should be included in the follow-up of childhood narcolepsy.

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THE RELATIONSHIP BETWEEN SLEEP, MENTAL HEALTH AND PHYSICAL ACTIVITY IN ADOLESCENTS WITH NARCOLEPSY

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Introduction: Childhood narcolepsy is a significant life-long sleep disorder with no cure. Narcolepsy is characterized by excessive daytime sleepiness, cataplexy, sleep paralysis, hallucinations and disturbed nocturnal sleep. Limited research suggests that Narcolepsy is associated with mental health and impaired health related quality of life (HRQOL), although the predisposing risk factors are unclear. Of particular interest are the variable sleep patterns and levels of physical activity that may be related to adverse outcomes in childhood Narcolepsy. A stronger understanding of the bidirectional relationships between abnormal sleep patterns, physical activity and mental health in adolescents with narcolepsy may be valuable for clinicians dedicated to optimizing outcomes in childhood Narcolepsy.

The objectives of this study are to:
1) Evaluate the relationship between sleep patterns, mental health and HRQOL
2) Evaluate the relationship between physical activity levels, sleep patterns, mental health and HRQOL

Materials and methods: This is a cross-sectional study. Adolescents (ages 10-18 years) with Narcolepsy were prospectively recruited from the Hospital for Sick Children in Canada. Healthy adolescents were recruited as controls for this study. Sleep quantity and quality were measured objectively using actigraphy for 7 days and subjectively using sleep diaries and the Pittsburgh Sleep Quality Index (PSQI) questionnaire. Mental health was evaluated using The Children's Depression Inventory-2nd edition (CDI-2) and The Screen for Childhood Anxiety Related Emotional Disorders (SCARED). HRQOL was assessed using the PedsQL 4.0 Generic Core Tool. Physical Activity (PA) was assessed objectively using pedometers for 7 days and subjectively using the Godin Leisure-Time Exercise Questionnaire.

Results: Seventeen adolescents with Narcolepsy (mean age=14.53 ± 1.94, mean BMI Z-score=1.2±0.75, mean Epworth sleepiness score=12.94±4.49) and 12 controls (mean age 16.00± 0.60, mean BMI Z-score=0.23±0.83, mean Epworth sleepiness score=5.33±4.07) participated. Adolescents with Narcolepsy reported impaired mental health and worse HRQOL, poor subjective sleep quality and participated in less PA.

In adolescents with Narcolepsy, subjective sleep quality was significantly correlated with depressive symptoms ($R^2=0.757$, $p< 0.01$), anxiety ($R^2=0.598$, $p=0.01$) and HRQOL ($R^2=-0.600$, $p< 0.01$). Self-reported PA was significantly correlated with subjective sleep quality ($R^2=-0.670$, $p=0.03$), sleep duration ($R^2=0.827$, $p=0.03$), and sleep efficiency ($R^2=0.632$, $p=0.05$). Self-reported PA was also correlated with depressive symptoms ($R^2=-0.504$, $p=0.04$) and HRQOL ($R^2=0.495$, $p=0.04$). In healthy adolescents, subjective sleep quality was only significantly associated with depressive symptoms ($R^2=0.659$, $p=0.02$).

Conclusions: In adolescents with Narcolepsy, subjective sleep quality is associated with mental health and HRQOL. Also, participating in more physical activity is associated with better sleep (quantity and quality), mental health and HRQOL. These results are relevant in the context that optimizing sleep quality and physical activity are potential non-pharmacological therapies to help improve outcomes such as mental health and HRQOL in pediatric narcolepsy.

Acknowledgements: Patients and families for participating
Introduction: Cataplexy (sudden muscle weakness evoked by strong emotions) is pathognomonic of narcolepsy type 1. Cataplexy diagnosis may challenge with other episodic falls, and its assessment only by clinical interview as recommended by current consensus criteria may result in wide burden of uncertainty. Our study aimed at describing the motor pattern of cataplexy and to determine its phenomenological differences from pseudocataplexy in the context of episodic falls differential diagnosis.

Methods: We selected 30 video recorded cataplexy and 21 pseudocataplexy attacks in 17 and 10 patients with narcolepsy type 1 and functional neurological disorder respectively, together with self-reported attacks features, and asked expert neurologists to blindly evaluate the motor features of the attacks. Video documented and self-reported attacks features of cataplexy and pseudocataplexy were contrasted.

Results: Video-recorded cataplexy can be positively differentiated from pseudocataplexy by the occurrence of facial hypotonia (ptosis, mouth opening, tongue protrusion) intermingled by jerks and grimaces abruptly interrupting laughter behavior (i.e. smile, facial expression) and postural control (head drops, trunk fall) under clear emotional trigger. Facial involvement is present in both partial and generalized cataplexy. Conversely, pseudocataplexy is associated with persistence of deep tendon reflexes during the attack. Self-reported features confirmed the important role of positive emotions (laughter, telling a joke) in triggering the attacks, as well as the more frequent occurrence of partial body involvement in cataplexy compared to pseudocataplexy.

Conclusions: Cataplexy is characterized by abrupt facial involvement during laughter behavior. Video recording of suspected cataplexy attacks allows the identification of positive clinical signs useful for diagnosis and, possibly in the future, for severity assessment.
A STANDARDIZED TEST TO DOCUMENT CATAPLEXY

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Introduction: Cataplexy is the pathognomonic symptom of narcolepsy type 1 (NT1). Since it is considered difficult to be directly observed or documented by clinicians, its diagnosis relies mainly on history taking. Our study aimed at developing a standardized video recording procedure under emotional stimulation to document cataplexy and testing its utility in the diagnostic work-up of suspected hypersomnia of central origin.

Methods: Two-hundred-eight consecutive patients underwent the diagnostic work-up and reached the final diagnosis of NT1 (n=133), idiopathic hypersomnia or narcolepsy type 2 (IH/NT2 group, n=33), or subjective hypersomnia (sEDS group, n=42). All subjects underwent a standardized video recording procedure while watching funny movies selected according to individual preferences, and a technician blind to clinical features reviewed the recordings to identify hypotonic phenomena that were finally confirmed by patients.

Results: The video recording under emotional stimulation captured hypotonic phenomena in 72.2%, 9.1% and 4.8% of NT1, IH/NT2, and sEDS subjects (p< 0.0001), respectively. When tested against CSF hypocretin deficiency, the documentation of a hypotonic episode at the test showed an area under the ROC curve of 0.823±0.033 (p< 0.0001). NT1 patients under anticataplectic medications showed less frequently hypotonic episodes than untreated ones (48.0% vs 77.8%, p=0.003).

Conclusions: A standardized video recording procedure under emotional stimulation can improve the characterization of suspected hypersomnia of central origin. Further multi-center studies are warranted to confirm the present findings and integrate a shared procedure for the laboratory work-up of narcolepsy.
Narcolepsy oral abstract presentations

A DOUBLE-BLIND, PLACEBO-CONTROLLED, RANDOMIZED-WITHDRAWAL, MULTICENTER STUDY OF THE EFFICACY AND SAFETY OF SODIUM OXYBATE IN PEDIATRIC SUBJECTS WITH NARCOLEPSY WITH CATAPLEXY


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Introduction: Narcolepsy is a life-long neurological disorder with disease-onset largely occurring during childhood/adolescence. Few treatments have been formally evaluated in pediatric patients. This double-blind placebo-controlled randomized-withdrawal study evaluated the efficacy and safety of sodium oxybate (SXB) in pediatric subjects with narcolepsy with cataplexy.

Materials and methods: Children and adolescents (7-16 years) diagnosed with narcolepsy with cataplexy who were on stable-dose SXB treatment or were SXB-naïve were eligible. SXB-naïve subjects were titrated to a stable dose. After a stable dose period (SD), all subjects entered a two-week double-blind, placebo-controlled withdrawal period (DB) and were randomized 1:1 to continue to receive SXB (at stable dose) or be switched to placebo. Efficacy assessments compared measurements during or at the end of the DB period, relative to the SD period.

Results: The trial enrolled 106 subjects; 63 were randomized. Among randomized subjects, 41% were aged 7-11, 44% were female, and 38% were on SXB treatment at study entry. A pre-planned interim analysis of 35 subjects showed that efficacy was achieved (p< 0.005) based on the primary endpoint (change in weekly cataplexy attacks). The double-blind randomized withdrawal period was therefore terminated early, which resulted in 63 subjects in the final efficacy analysis. Results showed change in weekly cataplexy attacks (primary endpoint) was significantly increased in the placebo group (median 12.7/week) compared to subjects continuing SXB treatment, who had little change in cataplexy (median 0.3/week; p < 0.0001). Cataplexy severity, assessed by Clinical Global Impression of Change was worse in the placebo group (overall difference p=0.0006) than in subjects continuing SXB treatment, with 65.6% subjects assessed as much worse or very much worse in the placebo group, compared to 17.2% in subjects continuing SXB treatment. Excessive sleepiness was worsened in the placebo group, with a median increase of 3.0 points on the Epworth Sleepiness Scale for Children and Adolescents, compared to no change in subjects continuing on SXB (p=0.0004). CGIc for narcolepsy overall showed worsening of disease in the placebo group (59.4%) compared to the group continuing SXB (10.3%; p< 0.0001). Treatment-emergent adverse events occurring in >10% of the overall sample were enuresis, nausea, vomiting, headache, and weight decreased.

Conclusions: Results of this study indicate that sodium oxybate is efficacious in reducing cataplexy and excessive sleepiness in pediatric patients with narcolepsy. The safety profile is consistent with the published literature in adult and pediatric patients.

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Narcolepsy
Board #063: P6 - Wednesday
NARCOLEPSY TREATMENTS: COMPARISON OF PITOLISANT, MODAFINIL AND SODIUM OXYBATE VIA A NETWORK META-ANALYSIS

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Introduction: Narcolepsy, a chronic disabling disease, is characterized by two main symptoms: the excessive daytime sleepiness (EDS) measured by the Epworth Sleepiness Scale (ESS) and/or the Maintenance Wakefulness Test (MWT) and the cataplexy attacks rate (CAR). We performed a Multiple-Treatment comparison of three main treatments on EDS, CAR and Safety in randomized clinical trials (RCTs) through a Network meta-analysis (NMA).

Materials and methods: A protocol was prepared according to meta-analyses guidelines. Study selection was defined as the set of all RCTs conducted in adult narcoleptic patients assessing at least one of the 3 treatments and placebo. Univariate meta-analyses were performed separately for ESS, MWT and CAR first, and confirmed by a multivariate comparison based on an aggregating Z-score. Safety index was built as the incidence of the observed Adverse Events. Finally, a global Risk/Efficacy index was calculated as a summary mean of Efficacy and Safety Z-score. A network meta-analysis was needed, due to the multiple treatment comparison and multi-arm studies needing correction on correlation matrix. The random model was a priori assumed due to the expected between studies heterogeneity.

Results: In adult narcoleptic patients Modafinil/Armodafinil (MDF) and sodium oxybate (SXB) and recently Pitolisant (P), have demonstrated their efficacy to reduce EDS and P and SXB have also demonstrated their efficacy to reduce CAR. A total of 14 studies are included in the NMA: 7 comparing MDF to placebo, 3 comparing SXB to placebo, 3 trials comparing P to placebo, and 3 studies providing multiple comparisons. Among them only one trial compares SXB to MDF and placebo, and 2 trials compare P to MDF and placebo. As founded in the studies, 6 treatments were considered: MDF at 200-400 mg/d, SXB at the dose 6g/d (SXB6) and the dose 9g/d (SXB9) and P at dose up to 20mg/d (P20) and up to 40mg/d (P40), and placebo. Placebo was considered as the reference value.

SXB9, MDF and P40 were found significantly different from placebo for ESS, MWT and CAR. In the ranking of treatments performed according to P-scores (Equivalent Sucra Values) and for all the efficacy endpoints confirmed by the multivariate meta-analysis, the highest treatment effect was found for P40, followed by SXB9 and MDF. The best safety profile compared with placebo was for Pitolisant (all doses), followed by Modafinil, SXB6 and SXB 9. SXB was characterized by a higher Adverse Events incidence. Finally, in combining Risk through a compensatory Additive Risk/Benefit index, P40 was observed with an overall superiority compared with the other alternatives.

Conclusions: This network meta-analysis provides evidence of the superiority of Pitolisant up to 40mg/d over either Modafinil or Sodium Oxybate on efficacy (EDS and CAR) and safety.

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HOW REAL ROAD-DRIVING PERFORMANCE, SIMULATED DRIVING PERFORMANCE, AND MAINTENANCE OF WAKEFULNESS TEST ARE RELATED IN NARCOLEPSY/HYPER Somnia PATIENTS?


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Introduction: Narcolepsy and idiopathic hypersomnia (IH) are rare central disorders that induce severe daytime sleepiness increasing the risk of sleep-related accidents. To our knowledge, no study to date has compared the relationships between real driving performance, simulated driving performance and objective level of alertness as measured by Maintenance of Wakefulness Test in patients suffering from central hypersomnia, yet these are important questions to be able to provide a complementary means of evaluating fitness-to-drive in addition to the classical MWT in this at-risk patient population.

Materials and methods: Twenty-seven patients (13 patients with narcolepsy and 14 patients with idiopathic hypersomnia; mean age = 33.8 ± 11.1 years, range = 18-65 y; 4 males) and 27 matched healthy controls (age = 33.3 ± 10.4 years, range = 21-62 y, 4 males) were recruited. Patients were randomly assigned to receive modafinil (400 mg) or placebo for 5 days prior to the driving test. Standard Deviation of Lateral Position (SDLP) of the vehicle in real and simulated driving, and mean sleep latency in the Maintenance of Wakefulness Test (MWT) were assessed.

Results: Treated patients suffering from narcolepsy or IH exhibited shorter mean sleep latencies in the MWT than controls (Mann-Whitney U test, Z = -2.482, P < 0.05). Regarding simulated versus real driving performance in narcoleptic/hypersomniac patients, the SDLP of the vehicle in real driving condition correlated significantly to the one of simulated driving (Rho Spearman, r = 0.34, P < 0.05). In addition, regarding simulated driving performance versus objective sleepiness, the SDLP correlated significantly with the mean sleep latency on the MWT (r = -0.56, P < 0.001).

Conclusions: In narcoleptic/hypersomniac patients, simulated driving performance in addition to mean sleep latency on the MWT correlate with real driving performance. Driving simulator evaluations could help physicians in their decisions about the fitness-to-drive. The MWT and the driving simulation task are therefore complementary to capture precise aspects of real highway driving performance such as level of alertness, vigilance and lane control.

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Narcolepsy
Board #066: P6 - Wednesday
TREATMENT WITH SODIUM OXYBATE DECREASES BODY MASS INDEX IN NARCOLEPSY TYPE 1

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Introduction: Individuals with narcolepsy type 1 often gain body weight after disease onset, frequently leading to obesity. Previous work suggested this weight gain may be counteracted by treatment with sodium oxybate (SXB). This has not yet been confirmed, and long-term follow-up data are not available. We assessed body mass index (BMI) change after initiating treatment with SXB and compared this with BMI change after initiating treatment with modafinil in narcolepsy type 1.

Materials and methods: In the study period between 2009 and 2016 there were 80 individuals that fulfilled the entry criteria for this retrospective study: 56 had newly started treatment with sodium oxybate, and 24 had newly started modafinil. Gender and baseline BMI specific differences between both treatment groups were compared using Student´s t-tests and mixed effect modeling.

Results: Mean follow-up was 2.2 years in SXB patients and 1.4 years in modafinil patients. Those using sodium oxybate lost weight with a mean BMI decrease of 2.58 kg/m² between first and last measurement (women; p<0.001) and 0.72 kg/m² (men; p=0.050). Patients using modafinil, however, gained weight with a mean BMI increase of 0.80 kg/m² (women; p = 0.021) and 0.42 kg/m² (men; p=0.221). Medication (p=0.004) and baseline BMI (p=0.014) were predictors for BMI decrease.

Conclusions: Treatment with sodium oxybate reduces BMI in narcolepsy type 1, while modafinil treatment does not. This effect is most pronounced in those who already have a higher baseline BMI. Future prospective studies must clarify a possible dose-response relationship and predictive markers for this effect.

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**Introduction:** Pitolisant, the first potent and highly selective Histamine H3-receptor antagonist/inverse agonist in clinics, activating the histaminergic neurons, demonstrated its efficacy over 7-8 weeks in reducing Excessive Daytime Sleepiness (Lancet Neurol. 2013) and cataplexy attacks (Lancet Neurol. 2017) in adult narcoleptic patients (NP) with or without cataplexy. We compared the anti-cataplectic efficacy results in different phase II and III Randomized Clinical Trials (RCT).

**Materials and methods:** The Weekly Rate of Cataplexy attacks (WRC) was estimated according to the daily diary notification of cataplexy attacks in adult NP treated with pitolisant once-a-day (OD) with a maximal daily dose up to 36 mg. WRC was the first endpoint in the pivotal phase III study HARMONY-CTP and in the phase II study HARMONY II. WRC was a second endpoint in HARMONY I, HARMONY III and phase II studies. Doses varied from 4.5 to 36 mg/d according to an individual titration design and treatments lasted from 7 to 1 year. In some studies, serotonin receptor selective inhibitors and sodium oxybate were allowed.

**Results:** WRC reduction at 8 weeks was the main objective of the pivotal HARMONY CTP study (n=105): pitolisant reduced WRC by 75% from 9.15 to 2.27 (p< 0.0001 vs placebo). This large WRC reduction was also confirmed in the sub-group of patients presenting >15 WRC (p< 0.0001 vs placebo). In the pivotal HARMONY I study (n= 76), after 8 weeks, pitolisant reduced WRC (secondary endpoint) by 62% (p= 0.034 vs placebo). In the long-term open label study HARMONY III (n=104), pitolisant reduced total and partial WRC by 76% and 64% respectively after 12-month-treatment. In the open-label phase II study P06-06 (n=27), pitolisant reduced WRC by 40% (p = 0,024) after 1 month only. In HARMONY II (n=15), WRC after 8 weeks was reduced by 56% in the sub-group of pitolisant alone and by 71% in the sub-group pitolisant + modafinil.

**Conclusions:** Pitolisant demonstrated a potent anti-cataplectic effect with a reduction by 60-70% which was consistent through all RCT and maintained during at least 12 months. This property of this novel compound, combined with the Excessive Daytime Sleepiness reduction it elicits and with its very good safety profile suggests that pitolisant is a new therapeutic option for patients with narcolepsy with or without cataplexy.

**Acknowledgements:** HARMONY I investigators, HARMONY CTP investigators, HARMONY III investigators and all other studies investigators.
Background: Cataplexy is a major symptom of narcolepsy and is defined as a sudden loss of muscle tone during wakefulness while consciousness is preserved. It is a dynamic, multi-phased process which involves different brain regions before, during and after its occurrence. Monoaminergic neuronal populations that are important wake-promoting systems play also an important role in pathophysiology of narcolepsy with cataplexy. In this work we sought to understand if the modulation of the serotonin transmission can influence cataplexy occurrence in mice.

Methods: The mice were implanted with EEG electrodes and EMBLA™ hardware was used for signal acquisition and Somnologica-3™ (Medcare) software for data analysis. High resolution camera also was used to record animal behavior during different vigilance state.

Result: Our results showed that introducing a null 5-HTT gene (serotonin transporter) in the animal model of cataplexy (Hcrt KO mice) greatly reduced cataplectic attacks but REM sleep amount increased. This decrease in cataplexy was even more pronounced after sleep deprivation, with 4 fold decrease as compared to Hcrt KO mice.

Conclusion: This finding indicates that serotonergic system is a major downstream hcrt pathway to regulate cataplexy onset and duration supporting the serotonergic system as the therapeutic target for controlling cataplexy in narcolepsy patients.
**A CASE OF COMORBIDITY OF NARCOLEPSY AND SCHIZOPHRENIA**

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The patient was a 15 years old female. She was increased daytime sleeping for 3 years, abnormal mental behavior for 10 months, and was admitted to our hospital in August 2014. Three years ago (2011), the patient began to appear attacks of falling sleep in the day, sleep in class, can be awakened by others or wake up by herself. She feel both lower limbs weakness when laughing, no falls. No sleep paralysis, no fear and hallucinations before sleeping. Behave lazy, exercise less, eat more, get fat, continue to school with worse academic performance. Ten months ago (November 2013), she appeared abnormal mental behavior, call parents to take her home when she was in school. She was found sleep walking to teacher’s room without wearing clothes at 4AM. She cried and stared occasionally after her mother got her home, she said she was falling in love with someone which was confirmed not existed. She laughed and cried occasionally. She got bad temper, self talking a lot and poor sleeping. Sometimes the patient lied alone and said, “go away, shame on you”. She didn’t explain when asked and can’t control her temper. From then on, she had a lazy lifestyle, less exercise, sitting or lying in bed, sleeping or greedy, doing nothing in addition to sometimes checking cellphone. She has been to lot of hospitals for treatment, bad outcome because of poor compliance. Past history, personal history and family history no exception.

Neurological examination showed expression indifferent, but no obvious positive signs. Wechsler Intelligence Scale: Language IQ 92 points; Operating IQ 120 points; Total IQ 105 points. EEG, Abdominal, pelvic ultrasound and head MRI showed normal. Negative symptom scale: no significant negative symptoms. Positive symptoms scale: there are often hallucinations, mostly auditory hallucinations, the content is mostly discussed, or the content of love, thinking content often suspicious, or suspected of being peeping. Emotional instability, irritability, delusions of love obvious. Self rating Depression Scale: rough score 52 points, standard score of 65. There may be moderate to severe depression. Anxiety self-rating scale: rough score 38 points, standard score of 47. No prominent clinical symptoms. PSG (November 5, 2011) : Sleep efficiency of 79%. PSG (March 25, 2012) : Sleep efficiency decreased (73.9%), AHI=2.18beats/hour. MLST showed mean sleep latency was 3.8 min. MLST (September 23, 2014) showed 4/5 times of REM sleep, and mean sleep latency was 3.1 min.

The patient underwent medical evaluation and testing, and comorbidity of narcolepsy and schizophrenia was diagnosed. She was treated with Concerta, Prozac, Olanzapine. Narcolepsy symptoms improved significantly, mental symptoms improved significantly, has been able to go to school, improve academic performance, improve interpersonal relationships. Patients with narcolepsy can have obvious psychiatric symptoms. Narcolepsy can overlap with mental illness. Narcolepsy and psychiatric disorders (schizophrenia) can be comorbidity. A treatment regimen consisting of a combination of a psychostimulant and antipsychotics may be potentially beneficial, but would require further study.
CLINICAL CHARACTERISTICS OF PEDIATRIC NARCOLEPSY LEARNED FROM SCREENING AND ENROLLMENT FOR A PHASE 3 STUDY OF SODIUM OXYBATE IN CHILDREN AND ADOLESCENTS

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Introduction: Data on pediatric patients with narcolepsy are limited. Therefore, examination of screening samples from pediatric studies provides a meaningful source of additional information. A post hoc analysis of the screening sample from a phase 3, multicenter study of sodium oxybate (SXB) in children and adolescents with pediatric narcolepsy was performed to identify the clinical characteristics of patients referred to the study.

Materials and methods: SXB-treated and SXB-naïve children and adolescents (7-17 years) diagnosed with narcolepsy type 1 (NT1) were eligible for study enrollment. All patients entered a screening period of up to 30 days. Screening failure was defined as failure to meet 1 or more of 12 inclusion criteria, fulfilling 1 or more of 30 exclusion criteria, or both. Patients underwent polysomnography (PSG) and were screened for HLA DQB1:0602 if not already tested. Patients who were tested for HLA DQB1:0602 prior to the study and enrolled, were analyzed as HLA DQB1:0602 positive. In addition to narcolepsy-related assessments, patients were screened for symptoms of depression (Children’s Depression Inventory Second Edition Self-Report Short Version [CDI-2SR(S)]), anxiety (Multi-Dimensional Anxiety Scale for Children-10 item [MASC-10]), suicide risk (Columbia Suicide Severity Rating Scale [CSSRS]), and substance use (urine toxicology).

Results: Thirty (5 SXB-treated, 25 SXB-naïve) of 136 children failed to meet one or more inclusion criteria and/or fulfilled one or more exclusion criteria. A total of 14 patients were confirmed HLA DQB1:0602 negative (4 SXB-treated, 10 SXB-naïve; 12 were excluded from study participation). One SXB-naïve patient was excluded for failure to satisfy the International Classification of Sleep Disorders-3 (ICSD-3) diagnostic criteria for NT1. Based on the original exclusion criteria, 6 SXB-naïve patients were excluded for T-scores ≥65 on CDI-2SR(S), 3 SXB-naïve patients were excluded for T-scores >65 on MASC-10, and 2 SXB-naïve patients were excluded for responses indicative of potential suicide risk on CSSRS. One SXB-naïve patient had an elevated T-score on CDI-2SR(S) and an elevated T-score on MASC-10, as well as a positive screen for suicide risk on CSSRS. Another SXB-naïve patient had an elevated T-score on CDI-2SR(S) as well as a positive screen for suicide risk. Urine toxicology was not conducted on all screened patients; however, 1 patient tested positive for cannabinoids. Two SXB-naïve patients were excluded for evidence of sleep-disordered breathing (SDB) on PSG with an obstructive apnea-hypopnea index of >5 without associated desaturation or hypoventilation.

Conclusion: The post hoc analysis of this screening sample provided important information regarding clinical characteristics of patients referred for the phase 3 clinical trial of SXB in pediatric narcolepsy. Despite a clinical diagnosis of NT1, 14 out of 136 patients (10.3%) were confirmed negative for HLA DQB1:0602. SDB only occurred in 2 out of 136 patients (1.5%), and both were SXB-naïve. In addition, depression, anxiety, suicide risk, and substance use may be important clinical considerations in the evaluation and treatment of pediatric patients with narcolepsy.

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PITOLISANT EFFICACY ON CATAPLEXY: A DOUBLE BLIND, RANDOMISED, PLACEBO CONTROLLED TRIAL IN PATIENTS WITH NARCOLEPSY (THE HARMONY-CTP TRIAL)

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Introduction: Pitolisant, a highly selective Histamine 3 Receptor antagonist/inverse agonist has shown its efficacy on Excessive Daytime Sleepiness (EDS) and its safety in the first pivotal study HARMONY I (Dauvilliers et al Lancet Neurol. 2013). Furthermore, pitolisant decreased the number of cataplexy episodes as shown in other studies. The HARMONY CTP study has been performed in order to confirm the efficacy of pitolisant to decrease the frequency of cataplexy attacks in narcoleptic patients, to confirm its efficacy in reducing EDS and its good safety profile.

Materials and methods: The study is a double-blind, randomized (1/1), placebo controlled phase III study including adult narcoleptic patients with ≥ 3 cataplexies per week and Excessive Daytime Sleepiness (EDS) (measured with the Epworth Sleepiness Scale, ESS, score ≥12); they were randomly assigned to pitolisant or placebo (1:1) once-a-day (OD) for 3-week flexible dosing (4,5-36 mg pitolisant) followed by 4-week stable dosing and then a 1 week placebo for a withdrawal symptomatology evaluation. The primary endpoint was weekly cataplexy rate (WCR) reduction during the 4 week stable period. Secondary endpoints were: sub group with high WRC ≥15, ESS, MWT, tolerance.

Results: Between 2013-2015, in 16 centers from 9 countries, among 117 selected patients, 106 were randomised, 52 to placebo and 54 to pitolisant. Patient characteristics were similar in the 2 groups with an initial WRC (geometric means) at 9.15 and 7.31 and an initial ESS (arithmetic means) at 17.4 and 17.3 respectively in pitolisant and in placebo group. The WCR during stable treatment period compared with the basal period was decreased by 75% with pitolisant and 38% with placebo (ratio rate 0.512; 95% CI, 0.43 to 0.60; p< 0.0001). At the end of the treatment, patients with high WRC > 15 represented 7% in pitolisant group and 24% in placebo group (p=0,005). At final The ESS score was reduced by 5.4 with pitolisant and 1.9 with placebo (p< 0.0001) and the MWT was enhanced by 95% with pitolisant and 6 % with placebo (p=0.003). Hallucinations were also significantly reduced compared to placebo (p=0.007). Treatments were well tolerated, with no serious adverse event. The most frequent adverse events for pitolisant (headache, irritability, anxiety and nausea) were mild or moderate except one severe nausea. No withdrawal syndrome was detected after abrupt treatment cessation.

Conclusions: Pitolisant, given OD in the morning up to 36 mg/day, demonstrated significant efficacy in reducing the Weekly Rate of Cataplexy and Excessive Daytime Sleepiness as well as other symptoms such as hallucinations and was well tolerated. Brain histamine neuron activation represents an entirely novel treatment option for patients with narcolepsy.

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A RANDOMIZED, PLACEBO-CONTROLLED, PHASE 3 STUDY OF THE SAFETY AND EFFICACY OF SOLRIAMFETOL (JZP-110) FOR THE TREATMENT OF EXCESSIVE SLEEPINESS IN PATIENTS WITH NARCOLEPSY

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Introduction: Solriamfetol (JZP-110) is a selective dopamine and norepinephrine reuptake inhibitor with wake-promoting effects. In two prior clinical studies in patients with narcolepsy type 1 and 2 (NT1/2), solriamfetol significantly improved wakefulness and reduced excessive sleepiness (ES). This phase 3 study was designed to further assess the safety and efficacy of solriamfetol in NT1/2.

Methods: This was a 12-week, double-blind, randomized, placebo-controlled, parallel-group study. Patients were randomized (1:1:1:1) to receive solriamfetol 75mg, 150mg, 300mg, or placebo for 12 weeks and were stratified by the absence or presence of cataplexy. Key eligibility criteria: diagnosis of NT1/2; mean sleep latency < 25 minutes on the Maintenance of Wakefulness Test (MWT); Epworth Sleepiness Scale (ESS) score ≥ 10; usual nightly sleep time ≥ 6 hours. Key exclusion criteria: use of medication that could affect ES or cataplexy; night-time or variable shift work; conditions other than narcolepsy causing ES.

Results: 239 patients were randomized; 236 received ≥1 dose of study drug (safety population). Of these 236 patients, 67.2% were female and 80.2% were white. Baseline ESS score and MWT mean sleep latency were 17.2 (3.2) and 7.5 (5.7) minutes, respectively. Efficacy analyses were based on a modified intent-to-treat population (mITT; n=231). solriamfetol significantly increased MWT mean sleep latency at week 12 (P < 0.0001 for 300mg and 150mg). Least squares (LS) mean (SE) change from baseline was 12.3 (1.4) minutes for 300mg, 9.8 (1.3) for 150mg, 4.7 (1.3) for 75mg (non-significant), and 2.1 (1.3) for placebo. Solriamfetol significantly decreased ESS scores at week 12 (P < 0.0001 for 150mg and 300mg; P < 0.05 for 75 mg). LS mean change from baseline on the ESS was -6.4 (0.68) for 300mg, -5.4 (0.66) for 150mg, -3.8 (0.67) for 75mg, and -1.6 (0.65) for placebo. Significantly more patients reported improvement on the Patient Global Impression of Change (PGIc) scale with solriamfetol relative to placebo at all doses at week 12 (P < 0.0001 for 150mg and 300mg; nominal P < 0.05 for 75 mg); the percentage of patients who improved was 84.7% for 300mg, 78.2% for 150mg, 67.8% for 75mg, and 39.7% for placebo. Improvements on the MWT and ESS (300mg and 150mg), and on the PGIc (all doses) were observed as early as week 1. The most common treatment-emergent adverse events (TEAEs; ≥5% across all solriamfetol doses) were headache, nausea, decreased appetite, nasopharyngitis, dry mouth, and anxiety; generally, the incidence of the most common TEAEs was dose dependent. One patient in solriamfetol 150 mg group had 2 serious TEAEs of non-cardiac chest pain and anxiety that were considered not related to study drug by the investigator; this patient continued in the study. Discontinuations due to TEAEs were more frequent than placebo in solriamfetol 150 and 300 mg groups.

Conclusions: In this large randomized, placebo-controlled phase 3 study, solriamfetol improved wakefulness and reduced excessive sleepiness in patients with narcolepsy. Safety and tolerability were consistent with the previous phase 2 studies in patients with narcolepsy.

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Introduction: ROHHAD is the acronym for rapid-onset obesity with hypothalamic dysfunction, hypoventilation and autonomic dysregulation. It is a rare and complex syndrome and most of the affected individuals present severe systemic complications and early mortality. Its physiopathology is currently unknown.

Materials and methods: Case description: We present the case of a 7-year-old boy, without any significant medical history, who presents hyperphagia and rapidly increasing weight, hydroelectrolytic disorders, autonomic dysregulation and behavioural changes. Also, a severe daytime sleepiness was one of the first complaints.

Results: Night video-Polysomnography showed a fragmented and poorly efficient sleep, although without evidence of sleep breathing related disorders. The multiple sleep latency test showed two SOREM. Levels of hypocretin-1 in cerebrospinal fluid were found to be low (52.8 pg / ml). The patient’s symptoms have progressively worsened with the evidence of severe hypoventilation during sleep in a second PSG performed two years later. At this moment there is no evidence of the other symptoms of Narcolepsy.

Conclusions: The presence of secondary narcolepsy with cataplexy has been described previously in only one patient with this syndrome. Our patient presented a severe daytime sleepiness at the onset of the disease. The results of the sleep studies suggested a Narcolepsy without cataplexy and preceded in two years the ventilatory disorder (central hypoventilation). The development of narcolepsy in the course of this disease may be explained by the hypothalamic dysfunction and could support the autoimmune theory as a possible cause of the ROHHAD Syndrome.
EVIDENCE FOR A NARCOLEPSY SPECTRUM DISORDER IN FAMILY MEMBERS OF PATIENTS WITH TYPE 1 NARCOLEPSY

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Introduction: The existence of a narcolepsy spectrum has been suggested in family members of patients with narcolepsy, but this has never been confirmed through systematic evaluation using sleep study and hypocretin evaluation.

Materials and methods: Narcolepsy cases (n=496) were identified among 5,462 patients visiting the Peking University People’s Hospital Sleep Center from 09/01/2012 to 12/03/2014, including 307 children (< 18y) meeting inclusion criteria. Two hundreds and one families (66%) with at least one parent available accepted further evaluation. The resulting 378 parents underwent HLA typing, polysomnography, multiple sleep latency test (MSLT), and questionnaire evaluations. CSF hypocretin-1 was tested in 4 subjects. Three subjects with a positive MSLT underwent a second MSLT for confirmation.

Results: We found 3 parents (0.8%) with narcolepsy-cataplexy (100% DQB1*06:02) and 9 with a positive MSLT but no cataplexy (78% DQB1*06:02). In the 6 parents tested for CSF hypocretin-1 level, two cases (one with and one without cataplexy) had low CSF hypocretin-1 (≤110 pg/ml), and one case without cataplexy had intermediary level (153 pg/ml). Repeat PSG-MSLT was positive in 2 of 3 relatives retested. Further analysis suggests that between 2 (0.5%) and 6 (1.6%) of the 9 subjects with narcolepsy but no cataplexy have hypocretin deficiency.

Conclusions: In parents of patients with cataplexy, 0.8% has narcolepsy-cataplexy, and an equivalent or larger number (0.5-1.6%) have mild type 1 narcolepsy without cataplexy due to hypocretin deficiency. These results substantiate the hypothesis that some subjects with hypocretin deficiency do not have cataplexy, and that subjects with cataplexy are the extreme of a disease spectrum. Mild symptomatology may explain why these subjects are rarely diagnosed in sleep centers.

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DEPRESSION AND DISTURBED NIGHTTIME SLEEP IN PATIENTS WITH CENTRAL DISORDERS OF HYPERSONOMLENCE

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Introduction: Narcolepsy type 1 (NT1), narcolepsy type 2 (NT2) and idiopathic hypersomnia (IH) are central disorders of hypersomnolence where the main complaint is the inability to stay awake and alert, not caused by insufficient sleep or misaligned circadian rhythms. NT1 is a rare neurologic disorder characterized by 5 major symptoms: excessive daytime sleepiness (EDS), cataplexy, hypnagogic hallucinations (HH), sleep paralysis (SP) and disrupted nightlife sleep (DNS). Since most of the studies focused in NT1, it is import to compare comorbidities and clinic spectrum among these groups.

Objectives: Describe demographic data and compare the clinical spectrum, including psychological tests and PSG-MSLT parameters of patients diagnosed as NT1, NT2 or IH in our center.

Materials and methods: 30 consecutive patients diagnosed with NT1, NT2 or IH by the sleep unit of clinical neurophysiology service. Diagnosis was made according to the criteria of the ICSD-3. Data was obtained from the digital clinical history: demographic and anthropometric data [body mass index (BMI) non-obese < 30 kg/m², obese ≥30 kg/m²]; scores on sleep-questionnaires [Epworth Sleepiness Scale (ESS) {no EDS ≤10, mild (11-15), severe (≥16)}; positive Ullaniinna Narcolepsy Scale (UNS) (≥14); Insomnia Severity Index (ISI) to evaluate the presence of DNS {no insomnia ≤7, subthreshold (8-14), moderate-severe (≥15)}]; psychological tests [Beck depression inventory II (BDI-II) {no-mild ≤19, moderate-severe (20-63)}; the state-trait anxiety inventory (STAI) considered positive above 50th percentil by sex and age]. We also looked for the presence of the symptoms from the pentad and HLA results. Parameters were obtained from a diagnostic nocturnal PSG-MSLT reports recorded in drug-free patients. We made the analyses through Sigmat-plot 10.0, parametric with ANOVA test and no parametric with Mann-Whitney.

Results: From our cohort, 6 were diagnosed as NT1, 14 as NT2 and 10% as IH. Sex distribution was 22 females and 8 males. Further analysis of mean age at diagnosis reveal NT1 patients were older compare to NT2 (p=0.010) and IH (p=0.014). Obesity was present in 16.7% of NT1 category, 0% NT2 and 20% IH. About sleep questionnaires, 100% of the patients reported EDS as mild to severe (ESS: 18.6, 15, 16.7). UNS was higher in NT1 (p<0.002). DNS measure trough ISI show moderate-severe insomnia in 83% of NT1 group, 29% NT2 and 80% IH. In terms of psychological tests, 44% of the cohort who score for moderate-severe depression was from NT1 group and 28% from NT2 and 28% IH. Anxiety state/trait in NT1 was (66.7 and 66.7%), NT2 (42,9 and 21,4%) and IH (70 and 60%). When counting the pentad, N1 patients had experienced a mean of 4 symptoms compare to NT2 2 (p=0.001) and IH 3 (p=0.022).

Conclusion: The clinical spectrum and neurophysiological studies results may overlap in patients with central disorders of hypersomnolence.

Acknowledgements: Almevan
**Introduction:** Narcolepsy is a rare neurological disease with excessive daytime sleep and cataplexy. Although the brain anatomy is normal by routine MRI examination, some functional dysfunction may be potential. Dopaminergic network is composed of many brain areas, such as middle frontal gyrus, inferior parietal lobe and so on. These brain areas serve dopamine as the main neurotransmitter, being involved in many neuro-cognitive activities. Dopaminergic network plays an important role in the homeostasis of sleep-wakefulness cycle. While many studies have investigated malfunction of dopamine in narcolepsy. Here we focus on the differences in brain dopaminergic network between narcolepsy and healthy cases by resting fMRI.

**Materials and methods:** 10 narcolepsy cases with age between 18-50 years were involved, another 10 healthy participants with age- and sex- matched were included as control. All the narcolepsy cases and healthy participants were underwent resting BOLD fMRI. Two-sample T test were used to test for differences in brain fALFF and ReHo between narcolepsy cases and healthy participants.

**Results:** Over activation in bilateral middle frontal lobe and post cingulate gyrus were seen in both brain fALFF and ReHo between narcolepsy cases and healthy participants.

**Conclusions:** Over activation in bilateral frontal lobe and cingulate gyrus were found in healthy participants compared with narcolepsy cases. Since frontal lobe and cingulate gyrus are composition of dopaminergic network, it is suggested that failure in dopaminergic network may play an important role in the pathogenesis of narcolepsy.

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Introduction: Narcolepsy onset usually occurs most typically adolescent teenagers juvenile with irrepressible excessive sleepiness. There are unsatisfied curative effects all over the world based on little data on epidemiological study and clinical characteristics. The author tried to show epidemiological study and clinical characteristics analysis on 366 patients in Gang’anmen Hospital these years to analyse the epidemiological and clinical characteristics of these patients.

Materials and methods: Data of 366 narcolepsy patients who had been diagnosed in clinic from January in 2013 to 2016 have been reviewed.

Results: Data of narcolepsy patients shows no difference between Guang'anmen Hospital and abroad with Ratio of gender and occurrence rate, but younger of age onset.

Conclusions: Narcolepsy is one kind of chronic neural system disease which has complicated symptom and uncertain predisposing factors, So diagnosis in time and combined therapy is the most important to improve patients lifestyle with health management.

Keywords: narcolepsy; epidemiological study; clinical characteristics
Neural Plasticity
O06: Neural plasticity, memory, parasomnia and pharmacology oral abstract presentations

THE EFFECTS OF ACUTE, SHORT-TERM VISUAL DEPRIVATION ON LOW-FREQUENCY EEG ACTIVITY DURING WAKEFULNESS AND SLEEP

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Introduction: Experimental evidence indicates that regional changes in slow-wave activity (SWA, 0.5-4.5 Hz) during NREM-sleep, and in theta activity (5-9 Hz) during wakefulness may reflect local variations in sleep need induced by recent experience-dependent brain plasticity. However, such evidence is mainly based on studies involving the sensorimotor domain. Previous attempts to extend these findings to a purely sensory system -such as the visual system- provided contradictory results. To clarify this issue, here we used high-density (hd-)EEG and highly standardized experimental conditions to evaluate the effects of short-term visual deprivation on low-frequency EEG activity during wakefulness and sleep.

Materials and methods: Twelve healthy volunteers (25.5±3.7 yrs, 6 M) participated to two experimental sessions (order counterbalanced across participants), each lasting from ~2.30pm to ~8.30am of the following day: a visual deprivation (VD) condition, during which subjects were blindfolded, and a visual stimulation (VS) condition. All wake activities were rigorously regulated: in VD, subjects had to listen to audiobooks for ~6 h, while in VS they watched movies for a similar amount of time. All participants slept for ~7.5 h (11.30pm - 7.00am), while their brain activity was recorded using hd-EEG (256 electrodes). Brief test sessions including an auditory psychomotor vigilance test (aPVT) and Likert-scales for sleepiness, alertness and mood were completed every 2 h and ~40 min after awakening. Three 2 min eyes closed hd-EEG recordings were obtained before and after sleep to investigate potential variations in local theta power. Mean SWA, slow wave density (sw/min) and negative amplitude (µV) were calculated for the first 20 min of NREM-sleep. Statistical analyses (paired t-tests) were restricted to an occipital and a centro-frontal region of interest (ROI).

Results: Relative to VS, VD was associated with reduced N1 and REM latency and with increased REM duration and proportion (p< 0.05). No differences were observed in other sleep parameters. No significant differences between VS and VD were observed in aPVT reaction time, subjective sleepiness, alertness and mood either before or after sleep. In eyes-closed wake recordings before sleep, occipital (but not frontal) theta power was higher after VS than after VD (p< 0.03; ~11.00pm) and this difference disappeared after a night of sleep (p>0.23; ~8.00am). During the first 20 min of NREM-sleep, SWA and slow wave amplitude showed no significant differences across experimental condition. However, the density of occipital (but not frontal) slow waves tended to be higher in VS (p=0.09). Additional analyses showed that small (amplitude < 30 µV), occipital (but not large and/or frontal) slow waves were significantly more numerous after VS than after VD (p < 0.02).

Conclusions: Short-term visual deprivation is associated with an occipital decrease in theta activity during wakefulness, and in the density of small, local slow waves during NREM-sleep, likely reflecting local, experience-related changes in cortical plasticity. However, in contrast to previous observations involving the sensorimotor domain, sleep SWA and slow wave amplitude showed no clear changes, suggesting that important regional differences may exist with respect to the morphology of slow waves and their relation to experience-dependent modifications.
EVOLUTION OF MACROSLEEP IN THE ACUTE AND SUBACUTE PHASE AFTER STROKE

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Introduction: A restorative sleep is essential for physical and psychological health. Even though literature is highly heterogeneous, stroke patients mostly tend to have a lower sleep efficiency, reduced N2, N3 and REM sleep, and generally a more fragmented sleep, especially in the acute phase. Crucially, there might be an association between an impaired sleep architecture and impaired cognitive outcome. As such, a poor sleep efficiency, a low amount of N2 and N3 and enhanced wakefulness after sleep onset have been linked to an acute impaired outcome. However, the specific role of macrosleep variations for the long-term recovery is still unknown. Therefore, we aim at observing the evolution of sleep macrostructure at several time points after stroke and relating them to the long-term clinical outcome. We will further apply transitional sleep scoring which might allow a more profound insight into sleep stability.

Materials and methods: We have measured so far 8 adult stroke patients (6m, 2f; age±SEM 50.7±4.0 years; range: 27-60; 5 hemispheric, 2 bithalamic, 1 cerebellar) in the acute (day range: 3-17) and 4 of those patients in the subacute phase (day range: 72-120). We applied high-density EEG during a full night of sleep, and investigated the cognitive outcome by neuropsychological examination. We relate our data also to 2 healthy not-yet age-matched controls (31±2.1 years), having spent one night at the hospital. The transitional sleep scoring method classifies the sleep recording epoch- and time-independently, thereby allowing for a detailed and continuous scoring of sleep stages and transitions throughout the night.

Results: Our very preliminary analysis shows that in the acute phase, stroke patients, as compared to controls, descriptively tend to sleep less (values expressed as means±SEM; 64.3%±3.9 vs. 75.3%±6.5), to be more awake (35.7%±3.9 vs. 24.7%±6.5), to have less N3 (10.6%±1.8 vs. 23.4%±0.5) and presumably less REM sleep (12.1%±2.2 vs. 16.6%±3.8). Patients might exhibit more sleep transitions than controls (211.6±20.7 vs. 157±38.2). In the subacute phase, patients sleep shows non-significant improvements (70.2%±35.1 sleep efficiency, 19.1%±9.5 of N3, 13.9%±6.9 of REM sleep). The classical sleep scoring captured less transitions (211.6±20.7) as compared to the transitional scoring (338.4±42.4) in the acute phase, while the percentage of sleep stayed almost similar (64.3%±3.9 vs. 69.8%±3.6).

Conclusions: In line with current literature, our preliminary results seem to support the evidence that stroke patients may display variations in macrosleep, especially in the acute phase, having a lower sleep efficiency, less N3 and less REM sleep. Our data also show that all-night high-density EEG recordings are feasible in this hospital setting. Furthermore, transitional scoring may provide a more profound insight into sleep stability.

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Neural Plasticity
Board #097: P4 - Tuesday
RELATIONSHIP BETWEEN SUBJECTIVE SLEEP PERCEPTION AND BRAIN MORPHOLOGICAL CHANGES ASSOCIATED WITH CYCLIC MENSTRUAL PAIN IN PRIMARY DYSMENORRHEA

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Introduction: Primary dysmenorrhea (PDM), a viscero-nociceptive stimulation of cyclic nature, may enhance women’s pain sensitivity both within and outside the painful menstruation phase and the severity of experienced PDM pain has been associated with the trait-related abnormal gray matter (GM) changes. Here we investigated if this central reorganization modified the perceived sleep quality in the PDM patients in the pain-free state.

Materials and methods: Self-reported sleep perception was quantified from sleep variables of a structured questionnaire and from a sleep diary kept from the first day of menstrual flow and for a menstrual cycle in 31 PDM women and 31 healthy controls (20-30y, right-handed, non-smoking and non-shift workers without psychiatric, sleep and neurological comorbidity). Voxel-based morphometry (VBM) and regression analyses were used to study the regional GM volume modification between PDM and control participants and to investigate whether regional GM volume changes are associated with the perceived sleep quality.

Results: The PDM group reported a significantly lower perceived sleep efficiency, poorer sleep quality and lower alertness upon morning awakening in their sleep diary throughout the entire menstrual cycle. Moreover, the daytime vitality, daytime alertness, daytime functions and psychological stress are generally worse in women with PDM than those without menstrual complaints across the menstrual cycle, which further is suggestive of disrupted sleep. The PDM subjects also showed a trend to have a higher global score in the Ford insomnia response to stress survey as compared with the control participants. The GM volume of the left heschl’s gyrus, which was negatively correlated with the perceived sleep quality, was revealed to be larger in the PDM than the control participants even in their pain-free state (periovulatory phase). In addition, the alternation of the GM volume of the left heschl’s gyrus was not associated with depressive symptoms or anxiety.

Conclusions: Given that the left heschl’s gyrus involves the primary auditory processing and its cortical thickness has been found to increase in the primary insomnia patients as compared with healthy controls, the observed poorer subjective sleep in the PDM patients may be conceivably associated with their inverse GM volume changes due to enhanced sensory processing that leads them in a perpetual cycle of hyperarousal and increased sensitivity to sensory stimulation.

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MINDFULNESS (VIPASSANA) MEDITATION AND SLEEP ORGANIZATION: A MACRO AND MICRO SLEEP ARCHITECTURE ASSESSMENT

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Introduction: Meditative practices condition brain functions in different ways and at different levels that helps in attaining a perfect mind body harmony. Buddhist meditative practices such as Vipassana meditation utilizes the techniques of mindfulness to enhance self-awareness. As sleep is important to establish health and wellbeing, we have evaluated the changes in sleep architecture brought by Vipassana meditation practice.

Materials and methods: Whole night polysomnography studies were carried out among two groups of Vipassana meditation practitioners (senior meditators, >5 years of daily meditation practice n= 20, 30-60 years of age and in novice meditator group, < two years of meditation practice, n=19, 30-60 years of age), and in non-meditating control subjects (n=19, 30-60 years of age). The sleep architecture differences were compared among those who had a sleep efficiency index more than 85%. Only male subjects were used for the study.

Results: Senior Vipassana meditators showed distinct changes in sleep architecture from that of novice as well as control subjects. It appears that long term practice of Vipassana meditation improves sleep organization as they showed enhanced slow wave sleep and REM sleep states along with concomitant decrease in micro arousals and wake. The senior meditators showed no decline in slow wave sleep even at the age of 60 years whereas the slow wave sleep was significantly reduced among control subjects. Similarly the senior meditators showed significant changes in REM sleep with significantly enhanced REM sleep duration, REM density as well as enhanced Rapid eye movement activity from that of novice and control groups. The spindle -delta dynamics across sleep cycles ( neuroloop gain analysis ) showed a significant reduction of integrated sigma activity as well as delta activity across sleep cycles among senior meditators . The scalp topography of alpha (8-12 Hz), beta (13-30Hz) power across sleep cycles during the first three sleep cycles did not show any between group differences.

Conclusion: On the whole the study summaries that Vipassana meditation, with its greater potential to regulates many physiological and behavioral states help to foster a proper sleep organization. We attribute these changes to the enhanced plasticity events and endocrine regulations achieved through proficient meditation practice.

Acknowledgements: To the funding agencies, CCRYN (Central council for yoga and naturopathy, New Delhi and DST- SATYAM (Department of Science & Technology - under Science & Technology for Yoga and Meditation), New Delhi. To all participants of the study as well as the to VRI (The Vipassana Research Institute), Global Pagoda, Mumbai
Introduction: Sleep is a complex brain state and is necessary for normal functioning during waking. Prolonged wakefulness leads to a homeostatic response manifested in increased amplitude and number of electroencephalogram (EEG) slow waves during recovery sleep. Cortical networks show a slow oscillation when the excitatory inputs are reduced (during slow wave sleep, anesthesia), or absent (in vitro preparations). It was recently shown that a homeostatic response to chemical and electrical stimulations can be induced in cortical cultures.

Materials and methods: We used cortical and corticothalamic co-cultures grown on microelectrode arrays and stimulated them with a cocktail of waking neuromodulators at two different concentrations and recorded their spontaneous firing activity over 24 hours.

Results: We found that recovery from stimulation resulted in a dose-dependent homeostatic response. Specifically, the inter-burst intervals decreased, the burst duration increased, the network showed higher cross-correlation and strong phasic synchronized burst activity in both cortical and corticothalamic cultures. In cortical cultures, spectral power below < 1 Hz significantly increased and the increase was related to steeper slopes of bursts. The power spectrum in corticothalamic cultures showed also an increase in slow frequency power with a shift toward higher prominent peak as compared to cortical cultures. Computer simulation suggested that a small number of clustered neurons can potently drive the behavior of the cortical network both at baseline and during recovery.

Conclusions: This simple in vitro model appears valuable for dissecting network mechanisms of sleep homeostasis. Our findings suggest that the slow oscillation is cortical but the thalamocortical network shapes slow wave activity, both in vitro and in vivo.
Neural Plasticity
Board #099: P4 - Tuesday

CHANGES IN CEREBRAL BLOOD FLOW AFTER A DAY OF WAKING AND A NIGHT OF SLEEP DEPRIVATION

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Introduction: Insufficient sleep causes substantial impairments across cognitive domains in healthy subjects, and sleep deprivation exhibits a rapid antidepressive effects in mood disorders. Here, we tested the hypotheses that a day of waking followed by sleep deprivation would be associated with changes in cerebral blood flow (CBF).

Methods: Thirty-eight right-handed, healthy, adult male volunteers (mean age 22.1± 2.3 years) underwent 3T magnetic resonance imaging (MRI) with a pseudo-continuous arterial spin labeling (PCASL) functional full-brain scan for quantification of cerebral blood flow (CBF). Subjects were scanned in the morning after a night of normal sleep, again after 14 hours of waking, and finally 9 hours later (23 hours after the first scan). Nineteen of the subjects (control group) had a night of normal sleep between the second and third scan, whereas nineteen subjects were sleep deprived (experiment group) under constant supervision. PCASL scans were analyzed and CBF was quantified using SPM8 and in-house scripts. The analyses were corrected for multiple comparisons and blood hematocrit obtained at all time points.

Results: A day of waking was associated with statistically significant (p < 0.05) increases in CBF in the hippocampi, the amygdalae, the occipital lobe, the somatosensory cortices and the anterior aspect of the thalamus (N=38). No decreases in CBF were found, and all observed changes were reversed after sleep (N=19). 23 hours of waking (i.e. after a night of sleep deprivation) was associated with statistically significant CBF reductions in the parietal and frontal cortices and the posterior cingulate, as well as continued increases in unimodal cortices and the anterior cingulate. The most prominent change after sleep deprivation was gross reductions in CBF in the thalamus.

Conclusions: These findings indicate that circadian variability and widespread changes after sleep deprivation in CBF may be robustly measured using quantitative and fully non-invasive flow-weighted MRI. Findings are thought to be of relevance to elucidating the antidepressive effect of sleep deprivation. The findings emphasize the usability of MRI in chronobiology research.

Acknowledgements: The project was run without specific funding. The authors thank the Department of Neurology, Oslo University Hospital for assistance with blood collection and Hct measurements and dr. PW Holmes for help in performing the Hct/T1b-corrections.
Introduction: Stroke alters cortical disinhibition/excitability affecting motor control presumably increasing LMS. This study evaluates all LMS with durations of 0.1 to 10s for affected and unaffected side of early-phase stroke patients.

Materials and methods: LMS from leg activity meters were obtained on 11 patients (average age±SD: 66.3±15, 45% female) at 3-19 days post stroke and compared to normal controls. Average NIH stroke severity scale was 9.7±4(range 4-18). Records were scored using revised PLM criteria that ends a run of LMS whenever the inter-movement interval between onsets (IMI) is too short. This avoids erroneously accepting many closely spaced LMS with too short IMI as classical PLMS.

Results: LMS with IMI< 10 number/hr and standard deviation of duration for stroke patients were larger than for RLS (p=0.03) but PLMS index was less than RLS and did not differ from normal. LMS were greater in unaffected side than affected side of stroke. The difference between unaffected and affected sides in number of LMS with IMI< 10 was high in cortical and subcortical stroke (range:194-752,41-159) and minimal in brainstem stroke (range: -43 to +21).

Conclusions: LMS observed post- stroke are not typical PLMS in their characteristics but are greater in number than for normals. Numbers of LMS packed closely together (onsets< 10 s apart) are excessive and more on the unaffected than affected side for cortical and subcortical but not brainstem stroke. These assessments of LMS with short interval between onsets may provide objective motor output measures of disinhibition/excitability reflecting neural plasticity relevant for post-stroke recovery.
Introduction: Growing evidence suggests that sleep disturbances are common in Alzheimer`s Disease (AD). The nature of such sleep abnormalities and their specificity are still a matter of debate. The aim of the current study is to evaluate the sleep pattern in patients with AD, both subjectively and objectively, using clinical scales, as well as, polysomnographic assessment.

Materials and methods: 20 patients with probable AD, according to DSM-IVR criteria, and 20 healthy age and sex-matched controls were enrolled in the study. They underwent full medical, neurological, psychiatric history and examination, brain MRI, relevant lab investigations, Mini-Mental-State Examination (MMSE), Psychometric Sleep Assessment Instrument-Arabic version (including Pittsburg Sleep Quality Index, PSQI), and all-night polysomnography. Patients only were subjected to Clinical Dementia Rating (CDR) scale.

Results: Psychometric sleep assessment showed significantly impaired sleep quality in AD patients, with prolonged sleep latency, interrupted sleep, increased awakenings, and decreased night sleep time. Polysomnography showed increased sleep latency (SL), decreased sleep efficiency (SE), increased arousal index (AI), increase in stage I and II sleep, with decrease in both slow wave sleep (SWS) and REM. Delayed REM latency was significantly observed, with no significant change regarding REM density, sleep related respiratory events, or periodic limb movements (PLM). Correlation between disease severity and sleep changes did not show significant results.

Conclusions: Sleep is significantly impaired in AD patients, at both the subjective and objective levels. The polysomnographic profile showed impaired sleep efficiency and continuity, with changes in REM parameters, different from those described in normal aging and depression. Such findings raise the awareness about proper sleep assessment and management in AD and the possible role of polysomnography as a surrogate marker, especially in differentiating AD from other confusing conditions, like depressive pseudo-dementia.

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Neurological Sleep Disorders Affecting Sleep
Board #096: P5 - Wednesday
DIFFERENTIAL DIAGNOSIS OF NOCTURNAL EVENTS

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Introduction: Paroxysmal events of simple or complex motor movements during sleep may be epileptic or non-epileptic. The main features of the differential diagnosis of these paroxysmal events are parasomnias and nocturnal seizures (mainly nocturnal frontal lobe epilepsy)(1). Despite the use of polysomnography (PSG) and electroencephalography (EEG) recording in their differentiation, there are still no clear clinical and electrophysiological diagnostic criteria(2,3). On the other hand, sleep disorders of epileptic patients are two times more common than healthy controls(4). Among sleep disorders, obstructive sleep apnea syndrome (OSAS) increases frequency of seizures due to increased hypoxia in patients with epilepsy. OSAS treatment reduces the frequency of nocturnal seizures and interictal discharges(5,6).

Materials and methods: Patient datas in epilepsy and sleep disorder polyclinics of Neurology Department of Dokuz Eylul University were examined retrospectively between January 2014 and February 2017. There were eighteen PSG with EEG recordings that made because of preliminarly diagnose of parasomnia, nocturnal seizures or OSAS.

Results: Evaluation of 18 patient’s data; OSAS was detected in 5 patients and interictal discharges were present in one of them. Intercital discharges were present in the EEG of 4 patients without non-rapid eye movement (NREM) parasomnia or OSAS. 3 patients diagnosed with NREM parasomnia and 6 patient`s PSG was completely normal.

Conclusions: The use of PSG with EEG recording is guiding to make differential diagnose between epilepsy and parasomnia. In particular, the difficulties in distinguishing between nocturnal frontal lobe epilepsy and parasomnias have been shown in many studies in the literature(2,3). It should also be kept in mind that patients with frequent nocturnal seizures need to be questioned in terms of OSAS and evaluate them with PSG is an important factor in reducing seizure frequency.

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Neurological Sleep Disorders Affecting Sleep
Board #060: P3 - Tuesday
A PRE-CLINICAL INVESTIGATION INTO THE POTENTIAL USE OF PITOLISANT AS NEW INTERVENTION FOR SLEEP PROBLEMS IN PRADER-WILLI SYNDROME

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Introduction: Prader-Willi syndrome (PWS) is a rare neurodevelopmental disorder that is linked to genomic imprinting abnormalities. PWS patients suffer from sleep disturbances such as excessive daytime sleepiness (EDS), rapid eye movement (REM) sleep alterations and, in some cases, cataplexy. Here we present a pre-clinical study in which we tested the effects of Pitolisant in a mouse model of PWS, carrying a deletion of Snord116, which presents sleep, feeding and metabolic abnormalities. Pitolisant is an inverse agonist of histamine 3 receptor (H3R) and, recently, has been proposed as new therapeutic intervention for EDS and narcolepsy.

Materials and methods: We characterized sleep architecture in PWS (PWScr^{m+/p-}) mutant mice compared to wild-type littermate controls (PWScr^{m+/p+}). In particular, we recorded EEG/EMG and temperature profiles before and after injection of Pitolisant or placebo in both groups. Mice were constantly monitored for a total of 48 hours, starting at the beginning of light-off phase (active phase). Pitolisant (20mg/Kg)/placebo was injected after 24 hours of baseline profiling, and mice were monitored for additional 24 hours.

Results: In this new study, mutants treated with Pitolisant presented a reduction of non-REM sleep during the active phase (i.e. dark phase, the 12 hours immediately following the injection). This latter effect on sleep was present also in wild-type PWScr^{m+/p+} mice, in which REM sleep was almost suppressed during active phase and wakefulness was significantly increased. On the other hand, the wake promoting effect of Pitolisant disappeared during inactive phase (i.e. light phase, from 12 to 24 h after pitolisant/placebo injection) in both genotypes. Moreover, the baseline increase in REM sleep characteristic of PWScr^{m+/p-} mice, already described in our previous paper, was abolished after Pitolisant administration. Surprisingly, a significant reduction of body temperature was observed after Pitolisant injection, for the first 6h, in both groups of animals. Placebo did not show any affect in sleep-wake cycle and body temperature in both groups of mice investigated.

Conclusions: Our preliminary results demonstrate that Pitolisant enhances wakefulness and reduces EDS during the day in PWS mice. Moreover, the effects on REM sleep may be mediated by alteration of the core body temperature. Therefore, further investigation is necessary to clarify the direct or indirect control of sleep by Pitolisant, as well as its clinical use to ameliorate the quality of sleep in PWS patients.
Introduction: Prader-Willi syndrome (PWS) is a paternally imprinted disorder that leads to sleep and feeding alterations. In our study we have investigated the role of the hypothalamus in PWS mice carrying a paternally-inherited deletion of the small nuclear ribonucleic acid (RNA)-116 (SNORD116), the main genetic defect associated with the human syndrome. The hypothalamus represents the main regulatory center for feeding behaviour and sleep processes. In particular, two specific neuronal populations of the lateral hypothalamus (LH), the melanin concentrating hormone (MCH) and orexin/hypocretin (OX) neurons, regulate both sleep-wake cycle and feeding behaviour. Therefore we tested the hypothesis that MCH and OX represent a key regulatory mechanism in the pathophysiology of PWS. Thus, we characterized firing patterns and neural dynamics in the (LH) in relation to the sleep-wake cycle in a mouse model for PWS. Our mutants present a micro-deletion of the Snord116; significantly, Snord116 is highly expressed in the hypothalamus.

Materials and methods: To investigate whether the MCH (Precursor of MCH (Pmch) and its receptor MCH receptor 1 (MchR1)) and OX systems (prepro-Orexin (Ppox) and its receptors OX receptor 1 (OxR1) and OX receptor 2 (OxR2)) are altered in PWS, we perform total sleep deprivation for 6h. Then we assessed gene expression profiles from PWScr<sup>m+/p</sup>− and wild-type PWScr<sup>m+/p</sup> tissues at three time points: during baseline (T0), after a sleep deprivation (T1) and after 2hr of sleep deprivation (T2). In particular we studied hypothalamus (Hy) as well as parietal cortex (PC) and frontal cortex (FC). Moreover, we recorded single unit activity (SUA) in the LH, using tetrode-based in vivo recordings. The recordings followed baseline (T0sua), the last hour of SD (T1sua) and the first hour after SD (T2sua). Simultaneously, EEG/EMG electrodes were implanted to assess sleep-wake cycle.

Results:

Gene expression: MCH systems: At T1, an increase of Mchr1 was observed in PWScr<sup>m+/p</sup>− compared to PWScr<sup>m+/p</sup> (p= .012). At T2 the whole MCH system was found increased in PWScr<sup>m+/p</sup>− locally, in the Hy, compared to PWScr<sup>m+/p</sup>.

OX systems: At T0 Ppox (p= .04) and its receptors were increased in PWScr<sup>m+/p</sup>− relative to PWScr<sup>m+/p</sup>+. At T2, we found that Ppox in the hypothalamus (p= .045) and Ox1R and Ox2R in the PC and FC, were significantly altered in PWScr<sup>m+/p</sup>− relative to PWScr<sup>m+/p</sup>+. 

SUA: we identified various firing patterns of the LH that accurately respond to specific sleep-wake stages across conditions (i.e. T0sua, T1sua, T2sua). Moreover, we observed that the percentage of sleep-dependent neurons in PWScr<sup>m+/p</sup>− mice were negatively correlated with the percentage of time spent in sleep. We also reported a significant decrease in the firing rate in sleep-active neurons in PWScr<sup>m+/p</sup>− compared to PWScr<sup>m+/p</sup>+. 

Conclusions: These results suggest that MCH and OX systems are altered in PWS. In addition, a different sleep-dependent neuronal activity in the LH was observed in our mouse model, suggesting that specific neuronal assemblies within this region encode for the main symptoms of the PWS. Our preliminary results indicate that MCH and OX systems can be the target for the development of specific interventions in PWS.
Introduction: Multiple sclerosis (MS) is an autoimmune disease of the central nervous system (CNS) that causes myelin destruction and axonal damage in the brain and spinal cord. Previous studies suggest that multiple sclerosis patients have higher frequency of sleep disorders comparing to healthy controls and that sleep disorders contribute to the development of fatigue which is a common and debilitating symptom of MS. Although, peripheral and CNS immune mechanisms are the mainstay of the MS pathophysiology, which also contribute to the development of fatigue and sleep disturbances, the impact of MS immunomodulatory therapy on sleep of MS patients remains unknown. The aim of this study was to determine sleep and fatigue characteristics in MS patients and their correlation to immunomodulatory treatment.

Methods: A cross-sectional self-report survey of 39 MS patients (27 females, mean age 40.97 +/- 9.17 years) and 21 controls (13 females, mean age 41.86 +/- 10.60 years) was conducted. Out of 39 consecutive MS patients enrolled, 29 received immunomodulatory therapy and 10 were treatment naïve. All subjects completed standardized Croatian version of Epworth Sleepiness Scale (ESS), Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), STOP-Bang Questionnaire, Restless Legs Syndrome Rating Scale (RLS-RS), Modified Fatigue Impact Scale (MFIS) and Fatigue Severity Scale (FSS).

Results: Statistically significant difference between MS patients and controls was observed in RLS-RS score (median 4 vs. 0, p=0.015), total MFIS score (median 23 vs. 12, p=0.020) and MFIS-F score (median 13 vs. 7, p=0.011). Also, treatment naïve patients had significantly higher RLS-RS score comparing to treated patient group (median 14.50 vs. 0, p=0.015). No statistically significant difference between treatment naïve and immunomodulatory treated patient group was observed in Expanded Disability Status Scale (EDSS) (median 1.50 vs. 1.50, p=0.437). Positive correlation was found between EDSS and total MFIS score (rS = 0.367, p=0.050), MFIS-F (rS = 0.476, p=0.009) and FSS score (rS = 0.414, p=0.025) in treated patient group, while for non treated group there was no statistically significant correlation between the clinical parameters and questionnaires.

Conclusion: Results of this study confirm previous findings that RLS is more frequent in MS patients than non-MS population. Novel finding of this study is that immunomodulatory treatment might have beneficial influence on development of RLS in MS patients. As all available immunomodulatory therapies abrogate only peripheral autoimmune response, remaining neurological deficit measured by EDSS in treated MS patient reflects chronic compartmentalized CNS inflammation and neurodegeneration and these processes might be important in development of fatigue.
Neurological Sleep Disorders Affecting Sleep
O04: Neurological sleep disorders affecting sleep oral abstract presentations

AGENESIS OF THE CORPUS CALLOSUM: EFFECT ON SLEEP ARCHITECTURE

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Introduction: The effect of agenesis of the corpus callosum agenesis (ACC) on sleep architecture is unclear. Conflicting results have been published. One study showed increased stages N3 and REM sleep in 4 patients, whereas another showed decreased slow wave sleep (SWS) and REM in 2 patients. Based on our observations, we hypothesized that patients with ACC have increased stage N3 and reduced REM sleep.

Materials and methods: We performed a retrospective chart review of nocturnal polysomnograms (NPSGs) of all patients with ACC between August 2004 and May 2017 at an academic tertiary care hospital with an accredited sleep disorders center. Exclusion criteria were age < 2 or > 18 years, non-discernible sleep stages, structural abnormalities other than ACC, study other than full-night PSG. Of 14,413 NPSGs, we found 22 with ACC, 11 of which met exclusion criteria. We noted the sleep architecture, total sleep time, sleep latency and associated parasomnias of these patients. We then compared the findings to 2 sets of controls. The first set of controls, labeled “contemporary matched controls,” were subjects matched for age, gender and body mass index (BMI). The second set of controls, labeled “historical normal,” were normative values reported in the literature by Williams et al. (1974). For these, we included only those 8 subjects ≥ 3 years because of the lack of historical data on children < 3 years. We then performed a Student’s t-test to compare the data sets.

Results: The subjects had a mean of 38.7 ± 13.8% (S.D.) stage N3 sleep and 17.4 ± 9.1% REM sleep. The matched-controls had a mean of 28.3 ± 8.3% N3 sleep and 25.1 ± 5.0% REM sleep. Of the 8 subjects ≥ 3 years old, the mean Stage N3 sleep was 40.8 ± 13% with 15.1 ± 19.3% REM sleep. The historical-controls had a mean of 20.1 ± 1.3% stage N3 and 29.05 ± 1.1% REM sleep. The ACC subjects had a mean BMI = 15.3 ± 1.35 kg/m² and AHI = 3.5 ± 1.85. The matched-controls had a mean BMI = 16.2 ± 2 kg/m² and AHI = 3.5 ± 1.85. ACC subjects had increased Stage N3 sleep compared to contemporary matched-controls (p < 0.05) and normal historical-controls (p = 0.001). Their REM sleep was reduced compared to contemporary matched-controls (p = 0.02) and normal historical-controls (p = 0.001).

Conclusions: Stage N3 sleep appears to be increased and REM sleep is decreased in those with ACC compared to normal children and to patients matched to age, gender, BMI and SDB severity. A prospective study of ACC subjects will be needed to confirm these findings.
**Neurological Sleep Disorders Affecting Sleep**

**Board #098: P5 - Wednesday**

**BRAIN IN PAIN: PREVALENCE OF SLEEP PROBLEMS IN A UNIVERSITY-BASED HEADACHE CLINIC**

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**Introduction:** Chronic migraine is a common medical condition affecting more than 2.4% of the general population. Sleep problems have been identified as a modifiable risk factor for progression from episodic to chronic migraine. There is a high self-reported prevalence of sleep disturbances in patients with any headache diagnosis, especially in chronic migraine and medication overuse headache. The relationship between headaches and sleep is poorly understood. The primary objective was to study the frequency of sleep complaints with specific headache diagnoses in patients presenting to a university-based tertiary care headache clinic.

**Materials and methods:** All new patients at a tertiary headache clinic complete a detailed patient intake questionnaire prior to their first visit. This questionnaire contains a section on sleep symptoms and previous sleep disorder diagnoses. We asked, "Do you have any problems that interfere with getting good sleep? Please select all that apply: •Insomnia •Trouble falling asleep •Trouble staying asleep •Waking up not feeling refreshed •Frequent awakening •Sleep apnea •Narcolepsy •Hypersomnia •Other” The patient’s clinical diagnoses under IHS beta-3 was included for the analysis.

**Results:** Of the 1721 patients included, 1156 (67.2%) endorsed “any difficulty with sleep”. Demographics: Women 76.5%, ages 25 to 64 in 81.7%, employed in 59.7%, below high school education 4.7%. The most common sleep problems reported were: Waking up not feeling refreshed (725, 63.8%), Trouble staying asleep (698, 61.4%), Trouble falling asleep (652, 57.3%), Frequent awakening (605, 53.2%), Insomnia (383, 33.7%), Sleep apnea (163, 14.3%). There was no difference in some characteristics of those reporting sleep problems vs. those that did not including gender: female 67.5% vs. male 64.4%, employed 61.6% vs unemployed 71.2%. Certain headache diagnoses were much more common in patients reporting sleep problems: Chronic migraine (71.9% vs 52.3%), Medication overuse headache (55.4% vs 42.3%), Post-traumatic (9% vs 3.4%) and Cervicogenic headache (9.9% vs 6.3%).

**Conclusions:** A large majority of the patients presenting to our university-based headache clinic have sleep complaints, especially waking up not feeling refreshed, trouble staying and falling asleep, and frequent awakenings. In spite of having insomnia symptoms, patients did not report insomnia as frequently. The majority of patients with sleep complaints were more likely to have chronic headache. It is important to pay attention to sleep comorbidities associated with headache, since sleep disorders have been identified as modifiable risk factors for migraine progression. These results suggest that sleep assessment and treatment should become an integral part of specialty headache care.

**Acknowledgements:**
Introduction: Vagus Nerve Stimulation (VNS) is used with relative frequency for the treatment of medically refractory epilepsy. VNS devices function by activating an electrical impulse for a set duration of time followed a set duration of inactivity. A known adverse effect of VNS is obstructive sleep apnea (OSA). The mechanism by which VNS improves seizure or triggers sleep apnea has not been completely elucidated. Autonomic changes are seen during obstructive apneas as demonstrated by reduced heart rate variability (HRV). Similar changes may be seen with VNS.

Methods: A retrospective review of polysomnography data was performed for subjects < 20 years of age, diagnosed with epilepsy, and treated with VNS from January 1, 2006 to July 31, 2016. EKG data was collected from the studies and categorized based upon sleep stage (N2, N3, or REM) and whether the VNS was in a period of activation or inactivity. HRV was computed for time domains including the standard deviation of beat to beat (RR) intervals (SDRR, ms), the standard deviation of the successive difference between adjacent RR intervals (SDSD, ms), the root mean square of the successive difference between adjacent RR intervals (RMSSD, ms), and the proportion of successive RR intervals that differ by more than 50 ms (pRR50, %). Due to the short duration of VNS activation, frequency domains were not reliable. The data were analyzed using three-way mixed model ANOVA.

Results: 10 subjects were included (6 males, 4 females). The average age was 11.51 years. HRV values are reported during VNS activation vs VNS inactivity: SDRR during N2 (27.23 ± 4.88 standard error of the mean (SEM) vs 39.70 ± 4.88 SEM, p < 0.0001), N3 (24.50 ± 4.92 SEM vs 31.87 ± 4.93 SEM, p < 0.0001), and REM (23.46 ± 4.95 SEM vs 34.43 ± 4.95 SEM, p < 0.0001), SDSD during N2 (31.14 ± 7.13 SEM vs 41.98 ± 7.13 SEM, p < 0.0001), N3 (28.23 ± 7.19 SEM vs 34.17 ± 7.19 SEM, p < 0.001), and REM (23.23 ± 7.22 SEM vs 29.75 ± 7.23 SEM, p < 0.001), RMSSD during N2 (29.92 ± 6.95 SEM vs 41.80 ± 6.95 SEM, p < 0.0001), N3 (27.23 ± 7.01 SEM vs 34.02 ± 7.01 SEM, p < 0.0001), and REM (21.49 ± 7.04 SEM vs 29.69 ± 7.04 SEM, p < 0.0001), and pRR50 during N2 (10.23 ± 3.18 SEM vs 15.69 ± 3.19 SEM, p < 0.0001), N3 (8.81 ± 3.20 SEM vs 12.64 ± 3.20 SEM, p < 0.0001), and REM (5.40 ± 3.21 SEM vs 7.09 ± 3.21 SEM, p < 0.05).

Conclusion: HRV as measured by time domain indexes decreased during VNS activation compared to time of VNS inactivity. This was true for all sleep stages. The presence of HRV changes occurring during VNS activation may suggest that VNS induced autonomic changes have a role in the pathophysiologic mechanism of obstructive apnea in patients with VNS. Additional studies are needed to further explore the relationship between OSA and VNS therapy.

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**Neurological Sleep Disorders Affecting Sleep**

**Board #064: P3 - Tuesday**

**PREVALENCE OF PERIODIC LIMB MOVEMENTS DURING SLEEP AMONG MULTIPLE SCLEROSIS PATIENTS: POTENTIALLY BENEFICIAL EFFECT OF BACLOFEN AND GABAPENTIN**

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**Introduction:** While association of multiple sclerosis (MS) and restless leg syndrome is well-documented, relatively little is known about the prevalence of periodic limb movements during sleep (PLMS) in MS.

**Materials and methods:** Polysomnography data from 99 patients with MS (73% women, mean age = 52 +/- 12 years) in routine clinical practice was retrospectively analyzed for the presence and frequency of PLMS. MS duration since diagnosis, use of disease-modifying therapy, and other concurrent medications were recorded. PLMS index was determined, with values greater than 5 per hour considered as significant.

**Results:** 41 (43%) of the patients exhibited PLMSI >5. Higher PLMSI was associated with increased age (p=0.02), but not duration of disease (p=0.171). No relationship was found between PLMSI and any disease-modifying therapy. Patients treated with baclofen or gabapentin were significantly less likely to have PLMSI>5 ($\chi^2=9.35$, p=0.002 for baclofen, $\chi^2=4.26$, p=0.039 for gabapentin). Use of tizanidine, ropinirole, pramipexole was not associated with PLMSI.

**Conclusions:** Prevalence of PLMS in MS population is higher than among healthy controls, and is correlated with older age, but not duration of disease. Baclofen and gabapentin use was associated with lower rates of PLMS in MS population, suggesting a potential therapeutic benefit, that should be confirmed in a prospective clinical trial setting.
Neurological Sleep Disorders Affecting Sleep
Board #065: P3 - Tuesday
SUBJECTIVE REPORTS OF SLEEP PROBLEMS IN CHILDREN AND YOUTH WITH EPILEPSY - ASSOCIATED WITH OBJECTIVE MEASURES OF SLEEP?

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Introduction: Sleep disturbances are common in children and adolescents with epilepsy (CYWE), and screening for sleep disturbances is recommended. This may include use of questionnaires, e.g. the Children's Sleep Habit Questionnaire (CSHQ), and the Sleep Self Report (SSR). However little is known on the relationship between subjective reports of sleep problems and objective measures of sleep in CYWE. The aim of this study is to investigate associations between reports of sleep problems on the CSHQ and the SSR, and objective measures of sleep (presence of interictal activity - IEA - and/or disturbance of sleep structure) and to estimate the sensitivity of CSHQ toward objective sleep measures in CYWE.

Materials and methods: Participants were 71 children and youth aged 10-18 years with genetic generalized or focal epilepsy referred to a tertiary epilepsy treatment center in Norway. Subjective sleep was assessed by parent report on the CSHQ and self-report on the SSR. Participants underwent a 24 hour EEG recording and IEA was quantified by number of spikes, and sleep structure was assessed by visual inspection by means of a spectrogram - a Fourier analysis with calculation of a frequency-based spectral computation. All data analyses were conducted using SPSS version 23 (SPSS Inc., Chicago, Ill.), and variables were compared by Student’s t-test.

Results: Total CSHQ and SSR scores were significantly higher in CYWE with IEA compared to those without (total CSHQ score 47.5 versus 43.2, p=0.016; total SSR score 22.5 versus 19.8, p=0.033). Total CSHQ score above clinical cut off (>41) correctly identified 72 % of CYWE with IEA. The CSHQ subscales Sleep Onset Delay and Day Time Sleepiness bordered on being significantly associated with IEA (p=0.063 and p=0.087 respectively). The SSR subscales Sleep Behavior and Day Time Sleepiness bordered on being significantly associated with IEA (p=0.074 and p=0.081 respectively). Total CSHQ and SSR scores were not significantly higher in CAWE with a disturbed sleep structure (Total CSHQ score = 45.3 versus 47.7, p=0.226; total SSR score = 22.8 versus 21.1, p=0.169). The CSHQ subscale Sleep Duration bordered on being significantly associated with a disturbed sleep structure (p=0.059).

Conclusion: Subjective sleep complaints are common in CYWE, but the association with objective measures of sleep is questionable. A questionnaire commonly used to investigate sleep disturbances in CYWE do not seem to have sufficient sensitivity towards objective measures of sleep disturbances to be used as a single screening instrument. Larger samples are needed to investigate associations between specific types of subjective sleep complaints and objective measures of sleep disturbances in CYWE.
**Introduction:** There is a high prevalence of type 2 diabetes mellitus (T2DM) and impaired fasting glucose (IFG) among obstructive sleep apnoea (OSA) patients, however local Malaysian data was limited.

**Materials and methods:** This study was conducted to determine the prevalence of T2DM and IFG among OSA patients in a multi-disciplinary sleep clinic. This was a 4-year cross-sectional study conducted in UiTM respiratory clinic. Demographic and anthropometric indices, polysomnographic studies, cardiovascular risks and metabolic profiles from medical records were reviewed. Patients were considered to be diabetic if they were using diabetic medications or/and had clinician diagnosed T2DM. Patients were considered to have impaired fasting glucose if fasting glucose levels more than 5.6 mmol/L without clinician diagnosis of T2DM.

**Results:** A total of 183 OSA patients were included in this study with median age 54 (19) year old, male 62% (n=113), median BMI 36.2 (11) kg/m² and OSA severity; mild 13% (n=24), moderate 26% (n=47) and severe 61% (n=112). The prevalence of T2DM was 49% (n=89), and IFG was 19% (n=34). Median age T2DM and IFG were significantly different from normal fasting glucose (NFG) group ; 55(14) and 56 (19) vs 44 (23), p 0.000 and p 0.005 respectively. Median total AHI of IFG were significantly different compare to T2DM and NFG; 61 (53.1) vs 36 (40.8) and 27 (40.8), p 0.018 and p 0.004 respectively. T2DM and IFG were associated with hypertension compared to NFG; OR 21.3 (6.9-65.3) and 3.9 (1.5-10.2) respectively.

**Conclusions:** There was a high prevalence of T2DM and IFG among OSA patients. However, IFG with OSA presented with highest total AHI score. Therefore, OSA patients with impaired range of fasting glucose should undergo oral glucose tolerance test and HbA1c to determine whether these patients have impaired glucose tolerance or T2DM.
NOCTURNAL EYE MOVEMENTS IN CONGENITAL AND LATE-ONSET BLINDNESS

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Introduction: Since the discovery of periods of sleep characterized by rapid eye movements (EMs), a sleep stage now defined as REM sleep, the question remains unsolved as to whether these are periods with visual-like processes (cortical scanning) or whether they are merely indicative of arousal. We reasoned that if rapid EMs during sleep are indicative of the presence of visual imagery in dreams, they should be absent in congenitally blind subjects, and largely reduced in late-onset blindness.

Materials and methods: We examined 11 blind subjects (3 males, 8 females) and 11 sex- and age-matched normal-sighted subjects (5 males, 6 females; 43.9 ± 14.8 years). Half (five) of the blind subjects were blind from birth (congenitally blind, CB; 40.8 ± 16.1 years) and six lost their vision later in life (late blind, LB; 47.5 ± 14.7 years). In all cases, blindness was of peripheral origin, affecting either the retina or optic tract. Using the two electrooculographic (EOG) signals recoded as part of a polysomnography (PSG) and a previously validated method (Christensen et al, Sleep Med. 2017:33:171-80), we detected periods of EMs in all stages, from lights off to lights on. Further, a post-validation of the detector was conducted, where the automatically identified EM periods were compared to a consensus of manual identification performed by two independent polysomnographic experts throughout the first sleep cycle of three CB and three LB subjects.

Results: Compared to sighted participants, both CB and LB subjects showed significantly less coverage of EMs in nocturnal wakefulness, REM sleep, N1 sleep and N2 sleep. No significant differences in EMs were found between CB and LB subjects. None of the blind subjects showed a coverage value in REM sleep or in N1 sleep higher than the minimum value of the sighted subjects. Post-validation of the detector applied on blind subjects, revealed an overall accuracy of 95.6 ± 3.6% ranging from 87.9 ± 12.1% in nocturnal wakefulness to 99.5 ± 0.6% in N2 sleep. The accuracy of detecting EMs in REM sleep was 98.2 ± 2.8%.

Conclusions: Our results reflect that loss of vision results in stationary eyes during sleep. The hypothesis that rapid EMs reflects visual processes during sleep is corroborated by the results in our CB subjects, who do not report any visual content in their dreams. However, some LB subjects do report visual content in their dreams, although no EMs were present, suggesting that the brain’s ability to reallocate visual areas to other senses happens faster than the subjective feeling of what vision is.
CHANGES IN ABNORMAL BRAIN OSCILLATIONS CAN PREDICT THE EFFICACY OF THERAPEUTICS IN HUNTINGTON'S DISEASE MICE

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Introduction: Disrupted sleep and abnormal brain oscillations are common early features of many neurodegenerative disorders including Huntington's disease (HD). The medications used for symptomatic treatment of HD often affect sleep in normal subjects. To test whether these drugs can correct the abnormal sleep and brain oscillations seen in HD, we treated a transgenic mouse model of the disease (R6/2) with hypnotics, and then monitored the changes in sleep-wake behaviour.

Materials and methods: We treated wild-type (WT) mice and symptomatic R6/2 mice acutely with zolpidem, amitriptyline, or paroxetine (0, 5, 10 and 20 mg/kg for each drug). A subgroup of R6/2 mice was also treated chronically with paroxetine (0 or 20 mg/kg/daily) from a presymptomatic stage of the disease. EEG/EMG was recorded after acute treatments, at the end of chronic treatment period, and two weeks after chronic treatment stopped.

Results: Symptomatic R6/2 mice had abnormally increased amounts of REM sleep during the active dark period that was normalized by all tested drugs. Acute treatment with zolpidem and amitriptyline, but not paroxetine, also suppressed the abnormal low-gamma (25-45 Hz) EEG oscillations seen in R6/2 mice. Chronic treatment with paroxetine, however, prevented the development of abnormal gamma oscillations in R6/2 mice, an effect that persisted for at least two weeks after treatment stopped.

Conclusions: Our results provide evidence that the abnormal sleep and brain oscillatory activity seen in HD mice can be corrected by drugs. This indicates that at least some of the pathophysiological changes are not 'hardwired' in the HD brain. Critically, our data show that the development of abnormal brain oscillations is prevented in HD mice when REM sleep is normalized from an early presymptomatic stage of the disease. This suggests a possible mechanistic link between early disruption of REM sleep and the emergence of abnormal brain oscillations in HD.

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FACTORS ASSOCIATED WITH SLEEP QUALITY IN TURKISH PATIENTS WITH MULTIPLE SCLEROSIS

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Introduction: A limited number of studies have examined the factors associated with sleep quality among patients with multiple sclerosis (MS). The purpose of this study was to evaluate sleep quality and to determine the associations between sleep quality and demographic and health-related characteristics, anemia, fatigue and physical activity in Turkish patients with MS.

Materials and methods: The study was designed as a cross-sectional survey. A total of 105 patients with MS attending a neurology outpatient clinic in Ankara, Turkey were enrolled in this study. Inclusion criteria were patients aged 18 years or older, diagnosed with MS for at least one month, those who were relaps-free for the past 30 days and able to communicate in Turkish. Exclusion criteria were severe comorbidity, major psychiatric disorder, alcoholism, previously diagnosed sleep disorders, pregnancy, lactation, working in the night shift, and clinically unstable condition. The sample included 102 patients (67.6% female). The study was approved by the Hospital Ethical Committee, and written informed consent was obtained from all participants. Data were collected by an information form, the Pittsburgh Sleep Quality Index (PSQI), the Visual Analogue Scale for Fatigue (VAS-F) and the short version of the International Physical Activity Questionnaire (IPAQ-S). Anemia was evaluated by measuring hemoglobin levels. Data analysis were performed using descriptive statistics, Mann-Whitney U test, Kruskal-Wallis H test, Spearman's correlation coefficients and logistic regression analysis. A p value of less than 0.05 was considered as statistically significant.

Results: The mean age of the patients was 36.93 ± 10.50 years (range= 19-75), and the median disease duration was 60 years (range= 1-300). Ninety patients (88.2%) had relapsing remitting MS. The mean global PSQI score was 5.98 ± 3.94, and 52.0% of the participants had poor sleep quality. Approximately 20.0% of the patients had anemia. The global PSQI scores were higher in patients who never smoked or who quit smoking (z = -2.24; p = 0.025), those who had a comorbidity (z = -2.34; p = 0.019), those who had poor self-rated health (z = -2.54; p = 0.011) and patients with low levels of physical activity (z = -2.49; p = 0.013). There were a positive correlation between the global PSQI score and the VAS-F fatigue subscale score (r = 0.39; p < 0.001). The global PSQI score was negatively correlated with the VAS-F energy subscale score (r = -0.32; p = 0.001) and the total IPAQ-S score (r = -0.32; p = 0.001). The multivariate logistic regression analysis showed that the only factor associated with poor sleep quality was a higher VAS-F fatigue score (adjusted Odds Ratio, 1.283; 95% confidence interval, 1.031-1.596), after controlling for potential risk factors.

Conclusions: The results of the study indicated that poor sleep quality was common in patients with MS. Poor sleep quality was also associated with fatigue among patients with MS. A better understanding of risk factors related to sleep quality may facilitate appropriate interventions that improve health outcomes in this population.

Acknowledgements: The authors thank the patients who participated in this study.
Introduction: Temporal lobe epilepsy (TLE) is a prevalent epileptic syndrome with partial complex seizures in adults, and the non refractory TLE patients, despite of their seizures control, still remain with cognitive complaints. The cyclic alternating pattern (CAP) is an EEG pattern in NREM sleep that has been associated with sleep instability. CAP affects the epileptiform activity, and distribution of discharges occurring during the phase A of CAP. The effect of CAP in temporal lobe epilepsies still remains unclear. The aim of this study was to analyze the CAP rate expression in patients with non-refractory TLE compared to a control group of healthy individuals.

Material and methods: This study included 13 patients (7 females and 6 males), aged between 23 and 49 years (mean = 33.8 ± 8.5 years old), with diagnostic criteria for non-refractory TLE. The control group consisted of 13 healthy volunteers (5 females and 8 males), aged between 19 and 53 years (mean = 26.1 ± 9.25 years). All patients underwent a clinical neurological evaluation, and neuroimaging examination. Polysomnograms were performed during a full nocturnal sleep period. Records of sleep pattern were visually sleep/wake staged by two blind, according to the standard American Academy of Sleep Medicine (AASM) criteria, and using visual scoring of CAP after a previous scoring of sleep in accordance with international criteria. The two groups were compared using the Student t-test and confirmed using the Mann-Whitney U-test in cases of data asymmetry. The level of significance was established as 5% with SPSS system.

Results: All subjects in this study exhibited normal sleep efficiency. The sleep parameters were significantly different between patients with non-refractory TLE and control group. Patient group presented a shorter sleep latency, an increase in sleep stage shift, a greater number of arousals, a greater number of arousals in NREM sleep, a longer total duration of arousals, a longer total duration of arousals in NREM sleep, an increase in arousal index and an increase in arousal index in NREM sleep (p< 0.05). The comparison of CAP expression between the groups showed significant differences, particularly in the CAP rate (44.02 ± 5.23 versus 31.83 ± 3; p< 0.001). Patients with TLE had an increased CAP rate and longer duration of CAP time compared to the control group, and the duration of phases A and B did not differ, and no sex difference was identified.

Conclusion: Our results showed that patients with non-refractory TLE have an increase in CAP rate and the duration of their CAP was longer, when compared to the control group. The CAP analysis was applicable in non-refractory epileptic adults, where in increased sleep instability can be linked to rate changes of CAP in our patients with non-refractory TLE. Sleep instability in TLE is associated with epilepsy itself and might express the bidirectional relationship between the epileptic foci and sleep maintenance.
INSOMNIA IN YOUNG CHILDREN WITH ANGELMAN SYNDROME: CHARACTERISTICS AND PHENOTYPE-GENOTYPE ASSOCIATION

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Introduction: Angelman syndrome (AS) is a rare neurological disorder characterized by severe developmental delay, speech and movement impairment and an apparent happy demeanor. Sleep problems are also common in AS. Nevertheless, little is known about this clinical feature. The goal of this study was to assess in young children with AS the frequency and characteristics of insomnia, and to investigate the association between insomnia, genetic mechanisms and other common clinical features.

Material and methods: This was a cross-sectional study. Families of children aged 0-8 years diagnosed with AS at the Corporació Sanitaria Parc Taulí of Sabadell (Barcelona, Spain) were invited to participate. Parents completed The AS Questionnaire. This questionnaire was designed to investigate in young children with AS the main clinical features (newborn information, physical and neurological features) and behavioral characteristics. The study population was divided into four genetic groups (from the most severe to the less severe phenotype): 1- Deletion I (5.9 Mb), 2- Deletion II (5 Mb), 3- UBE3A mutation, and 4- Uniparental paternal disomy/Imprinting centre mutation. Informed consent was obtained in all cases. The study protocol was approved by the institution's research ethics committee.

Results: Overall 24 children have been enrolled. The mean age was 4.9±2.1 years, 50% were boys and 62.5% had seizures. Most children reported insomnia (75%), mainly the first four months of life (61%). Frequent nightwakings occurred in 66.7%. Children with seizures had a similar frequency of nightwaking than those without (73.3% vs. 66.7%, p=1.0). All children with insomnia reported diurnal hypersomnolence. There were no associations between the different genetic mechanisms and the frequency of insomnia (deletion I 66.7%, deletion II 71.4% and other genetic mechanism 87.5%). Interestingly, children diagnosed with AS and auditory hypersensitivity, olfactory hypersensitivity or both were more likely to have insomnia compared with children without (85.0% vs. 25.0%, p=0.035).

Conclusions: Insomnia is frequently reported by parents of young children with AS independently of the genetic mechanism involved. Moreover, it appears that sensory processing impairment may play a role in insomnia problems in children with AS.
OSA IN EPILEPSY: ARE THERE DIFFERENT RISK FACTORS?

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Introduction: Classical risk factors for OSA not always are present un people with epilepsy and SAS. The objective of this study is to analyze the differences between risk factors for people with epilepsy and SAS and other similar group only with SAS.

Materials and methods: A cross-sectional study of adults diagnosed with OSA by nocturnal polysomnography between 2014 and 2017 in the Sleep Disorders Unit. Two study groups were formed: subjects with epilepsy diagnosed with OSA and others with OSA only. For statistical analysis, logistic regression models controlled by potential confounding variables were used.

Results: 66 patients: 50 (75.6%) Epilepsy+SAS and 16 (24.24 %) SAS only. Relative frequencies in obesity (13.6% Vs 86.3 %), hypertension(18.7 %Vs 26%), diabetes (0% Vs 4%), dislipemia (18.7% Vs 22%), polyglobulia (6.25%Vs1 4%) and depression (6.25%Vs 12%) are lower in people with SAS only, there are no statistically significant differences between both groups. In logistic regression models, the group of patients with epilepsy and SAS trend to show a higher risk of severe SAS (OR 2.16) and previous vascular event (OR 3.98) and lower risk of depression (OR 0.48), polyglobulia (OR 0.48), obesity (OR 0.39) and hypertension (OR 0.65).

Conclusions: Patients with epilepsy and SAS show a tendency to present higher risk of severe SAS and previous vascular event than others with only SAS.
More studies are needed to confirm it.
Neurological Sleep Disorders Affecting Sleep
Board #070: P3 - Tuesday

SLEEP DISORDER AND EPILEPSY: COMORBIDITY OR RELATED CONDITIONS

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Introduction: The mutual influence between epilepsy and sleep is seldom taken into account in clinical practice, although its impact may be important. The prevalence of sleep disorders in patients with epilepsy is estimated as two- to threefold in adults when compared with controls. In children this factor maybe even higher. A new aspect is the effect of treating the sleep disorder and vice-versa. For the latter some reports point to the effect of Vagal nerve Stimulation on respiration during sleep. Except for one or two studies in small groups of patients with obstructive sleep apnea as co-morbidity to their epilepsy, nothing is known about the effect of treating the sleep disorder on the epilepsy in the same patient. As a third line center dedicated to epilepsy and sleep disorders we have the possibility to study these mutual aspects.

Materials and methods: Clinical evaluation, night sleep video-EEG monitoring with simultaneous sleep recording.

Results: Patient JvH, male, born 30.03.1989. Complaints: restless sleep, snoring and sleepy during daytime, seizures during the night (tonic generalized, along with "small movements"). Normal findings at examination except for 140 kg body weight. Diagnostic problem: frontal lobe epilepsy (FLE), parasomnia or both? Possibility of the obstructive sleep apnea syndrome (OSAS) as a comorbidity? Other possibilities for the apneas during or outside the seizures? Epilepsy and sleep monitoring revealed FLE with tonic seizures accompanied by apneas due to the tonic contraction of (respiratory) muscles, along with severe OSAS.

Conclusions: The case study demonstrates coexistence of two different apnea types and epileptic seizures during sleep in same patient: one type of apnea is caused by seizures, while another (OSAS) exists as a comorbidity, being an example how important knowledge of possible influences between epilepsy and sleep disorders can be.
SUBJECTIVE AND OBJECTIVE FEATURES OF SLEEP DISORDERS IN PATIENTS WITH ACUTE ISCHEMIC OR HAEMORRHAGIC STROKE

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Introduction: More than one third of stroke patients develop sleep disorders such as sleep apnea, periodic limb movement disorder, insomnia, and hypersomnia. However, scientific sleep data, especially based on polysomnography analysis, in the group of stroke patients are scarce. The aim of the study was to investigate the subjective and objective sleep parameters in the patients with an acute ischemic or haemorrhagic stroke.

Materials and methods: Participants were patients hospitalized in neurology department with diagnosis of ischemic or hemorrhagic stroke. Patients with anamnesis of stroke or another brain lesion, clinically unstable, having aphasia and/or agnosia were not involved. Within the acute period (3-10 days after the first stroke symptoms) they were investigated with questionnaires about sleep complaints and symptoms, Epworth Sleepiness Scale (ESS), National Institute of Health Stroke Scale, Modified Rankin Scale. Patients were included for further polysomnography (PSG) and sleep electroencephalography (EEG) according to these criteria: 1) patients expressing severe sleep related complaints and/or symptoms that are new or have exacerbated after the stroke; and/or 2) patients having the ESS score equal or more than 10.

Results: 66 patients (44 males) with the mean age of 60.3 ± 10.6 years were examined in the acute period of stroke. 33 (50%) patients had at least one or more new or exacerbated sleep complaints and/or symptoms, mostly related to obstructive sleep apnoea (OSA) and insomnia. ESS score median was 5, mean - 5.8 ± 3.4 [0÷15], when ESS ≥ 10 was found in 9 patients. Finally, 13 (19.7% of the whole sample) patients were selected for performing PSG. 12 of 13 patients were diagnosed with sleep disorder: 1 patient got the diagnosis of mild OSA, 1 - central sleep apnoea (CSA), 2 - combination of OSA and CSA, 1 - combination of mild OSA, periodic limb movement disorder (PLMD) and REM sleep behaviour disorder (RBD), 1 - combination of mild OSA and PLMD, 3 - combination of PLMD and insomnia, 3 - insomnia. Majority of patients had diminished total sleep time, inefficient sleep, prolonged sleep onset, increased amount of light (N1 sleep stage) sleep, and frequent arousals. There were no significant relations between type, location or treatment of stroke and various PSG measures, as well as type of a diagnosed sleep disorder. Full sleep EEG of all 12 patients did not reveal any epileptiform activity, only focal slow waves related to the stroke zone.

Conclusions: Half of our acute stroke patients had at least one or more new or exacerbated sleep complaints and/or symptoms, mainly related to OSA or insomnia. In the selected PSG group almost all patients were diagnosed with a sleep disorder, half of them having non-breathing sleep disorder, such as periodic limb movement disorder, REM sleep behaviour disorder and insomnia.
**Neurological Sleep Disorders Affecting Sleep**  
Board #102: P5 - Wednesday  
**SLEEP DISORDERS IN CEREBRAL PALSY CHILDREN**

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**Introduction:** Sleep disorders are a group of syndromes characterized by disturbance in the patient's amount of sleep, quality or timing of sleep. Children with cerebral palsy, are considered to be a population at risk for the occurrence of sleep problems. Sleep disorders in children with cerebral palsy can be caused by endogen and exogen factors. The aim of this study was investigating the relationship between endogen factors and sleep disorders in children with cerebral palsy.

**Materials and methods:** This was analytic descriptive study with cross sectional method. Subject were children with cerebral palsy who met the inclusion and exclusion criteria in Special School for children district of Bandung in Mei-July 2017. Sampling was done randomly. The screening tools for sleeping disorders was Sleep Disturbance Scale for Children (SDSC).

**Results:** There were 52 subjects research. Girls aged 11-14 years was the most subject who had sleep disorders. The prevalence of sleep disorders in 8-14 years cerebral palsy children was 66,7%. In this study insomnia is the most common sleep disorders. The statistical analyzed showed there were not significant association between endogen factor : type of GMFCS, type of motoric disabilities, amount of comorbidities and type of spastic of cerebral palsy with sleep disorders (p>0,05)

**Conclusions:** This study showed no association between cerebral palsy endogen factors with the presence of a sleep disorder.
Introduction: There have been several human studies regarding sleep parameters and their potential relationship with Alzheimer's disease (AD) pathogenesis. In this pilot study we investigated sleep architecture in subjective memory impairment (SMI), mild cognitive impairment (MCI), and AD patients who completed amyloid PET scans prior to assessment of their sleep architecture using WatchPAT® which enables measurements of sleep parameters at home. We hypothesized that patients with AD spectrum disorders or subjects with amyloid pathology in the brain may have more sleep problems.

Materials and methods: From the FLORIAN study at Asan Medical Center, Seoul, Korea, a total of 45 subjects (AD, 16; MCI 17; normal cognition or SMI, 6; and other dementia, 6) were enrolled. The FLORIAN study, as shown on the poster presented by Dr. E Rhee, is an in-house cohort of AD spectrum disorders and other dementia, in which participants completed detailed neuropsychological tests, MRI, 18F-Florbetaben PET, and blood tests. Unexpectedly, around 30% of AD subjects failed to complete the WatchPAT monitoring and finally a total of 38 subjects (AD, 11; MCI 16; normal cognition or SMI, 6; other dementia, 5) completed the study. Quality and quantity of sleep and other sleep architectures were measured overnight by monitoring peripheral arterial tone signal reflecting the sympathetic nervous system activation.

Results: MCI patients showed increase in light sleep time and AD patients slept less on supine position compared to normal control/SMI subjects. When analyzed per amyloid imaging, subjects with amyloid positivity had a tendency to have delayed sleep latency compared to the amyloid negative group.

Conclusions: This pilot study results suggest poor sleep quality in AD spectrum disorders or subjects with amyloid in the brain. Further studies with increased number of subjects and longitudinal follow-up will provide more information of the causal relationship between the sleep and AD pathogenesis.
Introduction: Portable sleep recording devices have been developed to shorten the delay in sleep apnea diagnosis. In stroke patients current AASM guidelines still recommend attended polysomnography (PSG) for the diagnosis of sleep apnea. The aim of this study was to study feasibility and validity of non-attended level III polygraphy (PG) versus level II polysomnography (PSG) in the diagnosis of sleep apnea in a stroke rehabilitation unit.

Materials and methods: Patients of the HOPES study (see clinical trials NCT02748681) positively screened by PG (SOMNOmedics GmbH, Germany) with an Apnea Hypopnea index (AHI) between 15-30/h per time in bed (TIB) subsequently underwent PSG confirmation.

The influence of non-detected wake time periods on OSA classification was studied by comparison of intranight AHI/total sleep time (TST) versus AHI/TIB and the night-to-night variability of the AHI between the two measurements was further assessed with Bland Altman plots.

Results: Thirty eligible stroke patients were included. 90% of PG and PSG sleep studies were performed with acceptable recording quality. Intranight AHI/TST versus AHI/TIB demonstrated no significant differences and a high correlation (p< 0.001; r = 0.931). One AHI diagnosis was changed from moderate to light OSA. The 95% confidence interval of the Bland Altman plots varied from -7.90 to +5.72, which indicates a tolerable scattering. Night-to-night variability showed differences of AHI > 10 in 47% of sleep studies.

Conclusion: Wake time periods not estimated by PG did not alter the AHI classification in an intranight comparison with PSG. There is a relatively high night-to-night AHI variability which is comparable to PSG findings of 65% AHI variability from authors investigating otherwise healthy OSA patients. These findings confirm good feasibility and sufficient validity of level III PG in stroke patients. This guarantees high accessibility of OSA diagnosis in stroke patients during in-hospital rehabilitation and a prompt treatment initiation.
Introduction: Ehlers-Danlos Syndrome hypermobility subtype (hEDS) is a hereditary collagen-vascular disease characterized by joint hypermobility, vascular instability, and chronic pain. Most patients with hEDS report symptoms of sleep and autonomic impairment, however there are limited data on sleep and autonomic measures in a single cohort of patients with hEDS.

Materials and methods: A consecutive series of patients (n=27) were diagnosed with hEDS using the revised Villafranche Nosology. All patients underwent 18-channel video polysomnography and autonomic testing. Sleep parameters were scored according to current AASM criteria. Autonomic testing included measurements of heart rate variability with deep breathing, Valsalva maneuver, and head up tilt table testing at 70 degrees for a minimum of 10 minutes with continuous blood pressure and heart rate analysis. Some patients also underwent evaluation of sweat production with quantitative sudomotor axon reflex (QSART) testing (n=11).

Results: Most patients were young (33.1 ± 16 yrs.), female (76%), and of normal body-mass-index (25.28 ± 5.8 Kg/m²). Seventy percent of patients were diagnosed with obstructive sleep apnea (OSA, AHIM11.6 ± 11.5), without oxygen desaturations (min O₂ 94.7% ± 6.1). Patients had frequent spontaneous arousals (26.2 ± 35.5), prolonged sleep-onset latency (33.5 min ± 28.5) and prolonged wake time after sleep onset (47.0 min ± 36.4). Forty eight percent of patients were diagnosed with postural tachycardia syndrome (POTS) based on tilt table testing, and 50% had a reduced sweat response. Thirty three percent of patients were taking a hypnotic, 26% were taking stimulants, 66% patients an autonomic cardiovascular medication, and 63% of patients were on pain medications.

Conclusions: Mild OSA, POTS, and sympathetic cholingergic impairment was common in our hEDS cohort. Polypharmacy was also common, with all patients taking either a hypnotic, stimulant, cardiovascular medication, or pain medication. Patients with hEDS exhibited frequent spontaneous arousals, the etiology of which deserves further investigation.
INTRODUCTION: Respiratory impairment is the most common cause of morbidity and mortality in patients with inherited neuromuscular diseases (NMDs). Breathing disorders are observed primarily during sleep, due to the occurring changes in respiratory function. Non-invasive ventilation (NIV) during sleep is well-established in treating sleep-disordered breathing (SDB) in these patients. However, studies exploring the relationship between daytime function tests and nocturnal respiration variables have conflicting results. Aim of the study was:
1) to record SDB characteristics in patients with inherited NMDs and to explore possible associations with daytime symptoms and pulmonary function tests
2) to assess the effects of sleep NIV use on daytime respiratory function and its impact on survival.

MATERIALS AND METHODS: Records of patients with inherited NMDs referred to the Sleep Unit of a tertiary hospital ("G. Papanikolaou" General Hospital, Thessaloniki, Greece) during the period 1997-2013 were retrospectively reviewed.

RESULTS: Consecutive patients with inherited NMDs (n=25) were studied. Asymptomatic patients had significantly higher Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP) values (p< 0.05). Age was negatively correlated with mean SpO2 (p< 0.05) and lowest SpO2 (p< 0.05) during sleep and positively correlated with t≤90% (p=0.001) and Apnea Hypopnea Index (AHI) (p< 0.001). Bicarbonate value in arterial blood gases was positively correlated with AHI and hypopneas/h (p< 0.05). Forced Expiratory Volume in the first second (FEV1), Forced Vital Capacity (FVC), MIP and MEP values were not correlated with any respiratory variable during sleep, while peak cough flow (PCF) was positively correlated with mean SpO2 during sleep (p< 0.05).

Patients under NIV during sleep presented with improvements in daytime arterial blood gases after 1, 2 and 3 years, despite the observed decrease in FEV1 and FVC. These changes were not statistically significant, apart from bicarbonate value that was decreased significantly after one year under NIV (p< 0.05). Mean survival was 504.8 (SE:60.9) months for patients who did not receive NIV and 515 (SE:24.5) months for patients under NIV during sleep, with no statistical significance between the two groups.

CONCLUSIONS: In patients with inherited NMDs, low MIP and MEP values could direct physicians to search meticulously for symptoms suggestive of respiratory impairment and nocturnal hypoventilation. Older age, higher bicarbonate value in arterial blood gases and low PCF could be indicative of SDB in these patients. Respiratory function was maintained during the first 3 years studied under NIV and survival was prolonged.
Neurological Sleep Disorders Affecting Sleep
Board #104: P5 - Wednesday

SLEEP IMPAIRMENTS IN PATIENTS OF FIBROMYALGIA

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Introduction: Fibromyalgia patients frequently complain of less and fragmented sleep, resulting day time dysfunction (not feeling fresh after awakening in morning). Patients are having difficulty in falling sleep reportedly due to severe pain. Sleep is complimentary to antinociception. Sleep restored patients report with increase in pressure pain threshold. The present study is undertaken to study various sleep parameters in 30 fibromyalgia patients by using PSQI and ESS questionnaires.
In the preliminary study we have recruited 7 fibromyalgia patients and 7 age and sex matched controls. We are including right-handed patients with above quoted age group and diagnosed (according to ACR-2010), as primary fibromyalgia and referred from Physical Medicine and Rehabilitation and Rheumatology department. Fibromyalgia patients suffering from other chronic diseases (like other pain syndrome, major psychiatric disorders besides depression, autoimmune disease, rheumatic disease) are excluded from the study.

Materials and methods: Sleep parameters like sleep pattern latency, duration, habitual sleep efficiency, sleep disturbances and daytime dysfunction were assessed and determined by using a standardised and validated questionnaire like Pittsburg Sleep Quality Index (PSQI) and we also assessed sleepiness during various daily chores by Epworth Sleepiness Scale (ESS).

Results: The followings trends are seen in the patients of fibromyalgia studied so far: ESS in fibromyalgia shows tendency of dozing mostly after lunch followed by sitting / reading also in sitting inactive during sitting, inactive in public places.
More number of fibromyalgia patients showing global PSQI score are in the range of 7-9. Various sleep parameters like subjective sleep quality: score 2 which is fairly bad, sleep latency score: 3, sleep disturbances score: 2, sleep duration: 5-6 hours daily and Daytime dysfunction: score 2.

Conclusions: Patients with fibromyalgia show poor scoring in Health-related Quality of Life (HRQoL) questionnaire due to pain which leads into gross sleep disturbance per se in terms of latency and duration. This sleep disruption further causes alteration in pain processing mechanism and vicious cycles ensues.

Future directions: We will complete the study with committed number of fibromyalgia patients and later complete data will be statistically analysed for detailed discussion and results. We will also perform Polysomnography with patients with extreme scores and severe sleep impairments.

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SEVERE SLEEP RESTRICTION IN EXPEDITION ADVENTURE RACE COMPETITORS

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Introduction: Expedition adventure racing is a multi-disciplinary ultra-endurance team sport in which individuals competitively self-navigate a route along pre-arranged checkpoints in wilderness locations. Events continue over multiple days, and competitors self-manage the frequency and length of rest during the race. As a result, athletes experience severe sleep restriction during the multi-day races, with expected consequences for cognitive and physical functioning. This study aimed to characterise the sleep-wake behaviour and perceived impairment resulting from restriction during two multi-day adventure races completed in 2015.

Materials and methods: Participants were competitors in two separate multi-day expedition adventure races. Nine athletes (8M, 1F, \( M_{\text{age}} = 38.78 \) years) representing three teams took part in the first race in Australia, and 15 athletes (10M, 4F, \( M_{\text{age}} = 35.36 \) years) representing four teams took part in the second race in Alaska. Sleep-wake behaviour was measured via continuous wrist actigraphy pre-race, during the event, and post-race. Participants also completed self-report measures of sleep disturbance, sleep-related impairment, fatigue (using PROMIS self-report instruments) and cognitive function (NEURO-QOL v2.0) at three time points, relating to the periods pre, during, and post-race.

Results: Participants were on course between six to seven and a half days for the first race. During this time, participants' actigraphically-measured mean total sleep time was 14 hours and 26 minutes (SD = 151 minutes), an average of 134 minutes per 24 hours of the race (SD = 15 minutes). Participants accrued an estimated 33 hours and 46 minutes of sleep debt (SD = 6 hours, 7 minutes) across the race. For the second race, competitors were on course approximately six and half days, and their mean total sleep time was 14 hours and 16 minutes (SD = 199 minutes). On average, participants slept for 143 minutes per 24 hour period (SD = 33 minutes). During the events, individual sleep duration was yoked to that of other team members, but was variable before and after the race, and significantly higher in the 24-hours post-competition. Analysis of self-report measures via repeated measures ANOVAs indicated that although perceived sleep disturbance did not increase during race, participants reported significantly increased sleep-related impairment and fatigue during races, as well as reduced cognitive function.

Conclusions: Expedition adventure racing athletes voluntarily undergo severe extended sleep restriction during events, and represent a unique real-world model of performance and recovery following severe sleep restriction.

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THE EFFECT OF DOUGH (IRANIAN YOGURT DRINK) ON REACTION TIME IN COMPARISON TO WATER IN HEALTHY YOUNG ADULTS

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**Introduction:**

Dough is a drink made from yogurt. Although it has been widely used in Iran and some other countries after main dishes and specially after lunch, few study is available about its effect on cognition.

**Materials and methods:**

Seventeen healthy young adult volunteer who had no sleep deficiency were enrolled in the study sequentially. All of them were invited by the advertisement. Test Of Variable of Attention were used for determining reaction time (and related variables). Assessments were done before and 120 minutes after drinking 250 cc Dough or water. With regard to circadian rhythms Intervention by Dough and water were done in morning and afternoon.

**Results:**

Dough significantly increased reaction time, commission and omission error. These effects were significant in the afternoon when volunteers consumed Dough. Their reaction time changed from 306.8±55.4 to 327.4±67.8 (p=0.024). Also reaction time increased in morning but this change was not significant. No items in Test Of Variable of Attention were changed with water consumption.

**Conclusions:**

Dough consumption can increases reaction time, omission and commission errors. With regard to cognitive effects of Dough, time of drinking and activity after the use should be considered. It may be important because of increasing accidents risks. It's potential use in clinical setting especially insomnia can be considered.

**Acknowledgements:** We would like to thank all individuals, who participated in the study.
SECONDARY TO EXCESSIVE MELATONIN SYNTHESIS, CONSUMPTION OF TRYPTOPHAN FROM OUTSIDE THE BLOOD-BRAIN BARRIER AND MELATONIN OVERSIGNALING IN PARS TUBERALIS MAY BE CENTRAL TO WINTER DEPRESSION

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Seasonal affective disorder is defined as recurrent episodes of major depression, mania, or hypomania with seasonal onset and remission. In this class of mood disturbances, a unipolar major depressive disorder known as winter depression is common in populations living in northern latitudes far from the equator. Winter depression repeatedly occurs in the autumn or winter and remits in the spring or summer, and its etiopathogenesis is currently unknown. However, one can surmise that excessive melatonin production during the reduced duration of daily sunlight in the autumn and winter plays a role in its pathophysiology. Melatonin is synthesized from tryptophan within the pineal gland, which is located outside the blood-brain barrier, and overproduction of melatonin may lead to augmented consumption of tryptophan, from which serotonin is synthesized. As tryptophan is captured from the blood and excessively utilized by the pineal gland, tryptophan blood levels may decline; as such, it is more difficult for tryptophan to pass through the blood-brain barrier and reach the serotonergic neurons as the ratio of tryptophan to the other amino acids that compete for the same transporter to enter the brain is diminished. Thus, less tryptophan is available for serotonin synthesis. Moreover, melatonin is known to modulate thyrotropin expression in the thyrotrophic cells of the pars tuberalis of the pituitary gland, and overproduction of melatonin in the autumn or winter months may cause excessive signaling in pars tuberalis, reducing its release of thyrotropin and resulting in central hypothyroidism. Both conditions reduced serotonin production and central hypothyroidism may cause depression. Furthermore, excessive synthesis of melatonin during the autumn and winter may negatively affect expression of neuromedin U in the pars tuberalis, causing an increased appetite, which is common in winter depression patients. The hypersomnia common in winter depressive patients can be ascribed to excessive circulating melatonin, a hormone that increases the propensity for sleep. Furthermore, central hypothyroidism may also increase sleepiness, as it is known that hypothyroid patients usually experience excessive somnolence. We propose studies to evaluate winter depression patients with regard to the necessity, or not, of offering them an increased amount of tryptophan in their diets during the autumn and winter. We also suggest that the administration of triiodothyronine to winter depressive patients may mitigate their central hypothyroidism.
Introduction: Sleep hygiene was found as an important predictor for sleep quality. People's sleep hygiene can have a major role in their daily function. The purpose of the study was to determine sleep hygiene patterns and sleep hygiene behaviors and factors affecting them in the general population of Doorod, Iran.

Material and methods: In this cross-sectional study, 915 men and 616 women were selected randomly from 25 clusters of different parts of the city. The inclusion criteria were age between 18 and 65 years and living in Doorod. The exclusion criteria were psychiatric disorder and known general medical conditions that affecting sleep. The data collection instruments were demographic questionnaire and Sleep Hygiene Questionnaire, consisted of 13 items about biological rhythm and bedroom environment and behaviors that affecting sleep. Data were analyzed by using SPSS version 16 software.

Results: The highest percentage was obtained for irregular woke and went up from day to day or at weekend and holidays (72.8%). Only 8.9% participants were classified as having good sleep hygiene. The mean age of very poor, poor, moderate, and good sleepers was 32.8 ± 12.4, 31.7 ± 16.4, 38.5 ± 12.8, and 35 ± 13.7 years, respectively. There were significant differences between the age of poor and moderate sleepers and also sleep hygiene patterns with respect to sex, education level and job.

Conclusion: Poor sleep hygiene were more frequent in Iranian peoples and the major problem in sleep hygiene in our study was inappropriate sleep schedule.

Acknowledgements: We would like to thank all patients and their relatives for their participation in the study.
INFLUENCE OF LEGAL DRUGS (ALCOHOL, NICOTINE AND CAFFEINE) ON THE SLEEP OF INDIVIDUALS WITH AND WITHOUT MENTAL DISORDERS

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Introduction: Alcohol, nicotine and caffeine are among the most widely consumed psychotropic substances in the world, and their use in patients with mental disorders is even more prevalent than in healthy individuals. Although psychiatrists have traditionally seen insomnia and other sleep problems as symptoms of mental disorders, growing evidence suggest that sleep problems may also influence the development and course of these disorders. Considering the high prevalence of alcohol, nicotine and caffeine use among the psychiatric population, mental health professionals should be aware not only of the direct influence of these substances on the mental status of patients, but also of the effect these substances may have on sleep, bearing in mind that the latter will also influence the course of mental disorders. This study aims to review literature on the effect of alcohol, nicotine and caffeine on the sleep of individuals with and without mental disorders.

Materials and methods: A search on PubMed and Google Scholar was conducted and the full text of selected articles was reviewed.

Results: In non-alcoholics, evidence shows that acute alcohol intake decreases sleep latency, consolidates and increases the quantity of NREM sleep during the first half of sleep and increases sleep disruption during the second half; total REM sleep time seems to reduce, especially with moderate to high doses of alcohol intake. In alcoholics, both during periods of drinking and in abstinences, several sleep problems are referred, from profound insomnia to excessive daytime sleepiness. Regarding nicotine, most studies indicate that smokers have poor sleep quality and less total sleep time compared with non-smokers. Concerning caffeine, several population-based studies show that daily intake of caffeinated drinks is associated with disturbed sleep and daytime sleepiness. No rigorous studies specifically designed to assess the effect of legal drugs on the sleep of individuals with or at risk of developing mental disorders were found.

Conclusions: The use of legal drugs is associated with sleep problems in individuals without mental disorders. Studies on the effect of alcohol, nicotine and caffeine on the sleep of patients with mental disorders are missing. Given the bidirectional relationship between sleep and mental problems and the high prevalence of legal drug use in the psychiatric population, special attention should be given to the effect these substances may have on the sleep of individuals with or at risk of developing mental disorders.
INFLUENCE OF DISORDER OF BIOMECHANICAL INDICATORS OF A PERSON ON THE DEVELOPMENT OF INSOMNIA

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Introduction: To reveal the influence of biomechanical disorders on the development and course of insomnia.

Materials and methods: The study involved 65 people aged from 24 to 45 years (36 ± 3.1 years). All participants suffered from sleep disorders. Evaluation of the quality of sleep was carried out using PSQI. The patients had no pain syndrome and no significant degenerative-dystrophic changes of the spine were revealed. A vertebro-neurological examination and a visual-optical analysis (VOA) of human statics and dynamics were performed. During the VOA, the symmetry of the spine and extremities and the displacement of the center of gravity were analyzed. In the frontal plane, lines of symmetry were estimated: biauricular, biacromial, bicostal, bicrystoiliacal. In the sagittal plane lines were evaluated: occipital-zygomatic and clavicular-scapular. After this, the patients were divided into two groups. Patients in both groups took hypnotic drugs for two weeks, while patients from the first group (32 people) additionally underwent a course of biomechanical correction.

Results: At the beginning of the study, the average of PSQI was 14.0 ± 2.4 (from 8 to 18). After the course of biomechanical correction in the first group, the following results of changes in parameters were obtained: displacement of the center of gravity along the sagittal and frontal axis significantly decreased from 1.9 ± 0.2 to 1.0 ± 0.2 ° (p < 0.05). A statistically significant decrease in the deviation of the lines of symmetry at the level of the biacromial line was found to be 1.1 ± 0.2 ° from the initial value of 2.1 ± 0.2 ° (p < 0.05). Deviation at the level of the biauricular line: the angle shift before and after the course of biomechanical correction was 3.3 ± 0.3 ° - 1.6 ± 0.2 °, respectively (p < 0.05). There was a change in the position of the upper clavicular-scapular line before the course of manual therapy and after (7.12 ± 0.5 ° and 4.17 ± 0.5 °, respectively).

At the end of the study (after 1 month) the average PSQI value was 6.94 ± 1.6 in patients from the second group. Patients in the first group had 4.86 ± 1.18.

Conclusions: Disturbance of human biomechanics can lead to a decrease of sleep quality. If biomechanical changes lead to the development of a pain syndrome in the back, this will further exacerbate insomnia.
**Objective:** The sleep disorders and disturbances are generally underestimated in patients with epilepsy. The aim of this study is to determine the frequency of sleep disturbances and the comorbidity of sleep disorders in people with epilepsy without any complaints about sleep and relation of SUDEP risk.

**Methods:** Sleep complaints and presence of sleep disorders were assessed with four questionnaires in 119 epilepsy patients, who had any spontaneous complaints about sleep. History about NREM or REM parasomnian features was asked to their relatives or partners. Afterwards, subjective sleep features were evaluated with Pittsburgh Sleep Quality Index (PSQI), the Epworth Sleepiness Scale (ESS), the Berlin Questionnaire for Sleep Apnea and Restless Leg Syndrome (RLS) with International Restless Legs Syndrome Study Group (IRLSSG) severity scale. The patients’ SUDEP7 scores were also determined.

**Results:** One hundred one patients with focal, and 38 patients with generalized epilepsy were evaluated after their consent. The daily sleep quality was poor in 34 (24.5%) patients with PSQI. Daily sleepiness was present in 7 (5%) patients with ESS. Mild or severe RLS was detected in 24 patients (17.2%). Twenty-five patients (18%) had severe sleep apnea risk with the Berlin Questionnaire. The PSQI, ESS, Berlin Questionnaire, IRLSSG, SUDEP7 scores were 4.32 (±2.9), 3.13 (±3.3), 0.42 (±0.7), 1.11 (±3.5), 2.43 (±1.7) respectively in generalized epilepsy patients; and 4.02 (±3.3), 3.6 (±3.8), 0.65 (±1), 1.87 (±4.9), 1.89 (±1.3) in focal epilepsy patients. There were no significant differences between two groups' scores. There was significant relation between PSQI and seizure frequency (p=0.014). Also there was statistically relation between SUDEP 7 scores and PSQI scores (p=0.016).

**Conclusion:** Our results emphasized the magnitude of the comorbidity of sleep disorders in epilepsy patients, even for those who do not have complaints about sleep. There were no differences of sleep features between generalized or focal epilepsy groups. Special care and attention are necessary to determine sleep features in epilepsy patients. Sleep characteristics may also be important when determining SUDEP risk.
Aim: To study the association between incident chronic rhinosinusitis (CRS) and development of sleep problems over a 10 year period.

Method: As part of the Respiratory Health in Northern Europe study (RHINE), a questionnaire was sent to 16500 individuals in five Nordic countries (Sweden, Norway, Denmark, Iceland and Estonia) in year 2000. It included questions on airway diseases, age, sex, BMI, smoking habits, comorbidities, education and sleeping problems assessed by the Basic Nordic Sleep Questionnaire. An almost identical questionnaire was sent to the same individuals in 2010 with a response rate of 53%. CRS was defined according to the European Position paper on Rhinosinusitis and Nasal Polyps (EPOS). A subgroup of 5145 individuals without nasal symptoms in 2000 was studied.

Results: After 10 years 141 (2.7%) of the individuals without nasal symptoms in 2000 had developed CRS. After adjusting for age, sex, BMI, delta BMI, smoking, asthma, gastroesophageal reflux, comorbidities, education, center and sleep problems at baseline, CRS was found to be an independent risk factor for DIS ((adj. OR 95% CI) 2.6 (1.6-4.3)), DMS 1.8 (1.2-2.7), EMA 2.8 (1.8-4.3), EDS 2.7 (1.8-4.0) and snoring 2.8 (1.8-4.4).

Conclusion: CRS is an independent risk factor for developing sleeping problems and EDS.
THE IMPACT OF PEDIATRIC OBSTRUCTIVE SLEEP APNEA ON PATIENT AND FAMILY QUALITY OF LIFE

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Introduction: Little is known about the impact persistent obstructive sleep apnea (OSA) on families. Given the relative high prevalence of this disorder in children, the main goal of this study was to describe and quantify the impact of OSA in children and their families.

Methods: Prospective case series for children with infant and persistent OSA referred to a multidisciplinary Upper Airway Clinic from 2014 to 2016 at a tertiary pediatric center. Patients and family completed validated questionnaires for quality of life, including the Family Impact Questionnaire (FIQ), Pediatric Sleep Questionnaire (PSQ) and the Pediatric Quality of Life (PedsQL) Inventory. ANOVA and Pearson correlation were used for evaluation of the data.

Results: We assessed 68 families. Patients had a mean age of 12.5 years old and 72% were female. The mean obstructive apnea-hypopnea index (oAHI) was 9.7±10.2 (range 0-39.8) and the mean apnea-hypopnea index (AHI) was 10.4±10.5 (range 0.1-39.8). The mean score for the FIQ was 42.9±14.7 (range 7-87) with negative impact subscales of 23.0±2.3 (range 0-31). The latter is similar to the scores seen for children living with developmental disabilities (19.6 to 28.2, SD 5.07-13.07). Negative impact areas included negative feelings about parenting and negative impact on social relationships. There was a weak correlation between the AHI and FIQ scores (r=0.18) but no significant differences by OSA severity as measured by the oAHI (P=0.39) Higher FIQ scores (and poorer quality of life) had a moderate correlation with PedsQL scores (r=0.41). More severe OSA (moderate-severe) was associated with higher mean PSQ scores when answered by patients (29.6±17.5, range 0-74, P=0.036) but not when answered by parents (29.2±13.6, range 3-66, P=0.34). For those children with a sleep study before and after treatment, the PedsQL Inventory completed by the child improved from 44.1±13.8 to 24.2±9.1 (P=0.011); there was weak correlation with OSA severity (r=0.350). The PedsQL completed by parents did not correlate with OSA severity (P=0.945).

Conclusions: OSA negatively impacted patients and their families as reflected by high family impact score. The PedsQL appears to be a more reliable indicator of obstructive sleep apnea when completed by the patient than when completed by their parents.
THE EFFECT OF CLEFT PALATE REPAIR ON POLYSOMNOGRAPHY RESULTS

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Introduction: There is a hypothetical risk that repair of the cleft palate (aka palatoplasty) will worsen or induce obstructive sleep apnea (OSA) in infants and children. However, there is little published information regarding the impact of cleft palate repair on OSA. The goal of this study was to assess polysomnographic (PSG) results for children evaluated before and after cleft palate repair.

Materials and methods: Retrospective case series for children with cleft palates repair was performed between January 2008 to December 2016 at a tertiary pediatric care center. Only children who had preoperative and postoperative PSG were included. Analysis was completed using paired t tests.

Results: 73 children met the inclusion criteria. The mean age was 1.96±0.65 years, (range 0.6-16.4) and 52% (38/73) were female. Pierre-Robin sequence was the most common comorbidity at 62% (45/73). Prior to palatal repair, the mean apnea hypopnea index (AHI) was 12.2±6.2 events/hour, and mean obstructive apnea-hypopnea index (oAHI) was 8.6±4.2 events/hour. The mean oxygen saturation nadir was at 87.5±2.2%, the mean arousal index was 15.5±1.8/hour, and mean sleep efficiency was 76.2±2.6%. After cleft palate repair, there were no significant changes in the mean AHI, which was 6.03±2.16 events/hour (P = 0.067), the mean oAHI which was 5.9±3.2 events/hour (P = 0.302), or mean oxygen saturation nadir was 87.9±4.5% (P = 0.873). The mean arousal index improved to 13.1±1.3/hour (P = 0.02) and mean sleep efficiency increased to 81.7±2.6% (P = 0.002). Prior to surgery, 67% (49/73) of children had an oAHI >1; after surgery, 64% (47/73) had an oAHI >1 (p = 0.727).

Conclusion: There was no significant worsening of sleep parameters in this cohort of children who underwent cleft palate repair.

Acknowledgements: none
**Introduction:** Adolescents comprise one of the highest risk groups for both chronically deficient sleep and drowsy driving-related accidents. Therefore, interventions targeted towards reducing sleep loss in young drivers such as delaying school start times have potentially significant public health implications. We analyzed both school night sleep duration (SD) in 12th-grade students, and driving accidents in 16-18 years old in a large socio-demographically diverse school district in the US before and after a 50-minute delay in high school start times (i.e., 7:20 to 8:10 am) that was implemented in the 2015-16 academic year.

**Materials and methods:** Data regarding self-reported average school-night SD was obtained from the Fairfax County (Virginia) Youth Survey (FCYS), an anonymous survey administered annually to all 8th, 10th, and 12th-grade public school students. SD was based on responses to the following survey item: “On an average school night, how many hours of sleep do you get?” with response options of ≤4 hours, 5, 6, 7, 8, 9, and ≥10 hours. De-identified data on licensed drivers and crash rates (including overall crash rates, distraction, speed, and alcohol-related accidents) for 16-18-year-olds from September through June of each year for both Fairfax County (FC) and the rest of the state were provided by Virginia (VA) Department of Motor Vehicles. A reportable traffic crash was defined as a “crash on a public highway which involves death, injury or property damage in excess of $1,500”.

**Results:** A total of 10,119 and 10,388 12th graders were included in the 2014-15 and 2015-16 FCYSs respectively. Figure 1 shows the percent of 12th graders reporting getting the amount of sleep in each category in 2014-15 and 2015-16. More students in 2015-16 versus 2014-15 (48.1% versus 40.8 %) reported ≥7 hours of sleep (95% CI 1.006-1.02, p< 0.001).

Table 1 shows the 2014-15 and 2015-16 comparisons for crash rate data in FC and the rest of the state. There was a 5.25% decrease in the overall adolescent crash rate in FC between 2014-15 and 2015-16 (95% CI 0.92-0.96; p=< 0.0001). Interestingly, there was also a significant reduction in distraction-related accidents, by 8.7% (95% CI 0.87-0.95; p=< 0.0001) and alcohol-related accidents by 20% (95% CI; 0.71-0.91, p=0.0006). In contrast, there was a small but significant increase in adolescent crash rates in the rest of VA by 3.5% (95% CI 1.01-1.05, p=< 0.0001) but no significant change in the alcohol- or distraction-related accidents in VA between the two academic years.

**Conclusions:** The implementation of a 50-minute delay in high school start times was associated with a significant increase in sleep duration in 12th grade students and a reduction in adolescent crash rates, including distraction-related and alcohol related accidents.
EFFECTS OF PAIN TREATMENT ON SLEEP IN NURSING HOME PATIENTS WITH DEMENTIA AND DEPRESSION - A MULTICENTRE PLACEBO-CONTROLLED RANDOMISED CLINICAL TRIAL

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Introduction: Around 60% of nursing home (NH) patients experience nighttime sleep disturbances and 50-80% of NH patients have dementia. Approximately 60% of NH patients experience pain every day. In this study we aim to investigate the effects of pain treatment on sleep in nursing home (NH) patients with dementia and depression.

Materials and methods: This study is a multicenter, two-armed, double-blinded, placebo-controlled, randomized clinical trial, conducted between August 2014 and September 2016. 106 long-term patients with dementia and depression according to the Mini Mental Status Examination and the Cornell Scale for Depression in Dementia from 47 NHs in Norway were included. Patients received stepwise pain treatment in which those who did not use analgesics were randomized to receive either paracetamol (3 g/day) or placebo tablets; those who already used pain treatment were allocated to buprenorphine transdermal system (max. 10 ug/hour/7 days) or placebo transdermal patches. Sleep was assessed continuously for 14 days by actigraphy, one week of baseline measurement and one week of ongoing treatment. The following sleep parameters were evaluated: total sleep time (TST), sleep efficiency (SE), sleep onset latency (SOL), wake after sleep onset, early morning awakening (EMA) and number of wake bouts (NoW).

Results: In the intervention group (paracetamol/buprenorphine), SE (70% to 72%), SOL (32 to 24 min), and EMA (50 to 40 min) improved compared to the control group (SE, 70% to 67%; SOL, 47 to 60 min; EMA, 31 to 35 min). Treatment effects were significant (p< 0.01, p< 0.05, p< 0.05, respectively).

Conclusion: Compared to placebo, pain treatment improved sleep as measured with actigraphy. This implies that sleep, pain and depression in NH patients should be critically evaluated, and that pain treatment should be considered to be a potentially beneficial treatment.

Trial registration: ClinicalTrials.gov NCT02267057, EudraCT 2013-002226-23

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**Introduction:** Sleep complaints are the most common among shift and night workers. Health of shift workers is often reported to be worse compared to day workers. The aim was to reveal the relations of sleep duration and sleep quality to work load and health complaints among truck drivers in Ukraine.

**Materials and methods:** Forty eight truck drivers (mean age ± SD: 50,8 ± 10,1 years) were observed individually using questionnaire. They worked about 2-week runs to deliver cargo to EU countries. Sleep duration and sleep quality at the working days and also at the days off were self-assessed by 5-anchor Likert scale. Health complaints index (HCI) and pathological index (PI) were calculated by Voytenko’s method from 29 points of the questionnaire. Data were analyzed using Pearson correlation at p< 0,05.

**Results:** Sleep duration and sleep quality at the days off positively correlated to the number of days-on-duty over a year (r=0,24 and r=0,32 respectively). Sleep duration at the days off negatively correlated to the number of night working hours (within 22:00-6:00) over a year (r=-0,28). Sleep quality at both working days and days off negatively correlated to both HCI and PI (r=-0,40; r=-0,35; r=-0,33; r=-0,32 respectively).

**Conclusions:** Work load increase results in the sleep need increase in truck drivers that is realized during the days off. Night working decreases the sleep duration at the days off that could reflect the reduction in the recovery capabilities of a human body. Sleep quality deterioration at both the working days and the days off is associated with the increase in health complaints. Such findings evidence the necessity to improve the hygiene of both the working hours and sleep of truck drivers.

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Introduction: Anxiety is a phenomena that affects mental health and sleep. It is more noticeable at students and high-schoolers, this period being characterized by high level of stress. Physical exercises were proposed to improve the negative impact of anxiety on sleep and cognitive processes.

Materials and methods: Tranversal study on 84 persons (34 medical students from II year, 50 twelfth- graders). There were used 3 questionnaires: Spielberger's The State-Trait Anxiety Inventory, The Pittsburgh Sleep Quality Index, Dijon Score for the level of physical training.

Results: Physical training (PT) - anxiety level - from those with poor PT (7.23 %) - all present severe anxiety (100%), medium PT (51.81%) - severe anxiety (57%) and moderate anxiety (43%), and only in the group with good PT (40.96%) students present normal anxiety level (9%).

Physical training (PT) - sleep efficacy (SE) - the majority of students with good PT have a high SE (86%), group with medium PT shows high SE for all students, and those with poor PT - 25% show a low SE.

Anxiety level - sleep latency (SL) - students with normal anxiety show a medium SL (47%), those with moderate anxiety present a minimum SL (44%) and medium SL (41%), and a number of students with severe anxiety show minimum SL (67%), others increased one (33%).

Conclusions: Sleep latency is increased by the high level of anxiety, whereas the total time of sleep is decreased. Physical exercises reduce anxiety and enhance the sleep quality. Thus, the correlation physical activity- anxiety reduction- improvement of sleep quality, was demonstrated.

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Sleep is important for the body to conserve energy, restore its normal processes, promote physical growth, and support mental development, especially during childhood and adolescence. Some epidemiological studies have described a relationship between the use of some wireless communication devices, mainly mobile phones, and poor sleep affecting daytime functioning. However, most of the studies focused on sleep quality and sleep problems using self-reported questionnaires. The objective of the study is to assess the association between the use of several wireless communication devices and sleep quality and sleep problems using objective and self-reported measurements in adolescents of 17-18 years of age.

We used data from a population-based birth cohort established in Menorca in 1997-1998 (n=485), as part of the Spanish INMA -Environment and Childhood- Project. Self-reported questionnaires were used to assess the use of wireless communication devices when adolescents were 17-18 years of age. Information about frequency and duration of mobile and cordless phone calls, tablet use, and frequency and type of mobile phone use (i.e. watch videos and play games online, call, text, and follow social network sites) the hour before going to bed was collected. Mobile Phone Problem Use Scale (MPPUS-10) was used to assess problematic mobile phone use. Actigraph xGTX3X-BT placed on wrist for seven nights and sleep diaries were used to objectively assess sleep quality at 17-18 years old. Actigraphic sleep outcomes included sleep latency, sleep efficiency, total time in bed, total sleep time, and Wake After Sleep Onset. Moreover, Pittsburgh Sleep Quality Index (PSQI) and its subscales were used to assess sleep problems. Adolescents with data on at least one exposure and one outcome were included in this study (n=258). We performed multiple imputation of missing covariate values and inverse probability weighting to account for missingness and selection bias. Logistic, multinomial logistic, and linear regression models adjusted by parental and adolescent socioeconomic and lifestyle variables were used to estimate the association between the use of wireless communication devices and sleep quality and sleep problems.

Adolescents that made more than one mobile or cordless phone call per week were more likely to have a worse subjective sleep quality than those making less calls [OR=2.88 (95%CI 0.93; 8.97) and OR=2.21 (95%CI 1.07; 4.58), respectively]. Adolescents that reported a higher problematic mobile phone use were more likely to have a worse subjective sleep quality than those reporting no problematic use [OR=3.64 (95%CI 1.32; 10.02)]. Adolescents that used the tablet 30 minutes or more daily were more likely to have lower objective sleep efficiency ($\beta$=-6.63 (95%CI -12.49;-0.77).

This study suggests that higher mobile phone and cordless phone use and problematic mobile phone use are associated with poor sleep quality and that higher tablet use decreases sleep efficiency in adolescents. These results are of special interest because the increasing use of wireless communication devices among adolescents could affect sleep and daytime functioning.
POLYSOMNOGRAPHIC ABNORMALITIES IN SPECIFIC LANGUAGE IMPAIRMENT. CHARACTERISTICS AND INFLUENCE ON CLINICAL EVOLUTION

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Introduction and objectives: Specific Language Impairment (SLI) is a relatively frequent entity of childhood and one of the most important causes of communication disorders in this population. Paroxysmal EEG abnormalities are frequently found in polysomnography (PSG) studies, in most of the cases without associated epileptic seizures. The identification of paroxysmal EEG discharges in PSG studies can be a marker of bad clinical and cognitive evolution and prognosis. We aimed to describe the characteristics and clinical evolution of a population of children with SLI who presented paroxysmal EEG abnormalities in PSG.

Materials and methods: We analyzed the clinical and polysomnographic characteristics of the children referred from the Maturation Unit of University Virgen Macarena Hospital with the diagnosis of SLI in whom paroxysmal EEG abnormalities were identified.

Results: The 31.85% of the children diagnosed with SLI (31 children, 4 girls) had paroxysmal EEG anomalies in the PSG. Of these children, 62.87% had an initial diagnosis of SLI with difficulty for expression and comprehension, 8.57% expressive SLI (SLI-E), 14.29% autism spectrum disorder (ASD), 11.43% SLI vs ASD and 2.85% SLI and deficit disorder attention and hyperactivity (ADHD). The anomalies we identified were focal in 94.29% and generalised in 5.71%; 16.41% of those appeared during wakefulness and sleep and 82.86% exclusively during sleep; all these abnormalities were expressed in NREM sleep, being more expressive in stage 1 and 2 of NREM sleep. The mean follow-up time of these children is 3 years and 8 months, during that time in 31.42% of children the diagnosis has been modified, showing an increase in the percentage of children diagnosed with ASD from 14.29% to 37.14%, which explained the torpid evolution of these patients.

Conclusions: Children diagnosed with SLI may have paroxysmal EEG abnormalities without implying the presence of epileptic disorder. In our studied population these anomalies have a focal predominance and were related to a worse prognosis. These abnormalities were more expressive or even exclusive during sleep, revealing the importance of PSG.
SLEEP DISORDERS IN PATIENTS WITH MULTIPLE SCLEROSIS

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Introduction and objectives: Patients with multiple sclerosis (MS) frequently have unrecognized sleep disorders at higher frequency than the general population. Sleep disorders such as insomnia, sleep related breathing disorder (SBD), periodic limbs movement disorder (PLMD), REM sleep behavior disorder (RBD), narcolepsy and restless legs syndrome (RLS) have been reported; these processes are related to fatigue and poor quality of life in these patients. We aimed to identify the presence of sleep disorders in 60 patients diagnosed with MS and to analyze the demographic and clinical findings of that subpopulation presenting both pathologies.

Materials and methods: A telephone survey was conducted on 60 consecutives MS patients as an initial screening to identify the presence of sleep disorders. Sleep disorders screening scales were used to assess the presence of insomnia, narcolepsy, RLS, PLMD, SBD, RBD, etc. Clinical data were collected from our Multiple Sclerosis Unit database in order to analyze the possible relation between these sleep disorders and MS.

Results: We study 60 consecutives patients (31 female and 29 male) diagnosed with MS: clinically isolated syndrome (CIS) 3.3%, relapsing remitting (RR) 70%, secondary progressive (SP) 20%, primary progressive (PP) 6.7%. The mean age of the studied population was 46 years old, mean follow-up time was 12 years, mean Expanded Disability Status Scale (EDSS) was 3.9, mean annualized frequency of relapses was 0.45. On the first telephone survey 55% of the patients complained of sleep disorder symptoms: CIS 0%, RR 72.7% (57.1 % from the total RR) and SP 18.2% (50% from the total SP), PP 9.1% (75% from the total PP). The initial screening made us to suspected insomnia in 45.5%, PLMD in 12.1%, insomnia + PLMD in 21.2%, RLS 3%, SDB in 6%, SDB + insomnia in 6%, poor quality sleep in 3% and poor quality sleep + insomnia in 3%.

Conclusions: Sleep disorders are more frequent in patients with MS than in the general population and usually are unrecognized. The most frequent are insomnia (41.7%) and PLMD (18.3%). A multifactorial etiology for insomnia associated with MS has been proposed, such as nycturia, spasticity, pain, and depression; therefore sleep disorders are more prevalent in the SP and PP groups. In general women have more complaints regarding sleep problems. The diagnosis and treatment of sleep disorders is important in MS patients, especially considering the fact that sleep disturbance increment fatigue and have a negative impact on the quality of life.
Introduction: Acute partial sleep deprivation has been shown to consistently increase food intake. This study aimed to evaluate the effect of sleep deprivation on food intake in individuals reporting or not binge eating symptoms, controlling for self-reported emotional eating (EE).

Materials and methods: Twenty-eight participants (age $M = 23.75 \pm 4.03$, 21% male), 14 reporting symptoms of binge eating and 14 healthy controls, were assessed before breakfast after a night of habitual sleep and after a night of partial sleep deprivation (5 h of sleep allowed) in a counterbalanced order. They were then offered a large and varied breakfast (sweet and salty food), in which food intake was unobtrusively measured. Food intake throughout the day was also measured via a food diary. Sleep was monitored through sleep diaries and an electronic portable device called Zeo was used to objectively control the compliance to the instructions.

Results: A repeated measures ANCOVA revealed a significant NIGHT*EE interaction. Using a median split, a Low-EE and a High-EE group were created. A repeated measures ANOVAs Night (habitual vs. sleep-deprived) * Group (Low-EE vs. High-EE) revealed a significant Night* Group interaction ($F(1,26) = 4.42$, $p = .045$) and a marginal Group effect ($F(1,26) = 3.25$, $p = .083$) on food intake at breakfast. Simple effects revealed that Low-EE participants ate less after sleep deprivation ($M = 397.09 \pm 182.72$ Kcal) than after the habitual night ($M = 488.72 \pm 242$ Kcal; $t = 2.66$, $p = .02$). A significant Night*Group interaction ($F(1,26) = 4.28$, $p = .049$) was also found for the daily food intake. Simple effects revealed that daily food intake of Low-EE participants was higher after sleep deprivation ($M = 1907.42 \pm 611.17$ Kcal) than after the habitual night ($M = 1673.36 \pm 507.57$ Kcal; $t = -2.44$, $p = .03$). A significant effect of the Night ($F(1, 26) = 7.12$, $p = .013$) was found on the amount of snacks consumed throughout the day: both groups consumed a higher number of snacks after the deprivation night ($M = 2.32 \pm 1.76$ Kcal) compared to after the habitual night ($M = 1.68 \pm 1.25$ Kcal).

Conclusion: Findings suggest that sleep deprivation may increase snack consumption in participants regardless of binge eating symptoms. Moreover, daily food intake may increase after sleep deprivation only in people that do not report emotional eating.
ACUTE ENERGY BALANCE ALTERATION MODIFIES SLEEP ORGANIZATION IN HEALTHY MEN


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**Introduction:** A link between sleep organization and metabolic regulation has been reported but the impact of changes in energy balance on sleep is less understood. We evaluate whether changes in energy balance modulate nighttime sleep organization and the spectral power of sleep.

**Materials and methods:** We studied a sample of 10 healthy young normal-weight men. They underwent a 5-consecutive nights in-lab protocol, where sleep was measured at baseline (BL, 1st night), after 2 days of Caloric Restriction (CR, 10% of individual energy requirements), and after 2 days of caloric supply restoration by ad libitum feeding (AL). Sleep was assessed by PSG and sleep stages scored according to R&K. Spectral power analysis of artifacts-free EEG segments (C4-O1 derivation) was conducted during the first 2 hours after sleep onset. Delta (0.5-4.5 Hz), theta (4.5-8 Hz), alpha (8-12 Hz), sigma (12-15 Hz) and beta (15-25 Hz) power was calculated and compared between BL, CR and AL conditions.

**Results:** Total sleep time, sleep efficiency, wakefulness, REM sleep or non-REM stages S1 and S2 were similar between conditions. However, S4 time (65.2±9.0 vs. 82.5±5.1 min., p=0.003) and percentage of TST (16.1±2.3 vs. 19.7±1.4 %, p=0.01) was increased after 2 nights of CR compared with BL (but similar to AL). Higher delta- (51.3±1.3 vs. 52.8±1.2 %, p=0.05) but lower beta-power (11.4±0.6 vs. 9.7±0.7 %, p=0.03) was found after CR compared with AL. Theta-power was lower after AL compared with both BL and CR (p=0.001). Alpha or sigma bands were not affected by changes in energy balance.

**Conclusions:** Acute depletion of energy balance increases the deepest stage of non-REM sleep. Spectral analyses suggest a deepening of the ongoing sleep process after CR, reflected by an increased delta- and reduced beta-power. These findings provide further evidence for a strong connection between energy homeostasis and sleep regulation in humans.

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A SINGLE NIGHT MODERATE SLEEP RESTRICTION AT-HOME INCREASES HUNGER AND CALORIC INTAKE IN YOUNG ADULTS

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Introduction: Experimental studies under laboratory conditions have reported a link between sleep restriction and metabolic homeostasis. We assessed the effect of one-night moderate sleep restriction at-home on sleep patterns and food intake regulation in healthy human participants.

Materials and methods: Participants were part of a cohort follow-up study since infancy. They were assessed in early adulthood for two successive nights: the first night (N1), following their usual sleep routine, and the second one (N2), following a moderate sleep restriction (sleep from 03:00 to 08:00h). Sleep was recorded at-home by a non-invasive ambulatory system that measures peripheral arterial tonometry through a plethysmographic based finger-mounted probe (Watch-PAT200, Itamar Medical, Israel), placed in the non-dominant wrist. Sleep duration, rapid eyemovement sleep (REM), light sleep (LS), deep sleep (DS) and wake were automatically scored. Visual analogue scales (VAS) and 4-consecutive dietary records were used to measure hunger/satiety feelings and daily food intake (daytimes preceding N1 and following N2), respectively. Caloric and macronutrient dietary composition was analysed using specific software for food composition (FoodProcessor SQL®, USA).

Results: Subjects were 20.8±0.6 yrs., 53% (n=8) males, mean body-mass index 27.5±6.2 kg/m². Sleep and REM latencies, LS time and Wake episodes were similar between nights. Compared with N1, sleep efficiency (83.2±6.6 vs. 78.4±9.4 %, p=0.04) and total sleep time (6.7±0.9 vs. 5.2±0.9 h, p=0.003) were lower. DS was higher (22.3±4.1 vs. 25.5±0.9 %, p=0.05) in N2. After N2, overall rating for hunger (p50-iqr) was higher compared to the daytime after N1 (22.5-16.5 vs. 34.8-17.8 mm, p=0.002), whereas satiety feelings did not differ. All-day caloric intake was higher after N2 (1698.4 ± 538.2 vs. 2272 ± 837.2 Kcal, p=0.007) due to increased amount of fat and proteins (both p< 0.01) but not carbohydrates (p=0.06).

Conclusions: A single night moderate sleep restriction at-home implies altered sleep patterns, increased hunger and caloric intake, the daytime in young adults. Our results provide further support to the role of sleep on food intake regulation in humans.

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SLEEP INTERVENTIONS IMPROVE SUBJECTIVE SLEEP, MOOD, AND RACE PERFORMANCE IN CANADIAN NATIONAL TEAM SPEED SKATERS

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Introduction: Previous research has shown benefits of sleep optimization for performance in elite athletes. This pilot study focused on evaluating the impact of a sleep optimization program on subjective sleep, mood, and race performance in Canadian National Team speed skaters.

Methods: Seven Canadian National Team long track speed skaters (mean age 24.3y ± 4.2; 3 females) were enrolled in the study during the 2016-17 World Cup season. The Athlete Sleep Screening Questionnaire (ASSQ) and the Profile of Moods State (POMS) were completed during a baseline phase (BLP) prior to the Canadian World Cup Selections and following a two-week sleep optimization phase (SOP) during the Canadian Single Distance Championships, with both events held in Calgary, AB. The SOP consisted of daily napping, increasing night time sleep, and a bedtime routine which included an electronic device curfew and wearing blue light blocking glasses 2 hours before bedtime. Paired sample t-tests were used to assess differences between the BLP and the SOP in POMS, ASSQ, and the race performance times which included performance times from all the races that the athlete normally skated.

Results: Athletes showed an improvement in subjective sleep from the BLP to the SOP in increased reported hours of sleep (t₆ = 2.50, p = 0.046), improved sleep satisfaction (t₆ = 6.97, p = 0.0004), reduced sleep latency (t₆ = 3.24, p = 0.017), and a reduced ASSQ sleep difficulty score (t₆ = 4.60, p = 0.003). Athletes also reported improvement in mood with reduced fatigue (t₆ = 4.04, p = 0.006), increased vigor (t₆ = 4.39, p = 0.004) and reduced total mood symptoms (t₆ = 2.40, p = 0.05). For race performance, there was an overall average improvement of 0.46% from the BLP to the SOP, but this was not statistically significant (t₉ = 1.08, p = 0.31). However, this improvement was 0.31% larger when we compared the athletes in the same competitions from the previous year (0.15%).

Conclusion: In this small sample of Canadian long track speed skaters, subjective sleep, mood, and race performance was improved after a sleep optimization protocol. Although race performance was not statistically significant, the improvement was meaningful when you consider the margin of success in a race is so small when competing at the world-class level. For example, one athlete showed a 0.29% improvement from the BLP to the SOP in their 1,000m race. This resulted in a 0.23 second improvement which translated into the athlete finishing the race 2.93 metres faster than at the BLP. Future research should employ a larger sample size with a control group to provide evidence that sleep optimization interventions are effective at improving training, recovery and performance in elite athletes.

Acknowledgments: Research supported by Own the Podium, Mitacs and Canadian Sleep and Circadian Network.
IMPACTS OF OPERATIVE TIME ON SLEEP QUALITY FOLLOWING SPINAL STENOSIS SURGERY

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Introduction: Anesthesia is associated with postoperative sleep disturbance. Thus far, the relation between operative time and postoperative sleep disturbance has not been investigated. The purpose of this study was to explore whether the changes in sleep in patients underwent morning surgery differed from those underwent afternoon surgery.

Materials and methods: Twenty patients underwent morning spinal stenosis surgery and 21 patients underwent afternoon stenosis surgery were included. Self-report questionnaires (e.g., Verran and Snyder-Halpern sleep scale, Epworth Sleepiness Scale) were required to complete in 1 day before surgery and during 3-5 days after surgery.

Results: Following spinal stenosis surgery, morning surgery group's sleep quality decreased after surgery ($t=2.60$, $p=0.02$). The result form ANCOVA indicated the morning surgery exhibited poorer postoperative sleep quality than those in afternoon surgery group ($F=6.26$, $p=0.04$). Poorer postoperative sleep quality presented, the greater next-day daytime sleepiness expressed ($p < 0.0001$).

Conclusions: Findings suggest that poorer sleep quality were significantly presented after morning surgery. Clinical health providers should pay attention on patients who undergoing morning surgery to reduce their postoperative sleep disturbance. Moreover, for clarifying the mechanism, endocrine indicators in circadian rhythm could be evaluated in future study.
LONG TERM EFFECTS OF METHYLPHENIDATE ON THE SLEEP PROBLEMS OF CHILDREN WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

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Introduction: We investigate the sleep problems of attention-Deficit/hyperactivity disorder(ADHD) children using objective and subjective measurement with yearly testing for five years, and investigated the effect on sleep and sleep complaints, of methylphenidate -MPH- prescribed to these children for 5 years.

Materials and methods: From July 2009 to December 2015, we recruited ADHD children age between 6 and 12 years old. 266 children were enrolled in our study. We use objective measurements: Polysomnography (PSG) and, Continuous Performance Test (CPT) and subjective measurements: OSA-18 Questionnaire, Disruptive Behavior Rating Scale (DBRS) and Child Behavior Checklist (CBCL) to analyze sleep complaints and problems and ADHD symptoms at each yearly testing. All ADHD children received MPH treatment, and all children with OSA and enlarged adenotonsils-T&A- were treated the 1st year with T&A surgery. Descriptive statistics and repeat measure tests were used to analyze the datas.

Results: 266 ADHD children (mean age 8.8±2.3 years old) were included. 173 (65%) children had associated obstructive sleep apnea (AHI = 9.0±0.8/hour) and 93 (35%) children were without OSA (AHI = 0.9±0.2/hour). In sleep study finding, PSG data show AHI(Apnea-hypopnea index), HI, ODI(Oxygen desaturation index), and sleep efficiency showed significant improvement ( P< 0.001, 0.001, < 0.001,0.001 ) at first year follow-up. Similarly CPT data (p=0.047), DBRS(p< 0.001) and some domains of CBCL questionnaires were significantly improved. But at 5 years follow-up ODI, sleep efficiency and mean SaO2 show slight worsening (p=0.002, < 0.001, < 0.001) as did the OSA 18 Questionnaire, and performance and ADHD tests- CBCL and DBRS - showed worsening despite continuous MPH intake at five years follow-up.

Conclusions: After initial treatment of ADHD with and without OSA, sleep problems and ADHD symptoms have significant improvement. But long term follow-up indicate worsening of the tests at 5 years, raising the question of why, and indicating needs for regular re-testing.

Acknowledgements: We would like to thank the Department of Child Psychiatry and Sleep Center of Chang Gung Memorial Hospital for supporting our research.
ASSOCIATIONS OF SLEEP DURATION WITH SUICIDAL IDEATIONS, PLANS, AND ATTEMPTS IN ADOLESCENTS: DOSE-RESPONSE METAANALYSIS OF OBSERVATIONAL STUDIES

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Introduction: Suicide is the leading cause of death in adolescents in the modern society. Previous studies have found mixed results with some literature suggesting the association of both shorter and longer sleep duration with youth suicidal behaviors and some denying. In addition, the question of whether there is a threshold of sleep duration that raises the risk of suicide remains unanswered. The purpose of the current study was to examine potential linear and non-linear dose-response relations between sleep duration and the risks of suicidal ideations, plans, and attempts in adolescents.

Materials and methods: Electronic databases, namely the EMBASE, PubMed, PsycINFO, Wanfang Data Chinese database, and China Knowledge Resource Integrated Database, were searched from their inception to April 18, 2017. We included studies examining the association between sleep duration and suicidal ideations, plans, or attempts in adolescents. Two investigators independently extracted data and evaluated the study quality by the Critical Appraisal Checklist recommended by the Joanna Briggs Institute. A random-effects dose-response model was used to estimate the potential linear and nonlinear dose-response relations.

Results: We identified 16 reports including a total of 635,606 participants for systematic review and 12 reports were further used for dose-response metaanalysis. There were a U-shaped dose-response associations of sleep duration with youth suicidal ideations, plans, and attempts (All P non-linearity < 0.001). The lowest risk was observed at sleep duration 7-8 hrs in youth suicidal ideations, 8 hr in youth suicidal plans, and 9 hr in youth suicidal attempts.

Conclusions: Short sleep duration is associated with increased risk of suicidal ideations, plans, and attempts in adolescents and the nadir of the curve was observed at sleep duration 7-8 hrs in suicidal ideations, 8 hr in suicidal plans, and 9 hr in suicidal attempts.
EVALUATION OF DISE, POLYSOMNOGRAPHY AND CEPHALOMETRIC PARAMETERS TO IDENTIFY FACTORS FOR OUTCOME OF SLEEP SURGERY

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Introduction: Obstructive sleep apnea syndrome (OSAS) is a global health problem that affects up to 20% of adults and is an issue of cost. The main pitfall of the treatment of obstructive sleep apnea syndrome is that it is not a completely curable disease but rather chronic disease. In CPAP-intolerant cases, surgical intervention can be considered as an option. Multilevel sleep surgery including Uvulopalatopharyngoplasty (UPPP) may be indicated to improve compliance and outcome in OSAS. However, overall success rates for UPPP were reported to be less than optimal (40.7%) and also there is little current prospective data about surgical outcome predictors. In this study, by analyzing various parameters and characterization of anatomical structure, we aimed to determine factors predicting treatment success after multilevel surgery in patients with OSAS.

Materials and methods: This retrospective study enrolled the patients who underwent multilevel sleep surgery. The operations were performed based on preoperative physical examination and DISE findings. Data were collected including demographic data, pre- and postoperative polysomnography, cephalometric parameters, and DISE findings. The patient were divided into 2 groups according to postoperative polysomnography result; the success group (50% decrease in AHI or less than 20 of postoperative AHI) and the failure group. The association of surgical outcome with DISE findings was evaluated.

Results: Total 66 patients were enrolled in our study. The number of success group was 32 (48%) and the failure group was 34 (51%). The success group had significantly higher tonsil grade (p = 0.017) and lower mallampati score (p = 0.004) in terms of preoperative physical findings. In preoperative polysomnography, Duration of Saturation < 90% (CT90, min) was significantly higher in failure group (p = 0.01) and also Percentage of Saturation < 90% was higher in failure group (p = 0.006). There were no significant cephalometric parameter related to surgical outcome. In perspective of DISE findings, Retrolingual shape (Fujita classification) and velopharynx grade (Fujita classification) were correlated with surgical outcome significantly (p = 0.013, 0.030). In multivariate logistic regression analysis, predictive factor for the successful surgical outcome were Friedmann grade (p = 0.002, odds = 2.489), Hypopharynx shape (Concentric vs AP, Lat, p = 0.04, p = 0.02), Total sleep percentage with oxygen saturation below 90% (CT90) (odds = 0.4, p = 0.006).

Conclusions: The aim of the present study is to evaluate and analyze factors related to surgical outcome. DISE, preoperative polysomnography parameters could be a useful predictor of the therapeutic response to multilevel sleep surgery. This study might contribute to the selection of surgical candidacy for OSAS to improve overall outcome of sleep surgery.

Acknowledgements:
Thanks to Min Young Seo, Sang-Duk Hong, Hun-Jong Dhong, Seung Kyu Chung, Hyo Yeol Kim
**Introduction:** It is well established that certain parental cognitions about their child's sleep and bedtime behaviours used to settle their child to sleep are linked to poorer child sleep. However previous research has focused almost exclusively on mothers and also explored only a limited range of cognitions. The current study aimed to investigate whether parental (both mothers and fathers) cognitions about their own sleep were related to their cognitions about their child's sleep, to determine whether parental cognitions and behavioural practices were predictive of child sleep and to explore, within each parent dyad, whether congruency in their cognitions and behavioural practices was associated with child sleep.

**Materials and methods:** 46 families (comprising mother, father and 12-24 month old child) took part in the study. Parents separately completed questionnaires covering; cognitions regarding their own (Dysfunctional Beliefs and Attitudes about Sleep Scale) and their child's sleep (Parental Cognitions about Infant Sleep Questionnaire), general sleep practices in relation to both their own and their child's sleep (modified Sleep Practices and Attitudes Questionnaires) and settling strategies used with their child (Parental Interactive Bedtime Behaviour Scale). Child sleep was assessed by both parental report (Brief Infant Screening Questionnaire) and by 5 nights of actigraphy (average sleep efficiency).

**Results:** In both mothers and fathers higher levels of dysfunctional cognitions about their own sleep significantly predicted higher levels of concern or worries about their child's sleep (p=.020 and p=.001 respectively). Mothers' report of their child's sleep was significantly predicted by the general sleep-related practices they used with their child (p=.033) and the use of active/physical settling at bedtime (p=.034). Their cognitions about their own sleep and their child's sleep, their own general sleep practices and use of other settling strategies with their child made no significant contribution. Fathers' report of their child's sleep was significantly predicted by their cognitions about their child's sleep (p=.014) and the use of active/physical settling (p=.035). Their cognitions about their own sleep, their own general sleep practices and use of other settling strategies with their child made no significant contribution. Child sleep efficiency assessed by actigraphy was not significantly predicted by parental cognitions or the practices of either mother or father. The degree of congruency between parents in each dyad in terms of their cognitions and their behavioural practices related to sleep was not predictive of children's sleep (neither parent report nor actigraphy).

**Conclusions:** Differences between mothers and fathers in how their thoughts and behaviours relate to their reports of child sleep highlight the importance of including both parents in future studies and raise the possibility that preventive approaches/interventions for child sleep difficulties could be tailored to better meet the needs of the whole family. Results also support the idea that parents' reports of child sleep and the child's objective sleep patterns may be determined by different factors, again with implications for research and clinical services.

**Acknowledgements:** With thanks to my supervisors (Dr Luci Wiggs and Professor Jane Appleton) and funding provided by the Nigel Groome/Oxford Brookes University 150th Anniversary Studentship.
SLEEP AWARENESS WEEK 2017: ACTIONS OF HEALTH PROMOTION IN THE INTERIOR OF SÃO PAULO STATE

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Introduction: Since 2008, on the World Sleep Day, actions are promoted worldwide for a better sleep. The purpose was describe the actions of health promotion realized in two cities of the interior of São Paulo State, during the Sleep Awareness Week of 2017.

Materials and methods: The coordination of the activities in Bauru and Botucatu was performed by a speech pathologist, in partnership with a physical therapist from São Manuel and an ENT physician from Botucatu. Cooperations were conducted with universities, hospitals, companies and commercial services for the presentation of lectures about good sleep hygiene, the influence of communication technologies on sleep quality and specific issues about sleep in shift workers.

Results: Lectures were realized in the following locations: FEMSA Coca-cola, Bauru / SP (60 shift workers), Bauru School of Dentistry USP (38 subjects), Faculty of Agudos FAAG, Agudos (54 university students), University of the Sacred Heart USC, Bauru / SP (31 university students), Marechal Rondon Faculty (31 university students), Medical School of Botucatu (92 subjects), Botucatu State Hospital, (52 subjects), “Açaí da Barra” Bauru (47 subjects), and “2nd pro sleep walk”, Bauru (50 subjects), covering different age groups (children, adolescents, university students and elderly). The lectures were held in universities and in companies. For the other actions, subjects were individually approached, booklets were distributed, the contents were explained and doubts were clarified. In a total, 455 people received informations about the importance of sleep.

Conclusions: The sleep awareness week is important for the propagation of sleep information and elucidation in the population.

Acknowledgements: Sleep Brazilian Association
NURSES' STRATEGIES FOR MANAGING SLEEP WHEN STARTING SHIFT WORK - IMPLICATIONS FOR INTERVENTIONS TARGETING SLEEP BEHAVIOURS IN A SHIFT WORK POPULATION

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Introduction: Shift work is related to short and disturbed sleep. Various aspects of a shift schedule will produce different opportunities and conditions for sleep depending on how they interact with circadian rhythms and the homeostatic drive for sleep. A third factor influencing sleep between shifts is the activation of the stress system. The aim of the current study was to examine sleep behaviours and strategies that nurses used when starting shift work and determine which sleep behaviours should be promoted when developing a programme for sleep interventions for newly graduated nurses.

Material and methods: 11 (mean age 29.1±8) newly graduated nurses (3-12 months work experience) from different hospitals in Sweden were recruited for a semi-structured interview (approx. 45 min). Deductive content analysis was used to examine sleep strategies related to the homeostatic and circadian regulation of sleep, and to managing stress.

Results: In relation to morning shifts (starting 6:45h) most nurses perceived sleep as somewhat disturbed. Some had a strategy of undertaking activities that helped them unwind before bedtime, such as having a shower, watching TV, surfing the Internet or using relaxation techniques. One nurse had a strategy of getting up early in the morning before a morning shift in order to facilitate sleep in the evening, thereby enhancing the homeostatic drive for sleep. One nurse tried to keep her bed times constant despite irregular work hours in order to maintain a stable circadian rhythm.

In relation to evening shifts, few experienced problems with sleep. Most had a lie-in before starting an evening shift and were being quite inactive before the shift started.

Most nurses reported sleep problems when an evening shift was followed by a morning shift, i.e. a quick return, with many having problems unwinding and stopping thinking about work before bedtime. A few nurses described experiencing stress from knowing that their sleep would be short. Many had a strategy of undertaking other activities to unwind (see examples from morning shifts) before going to bed. A few went to bed straight away but described experiencing difficulties falling asleep. A few who reported no problems with sleep during quick returns said that they undertook activities that made them detach from work, with one regularly using a relaxation technique. The five nurses who worked night shifts had strategies of either sleeping in the evening before the nightshift, or staying up as long as possible the night before, thereby reducing the homeostatic drive for sleep during the shift.

Conclusions: Newly graduated nurses would probably benefit from a sleep programme based on cognitive behavioural therapy techniques that are modified to fit shift workers. Behaviours and strategies that should be targeted are: routines and techniques for unwinding before bed time; sleep behaviours that promote building up enough homeostatic pressure for initiating sleep (e.g. not having long lie-ins before evening shifts that are followed by morning shifts); and sleep behaviours that promote a stable circadian rhythm.

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RELATIONSHIP BETWEEN SLEEP DISTURBANCES AND HEALTH-RELATED QUALITY OF LIFE - RESULTS FROM THE GEORGIA SOMNUS STUDY

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Introduction: Evidence indicate that sleep disorders contribute to the growing health burden observed in modern societies. While sleep problems have been reported to influence health related quality of life (HRQoL), the association between them is less clear in the developing world. Therefore, the aim of the present study was to investigate the prevalence of various sleep disturbances and their associations with HRQoL in an urban Georgian population taken into account sociodemographic and clinical variables, and the severity of sleep problems.

Materials and methods: 395 unpaid volunteers, aged between 20 and 60 years, from 2 main urban cities of Georgia were surveyed. Participants completed Pittsburgh Sleep Quality Index (PSQI), Epworth sleepiness scale (ESS), STOP BANG questionnaire, Insomnia Severity index (ISI), Beck depression inventory, short form (BDI-SF), and Short-Form Health Survey (SF-12). Sociodemographic data (age, gender, marital status, employment and economic status) and body mass index (BMI) were obtained. Group comparisons were performed with the Mann-Whitney test. The hierarchical multiple regression analysis were conducted for each sleep variable.

Results: Poor sleep quality was observed in 43% of the sample. The prevalence of daytime sleepiness (score >10) was 17%; A risk of apnea (assessed by STOP-Bang ≥3) was identified in 34.2% of the population. As of risk severity, 27.4% of the participants presented an intermediate risk (score 4-5) and 6.8% - a high risk of sleep apnea (score ≥ 5). Overall, 32.9% of the population reported subthreshold insomnia, while 9.4% reported moderate insomnia, and 1.8% - severe insomnia. All SF-12 component scores and physical and mental component summaries (PCS and MCS) were significantly lower in poor sleepers, in subjects with daytime sleepiness, apnea risk, or insomnia (no insomnia versus three other category). The mean values of SF-12 subscales decreased incrementally in most SF-12 dimensions across insomnia and apnea severity. The effect of insomnia severity was more pronounced on MCS, while apnea severity - on PCS. Hierarchical regression analyses showed that after controlling for major confounding factors (demographic characteristics, depression, BMI), the addition of the PSQI global score to the model, significantly increased its predictive capacity (ΔR²) by 3.5% for PCS and 2.9% for MCS; for the other SF-12 component scores, ΔR² increase ranged between 1.4% and 4.6%. In addition, ESS, STOP-Bang and ISI scores exerted clear effects on SF-12 PCS and MCS domains in a separate regression models. The greatest effect was observed in the association between ISI with MCS (ΔR²=0.039, p< 0.001, β = -0.24). In all models, depression was significantly associated with both MCS and PCS, while economic status - only with MCS.

Conclusions: Study findings confirm and extend observations from other studies and strongly support the importance of sleep for HRQoL. Expanding the evaluation of sleep problems in the general population would provide greater insight into the prevalence of sleep disorders, their implications for health and behavior and the best possible intervention programs designed to strengthen sleep-related health-care and consequently enhance HRQoL. This is especially important in those countries where advancements in sleep medicine are needed.

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**Introduction:** Both obstructive sleep apnea (OSA) and short sleep duration have been separately associated with inadequate levels of 25-hydroxyvitamin D (25OHD). However, whether these 2 factors may concurrently influence 25OHD is unknown. Thus, we hypothesized that both OSA and short sleep duration would be independently associated with lower concentrations of 25OHD in a gender and age dependent manner.

**Material and methods:** This cross-sectional study is part of the prospective EPISONO cohort (Brazil), which included 712 individuals who underwent polysomnography, answered sleep questionnaires and had their blood collected for serum 25OHD quantification.

**Results:** Individuals with a sleep duration of ≤6 hours had a 2-fold increased odds of 25OHD< 20 ng/mL (OR=2.10, 95% CI 1.05-4.20, \(P=0.03\)) compared to those who reported more than 6 hours of sleep, even adjusting for confounding factors. Subset gender analysis revealed that men with a sleep duration of ≤6 hours had a 4-fold increased odds of 25OHD< 20 ng/mL (OR=3.74, 95% CI 1.22-11.40, \(P=0.02\)). However, in women, short sleep duration was not associated with lower 25OHD levels. Regarding age, sleep duration of ≤6 hours was significantly associated with 25OHD< 20 ng/mL (OR=2.91, 95% CI 1.09-7.76, \(P=0.03\)) only in younger participants (< 50 years-old). OSA was not an independent factor related to 25OHD concentrations in men or women. Sleep parameters, such as sleep latency, sleep efficiency, N1, N2, N3 or REM sleep, arousal index, oxygen saturation and desaturations did not present any association with 25OHD< 20 ng/mL.

**Conclusion:** Our findings showed that a sleep duration of ≤6 hours, but not OSA, was an independent factor associated with 25OHD serum levels below 20 ng/mL, especially in men and younger individuals.

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Other
Board #025: P5 - Wednesday
TOTAL SLEEP TIME IN A BRAZILIAN BIRTH COHORT: PRELIMINARY

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Introduction: The total sleep time (TTS) is a major factor studied in medicine, being associated with
physiological and metabolic disorders, such as appetite regulation, immunity, hormonal function and
cardiovascular system. Nowadays, the technological evolution is promoting a reduction in the sleep time of
humans, especially in modern societies. Birth cohort studies bring the possibility of conducting research with a
temporal window that begins at birth and extends to the present, representing an opportunity that may help us
to understand the mechanisms that lead to sleep deprivation. In these preliminary results, we evaluate the total
sleep time in a young adult population and the relation of total sleep time with sleep quality, sleepiness, obesity,
hypertension and Willis-Ekbon Disease.

Methods: The study population came from a larger study called COBRAS (COorte BRASsileiras) and started in
the 1970s with the initial objective of studying the development of live births in the region of Ribeirão Preto, Sao
Paulo, Brazil. Firstly, a cross-sectional study of this population was carried out to evaluate the total sleep time,
sleep quality (Pittsburgh Sleep Quality Index - PSQI), sleepiness (Epworth scale), the presence of Willis-Ekbon
Disease and anthropometric data such as weight, height, BMI and blood pressure. Total sleep time was assessed
using a questionnaire.

Results: Out of more than 5000 individuals, 1560 were interviewed so far. The mean age and standard
deviation (SD) were 33 +/- 7.6 years. The total sleep time was (mean ± SD) 6.7 +/- 1.5 hours. Women sleep
significantly more than men (mean+/-SD), 6.9+/-1.6 vs 6.6+/-1.4 hours (p< 0.001), respectively. We observed
a negative correlation between TTS and sleep quality (r=-0.4; p< 0.001) and TTS and drowsiness (r = -0.59, p
< 0.05). There was no difference in TTS in individuals with and without WED.

Conclusion: We observed a reduction in TTS in men compared to women. Total Sleep Time correlated
negatively with PSQI and sleepiness.

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PORTUGUESE INFANTS SLEEP HABITS

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Introduction: Sleep habits (SH) are dependent on biology, age, culture and socio-economic environment. Knowledge of SH of a population is crucial to precociously identify pathology and prevent complications.

Objective: To characterize the sleep habits of a Portuguese sample of infants up to six months of age.

Materials and methods: Observational, descriptive and longitudinal study. Newborns in a maternity of a Portuguese tertiary hospital were randomly assigned during six months; informed consent from the mothers was obtained. The same questionnaire about sleep habits in the 1st, 2nd, 4th and 6th month of age of their children was answered by telephone or e-mail.

Results: A total of 335 infants (50.2% boys) out of 470 newborns selected were included, those in which the mothers answered to at least 3 of the 4 questionnaires. Most infants sleep in their own bed in their parents´room until 6 months (1;2;4;6mth: 72,2%;77,3%;72,5%;59,1%), but a significant number sleep in their own room (1;2;4;6mth: 9%;5,1%;13,7%;28,4%) or in their parents´ bed (1;2;4;6mth: 8,7%;8,7%;7,2%;4,8%). Median duration of nocturnal sleep was similar up to six months of age (nine to ten hours), as well as the median time to get asleep (about 15 minutes). Median duration of daytime sleep decreased with age (1;2;4;6mth: 8h;6h;5h;4h), as well as the number of naps (1;2;4;6mth: 4;3;3;2). Median duration of naps was similar (1,5-2 hours). Way to fall asleep: with breast/bottle feeding (1;2;4;6mth: 46%;37,6%;31,9%;25,7%), on lap (1;2;4;6mth: 57%;48,4%; 33,7%;28,4%), on parents' bed/couch (1;2;4;6mth: 32,6%;27,2%;20,3%;19,1%), in the presence of parents (1;2;4;6mth: 54%;27,8%;43,3%;11,3%), with light (1;2;4;6mth: 31,6%;27,8%;20,3%;11,3%), with presence light (1;2;4;6mth: 55,2%;56,4%;55,2%;58,8%) with an object (1;2;4;6mth: 21,2%;31%;41,8%;43,9%), with pacifier (1;2;4;6mth: 42,7%;58,5%;51%;49,9%), with music (1;2;4;6mth: 29,6%;30,4%;19,7%;20,3%), listening stories/songs (1;2;4;6mth: 24,2%;22,1%;20,3%;21,8%), with TV (1;2;4;6mth: 19,1%;16,4%;11,3%;10,1%), on lap (1;2;4;6mth: 20,9%;19,4%;10,4%;9,3%) - these last two habits were significantly different over time (p< 0,001). Nocturnal awakenings were frequent, decreasing with age (1;2;4;6mth: 83%;77,6%;69,6%;54,9%). How they fall asleep after a night awakening: with breast/bottle feeding (1;2;4;6mth: 50,4%;37,9%;29,9%;20,3%), on lap (1;2;4;6mth: 34,4%;28,4%;14,6%;12,2%) - these two habits were significantly different over time (p< 0,001) - alone (1;2;4;6mth: 30,7%;40,3%;38,5%;35,8%), in the presence of parents (1;2;4;6mth: 48,7%;37,9%;34%;27,5%), with light (1;2;4;6mth: 10,7%;4,8%;6%;3,9%), with presence light (1;2;4;6mth: 51,3%;56,1%;41,2%;34,3%). About a third of mothers were worried about their children´s sleep (1;2;4;6mth: 37,3%;32,3%;36,2%;31,1%).

Conclusions: Sleep habits changed significantly in the first months of life. Dependence on parents to sleep was very frequent, although diminishing with age. It was possible to identify potentially deleterious habits for adequate sleep hygiene, already present very early. To prevent sleep disorders, such as behavioral insomnia, it is important to intervene very early, ideally during pregnancy.
Introduction: Sleep disorders (SD) are frequent in children and have a negative effect on child’s cognitive development, behavior, health and quality of life. Parents’ sleep education is recommended by the American Academy of Sleep Medicine; we believe that it should be initiated as early as possible.

Objective: To assess the impact of maternal information on development of healthy sleep habits of children.

Materials and methods: Experimental, longitudinal, randomized study. Mothers given birth in a maternity of a tertiary hospital were randomly assigned, during six months, for receive (GI) or not (GII) information on sleep hygiene (SH). Individual oral 15 minutes training sessions (TS) were provided; a leaflet was delivered. The same sleep habits questionnaire was answered by mothers of two groups by telephone or e-mail at the 1st, 2nd, 4th and 6th month of children. Informed consent was obtained.

Results: 335 out of 470 mothers (infants-50.2% boys) answered at least 3 of the 4 questionnaires. Children of GI mothers sleep more frequently in their own bed: 1, 2, 4, 6th month: OR 4.51, IC95%(1.69-12); OR 5.66, IC95%(2-15.9); OR 4.05, IC95%(1.1-13.5). GI mothers children fall asleep more frequently alone (A) and in their own bed (B) and need less breast/bottle feeding to fall asleep (C) than children of GII mothers:

A-[1;2;4;6mth: OR 4.11, IC95%(2.3-7.4); OR 5.34, IC95%(2.5-11.5); OR 6.05, IC95%(3.3-10.9); OR 4.29, IC95%(2.4-7.6)]; B-[1;2;4;6mth: OR 3.92, IC95%(2-7.6); OR 5.8, IC95%(2.9-11.7); OR 4.79, IC95%(2.7-8.4); OR 6.1, IC95%(3.5-10.6)]; C-[1;2;4;6mth: OR 1.49, IC95%(0.9-2.4); OR 1.54, IC95%(0.9-2.5); OR 1.62, IC95%(0.9-2.6); OR 2.68, IC95%(1.5-4.6)]. No significant differences were found between 2 groups regarding need for light, television or other routines to fall asleep.

Children of GI mothers go back to sleep after a nocturnal awakening more frequently alone (A) and need less breast/bottle feeding (B).

A-[1;2;4;6mth: OR 3.08, IC95%(1.7-5.4); OR 1.44, IC95%(0.83-2.5); OR 2.78, IC95%(1.6-4.9); OR 3.79, IC95%(2-7.1)]; B-[1;2;4;6mth: OR 1.95, IC95%(1.2-3.2); OR 3.17, IC95%(1.9-5.3); OR 2.71, IC95%(1.6-4.6); OR 2.35, IC95%(1.3-4.3)]. No significant differences between 2 groups were found regarding need for light or lap to fall asleep after a nocturnal awakening. Results adjusted for maternal age at birth, education level and mother’s race.

Conclusions: Maternal SH information about sleep was positively associated with the adoption of healthy sleep habits in children up to six months of age. This study shows the importance of preventive education on development of pediatric sleep quality. Further studies are needed to validate these results.
SLEEP COMPONENTS INCREASING THE LIKELIHOOD OF BEING DISSATISFIED WITH ONE'S GRADE POINT AVERAGE AND OF HAVING AN AVERAGE UNDER A-

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Introduction: According to some scientific texts, most university students neglect their sleep and present more sleep problems than does the general population. Although the students' level of satisfaction with their academic performance may be more important than their actual average, this level of satisfaction has never been considered in studies on sleep. The objective of this research was thus to determine which components of the subjective evaluation of sleep are most closely associated with university students' dissatisfaction with their academic performance and with their having an overall average under A-.

Materials and methods: The sample was composed of 112 university students enrolled in the Université du Québec à Trois-Rivières (age=22.0±2.3 years; 88% women). The participants were solicited in class and through an advertisement published on the university's social networks. They completed an online questionnaire made up of the validated French version (Blais, Gendron, Mimeault, & Morin, 1997) of the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) as well as questions on their overall average and satisfaction with this average. Logistic regression analyses were conducted to determine to what extent each of the seven sleep components measured by the PSQI increased the probability of the students being dissatisfied with their academic results and of their having an overall average under A-.

Results: Three of the seven components in the PSQI increased the probability of the students being dissatisfied with their academic performance. Subjectively evaluating one's quality of sleep as poor or very poor increased the probability of being dissatisfied with one's academic performance 4.81 times, taking more than 30 minutes to fall asleep increased it 3.62 times, and taking sleeping drugs at least once a month increased the probability 2.88 times. Three components also increased the probability of the students having a general average under A-. Taking more than 30 minutes to fall asleep increased the probability of having an average under A- 2.64 times, finding it hard to stay awake and lacking enthusiasm during the day increased the probability 2.73 times, and subjectively evaluating one's quality of sleep as poor or very poor increased the probability 2.64 times. Total sleep time, sleep efficiency (the time spent sleeping out of the time spent in bed) and sleep disturbances (for example, being too cold or too hot or having bad dreams) did not show any significant relationship with a student's overall average or satisfaction with this average.

Conclusions: The various sleep components differently affect the likelihood of being dissatisfied with one's academic performance, on the one hand, and of having an overall average under A-, on the other hand. The present study therefore underscores the importance of considering this level of satisfaction in future studies.
SLEEP FOR HEALTH IN HOSPITAL (SHH): IMPROVING THE SLEEP ENVIRONMENT OF CHILDREN'S WARDS

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Background: Poor sleep quality impairs immune function, pain sensitivity and emotional regulation -- all important factors in the recovery of hospitalised children and the wellbeing of their co-sleeping parents. We have published qualitative data indicating that noise, light and ward routines significant disturb sleep in children’s wards with adverse daytime effects. We report the outcomes of a complex intervention designed to improve the ward sleep environment.

Methods: The SHH programme comprises three domains:

- Knowledge and empowerment: achieved through brief mandatory staff training and parent information leaflets
- Environmental change: red torches for night observations and sound level meters at nursing stations
- Behaviour change: adherence to curfews enforced by a flag erected at the nurse station at 8pm, bed signs indicated usual bedtime for each child, nap signs on the cot for day naps and posters around the ward areas all bearing the SHH logo identity and reminding everyone of the ‘8 is late’ curfew rules.

Continuous overnight sound level monitoring over 3 days recorded median decibel (dB) sound pressure before and after intervention in the acute surgical ward. Staff completed the NOMAD questionnaire based on normalisation process theory to measure the extent to which a complex healthcare intervention has been effectively integrated into usual care.

Results: Over 275 medical and nursing staff have been trained. Of the first 96 surveyed, 100% were committed to promoting optimal sleep after their session compared to 66% prior to training. Comments included ‘Didn’t appreciate how much sleep deprivation affected children & their parents’. Of the staff completing the NOMAD questionnaire 24/25 reported that SHH was a normal part of their ward work and all recognised its purpose and value. Median sound levels decreased from 59.6 to 46.4 dB. Medical staff re-evaluated their prescribing regimens to avoid sleep disruption.

Conclusions A carefully planned complex intervention can alter staff and parent behaviour to promote respect for children’s sleep in hospital alongside safe care.

References

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FACTORS AFFECTING SLEEP PATTERNS IN SINGAPOREAN ADOLESCENTS: A POLYTECHNIC POPULATION STUDY

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Introduction: The National Sleep Foundation (2015) recommends adolescents aged 18-25 to sleep 7-9 hours to benefit from the full restorative effects of a good night's rest. Sleep is essential in adolescents as it has many implications, including mood, academic performance (Wolfson & Carskadon, 1998), and the proper development of our brain (Feinberg & Campbell, 2013). Current research suggests that improving sleep habits can improve performance in daytime activities in sleep-deprived adolescents to its normal level (Adan et al., 2006). These factors can be classified into three domains, namely individual, home, and scholastic.

Materials and methods: Online survey of 385 participants. The participants were recruited from Temasek Polytechnic (TP) through convenience sampling via a Research Participation (RP) scheme, where students who are either from the School of Humanities and Social Sciences (HSS) or currently taking a research module are able to sign up for available research studies. Online survey was used to collect information on the participants' demographic characteristics, sleep variables including time spent in bed, sleep quality, sleep onset latency, expected sleep need (e.g. "How many hours of sleep do you think you need?"), difference in earliest and latest bedtime and rising time, sleep disruption and sleep quality. In the survey, we would also explored individual domain factors, namely, the participants' use of information and communication technologies (ICT) and their knowledge and attitudes towards sleep, home domain factors, namely, the physical sleep environment and level of parental monitoring, and finally, scholastic domain factors, namely, the importance of academics and their school schedule.

Results: Generally, the participants were sleep deprived in a regular school weekday (M = 6.77, SD = 1.73). In addition, the difference in the earliest and latest sleeping time in a weekday varied from 0.25 hours to 15 hours (M = 4.53, SD = 2.43). Results also showed a significant negative correlation between sleep duration in the weekday and sleep quality (r = -.183, p < .001).

Two separate multiple linear regression analyses were conducted for factors that influence sleep (r = .282, F (3, 385) = 10.946, p < .001) and wake range (r = .390, F (3, 385) = 22.828, p < 0.001). The regression models explained 7.9% and 15.2% of the variances, respectively. Both sleep hygiene scores and range of school starting time significantly predicted sleep and wake range in the students.

Conclusions:
• Temasek Polytechnic students have generally insufficient sleep in the weekdays but not in the weekend
• Students generally report good sleep quality
• Students have irregular sleep and wake schedules in both the weekdays and weekends
• Interventions should put more focus on electronic use at night due to its largely biological influences on sleep
• Improvements on observable sleep hygiene should be the next step to address less than ideal situations (e.g. irregular school schedules, poor sleep environment)
• Before undertaking interventions involving parental supervision, both parents and their children should be educated with the same sleep knowledge and hygiene
• Interventions may consider raising parent’s awareness of their child school schedule and the polytechnic education system
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Introduction: Cannabis consumption is associated with an increased risk of accidents and this is linked to reductions in vigilance. The study looks at the relationship between the quantity of cannabis consumed and the duration of effects on vigilance measured by reaction times and simulated driving.

Materials and methods: A randomized cross over double blind study in cannabis consumers (consumption >1 joint/week) with measures of reaction time (Psychomotor Vigilance test (PVT) and driving skills (York driving simulator); vigilance (Karolinska) blood and oral fluid levels of THC over 24 hours following the consumption of cannabis in cigarette at 0, 10 or 30 mg of THC.

Result: 30 men mean age 21.5 ans (sd=3.26), mean BMI 21.54 (sd=2.04) kg/m², dont 15 fumeurs occasionnels (CO) et 15 chroniques (CC). Concentrations of THC were significantly increased in CC compared with CO after cannabis consumption. 2 hours after 30mg the mean vigilance score (VAS) were reduced (CO 5.27±1.79 vs CC 4.33±1.45), as was the mRRT (CO 3.47±0.69 vs CC 3.86±0.48) with an increase in speed deviation (CO 7.44±6.09 vs CC 3.61±2.16) and of road position(CO 29.6±2.63 vs CC 28.03±2.13) which was still present at 6 hours, more marked in CO. The risqué of accident was increased at 2 and 4 hours after the consumption of cannabis ( p=0.05 at 2 hours and p=0.008 at 4 hours).

Conclusion: The consumption of cannabis reduces vigilance and increases driving errors.
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Introduction: The increase in the last decades in the world of the traffic accidents that result in fatal victims is worrisome. According to OMS data, 3,500 people die on the world’s roads every day. In England, between 2006 and 2014, 5000 people died in traffic accidents, in which the driver was a commercial driver. In our country, Chile, of the total of fatal accidents occurred to workers, 52% was a traffic accident. It has been established that there is a relationship between sleep apnea syndrome and the risk of suffering traffic accidents, so it is fundamental to detect them in commercial drivers, but this is expensive and difficult to apply in many countries. The objective of this study is to identify the prevalence of factors associated with Obstructive Sleep Apnea in commercial drivers, which allow us to develop low cost screening instruments for this pathology in the future.

Materials and methods: The data were analyzed with STATA 12.0. The following categorical variables were analyzed: OSA (obstructive sleep apnea syndrome) (-), mild OSA, moderate OSA, severe OSA; Diabetes Mellitus, hypertension, smoking, alcohol, snoring, history of apneas, drowsiness while driving, sleeping while driving. The association of these variables with the presence and severity of sahos was analyzed using the chi square test, alpha error 0.05. The numerical variables analyzed were: age, BMI, abdominal diameter, neck diameter, glycemia, triglycerides, total cholesterol, HDL, LDL, Epworth Scale. The association between these variables and the presence and severity of OSA was analyzed through ANOVA ONEWAY, alpha error 0.05. We also perform a stepwise selection with all the variables in a logistic regression model with 10% probability of retention. This model provided glycemia, HDL, BMI and abdominal diameter as explanatory variables. With this definition of variables, we estimated a logistic regression model whose dependent variable is the severity of OSA.

Results: 80 commercial drivers were recruited, which were submitted to Polysomnography. 84.2% of whom were obese. 10 subjects (12.5%) had no OSA, 14 subjects (17.5%) had mild OSA, 13 subjects (16.2) moderate OSA and 43 (53.7%) severe OSA. The number of subjects with OSA was higher than predicted (prevalence of 87.5%), therefore the number of patients without OSA was too small, so we could not perform statistical comparisons between OSA (-) vs OSA (+). So we decided to analyze the relationship with the presence of moderate OSA and severe OSA, but none of the analyzed variables was significantly associated to these. With all the variables we made a stepwise selection in a logistic regression model, which provided as explanatory variables glycemia, HDL, BMI and abdominal diameter. With this definition of variables a logistic regression model was estimated whose dependent variable is the severity of OSA (OSA (-) + mild OSA vs moderate OSA + severe OSA). With these results we were able to construct a predictive model of moderate OSA or severe OSA with a discrimination capacity of 81%.

Conclusions: Once our instrument will be validate, we can use it as an OSA screening instrument for drivers

Acknowledgements: All commercial drivers who participated
Introduction: Sleep loss has been shown to lead to changes in subjectively rated facial appearance. Sleep deprived people are perceived as less healthy, paler and more tired. However, the reasons for this are largely unexplored. In this study, we aimed to investigate whether facial skin colour could be seen to change following sleep deprivation using objective spectrophotometry.

Materials and methods: 181 individuals (103 female, ages 18-45) participated in a sleep-deprivation experiment. Participants were randomised into: one night of total sleep deprivation or normal sleep (8-9 hours in bed). The following day (approximately at 13:00) facial photographs were taken of participants. For a subset of 141 participants, skin colour was also measured using a spectrophotometer at three locations on the face (left cheek, right cheek and the forehead). Each facial photograph was later rated by 60 individuals on tiredness and paleness on a scale of 1 (very tired/not at all pale) to 7 (very awake/very pale).

Results: Subjective ratings showed that sleep deprived individuals looked paler ($p < .001$, Bayesian 95%CI = 0.09-0.20) and more tired ($p < .01$, Bayesian 95%CI = 0.03-0.13). However, objective measurements of sleep did not show any difference in lightness ($p = .72$, Bayesian 95%CI = -0.67-1.04), yellowness ($p = .95$, Bayesian 95%CI = -0.59-0.53) or redness ($p = .69$, Bayesian 95%CI = -0.64-0.45).

Conclusions: This study finds that sleep deprived faces appear subtly more tired and paler to observers. However, given that we find no difference in skin colour on the face as measured by spectrophotometry, it suggests that the change in subjective facial ratings are not due to the skin colour changes measured here. It is possible that the subjective changes relate to other perceived facial features, such as changes in the appearance of the eyes. Overall, we find that while observer ratings of the face following sleep loss are changed, there appears to be no difference in facial skin colour as measured by spectrophotometry.
THE EVOLUTIONARY CONSERVED MICRORNA MIR-137 REGULATES GENE EXPRESSION AND DIURNAL RHYTHM OF THE WAKE-PROMOTING HYPOCRETIN NEUROPEPTIDES

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Introduction: Wakefulness is regulated by the hypocretin/orexin (Hcrt) neuropeptides in both human and mouse. Other functions such as reward processing, emotion, mood regulation, and addiction have also been shown in Hcrt-deficient animals. Hcrt expression has a well-known circadian rhythm, but little is known about the regulation of this.

Materials and methods: In silico analysis predicted 14 miRNAs to target human prepro-hcrt and 14 miRNAs to target murine prepro-hcrt. For four of these the targeting was confirmed in vitro in h.crt-positive human cell line, and with the luciferase reporter assay. In vivo targeting was tested by intracerebroventricular injections of miRNAs in 4 day old mice. Potential h.crt-regulating cytokine stimulation of human cells and adult mice was conducted. Intraperitoneal injection of sleep promoting compounds, tanshinones, in adult mice at several time points was analyzed. miRNA level and HCRT mRNA was analyzed by qPCR, while h.crt-1 peptide was analyzed in a radioimmuno assay.

Results: We found several microRNAs (miRs) capable of regulating Hcrt. MiR-137, miR-637, and miR-654 target the human HCRT gene, while miR-137 and miR-665 target the mouse orthologue. Using the mouse as a model, we show that miR-137 and miR-665 are expressed in the brain including in lateral hypothalamus and that both miRs show a circadian rhythm similar to Hcrt. We further show that following upregulation of miR-137 and miR-665 upon IL-13 cytokine stimulation both in vitro and in vivo Hcrt mRNA is downregulated. Finally, we demonstrate that an active ingredient from the Chinese herb Danshen, which have been used widely for insomnia, increase miR-137 expression in the hypothalamus and downregulates Hcrt.

Conclusions: Together these data suggest that Hcrt expression is regulated in vivo in mice by miR-137 and miR-665. MiR-137 is conserved across species and human miR-137 also targets human HCRT, suggesting that our findings have relevance for understanding human sleep regulation.

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THE SURGICAL TREATMENT OF OBSTRUCTIVE SLEEP APNEA SYNDROME: IS ISOLATED VALUE OF AHI A SUFFICIENT CRITERION OF SUCCESS?

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Introduction: Uvulopalatopharyngoplasty (UPPP) and its combination with bipolar radiofrequency surgery of the tongue base (UPPP + RFBT) are the most common surgical treatment modalities of obstructive sleep apnea syndrome (OSAS). These procedures should improve the results of polygraphy, decrease the daytime sleepiness and influence also the incidence of cardiovascular disorders and snoring. In this project, we concentrate on the comparison of apnea - hypopnea index (AHI) change with subjective results and satisfaction of patients.

Materials and methods: In our hospital 106 patients underwent surgical treatment of OSAS during a period from 2014 to 2016. The set of patients was divided into several groups according to anatomical conditions and results of a polygraphy. The first group underwent UPPP and second one underwent UPPP+RFBT. Both of these groups were divided according to the grade of sleep apnea. We assessed apnea - hypopnea index (AHI) by polygraphy. The polygraphy was performed before surgery and 6 months after surgery. We compared subjective results after surgery to change in AHI and Sher’s criteria.

Results: Despite of being invited only one half of all the patients turned up to control monitoring after surgery. In the end, we had 53 patients with postoperative monitoring, 28 of them underwent UPPP and 25 underwent UPPP+RFBT. We noticed an improvement of presurgical AHI in 77% of the patients. This portion correlates with the results of subjective satisfaction of patients. The patients reported complete elimination of symptoms (snoring and daytime sleepiness) in 81%, 19% of the patients felt partial improvement. Nobody quoted subjective worsening after surgery, although we registered in 23% worsening of AHI. The results based on proportional decrease of AHI didn’t correlate with the subjective satisfaction of the patients.

Regarding the severity of OSAS the improvement of AHI was noted in 47% in a mild OSAS cases treated by both surgical modalities. The efficiency in moderate OSAS was 56%. Only the group with severe OSAS (treated by UPPP + RFBT) was improved in 80% of cases. The Sher’s criteria of success were met in 40% of all patients after surgery.

Conclusions: The surgical treatment of OSAS is an important method in cases where non surgical treatment fails or is refused. The results of this project show a poor correlation between AHI change and subjective feelings after surgery. We find out unsatisfying results based on simple changes of AHI values, but a majority of the patients were satisfied with subjective improvement after the surgery. Isolated AHI change is probably not a good criterion of surgery success. We suggest to add also the subjective parameters (e.g. ESS) to the evaluation.
SLEEP FRAGMENTATION HYPERSENSITIZES HEALTHY YOUNG WOMEN TO DEEP AND SUPERFICIAL EXPERIMENTAL PAIN

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Introduction: The effect of sleep deprivation on pain sensitivity has typically been studied using total and partial sleep deprivation protocols. These protocols do not mimic the fragmented pattern of sleep disruption usually observed in individuals with clinical pain conditions.

Materials and methods: Therefore, we conducted a controlled-experiment to investigate the effect of sleep fragmentation on pain perception (deep pain: forearm muscle ischaemia, and superficial pain: graded pin-pricks applied to the skin) in 11 healthy young women following two consecutive nights of sleep fragmentation, compared with a normal night of sleep.

Results: Compared to normal sleep, sleep fragmentation resulted in significantly poorer sleep quality, morning vigilance, and global mood. Pin-prick threshold decreased significantly (increased sensitivity), as did habituation to ischaemic muscle pain (increased sensitivity), over the course of the two nights of sleep fragmentation compared to the night of normal sleep. Sleep fragmentation did not increase the maximum pain intensity reported during muscle ischaemia (no increase in gain), and nor did it increase the number of spontaneous pains reported by participants.

Conclusions: Our data show that sleep fragmentation in healthy, young, pain-free women increases pain sensitivity in superficial and deep tissues, indicating a role for sleep disruption, through sleep fragmentation, in modulating pain perception.

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FUNCTIONAL ORTHODONTIC APPROACH WITH UPPER JAW EXPANSION & MFT HELPS FOR THE MOUTH BREATHER AND SLEEP APNEA

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Introduction: functional orthodontic treatment with upper jaw expansion and MFT

Introduction: Recently we need to think the each patient's function for the long term stability before, during and after orthodontic treatment. We always treat and care with AD concept & MFT (Myofunctional therapy) and then we can keep the long stability for each patient. Now I am sure We need to think about morphology and function for the treatment from AD & MFT concept. It helps our team approach based on Efforts=Result and good communication between us and patients for a long time. I would like to introduce our team approach and educations and motivations (M.I.H.O. = Motivation & International Health Organization)

Materials and methods: 100 growth child with early orthodontic treatment

Results: better upper airway expansion and from the mouth breath to the nose breath

Conclusions: functional orthodontic treatment with upper jaw expansion & extra oral approach with MFT leads to the upper airway expansion and better nose breath against mouth breath.

Discussion: I would like to discuss about our Myofunctional orthodontic approach and long term stability with my orthodontic cases.

1: MFT approach can support the better occlusion and stability
2: Early treatment and observation control with MFT can effect for the good stability.
3: Orthodontic stable result needs to establish for the dental functional occlusion.
4: Digital education system for our staff, patients and their family and students.
Dietary Supplement Containing Asparagus Extract for Improvement of Sleep in Healthy Adults

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Introduction:
In recent years, several researchers have reported that the heat shock pathway might influence sleep and circadian rhythm. We have developed ONR-8, a dietary supplement containing asparagus extract that has been characterized to induce heat shock protein 70 (HSP70). In a preliminary study, asparagus extract reduced the disturbance of circadian rhythm caused by a phase shift in the light/dark cycle in rat. Here, we have investigated the effect of ONR-8 on sleep and sleep-wake rhythm in two trials among healthy human volunteers.

Materials and methods:
The first trial was a randomized, double-blind, placebo-controlled, crossover study among 20 healthy male participants with an evening-type chronotype. The second trial had the same design as the first, but was conducted among 50 healthy participants who delayed their sleep onset time/offset time on weekends as compared with weekdays. In both trials, participants took ONR-8 or placebo for 2 weeks. In the first trial, performance was assessed by a psychomotor vigilance test (PVT), and subjective sleep was scored by the Athens insomnia scale (AIS) and Epworth sleepiness scale (ESS). In the second trial, subjective sleep quality was evaluated by the St. Mary’s Hospital sleep questionnaire (SMH) and a visual analogue scale (VAS), and the feeling of fatigue was assessed by VAS every Monday morning. Moreover, health-related QOL was estimated by SF-36, and objective sleep parameters were evaluated by actigraphy for 1 week before supplement intake and continuously during the study period.

Results:
In the first trial, the AIS score was significantly improved for subjects taking ONR-8 as compared with placebo. After excluding participants who fell asleep during the test, we found that ONR-8 supplementation led to a significantly faster reaction time in PVT assessed after lunch as compared with placebo. In the second trial, the SMH score for alertness upon awakening and the VAS score for sleep quality were significantly better in the ONR-8 treatment than in the placebo treatment. In addition, the VAS score for a feeling of fatigue tended to be improved in the ONR-8 treatment. The mental health subscale score of SF-36 was significantly better for subjects taking ONR-8 than for those taking placebo. Actigraphy data showed that the sleep offset time on weekends was significantly earlier in the ONR-8 treatment. There were no adverse clinical events throughout either trial.

Conclusions:
These findings suggest that ONR-8 improves sleep quality and daytime performance, and has a tendency to improve the feeling of fatigue on a Monday after delayed offset of weekend sleep among healthy individuals. Furthermore, ONR-8 seems to reduce the disturbance of sleep-wake rhythm. From these observations, we deduce that ONR-8 has the potential to improve alertness on Monday mornings and to prevent blue Mondays.
Introduction: Sleep disorders are common in neurological patients and they can disturb recovering processes, and may also affect neurologic diseases by worsening some important general healthy issues, such as blood pressure, glycemia etc.

The aim of this study was using questionnaires, to assess sleep disorders in neurological patients.

Materials and methods: The study sample included 40 patients which were divided into 4 groups by 10 patients each, according to their diagnosis: patients with primary headache (PH), patients with mood disorders (MD), patients with lombar pain (LP) and patients after stroke (St). Participants' sleep quality, breathing sleep disorders, sleepiness and insomnia levels were assessed using questionnaires: Pittsburgh sleep quality index (PSQI), Insomnia Severity Index (ISI), Berlin questionnaire (BQ), Epworth Sleepiness Scale (ESS)).

Results: According to the PSQI, poor sleep quality was in all 4 groups, BQ was high positive for MD patients and low positive for other 3 groups; the ESS revealed normal data for all participants. According to ISI, patients with PH and MD presented clinical insomnia (moderate severity), patients with LP and St had subthreshold insomnia.

Conclusions: According to the results of our study, patients with neurological diseases have low quality of sleep, have high risks for developing sleep breathing disorders and insomnia. So, sleep disorders are frequent comorbidities which worsen patients’ health. Thus, correct management of sleep disorders can improve outcome of neurological diseases.

Acknowledgements: This research has been executed within the Institute of Neurology and Neurosurgery, Chisinau, MD. We thank all the participants involved in the study.
THE ACCURACY OF THE STOP BANG QUESTIONNAIRE IN THE IDENTIFICATION OF OBSTRUCTIVE SLEEP APNOEA (OSA) WITH POLYSOMNOGRAPHY AS THE GOLD STANDARD IN ADULT PATIENTS WITH SYMPTOMS OF SLEEP DISORDERED BREATHING IN A TERTIARY CARE CENTRE IN SOUTH INDIA

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Introduction: The STOP BANG Score (SBS) is a newly introduced screening questionnaire for Obstructive Sleep Apnoea (OSA) and contains 8 questions based on Yes/No answers. Our study was to understand the utility of SBS in identifying OSA keeping Polysomnography (PSG) as the gold standard.

Materials and methods: This cross sectional study was conducted over a period of one year from November-2013 to October-2014 at KIMS Hospital, Trivandrum, India. The study population included patients with symptoms suggestive of OSA who were offered PSG in our institution. We collected data of 200 patients for our study. A questionnaire comprising both the ESS and STOP BANG questionnaires was given to the patients and they were asked to fill it. Type 1 polysomnography was done for all the patients. Following polysomnography, the final manually scored Apnoea - Hypopnoea Index (AHI) was documented. Statistical analysis was done by descriptive statistics using sensitivity, specificity and ROC curves. The sensitivity and specificity of both the STOP BANG and ESS questionnaires in identifying OSA were calculated. The ROC curves and area under curve of both questionnaires were found out. The co relation between the STOP BANG questionnaire and the Epworth Sleepiness Scale in the identification of OSA was also analysed.

Results: We included 200 patients who were having symptoms of OSA and posted for polysomnography in our institution. Out of 200 patients, 144 were males. Majority were in the age group of 40 to 50 yrs. 180 patients were found to have OSA following polysomnography, out of which 110 had severe OSA, 45 had moderate OSA and 25 had mild OSA. Regarding the SBS, 35 patients had score from 0 to 3, 143 patients had score from 4 to 6 and 22 patients had score more than 6. The sensitivity and specificity of STOP BANG score were 90.6% and 90% respectively with a cut off of 4 whereas lower scores had high sensitivity but low specificity. Youden’s index was highest with this cut off value. Higher cut off values gave high specificity, but the sensitivity was low. Regarding ESS score, out of 200 patients 83 had score 0 to 9, 93 had score 10 to 15 and 24 had score more than 15. The sensitivity and specificity of ESS with cut off value of 10 from our study was 58.33% and 40% respectively.

Conclusions: STOP BANG Score (SBS) is a better clinical tool to predict Obstructive Sleep Apnoea (OSA) as compared to Epworth Sleepiness Scale (ESS). It is easy to administer. The higher the SBS, the higher is the chance of having severe OSA. The use of SBS in screening for OSA should be encouraged. Most of the patients with severe OSA with high risk according to SBS had low ESS. Hence ESS underestimates the severity of OSA. Moreover, the questions in ESS covers factors related to excessive sleepiness only whereas SBS covers questions related to sleepiness and other risk factors of OSA. Hence SBS can be used for OSA screening whereas ESS is better used for sleepiness screening.

Acknowledgements: Dr. MI Sahadulla, Chairman and Managing Director (CMD) - KIMS hospital
Objective: This study aims to prove that Indonesian version of Berlin questionnaire (Berlin-ID) are valid and reliable as a tool to screening obstructive sleep apnea (OSA) patients in primary care.

Background: In Indonesia, OSA is still being a health problem because of under-diagnosed and under-treated by health workers. One of specific questionnaire to screening OSA patients is berlin questionnaire. However in Indonesia this tool has not been validated.

Methods: This study used cross sectional design. Firstly, we used parallel back-to-back translation and cultural adaptation based on Beaton and Guillemin method\(^9\) to producethe Indonesian version (Berlin-ID). The final step were validation and reliability test of Berlin-ID to 20 patients in sleep department of CiptoMangunkusumo General Hospital. Criteria validity was evaluated using Kendall correlation test between domains in Berlin-ID with Apnea Hypopnea Index(AHI) from polysomnography as the gold standard measure and construct validity was evaluated using Factor analysis. Berlin-ID reliability assessed by internal consistency using Cronbach alpha and test-retest reliability using Kendall correlation test and Wilcoxon comparative test.

Results: Data collection was done to 20 suspected OSA patients in CiptoMangunkusumo National General Hospital, Indonesia. Most subject were males (55%) and obese with BMI >30 (55%). Basedon the polysomnography report, 16 patients (80%) had OSA using the AHI \(\geq 5\) as the cutoff point. The Criteria validity showed a strong correlation range between 0.677-0.764 (p< 0.05) and good construct validity (Keiser-Meyer-Olkin measure of sampling adequacy 0.606, Bartlett’s test with chi-square 20.234, and p< 0.05) with eigen value 2.090 in component 1 and r >0.4 (range 0.675-0.914). The test-retest reliability value showed a good range = 0.802 - 1.000 (p< 0.05) and comparative test-re-test showed no differentiation (p >0.05). The Cronbach’s alpha of Berlin-ID was 0.831 in category 1, 0.790 in category 2, 0.878 in category 3, and 0.735 in total item. The sensitivity, specificity, positive prediction value, and negative prediction value were 87.5%, 75%, 93.3% and 60% respectively.

Conclusion: The Berlin-ID are valid and reliable to screening OSA patients in Indonesia with high sensitivity and specificity.
OBSTRUCTIVE SLEEP APNEA WITH LEFT VENTRICULAR DYSFUNCTION IS SIGNIFICANTLY ASSOCIATED WITH NON-SURVIVAL DISCHARGE AFTER THE RETURN OF SPONTANEOUS CIRCULATION OF THE OUT-OF-HOSPITAL CARDIAC ARREST

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Introduction: The relationship between obstructive sleep apnea (OSA) and mortality has been little known in patients with aborted sudden cardiac arrest (ASCA) after the return of spontaneous circulation (ROSC) of the Out-of Hospital Cardiac Arrest (OHCA). Therefore, we investigated OSA and non-survival discharge in patients with ASCA after ROSC of the OHCA.

Materials and methods: We reviewed and retrospectively analyzed data from consecutive 229 OHCA occurring from 2010 to 2016 in which patients aged 19 years or older had an OHCA in the Emergency Room and admitted into intensive care unit in Eulji University Hospital, Deajeon, Korea. All patient have undertaken emergent coronary angiogram, hyponea-apnea index (AHI) and echocardiogram to evaluate the cause of OHCA and divided into two groups; survival (n=102) vs. non-survival discharge (n=127).

Results: The mean age of non-survival was older than survival group (70±15 vs. 60±16, p< 0.001). However, baseline characteristics were also similar between two groups. The proportion of ventricular arrhythmia (64% vs. 19%, p< 0.001), AHI>5 (30% vs. 5%, p< 0.001) and low ejection fraction (23±27% vs. 43±16%, p< 0.001) were significantly higher in the non-survival than survival group while the proportion of prescribed anti-arrhythmic drugs for atrial and ventricular arrhythmia was similar between two group (33.3% vs. 23.6%, p=0.104). The etiology for proportion of acute myocardial infarction confirmed by emergent intervention was similar between two groups (44% vs. 50%, p=0.345). Multivariate regression analysis showed that ejection fraction and OSA were odd ratio 2.78 (1.45-4.90) with p=0.003 and 1.45 (1.15-2.21) with p=0.001.

Conclusions: In the patients with ASCA after the ROSC with OHCA, Non-survival was significantly associated with ejection fraction and OSA.
INCIDENCE AND CHARACTERISTICS OF SLEEP APNEA HEADACHE IN KOREA

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Introduction: The prevalence of sleep apnea headache has not been established and its possible mechanism is unclear. This study evaluated the frequency of sleep apnea headache in Korean patients with obstructive sleep apnea (OSA) with the aim of identifying their clinical characteristics as well as the sleep parameters that are correlated with headache intensity.

Materials and methods: Between January 2005 and December 2014, 2000 patients who were referred to our sleep clinic underwent overnight polysomnography and were interviewed by a neurologist. The neurologist also reviewed the medical records and headache questionnaires of 1659 patients with OSA. We selected patients with sleep apnea headache based on diagnostic criteria of the International Classification of Headache Disorders (III beta version). Descriptive statistics were applied to analyze clinical characteristics and various sleep parameters. Pearson's correlation coefficient and single/multivariate linear regression analysis were used to identify predictors of headache intensity.

Results: Sleep apnea headache was diagnosed in 139 (8.4%) of the patients in this single-center study. The diagnosed patients had male dominancy (87.8%), severe sleep apnea (mean apnea-hypopnea index [AHI]>30), and were middle-aged (mean of 43.5 years old). The ratio of the apnea-hypopnea time to the total sleep time, AHI, the oxygen desaturation index, and the arousal index were positively correlated with headache intensity. AHI was the best predictor of headache intensity in the patients with sleep apnea headache.

Conclusions: The frequency of sleep apnea headache among the Korean patients in this study was lower than in previous studies. We found that there was a strong positive correlation between OSA severity (mostly, AHI) and headache intensity in patients with sleep apnea headache.

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THE IMPACT OF SLEEP DISTURBANCE TO CAREGIVERS OF ALZHEIMER’S DISEASE

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Introduction: Dementia brings not only cognitive decline but ultimately the loss of independent living and personal integrity. Especially, sleep problems are common in Alzheimer’s disease (AD) and one cause of institutionalization. As the disease distress for AD is increasing by sleep problems, the distress laid on the caregivers whose family members are affect with such conditions is also in the rise. So, we investigate the relationship between sleep problems and caregiver distress in AD.

Materials and methods: All subjects, who have taken neuropsychiatric inventory between May of 2015 and October of 2016, were retrospectively reviewed. We included newly diagnosed patients with major neurocognitive disorder due to probable/possible Alzheimer’s disease in their early phase, demonstrating clinical dementia rating of 1. Patients with severe medical comorbid conditions that may act as confounding factors in increasing the caregiver distress were excluded. Consequently, forty-six subjects were included. We explored the correlation between behavioral and psychological symptoms of dementia and caregiver distress.

Results: Depression, agitation, sleep problem, anxiety, delusion, disinhibition, appetite problems, apathy and euphoria demonstrated significant positive correlation with the caregiver’s distress of AD patients. Among those, three behavioral and psychological symptoms of dementia (BPSD) especially showed strong correlations; depression (r =0.743, p< 0.001), agitation (r=0.720, p< 0.001) and sleep problem (r=0.709, p< 0.001).

Conclusions: Depression and agitation are well-known symptoms that increase the AD caregiver burden. Our findings suggest that sleep disturbance is also a major BPSD that may increase the caregiver distress significantly. Therefore, early identification of sleep problems and adequate interventions to AD patient are essential to alleviate the agony of the AD caregivers. This may, in turn, lead to better management of the AD patients and reduce too early institutionalization.

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Introduction: Shorter sleep duration has been reported in pediatric samples, which is often associated with the daily routine of the parents. Due to their working schedules, children frequently stay at childcare centers or at school for full-time. However, few institutions have educational approaches focused on improving the sleep quality of the children. In this sense, we have developed the Pilot Project “The Art of Dreaming”, aiming to introduce sleep in early childhood education by promoting awareness of teachers, parents, and caregivers.

Materials and methods: The activities were carried out in a public school from Sao Paulo city, Brazil, in 2016, and included teachers and students of 3-5 years-old. First activity consisted in meetings between the teachers and sleep specialists, in which they discussed about the importance of sleep during childhood and its association with school performance. Informative booklets were sent to the parents or caregivers. This material addressed important concepts about sleep ontogeny and sleep disorders. Children were asked to draw the room where they slept at night. From the drawings, it was possible to identify important factors that influence their sleep, such as the presence of electronic devices.

Results: In total, 4 teachers and 97 children of 3-5 years-old participated in the project. It was a full-time school with a start time at 06:45 AM and an end time at 05:00 PM. Great part of the children was at the school all day. However, children had no opportunities of naps during daytime. As a consequence, teachers reported that the children frequently became very agitated at the end of the day, impacting negatively on their performances at school. Regarding the classroom activity, the drawing proved to be an easy and playful method to assess the habitual sleep conditions of children. Most of the children have indicated in the drawing that they still slept with their parents in the same room or even in the same bed. Great part of the children also illustrated the presence of electronic devices in the room, including television and computers. Another important sleep feature observed during this activity was the frequent representation of an attachment object.

Conclusions: The great goal of the Pilot Project “The Art of Dreaming” was to promote sleep awareness in 3 different levels, reaching teachers, students, and parents or caregivers. The project highlighted that simple and playful activities are important tools in teaching-learning process of sleep as an approach for health promotion. The drawing activity was an effective and easy method to assess important environmental and social features of sleep of the children. This method could be largely used by teachers or even health practitioners as an approach to promote a better sleep hygiene in pediatric samples.

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Other
Board #149: P2 - Monday

BEHAVIOURAL OBSERVATIONS STEP 1: “FIDGETY PHILIP”, THE GODFATHER OF ADHD?

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Introduction: Psychiatrist Heinrich Hoffmann's "Die Geschichte vom Zappelphilipp" (1845) is a story depicting a boy, Philip, displaying fidgety behaviours. Over time, paediatricians/psychiatrists identified the symptoms “Fidgety Philip” (FP) presented as characteristics of ADHD. Our goal was to develop a learning tool to teach how to annotate behavioural observations. The first step in this endeavour was to analyze FP cartoons with the goal of training research assistants (RAs) and developing a shared annotation language.

Methods:
(A) Using a REDCap survey structure, seven RAs without formal training analyzed three FP cartoons separately, for 8.5 minutes each. The survey comprised of
(i) describing the scene;
(ii) ranking the importance of features;
(iii) predicting what happens next; and
(iv) determining/explaining prediction accuracy.
The first and second cartoons were reversed to avoid assumptions based on the ongoing sequence.
(B) Qualitative information was analyzed and negotiation points were noted.
(C) Quantitatively, individual results were combined to determine totals/means of observations.
(D) Previously designed pictograms were used to agree on main features in each cartoon.

Results: Qualitative information was divided into
(i) descriptions; and
(ii) interpretations.
The total number of descriptions (168) was greater than the total number of interpretations (106). In the first cartoon, the total number of descriptions and interpretations were similar: 48 descriptions versus 43 interpretations. The following two cartoons yielded more descriptions than interpretations: 58 versus 39 in the second cartoon, and 62 versus 24 in the third. This, supported by calculations of means, demonstrated a trend towards a higher ratio of descriptions to interpretations with the sequence. The accuracy of prediction (based on five RAs) between the first and second images was 0%, and 40% between the second and third.

Conclusion: Descriptions, interpretations, and predictions are formed by the "Gestalt"-perception of each individual. The reduction of interpretations can be attributed to the learning experience that occurred between the first and last cartoon; relevant, neutral descriptions became the focus, while subjective interpretations decreased. To increase the descriptive quality of annotations, pictograms may serve as a neutral language that can be applied to the characterization of movements associated with so-called disruptive behaviours.

CROSS-CULTURAL DIFFERENCES IN YOUNG CHILDREN’S SLEEP: THE ROLE OF RELIGION IN A SAMPLE OF CHRISTIAN AND MUSLIM TODDLERS AND SCHOOL-AGED CHILDREN IN GREECE

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Introduction: Sleep patterns of young children vary widely. Studies have confirmed an interesting interplay between biological and sociocultural determinants. Nevertheless, the possible effect of the family’s religion on the sleep of young children has not been researched extensively. The aim of the study was to investigate possible associations between sleep-wake patterns and cultural and sociodemographic factors in a sample of children in Greece, particularly assessing the possible effect of religion.

Materials and methods: The study sample consisted of 381 children, 275 Christians and 106 Muslims, aged 2.5 to 9 years, who live in Thrace, Greece.

Results: Results showed cross-cultural differences in sleep patterns of Muslim and Christian children, concerning bedtime resistance/sleep anxiety (BRSA), sleep duration and daytime sleepiness scores. Specifically, Muslim children were reported by their parents as having higher levels of BRSA and more problems with sleep duration than Christian children, but lower levels of daytime sleepiness. Factors influencing sleep duration were place of residence, number of people living at home, having own bedroom and history of breastfeeding.

Conclusions: In conclusion the findings of the study indicate significant cross-cultural differences in sleep patterns of toddlers and school-aged children in northern Greece, when religion is taken into account. Future research needs to focus on possible differences in sleep patterns between subcultural or ethnic groups and minorities.
TO EXPLORE THE EFFECTS OF MIDNIGHT GLYCEMIC-INDEX DIET INTAKE ON THE SLEEP OF MEDICAL COLLEGE STUDENTS IN THE CENTRAL OF TAIWAN

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**Introduction:** Sleep is a common health problem of modern society. Many evidences support that food intake may play a role on the impact of sleep. Further analyze the importance of food intake on the regulation of sleep, and the relationship between mealtimes and sleep. In addition, the study also found that the glycemic-index (GI) may affect the duration and quality of sleep, but the relationship yet to be identified.

This study used a cross section design to explore whether there are association between sleep (quality, duration) and diet intake (glycemic-index type, midnight time intake) among medical college students in Taichung, Taiwan.

**Materials and methods:** Using a cross-sectional design, 108 participants were recruited from medical college in Taichung, Taiwan. They completed demographic data and the Pittsburgh Sleep Quality Index (PSQI). One trained research staff conducted participants used Sleep diary to measure their sleep data. And to guide them using the LINE App to recording their dietary contents and mealtime. From the backward pictures and time data, researcher grouping their dietary glycemic-index type (high, medium, low) and intake time. This study analyzed the data of midnight intake.

**Results:** Over half participants had less than 7 hours sleep duration and poor sleep quality (59% and 51.4%). A total of 49 (47.6%) participants had midnight intake and the intake content showed that the glycemic-index type are low (n=10; 20.4%), medium (n=9; 18.4%), high (n=30; 61.2%). There are no significant differences between midnight eating groups in sleep duration, latency, efficiency and quality. Future analysis result of PSQI related in the group of medium glycemic-index intake the sleep duration is shortest (p=.034). But in the low glycemic-index group the sleep duration is longest (p=.034). And in the group of high glycemic-index intake have more sleep disturbances (p=.006).

**Conclusions:** The results of this study will help to understand the impact of between meal times and the glycemic-index diet intake on sleep, in order to provide the basis of clinic practices for managing sleep problem. Promoting longer sleep duration and sleep quality has include avoiding high glycemic-index intake before bedtime.

**Keywords:** sleep quality, sleep duration, glycemic-index diet, midnight intake
ASSOCIATION BETWEEN HAEMOGLOBIN AND BLOOD FERRITIN WITH SLEEP DISORDER IN PEDIATRIC PATIENT WITH BETA THALASSEMIA MAJOR IN HASAN SADIJKIN HOSPITAL BANDUNG

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Introduction: Beta thalassemia major is the most common inherited blood disorder worldwide that can lead to chronic anemia. Sleep disorders have been reported in adults with anemia, with periodic leg-movement syndrome and sleep fragmentation being the most common disorders. Little is known about sleep disorder in children with thalassemia, specifically. The object of this study was to investigate the association haemoglobin, blood ferritin with sleep disorders in pediatric patient with beta thalassemia major.

Materials and methods: This was a cross-sectional study involving pediatric patient with beta thalassemia major aged 8-14 years who regularly underwent blood transfusions in Hasan Sadikin General Hospital Bandung from January to May 2017. All subjects were measured with Sleep Disturbance Scale for Children (SDSC).

Results: During study period, 54 subjects were included in this study; 55.55% of them were male with the mean (SD) age of 11.12 (1.77) years. The mean hemoglobin level was 6.99 (0.85) g/dL and blood ferritin level was 3890 (2017) µg/L. Based on SDSC reports, there were 33.33% subjects who had sleep disorders. Statistical analysis using Chi square test showed significant association between haemoglobin level and sleep disorder (p 0.048), but no significant association between blood ferritin level and sleep disorders (p 0.170).

Conclusions: The prevalence of sleep disorder in pediatric patient with beta thalassemia major is quite high. There is significant association between haemoglobin level and sleep disorders, so this could be as important point for clinician to improve patient's quality of life.

Acknowledgements: Department of Neurology, Universitas Padjajaran, Hasan Sadikin Hospital, Bandung, Indonesia
A LONGITUDINAL STUDY EXPLORING THE RELATIONSHIP BETWEEN NEGATIVE SOCIAL WORLDVIEW AND SLEEP QUALITY IN A CHINESE SAMPLE

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Introduction: Social cynicism is a general negative belief about human nature and social world, that there are biases and mistrusts. With the mistrust of others in social context, social cynics are expected to have lower concern over human kindness, to be more sensitive to potential threats, and to suffer more from sleep problems. Would this negative worldview affect people’s sleep quality? Or do sleep problems change one's perception about the social world? Few studies in the field have examined the relationship between these two constructs. The present research examined the relationship between social cynicism and sleep quality in a Chinese sample.

Materials and methods: This study is part of a longitudinal project on the formation and transformation of beliefs among Chinese people. Internet survey data were collected at three waves: W1, W5 and W6, between 2009 and 2016. A total of 7,187 participants (64.1% female, 64.6% full-time student, mean age = 24.9) responded to the online survey. Measures included the Pittsburgh Sleep Quality Index, Social Axiom Survey II and selected items from the International Personality Item Pool Big-Five Domain scale, measuring neuroticism.

Results: Cross-sectional analyses confirmed significant yet weak correlations among poor sleep quality and social cynicism (ranging from .113 to .149, p < 0.05). Both social cynicism and poor sleep quality had moderate correlations with neuroticism. After controlling for gender and age, cross-lagged analyses did not show any significant temporal relationships between social cynicism and sleep quality, while a bi-directional relationship was shown between neuroticism and sleep quality. Individuals who scored high on neuroticism at Wave 1 tended to have poorer sleep quality (b = −.125, p < .01) and be more cynical (b = −.095, p < .05) later at Wave 5. Meanwhile, individuals who reported better sleep quality at Wave 1 tended to be less neurotic (b = −.070, p < .05) at Wave 5. The model achieved good fit, χ² (301) = 1317.378, p < .001; RMSEA = .022 (90% CI = .020-.023), Cfit p = 1.000; CFI = .961; TLI = .948; SRMR = .039.

Conclusions: Social cynics tend to have poor sleep quality. However, this negative social worldview and poor sleep do not seem to be casually linked in the present study. That they might be under the same influence of some common factors such as neurotic personality is a more viable hypothesis, and should be further explored in future research.

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Other
Board #030: P5 - Wednesday
EFFECTS OF SLEEP DEPRIVATION ON COGNITIVE AND PHYSICAL PERFORMANCE IN UNIVERSITY STUDENTS

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Introduction: Sleep deprivation is common among university students and is associated with poor academic performance and physical dysfunction. Current literature, however, has a narrow focus with regards to domains tested. This study aimed to provide a more holistic assessment of sleep deprivation by assessing both cognitive and physical performance.

Materials and methods: A randomised controlled crossover study was carried out on 64 undergraduate and postgraduate student participants (male: n=37; 58%) aged 22 ± 4 years (mean ± sd) as this group often experiences periods of acute sleep deprivation due to academic and social commitments. Participants were randomised into two conditions: normal sleep or one night of sleep deprivation. Sleep deprivation was monitored using an online time-stamped questionnaire at 45 minute intervals, completed in the participants’ homes. The outcomes were cognitive: working memory (Simon game © derivative) and physical: reaction time (ruler drop testing), heart rate and blood pressure during submaximal cardiopulmonary exercise testing.

Results: Reaction time and systolic blood pressure post-exercise were significantly increased following sleep deprivation (mean ± sd change: reaction time, 0.15 ± 0.04 s, p=0.003; systolic blood pressure, 6 ± 17 mmHg, p=0.012). There were no significant changes in other cognitive or cardiopulmonary variables.

Conclusions: These findings indicate that acute sleep deprivation can impact on physical but not cognitive function in young healthy university students, potentially placing these individuals at increased risk of accidental injury. Further research is needed to identify the mechanisms behind these effects and the impact of chronic sleep deprivation in this population.
Introduction: Of the present study was to evaluate the serum levels of melatonin in type-2 diabetic patients and to clarify whether there is an influence of adiposity and smoking.

Materials and methods: 26 type-2 diabetic (T2D) patients were recruited in the pilot study and 12 healthy subjects (non-smokers) were selected as controls (C). The study groups were matched for age and sex. Melatonin was measured in saliva by ELISA. Statistical analyses were performed using SPSS Statistic software.

Results: Patients with T2D had significantly lower melatonin level than healthy control subjects (p< 0.003), besides T2D patients with adiposity (BMI >30 kg/m2) had significantly lower melatonin level than patients without adiposity (p< 0.035), as well as T2D smokers had significantly lower melatonin level than T2D non-smokers.

Conclusion: T2D patients are associated with decreased melatonin level in saliva. Adiposity and smoking have influence on the decrease of melatonin concentration of T2D patients.

Acknowledgements: This study was supported in part by grant No. 2014.10-4/VPP-1.1.2 and 5.1.2 of the framework of the Latvian National Program.
DIURNAL DYNAMICS OF PQ-INTERVAL IN HEALTHY PERSONS: ON THE ISSUE OF NORMAL CHARACTERISTICS

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Introduction: The standards for the analysis of 24-hour ECG including periods of physical activity and sleep are not well defined. In particular, the actual normal values for PQ-interval duration (120-200 ms) result in abnormal findings in 78% of healthy persons. The aim of this study was to evaluate the duration of the daily dynamics of the PQ-interval in healthy persons of different age and gender.

Materials and methods: 113 healthy persons (75 male, 38 female) aged 16-51 years, have been divided into four groups: 1 (n=38) - 16-20 years, 2 (n=28) - 21-30 years, 3 (n=21) - 31-40 years, 4 (n=26) - 41-51 years. All persons underwent a 24-hour multifunctional monitoring, including 12-lead ECG ('Kardiotekhnika-07', Incart, St. Petersburg, Russia) to assess the daily dynamics of the duration of the PQ-interval. This device allows precise recording of the ECG low-amplitude components by multi-bit analog-to-digital conversion. We analyzed the value of the correlation coefficient between the duration of PQ- and RR-intervals, as well as the regression coefficient indicating changes of PQ-interval depending from the RR-interval. Wandering atrial pacemaker episodes were excluded from the analysis.

Results: We detected an expression of individual and inter-individual fluctuations in the duration of PQ-interval: minimum value of 88 to 176 ms (M±m, 116.8±1.6 ms), maximum value of 124 to 276 ms (177.0±2.6 ms). In the persons older than 30 years, the duration of PQ-interval, calculated separately for day and night was higher (p< 0.05). Circadian index PQ-interval did not change with increasing age, its value remained within the range of 1.11-1.13. The average daily value of the minimal PQ-interval increased after 30 years (p< 0.01), while there was a trend to higher values of this parameter in men (p=0.06). The duration of the minimal PQ-interval of 110-100 ms was observed in 48% (n=32) of persons in the 1-st and 2-nd group, 17% (n=8) in the 3-rd and 4-th group, the duration of less than 100 ms respectively in 18% (n=12) and 6% (n=3). The upper limit of the average daily duration of standard PQ-interval in different age groups did not differ, the gender differences were not determined. The PQ-interval duration of ≥220 ms occured in 5% (n=3, before and after 30 years). Bradycardia with PQ-interval duration of >200 ms was seen in some individuals. The correlation between changes in the RR- and PQ-intervals was strong (r=0.711) and reliable in 71% (n=80); unreliable correlation was observed in 12% (n=13). The lack of correlation between the duration of RR- and PQ-intervals was seen only in 15% (n=13) of persons, all of them aged < 40 years.

Conclusions: Normal values for the minimal PQ-interval calculated for the day time should be set at 95 ms in patients < 30 years and at 100 ms in patients >30 years of age. Normal range for the maximal PQ-interval duration should be increased up to 220 ms. In this case, 95% of healthy persons will have not values greater than normal.

Acknowledgements: Nil.
THE BRUGMANN FATIGUE SCALE: SHAMELESSLY COPYING THE EPWORTH SLEEPINESS SCALE TO MEASURE BEHAVIORAL REST PROPENSITY

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Introduction: While often confused, fatigue as opposed to sleepiness, mostly requires rest, not sleep to recover from. Clinical evaluations of fatigue mainly rely on assessments of symptom-intensity, however without taking into account the need to engage in behavioral countermeasures. We therefore developed an 8-item 4-point Likert scale (the Brugmann Fatigue Scale; BFS) sharing a similar conceptual background with the Epworth Sleepiness Scale (ESS), to assess both mental and physical fatigue and focusing specifically on rest propensity.

Materials and methods: Out of 496 consecutive patients addressed to the sleep unit of an academic hospital, we selected a sample of 295 hypnotic-free subjects (122 females) within a retrospective cohort design. The present study examines (a) the psychometric properties of the BFS and (b) measurement invariance regarding perceived sleep quality, in parallel with common sleepiness and fatigue scales (ESS and Fatigue Severity Scale; FSS). In addition, (c) correlations of the BFS with polysomnographic variables and other clinical scales were explored descriptively.

Results: Rasch analyses revealed that the BFS possesses sound psychometric characteristics (rating scale functioning, item fit, dimensionality and measurement invariance) allowing for valid, reliable, linear and unidimensional measurement of mental and physical rest propensity, irrespective of perceived sleep quality. In addition, the BFS was significantly correlated to periodic limb movements during sleep and inversely to REM sleep duration. For both mental and physical subscales, scores above 6 are proposed as cut-off values.

Conclusions: In analogy to the ESS, the BFS shows to be a unique and precise instrument assessing symptomatic fatigue with respect to rest propensity and might provide new insights in how individuals discriminate both constructs from a behavioral point of view, aside from any semantic confusion.
Introduction: Fragmented sleep in infancy is very common and known to diminish with age. However, some infants continue to have fragmented sleep even at older ages straining the life of the whole family. Some longitudinal studies have suggested that more matured sleep is connected to better cognitive and language functioning. However, the influence of early-onset fragmented sleep to psychomotor development is not yet known. In the current study psychomotor development and parent-reported sleep characteristics were investigated in infants with and without fragmented sleep.

Materials and methods: Infants with \( n = 82 \), \( \geq 3 \) night awakenings) and without fragmented sleep \( n = 69 \), \( \leq 1 \) night awakening) were studied within the CHILD-SLEEP birth cohort with the Bayley Scales of Infant and Toddler Development (Bayley-III) at 8 and 24 months of age. In addition, parent-reported sleep quality and quantity measures of sleep were investigated with the Brief Infant Sleep Questionnaire (BISQ) at 8, 18, and 24 months of age.

Results: Contrary to our expectations, psychomotor development between the two groups did not differ at 8 or 24 months of age due to fragmented sleep. However, the infants with fragmented sleep slept less during the night and daytime compared to infants without fragmented sleep. In addition, the infants with fragmented sleep had longer sleep latency and they spent more time awake during the night than infants without fragmented sleep. Interestingly, girls with fragmented sleep slept less in total and during the night than boys with fragmented sleep whereas there were no gender differences in infants without sleep fragmentation.

Conclusions: Fragmented sleep in infancy seems not to have a negative effect for the overall psychomotor development at the age of 24 months despite the differences in sleep length in infants with and without fragmented sleep. It is possible that the effects of fragmented sleep are evident in more specific neurocognitive functions, such as attention and executive functioning.

Acknowledgements: We would like to thank all the families who have participated in the CHILD-SLEEP birth cohort. We are also grateful for the nurses at the maternity clinics who introduced the study to the families. The project was funded by the Academy of Finland, Gyllenberg foundation (TP), Yrjö Jahnson Foundation, Foundation for Pediatric Research, Finnish Cultural Foundation, the Competitive Research Financing of the Expert Responsibility area of Tampere University Hospital, Arvo and Lea Ylppö Foundation, and the Doctors’ Association in Tampere.
SLEEP HABITS AND SLEEP DISTURBANCES IN A PEDIATRIC POPULATION OF CABO VERDE

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Introduction: Sleep habits are known to have a profound cultural influence, with great variation among populations. The aims of this study were:
   a) To describe the sleep habits and sleep disturbances of a pediatric population from Cabo Verde;
   b) Compare the results with those from other cultures.

Methods: Cross-sectional survey, culminating in a correlational study. Data was collected between September and November of 2016 by conducting the Portuguese version of the Children's Sleep Habits Questionnaire (CSHQ). The interviews took place in surveillance appointments in primary care centres of São Vicente and the respondents were the parents of children between 2 and 15 years old. Total scores, subscale scores and item scores were obtained and analysed. The cut-off with the best diagnostic confidence was 56, as suggested by a ROC curve weighting both sensitivity and specificity equally. Internal consistency was assessed using Cronbach's alpha (α=0.77). The distribution of scores across subgroups of children differing by age, gender, existence of parent reported sleep problems, number of cohabitants, father and mother age and level of father and mother school years were compared using Mann-Whitney's U-Test or Kruskal-Wallis test. The Bonferroni correction was used to set the family-wise error rate at 0.05% (p< 0.001).

Results: 206 complete questionnaires, response rate of 100%. The mean age was 6.6, and there were 95 males in the sample (46%). The mean CSHQ score was 52.72 (min 36; max 79; SD 8.82). The estimated prevalence of sleep disorders was 29.9% and the prevalence of parent reported sleep problems was 22.82%. The existence of parent reported sleep problems displayed positive sample correlation with all CSHQ subscale scores and with the CSHQ total score. The distributions of CSHQ total scores and subscale scores showed no statistical differences across gender or age. Significant differences were found between age subgroups in the items "goes to bed at same time", "needs parent in room to sleep", "sleep same amount each day", "wets bed at night", sleeps while riding in car" (p< 0.001), with younger children having higher scores. The items “falls asleep in own bed” and “falls asleep in other’s bed” presented better scores for higher levels of mother education (p< 0.001). During the week days, the average wake up time was 7:15h (SD 1:02) and the average bedtime 20:30h (SD 0:57). The average number of total sleep hours was 12,5 (SD 2).

As compared with Dutch, Chinese, North-American and Portuguese previous studies, our sample had higher CSHQ scores and increased total sleep hours.

Conclusions: This was the first study about sleep habits in Cabo Verde. When compared to other cultures, this population scored higher in all CSHQ subscale scores, as well as in the CSHQ total score. The average sleep duration was higher than reported in other studies. Bedtime was delayed and sleep duration decreases with increasing age, as identified in previous studies.

Cultural, social and environmental characteristics of sleep practices, such as co-sleeping and crowded housing, may contribute to higher CSHQ scores.
SOUND CONDITION DEPENDENT CHANGES IN BRAIN ELECTRICAL ACTIVITIES AT THE TIME OF SLEEP ONSET

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Introduction: Environment sound could adversely affect sleep initiation. However, it is unknown how environment sound affects neural activities as well as how it conveys effects on neural circuits connectivity. In this study, we examined difference of brain neural substrates under different ambient sound conditions during the process of sleep onset.

Materials and methods: 12 healthy adult volunteers (12 males 20.69+/-0.27 years old) participated in the study. Each participant underwent two PSG sessions, each of which had different sound condition; No noise [NN], City noise(40dB) [CN]. This study has been approved by Ethic’s committee of Shiga University of Medical Science.

PSG data were later analyzed by trained scorer. EEG recordings were extracted from the PSG data, and the data were processed by Low Resolution Brain Electromagnetic Tomography (LORETA) software.

Results: Sleep latencies were not different as average sleep latency was 38.13±11.96 minutes in NN, and 35.83±12.56 minutes in CN.

LORETA analysis found brain activity at the before and after 10 minutes of sleep onset could be categorized into 4 types of microstates respectively in both conditions. Each microstate had differential electrical activity patterns, and traditional 4 patterns of microstates were found for 10 minutes before sleep in NN as described previously. Interestingly, in CN conditions, microstates corresponding to more process in the auditory cortex and parietal regions were found. This auditory system related microstates were not found in NN condition, and auditory cortex dominant microstates (ACM) and parietal region dominant microstate (PRM) spans 33.85% and 12.17% of time respectively. Furthermore, this auditory process related microstates were found after sleep onset, and ACM and PRM spans 31.25% and 18.60% of time after sleep onset.

To examine neural connectivity changes affected by sound conditions, we defined 11 regions of interest as follows; Lt_BA6, Rt_BA6, Lt_BA40, Rt_BA40, ACC, Lt_DLPFC, Rt_DLPFC, Lt_Ant_Insula, Rt_Ant_Insula, Lt_BA22 and Rt_BA22.

Coherence analysis by LORETA showed that reciprocal connectivity was decreased after sleep onset in NN. However, it was found reciprocal connectivity remained high between ACC and both DLPFCs in NN even after sleep onset.

Conclusions: Current study addressed the effects of sound conditions at sleep onset. Although sleep latency was not affected by sound conditions, neurophysiological activities were different. It was of note that connectivity between ACC and DLPFCs were higher in noisy condition, when only auditory systems were electrically active. This result suggested that sound condition may influence higher cognitive functions continuously after sleep onset, even sound itself evoke potentials in auditory related regions in the brain.

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THE MARKET VALUE OF SLEEP: USING ECONOMIC INPUT-OUTPUT ANALYSIS TO SHIFT SOCIETY’S VIEWS ON SLEEP LOSS

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Introduction: Modern society is driven by economic profit and output. Sleep loss is considered to impact profit and output via fatigue related accidents. However, the consequences of sleep loss are not limited to these short term performance decrements. Sleep loss also impacts physical and mental health, contributing to the prevalence of many diseases and social issues. These burden society with increased medical and social welfare costs. Fatigue Risk Management Systems and prescriptive legislation do not directly address these consequences. Sleep education programs do aim to address these issues but to initiate wide reaching change to society’s relationship with sleep what may be needed is a complete shift to how society values sleep. Thus, as a call to arms to other sleep scientists to creatively consider ways of shifting society’s views on sleep, we posed a series novel questions.

Given that modern society is driven by economic profit and output we asked 'Could sleep loss be factored into the economy, could we assign a monetary value to sleep loss, and could sleep loss be linked to industry output?' Furthermore, if we could do this, how would it look, what would the market value of a minute of sleep be, and how would this price differ between industries?

Materials and methods: Data collected in the Australian Bureau of Statistics’ 2011-12 Australian Health Survey was used for analysis. Economic Input-Output (IO) analysis was chosen to calculate a cost ‘footprint’ of production within 19 industry sectors of the Australian economy. Next, sleep loss was considered a ‘recourse’ of an industry’s production which allowed for the calculation of the value of a minute of sleep, and the amount of sleep lost per dollar spent on products in each industry.

Results: Calculating the dollar amount associated with sleep duration allowed for comparisons of the price that each sector would pay for sleep at the current market value. The industry sector that valued the sleep of its employees the highest were Real Estate ($465 dollars earned per minute slept) and Manufacturing ($285), with the lowest being Health ($6).

The amount of sleep lost per dollar spent within each Australian industry was also calculated. The largest sleep loss impacts were found in the Transport industry sector, where every thousand dollars spent resulted in 86 minutes of lost sleep. In total, Australian household consumption is responsible for 16 billion minutes of sleep lost per year, with the Manufacturing sector contributing the largest amount: 3.1 billion minutes (19%) of lost sleep.

Conclusions: These metrics identify industries that have moderate sleep loss in their workforce, as well as others industries that have a well slept workforce but have prevalent sleep loss in their supply chain. The findings can be used to encourage consumers and businesses to revaluate sleep, and work towards a well-rested, healthy, and safe society. While we are not advocating for a ‘sleep tax’ to be imposed on industries, we are advocating for creative ways to challenge society’s largely poor relationship with sleep.
Introduction: Sleep Medicine is a medical subspecialty devoted to the diagnosis and management of sleep disturbances and disorders. Obstructive sleep apnoea is the most common type of sleep apnoea and is caused by obstruction of upper airway. Palatopharyngeal surgery is the commonest surgical procedure done to successfully relieve airway obstruction.

Material and methods: In the clinical presentation of snoring, daytime sleepiness, morning mood changes like irritability anxiety depression, forgetfulness, increase heart rate and blood pressure, weight gain, heartburn and gastroesophageal reflux disorders, hypoxemia, decreased sex drive, diabetes, thick neck, mostly male over forties, patients were assessed by Polysomnography. Obstructive sleep apnoea diagnosed and severity assessed. Treatment options of weight reduction, lifestyle changes, physical intervention of positive airway pressure by CPAP, Auto CPEP, discussed and applied and used. Appropriate selected patients were offered surgical treatment to modify upper airway anatomy with the hope of unobstructed free silenced flow of air through nose and pharynx. Nasal surgery is straightforward to correction of any deviation of septum with reduction of turbinates if necessary. Pharyngeal surgery starting with uvulotomy, reduction of posterior pillars, Tonsillectomy, Uvulopalatopharyngoplasty, Zeetaplasty, expansion pharyngoplasty, Base of the tongue reduction was done using monopoler diathermy of Bialy Lab {Diathermy} with usefully designed needle where Hi Tack like LASER, Coablation, Radiofrequency is not available.

Results: 120 patients of age ranging from 24 -60 years were operated and followed up for 5 years. Postoperative results and steps of surgery using monopoler needle will be documented.

Conclusions: A number of surgical procedures of sleep surgery could safely be performed by using Proper Diathermy Machine, with little hazards where expensive appliances like LASER, Radiofrequency, Coablation is not affordable. My recommendation is to start the procedures and with experience and time using devices become safe.

Acknowledgements: Holy Family Red Crescent Medical College, Anwer Khan Modern Medical College, Dhaka And Comilla Central Medical College Hospital, Comilla, Bangladesh
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Results: The advantages, surgical technique, dynamics of procedure benefits of past and present procedures and results were compared among 40 cases of Uvulopalatopharyngoplasty with 80 cases of expansion pharyngoplasty and documented.

Conclusions: Though the surgical procedure suitable for every patient is an individual assessment. expansion pharyngoplasty shows far better results in improvement of airpassage and symptoms.

Acknowledgements: Holy Family Red Crescent Medical College, Anwer Khan Modern Medical College, Dhaka And Comilla Central Medical College Hospital, Comilla, Bangladesh
ART AS AN EFFECTIVE EDUCATIONAL MODEL IN SLEEP MEDICINE

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Introduction: Art had long been used as a vehicle for education to potentiate several general and specific competences in schools and community-based learning programs. Sleep science is a field of universal potential interest since sleep is essential for preserving individual and public health. Furthermore, different sleep disturbances may benefit from educational strategies as preventive or therapeutic tools. Therefore there is a need to effectively disseminate the knowledge about sleep physiology and sleep medicine among the overall community. However, this can be a challenge in the context of a complex socio-economic and cultural diversity. We provide a subjective rather critical appreciation of a pilot experience involving different kinds of artistic expression as a pedagogic model for sleep physiology, adequate sleep-related behaviors and sleep disorders.

Materials and methods: Different kinds of artistic expression like dance, enactment, performance and comedy were used integrated on a show about sleep and dreams organized during the 2017 World Sleep Day celebrations. Simultaneously, a traditional-educational meeting took place in intervals between the performances with a more scientific and formal explanation about the action.

Results: 310 individuals (4 to 85 years old) attended to the pilot artistic based program. All of them recognized the usefulness of such kind of event to spread knowledge about sleep and sleep habits. School leaders, municipalities and general public request the replay of the show in future occasions valuing it as an important health related educational mediator.

Conclusions: Art can be an effective tool to spread knowledge about sleep science and sleep medicine regardless of age group, socio-economic status and cultural profile. Furthermore, artistic expression may be used as an educational tool to prevent or improve sleep disturbances and sleep-related disorders.
COMPARING BODY-MASS INDEX IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS

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Introduction: Low body mass index (BMI) has been linked to an increase in overall mortality in patients with severe chronic obstructive pulmonary disease (COPD). Current global obesity epidemic is changing the nutritional profile of COPD patients. We sought to investigate the correlation between BMI and COPD.

Materials and methods: We consecutively enrolled adult patients with COPD admitted to 'Victor Babes' Hospital, Romania from November 2014 to May 2016. Patients were measured for BMI, interviewed with CAT and mMRC questionnaires and spirometry was performed.

Results: 678 patients (63.35±9.6 yo, 75% male) with COPD were assessed. Out of the total patient number, 25 (3.7%) were underweight, 191 (28.2%) had a normal weight, 192 (28.3%) were overweight and 270 (39.8%) were obese, the average BMI being 28.65±6.9 kg/m². When compared normal and underweight patients with the obese ones, we found significant differences regarding FEV1/FCV% (56.66±12.5 vs. 64.55±10.7, p< 0.001), FCV% (79.93±23.2 vs. 73.25±20.8, p=0.001), CAT (23.47±7.8 vs. 25.34±6.1, p=0.003) and mMRC (2.66±0.7 vs. 2.87±0.6, p=0.001). The occurrence of comorbidities such as hypertension (HT), diabetes (DM) or stroke was associated with obese patients (50% vs. 84% for HT, 6.5% vs. 33.3% for DM and 4.6% vs. 8.1% for stroke).

Conclusions: Low BMI is associated with a decreased FEV1/FCV% ratio, but a less severe COPD dyspnea, as showed by decreased CAT and mMRC questionnaires.
A COMPARISON OF UPPER AIRWAY PATENCY BY DEXMEDETOMIDINE AND PROPOFOL USED FOR INTRAOPERATIVE SEDATION IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Background: Sedation state by dexmedetomidine is known to be similar with physiologic sleep status, and respiratory depression was observed less frequently. On the other hand, sedation by propofol can cause respiratory depression, even though it has advantages of rapid onset, short duration, and clear recovery. Little is known about the influences of each drug on upper airway patency. Thus, we planned to investigate if there was any difference in the occurrence of upper airway collapse or the requirement of airway intervention in patients sedated with dexmedetomidine or propofol.

Methods: To evaluate the sleep architecture of each patient, Watch-PAT 200 was accoutered on the patient’s wrist and index finger during the night before surgery. Patients with apnea/hypopnea index (AHI) ≥ 5/h were enrolled in this study. Spinal anesthesia was performed routinely for the surgery. After confirming appropriate sensory and motor block, intraoperative sedation was initiated by dexmedetomidine or propofol infusion at a level of modified Wilson sedation scale 3. During the sedation period, end-tidal carbon dioxide was monitored to detect apnea efficiently. When any sign, such as snoring or apnea, was presented, the attending anesthesiologist extended the patient’s head using a shoulder role or inserted an artificial airway. The primary outcome was the proportion of patients who presented upper airway obstruction signs during the intraoperative sedation. The secondary outcomes included the hemodynamic changes during sedation, recovery time from modified Wilson sedation scale 3 to 1, and other complications related to sedation.

Results: Total 50 patients with obstructive sleep apnea were included for final analysis (26 in the dexmedetomidine group and 24 in the propofol group) and their basal sleep characteristics were comparable. During the intraoperative sedation period, the proportion of patients with upper airway obstruction signs was significantly less in the dexmedetomidine group than in the propofol group (11.5% vs. 41.7%, P = 0.035). An artificial airway was more required in the propofol group than in the dexmedetomidine group (7.7% vs. 33.3%, P = 0.035). Patients were subclassified by the AHI level (mild, 5-14/h; moderate, 15-29/h; severe, ≥ 30/h). Although the proportion of upper airway obstruction signs or artificial airway insertion was higher in each subgroup comparison, it had no statistical significance. Systolic arterial pressure and heart rate were comparable between the two groups during the sedation. After cessation of each drug, patients of the dexmedetomidine group recovered slower than those of the propofol group (23.7 ± 5.8 min vs. 9.4 ± 3.7 min, P < 0.001). Other complication related to sedation was not observed.

Conclusion: Upper airway obstruction occurred less in patient with obstructive sleep apnea, when dexmedetomidine was used for intraoperative sedation compared to propofol. It seems that dexmedetomidine preserves upper airway tone better than propofol does. Thus, dexmedetomidine will be an advantage in sedation for the patients with obstructive sleep apnea.
ENHANCED N3 IS CORRELATED WITH HIGH MELATONIN LEVELS AMONG SENIOR MINDFULNESS MEDITATION PRACTITIONERS

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Introduction: Mindfulness meditation is being as a most emerging psychophysiological technique in attenuating sleep related problems across age groups (Nagendra RP et al 2012) Various studies with subjective assessment of sleep and wellbeing have shown positive relation with the duration of practice with increased quality of sleep and wellbeing across disease conditions (Vera FM et al. 2009; J Ong JC et al 2014 Hubbling A et al 2014 ). Whole night polysomnography recordings and melatonin assessment were carried among senior Mindfulness practitioners to assess the effect of meditation practice on sleep architecture.

Materials and methods: 65 healthy volunteers [Vipassana meditators =41] and non meditating [controls =24] participated in the study with their written informed consent. Meditators were practicing Vipassana meditation (2-4 hours daily since more than three years), one of the earliest meditation techniques that follow the strategy of mindfulness. The control subjects were healthy individuals not practicing any form of meditation, yoga or on regular physical activity. Two day consecutive whole night polysomnography recordings (EEG-2110, Nihon Kohden Corporation, Japan) were carried out and offline sleep scoring was done as per ASSM guidelines. Venous blood was drawn on the first day (8pm and 6 am sample) of the recording to estimate Melatonin by radioimmunoassay.

Results: Both the groups were comparable for their age [controls = 45.67± 9.72 years, Meditators = 44.04 ± 9.56 years, F (1, 63)=0.40, p=0.52]. No significant difference in the Duration of sleep [controls =357.14±63.36 minutes, meditators= 375.98±62.07 minutes, F (1,58)=1.30, p=0.25], Percentage of sleep state N1 [controls =19.29±11.18, meditators =12.00±8.55,F(1,63)=8.16,p=0.00] and N2 [controls =50.43±11.55, meditators =42.09±11.75,F(1,58)=7.35,p=0.009] was less, whereas, percentage of N3 [controls=6.86±1.39, meditators=15.57±9.06, F(1,58)=19.30, p=0.00] and REM sleep states [controls=22.40±7.76, meditators =32.20±8.89, F(1,58)=19.30, p=0.00] were significantly high among meditators than controls. Diurnal Melatonin levels showed a significantly higher levels in meditators (morning 301.53±54.44 evening 381.80±65.51) than controls (morning 62.95±5.69,evening66.95±12.65) [morning F(1,58)=16.04, p=0.00, evening F(1,58) =16.41,p=0.00]. Pearson’s correlation among meditators showed melatonin [ morning r=0.42,p=0.02] demonstrated a significant and moderate to strong correlation with percentage of N3 sleep state.

Conclusions: Vipassana meditators demonstrated higher percentage of N3 and REM sleep when compared to controls. Meditation induced neural plasticity changes could have bought these changes (Ivanovski B and Malhi GS. 2007). Further, high melatonin levels in meditators correlated with N3 sleep state. High melatonin levels observed among meditators could be due to heightened pineal activity, reduced hepatic metabolism or higher serotonin levels that are precursor of melatonin which is known to enhance with meditation practice (Liou CH et al 2005). However, the precise mechanism needs to be studied. The present study demonstrated that Mindfulness meditation can exert positive beneficial effect on sleep with enhanced melatonin levels which potentially can be of great clinical value.

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**Introduction:** In recent years, it had been a development of ICT technology which connected our life with the Internet environment. Activity of circadian rhythm was involved in control of sleep-wake cycles and numerous physiological processes. Japanese government made the guideline in 2014 for good daily life that the Japanese people sleeping environments deteriorated due to the enhancement of the ICT. It was not only partly reported as related occupational ergonomics: patterns of performance degradation and restoration during sleep restriction and subsequent recovery; effects of recovery sleep after one work week of mild sleep and performance, but also association between mobile device and sleep disturbances among Japanese adolescents. The purpose of this study was to investigate relationship between net dependence and sleeping environment in Japanese young people.

**Materials and methods:** There were 86 healthy students (male: 56, female: 30) participated in this study. Jissen Women’s University Ethics Committee approved the study (H26-2). It was answered the sleep of Morningness-Eveningness questionnaire (MEQ) and Young's scale for Internet addiction questionnaire. As for the sleeping environment and the net dependence, data was collected by questionnaire on the Internet. For net dependence, the total score was divided into three stages. Net dependence trend “Low”, “medium”, “high”. For the MEQ the total score was divided into 5 stages. There were “Obvious night type”, “moderate night type”, “intermediate type”, “moderate morning”, “Obvious morning”. The SAS was used. All ANOVAs were performed with all independent variables and a single dependent variable. All significant values are reported at p< 0.05.

**Results:** In this study, the net dependence trend “low” was 2%, the net dependency trend “medium” was 38%, and the net dependency trend “high” was 59%. For the MEQ, the obvious night type was 1% of the whole. Moderate night type was 64%. The intermediate type was 35%. People who were classified as moderate in the morning and in the obvious morning were not among the subjects this study. There was no significant difference.

**Conclusions:** Decreasing in sleeping time was linked to physical problems such as obesity but also to change in performance at daily activities and mood disorders. Use of social media has been shown to delay sleep onset and melatonin secretion and stimulation of wake systems by interaction with those may exacerbate these effects. The major finding were that, our study was the university students in Japan adapted their sleeping environments to their own lifestyle. It did not show a strong correlation with the net dependence trend. The Japanese government suggested that junior high school students and high school students have more dependence on the Internet and that the sleeping environment has deteriorated, it was a night type. However, this research was suggested that they might adapt to these circumstances when becoming a college student. Nowadays, The ICT has rapidly developed, and its technology supported daily life. In other words, Japanese young people were not based on a full commitment to the Internet.

**Acknowledgement:** We thank all the individuals who were associated with this study.
Introduction: In 2000, the Institute of Medicine estimated that almost a 100,000 people die each year from medical errors mostly in the hospital setting. Cognitive performance during a period of sleep loss is directly related to length of time awake as well as circadian time with tasks most affected by sleep loss including those that are long and monotonous such as an 8 or 12hr In-Patient Physician shift. For adults, adequate sleep time is between 7 to 9hrs. In this study, we conducted a survey amongst In-Patient Physicians regards how their sleep time affects perception of care provided.

Materials and methods: We surveyed practicing In-Patient Physician across 4 mid-western states in the US in varying settings. Respondents completed a 5-page survey with 43 questions related to type of shift (7-on 7-off days, nights, other), timing of shift and patient load per shift. Sleep characteristics as well as perceived impact of sleep time on medical decision making were asked.

Results: 200 surveys were sent through emails and 21(10%) were returned. Of the respondents, 15 were males and 6 were females.12(57%) were on days only, 3(14%) nights only and rest were days and nights. Average sleep time was < 7hrs(62%) and 7-9hrs(38%) in the 24hrs preceding a shift start. 15(75%) respondents reported feeling sleeping during their shift. For those respondents sleeping less than 7hrs, 30% felt it affected making a correct diagnosis most of the time, 50% felt it led to medication errors and communicating with patients and family while 70% said affected completing their task on time.

Conclusions: Reducing medical errors in the hospital setting requires that frontline providers such as In-Patient Physicians are able to self-identify potential contributors to errors. Reduced sleep time is perceived by In-Patient Physicians to impact on the quality and safety of care provided to patients.

Acknowledgements: None
SLEEP PATTERNS AND ASSOCIATED RISK FACTORS FOR MENTAL HEALTH SYMPTOMS IN STUDENTS PURSUING POST-SECONDARY EDUCATION: A SYSTEMATIC REVIEW

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Introduction: Mental health conditions such as depression and anxiety represent a growing health concern among students in institutions of higher education. Students pursuing post-secondary education are a group that is increasingly recognized to be at risk for both mental health problems and significant sleep problems. While it has been hypothesized that sleep disturbances may be a risk factor for developing symptoms of depression and anxiety, little is known about the frequency and severity of sleep disturbances and their association with mental health conditions within this student population. The purpose of this systematic review is to synthesize the existing evidence on the association between sleep patterns and mental health conditions (depression and anxiety) in students pursuing post-secondary education.

Materials and methods: An experienced librarian developed a systematic search strategy to identify potentially relevant articles in MEDLINE, PsycINFO and CINAHL. The databases were searched from inception to August 2016. Random pairs of independent reviewers screened all retrieved titles and abstracts and rated the methodological quality of eligible studies.

Results: A total of 2687 abstracts were identified. Of these, 41 were duplicates. A total of 33 articles are being critically appraised from MEDLINE and screening is in progress for the other two databases. Only studies with a low risk of bias will be included in the synthesis.

Conclusions: The results of this systematic review will enhance our understanding of the association between sleep disturbances and mental health conditions in post-secondary education students. More importantly, this review will help us develop and evaluate interventions to target these specific mechanisms in at-risk students with rigorous evaluative methods.

Acknowledgements: University of Ontario Institute of Technology (UOIT) and the UOIT-Canadian Memorial Chiropractic College (CMCC) Centre for the Study of Disability Prevention and Rehabilitation.
**Introduction:** The use of mobile information and communication technologies (ICTs) such as smartphones has increased rapidly in recent years. Smartphones are popular devices and include many features however a number of negative health outcomes associated with high end users have been identified including addiction, poor mental health, and sleep disturbances. The purpose of this study was to examine smartphone use, sleep quality and quantity, and mental health outcomes in university students.

**Materials and methods:** A cross-sectional design study using non-random purposive sampling was used. Participants meeting eligibility criteria were recruited from the university campus using recruitment e-mails and were asked to complete the Mobile Technology Use and Health Outcomes Questionnaire (MTUHOQ). The MTUHOQ consists of six sections related to mobile ICTs and use; mobile ICT use and health risk profile; pain and discomfort and vision status; internet addiction questionnaire, and nomophobia questionnaire. Both sleep quality and quantity were assessed based on self-report.

**Results:** A total of 420 university students completed the questionnaire, of which 58% (n=245) were females. The majority (67%) rated their sleep quality as poor or very poor, with significantly more females (91.2%) reporting poor or very poor sleep quality compared to males (35%). Males averaged 5.7 hours (Standard Deviation [SD] 1.06) of sleep during the school week while females averaged 5.9 hours (SD 1.06). The majority of the sample (88%) reported sleeping with their smartphones next to them in bed. Mental health was rated as poor or very poor by 56% of females compared to 78% of males.

**Conclusions:** The results of this study suggest that high end smartphone users rated their sleep quality as poor or very poor and were severely sleep restricted. Furthermore, excess use of smartphones resulted in poorer physical and mental health outcomes.

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POOR SLEEP IN CHILDREN WITH COMPLEX AUTISM IS LINKED TO SLEEP DISTURBANCES OF THEIR ADOLESCENT SISTERS

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Introduction: Reports of sleep problems in Autism Spectrum Disorders (ASD) are reported in up to 86% of autistic individuals. Current sleep research suggests that sleep problems lead to a number of adverse effects, including health, mood, memory, academic performance and daytime behavior. Parental reports consistently describe atypical sleep onset delay (an increased amount of time between going to bed and falling asleep) as well as night-time awakenings and parasomnias (atypical movements or behaviours during sleep, e.g., sleep walking). Yet, very little research has examined the complexities of sleep hygiene and sleep patterns of siblings living with ASD. Being the typically developing (TD) sibling of a child with ASD can be both a challenging and enriching experience. Siblings' experiences can be complex and often difficult to capture using traditional methods, as they are often habitual and taken for granted.

Materials and methods: The current study takes a phenomenological approach supported by written diaries, photo logs and Photovoice groups along with background testing and 1-1 interviews over a period of 12 weeks. 16 sisters were actively involved by: i) collecting photo data by themselves, ii) determining the content of the data and categorising, and iii) analysing and interpreting the data that consists of their observations, experiences and reflection. This is the first study to use longitudinal Photovoice methodology in order to give TD sibs an active participatory role, a rare methodological approach in the current field of research. Each interview was audio-recorded and transcribed following the guidelines of phenomenological analytic approach. Background testing and sleep questionnaires were also administered.

Results: The average age of the sisters was 12.27 years old (SD=1.33) and the average age of their siblings with ASD was 11.6 years old (SD=1.62). TD sibling-driven content analysis identified four major categories: 1) the impact of lack of sleep in education, 2) poor sleep routines, 3) night awakenings due to their ASD sibs sleep problems 4) frequent night-time help for ASD siblings to ease up their sleep problems. Data from sleep questionnaires confirmed previous studies that night-time awaking and sleep onset delay are frequent sleep problems faced by children with ASD.

Conclusions: The current study revealed that TD siblings suffer from sleep problems due to environmental factors, namely, living with a brother or sister with autism in the same household. This new finding requires further sleep related studies using multi-dimensional measures including objective sleep measures with siblings and whole family members narratives. These results help us to raise awareness amongst parents, teachers and clinical therapists around the importance of sleep and possible implications in the life of family members living with autism.

Acknowledgements: We would like to thank the Association of Parents at Messinia Prefecture for giving us access to the siblings their families and all siblings who kindly participated in our research.
THE RELATIONSHIP BETWEEN EPWORTH SLEEPINESS SCORE AND VISUAL ANALOG SCALE IN FIBROMYALGIA PATIENTS

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Introduction: Fibromyalgia syndrome is a rare intraarticular rheumatic disease with unknown etiology that is frequently seen in women. Sleepiness and/or fatigue are most common symptoms in fibromyalgia patients. It is hypothesized that the pain in fibromyalgia patients might contribute to their sleepiness. The purpose of this study is to investigate the relationship between pain and sleepiness in fibromyalgia patients.

Materials and methods: Sixty female patients diagnosed as FMS were evaluated by a physician according to American College of Rheumatology criteria. Epworth Sleepiness Scale (ESS) was used to determine the daytime sleepiness and Visual Analog Scale (VAS) was to evaluate the pain level. Sperarman’s rho test is used for statistical analysis.

Results: ESS scores were found 5.9±2.9 (range:1-13) and VAS scores were found 5.5±2.8 (range 3-10). We did not find any significant correlation between sleepiness score and visual pain score (r= -0.18, p=0.14).

Conclusions: As a conclusion sleepiness score in fibromyalgia patients did not reach the pathologic level of above 10 of ESS and there are not any significant relationship between sleepiness scores and VAS scores.
ARE COUPLES’ SLEEP POSITIONS AS THEY FALL ASLEEP EVIDENCE OF THEIR LEVEL OF CONJUGAL SATISFACTION?

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Introduction: Although a number of websites describe the links that are said to exist between a couple's sleep positions and their level of conjugal satisfaction, no scientific studies have been performed to date on this topic. The objectives of the present study were to draw up a profile of the sleep positions adopted by couples and to determine whether there is a difference in conjugal satisfaction according to the sleep position adopted at the time of falling asleep.

Materials and methods: Eighty-three students were recruited at the Université du Québec à Trois-Rivières. The participants were mainly women (n=78), and their average age was 22.59 years (SD=2.67). Most were full-time students in the bachelor's degree program in psychology, and had an average income under $15,000. The average duration of the participants' relationship as part of a couple was 3.48 years (SD=2.74). The students participated in the study online. They first had to fill out a questionnaire developed by the research team on sleep positions. They then had to respond to questions on the Dyadic Adjustment Scale (Spanier, 1976). Descriptive analyses were conducted, along with variance analyses. The score obtained on the Dyadic Adjustment Scale was the dependent variable, whereas the individual’s sleep position, the partner’s sleep position, the contact made by the partner, and the contact the participant made with the partner were the independent variables.

Results: The average score that the participants obtained on the Dyadic Adjustment Scale (122.5±14.1) revealed a very high level of conjugal satisfaction. Most of the participants (56.6%) said that they slept on their side, with their back to their partner, whereas the partners' most frequent position (34.9%) was to sleep on their side facing the participant. About 86% of the participants reported that their partner and they were touching with at least one part of their body as they fell asleep. No differences were observed between the physical contacts reported and the couples' sleep positions as they fell asleep, on the one hand, and the level of conjugal satisfaction, on the other.

Conclusions: The couples in their twenties that are very satisfied with their relationship do not adopt different sleep positions from couples of the same age who are less satisfied, which contradicts the popular beliefs disseminated on the websites.
Introduction: Sleep disturbances are common during pregnancy, yet under-diagnosed and under-investigated. Assessment of sleep quality is clinically relevant in view of the previous findings that sleep disturbances may be associated with an increased risk for adverse pregnancy or delivery outcomes. We investigated sleep quality during pregnancy focusing on insomnia, nocturnal breathing problems and sleepiness.

Materials and methods: A total of 1858 pregnant women from the FinnBrain Birth Cohort Study were studied three times prospectively during pregnancy. Sleep quality was assessed in early, mid-, and late pregnancy (gestational weeks/gwks 14, 24, and 34, respectively) by using the Basic Nordic Sleep Questionnaire (BNSQ). Responses regarding insomnia symptoms, sleepiness symptoms, and breathing problems were dichotomized to represent clinically significant problems. To analyze the changes in sleep variables between the pregnancy stages, McNemar's test was used to compare dichotomous variables.

Results: Each insomnia symptom type (difficulties falling asleep, number of nocturnal awakenings per week and per night, and too early morning awakenings) increased from early pregnancy to late pregnancy (all p values < 0,001). Snoring increased across pregnancy (p < 0,001). Witnessed apneas remained rare. General sleep quality level remained the same during early and mid-pregnancy, but decreased towards late pregnancy (p < 0,001). Women also took more naps in early and late pregnancy comparing to mid-pregnancy (p < 0,001). Morning and daytime tiredness decreased from early to mid pregnancy (morning tiredness p < 0,05, daytime tiredness p < 0,001) and also from early to late pregnancy (morning tiredness p < 0,001, daytime tiredness p < 0,05).

Conclusions: Our study is in keeping with previous findings that general sleep quality declines as pregnancy proceeds. Using a detailed sleep questionnaire, we further suggest that sleep onset insomnia, sleep maintenance insomnia, and snoring worsened as pregnancy proceeded. However, no increase in negative daytime consequences was found, presumably indicating a compensatory capacity against pregnancy-related sleep impairment.
Introduction: An increasing body of evidence shows the many ways by which insufficient sleep increases risk of metabolic diseases such as obesity. Such mechanisms include widespread changes in endocrine networks and a strong propensity to non-homeostatic eating. However, few studies have concurrently tested associations between sleep duration and objective measures of metabolic health in addition to diet. We therefore used National Diet and Nutrition Survey data to study associations between sleep duration, metabolic health, and diet in a representative group of UK adults.

Materials and methods: Adults answered a question about weekday sleep duration and another on weekend sleep duration. They also completed 3 to 4 days of food diaries. Blood pressure and waist circumference were recorded, and fasting blood lipids, glucose, HbA1c, thyroid hormones, and CRP were measured in a subset of participants. We used regression models to explore associations between sleep duration and

1) adiposity (BMI and waist circumference);
2) glucose metabolism (fasting glucose and HbA1c);
3) lipid metabolism (HDL-cholesterol, LDL-cholesterol, and triglycerides);
4) thyroid function (free T3, free T4, and TSH);
5) systemic inflammation (CRP); 6) the metabolic syndrome;
7) energy and macronutrient intakes; and
8) indices of diet quality (fibre, saturated fatty acids, total sugar, fruit, and vegetable intakes).

Results: In these adults (n = 1,615, age 19 to 65 years, 57.1% female), sleep duration was negatively associated with BMI (-0.46 kg/m² per hour, 95% CI -0.69 to -0.24 kg/m², p < 0.001) and waist circumference (-0.9 cm per hour, 95% CI -1.5 to -0.3 cm, p = 0.004), and positively associated with HDL-cholesterol (0.03 mmol/L per hour, 95% CI 0.00 to 0.05, p = 0.03), after adjustment for age, ethnicity, sex, smoking, and socioeconomic status. Sleep duration tended to be positively associated with free T4 levels and negatively associated with HbA1c and CRP after adjustment (p = 0.09 to 0.10).

In contrast to our hypotheses, sleep duration was not associated with any dietary measures.

Conclusions: Together, our findings show that longer sleep is associated with lower BMI, lower waist circumference, and higher HDL-cholesterol in UK adults. The results further support the importance of achieving sufficient sleep in curbing current trends in metabolic disease prevalence. In the future, prospective studies using more objective measures of sleep will help clarify the relationships between sleep, dietary habits, and metabolic health.

Acknowledgements: We thank the study participants, the UK Data Service, Victoria Burley for her help in preparing the data for analysis, and Darren Greenwood for his advice on the statistical analyses.
CAN NAPPING AMONG UNIVERSITY STUDENTS BE LINKED TO QUALITY OF SLEEP AND ACADEMIC PERFORMANCE?

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Introduction: Certain scientific texts show that poor quality of sleep is a common problem for students, and that taking naps is one of the strategies that students use to deal with this problem. There is however a lack of consensus on the advantages and disadvantages of napping. It therefore seemed appropriate to develop a profile of napping among university students, and to better understand the links between taking naps and academic performance for these students.

Materials and methods: The participants were 98 university students (80 women, 18 men) with an average age of 22.06 (SD=2.20). More than 60% of the students were enrolled in the bachelor's degree program in psychology. They were approached during certain classes at the Université du Québec à Trois-Rivières and asked to fill out an online questionnaire. This questionnaire was comprised of the Insomnia Severity Index and questions on the students' napping habits, overall academic average, and level of satisfaction with this average.

Results: Nearly 70% of the students reported taking naps at least once a week. The nap generally took place at 3 pm and lasted an average of 58 minutes (range=10-180). The main reason mentioned for taking naps was feeling sleepy during the day (72%). For students that did not take naps, the reasons reported were not feeling the need to (43%), feeling more tired afterwards (28%), and not having the time (18%). Generally, the more frequently the students took naps, the higher their score was on the ISI (r=0.35, p<0.001). Post-hoc comparisons made after conducting an ANOVA (F=5.53, p=0.002) showed that the students with an overall average under B+ had significantly higher scores on the ISI (11.93±6.53) than those with an average above A- (4.72±3.97). The frequency of naps seemed to be negatively associated with the students' overall average, but this relationship was not found to be statistically significant at a 5% threshold (F=2.36, p=0.077).

Conclusions: Napping is a very frequent practice among the students surveyed, and it is linked to poor sleep quality. The present study does not however allow us to conclude that there is a negative relationship between napping and academic performance.
PSYCHOLOGICAL EVALUATION OF PATIENTS SCHEDULED FOR MAXILLOMANDIBULAR ADVANCEMENT AS A TREATMENT FOR OBSTRUCTIVE SLEEP APNEA: PRELIMINARY REPORT


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Introduction: Maxillomandibular advancement (MMA) is an alternative to nasal CPAP and an effective treatment for obstructive sleep apnea (OSA). However, it may impact on patients’ mental and emotional health. We sought therefore to ascertain the psychological trait of 23 patients scheduled for MMA.

Materials and Methods: A personality examination through the Hospital Anxiety and Depression Scale (HADS-A; HADS-D) and the Rorschach Inkblot Method (RIM).

Results: The mean apnea-hypopnea index at baseline was 46.2 + 18.8 events/hour. A high prevalence of personal trait compatible with difficult social relationship, anxiety and mood disorder emerged from RIM in our population (15 of 23 patients equal to 65% of the study cohort). Nevertheless, the mean HADS-A and HADS-D (10 + 6.3 and 9 + 6.8 out of 21 points, respectively) did not reach a clinically meaningful significance.

Conclusions: Patients affected by severe OSA, unwilling to wear nasal CPAP and scheduled for MMA, frequently present with anxiety disorder and relational difficulties as a trait of personality. The possible impact of such psychological trait on the mental health after a surgical procedure that alters the patient’s face profile is not yet clear, as it is for those who may suffer from severe personality or psychotic disorder. Prospective studies in this field are therefore needed.
INTRODUCTION: Sleep disruption is a well known problem among critically ill patients in an intensive care unit (ICU) which persist during recovery and after transfer to step down unit (SDU) or wards.

MATERIALS AND METHODS: 24 hr polysomnography (PSG) study was done in patients recovering from CCI in ICU with simultaneous recording of noise, light and nursing care activities and repeated after shifting to step down unit (SDU).

RESULTS: 26 patients underwent PSG study in ICU and then in SDU. Mean APACHE II and SOFA Score were 19.38 ± 3.72 and 5.11 ± 1.27. Paired t-test showed reduction in N1% (28.80 ± 7.30, 21.8 ± 4.3: p = 0.0001) and N2% (60.3 ± 8.65, 55.8 ± 4.0p = 0.021) and improvement in N3% (6.66 ± 2.30, 14.34 ± 3.8 p < 0.0001) and REM% (4.20 ± 3.68, 8.2 ± 3.5 p = 0.01) . Day time sleep and arousal index were reduced (49.55 %, 37.71%; p< 0.0001) and (22.65 ± 10.49, 16.55 ± 5.15: p = 0.006) respectively. The difference in mean illuminance during day and night time in ICU (77.09 ± 3.66, 14.98 ± 2.04 lux) and HDU (160.52 ±6.07, 23.67 ±2.62lux) was significant (p< 0.0001). Mean Sound level was high (59.17±1.69 dB,59.12±1.49 dB;p = 0.904). Mean nursing care activities difference was significant (50.8± 6.34 , 33.96 ± 5.34: p< 0.0001).

CONCLUSIONS: Sleep is highly disturbed and fragmented in ICU and SDU. However, the pattern of sleep shows trend towards recovery as patient recovers from critical care illness.
Introduction: Amyotrophic lateral sclerosis (ALS) is a progressive and fatal neurodegenerative disease characterized primarily by involvement of motor neurons, although involvement of other systems, among which also autonomic nervous system, has been described. The aim of this study was to investigate cardiac autonomic control during sleep in patients with ALS by means of heart rate variability (HRV) analysis.

Materials and methods: Thirteen Sardianian patients affected by ALS (8M/5F; mean age 62.3 +/- 10.0 yrs) were compared to 10 healthy controls matched for age and sex. All subjects underwent a full-night polysomnography (PSG) study. HRV was assessed by means of a continuous electrocardiogram (ECG) recording during the PSG. Time-domain parameters (mean RR interval, SDNN, SDANN, SDNN index, rMSSD, pNN50% and pNN20%) and power-spectrum analysis (total PWR, LF, HF, LF/HF index) were computed. Each parameter was evaluated in NREM sleep (light sleep and SWS), REM sleep and wake after sleep onset (WASO).

Results: Compared to controls, patients showed a significant reduction in: total PWR during NREM (p=0.005), LF in NREM (p=0.01) and REM (p=0.003) sleep, and WASO (p=0.06) and also in HF during NREM (p=0.04) and REM (p=0.05) sleep and WASO (p=0.03).

Conclusions: Our findings indicate a subclinical alteration in cardiac autonomic control during both sleep and wakefulness in patients affected by ALS, with a reduction of HRV components consistent with impairment of both vagal and sympathetic systems, and indicating a marked rigidity of autonomic nervous system, with poor reactivity to internal and external stimuli. These findings suggest the potential importance of autonomic assessment in ALS, in conjunction with motor neuron function, mostly because dysautonomia, in particular reduced heart rate variability (HRV), and increased sympathetic tone have been identified as mortality risk factors.
GRAPH THEORY-BASED ANALYSIS OF EEG DURING NREM SLEEP REVEALS CHANGES IN FUNCTIONAL CONNECTIVITY IN SLEEP-RELATED HYPERMOTOR EPILEPSY (SHE)

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INTRODUCTION
Dynamic key points of sleep microstructure have been shown to be associated with epileptic activation in Sleep-Related Hypermotor Epilepsy (SHE), identified within the system of the cyclic alternating pattern (CAP), that correlate with reactive slow wave events [1].

PURPOSES
The aim of this study is to explore the A1 component of CAP with a weighted graph [2] representing sleep EEG connectivity networks, as measured by the Phase Lag Index (PLI), collected from non-lesional SHE patients, compared to a normal control group. This, in order to test the hypothesis that the occurrence of CAP subtypes A1 during light sleep (LS) and slow wave-sleep (SWS) shows changes in the pattern of synchronization in subjects affected by SHE, in the 0.5-2.5 frequency domain, which is the predominant rhythm of CAP A1 subtypes, generated by frontal brain structures [3].

METHODS
Recordings (5 patients and 7 controls) were carried out using a 19-channel EEG BQ Sysplus Micromed system, signals were sampled at 256 Hz and digitally band-pass filtered at 0.1-70 Hz. PLI was computed between all pairs of channels for 20 to 40 EEG epochs of 4 seconds, for each subject, containing artifact-free A1 CAP subtypes, visually chosen from the whole recording, during in and SWS. The corresponding connectivity matrix for each trial/condition/subject was represented by weighted graphs, using the open-source java-based application "Brainwave" [4] and Clustering index (Cw) and Path Lenght (Lw) for the 0.5-2.0 frequency band were obtained. Data were statistically validated with the Student t-test.

RESULTS
The mean global Cw was significantly lower in the SHE group than in controls for SWS (0.324±0.001 vs. 0.372±0.008, p <0.0025) and LS (0.304±0.007 vs. 0.338±0.013, p <0.01); the mean global Lw was significantly lower in the SHE group than in controls for SWS (3.458±0.0889 vs. 3.092±0.069, p <0.04), and not significantly lower for LS (3.653±0.082 vs. 3.432±0.120 p < 0.14).

DISCUSSION
According to the results, functional EEG networks of CAP A1 subtypes appear to be less clusterized and more "rapidly" connected in SHE. This suggests that SHE patients have a different functional connectivity of brain areas during these CAP events.

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PSYCHOLOGICAL ISSUES AND SLEEP DEPRIVATION: ARE THERE GENDER DIFFERENCES?

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Introduction: Sleep deprivation is one of the increasingly reported health concerns among general population. Sleep deprivation results in altered physical and mental health, thereby affecting individual performance. Several factors may lead to disturbed sleep. Mental health issues could be both a cause and effect of sleep disturbances. The understanding of the causal factors may help guide therapy.

The purpose of this study was to identify psychological issues that caused sleep disturbances and to check if there were gender differences among the various factors.

Materials and methods: This was a prospective study, conducted in a free-standing sleep clinic in Chennai, India from January 2016 to May 2017. All the patients who were referred for psychological counseling by the primary sleep physician during the study duration were included in the study. A structured interview was conducted by the Clinical psychologist and details of sleep and psychological problems were collected. The psychological causes were classified into four domains - Family, health, work issues and other stressors/emotions. The results were analyzed within and between the genders.

Results: A total of 202 patients (Mean age - 45 years) were included in the study, Males - 103 (51%) age 25-76 years and Females - 99 (49%) age 19-70 years. The predominant cause of sleep disturbance was family related issues (80%), followed by work related issues (50%) and health issues (43%). There were significant differences in the causes of sleep disturbances between men and women. Majority of women (59%) perceived family related issues as the main cause of their sleep disturbances, as against 21% men (p< 0.05). However, majority of men (40%) perceived work-related issues as the major reason for their sleep problems, as against 10% women (p< 0.05). There were also significant differences in the other two domains - health related issues - men 28% and women 15% and other stressors - men 21% and women 5%.

Conclusions: In our study, we found that family related issues were the main factor for poor sleep quality among women. Men experienced more difficulties when compared to women in the domains of health and work.
ACTigraphic Sleep Patterns and Hypertension in the Hispanic Community Health Study/Study of Latinos

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Introduction: Self-reported short sleep duration predicts increased hypertension risk. However, there is a paucity of information on what aspects of objectively measured sleep are associated with hypertension. The aim of this study was to evaluate the association between actigraphy-based measures of sleep and prevalent hypertension in a sample of U.S. Latinos.

Materials and methods: We analyzed data from 2,148 participants of the Sueño sleep ancillary study to the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) who underwent one week of wrist actigraphy to characterize sleep duration, sleep efficiency, sleep fragmentation index and daytime naps (≥2 naps of 15 minutes). Insomnia was defined as an Insomnia Severity Index ≥15. Hypertension was defined based upon self-reported physician diagnosis. Survey linear regression was used to evaluate the association of sleep measures with hypertension prevalence. Sensitivity analyses excluded participants with an apnea-hypopnea (AHI) ≥15.

Results: The mean age was 46.3±11.6 years and 65% of the sample was female. The mean sleep duration was 6.7±1.1 hours. Thirty-two percent of the sample had prevalent hypertension. After adjusting for age, sex, ethnic background, site and AHI, each 10% reduction in sleep efficiency was associated with a 7.5% [CI= -12.9, -2.2], p=0.0061 greater hypertension prevalence, each 10% increase in sleep fragmentation index was associated with a 5.2% [CI= 1.4, 8.9], p=0.0071 greater hypertension prevalence and frequent napping was associated with a 11.6% greater hypertension prevalence [CI= 5.5, 17.7], P=0.0002. In contrast, actigraphy defined sleep duration (p=0.20) and insomnia (p=0.17) were not associated with prevalent hypertension. These findings persisted after excluding participants with an AHI ≥15.

Conclusions: Independent of sleep disordered breathing, we observed associations between reduced sleep continuity and daytime napping, but not short sleep duration, with prevalent hypertension. Longitudinal studies are needed to evaluate whether poor sleep quality predicts a higher risk of development or progression of this common disease.

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CEREBRAL HEMODYNAMICS IN SLEEP APNEA AND ACTIGRAPHY-DETERMINED SLEEP DURATION IN A SAMPLE OF THE HISPANIC COMMUNITY HEALTH STUDY: STUDY OF LATINOS

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Introduction: We sought to evaluate cerebral hemodynamics in sleep apnea and actigraphy-determined short sleep duration using transcranial Doppler ultrasound (TCD) blood flow velocity in a sub-sample of Hispanics/Latinos without stroke and cardiovascular disease.

Materials and methods: This study analyzed 95 participants with TCD determined cerebral hemodynamics, who had one week of actigraphy and home sleep apnea testing. The sample was from the Sueño study, which is the sleep ancillary to the Hispanic Community Health Study/Study of Latinos (HCHS/SOL). Sueño obtained information on sleep habits through questionnaires and actigraphy in a sample of 2,252 HCHS/SOL participants. We evaluated the association between sleep apnea (AHI ≥5) and short sleep duration (< 6.8 hours) with blood flow velocities, and vascular resistance using the Gosling pulsatility index (PI) for the middle cerebral (MCA) and basilar arteries. We performed Spearman’s rank correlation, Wilcoxon-rank sum test and age-and-sex adjusted linear regression to evaluate associations between sleep apnea, short sleep and cerebral hemodynamics.

Results: The median age was 48 years (range 20-64) with 71 % female. Twenty percent of the sample had sleep apnea (AHI ≥5) and the median sleep duration was 6.8 (range 3.2-8.7) hours. Sleep apnea had lower median blood flow velocities in the basilar artery [30.5 cm/s (10.2) vs 39.4 cm/s (13.3) p< 0.05], but not in the MCA. Whereas short sleepers had higher median vascular resistance in the MCA [PI = 0.92 (interquartile range 0.18) vs. 0.86 (0.14), p< 0.05] and basilar artery; [PI = 1.0 (0.17) vs. 0.93 (0.24), p< 0.05]. In age-and-sex adjusted linear regression models, sleep apnea was associated with a 0.37 (0.19) cm/s reduction in blood flow velocity (p< 0.05). Short sleep was associated with 0.05 (0.03) unit increase in PI in the MCA (p< 0.05).

Conclusions: In this sample of Hispanic/Latinos, sleep apnea was associated to decreased daytime cerebral blood flow. While actigraphy-defined short sleep duration was linked to increased cerebrovascular resistance in the middle cerebral artery.

Acknowledgements: The Hispanic Community Health Study/Study of Latinos was carried out as a collaborative study supported by contracts from the National Heart, Lung, and Blood Institute (NHLBI) to the University of North Carolina (N01- HC65233), University of Miami (N01-HC65234), Albert Einstein College of Medicine (N01- HC65235), Northwestern University (N01-HC65236), and San Diego State University (N01-HC65237). The following Institutes/Centers/Offices contribute to the HCHS/SOL through a transfer of funds to the NHLBI: National Institute on Minority Health and Health Disparities, National Institute on Deafness and Other Communication Disorders, National Institute of Dental and Craniofacial Research, National Institute of Diabetes and Digestive and Kidney Diseases, National Institute of Neurological Disorders and Stroke, NIH Institution-Office of Dietary Supplements. The project described was also supported by Grant Number 1KL2TR000461 (Dr. Ramos), Miami Clinical and Translational Science Institute, from the National Center for Advancing Translational Sciences and the National Institute on Minority Health and Health Disparities. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH.
**Introduction:** The Pittsburgh Sleep Quality Index (PSQI) is currently the most common measure of sleep quality. Its questions refer to “usual” sleep habits over the past month. However, for long it is known that sleep timing and sleep duration varies significantly between workdays and work-free days. A recently submitted study in the general population used the original and two adapted versions of the PSQI that replaced “usual” by explicitly referring to sleep on work- or work-free days. This study showed, that also sleep quality differs significantly between work- and work-free days. Here, we investigated these differences in a sample of patients with sleep disorders. Additionally, we analyzed how these scores relate to chronotype and social jetlag assessed by the Munich ChronoType Questionnaire (MCTQ).

**Materials and methods:** 341 individuals (mean age = 35 years; 69% female) from the general population (GP) as well as 258 patients (mean age = 43 years; 48% female; insomnia, paradoxal insomnia, narcolepsy, hypersomnia, obstructive sleep apnea and sleep movement disorders) from a sleep medicine clinic (SMP) filled out the three versions of the PSQI: usual sleep quality (PSQIu), sleep quality on workdays (PSQIw) and sleep quality on work-free days (PSQIf). Mann-Whitney was used to compare GP and SMP scores. FKruskal-Wallis was used to compare healthy subjects scores to patients of different disorders and Friedman test followed by Dunn to compare PSQIu, PSQIw and PSQIf in SMP.

**Results:** PSQI scores are higher in patients both on workdays (Mdn = 12 vs. 5, U = 11975.5, p < 0.001) and work-free days (Mdn = 9 vs. 3, U = 11270.5, p < 0.001; Mann-Whitney test). We found also a difference between GP and SMP separately by different disorder categories (PSQIw: H(7) = 235.2, p < 0.001, PSQIf: H(7) = 233.1, p < 0.001; Kruskal-Wallis test). There is also a difference between PSQIf vs. PSQIu and PSQIw in SMP (repeated Measures Friedman test (χ²(2) = 156.2, p < 0.0001, followed by Dunn's multiple comparisons test), as previously seen in GP. The average PSQI score on workdays was two points higher compared to that on free-days on both samples (GP and SMP).

**Conclusions:** These results indicate that PSQI also in sleep disorders patients primarily.
PERCEIVED SLEEP QUALITY OF SLEEP PROFILES DERIVED FROM CONNECTED SLEEP DETECTOR DATA

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Introduction: The advance of connected sleep detection devices enables collecting sleep data automatically in free-living settings of large cohorts over long periods. This data is valuable in understanding which sleep patterns are most important for perceived sleep quality, which can in turn help people effectively improve their sleep.

Materials and methods: Present study is based on anonymous data from 19,952 users of Nokia sleep trackers and their answers to a sleep survey. The sleep tracker data included bedtime, sleep duration, and wake up frequency during night. The sleep regularity index (SRI) was calculated using an adjusted version of the formula provided by Sano et al., 2017: \( \frac{1+1/24 \int_{18}^{42} s(t) s(t+24) \, dt}{2} \), where \( t \) is the time, \( s(t) = 1 \) during wake, and \( s(t) = -1 \) during sleep. Bedtimes and wake-up times were given as values between 18:00 the first day and 18:00+24 the next day. K-means and the Elbow method was used for clustering into sleep profiles. The multiple-selection survey question was: How would you describe your sleep?
(a) I sleep well most of the time,
(b) My sleep seems ok but I´m often tired,
(c) I often have difficulty falling asleep,
(d) I frequently wake up during the night,
(e) It takes me a long time to wake up in the morning.

Survey declaration ratios for each cluster were compared using a t-test with cutoff at 0.01.

Results: Users were divided into 5 sleep profiles. Users of profile 1 woke up significantly more frequently during the night than others (4.0 times versus 2.2). Users of profile 2 woke up significantly less times (1.5 times versus 2.9). Users of profile 3 slept significantly less (6.2 hours versus 7.6) and went to bed significantly later (at 00:46 versus 23:38). Users of profile 4 slept significantly longer (7.9 hours versus 7.1) and went to bed significantly earlier (at 23:24 versus 00:05). Users of profile 5 had a very irregular sleep (SRI of 0.15 versus 0.90).

Among users of profile 1, a significantly lower proportion declared (a), 27% versus 37%, and a higher proportion declared (c), 20% versus 17%. Among users of profile 2, a significantly higher proportion declared (a), 41% versus 33%, and (b), 44% versus 36%, and a significantly lower proportion declared (c), 15% versus 18%. The perceived sleep quality of users of profiles 3 and 4 was similar to overall average. Among users of profile 5, it seemed that a higher proportion declared (c) and (e), but there were too few users (108) for the difference to be significant.

Conclusions: Sleep data from connected devices successfully enabled the identification of profiles with different sleep quality declaration rates. Considering that the declaration rates of good sleep (a) was low for profile 1 and high for profile 2, it appears that waking up frequently during the night could be the most important factor in improving perceived sleep quality.
SLEEP DISTURBANCE MEDIATES THE RELATIONSHIP BETWEEN INJURY SEVERITY AND EXECUTIVE FUNCTION DIFFICULTIES IN CHILDREN 18 MONTHS FOLLOWING TRAUMATIC BRAIN INJURY

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Introduction: Sleep is a neurorestorative process and provides a plausible candidate mechanism to explain variability in children's functional outcomes after Traumatic Brain Injury (TBI). A common consequence of TBI is difficulty with self-regulation and the mental processes required for planning, working memory and focused attention. The aim of this study was to examine whether sleep disturbance mediates the relationship between TBI severity and executive functioning difficulties.

Materials and methods: Data from 157 children with a mild (n=101), moderate (n=39), or severe (n=17) TBI aged 6-14 (Mage = 10.78, SD =2.54; 74.5% boys) were included in this analysis. At 18 months post injury, parents assessed their children's sleep quality, daytime sleepiness, and sleeping patterns using a 4-item composite score from the Child Behavior Checklist (CBCL), with higher scores indicating greater sleep disturbance. Executive functions were measured using the Behavioral Regulation (BR) and Metacognition (MC) Indices of the Behavior Rating Inventory of Executive Function (BRIEF), with higher scores indicating poorer functioning. TBI severity was measured by the Glasgow Coma Scale (GCS), as these scores were reflected before a transformation was applied, higher scores indicate greater TBI severity. Two mediation analyses were conducted to test the effect of sleep on the relationship between TBI severity and the BR and MC indices of the BRIEF.

Results: 28% of the participants had experienced at least one sleep problem. Both mediation analyses showed that greater TBI severity was associated with increased parent-reported endorsement of children’s sleep problems, which in turn was associated with poorer a) behavioral regulation (BR mediation indirect effect $\beta = 2.49; Bc 95\% CI [0.63, 5.81]$) and b) metacognition (MC mediation indirect effect $\beta = 3.39, Bc 95\% CI [1.17, 6.71]$).

Conclusions: These data support the hypothesis that sleep plays a role in functional recovery after pediatric TBI. Results suggest that sleep problems may undermine executive functions necessary for effective learning and self-regulatory capacity. This relationship is likely to be cyclical. Executive functioning difficulties may hinder children's ability to regulate their daytime behaviours and sleep practices, impacting effective rehabilitation and recovery after TBI. Future studies should employ a rigorous approach to assessing sleep, including using standardized questionnaires and objective sleep measurement (e.g., Actigraphy and polysomnography). Increased awareness about the impact of sleep problems on recovery after pediatric TBI, as well as developing and testing interventions to address sleep problems in this population may be warranted.

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USE OF A COMPUTER ALGORITHM FOR DEFINING THE CARE PATHWAY OF PATIENTS SUFFERING FROM SLEEP DISORDERS

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Objective: Validation of an online algorithm for patient suffering from sleep disorders which triages patients into three care pathways: respiratory (TR), insomnia (I) and complex sleep disorder (TC) requiring a consultation with a sleep specialist.

Methods: Observational study comparing the care pathway selected by a sleep physician following medical interview with that selected by the algorithm after automatic analysis of an online sleep questionnaire filled in by the patient. The questionnaire and algorithm were developed by a panel of experts.

Results: 130 patients were included with 128 questionnaires analysable: 73/130 (57%) women, mean age 48+/-14.6. Presenting complaints included sleep onset insomnia (45%), sleep maintenance insomnia (49%), early morning waking (39%), the sensation of not sleeping (50%); respiratory problems including snoring (55%), respiratory pauses (19%), sleepiness (31% dont 8% falling asleep while driving), and depression (23%). The care pathway selected by the physician was 31% TR, 20% I 47% TC while that selected by the algorithm was 32% TR, 17% I, and 55% TC. The concordance was 76.5% (khi2 p< 0.0001): insomnia (Sens 62%, Spe 94% PPV 73%; NPV 91%); respiratory disorders (Sens 65%, Spe: 93% ; PPV 81% ; NPV 86%); and complex sleep disorders (Sens 90%, Spe 75% PPV 76% ; NPV 90%).

Conclusion: Algorithmic analysis of an online sleep questionnaire allows efficient selection of a care pathway for over 60% of insomniacs and patients with OSA, and identifies patients with complex sleep disorders who need management in specialized sleep centres.
THE PERCEPTION OF SOMNAMBULISM IN THE BEGINNING OF THE NINETEENTH CENTURY IN VILNIUS

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Introduction: Supernatural explanations of the phenomenon of somnambulism persisted in the Western world through the Enlightenment and the nineteenth century, suggesting that somnambulism was a state of walking while in a dream, a power of the soul, supplying person's perceptive faculties, when the external senses were oppressed by the sleep. The aim of this study is to assess the perception of somnambulism in the beginning of the nineteenth century in Vilnius.

Materials and methods: Dissertatio inauguralis medico-practica de somnambulismo („Doctoral thesis on somnambulism“), the only doctoral thesis devoted to sleep disorders in the first half of the nineteenth century in Vilnius, written by Joannes Adamus Schloezer, published in 1816 and defended in Imperial University of Vilnius is analyzed.

Results: Somnambulism was stated to be a sleep disorder, that for a long time was perceived as „the miracle of nature, a huge rock, and a labyrinth of the philosophers“ in thesis by Schloezer. Sleepwalking usually manifests during night, when an excited person wakes up, stays in the bed talking or walks around, performs simple or complex tasks, with eyes closed or opened, not responding to visual, auditory or tactile stimuli, avoiding obstacles, and finally returns to bed, knowing nothing of the episode. Schloezer presents a clinical case of a complex sleepwalking causing daytime sleepiness and describes a 26-year-old woman treated in Vilnius University Clinic in 1815. The author analyzes the predisposing factors, causes and symptoms of somnambulism, and also discusses about prognosis and treatment options, mentioning the importance of antiphlogistic methods (bloodletting, leeches, laxatives), stimulating drugs (camphor, aether), herbal infusions and others.

Conclusion: Somnambulism was perceived as a sleep disorder and was treated mostly using antiphlogistic methods, based on humoral theories in the beginning of the nineteenth century in Vilnius.
Introduction: Sleep deprivation (SD) increases the occurrence of interictal epileptiform discharges (IED) compared to basal EEG in temporal lobe epilepsy (TLE). We aimed to evaluate whether morning sleep after partial nocturnal SD bears additional activating effects on IED compared with nocturnal sleep, and whether changes in sleep instability (as evaluated through the cyclic alternating pattern model, CAP) play a significant role.

Materials and methods: Thirteen adult TLE patients underwent in-lab nocturnal polysomnography (n-PSG) and, within seven days, morning SD-EEG, being awake the night before from 2 AM. For both recordings, we obtained the following markers for the first sleep cycles: IED/h (Spike Index, SI), sleep macrostructure, microstructure (CAP rate; A1, A2 and A3 Index), and SI association with CAP phases.

Results: The macrostructure of the first sleep cycles was similar in n-PSG and SD-EEG, whereas CAP rate and SI were significantly higher in SD-EEG. SI increase was selectively associated with CAP phases. D/h (Spike Index, SI), sleep macrostructure, microstructure (CAP rate; A1, A2 and A3 Index), and SI association with CAP phases.

Conclusions: SD increases the instability of morning recovery sleep compared with n-PSG, and particularly enhances A1 CAP phases, that are associated with the major occurrence of IED. Higher instability of post-SD recovery sleep may account for the increased diagnostic yield in SD-EEG in TLE patients.leep cycles was similar in n-PSG and SD-EEG, whereas CAP rate and SI were significantly higher in SD-EEG. SI increase was selectively associated with CAP phases. D/h (Spike Index, SI), sleep macrostructure, microstructure (CAP rate; A1, A2 and A3 Index), and SI association with CAP phases.
WORSENING OF OBSTRUCTIVE SLEEP APNEA (OSA) WITH MANDIBULAR RECONSTRUCTIVE SURGERY

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**Introduction:** Patients with prognathia can have concomitant undiagnosed sleep apnea. Mandibular surgeries for prognathia involve retraction of the mandible which might result in decreased retropharyngeal space.

**Case:** A 25 year old gentleman with no significant past medical history presented to the Sleep Medicine clinic with chief complaint of daytime sleepiness and disrupted nighttime sleep. He also had associated snoring and fatigue. On physical examination, the patient was well built man with normal vitals and a body mass index of 23 and had prognathia. He had Epworth Sleepiness Score of 15. On further questioning he admitted that his father had “snoring issues” and prognathia, however was never formally diagnosed or treated for sleep apnea. As a part of initial work up, the patient underwent an in-lab overnight polysomnogram using the recommended sleep staging and 4 or more additional parameters of sleep, attended by a technologist. The study showed moderate Obstructive Sleep Apnea (OSA) with an Apnea Hypopnea Index (AHI) of 21 per hour and oxygen saturation in the 80’s with Oxygen saturation nadir of 84%. As per the guidelines, the patient was initiated on Continuous Positive Airway Pressure (CPAP) therapy after a titration study with CPAP of 9 cm H2O. In regards to his prognathia, the patient was evaluated by otolaryngologist and recommended oral mandibular surgery. The patient underwent the surgery without any complications and completely recovered. However, his symptoms of sleep apnea gradually worsened and post-surgical polysomnogram evaluation at 16 weeks revealed worsening of his AHI to 34 per hour (pre surgical 21 per hour) and O2 sat nadir of 82%. A re-titration study was done and his pressure was increased to 11cm H2O with persistent symptoms. The patient is being worked up for uvulopalatopharyngoplasty (UPPP).

**Conclusion:** Surgery for prognathia can worsen sleep apnea and cause sleep apnea in patients not previously diagnosed with OSA due to narrowing of the retropharyngeal space postoperatively. Sleep evaluation should be done routinely as a part of pre-operative assessment before performing maxillary or mandible surgeries as these surgeries alter the upper respiratory apparatus architecture.
WAKING UP TO A SUDDEN DEATH OR WITH PANIC ATTACK?... - A CASE REPORT

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Introduction: Short sleep duration is associated with an increased cardiovascular and psychiatric disorder risks. Sympathetic nervous system activity disturbances have been associated with an increased risk of cardiovascular events. A 32-year-old healthy male, with no psychiatric history, presented a polymorphic ventricular tachycardia degenerating to ventricular fibrillation in October 2014, being inserted an Implantable Cardioverter Defibrillator (ICD) at the Coimbra Hospital and University Centre.

The condition began after a 10 years period of deliberate chronic sleep deprivation (total sleep time from 3 to 4 hours) from which the patient was forced to endure as a soldier of the special operations forces. For a period of 13 months, the patient was hospitalized seven times due to sudden cardiac death (SCD) events. After the first cardiac event, the patient developed feelings of fear and agoraphobia, by the early morning. Intriguingly, all SCD events emerged close to awakening, from 10 and 11 a.m.

In March, 2015, due to the psychiatric symptoms onset and circadian disruption, the patient was referred to the Sleep Medicine Centre for a sleep psychiatry consultation. The patient was diagnosed with a chronic sleep deprivation and pathological anxiety (with a relevant cognitive and neurovegetative component), which established a Panic Disorder.

Materials and methods: This is a case report presentation.

Results: In the psychiatric approach, the patient followed alternative psychopharmacological regimens and psychopathological stability was achieved in November 2015, with Zoloft® 50 mg id and Zyprexa® 2.5 mg id. It regulated the sleep-wake rhythm, increase the sleep duration to 7-8 hours, and stopped any cardiac events. He conducted a polysomnographic study in January 2016 that proved the absence of sleep deprivation and excluded any sleep disorder. There were observed four sleep cycles with total sleep time of 436 minutes and 96% of sleep efficiency (SE). Sleep onset latency (SOL) was 12.5 minutes. 4% N1, 36% N2, 37% N3 and 23% REM were found. From the respiratory point of view, general RDI of 4.1 events per hour, with minimal O2 saturation of 93% and average saturation of 96%. No periodic limb movement disorder (PLMD). EEG sleep within normality, without paroxysmal activity. Regarding EKG level, no changes were detected and the heart rate remained constant at 55-60 bpm.

From a cardiology point of view, catecholaminergic ventricular tachycardia was diagnosed, and molecular genetic study was requested.

Conclusions: The authors reported this case, due to the singularity and life-threatening character.

Keywords: Chronic sleep deprivation; Cardiac dysrhythmia; Sudden cardiac death; Panic disorder
CLINICAL FEATURES OF GASTROESOPHAGEAL REFLUX DISEASE IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME

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Introduction: Literature data suggest that at least 50% of patients with sleep disturbance examined at primary care practices have comorbid conditions. Due to these comorbidities and complications, obstructive sleep apnea (OSA) is often associated with increased medical expenses, although costs can be reduced with early diagnostics and appropriate treatment. Gastroesophageal reflux disease (GERD) seems to be one of such conditions. Nowadays the prevalence of gastroesophageal disturbances and the relationships between OSA and GERD are not researched.

Materials and methods: 55 patients (43 men and 12 women) with esophagitis have been examined at Grodno city hospital №2, Belarus. The average age was about 48 (37; 54) years. Patients with severe cardiovascular, gastrointestinal and other disorders were excluded from the study. Patients were divided into 3 groups: the 1st group - patients with esophagitis (n=25), the 2nd group - patients with esophagitis and mild OSA (n=21), the 3rd group - patients with esophagitis and moderate OSA (n=9). There was no severe OSA in our study. The Epworth sleepiness scale was applied to determine the level of daytime sleepiness. The diagnosis of OSA was established by means of pulse oximetry, cardiorespiratory monitoring and polysomnography. The expressiveness of symptoms of gastrointestinal tract involvement was estimated with the help of gastroesophageal reflux disease questionnaire (GerdQ). The higher the level of points is, the higher the probability of GERD is according to this questionnaire. Esophagogastroduodenoscopy (EGD) was used for visualization of upper gastrointestinal canal. Also morphological examination was provided by means of biopsy of the gastric body, the antrum, and the lower third of the esophagus. Nonparametric statistical methods were used for analyzing the data.

Results: Statistically significant differences were obtained between groups by means of Kruskal-Wallis test (p<0.05). Then Mann-Whitney U-test was applied to compare groups in pairs. In the 1st group of patients in comparison with the 3rd group statistically significant higher value of points of GerdQ was revealed (7 (6; 8,5) and 6 (4; 6) respectively) (p=0.016). In the 3rd group of patients in comparison with the 2nd group statistically significant lower value of GerdQ points was obtained (6 (4; 6) and 7 (6; 8) respectively) (p=0.019). There was no statistical difference between the 1st group and the 2nd group.

Conclusions: The results of the research demonstrate that patients with moderate OSA have lower value of symptoms of GERD in comparison with patients without OSA or with mild OSA. That means that EGD should be recommended for patients with OSA without reference to the severity of complaints.
REDUCED SLEEP DURATION ASSOCIATED WITH CONSUMPTION OF HIGHER CALORIE FOODS IN YOUNG ROLLER HOCKEY PLAYERS

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Introduction: Poor sleep in quality and quantity seems to adversely affect appetite and influence body composition. In addition to having greater energy and nutritional needs than the general population, athletes should sleep more hours a night, often for logistical reasons, their sleep is compromised, thus conditioning their appetite throughout the day. The aim of this study was to evaluate the sleep duration and eating habits of hockey players before a competition.

Materials and methods: A questionnaire was used to collect data on sports training, sleep duration and athletes’ eating habits in the month prior to the competition. We evaluated 74 players (9.0 ± 1.4 years) who trained on average 9.5 ± 3.6 hours per week.

Results: The anthropometric profile of the athletes was as follows: 33.3 ± 7.4 kg; 1.52 ± 1.34 m and 17.4 ± 3.2 kg / m ². Athletes with a reduced (52.4%; < 7 hours) or excessive sleep duration (36.1%; > 12 hours) were overweight (BMI > 85th percentile; P < 0.01). And athletes who slept a little, they consumed significantly more caloric foods (P < 0.05), such as potato chips (78.2%), soft drinks (66.4%), cakes (52.9%), and cookies (42.1%).

Conclusions: Athletes’ sleep duration negatively influenced their anthropometric profile and food choices, which can compromise their body composition, energy balance and nutritional needs, as well as their health and sport performance.

Acknowledgements: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed written consent was obtained from all individual participants included in this study.
POSTOPERATIVE COMPLICATIONS AFTER UVULOPALATOPHARYNGOPLASTY

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Introduction: Uvulopalatopharyngoplasty (UPPP) is up-to-date the most common type of surgery used to treat obstructive sleep apnea syndrome (OSAS). Studies focusing on complications can help us evaluate whether UPPP is suitable for a one-day surgery.

Methods: A retrospective study was conducted on 186 patients who underwent UPPP in a period of five years. The aim of the study was to monitor the number and type of early and late complications. Early complication was defined as a complication that occurred within the first two weeks after the operation, late complication occurred later than two weeks after surgery. The complications were divided into non-severe and severe (with the need of revision on operation theatre).

Results: In the group of 186 patients we recorded 45 early complications (24%). Transient postoperative velopharyngeal dysfunction (N=20) and bleeding (N=20) were the most common ones. In three patients, velofaryngeal dysfunction persisted even when checked for more than 2 weeks after surgery. Postoperative bleeding occurred in 20 patients, mostly on the 6th to 8th day after surgery, only 3 times on the day of surgery. Hypertension was diagnosed in 25% of patients with postoperative bleeding. Among other early complications were taste disorder (5x) and paresthesia of the tongue (2x). Overall in the group of 186 patients 12 late complications (6,4%) were noted: globus sensation (5x), persistent velopharyngeal dysfunction (3x), xerostomia (3x) and taste disorder (1x).

Severe complications - bleeding with the need of revision were present in 3,7 % (7/186) patients after UPPP.

Conclusions: UPPP is a most frequent surgical method for the treatment of OSAS. Most postoperative complications are mild. The percentage of severe complications is low. A discussion is warranted whether this surgical method is suitable for one-day surgery. Patients are anyway usually hospitalized not longer than 3 or 4 days after UPPP and most of the severe complications occur after this period. From this point of view one-day surgery does not increase the risks and seems feasible.
THE EFFECTIVENESS OF NIGHT-TIME VIDEOEEG MONITORING IN NOCTURNAL ENURESIS IS LOW

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Introduction: Children with nocturnal enuresis are occasionally referred for night time videoEEG monitoring to rule out nocturnal epileptic seizures. Our goal was to evaluate the efficacy of this investigation in bed-wetting.

Materials and methods: We analysed retrospective data of enuretic patients examined by our digital videoEEG monitoring system. For detecting the exact time of bed-wetting we have been using enuresis alarm (in 52% of all cases). All the patients were recorded with digital videoEEG using 19 standard electrodes for one night at our hospital. The total number of enuretic children was 33, aged 3-18 years. The male: female ratio was 21:12. There was only 1 child in the group with the only diagnosis of nocturnal enuresis. All the other patients had behavioural problems, ADHD, learning disability, tics, daytime epileptic seizures or a history of head trauma or malignancy. The referring physician reported epileptiform EEG in 18 of 33 cases. Antiepileptic treatment was administered to 3 children because of epilepsy (daytime seizures) and to 4 children because of former epileptic seizures. Four patients were treated with CBZ or VPA because of bed-wetting and epileptic discharges in the EEG and the referring neurologist fearing of unrecognised epileptic seizures.

Results: Nocturnal bed-wetting was recorded in 8 cases, but the exact time of the event was evident only in 2 of them due to enuresis alarm. In these 2 cases no epileptic ictal EEG phenomena were found in spite of the presence of inter-ictal epileptic discharges. Intercital epileptiform discharges were present in 6 of 8 wet children (75%) and in 16 children of the whole group.

Conclusions: The efficacy of videoEEG in nocturnal enuresis is generally low, because the children do not sleep as well at the hospital as at home and usually they get up in time to urinate. Applying enuresis alarm helps to detect the exact time of the enuresis event in time and enables to correlate it with the ictal EEG. We did not find any case of bed-wetting being the only symptom of nighttime epilepsy. The high rate of children suffering from neurodevelopmental problems in our group might indicate that nocturnal enuresis is just a further manifestation of abnormal brain development.
Other
Board #158: P4 - Tuesday
PRENATAL AND NEONATAL FACTORS PREDICTING SLEEP PROBLEMS AT AGE 11 IN CHILDREN BORN EXTREMELY PREMATURE

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Introduction: Prematurely born children have been reported to be at increased risk of sleep problems. The aim
of this study was to explore if prenatal or neonatal factors can predict sleep problems at age

Materials and methods: A prospective observational study of all infants who were born EP in Norway in 1999
and 2000. Prenatal and neonatal data, such as information about pregnancy complications, birth method, Apgar
score, born small for gestational age (SGA), number of days on respirator, steroids for bronchopulmonary
dysplasia, neonatal cerebral hemorrhage, necrotizing enterocolitis and more, were collected by all Norwegian
obstetric and pediatric departments. Parental questionnaire mapped current sleep problems and sleep habits
when the children were 11 years old.

Results: Of 231 of 372 eligible children, 28% snored, 27% had difficulty falling asleep or frequent awakenings,
17% suffered from daytime sleepiness and 25% had shorter sleep duration than recommended (< 9 hours).
Smoking in pregnancy predicted snoring (OR 4.3) and neonatal cerebral hemorrhage and being SGA at birth
defined difficulty falling asleep or frequent awakenings
(OR 2.2 and 2.3). No prenatal or neonatal factors predicted sleep duration less than recommended or daytime
sleepiness.

Conclusions: Of numerous relevant exposures during the prenatal and neonatal period, only smoking during
pregnancy, being born SGA and cerebral hemorrhage predicted sleep problems at 11 years of age.

Acknowledgements: The study was financially supported by the Norwegian Extra Foundation for Health and
Rehabilitation through the Premature Society. Thanks to members of the Project Extreme Premature Group.
**SURGICAL EFFECTS FOR OSAS PATIENTS IN OUR DEPARTMENT**

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**Introduction:** Recently, it has been found that sleep apnea syndrome was involved in severe public transportation accidents, and it is considered that the interest in sleep quality and importance is increasing.

**Materials and methods:** In our facility, we evaluate the severity of apnea for OSAS patients using portable polysomnography or overnight polysomnography. We classify them into three stages according to the results of polysomnography (Apnea hypopnea index (AHI): Less than 5, 5 or more and less than 20, 20 or more). We often perform surgery for the OSAS patients when their AHI score is more than 20. From our experience, it is considered that more than 40 (AHI score) is especially a good surgical indication. We perform nasal surgery when patients have nasal obstruction, and choose tonsillectomy for the tonsillar hypertrophy patients. For tonsillar hypertrophy patients, we sometimes perform Uvulopalatopharyngoplasty (UPPP) in order to increase surgical effects at the same time. We mainly have two kinds of UPPP. One is so-called conventional UPPP, and the other is modified UPPP.

**Results:** We compared these two kinds of surgery according to the pre- and post-surgery AHI score. We now have small number of patients, but modified UPPP might be more effective than conventional UPPP.

**Conclusions:** Our modified UPPP might be effective for severe OSAS patients. Further examination is necessary and it is also important to find out the surgical indication.

**Acknowledgements:** Department of respiratory medicine, Tokyo Medical and Dental University. Center for good sleep, Tokyo Medical and Dental University.
Introduction: Sleep and epilepsy are interrelated. Sleep and its disorders play an important role in the management of patients with epilepsy (PWE). Knowledge of associated features could lead to better understanding of this important link. Our aim was assessing the sleep structure of PWE in relation to pregnancy and perinatal complications (PPC) reported by history.

Materials and methods: PWE of age 18 and above underwent a detailed questionnaire-based evaluation at epilepsy and sleep disorders clinics and standard polysomnography (PSG). Parameters related to sleep were obtained based on standardized PSG scoring procedure. T-test was used for statistical analysis.

Results: Eighty patients were included in this analysis. Of which 21 (35.6%) reported PPCs by history. We found quite significant differences of objective sleep parameters in favor of PWE without PPCs. Statistically significant PSG findings were as follows (PPC/no PPC): wake after sleep onset (mins) - 60.7/99, total sleep time (mins) - 442.5/396.2, sleep efficiency (%) - 87.7/80.2, number of awakenings - 9.7/14.4, NREM2 latency (mins) - 22.3/43.6, NREM3 latency - 39.8/84.8, REM-sleep percentage from total sleep - 14.6/9.6 (p< 0.05 for all comparisons). There were no differences in seizure frequency and body-mass index in both groups.

Conclusions: We found a clear difference in sleep structure of PWE with and without PPCs. PWE reporting PPCs have overall worse sleep pattern, lesser amount of REM-sleep, and higher percentage of wake during sleep and increased number of awakenings. It is possible that PPCs in medical history may play a role in the formation of intrinsic sleep mechanisms later on or in the development of co-morbid sleep disorders in adult PWE.

Acknowledgements: Somnus Neurology Clinic staff
SHIFTWORK AND THE USE OF PRESCRIPTION MEDICATION FOR SLEEP, ANXIETY AND DEPRESSION: A PROSPECTIVE COHORT STUDY

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Introduction: There is only limited evidence to date linking shiftwork with clinical levels of sleep disturbance and mental health problems. Few studies have examined redeemed drug prescriptions using register data, which is the focus of this study.

Materials and methods: Data were obtained from three waves of the Finnish Public Sector Study (2000, 2004, 2008. 66-68% response rate). Participants were from two cohorts; local government employees in 10 towns - a mixture of healthcare workers and employees from other occupational sectors ('10 Towns Cohort'); and employees of 21 hospitals ('Hospitals Cohort'). The overall sample was N=53,275 (mean age 43.6 (SD=9.8), range 18-69), with approximately 73% coming from the 10 Towns Cohort. Women made up 82% of the entire sample. Responses to surveys were linked to records on redeemed prescriptions (until December 2011). Data from the two cohorts were analysed separately to examine the associations between work schedule and drug purchase. Cox regressions were used to predict time to first incident use of:

1. Hypnotics & Sedatives; and
2. Anxiolytics & Antidepressants. We separately compared 2- and 3-shift workers (i.e. rotating shifts either without, or with, nights) with dayworkers, matched for occupational group.

Each analysis was stratified by age (< = 39 years, 40-49 years and >= 50 years). HRs were calculated with adjustments for age, sex, socioeconomic status and marital status (Model 1); and with additional adjustments for alcohol consumption (Model 2). Participants were excluded if they had any recorded purchase of the drug in question prior to follow-up, or if they reported previous diagnosis of depression or other mental disease.

Results: There were fewer significant associations in the Hospitals Cohort than in the 10 Towns Cohort. The 10 Towns Cohort showed significant positive associations between 3-shift work and the use of both categories of medication; with the exception of Anxiolytic & Antidepressant use among the middle-age group. Among the 2-shift workers, the only significant associations were with the use of Anxiolytics & Antidepressants in the lower- and upper-age groups. In the Hospitals Cohort, the majority of associations were either non-significant or negative (i.e. indicative of a protective effect). The main exception was positive associations between 3-shift work and use of Hypnotics & Sedatives among the upper-age group.

Conclusions: The finding of greater use of hypnotics and sedatives by rotating nightshift workers adds to the limited evidence to date linking night with clinical levels of sleep disturbance. The finding of greater use of anxiolytics and antidepressants by some groups of shiftworkers provides limited evidence of a link between shiftwork and mental health problems.

Sensitivity analyses indicated that the disparity between cohorts was neither due to the presence of non-healthcare workers in the 10 Towns Cohort, nor to the presence of former shiftworkers in the control sample of the Hospital Cohort. Other possible explanations are that: the cohorts differ with respect to type of shift schedule e.g. the intensity of nightwork; shiftworkers in the Hospital Cohort may be more selected as it may be easier for them to transfer to daywork.
NOCTURIA IS NOT RELATED TO RESPIRATORY VARIABLES IN WOMEN OF MIDDLE AGE


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Introduction: The objective of this study was to examine the relationship between nocturia and OSA in women undergoing polysomnography (PSG) due to suspicion of obstructive sleep apnea (OSA).

Materials and methods: Participants were 23 consecutive female patients with an age ≥ 20 years old who gave their informed consent to participate in the study. All were referred to the sleep laboratory for suspicion of sleep disordered breathing at INCMNSZ in México City. The study was approved by the local ethics committee. Patients taking medications that exacerbate nocturia or polyuria by their mechanisms of actions (e.g., diuretics) were excluded. Patients with neurodegenerative disease, psychiatric illness, lung, renal and rheumatologic diseases, or were on CPAP, or supplemental Oxygen treatment were also excluded. Validated questionnaires for depression, fatigue, sleepiness were administered prior to the PSG night, along with the question about number of typical nighttime voids.

Patients were classified into two groups: Nocturia group (NG), who reported typically voiding at least twice a night over the month prior to their overnight PSG, and No-nocturia group (NNG), who reported having less than 2 voids per night.

Results: Fifty-two percent of the sample (n=12) reported ≥2 voids per night. The mean number of self-reported nightly voids for the NG was 2.2±0.8 (range 2 - 5). Age was the only organic characteristic that differed between groups, with women in the nocturia group being older (NNG=43.6 ±10.3, NG=58.9 ±12.7 years old, p=0.005). There were no statistically significant differences in sleepiness, fatigue, and depression scores. A comparison of PSG variables indicates statistically significant differences in the WASO time, higher in nocturia group (NNG=23.9±4.9, NG= 91.9±17.7 min, p=0.0009); lower sleep efficiency in NG, and REM sleep percent (lower in NG), all suggesting poorer sleep. Thirty-five percent of the sample had OSA with a mean AHI 8.7 ± 18.2 and mean ODI 3% 21.7 ± 30.1. Groups did not differ in the respiratory parameters. Surprisingly, the Periodic Leg Movement Index was higher in the nocturia group than in the group without nocturia (NNG=3.8±3.9 vs NG=22.6±29.3).

Conclusions: Nocturia is associated with reduced sleep efficiency and REM sleep percent, and increased WASO time, but in our small sample, was unrelated to level of sleepiness, fatigue or depression. Unlike previous studies, respiratory parameters during sleep were unrelated to nocturia. It could be possible that the relationship between nocturia and OSA reported by other researchers could involve OSA severity, gender, aging and importantly the presence of cardiovascular disease. Future research should explore this possibility.
SUBJECTIVE SLEEP ASSESSMENT DURING DIFFERENT QUARTERS OF PREGNANCY COMPARED TO NON PREGNANT WOMEN IN THE HOSPITAL ITALIANO OF BUENOS AIRES

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Introduction: To determine the appreciation of sleep satisfaction during pregnancy (WP) and to compared with the non pregnant women (CW). To determine the prevalence of sleep disorders WP and to compared with CW. To determine causes that fragment sleep in WP and to compared with CW.

Materials and methods: Transverse prospective observational study, performed from July 2013 to December 2015. A specific questionnaire was designed for the data collection of the study, and questionnaires of Oviedo, and Scale Epworth. All the full term expectant mothers who attended the Obstetrics Department as well as CW attending the Gynecology Department were included.

Results: 320 PW: 1st Quarter (Q): 106; 2nd. Q: 104; 3rd Q: 110 women. CW: 300. PW/CW: 31.6/30.8 years. Satisfaction of sleep: 17.6/18.9 p=0.04. Hypersomnia: 16.8/12.1 p=0.09. Insomnia DSM IV: 3.4/1.9 p=0.09. Restless legs syndrome: 18.2% (1st Q: 14.2; 2nd Q: 17.3; 3rd Q: 22.7); PW 23/CW 31.2 p=0.01. Snoring: 6.2/2.4. Apnea: 1.9/2.0 p=0.89. Increase in urinary frequency: 85.6/48.9 p=0.00. Not being able to spin / turn in bed: 36.2/6.5 p=0.00. Report uncomfortable sleeping position: 44.4/13.4 p= 0.00. Cramps: 28.4/13.4 p=0.00. Gastroesophageal reflux: 24.7/3.2 p=0.00. Bruxism: 9.7/25 p=0.00. Awakenings caused by a couple or children: 30/16 p=0.00.

Conclusions: Sleep disorders are common in mothers to be with hypersomnia and insomnia. The first cause fragment sleep in PW was increased in urinary frequency, after uncomfortable sleeping position. We believe that it is necessary to know the different causes that fragment the dream of the pregnant woman to treat them and in this way, to achieve a pregnancy and a pleasant sleep.

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SLEEP AND FATIGUE PROBLEMS AMONG SWEDISH COMMERCIAL AIRLINE PILOTS: LONG HAUL VERSUS SHORT HAUL

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Introduction: New EASA FTL (European Aviation Safety Agency flight time limitations) rules came into force February 2016 in order to protect airline crew against fatigue. This study evaluates the current severity of sleep and fatigue problems among Swedish commercial airline pilots with a special focus on the difference between those flying short haul (including domestic) and those flying long haul.

Materials and methods: 598 (out of 975 invited) member pilots of the Swedish Airline Pilots Association completed a web survey with questions about working conditions, sleep, health and fatigue (92 long haul pilots and 419 short haul pilots). Of these, a random selection of 60 pilots took part in a field study lasting 2 weeks with sleep and work diaries being recorded as well as actigraphy to measure sleep (problems) and fatigue.

Results: Web survey results reveal that 92% of pilots are men. 78% of pilots have more than 5,000 flight hours and 73% work full time as a pilot. 83% report to like their work as a pilot much to very much. Day work shifts of over 13 hours pose a big problem to 90% of pilots having experienced these. Early morning shifts (starting between 03:00 and 06:00) are a big problem to 89% of pilots having experienced these, whereas evening shifts (finishing between 19:00 and 01:00) are only problematic to 73%. The largest problems, however, concerning working times are night shifts over 10 hours long (97%) and working shifts with more than 6 sectors (i.e., flights) scheduled (92%). 22% of pilots have the possibility to influence their own working times, but only 35% of those are satisfied with the result of that. 53% feel that their working shedules frequently disturb their sleep and 32% that they frequently result in severe fatigue. 83% of pilots make errors and/or mistakes in the cockpit due to fatigue.

Sleep quality, as measured by the Karolinska Sleep Questionnaire (KSQ), is in general worse in long haul pilots compared to short haul pilots (14,2 versus 15,1). The KSQ fatigue index, however, was not significantly different between long haul and short haul pilots.

Preliminary field study results confirm the above, and moreover show that adaptation to multiple time zone crossings poses a specific problem for long haul pilots.

Conclusions: Our results raise concern about the amount of sleep and recovery Swedish pilots get. Fatigue levels are high and contribute to in-flight errors. Specific problems for short haul pilots are many flights within one work shift, and for long haul pilots the limited possibilities to adapt to multiple time zone crossings. It cannot be ruled out that this poses an even bigger problem in the rest of Europe and the world with a more congested airspace and less favourable working conditions than in Sweden.

Acknowledgements: This study was funded by the Swedish Transport Administration.
QUALITY OF LIFE AND MOOD IN CHILDREN AND ADOLESCENTS WITH CYSTIC FIBROSIS; ASSOCIATIONS WITH SLEEP QUALITY

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Introduction: Children and adolescents with cystic fibrosis (CF) experience sleep disturbance, elevated symptoms of depression and reduced health-related quality of life (HRQOL). We aimed to investigate the relationship between sleep quality, mood and HRQOL in children with CF and healthy controls.

Materials and methods: Children (7-12 years) and adolescents (13-18 years) with CF, free from pulmonary exacerbation, and healthy controls completed sleep evaluation including 14 days of actigraphy recordings and one night of oximetry. Age appropriate questionnaires assessed mood (Children’s Depression Inventory; CDI or Beck’s Depression Inventory; BDI), HRQOL (Cystic Fibrosis Questionnaire; CFQ-R or Pediatric Quality of Life Inventory; PedsQL), and daytime sleepiness (Pediatric Daytime Sleepiness Scale; PDSS).

Results: 87 children and adolescents with CF and 55 controls were recruited. Children with CF (7-12 years) had poorer objective sleep quality, more daytime sleepiness and higher CDI total scores, indicating lower mood, than controls, with a negative correlation between CDI score and sleep efficiency. Children with CF and controls with lower mood were sleepier. Adolescents with CF (13-18 years) demonstrated poorer objective sleep quality and more sleepiness than controls, but no difference in mood scores. Reduced objective sleep quality was significantly correlated with lower CFQ-R scores for physical and emotional functioning, vitality, treatment burden, health perceptions, social, role and respiratory health. There was also a significant association between increased daytime sleepiness and lower CFQ-R scores for vitality and role in adolescents with CF. In both control groups (7-18 years) there was no correlation between sleep quality and mood or HRQOL.

Conclusions: In clinically stable children and adolescents with CF, impaired sleep quality and daytime sleepiness is related to lower mood and quality of life in an age-specific manner. Future research should assess the benefits of optimizing sleep in children and adolescents with CF.

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LONG SLEEP DURATION AND HEALTH OUTCOMES: A SYSTEMATIC REVIEW, META-ANALYSIS AND META-REGRESSION

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Introduction: The dose-response of long sleep duration in mortality and the incidence of important health outcomes such as diabetes mellitus, hypertension, cardiovascular diseases, stroke, coronary heart diseases, obesity, depression and dyslipidemia has been explored.

Materials and methods: We collected data from 5,134,036 participants from 137 prospective cohort studies. For the independent variable, we categorized participants at baseline as having long sleep duration or normal sleep duration. Risk ratios (RRs) for mortality and incident health conditions during follow-up were calculated through meta-analyses of adjusted data from individual studies. Meta-regression analyses were performed to investigate the association between each outcome and specific thresholds of long sleep.

Results: Long sleep was significantly associated with mortality (RR, 1.39; 95% CI, 1.31 - 1.47), incident diabetes mellitus (1.26, 1.11 - 1.43), cardiovascular disease (1.25, 1.14 - 1.37), stroke (1.46, 1.26 - 1.69), coronary heart disease (1.24, 1.13 - 1.37), and obesity (1.08, 1.02 - 1.15). Long sleep was not significantly related to incident hypertension (1.01, 0.95 - 1.07). Insufficient data were available for depression and dyslipidemia. Meta-regression analyses found statistically significant linear associations between longer sleep duration and increased mortality and incident cardiovascular disease.

Conclusions: Future studies should address whether the relationship between long sleep and health outcomes is causal and modifiable.

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IDENTIFICATION OF THE DIFFERENT CLINICAL FACES OF OBSTRUCTIVE SLEEP APNEA IN CHILDREN

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Introduction: Cluster analysis has recently been used to identify subtypes of patients with OSA in adults. The author found that there were three different clusters, promoting individualized diagnosis and treatment. Although commonly observed in clinical practice, various clinical presentations of obstructive sleep apnea (OSA) in children have not been characterized formally. The lack of knowledge on the heterogeneity of OSA clinical presentation may pose critical challenges to their identification, which can result in missed or delayed diagnosis and personalized therapies. To further understand the heterogeneity of OSA clinical presentations in children, this study innovatively applied cluster analysis to identify the subgroups of OSA in children who experienced distinct combinations of symptoms and co-morbidities.

Materials and methods: It is a retrospective study. Subjects in our analysis were referred to sleep center of Beijing Children’s Hospital by otolaryngologists for sleep study because of clinical suspicion of OSA. Patients who were 3-14 years old and with mild, moderate to severe OSA after PSG monitoring (AHI > 5 or OAI > 1) were included. Each participant completed a pediatric sleep disorder questionnaire, physical examination, and standard polysomnography. Latent class analysis (LCA) was used to cluster subjects into groups, which were based on the symptoms and the presence of co-morbidities.

Results: Three distinct clusters were identified. They were classified into “nocturnal snoring and daytime sleepiness group” (cluster 1), “hyperactivity group” (cluster 2), and “minimally symptomatic group” (cluster 3), which consisted of 11.9%, 41.1%, and 47.0% of the entire group, respectively. The clusters did not differ significantly in terms of sex, BMI, TST, WASO, SE, SO, REM latency, N1%, N2%, N3%, REM%, average oxygen saturation and arousal index (ArI). However, they differed significantly in age, AHI, ODI and minimum oxygen saturation. Members of cluster 1 had the highest probability of experiencing snore heavily and sleepiness related symptoms. The nocturnal symptom included snore heavily (86.7%), have heavy or loud breathing (97.8%), struggle to breathe (88.9%), snore more than half the time (84.4%) and stop breathing (56.7%). The symptoms of sleepiness were also prominent, such as hard to wake up (57.8%), feel sleepy (80.0%) and look tired in the morning (67.8%). The majority of symptoms in this cluster are behavioral problems such as the child is more hyperactive than others of same age (74.0%), often fidgets with hands or feet or squirms in seat (90.4%), often move (86.5%), talk (79.5%), lose his temper (62.2%), interrupt or intrude on others (82.7%) and seem not to listen when spoken to directly (71.2%). Members in cluster 3 seldom present with heavy snore, excessive daytime sleepiness and hyperactivity whereas occasional minor snoring and mouth breathing.

Conclusions: Children with OSA have different patterns of clinical presentation, and the identification of the distinct clinical profiles of OSA can provide a foundation for more personalized diagnosis and therapies in the future.

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FEBRILE SEIZURES IN CHILDHOOD ARE ASSOCIATED WITH SLEEP-RELATED EPILEPTIC SEIZURES IN LATER LIFE

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Introduction: Sleep is important in management of patients with epilepsy (PWE) and may influence the clinical pattern. Factors associated with sleep may be equally important for seizures and epilepsy. Our aim was assessment of febrile seizures (FS) in childhood as possible factors in the context of sleep-related epileptic seizures (SRES) in adult PWE.

Materials and methods: We included diagnosed PWE in this analysis. They passed a detailed questionnaire-based evaluation of epilepsy and sleep complaints. Polysomnography (PSG) was done in some of them. Information on FS included their occurrence in childhood with appropriate description and link to elevated temperature irrespective of number. During assessment epileptic seizures were divided into 3 patterns: 1) no nocturnal seizures, 2) mixed pattern, 3) exclusively nocturnal seizures. Chi-square and T-test were used for statistical analysis.

Results: 153 PWE of age 18 and above were studied in this relation. Of them 16 (10.5%) have reported FSs during childhood. Seizure patterns were distributed as follows: 61 (39.9%) PWE did not report nocturnal seizures in their clinical pattern, 66 (43.1%) had mixed seizures during sleep and wakefulness, and 26 (17%) reported exclusively SRES. We performed a Chi-square analysis revealing that PWE with FSs in their medical history had higher occurrence of SRES (p< 0.05). No significant differences were found according to PSG sleep parameters.

Conclusions: Our results show interesting association between presence of FS in childhood and occurrence of SRES in adult PWE although without objective sleep structure differences. Possibly FSs promote some intrinsic mechanisms leading to proneness to SRES in adulthood.

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ASSOCIATION BETWEEN SLEEP QUALITY AND GLUCOSE CONTROL IN FILIPINO ADULTS WITH TYPE 2 DIABETES MELLITUS

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**Introduction:** Studies show that patients with short or poor sleep quality affects glucoregulation and quality of life negatively. A review of local literature has not revealed any studies on the topic of the association between sleep quality and glucose control.

The general objective of this study is to determine the association between sleep quality and glucose control among Filipino adults with T2DM.

**Methods:** Cross-sectional analytic study involving adult individuals with Type 2 diabetes mellitus seen consecutively at various outpatient clinics of the Lung Center of the Philippines and National Kidney and Transplant Institutes from September 2015 to May 2016.

Participants were 241 adults with type 2 diabetes (T2DM). Sleep quality was measured using the Pittsburg Sleep Quality Index Questionnaire. HbA1c within one month of the interview was used to assess glucose control with self-reported daytime sleepiness. Berlin Questionnaire and Epworth Sleepiness Scale were used to screen for obstructive sleep apnea and excessive daytime sleepiness respectively.

**Result:** Poor sleep quality was noted in 55% of Filipino diabetics in the study population. And among those with poor sleep, 70.45% have poor glycemic control. We found that sleep quality is directly although weakly correlated with glucose control.

Patients with poor glucose control were more likely to have poor sleep quality (OR 5.5012, 95% CI 3.0881 to 9.7997, \(p = 0.0000\)). HbA1c, asthma/COPD, and lack of bedroom companion are predictors of poor sleep quality among adult diabetic Filipinos based on PSQI scoring.

Among the study population, 33% are high risk for sleep disordered breathing using the Berlin questionnaire and only 26% have excessive daytime sleepiness using ESS.

**Conclusion:** The prevalence of poor sleep among diabetic Filipinos is high at 55%. Poor sleep quality is directly correlated with poor glucose control. Factors that worsen sleep quality among T2DM are elevated hbA1c, obstructive airway disease and sleeping alone in a bedroom.
Parasomnias

NEW VIDEO-POLYSOMNOGRAPHIC CRITERIA FOR THE DIAGNOSIS OF DISORDERS OF AROUSAL

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Introduction:
To estimate the diagnostic value of new video-polysomnographic (vPSG) criteria for disorders of arousal (DOA, e.g sleepwalking, sleep terrors) and established cut-off values to be used in clinical and research set-ups.

Materials and methods:
One hundred adult patients with a diagnosis of DOA (48 males, median age 28, range 19-59) and 50 sex and age-matched non-parasomniac participants (24 males, median age 28, range 20-60) underwent a vPSG assessment to 1) quantify the slow wave sleep (SWS) interruptions and 2) assess their electrophysiological and video-based behavioral characteristics and 3) propose new measures to assess SWS microstructure characteristics (SWS fragmentation index - SWSFI, slow, intermediate and fast postarousal EEG ratio and indexes). Receiver operating characteristic curves were drawn to find optimal cut-off values. The sensitivity of these thresholds was subsequently assessed in a second independent group of 60 patients with DOA.

Results:
A higher SWSFI, and increased slow / intermediate arousal indexes and ratio were found in DOA patients. The higher areas under curve were obtained for the SWSFI and intermediate arousal indexes (AUC = 0.88 and 0.87, respectively). The best SWSFI cut-off value reached a sensitivity of 79.0% and a specificity of 82.0%. Fifty-nine patients had at least one parasomniac episode (median, 2.5 episodes, ranging from 1 to 14). Having a SWSFI above 6.67/h and/or at least one parasomniac behavior during the vPSG assessment leaded to a sensitivity of 95.0%, with similar findings in the second patient group (90.0%). Patients with injurious and violent episodes tended to reach more frequently the SWSFI cut-off of 6.8/h (88.6% vs 72.8%, p=0.05). Patients with daily episodes had a lower slow postarousal EEG ratio (5.0 %vs 16.7%, p=0.03) and had more frequently vPSG parasomniac episodes (78.4% vs 52.0%, p=0.004) than patients with less frequent episodes.

Conclusions:
Frequent, slow and intermediate arousals in SWS and complex behaviors during vPSG are strongly associated with sleepwalking and sleep terrors, and may be used as promising biomarkers for the diagnosis and severity assessment of DOA. Further studies are needed to challenge these criteria in larger clinical samples, including patients with violent sleep behaviors related to other origins.
TREATMENT EFFICACY OF IMAGERY RESCRIPTING AND IMAGINAL EXPOSURE FOR NIGHTMARES. EVIDENCE FROM A RANDOMIZED WAIT-LIST CONTROLLED TRIAL

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Introduction: About 2-5% of the general population is suffering from nightmare disorder. Nightmares are associated with several negative consequences but can be effectively treated with cognitive-behavioral therapies. Imagery rescripting (IR) and imaginal exposure (IE) are commonly identified as active treatment ingredients of psychological nightmare treatments. However, it remains unclear which specific therapeutic elements are responsible for the beneficial effects on nightmare symptoms. With this randomized controlled trial, we aimed to investigate the isolated therapeutic efficacy of IR and IE for nightmares.

Materials and methods: In this trial we randomized 104 patients with a primary DSM-5 diagnosis of nightmare disorder into an IR, IE, or wait-list control group. In the intervention conditions all participants received three weekly 60 minutes individual treatment sessions. The treatment conditions only consisted of IR or IE and did not comprise of treatment elements such as extensive psycho-education, relaxation and safe-place exercises, or nightmare journals.

Results: Post-test results showed that compared to WL, both interventions effectively reduced nightmare frequency and distress, as well as other associated symptoms such as the number of nights with nightmares, insomnia complaints, and dysfunctional nightmare beliefs. These results were sustained at three- and six-month follow-up.

Conclusions: Given that the observed effects of IR and IE were comparable to those observed in meta-analyses for other psychological nightmare treatments, we conclude that IR and IE both seem to be active treatment components in nightmare therapies. Future research is needed to examine the potential superiority or equivalence of IR and IE in the treatment of nightmares. In a similar vein, future studies should investigate the potential beneficial effects of combining IR and IE.
COULD SLEEP PARALYSIS BE PLEASANT?

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Introduction: Sleep paralysis is defined as an inability to move at sleep onset or upon awakening and is often a very fearfull experience. The aim of our study is to clarify if sleep paralysis could also be perceived as a pleasant experience.

Materials and methods: In our Internet survey we reached out to participants who experience sleep paralysis recurrently. Participants completed a battery of questionnaires focused on description of sleep paralysis episodes and their occurrence, Trauma Symptom Checklist (TSC-40), Life Satisfaction Questionnaire (FLZ) and short version of Big Five Inventory (BFI-44).

Results: 189 participants who recurrently experienced sleep paralysis were included in our study. 39 (20,6 %) participants answered that they have experienced pleasant sleep paralysis. 37 participants (95 %) who experience pleasant sleep paralysis have also experienced lucid dreaming. Predictive factor for pleasant sleep paralysis is the ability to influence the course of episodes (OR=6.07; p< 0.05), the ability to induce sleep paralysis episodes (OR=4.09; p< 0.05) and the frequency of fear during episodes (never or sometimes fear OR=19.65; p< 0.1; mostly fear OR=14.01; p< 0.01). 23 (59%) participants have their pleasant sleep paralysis episodes accompany by hallucinations, 16 (41 %) have not. Fear could be present in pleasant sleep paralysis episodes, but 17 (43 %) experience it never, 16 (41 %) sometimes, 2 (5 %) mostly and 4 (10 %) always. People who experienced pleasant sleep paralysis experienced it less often (p< 0.001) and they experienced less fear during episodes (p< 0.001). We found one significant difference in questionnaire scores between participants with pleasant and unpleasant sleep paralysis in Big Five Inventory - Openness (p< 0.01), there were no significant differences in other questionnaires scores.

Conclusions: Pleasant experiences of sleep paralysis episode are relatively common. They occur more often in episodes with less fear and with the ability to induce and influence the course of episode. The majority of participants who experience pleasant sleep paralysis have also experienced lucid dreaming. These results could support the idea that some aspects of pleasant sleep paralysis and lucid dreaming, such as feeling of control over sleep paralysis episode, could be employed in psychotherapy.

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DO WE REALLY KNOW THE FREQUENCY OF SLEEP SYMPTOMS/PROBLEMS IN ADOLESCENTS?

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Introduction: A challenge when conducting sleep surveys is that sleep itself affects recall and, hence, the confidence with which an individual can assess the frequency of events. An underutilized strategy that can address this limitation is to include an ‘I don’t know’ key in the response set. This was undertaken in a study examining self-reported sleep problems in adolescence, a developmental phase when responsibility for sleep regulation is transitioning from parental to child control.

Materials and methods: The frequency of loud snoring, long pauses between breaths while asleep (i.e. ‘apnoea’), leg twitching/jerking during sleep (i.e. ‘PLMD’), confusional awakenings, daytime sleepiness, nightmares and sleepwalking were assessed using a 4pt scale (not during the past month, < 1/week, 1-2/week and ≥3/week) whilst self-awareness of sleep symptom/problem was assessed using the response key, ‘I don't know’. Participants included 42 female Asian-Australians, 120 female Caucasian-Australians, 118 male Asian-Australians and 165 male Caucasian-Australians aged 16-19 years attending Year 11/12 schooling. Asian students were exclusively of Chinese heritage.

Results: Chi-square analyses were used to examine the impact of gender and ethnicity on the frequency of ‘I don’t know’ responses. The percentage of adolescents who reported ‘I don’t know’ was highest for ‘apnoea’ (56.9%; M>F & Asian>Caucasian) followed by loud snoring (36.5%), PLMD (36.0%; M>F), confusional awakenings (32.9%), sleepwalking (18.2%; M>F & Asian>Caucasian), nightmares (6.2%; M>F) and daytime sleepiness (1.9%).

Conclusions: In general, male and Asian adolescents were more likely to report that they did not know whether they had experienced a sleep symptom/problem. Of note, however, is the high percentage of adolescents who were unable to report on sleep behaviours and especially apnoea, loud snoring, confusional awakenings and sleepwalking. This raises concerns as to the reliability of frequency estimates obtained in previous surveys and our general understanding of the prevalence of sleep symptoms/problems in the community. We propose that an ‘I don’t know’ response key be included in future surveys. As a broader response to overcoming the limitations of self-report, future studies may want to consider combining self-report with more objective measures of sleep behaviour—such as can be now derived from health monitoring applications on mobile phones and comparable devices. Given the high penetration of such devices, this may be a particularly attractive strategy when surveying adolescent sleep.
Introduction: Sleep talking (ST) was described by the ICSD-II as "the utterance of speech or sounds during sleep without simultaneous subjective detailed awareness of the event" (ICSD-II, 2001), while the recent revision of the ICSD reports the phenomenon as "Isolated symptoms and normal variants" of parasomnias (ICSD-3, 2014). A cross-sectional epidemiological study reported a high presence of ST both in the lifetime (66%) and current prevalence (17%) (Bjorvatn et al., 2010). ST has been recently addressed as a diagnostic marker to differentiate Lewy body dementia from other kind of dementia (Honda et al., 2013; ICSD-3, 2014). Nonetheless, specific investigations about its quantitative features and the influence on sleep quality still lack.

Materials and methods: 783 subjects (18-69 years) completed an on-line questionnaire about sleep quality and presence/frequency of parasomnia-related behaviours. The protocol included the Pittsburgh Sleep Quality Index Questionnaire (PSQI, Italian version - Curcio et al., 2013) and the Munich Parasomnia Screening (MUPS, 2008 - Fulda et al., 2008). The MUPS is a self-rating questionnaire, assessing the frequency of 21 nocturnal behaviors (from "never" to " every or nearly every night").

In order to evaluate the relation between ST frequency and frequency of other altered nocturnal behaviours in the whole sample, correlational analyses have been performed.

Results: ST prevalence was of 72% in the lifetime of our sample, and 11.49% of declared a current prevalence (MUPS frequency 6 " one or more times per week", or 7 "every night or nearly every night"). 90 subjects (M= 33, F=57; 18-68 years, M= 25.15, SD= 6.24) declared a frequency of at least once a week and have been selected for further analyses. In a comparison between frequent ST and a control group (no self-report of altered nocturnal behaviours), values at PSQI showed a sleep quality significantly lower for ST compared to controls. The results of the correlational analysis showed a significant positive trend for: hypnic jerks, rhythmic movement disorder, hypnagogic hallucinations, sleep-related bruxism, sleep-related groaning, nightmares, sleep terror, confusional arousal, sleepwalking, violent behaviour, REM sleep behaviour disorder (p< 0.02).

Conclusions: The results confirm a high presence of declared ST in an Italian sample and a significant co-occurrence with other altered nocturnal behaviours, coherently with previous findings (ICSD-II, 2001; Bjorvatn et al., 2010; Nielsen et al., 2009). Nonetheless, the ICSD-3 (2014) defines this phenomenon as non-pathological parasomnia, the self-reported poor sleep quality suggests ST could be interesting to study as an independent factor influencing sleep quality.

Due to these results, sleep studies on the quantitative EEG changes in ST and on the assessment of the association with cognitive performance are needed, both in healthy individuals and in pathological cohorts (i.e., dementia patients).

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A FEASIBILITY STUDY ASSESSING HOME VIDEO TELEMETRY POLYSOMNOGRAPHY (HVTP) AS DIAGNOSTIC PROCEDURE FOR ADULT PATIENTS UNDERGOING INVESTIGATION FOR PARASOMNIAS

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Introduction: The tests used to assess sleep disorders should provide individual's behavioural and physiological sleep patterns without modifying the sleep features that are designed to record. These techniques should also be well accepted by the patients and economically viable. Laboratory based polysomnography is the gold standard for sleep disorders diagnosis, but falls short in some of the criteria that should be respected. Home recording is a technique that might help to achieve a more natural sleep as well as decrease in the cost. The feasibility of comprehensive home sleep studies is unclear due to the complexity of recording both neurophysiological and cardiorespiratory parameters with synchronised audiovisual signals in an unsupervised and non-dedicated environment. This study aims to explore whether home video telemetry polysomnography (HVTP) can be performed successfully in people's own homes among patients referred to King's College Hospital telemetry unit to be investigated for parasomnias.

Methods: A fixed mixed method with three strands was adopted. Two quantitative strands dealt with data quality and cost aspects, and one qualitative strand dealt with acceptability. The three strands of this convergent parallel design were used to measure related but different facets of the study.

Results: Twenty-one patients underwent two nights of the study. A quality grading system developed to assess sufficiency and interpretability of the recorded data was used and it showed that data was sufficient in duration and continuity for sleep analysis in 97.6% of the nights recorded. The neurophysiological signal for sleep staging was good or very good in 95.1% of the studies. Cardiorespiratory signal quality was good or very good, scoring more than four out of six points for electrocardiogram and 85.4% for respiratory signals. Signal quality for the extended montage was good or very good, scoring more than six out of nine points in 95.1% of the studies. Video quality was good or very good with more than nine out of fifteen points in 95.1%, and audio signal was good or very good, scoring more than nine out of fifteen points in 80.5%. The cost was lower when compared to the standard tariff (636.65£ against 998£) for similar procedures within our hospital setting. All the patients accepted well the test.

Conclusions: The present study indicates that HVTP is technically feasible, acceptable to the patients and is economically viable.
Introduction: Studies have shown that patients with idiopathic REM sleep behavior disorder (iRBD) have attenuated sympathetic nervous system activity compared with controls in resting conditions. However, it has not yet been explored if the autonomous nervous system (ANS) reacts differently to induced pain in patients with iRBD compared to healthy controls. We used heart rate variability (HRV) to investigate the change in ANS response during pain inducing ice-water test and resting condition between patients and controls.

Materials and methods: Data from 8 patients and 12 controls were analyzed. We extracted a five-minute window of ECG-data during ice-water pain and one during a baseline resting state for all patients and controls. The ECGs were processed and analyzed in custom made computer programs (developed in LabVIEW 2015, National Instruments). We calculated the mean sympathetic and parasympathetic tonus using traditional time- and frequency HRV-parameters (SDNN, RMSDD, LF, HF, LF/HF). Secondly, we used the Lorentz plot method to find the maximal sympathetic tonus and minimal parasympathetic tonus during the resting and pain condition. We found the maximum Cardiac Sympathetic Index (CSI)-value and minimum Cardiac Vagal Index (CVI)-value by using a sliding window with maximum overlapping of 100 R-R intervals during the first five minutes after start of ice-water test and during the five-minute resting state. To measure the relative individual change of the HRV-parameters, we created a ratio of all HRV-parameters for each patient.

Results: The maximal sympathetic change from rest to pain was positive for both the iRBD group (CSI ratio: 2.35) and the control group (CSI ratio: 2.87) without a significant difference between the groups. The minimal parasympathetic change from rest to pain was close to zero for both groups (CVI ratio iRBD: 1.06. CVI ratio controls: 1.03. p=0.48). There was no difference in the pain/rest-ratio between iRBD-patients and controls in neither of the other HRV parameters (SDNN p=0.50, RMSDD p=0.13, LF p=0.71, HF p=0.31, LF/HF p=0.87).

Conclusions: Pain-induced changes in HRV parameters were not different between iRBD patients and healthy controls.
**EXPLoding HEAD SYNDROME: A CO-ACTIVATION OF ALPHA-FREQUENCY BAND OSCILLATIONS AS A NOVEL INTERICTAL FINGERPRINT?**

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**Introduction:** Exploding head syndrome (EHS) is a rare paroxysmal sensory parasomnia (Mitchell, 1876), with a slight female preponderance, and generally older age of onset. It is characterised by perception of abrupt, loud noises at transitional sleep-wake or wake-sleep states. A chronic occurrence of the attacks, with a highly variable frequency, is common. Despite its association with significant fear and distress, to date the pathophysiology of this sleep disorder is largely unclear, with some hypothesising sudden involuntary movements of middle ear components or the Eustachian tube. Others suspect a delay in the reduction of activity in selected areas of the brain stem reticular formation as the patient passes to sleep. More recently, transient calcium channel dysfunction has also been suggested. The aim of this study was to explore large-scale electrophysiological signatures of EHS by utilizing a novel EEG analysis with focus on multi-frequency temporal interactions.

**Materials and methods:** A retrospective case-control study of polysomnographic recordings of 4 patients (3 females, age range 53-69 years) with EHS, who were investigated between 2015 and 2017, was conducted. Only patients without other neurological conditions were included. All investigated recordings were interictal, with no EEG records of the sensory experience of EHS captured. Controls consisted of four patients without sleep or neurological pathologies, investigated during the same period, who were closely matched for age and for time period of being awake after falling asleep (e.g. WASO). Electroencephalographic analyses of records were performed on the sensor level. The whole-night time-frequency analysis (TFA) was derived using short-time Fourier transformation (STFT) with a 4096-point window and 4068 overlap on the signal of O1, O2, C3 and C4 electrodes, for frequencies in the range 0.05-45Hz at a step of 0.03Hz. Similarly, an event-related spectral topography and the TFA analysis were estimated using event-related FFT-based transformations. The resulting full range sleep spectrograms were analysed for the presence of between-frequency power interactions, and their interplay with the sleep stages.

**Results:** Hypnospectrogram analysis demonstrated the simultaneous power increase (co-activation) of alpha oscillations with another frequency band occurring at all WASO periods, in all four EHS patients. Co-activation was absent from all WASO periods of controls. In three patients, co-activation was with theta frequency band, whilst in one patient the second frequency band was in beta frequency, about 18 Hz. Spectral topography analysis suggested that the coexisting activations originated from distinct brain regions, which was also supported by hypnospectrogram analysis. No distinct EEG pattern or EEG event were found to consistently precede the co-activation periods.

**Conclusions:** Alpha-frequency band oscillations have been shown to phase-lock between widely separated cortical regions, and to form functional large-scale networks during stimulus processing and task execution. Their co-activation with other frequencies has been demonstrated to occur in response to cognitive demands. Our results suggest that EHS patients, unlike controls, exhibit an interictal EEG pattern of significant alpha frequency co-activations during sleep-wake states, perhaps implying substantial cognitive processing at transitional states of diminished consciousness, leading to erroneous amplification and modulation of external sensory stimuli.

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Parasomnia
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ELECTROPHYSIOLOGICAL DIFFERENCE IN OBSTRUCTIVE SLEEP APNEA WITH OR WITHOUT REM SLEEP BEHAVIOR DISORDER: CARDIOPULMONARY COUPLING ANALYSIS

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Introduction: Due to contrary pathophysiology, it was proposed that REM sleep behavior disorder (RBD) might protect against obstructive sleep apnea. The objective of this study was to assess the electrophysiological difference regarding electrocardiogram-based cardiopulmonary coupling (CPC).

Materials and methods: The polysomnography (PSG) data of 138 subjects with OSA (AHI ≥ 15/h), RBD with OSA (AHI ≥ 15/h), RBD, normal control (N=32, 26, 29, 51, respectively) were collected. For conducting case control study between RBD with OSA and patients with OSA only, a total of 32 OSA controls, matched for age, AHI and BMI were recruited. CPC parameters were obtained using CPC analyzer in RemLogic. Sleep spectrogram by CPC analyses revealed the percentage of stable tidal volume [high-frequency coupling (HFC), 0.1-0.4 Hz] and fluctuation tidal volume [low-frequency coupling (LFC), 0.01-0.1 Hz] during sleep.

Results: Although there was no significant Apnea-Hypopnea index (AHI) difference between RBD with OSA and OSA group (AHI 29.1±15.6/h vs. 34.1±18.9/h, p=0.332), there was significant difference in CPC measurements. In RBD-OSA group showed lower LFC (35.9±16.8 vs. 49.7±21.3, p=0.010) than OSA group. Unlike higher AHI in RBD with OSA than RBD group (29.1±15.6/h vs. 3.2±1.6/h, p<0.001), there was no significant difference in CPC study. Both OSA group and RBD with OSA group showed higher LFC (OSA vs. normal: 49.7±21.3 vs. 28.4±13.3, p<0.001, RBD with OSA Vs. normal: 35.9±16.8 vs. 28.4±13.2 p=0.035) and lower HFC (OSA vs. normal: 37.5±20.0 vs. 56.2±16.2, p<0.001, RBD with OSA vs. normal: 46.8±20.8 vs. 56.2±16.2, p=0.031) when compared with normal control group, respectively.

Conclusions: In terms of autonomic-respiratory interaction, RBD with OSA showed similar CPC profile (higher LFC and lower HFC than normal) to OSA group but less severe than pure OSA group. These findings support the idea that RBD has protective effect on OSA.

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Introduction: This is the case of the patient presenting with several episodes of sexual activity following bruxism episodes.

Materials and methods: The patient is a 49-year-old Caucasian male participant of a research study performed to establish possible association of sleep bruxism and other medical conditions. The patient has been suffering from severe bruxism, arterial hypertension, psoriasis and Barrett's esophagus. Obstructive Sleep Apnea Syndrome was suspected. He underwent several laboratory tests (metabolic, hormonal), video-polysomnography (PSG) and dental examination. Further assessment was conducted with: Athens Insomnia Scale (AIS), Epworth Sleepiness Scale (ESS), Berlin Questionnaire, STOP-BANG, Beck Depression Inventory (BDI), WHO Quality of Life-BREF (WHOQOL-BREF), Pittsburgh Sleep Quality Index (PSQI), Headache Impact Test-6 (HIT-6), Oral Behavior Checklist (OBC), Paris Arousal Disorder Severity Scale (PADSS), Perceived Stress Scale-10 (PSS-10) and a self-designed scale (Vratislavian Sleep Events Scale).

Results: Patient's complaints included snoring, fatigue, gnashing of teeth (day and night), bilateral pain located in masseter muscles and temporomandibular joints and perceived chronic tensing of the masseter muscles, low sleep quality, common nightmares (almost each day) and symptoms of periodic limb movement disorder. His physical examination was normal. Laboratory tests revealed lowered HDL cholesterol levels, hypertriglyceridemia and fasting hyperglycemia. Dental examination and OBC confirmed severe sleep and awake bruxism. The patient scored 10 points in ASI, 11 points in ESS, 21 points in PSS-10 and 0 points in PADSS (no symptom awareness). Video-polysomnography confirmed severe bruxism (Bruxism Episodes Index=10,1/h) with total 64 episodes lasting up to 21,5s (mean=6,5s), which often lead to arousals. Obstructive Sleep Apnea Syndrome was not confirmed. We observed REM latency=160 minutes, sleep architecture as follows: NREM1=6,9% of Total Sleep Time, NREM2=60,1% TST, NREM3=10% and REM=23%. Two REM stages were registered (lasting total 87 minutes) and one NREM3 stage (38 minutes). The patient presented several episodes of sexual activity during NREM2, NREM3 and REM, performing masturbation with his hand or friction moves pushing his loins against the quilt, lying in prone or sided position. Episodes lasted short, no ejaculation. Each of these events was preceded by bruxism episode with a registered arousal. Nocturnal events were not remembered.

Conclusions: According to our knowledge this is the first case presenting with sexsomnia associated by severe bruxism (sleep and awake). Pathophysiology of NREM parasomnias includes cortical arousals evoked by different stimuli, such as motor activity. Our patient’s timing of episodes suggests that bruxism may lead to cortical arousal followed by sexual activity during different sleep stages - not typical for sexsomnia, described as NREM parasomnia. Questionnaires showed lowered subjective quality of sleep, mild daytime sleepiness and increased probability of insomnia - analysis of the results could lead to the conclusion that these symptoms might be caused by reduced NREM3 duration. Arousals evoked by frequent bruxism episodes could be the main reason of disordered sleep microstructure. Severe bruxism in this patient is probably a typical somatoform reaction to perceived chronic stress and anxiety (also contributing to other sleep disorders). Reported subjective symptoms may contribute to further increase of stress - vicious cycle commonly observed in anxiety disorders.
Introduction: Interaction between sleep and epilepsy is reciprocal, complex and clinically relevant. Antiepileptic drugs (AEDs) control seizures and have a direct influence on sleep quality improvement. Otherwise, AEDs, related to the mode of action, can modulate sleep architecture. Potentially, AEDs that block excitatory activity such as perampanel (PER) could have a beneficial role in sleep regulation. The aim of this study is to determine the sleep modulatory properties of PER in patients with focal epilepsy through objective sleep evaluation.

Materials and methods: Patients meeting criteria for refractory focal onset seizures and clinical indication of treatment with PER were included in a prospective, monocentric pilot study carried out in our comprehensive epilepsy centre. Nocturnal video-polysomnography (NVPSG) was performed the day before treatment started and repeated 3 months later. Daytime sleepiness was assessed with the Epworth Sleepiness Scale (ESS) and subjective sleep quality with the Pittsburgh Sleep Quality Index (PSQI). After manual scoring of NVPSG recordings we considered for statistical analysis total bed time, total sleep time, sleep latency, sleep efficiency, REM-sleep latency and times and percentages in N1, N2, N3 and REM sleep stages.

Results: Twelve patients (7 males; average age 37.2 years, range 23-53; 6 frontal lobe and 3 temporal lobe epilepsy) completed the study. The baseline ESS showed that 3 patients (25%) had excessive daytime sleepiness (normal range: 0-10 points). Attending PSQI, 4 patients (33.3%) reported poor global sleep quality (cut-off score of 5). On initial NVPSG, 5 patients (41.6%) showed prolonged sleep latency (>20 minutes) and 4 (33.3%), reduced sleep efficiency (<85%).

After PER-therapy, no patient showed increased somnolence on ESS. On PSQI, no significant changes were observed in the global sleep quality and subscales. Based on NVPSG parameters, sleep latency and efficiency showed no significant variations.

Considering only the patients with prolonged baseline sleep latency, the improvement was indeed significant: all the 5 patients showed a reduction of 47.2% on average and 3 of them reached normal values (p=0.043; Wilcoxon). Moreover, from the 4 patients with reduced sleep efficiency, 2 improved their scores (p=0.715; Wilcoxon).

On sleep stages distribution, in the whole group of 12 patients, only N2 sleep time and percentage increases were significant on the NVPSG after PER (22.8%, p=0.006, and 17.1%, p=0.041, respectively).

Conclusions: PER increases significantly N2 sleep without modifying other parameters of the sleep architecture, in patients with focal epilepsy. Despite the reduced number of patients analysed in our study, PER significantly shortened the sleep latency when previous values were not normal. More interestingly, described modulations on sleep architecture seem not to be associated with excessive daytime sleepiness or significant changes of the subjective sleep quality.
Introduction: Hormone replacement therapy (HRT) is commonly prescribed to alleviate some of the symptoms of the menopause, which often are associated with higher frequency of sleep problems (Ameratunga, Goldin, & Hickey, 2012). The effect of use of HRT on sleep quality is, however, controversial. Therefore, the aim of this study was to investigate possible associations between HRT and good quality sleep in Norwegian women. Other factors, as satisfaction with life, neuroticism, frequency of night sweats and selected life style factors as smoking, frequency of exercise, and marital status (co-habiting or not) were also investigated.

Materials and methods: Data were obtained from the Health Study in Nord-Trøndelag (HUNT3, 2006-2008), and linked to data from the Norwegian Prescription Database. Sleep quality was assessed using the following 4 insomnia questions: During the last three months how often have you;
1) difficulties with falling asleep at night,
2) wake up repeatedly during the night,
3) awake early and cannot fall asleep again, and
4) felt sleepy during the day.
Good sleep quality was defined as reporting insomnia symptoms never/rarely or sometimes, while poor sleep quality meant reporting symptoms several times a week. Prescribed sleep medication included benzodiazepine-derived anxiolytics/hypnotics and Z-drugs. Data were analyzed using multiple logistic regression. All analyses were stratified by user/not user of sleep medication.

Results: In total, we analyzed 27756 females; 1733 (6.2%) used HRT and 25867 (93.2%) reported good sleep quality. Our data did not reveal any statistically significant associations between use of HRT and good sleep quality in women older than 39 years, both for non-users (OR=1.26, 95% CI [0.93-1.70], p=0.14) and users (OR=0.90, 95% CI [0.64-1.27], p=0.56) of sleep medication. Frequency of night sweats was not associated with use of HRT. However, lower levels of neuroticism, not smoking, living with a partner and high level of life-satisfaction, absence of night sweats were all associated with higher odds for good sleep quality. Interestingly, women below 39 years of age who reported use of HRT had significantly higher odds for better sleep compared to older women (OR=1.64, 95% CI [1.07-2.54], p=0.02).

Conclusions: Our results suggest that life-satisfaction, level of neuroticism, and absence of night sweats are the strongest predictors of good sleep; however use of HRT was not associated with good sleep quality in women older than 39 years.

MIGHT HYPNOTIC DRUG FORMULATION IMPACT ON THE POTENTIAL FOR ABUSE?

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Introduction: Key elements of substance-use disorders are dose increases, tolerance of and craving for the drug’s effects, and loss of control (1). These diagnostic criteria and definitions are used for all classes of abused drugs, including benzodiazepines (BDZs). The low toxicity of BDZs combined with the high potential for tolerance raises the risk of high-dose abuse. It has been recently reported that the long term use of high doses of BDZs for chronic insomnia induces a marked depression of slow wave activity and its physiological instability (2). Moreover, patients with high-dose BDZs intake show profound changes in cognitive function (3), as well as lower physical and psychological dimensions of Quality of Life (4). A retrospective study carried out using the database of hospital admissions to the addiction unit of a Dept. of Internal Medicine for detoxification showed an abnormal number of requests for detoxification from lormetazepam. Lormetazepam was the most commonly BDZ used (43.8%); moreover, the liquid formulation (drops) was preferred by 99.2% abusers of lormetazepam (5). In the last years, other hypnotics, as triazolam and zolpidem, have been available in the market.

Materials and methods: In order to evaluate the possible role played by the type of pharmaceutical formulation, we reviewed the data of the National Pharmacovigilance Network on the reported cases of “abuse” in the last 4 years for lormetazepam, triazolam and zolpidem.

Results: 239 cases with lormetazepam (drops N=117, tablets N=26, not specified N=96), 112 cases with triazolam (drops N=7, tablets N=74, not specified N=32) and 207 cases with zolpidem (drops N=14, tablets N=190, not specified N=3) abuse were recorded.

Conclusions: Our data indicate a greater addictive power of liquid formulation for lormetazepam, but not for triazolam and zolpidem. This result could be explained by the presence of non-negligible quantities of alcohol in the lormetazepam solution. Tablet formulation strongly reduces the addictive potential of lormetazepam, while liquid formulation reduces the addictive potential of zolpidem and triazolam.

References:
SLEEP INDUCTION EFFECT OF DAYTIME ADMINISTRATION OF MELATONIN NIOSOME GEL IN HEALTHY VOLUNTEERS

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Introduction: Melatonin is an endogenous hormone which induces sleep with a diurnal effect most prominent at night. Daytime administration of melatonin can induce sleep without serious adverse effects in healthy volunteers and also in non-painful diagnostic procedures done in children. However, oral melatonin has low bioavailability and a short duration of action. Melatonin niosome (MN) gel were formulated in order to overcome these problems. Along with the phase 1 study for pharmacokinetics, we studied the sleep induction effects in healthy volunteers.

Materials and methods: A prospective randomized, double-blind, crossover study was conducted in 16 healthy male volunteers. The MN gel (2.5 or 5 or 10 mg), was applied onto the upper labial mucosa at 9.00 am on 3 visits with 7 day washout periods. Actigraphy was used to monitor sleep on all subjects. Sleep stages were scored by EEG, EOG, and EMG on one subject each visit. All 5 subjects had sleep stages evaluated for the 3 different doses. Total sleep time (TST), sleep efficiency (SE), sleep onset latency (SOL), wake after sleep onset (WASO) and percentage of achieved sleep time was reported. The correlation of actigraphy data and EEG was studied.

Results: Sixteen healthy male volunteers (22.9±3.1 yrs) were recruited. The subjects recorded a sleep diary for 1 week and had sleep time ≥ 7 h each night to ensure sufficient sleep prior to the test day. Two subjects were withdrawn during the trial due to non-compliance with the protocol. The sleep parameters from EEG were not significantly different between the 3 different doses (n=5 for each dose). The TST and SE from actigraphy (n=15 per dose) had moderate to good correlation with the TST and SE sleep scored by EEG in all 3 doses. (r = 0.5-0.9) The percentage of achieved sleep induction goals (the subject was able to reach TST of more than 2 h and SOL within 30 min) was more than 60% in all 3 doses, with an incremental dose tendency. There were no serious adverse effects and no after effects after using MN gel.

Conclusion: MN gel (2.5, 5, and 10 mg) was able to induce daytime sleep in healthy volunteers with satisfactory sleep time and SOL. It is safe to use without any after effects or other side effects.

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ALLOSTERIC MODULATION OF ADENOSINE A2A RECEPTORS IN MICE INDUCES SLOW-WAVE SLEEP WITHOUT CARDIOVASCULAR EFFECTS

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Introduction: Insomnia is one of the most common sleep problems with an estimated prevalence of 10-15% in the general population and 30-60% in the older population. The adenosine A2A receptor (A2AR) agonist CGS21680 induces sleep when infused into the brain of rodents. However, it is commonly believed that administration of an A2AR agonist has limited clinical potential for treating sleep disorders, because of its cardiovascular side effects, including hypotension and tachycardia. Moreover, all currently existing A2AR agonists are not suitable for treating the central nervous system due to the lack of brain permeability, as it is widely accepted that the basic adenosine scaffold must be maintained in an A2AR agonist. Selective physiologic A2AR responses may, however, be evoked by a positive allosteric modulator, because its action, in contrast an orthosteric ligand, is limited to when and where the endogenous ligands are released. Allosteric modulation may be an alternative strategy for the treatment of insomnia, because the elevation of extracellular adenosine levels in the brain is positively associated with sleep.

Materials and methods: We have established A2AR-expressing Chinese hamster ovary cells to measure cAMP produced upon A2AR activation by using a fluorescence resonance energy transfer immunoassay and subsequently, screened 1194 small-molecule compounds for allosteric effects at A2AR in the cell-culture bioassay.

Results: We identified a positive allosteric modulator for A2AR (A2AR PAM-1). When we examined the sleep inducing activity of A2AR PAM-1 by monitoring the electroencephalogram, we found that the intraperitoneal (IP) administration of A2AR PAM-1 dose dependently (30-75 mg/kg) increased the total amount of slow wave sleep (SWS). The SWS-inducing effect of A2AR PAM-1 was suppressed by A2AR antagonist ZM241385 (15 mg/kg, IP) and abolished in A2AR knockout mice. Moreover, direct infusion of A2AR PAM-1 (200 nmol/ml) into the brain of mice during the night strongly induced SWS. In contrast to A2AR agonist CGS21680, blood pressure measured by using an electrosphygmomanometer and heart rhythm monitored by using electrocardiography were not affected after IP administration of A2AR PAM-1.

Conclusions: Small molecules like A2AR PAM-1 may help people with sleep problems to fall asleep.

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THE RELATIONSHIP BETWEEN SLEEP, CANNABINOIDS AND SEIZURES

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Introduction: Marijuana, the most widely produced and consumed illicit substance worldwide, has been used through a history for a medicinal and recreational purposes. Nevertheless, there is a long scientific debate about positive and negative properties of cannabinoids. There is a perception that cannabinoids exert hypnogogic properties and several clinical trials on certain cannabinoids report improvement of patient's sleep as a positive outcome. On the other hand, cannabinoid abuse has been associated with substantial adverse effects, such as dependence syndrome, impaired respiratory function, cardiovascular disease, and psychosis, linked to schizophrenia development. Moreover, in the last 20 years, there was an increase of production of "high-content Δ9-tetrahydrocannabinol" (Δ9-THC) cannabis and a spread of synthetic cannabinoids, with a much higher potency to cannabinoid receptor 1 (CB1R) compared to a typical marijuana plant. This led to an increased numbers of cannabinoid-related emergency department admissions with a health-threatening symptoms, such as seizures or generalized convulsions. To puzzle out discrepancy among studies, and to decipher whether cannabinoids induce sleep or trigger seizures we aimed to investigate the effects of cannabinoids on electroencephalogram (EEG) and behavior in mice.

Materials and methods: C57/BL6 mice were used throughout the experiments. For the continuous EEG recording we used our high-throughput EEG/EMG bioassay system, with an analysis software (Sleepsign, KisseiComtec). For the spike analysis, EEG traces were quantified using OriginLab v8.5 Pro. Experiments, involving behavioural assessment were equipped with a high-quality video recording using double-screen mode. LC-MS/MS spectrometry was employed to measure cannabinoids serum concentration.

Results: Here we report that an intraperitoneal administration of the natural cannabinoid Δ9-THC, one of the main constituent of marijuana, or the synthetic cannabinoid JWH-018, triggered electrographic seizures in mice. Continuous electroencephalography and videography gave us evidence that animals were not sleeping, but had behavioural and electrographic seizures with different intensity. Pretreatment of mice with AM-251, a cannabinoid receptor 1 (CB1R)-selective antagonist, completely prevented these cannabinoid-induced seizures.

Conclusions: Our data imply that abuse of cannabinoids can be dangerous and represents an emerging public health threat. Cannabinoid-induced seizures are mediated by CB1R and pretreatment with a selective CB1R antagonist (AM-251) completely prevented electrographic and behavioural seizures. Therefore, AM-251 could be used as a therapy for cannabinoid-induced seizures or similar life-threatening conditions.

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DEEPER SLEEP DURING CHRONIC CAFFEINE CONSUMPTION IN MICE

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Introduction: Caffeine is one of the world’s most widely consumed psychostimulants. It impacts human sleep and circadian physiology, and the acute effect of caffeine has been studied extensively.

Materials and methods: In the current study, we investigated the chronic effect of caffeine consumption on sleep and the sleep electroencephalogram (EEG) in mice (C57BL/6J, n=7). We recorded the EEG and electromyogram (EMG) continuously for control 36-h and subsequent 36-h where mice had exclusively access to caffininated drinking water (0.8g/L) (acute condition). The recordings were repeated after 14 days of caffininated water consumption for baseline 24-h and during and after 6-h sleep deprivation (SD). An additional control group (n=11) with normal drinking water was recorded and sleep deprived.

Results: The total amount of waking, NREM and REM sleep over 24-h did not change in acute and chronic caffeine vs. control, however the amplitude of the light-dark vigilance state rhythm was increased (rANOVA, p<0.05), with the highest amplitude in the chronic condition. Increased waking in the dark period was apparent in both the acute and chronic condition, however, chronic caffeine consumption resulted, additionally, in decreased waking in the light period. EEG slow-wave activity (0.75-4.0 Hz) during the light period was increased in the chronic condition compared to control. In the waking EEG, enhanced theta (7-9 Hz) and decreased slow-wave activity (0.5-5.0 Hz) were evident in the chronic condition, compared to control, denoting increased alertness. SD, by gentle handling, was remarkably difficult after chronic caffeine consumption and less successful than in the control group.

Conclusions: Together with the baseline SWA results, our data suggest that the animals under chronic caffeine experience increased sleep pressure during the light period. Concluding, we show that chronic and acute caffeine consumption induce different effects on sleep architecture and the sleep EEG.
Introducing: Aging increases the risk of obstructive sleep apnea (OSA). OSA in older adults may lead to
daytime sleepiness, cognitive decline, depressive symptoms, nocturia and increased risk of falls. Moreover, OSA
is related to chronic age-related chronic conditions, such as hypertension, diabetes and cardiovascular diseases.
Medications acting on the central nervous system might be a risk factor for OSA in older adults. However, the
effects of these drugs on the respiratory parameters during sleep are under-evaluated. As gabapentin is
increasingly used by older adults, including its off-label use for insomnia, we tested the acute effects of
gabapentin on polysomnography (PSG) parameters in older men without a previous OSA diagnosis.

Methods: This was a double-blind, randomized, placebo-controlled crossover study.
Non-obese men (>60 years) were included. Neuropsychiatric disorders, current alcoholism, current or previous
tabagism, nocturia, psychoactive drug use, Berlin questionnaire indicating high risk for OSA, other sleep
disorders, and Apnea-Hypopnea Index (AHI)>15 were exclusion criteria. Participants were assigned to one of the
intervention arms (gabapentin 300 mg or placebo at bedtime). After a 1-week wash-out, the same procedure
was repeated following the crossover design. Full PSGs were obtained. AHI and oxygen desaturation index (ODI)
were the primary endpoints. Other PSG variables were secondary endpoints. Wilcoxon signed-rank test
compared interventions responses. Cohen’s (d) measured effect sizes. The Number Needed to Harm (NNH)
using the American Academy of Sleep Medicine recommendation for CPAP treatment (AHI>20) was estimated.
Randomization order effect was assessed by ANCOVA. Spearman’s correlation assessed the effect of age on
outcome’s response. Adverse events were assessed before bedtime and after awakening.

Results: The study enrolled eight older men. AHI was higher in the gabapentin arm than in the placebo arm
(22.4±6.1 vs 12.2±4.3, p< 0.05). The effect size for AHI was moderate (d 0.67). NNH was 4. Respiratory events
were mainly obstructive. ODI was higher in the gabapentin arm (20.6 ± 5.8 vs 10.8 ± 3.9, p< 0.05), with a
moderate effect size (d 0.68). Subgroup analyses of the primary endpoints (non-REM or REM sleep and supine or
non-supine position) showed that gabapentin increased AHI only during non-REM sleep and in the supine
position. Randomization order did not affect the results. No significant correlation was found between individual
ages and AHI increases from placebo to gabapentin (rs = - 0.29, p = 0.49). No other PSG parameter differed
between groups. No adverse events were reported.

Conclusion: Gabapentin increased AHI and ODI in our sample of older men. To our knowledge, this is the first
report of the effects of an anticonvulsant drug on respiratory parameters during sleep. Effect sizes were greater
than those observed in studies with other drug classes, such as benzodiazepines, opioids, and antipsychotics.
Previous Number Needed to Harm estimates were not reported for comparisons. Therefore, agents acting on the
CNS, including anticonvulsant drugs, may lead to a higher risk of OSA development or worsen in some patients.
Long-term clinical trials aimed at elucidating this concern are warranted.

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HYPERSOMNIA AS A SOLE PRESENTATION OF A MONOANINÉRGIC ACTIVITY DISTURBANCE
- A CASE REPORT

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Introduction: Excessive daytime sleepiness (EDS) achieves a prevalence up to 30% in the adult general population. EDS isn’t a disease per se, but a symptom associated with different sleep disorders, as well as disorders with psychiatric etiology, such as affective disorders.

Authors present the case of a 21 years-old caucasian woman, without medical, psychiatric and surgical history, single and medical degree student, who in January 2016, was admitted to a Neurology outpatient care service, by a monosymptomatic complaint of exuberant EDS. This symptom made attendance and vigilance to morning classes, as well as the academic performance, impossible. It was found imperative EDS, increased total sleep time (12 hours), non-restorative long naps and sleep inertia. The Epworth Sleepiness Scale score (ESS) was 18. Patient did not report hypnagogic hallucination or sleep paralysis. She was hospitalized for investigation and from the infectious, immunological and neurological results, only hypersomnia in MSLT, with 7:44 minutes of mean latency, was revealed. No SOREM`s. No abnormalities were identified in cranial CT-scan, head MRI and MR-angiography. The patient was treated with Modiodal® in the maximum dosis of 400 mg daily, however, no clinical response was obtained.

Materials and methods: This is a case report presentation.

Results: In June 2016, she was referred to a Psychiatric outpatient care service, and an intrapsychic conflict was recognized, related to a neoplastic disease from her mother, three years before, but depressed mood was not objectified. In December 2016, she was referred to the Sleep Medicine Center at Coimbra Hospital and University Centre, where she performed an actigraphic study that confirmed the absence of sleep deprivation as a circadian rhythm sleep-wake disorder. A night PSG did not reveal any sleep related breathing or movement disorder, as well as any parasomnia, as expected. The report revealed a total sleep time of 450 min, with a 95% efficiency. Three cycles of sleep were completed, and the sleep fragmentation index, by micro-arousals (MA) was 18.4 per hour. Sleep onset latency (SOL) and REM latency was 7 and 95.5 minutes, respectively. N1=13%, N2=50%, N3=20% and REM=17% were determined. Increase K-complexes, in sleep microarchitecture was reported, but no paroxysmal activity was detected. In respiratory analysis, a RDI with 5 events per hour was established, with an O2 saturation average of 97% and no saturation under 90% was detected. No periodic limb movement disorder and no EKG disturbancies were reported. Heart rate was recorded in the range of 80-110 BPM. Patient’s hypersomnia symptom stabilized after a psychopharmacotherapy intervention in October 2016, with Elontril® 150 mg id and Triticum AC® 100 mg id.

Conclusions: The etiopathological determination of a hypersomnia can be markedly demanding and sometimes inaccessible. This case thus intends to enhance the atypicality of a monoaminergic disturbance, translated by a depressive disorder, without the classic mood change.

Keywords: Monoamine activity disturbance; Hypersomnia; Excessive daytime sleepiness; Depressive episode.
**Introduction:** Irritable bowel syndrome (IBS) has a significant negative impact on quality of life, mood and wellbeing. Part of this association may be related to the impact of IBS on sleep. Purpose of this study was to investigate the association between IBS complaints and sleep.

**Materials and methods:** An online survey was completed by Dutch university students. The presence and severity of IBS complaints was determined with the Birmingham IBS Questionnaire. Subscales of the SLEEP-50 questionnaire were completed to assess narcolepsy, insomnia, and circadian rhythm disorder. Total Sleep Time, number of nightly awakenings, and sleep quality were also assessed. Daytime sleepiness was assessed with Fatigue-Inertia and Vigor-Activity subscales of the Dutch version of the Profile of Mood States (POMS) scale. Nonparametric Spearman's rho correlations were computed to investigate the association between IBS and sleep outcomes.

**Results:** Data from N=1950 students were included in the analyses (83.6% women). IBS scores were significantly associated with SLEEP-50 subscale scores of insomnia ($r = 0.317, p=0.0001$), narcolepsy ($r = 0.242, p=0.0001$), and circadian rhythm disorder ($r = 0.127, p=0.0001$). Significant correlations were also found between IBS subjective sleep quality ($r = -0.208, p=0.0001$) and the number of nightly awakenings ($r = 0.246, p=0.0001$). Total sleep time was not significantly associated with IBS scores. Both Fatigue-Inertia ($r = 0.305, p=0.0001$) and Vigor-Activity ($r = -0.226, p=0.0001$) were significantly associated with IBS.

**Conclusion:** Irritable bowel syndrome complaints are associated with sleep disturbances and increased daytime sleepiness. Further research should investigate the impact of IBS-related sleep disturbances and associated reduced daytime alertness on the performance of daily activities such as driving a car or job performance.

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Introduction: Sexual assault victims (SAV) are 7 times more at risk of developing posttraumatic stress disorder (PTSD) than the general population. Daytime posttraumatic symptoms occur, SAV experiencing a hypervigilance state, intrusive thoughts, potential dissociative states and avoidance behaviors. Although less studied than daily ones, nighttime posttraumatic symptoms (e.g. recurring nightmares, insomnia) would contribute to the maintenance of PTSD in SAV and persist beyond the usual treatments. In addition, recurring nightmares are linked to higher suicidality risk. Several treatments directly addressing nighttime posttraumatic symptoms have emerged over the past three decades. Indeed, SAV are more likely to suffer from nocturnal posttraumatic symptoms (77%) than any other PTSD population given that sexual trauma often occurs in the evening at bedtime. The aim of the present project is to systematically review the relative effectiveness of treatments targeting nighttime symptoms (nightmares and sleep disturbances) in SAV suffering from PTSD.

Methods: The present systematic review included studies published on or before June 1, 2016 from PsychINFO, PubMed, Embase, The Cochrane Library, ProQuest and grey literature (Google Scholar). Keywords were: crime victims, sexual abuse, sexual assault victims, rape, incest, dreaming, insomnia, nightmares, parasomnias, sleep, sleep disorders, treatment, intervention, drug therapy, psychopharmacology. 22 primary studies were eligible and retained for assessment of methodological quality.

Results: Coding and data extraction were performed by three independent judges (kappa = 0.93). Total sample was predominantly composed of adult (94%) female victims (97%) suffering from psychiatric disorders (e.g. recurrent nightmares, insomnia, PTSD, major depression) before any treatment was initiated. Even though more than half of studies were case reports (N=16) with low methodological quality (e.g.: small sample, no objective measure), some studies with RCTs and controlled open trial (N= 6) had a good methodological quality, randomization, methodological control and were more inclined to provide objective results. In sum, types of studies were psychological (N=13), pharmacological (N=7) and multimodal (N=2). All studies (N=5) on Imagery Rehearsal Therapy (IRT) in SAV showed this intervention as being popular and effective in reducing unwanted nocturnal symptoms, most likely because of settings' flexibility (inpatient, outpatient, individual, in group, combined or not, etc.). Studies also using prazosin as treatment regimen (N=4), dosage between 1 and 9 mg, were effective in treating night symptoms in SAV. However, symptoms were likely to return if medication was discontinued.

Discussion: The present systematic review first suggests that IRT (psychological intervention) and prazosin (pharmacological intervention) are the most frequent and proven effective interventions to treat nighttime PTSD symptoms (significant reduction of nightmares and insomnia) in SAV. Second, these two interventions also noticeably increase sleep quality and quality of life in SAV. Finally, results of this systematic review highlight the need of studies with more complex methodological designs (larger and representative clinical samples of SAV, RCTs, valid and objective sleep measures) prior to replicate the results found in this current systematic review and to accurately specify treatment effectiveness. Furthermore, with these types of complex interventions, it would possible to provide the relative effectiveness with quantitative data so to conduct a meta-analysis.
Introduction: Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common childhood neuropsychiatric disorder affecting over 5% of school age children. ADHD is a developmental disorder characterized by difficulties with attention, hyperactivity and impulsivity which often lead to various behavioral problems and learning disabilities. Obstructive Sleep Apnea Syndrome (OSA) is the most common type of sleep disordered breathing (SDB) and its prevalence has been estimated at 2-4%. Sleep disorders are a frequent comorbid condition associated with ADHD according to a categorical approach. However, sleep disorders can also induce ADHD-like symptoms according to a dimensional approach and are thought to be the consequence of excessive daytime sleepiness.

Material and methods: It may be difficult for clinicians to differentiate the diagnosis of ADHD comorbid with a sleep disorder from sleep disorders with ADHD-like symptoms. Patients with primary sleep disorders presented often hyperactivity and/or attention deficit symptoms. Indeed, obstructive sleep disorders breathing with bad sleep quality can "imitate, mimic" ADHD in children. In this case, inattention and hyperactivity behavior are induced by sleep disorders but did not constitute a clinical diagnostic of ADHD.

Results: The clinician should gather a developmental and family history (of ADHD and sleep problems) to differentiate ADHD and ADHD symptoms induced by sleep disorder breathing. Clinicians should therefore routinely assess, monitor and manage sleep problems in the presence of both comorbidities in children with ADHD and vice-versa.

Conclusion: ADHD and ADHD-related sleep disorders pose a difficult clinical problem. From these observations, a decision tree to help diagnosis can be proposed for ADHD and ADHD-like symptoms, induced by sleep disorder breathing. Management of sleep problems in ADHD is crucial as they may aggravate ADHD symptoms. Future work and longitudinal research should clarify the direction of the relationship between ADHD, ADHD symptoms and sleep disorders.
Introduction: The objective was to compare the occurrence of a spectrum of different sleep problems in adults with attention-deficit/hyperactivity disorder (ADHD) and a control group, and to study the impact of current ADHD medication use and clinical ADHD subtype.

Materials and methods: Cross-sectional study of 268 clinically ascertained adult ADHD patients (DSM-IV criteria) and 202 randomly selected controls. Sleep problems were self-reported using validated questions, partly from Global Sleep Assessment Questionnaire. Chi-square/logistic regressions with adjustment for sex/age.

Results: ADHD patients clearly reported more sleep problems than controls: Lifetime occurrence of sleep problems (82.6 vs 36.5%), hypnotics use (61.4 vs 20.2%), current sleep duration below 6 hours (26.6 vs 7.6%), and symptoms/signs during the past four weeks of excessive daytime sleepiness, cataplexy, loud snoring, breathing pauses during sleep, restless legs, and periodic limb movements in sleep (significant odds ratios ranged from 1.82 to 14.55). Current ADHD medication use was associated with less cataplexy compared with not using medication. Patients with inattentive subtype reported better sleep quality and less restless legs than patients with hyperactive/impulsive subtypes.

Conclusions: Adults with ADHD reported a very high occurrence of many different sleep problems, underlining the importance of screening for sleep disorders. Among the ADHD patients, medication use was associated with fewer sleep-related symptoms. The inattentive subtype was associated with better sleep quality and less restless legs.
PARADOXICALLY STRONG ASSOCIATION BETWEEN SLEEP SPINDLES AND MEMORY CONSOLIDATION IN MAJOR DEPRESSION

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Introduction: There is robust evidence that sleep facilitates the consolidation of procedural memory. In depressed patients, however, sleep-related procedural memory consolidation is impaired (Dresler et al., 2010, 2011; Genzel et al., 2015). Sleep spindles have been shown to be involved in the off-line processing of simple motor procedural memory during sleep (Fogel & Smith, 2006). Neural mechanisms of off-line components of procedural memory in affective disorders however so far remain unclear. Here, we will look into the specific influence of sleep spindles on overnight consolidation of a procedural memory task in patients who suffer from depression and healthy controls.

Materials and methods: All participants were trained on a sequential finger-tapping task. Finger tapping performance was estimated by the number of correctly tapped sequences per 30-s trial. The percent increase in mean performance between the last three trials during training on the first day and the first three retest trials on the second day was our measure of overnight consolidation. We looked into the influence of spindle activity during the whole night and depressive state on overnight consolidation. Spindles were analyzed automatically using the SpiSOP toolbox (Weber, 2013) and Continuous Wavelet Transform (Adamczyk et al., 2015) over two central channels. Participants included 40 depressed patients (HAM-D >17) and 40 healthy control subjects matched for age and gender as a control group. All patients were medicated with antidepressants.

Results: Patients showed a general worse performance on the finger tapping task at the start of the task ($F(1,78)=11.441$, $p=.001$), compared to healthy controls. They however do not show a difference in the online training effect of the task ($F(1,78)=.002$, $p=.963$). In contrast, patients showed worse procedural overnight memory consolidation ($F(1,78)=28.052$, $p<.000$) than healthy controls. Surprisingly, the correlation between the spindle activity and offline overnight memory consolidation is nominally greater in patients ($r=.426$, $n=40$, $p=.006$) than in controls ($r=.244$, $n=40$, $p=.128$).

Conclusions: Our results suggest that, despite disturbed sleep pattern and general performance and overnight-consolidation impairments, depressed patients show a paradoxically strong relation between overnight consolidation and sleep spindle activity.
THE IMPACT OF SLEEP DEPRIVATION ON ATTENTION FUNCTIONING IN YOUNG ADULTS WITH ADHD

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Introduction: The present study aimed at identifying the impact of 28 hours of sleep deprivation on attention functioning in young adults with or without attention-deficit/hyperactivity disorder (ADHD).

Materials and methods: Twenty-six young adults (males, 18-31 years old, 10 with ADHD and 16 without ADHD) Participated in this study. The participants’ underwent laboratory assessment of attention functioning using online continuous performance test (OCPT). OCPT sessions were conducted in the morning of arrival to the laboratory following a week of regular sleep (7 h or more monitored by actigraph), and following 28 h of sleep deprivation during which the participant’s sleep was continuously monitored.

Results: Participants with ADHD had poorer performance than controls on both omission and commission errors of the OCPT task. Results showed higher rates of omissions and commission errors of ADHD participants compared with control. Sleep deprivation was associated with a significant increase in omission and commission errors in all participants. Moreover, there was a marginally significant interaction between ADHD status and timing of OCPT testing: young adults with ADHD demonstrated a more severe deterioration in attention functioning following sleep deprivation than did participants without ADHD.

Conclusions: The current preliminary results provide indication that sleep deprivation has a detrimental effect on the attention functioning of young adults in general, and young adults with ADHD in particular.
Sleep problems are common among psychiatric patients; particularly in affective disorders. Cognitive Behavioral Therapy - Insomnia (CBT-I) is a multi-component intervention including sleep restriction, stimulus control, sleep hygiene education, cognitive therapy and relaxation techniques. Research supports the efficacy of CBT-I, but few studies focus on how patients experience the methods used in CBT-I and little is known about how depressed patients cope with the methods. In this study 12 patients were interviewed after 6 group sessions of CBT-I. Semistructured interviews were conducted, audiotaped and transcribed verbatim. A qualitative content analysis was conducted. Transcripts were studied and themes identified. Themes were open coded and categories were formed; "Desperate for sleep", "I picked what, I needed", "Need to feel it´s working" and "Longing for the old pattern". Support from group members, therapists, written summaries, relatives and the right timing was important to succeed. Knowledge about how depressed patients experience factors promoting or inhibiting adherence to CBT-I has important clinical implications.
Introduction: In human, depression is generally thought to be associated with undiagnosed OSA or sleep problems. The aim of this study is to analyze the effects of sleep apnea patients underwent overnight polysomnography on depression.

Materials and methods: Data collections of 105 sleep apnea patients in an General Hospital. Dependent variable ; BDI(Beck depression inventory), Independent variables ; Biological data(BMI, Neck circumference, Waist), Polysomnography data[AHI(Apnea-hypopnea index), RDI(Respiratory disturbance index), Mean SpO2, Minimum SpO2, Snoring Index(PSG)PSQI(Pittsburgh sleep quality index), ESS(Epworth sleepiness scale), SI (Snoring index by scale)] Statistics ; IBM Statistics 23.0, hypothesis testing by multiple regression analyses.

Results:
(1) Independent t test -Sex differences of variables(Statistically significant) ; Neck circumference(p=0.000), Waist(p=0.001), WASO(p=0.028), AHI(p=0.005), Supine AHI(p=0.001), RDI(p=0.005), Supine RDI(p=0.001), Snoring Index(PSG, p=0.008), Mean SpO2(p=0.025)
(2) Multiple regression analyses- Effects of sleep variables(Predictor : BDI) ; Step1 PSQI B=0.6999, β=-0.424***, R2adj=0.172, F=22.55***, Step2 PSQI B=0.546, β=0.331***, SI(snoring index by scale) B=0.364, β=0.271, R2adj(ΔR2adj)=0.230(0.058), F=6.519**(** p< 0.01 *** p< 0.001).

Conclusions: Sex differences of sleep variables suggest poorer results in men with sleep apnea. The above results show that poor sleep quality and increased snoring will provoke incidence of depressive disorder in sleep apnea patients. Also, the above results suggest that sleep apnea have causality with depression and men are more vulnerable than women in the occurrences of depression by sleep apnea.
Objective: To investigate the relationship between sleep quality and mental health of preschool teachers.

Materials and methods: using PSQI (Pittsburgh sleep quality index) and SCL 90 (SCL-90) of Beijing city Fengtai District four kindergarten teachers were stratified sampling survey. PSQI questionnaire and SCL-90 questionnaire were issued 182 copies, 176 copies each, the recovery rate was 96.7%, the PSQI complete 171 questionnaires, integrity rate 97.2%; SCL-90 complete 176 questionnaires, the complete rate of 100%. effects associated with the logistic regression analysis of sleep quality of teachers.

Results: the poor sleep quality of the kindergarten teachers, the total average PSQI (4.68), poor sleep is mainly reflected in the daytime dysfunction, sleep quality, sleep time, sleep time, sleep efficiency, sleep disorder (high correlation coefficient between them). There is a positive correlation between the total score of PSQI and most of the ingredients of preschool teachers and SCL 90 factors (through data analysis). Regression analysis showed that somatization, obsessive-compulsive symptoms were the risk factors of sleep quality of preschool teachers (P < 0.05).

Conclusions: the sleep quality of preschool teachers is not optimistic, and the quality of sleep is related to mental health.

Acknowledgements: thank the leadership of the Fengtai Maternal and Child Health Care Hospital for the project support; thanks to the active cooperation of Fengtai District four kindergarten teachers.
GENDER DIFFERENCES IN THE ASSOCIATION BETWEEN SHORT SLEEP DURATION AND DEPRESSIVE SYMPTOMS IN YOUNG ADULTS: RESULTS FROM DE EPITEEN COHORT

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Introduction: The association between sleep duration and depressive symptoms it is still controversial and its specificities among young adults remain unknown. We aimed to estimate the association between short sleep duration and depressive symptoms in a sample of 21-years-old adults.

Material and methods: We analyzed 1514 young adults (52% women) from the EPITeen Cohort, Porto, Portugal. The Portuguese version of the Beck Depression Inventory-II was applied to assess the severity of depressive symptoms (scores>13 meaning presence of depressive symptoms). Sleep duration was collected as a part of the Pittsburgh Sleep Quality Index and categorized as short (≤6 hours), recommended (7-9 hours) and long (>9 hours) sleep duration. Odds ratios (OR) and 95% confidence intervals (95% CI) between sleep duration and depressive symptoms were computed using multinomial logistic regression (recommended sleep duration as the outcome reference category), adjusting for education, body mass index (BMI) and smoking status.

Results: At 21 years of age, 23.7% and 24.8% of men and women sleep six or less hours per night, respectively. Also, 20.9% of women and 10.4% of men present depressive symptoms at the same age. Among women, those who present a short sleep duration had double chances of presenting depressive symptoms than those who sleep 7-9 hours per night (adjusted OR=1.99, 95%CI:1.34-2.98), independently of their level of education, BMI and smoking status. A similar but non-significant association was observed for men (adjusted OR=1.41, 95%CI: 0.82-2.4).

Conclusion: In young women, short sleep duration is associated with depressive symptomatology. This association should be clarified in future longitudinal studies in order to elucidate the need of considering sleep duration when delineating strategies to prevent depression in this specific population.
A COMPARISON OF SLEEP SPINDLE ACTIVITY IN MAJOR DEPRESSIVE DISORDER AND HEALTHY ADULTS

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Introduction: Sleep disturbances and cognitive deficits are prominent characteristics of major depressive disorder. Sleep spindle activity (e.g. power, duration, and density), presumed to reflect neural plasticity, has been shown to be strongly associated with performance on declarative learning in healthy humans. A reduction in sleep spindle activity has been suggested as a possible sleep-related mediator of cognitive deficits in depressed patients. However, it remains unclear if any differences in spindle activity exist in depressed adults as a result of the lack of consensus in the literature. This may be due to presence of a variety of potential confounds in previous studies, including the effects of age, sex, and the menstrual cycle in female subjects on sleep spindles. In addition, past studies used automated spindle detection algorithms, which have recently been shown to be unreliable compared to manual scoring. We aimed to definitively determine if there are differences in sleep spindle activity between depressed and healthy adults by controlling for these potential confounds.

Materials and methods: We manually identified sleep spindles in both depressed and healthy adults and compared sleep spindle activity across the night between groups separated by sex. We selected adults from an age range (18-31 years old) known for stability in sleep spindle activity, and female subjects were included if they were not menstruating.

Results: We found that men and women with depression have shorter lasting spindles with lower max peak-to-peak amplitude and power than their healthy counterparts. These differences were significant for women across the night except for spindle duration in the first non-REM period; however, they were only significant for men in the latter half of the night.

Conclusions: After controlling for potential confounds, depressed subjects have specific lower baseline measures of sleep spindle activity than healthy controls. Future research should focus on whether or not these differences are associated with the cognitive deficits that are a characteristic of major depressive disorder.

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INFANTS WITH SLEEP PROBLEMS HAVE INCREASED RISK OF ADHD

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Introduction: Children with ADHD often suffer from sleep related problems. Sleep and ADHD have a complex and multidirectional relationship. Previous studies have indicated that mother reported sleeping problems in infancy or toddler age are associated with later behavioral or externalizing problems. Objective: To assess the association between sleep problems in infancy, as measured by dispensed hypnotics, and a diagnosis for ADHD in school age in a large population based cohort. To explore to which extent parental ADHD and parental education level affect the association.

Materials and methods: In this cohort study all children born in Norway in the years 2004-2010 were included, 410 555 individuals. Information on dispensed hypnotic drugs from 0-3 years of age was collected from the Norwegian Prescription Database, and diagnoses of ADHD (ICD-10 F90) from 5 years of age and until the end of 2015 was collected from the Norwegian Patient Registry. The data was analysed using Cox regression.

Results: The hazard ratio (HR) of ADHD for children who were dispensed hypnotic drugs at least twice was 2.4 for girls and 1.8 for boys. For the sedative antihistamine trimeprazine users the corresponding HR was 3.6 for girls and 2.5 for boys. After adjusting for parental ADHD and parental education the HR for trimeprazine users was 2.8 (95% CI 2.1-3.6) for girls and 2.0 (95% CI 1.7-1.4) for boys.

Conclusions: Children who were dispensed hypnotics in infancy had an increased risk of ADHD in school age. Girls dispensed the trimeprazine at least twice had a 3-fold increased risk of ADHD later. After adjusting for parental ADHD the HR for trimeprazine use was still high.
**Introduction:** Identification of risk factors for suicidal ideas will be helpful to prevent suicidal behavior. Insomnia may be one of the risk factors for suicidal ideas, but it remains unclear if it has an independent effect. Resilience is need to be considered as one of the major factors for decreasing the suicidal idea. But some previous studies, resilience was negatively associated with suicide attempt not with suicide idea. The aim of this study was to investigate the factors that impact suicidal idea in community-dwelling adults with particular attention to insomnia and resilience.

**Materials and methods:** A total of 432 community-dwelling adults (227 male, 205 female, 19 -68 years of age) completed the self-report questionnaire that covered basic socio-demographic data. To assess the psychological variables, the following instruments were applied: Insomnia Severity Index (ISI), Korean Version of the Connor-Davidson Resilience Scale (K-CD-RISC), Beck Hopelessness Scale (BHOP) and Scale for Suicidal Idea (SSI-Beck). People with an ISI score of 8 or higher were defined as insomnia.

**Results:** Women were more likely to have suicidal ideation than men (4.50±4.97 vs. 2.53±3.98, p< 0.05). Suicidal ideation had a negative correlation with resilience, and positive correlation with insomnia and hopelessness. Resilience, insomnia were significantly associated with suicidal ideation, adjusting for hopelessness, age, sex, presence of family members living together, and household income. Suicidal ideation was higher in insomnia subgroup (mean(SD)=4.61(5.28)) than non-insomnia subgroup (mean(SD)=2.53(3.74)). Additional analysis revealed that severity of sleep onset (β = 0.13, p < 0.05) and sleep maintenance problem (β = 0.15, p < 0.05) were significantly associated with suicidal ideation, but did not show an association with early morning wakening problem.

**Conclusions:** Suicidal ideation was related to insomnia and resilience. Higher suicidal ideation was associated with more severe insomnia and lower resilience. It would be especially helpful to pay more attention to insomnia and low resilience as a high-risk group. The understanding of these factors will be helpful for screening suicidal ideation and furthermore preventing suicidal behavior.
SLEEP QUALITY IN UNIVERSITY STUDENTS WITH PREMENSTRUAL DYSPHORIC DISORDER

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Background: Up to 8% of women in their reproductive years are affected by Premenstrual Dysphoric Disorder (PMDD). Sleep disturbances such as insomnia or hypersomnia are one of the DSM-IV-TR defining criteria for the diagnosis of PMDD and are found in about 70% of women with the disorder. However, studies are lacking that specifically address the effects of PMDD on quality of sleep.

Aim: This study was designed to evaluate the prevalence of Premenstrual Dysphoric Disorder (PMDD) and its impact on sleep quality in female university students.

Methods: We developed an 18-item PMDD scale based on The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) to diagnose PMDD in female university students who ranged in age from 18 to 30 years and had regular menstrual cycles. Participants were categorized into a PMDD group or a No/PMDD group and sleep quality was compared between the two groups. The evaluation tool used to measure sleep quality was the Pittsburgh Sleep Quality Index (PSQI).

Results: The prevalence of PMDD in female university students was 25.5%. Analysis of the PSQI demonstrated that 80.5% of those in PMDD group had a PSQI that scored >5; however, only 56.4% in the No/PMDD group had a PSQI that scored >5 (χ²=12.459, p< 0.001). The mean PSQI score was 8.2(3.4) in the PMDD group and was 6.5(3.1) in the No/PMDD group (t=3.648, p< 0.001).

Conclusions: Female university students who experience PMDD are deeply affected by sleep problems. Lower sleep quality, daytime dysfunction, and sleep disturbance are common sleep problems among female university students with PMDD.

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WAKE AND LIGHT THERAPY IMPROVED SLEEP IN PATIENTS WITH MODERATE TO SEVERE DEPRESSION

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Introduction: There is growing evidence for combined chronotherapeutic interventions as adjunctive treatments for major depression. The effect of combined wake therapy, light therapy and sleep time stabilization for patients hospitalized with moderate to severe depression is, however, only sparsely examined in randomized controlled studies. This combined intervention can be demanding, thus identification of predictors of response is needed. To achieve a sustained effect, patient adherence to the regime is essential. However, only a few studies have focused on patients’ experience of these combined interventions.

Objective:
1) To examine the efficacy of using wake and light therapy as a supplement to standard treatment of hospitalized patients with depression.
2) To identify predictors of response.
3) To illuminate patients’ experiences with wake and light therapy.

Materials and methods: A randomized, controlled study, in which 64 patients with moderate to severe depression were allocated to standard treatment or to an experimental intervention, consisting of three wake therapy sessions in one week, and for the entire nine week study period 30 minutes daily light treatment and sleep time stabilization.

1) Differences between groups were analyzed with repeated measures ANOVA (mixed model).
2) Predictors of effect were identified in follow-up data from the 27 intervention-group patients using Fisher’s exact test.
3) Individual semi structured interviews with 13 patients from the intervention group were conducted. Data were analyzed using qualitative content analysis.

Results:
1) Compared with the control group patients in the wake therapy group had a significant decrease of depressive symptoms in week one as measured by HAM-D17: 17.39 (CI 15.6-19.2) vs. 20.19 (CI 18.3-22.09) (p=0.04), whereas no statistically significant differences were found between the groups in weeks two to nine. At week nine the wake therapy group had a significantly larger increase in general self-efficacy (p=0.001), and waking up during the night was a significantly less frequent problem (1.9 times vs. 3.2) (p=0.0008). In most weeks, significantly fewer patients in the wake therapy group slept during the daytime, and if they slept, their naps were shorter (week three: 66 min. vs. 117 min. p=0.02). We found a significant negative correlation between the Morningness-eveningness (MEQ) score at baseline and HAM-D17 score, patients with lower MEQ scores (evening types) having a larger decrease in HAM-D17 scores (p=0.001).
2) Positive diurnal variation (evening best) was a predictor of response (p=0.02).
3) The patients’ overall experience with the treatment was positive. Some experienced a remarkable and rapid antidepressant effect, whereas others described more long-term benefits (e.g. improved sleep and diurnal rhythm). Yet recovery was fragile, and patients were only cautiously optimistic.

Conclusions: Our results suggest that the combined chronotherapeutic intervention beyond the first week is less useful as a general antidepressant treatment for highly medicated treatment-resistant inpatients with moderate to severe depression. However, it seems beneficial for patients with positive diurnal variation and for evening types. The improvements in general self-efficacy and sleep parameters are interesting findings and a topic for further research.

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A RESEARCH PROJECT AIMED AT DEVELOPING PRACTICAL USE OF SLEEP EEG FOR DIAGNOSIS OF MAJOR DEPRESSIVE DISORDER: MULTICENTER EXPLORATORY PROSPECTIVE STUDY


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**Introduction:** Clinical study findings indicated that 60% to 90% of major depressive disorder (MDD) patients suffer some sort of sleep disturbances such as difficulty of initiating sleep, nonrestorative sleep or increase in wake after sleep onset. Polysomnographic (PSG) studies also suggested that several sleep-architecture abnormalities in EEG profiles of MDD patients. A recent meta-analysis revealed that rapid eye movement (REM) density and reduced slow-wave sleep (SWS) are potential candidates for consistent MDD biomarker. However, there remain some cautions that publication, study-selection, and population biases could dissociate from real-world clinical situation for MDD diagnosis. Thus, we conducted a multicenter exploratory prospective study for developing practical use of sleep EEG for MDD diagnosis.

**Materials and methods:** We adopt a laptop single channel EEG device enabling facile sleep EEG measure at individual patients' home. Ninety MDD patients and one-hundred thirty patients with the other psychiatric disorders including insomnia are going to be recruited for the clinical trial as a study participants. EEG is measured two times form an electrode attached on participants' forehead during two nights of sleep before and after the treatment for their psychiatric disorders. In addition to the sleep EEG parameters described above, we focus on the alpha and sigma spindle density during non-rapid eye movement (NREM) sleep periods, and the beta activity during REM sleep periods. Patients are diagnosed by a psychiatrist using DSM-5 criteria. Depression severity is assessed by the 9-item depression scale of Patient Health Questionnaire (PHQ-9), the Beck Depression Inventory-Second edition (BDI-II), and the Hamilton Rating Scale for Depression (HDRS). Insomnia severity is assessed by the Athen Insomnia Scale (AIS) and the Pittsburgh Sleep Quality Index (PSQI).

**Conclusions:** Sleep may be a small window for seeing into brain resting state, and betray unmodified neural dysfunction. Our results could develop the MDD diagnosis method and promote greater understanding of MDD pathophysiology.

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NAPPING REDUCES ATTENTIONAL BIASES FOR NEGATIVE INTERPERSONAL STIMULI IN CLINICAL DEPRESSION

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Introduction: A recent study demonstrated that napping reduced emotional attentional bias during early childhood. Given the association between negative attentional bias and depressive symptoms, the current study investigated the effect of sleep on emotional attentional bias in patients with major depressive disorder using a napping paradigm.

Materials and methods: Fifty patients with major depressive disorder (mean age=34.69, 86% female), without other comorbid psychiatric conditions as assessed by the Structured Clinical Interview for DSM-IV, and 73 healthy controls (mean age=34.68, 70% female) were recruited from hospitals and the community, respectively. The six-day averaged sleep duration of the participants was measured by both sleep diary and actigraph before the experimental day. On the experimental day, participants completed Positive and Negative Affect Scale and performed the dot-probe task, which examined attentional biases towards faces expressing sadness and happiness, before and after random assignment of a period of 90-minute nap, 30-minute nap or wakefulness. Participants continued to record their sleep duration of the night of the experiment. A three-way analysis of variance with Group (Depressed, Control) and Condition (90-nap, 30-nap and wake) as between group variables and Time (Pre, Post) as within group variable was conducted to compare the attentional bias scores and the positive and negative affect.

Results: There were no significant differences on the age, sex ratio and averaged sleep duration between the depressed and control groups, \( p > .05 \). Significant interaction between Time and Condition was found for positive affect \( [F(2,117)=6.559, p=.002] \) and negative affect \( [F(2,117)=3.712, p=.027] \). The wake group had significantly decreased positive affect over time but the positive affect of the two nap groups remained unchanged. While the negative affect decreased over time in all three conditions, the decrease in the 30-min nap condition was larger than that in the wake condition. Significant three-way interaction was found for attentional bias for sad faces \( [F(2,105)=3.487, p=.034] \) but not happy faces. Among the depressed group, while higher negative attentional score (indicating shifting attention towards sad faces) was found after wakefulness, the attentional score remained unchanged after both 30- and 90-minute nap conditions. Among the control group, there were no significant changes in attention bias after napping or wakefulness. Notably, the sleep duration on the night of the experiment were not affected by the experimental conditions.

Conclusions: Our findings provide the first evidence that increased negative attention bias was found after a period of wakefulness across day, whereas napping could mitigate the changes exclusively in patients with depression. This study sheds light on the potential role of sleep in regulating emotional attention, particularly in clinical populations with emotional dysregulation.

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MODERATING EFFECTS OF DEPRESSIVE SYMPTOMS ON THE RELATIONSHIP BETWEEN PROBLEMATIC USE OF THE INTERNET AND SLEEP PROBLEMS IN KOREAN ADOLESCENTS

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Introduction: Problematic Internet use (PIU) is leading to marked distress and/or functional impairment. Adolescent PIU is highly associated with depression and sleep problems. We hypothesized the following: 1) that an adolescent group with PIU (PIUG) would have more sleep problems compared with an adolescent group with normal Internet use (NIUG); and 2) that depressive symptoms would moderate the relationship between PIU and NIUG.

Materials and methods: A total of 802 students between grades 7 and 11 were recruited. Measures were obtained through the following: 1) Young's Diagnostic Questionnaire, 2) Epworth Sleepiness Scale (ESS), 3) Insomnia Severity Index (ISI), and 4) The Children's Depression Inventory.

Results: Among the total of 766 participants who completed the questionnaires, 152 (19.84 percent) had PIU. The PIUG had significantly higher ISI (P < 0.0001) and ESS (P < 0.0001) scores compared with the NIUG. The mean bedtime of the PIUG was significantly later than that of the NIUG, both on weekdays (P = 0.019) and weekends (P < 0.0001). Additionally, the PIUG had significantly higher depressive symptoms compared with the NIUG (P = 0.001). We examined the moderating effect of depressive symptoms on sleep problems with PIU using the Baron and Kenny method. The step 1 analysis revealed that PIU did not have an effect on the ISI (P > 0.05). However, in step 2, we found a moderating effect of depressive symptoms on the ISI scores. In the depressed group, the ISI scores were not increased, even with increasing Young scores, but in the nondepressed group, the ISI scores increased with increasing Young scores (P < 0.0001). In the depressed group, the ESS score was decreased with increasing Young scores (P < 0.05), but in the nondepressed group, the ESS score was increased with increasing Young scores (P < 0.0001).

Conclusions: Both depression and PIU, as well as their interaction, can contribute to various sleep problems. Because sleep is essential for mental and physical development and daily functioning in adolescents, young people need adequate sleep time and sleep quality.

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Introduction: This study examined the association between sleep patterns and depression of middle school student in Korea. Materials and methods: 450 adolescents attending middle school (mean age 14.07 years, 40% male) responded to the survey. The participants answered self-administered questionnaires about sleep patterns (Morningness-Eveningness Questionnaire; MEQ), sleep problems (Insomnia Severity Index; ISI, Epworth Sleepiness Scale; ESS) and depressive symptoms (Children's Depression Inventory; CDI). Results: The depressive group represented 25.9% of the total study sample, with females exhibiting higher depressive index scores than males. Although the difference in total sleeping time between the depressive group and the control group was unspecified, ISI and ESS scores showed to be significantly higher in the depressive group than in the control group. The MEQ scores also showed a tendency toward the evening type in the depressive group. Also, there was a significantly positive correlation between total ISI and CDI scores. Those who scored higher than 8 on the ISI were 2.24 times more likely to belong to the depressive group, and those who scored higher than 7 on the ESS were 2.23 times more likely to belong to the depressive group. Conclusions: Depressive group tended to suffer from insomnia and experience more severe daytime sleepiness than students in the control group, and students suffering from more severe insomnia, tended to have higher CDI scores than their counterparts. Additionally, students suffering from insomnia and/or experiencing daytime sleepiness were at least twice as likely to develop depression as other students. Acknowledgements: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean Government (NRF-2014R1A1A2057866).
A COHORT STUDY: CHANGES IN DEPRESSION AMONG EIGHT SLEEP TYPES BASED ON THE 3 DIMENSIONAL SLEEP SCALE

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Introduction: The 3 Dimensional Sleep Scale (3DSS) assesses three sleep elements (sleep phase, quality, and quantity), and classifies individuals into eight sleep types: All Good Sleep, Owl (poor phase), Inefficient (poor quality), Short (poor quantity), Owl + Inefficient (poor phase and quality), Owl + Short (poor phase and quantity), Inefficient + Short (poor quality and quantity), and All Poor Sleep. We aimed to study the changes in depression among the eight sleep types classified according to the 3DSS for one year.

Materials and methods: Participants were 373 Japanese day workers (299 men and 74 women), and the average of age was 41.6 years. Data were collected in May 2013 and 2014. The 3DSS and Self-rating Depression Scale (SDS) were used to measure sleep condition and depression respectively. Participants who scored 45 and above in the SDS were classified as depression (+), and those who scored under 45 were classified as depression (-). Multivariate logistic regression was carried out with the backward selection method (likelihood ratio). Study 1: Participants classified as depression (-) in 2013 were selected for analysis and classified into eight groups based on the sleep types. Then, the odds ratio for changes in depression (+) in 2014 was calculated with All Good Sleep as the reference. Study 2: Participants classified as depression (+) in 2013 were selected for analysis, and classified into eight groups based on the sleep types. Then, the odds ratio for changes in depression (-) in 2014 was calculated with All Poor Sleep as the reference.

Results:
Study 1: The odds ratio for changes in depression (+) significantly increased in five sleep types. While four of the sleep types had sleep quality problem (Inefficient, Owl + Inefficient, Inefficient + Short, and All Poor Sleep), one had only sleep phase problem (Owl). Study 2: The odd ratio for changes in depression (-) significantly increased in only one sleep type (All Good Sleep). In addition, Short type was leading to changes in depression for the better.

Conclusions: The results of two studies suggested that people who were classified as All Good Sleep by the 3DSS could be save and recover from depression. In addition, sleep phase and quality problem are more likely to contribute to the mechanism than sleep quantity.

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Introduction: Blunted heart rate variability (HRV) both, in wake-time and in sleep, is a consistent finding in major depression [1] and in primary insomnia. As decreased HRV reflects a dysbalanced activity of the autonomous nervous system (ANS), we expected, that in major depression blunted HRV also correlate with increased subjective and objective sleep problems.

Materials and methods: Thirty-five healthy subjects and thirty-four depressed patients participated in this study. Sleep was objectively assessed with polysomnography containing EEG and ECG recordings. HRV was assessed in three artefact-free 5-min segments of each of the sleep stages REM, N2 and N3 sleep. The subjective sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI).

Results: HRV absolute frequency power was decreased over all sleep stages and frequency bands in depressed patients compared to controls. Blunted HRV, especially in REM sleep measures, was correlated with decreased sleep efficiency and total sleep time, measured both with objective sleep EEG and with subjective PSQI assessment.

Conclusions: We replicated our former findings that HRV measured in sleep discriminated depressed patients from healthy controls. The pattern of results confirmed our expectation, that blunting of HRV correlated to both, subjective and objective sleep problems, in depression.

Introduction: Nocturnal panic attacks have been described in patients with major psychiatric disorders. These nocturnal attacks generate fear and disarray, besides other generalized symptoms of anxiety, hence the importance of an early diagnosis and prevention of comorbidities.

Materials and methods: Case description: A 50-year-old man, who works as a jailer (with a high level of psychological stress), reported maintenance insomnia for years. This problem is related to episodes of rude awakening and, like he said ‘feeling like my heart is jumping in my chest’, associated with difficulty staying asleep. The patient suffers daily episodes and several attacks each night. The cardiologic evaluation, including a Holter-EKG test and an echocardiogram, was normal. In his sleep calendar, he described hypnagogic jerks, non-restorative sleep and poor daytime concentration.

Results: The polysomnography study revealed 12 nocturnal similar episodes. These episodes consisted in abrupt awakening and sudden jerking, during the course of which he stayed face up, with open eyes and scared face and always from deep no REM sleep. Sometimes, it was associated with arm movements. After these events, he fell asleep within some minutes. They were not related to any triggers. The episodes were not preceded by any respiratory events or relevant electrocardiographic changes, besides tachycardia that yielded at the end of the attacks. There also were not any electroencephalographic abnormalities prior or during the episodes. These events are suggestive of nocturnal panic attacks. The patient was referred to the department of Psychiatry, where symptoms of latent depression were detected and treated.

Conclusions: Nocturnal panic attack is a non REM rare entity distinct from sleep terrors, sleep apnea or nightmares, observed in patients with not obvious but often underlying psychiatric/psychologic disorders, although with external precipitating events (in this case, his job). It is very important to consider this medical condition for taking appropriate psychiatric measures and improve the quality of life of affected patients.
Introduction: Major Depressive Disorder (MDD) is often associated with insomnia and it has been hypothesized that circadian rhythm disruption may be involved in the etiology of MDD. We have conducted a large clinical study evaluating the effects of the circadian regulator tasimelteon on depressive symptoms in patients with MDD.

Materials and methods: 507 patients with MDD were enrolled in a double masked placebo controlled study randomized on either tasimelteon 20 mg (n=254) or placebo (n=253). Patients were assessed at baseline and weekly for 8 weeks on a number of depression scales including the Hamilton Depression Scale (HAMD).

Results: Tasimelteon and placebo treated patients appeared to improve similarly from baseline by 8.1 and 7.8 points respectively on the HAMD scale (pvalue =0.57). An analysis by race however revealed a significantly positive effect of tasimelteon among African American patients. Out of 507 randomized patients 166 (32.7%) were African American (AA) of which 78 were treated with tasimelteon and 88 with placebo. At 8 weeks African American MDD patients treated with tasimelteon improved by 9.9 points on the HAMD scale as compared to 6.9 points for the placebo treated patients (pvalue =0.018). In a responder analysis (improvement in the HAMD scale of 50% or greater from baseline) 59% of tasimelteon treated patients improved as compared to 30% of placebo treated patients (pvalue =0.0019).

Conclusions: Tasimelteon 20 mg was shown to improve symptoms of depression in African American patients with MDD in a meta-analysis of a large MDD clinical study which may suggest a circadian component in the etiology and treatment of Major Depression.

Acknowledgements: The authors would like to thank the patients and investigators who participated in the Magellan study (tasimelteon in MDD study).
Psychiatric Disorders Affecting Sleep/Wake
Board #108: P3 - Tuesday

QUANTITATIVE ANALYSIS OF SLEEP PATTERNS OF INATTENTIVE AND COMBINED ADHD SUBTYPES. DO EXIST DIFFERENTIATE SLEEP PATTERNS?

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Introduction: Attention Deficit Hyperactivity Disorder (ADHD) is characterized by symptoms of hyperactivity, impulsivity and/or inattention in childhood. It is one of the most prevalent disorders and most associated with difficulties in the cognitive functioning and, therefore, with the academic performance of the children, being able to influence in repeating courses or even in abandoning the studies. Following the Diagnostic and Statistical Manual of Mental Disorders in its revised version DSM V, ADHD can be divided into three subtypes: predominantly inattentive ADHD (ADHD-I), predominantly hyperactive/impulsive ADHD (ADHD), and ADHD of the combined type (ADHD-C). The objective of the present study was to assess the possible differences in sleep patterns in children with inattentive and combined subtype of ADHD.

Materials and methods: Fifty children (25 ADHD-I, 25 ADHD-C) aged between 7-11 years were evaluated with sleep quality objective measures (e.g. polysomnography) as well as subjective questions.

Results: We will present the results of phase latencies, the mean percentages of each phase, presence of arousals, indexes of leg movements as well as a relationship with subjective sleep quality (reported by parents).

Conclusions: The relationship between sleep patterns and ADHD is unclear. This may be due to the lack of literature that differentiates by subtypes. This study provides clarity to the need for differentiation by subtypes when diagnosing ADHD.

Acknowledgements: This study was funded by the Ministry of Economy and Competitiveness and by the European Regional Development Fund (ERDF) in the Call for Projects of Excellence (REF: PSI2014-58046-P).
Introduction: Sleep problems can cause mental illnesses. The objective of this study was to examine differences in sleep and general sleep problems, i.e. insomnia, consequences of insomnia, dysfunctional sleep related cognitions, sleep hygiene, parasomnia, and sleep apnea in various groups.

Materials and methods: 320 children and 303 adults participated in the study and provided information about their sleep. Healthy controls and patients were compared. Sleep related information, like sleep duration, sleep onset latency, sleep hygiene, night-awakenings, nightmares and breathing problems during sleep were assessed.

Results: Patients reported significantly more problems in insomnia, consequences of insomnia and parasomnia than healthy controls. Outpatients reported significantly more sleep related dysfunctional cognitions than healthy controls in childhood and adulthood. Furthermore, inappropriate sleep hygiene was referred significantly more often by outpatients than by healthy controls. Parasomnia decreased significantly from childhood to adolescence and further to adulthood.

Conclusions: Persistent sleep problems, particularly insomnia, consequences of insomnia and parasomnia in childhood may be an early risk factor for mental disorders or a severe risk factor which can influence mental disorders in childhood and adolescence.
LONGITUDINAL RELATIONSHIPS BETWEEN SLEEP PATTERNS AND PSYCHIATRIC SYMPTOMATOLOGY IN HIGH-RISK AND COMMUNITY CONTROL YOUTH

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Introduction: Sleep disturbance is hypothesized to underlie symptom progression across multiple domains of psychopathology, and may represent a modifiable target for transdiagnostic treatment development for youth at-risk for psychiatric illnesses. Our goal was to determine the extent to which specific sleep patterns predicted longitudinal changes in psychiatric symptom severity in a transdiagnostic sample of youth.

Materials and methods: 370 offspring (8-18 years old) of parents with bipolar I or II disorder (N=206) and community comparison parents (N=164) from the Pittsburgh Bipolar Offspring Study were included. Offspring had a range of psychiatric diagnoses at baseline, including bipolar spectrum, depressive, anxiety, substance use, behavior, and psychotic disorders. After baseline, follow-up evaluations occurred approximately every 2 years (mean baseline age = 10.09 ± 1.60yr, mean number follow-ups = 2.69 ± 0.73; mean follow-up duration = 5.84 ± 1.55yr). Parental psychiatric diagnoses and offspring psychiatric diagnoses, dimensional psychopathology, and sleep (School Sleep Habits Survey) were assessed. Lasso regression (a variable selection method) was used to identify offspring-reported sleep patterns associated with change in a multivariate psychiatric symptom outcome (mania, depression, anxiety, mood lability, inattention/externalizing) from baseline throughout follow-up. The analysis accounted for parental psychiatric diagnoses, as well as offspring demographics, medications, psychiatric diagnoses, and psychiatric symptoms at baseline.

Results: Lasso regression analysis identified baseline age, baseline psychiatric symptoms, and 14 sleep patterns as non-zero predictors of change in all five psychiatric symptom measures. Worsening across all psychiatric symptom measures was predicted by seven baseline sleep patterns, including shorter sleep duration, earlier risetime, weekday-weekend variability (greater weekend oversleep, smaller weekend midsleep delay), poor sleep continuity (nighttime awakenings, longer sleep latency), and daytime sleepiness. In addition, increasingly delayed sleep timing (risetime, midsleep, eveningness, weekend bedtime delay), nighttime awakenings, and sleepiness (daytime sleepiness, frequent napping) through follow-up predicted worsening psychiatric symptom severity. Sleep measures accounted for 20.1% of the variance in longitudinal psychiatric symptom change.

Conclusions: A constellation of sleep features may underlie symptom progression across domains of psychopathology in youth. These sleep patterns could represent viable transdiagnostic intervention targets for the prevention or treatment of psychiatric illness.

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**Psychiatric Disorders Affecting Sleep/Wake**  
Board #111: P3 - Tuesday

**KINETICS OF SLEEP PRESSURE BUILDUP DURING CONTROLLED EXTENDED WAKEFULNESS IN SLEEPY ADULT ADHD PATIENTS**

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**Introduction:** Sleep disorders are a frequent comorbid condition associated with Attention Deficit Hyperactivity Disorder (ADHD) but the links between ADHD and sleep disorders remain unclear. A proportion of adult ADHD patients exhibits an objective excessive daytime sleepiness assessed by Maintenance of Wakefulness Test (MWT). The aim of this study was to determine if this daytime sleepiness was related with a modification of the kinetics of sleep pressure buildup.

**Materials and methods:** 5 drug-free sleepy adult ADHD patients and 5 matched (in sex, age and chronotype) healthy volunteers have been recruited. To be included in the study, sleepy ADHD patients should have a mean sleep latency 4×40 minutes MWT< 20 mn. All volunteers underwent a 36-h of extended wakefulness in "constant routine" protocol. Karolinska drowsiness test (KDT) and MWT were repeated every 4hr. Sleep pressure was evaluated by theta-alpha (6-9Hz) band of EEG during KDT. Frontal power theta-alpha frequency (PTAF) was calculated after an automatic artifact rejection. Kinetics of sleep pressure buildup was defined by asymptote and time constant assessed by saturating exponential function MWT sleep latency and Normalized PTAF (by the 1rst KDT) was analyzed with two-way ANOVAs with repeated measure (Times*groups). Asymptote and time constant were compared between two groups with Mann-Whitney U-test.

**Results:** For MWT sleep latency, group (controls versus patients, (p=004) and time factors (p< 0.001) were significant but not the interaction. For PTAF, only time factor was significant (p=0.003). No significant effect was found for time constant and asymptote.

**Conclusions:** While MWT sleep latencies during the extended wakefulness are shorter in ADHD patients than healthy subjects, the kinetics of sleep pressure buildup is not different. The difficulty to remain awake during soporific circumstances in some ADHD patients is not explained by an alteration of homeostatic sleep process. This difficulty to remain awake may be related with a reduction of wake promoting signal and/or a primary disorder of vigilance/tonic alertness (as defined in psychology). Disturbed vigilance results in the incapacity to maintain a state of high sensitivity to incoming stimuli.

**Acknowledgements:** supported by AOI CHU Bordeaux.
Introduction: Attention deficit hyperactivity disorder (ADHD) is associated with a high percentage of comorbid psychiatric and sleep disorders in every lifespan. Numerous studies in adults or children have demonstrated an association between ADHD and evening chronotype and/or social jet lag (Misalignment of biological and social time). Evening chronotype is frequently associated with depression symptoms, inattention and impulsivity. We conducted an epidemiological study to confirm relationship between chronotype, social jetlag and ADHD symptoms.

Materials and methods: From August to September 2014, 491186 regular registered highway users were invited to participate in an Internet survey on driving habits and health. 36140 drivers answered a questionnaire exploring ADHD symptoms (Adult ADHD Self-Report Scale), chronotype and social jet lag (Munich Chronotype Questionnaire), anxiety and depression symptoms (Hospital Anxiety and Depression Scale) and daytime sleepiness (Epworth Sleepiness Scale). Jobless persons, retirees and shift workers were excluded. 18436 drivers were included in this study. Multivariate analyses with logistic regressions were conducted to control for potential confounding effects on the relationship between ADHD symptoms (absence or presence) and behavioral sleepiness variables (normal, mild and severe daytime sleepiness), anxiety and depression symptoms (non case, doubtful care, case), chronotype (intermediate, evening and morning chronotype), chronic sleep deprivation (in hours), social jet lag (yes or no), age and sex.

Results: 1678 participants (9%) reported ADHD symptoms. ADHD symptoms were associated with socio-demographic data: young (OR = 2.84, [2.2-3.5], p< 0001), males (OR = 1.43, [1.2-1.6], p< 0001) and psychological variables : anxiety symptoms (OR = 7.55, [6.5-8.7], p< 0001), daytime sleepiness (OR = 4.28, [3.5-5.2], p< 0001), depression symptoms (OR = 2.42, [1.8-3.1], p< 0001) and evening chronotype (OR = 1.23, [1.0-1.4], p< 0001). Finally, the risk of having ADHD symptoms increases by 1.13 (1.0-1.4, p< 0001) times per hour of lost sleep.

Conclusions: As expected, ADHD symptoms are associated with daytime sleepiness, anxiety and depression symptoms. This study also confirms that evening chronotype is associated with ADHD symptoms in adults. Chronic sleep restriction is more strongly related to ADHD symptoms than the misalignment between circadian time and social time (social jet lag). Sleep restriction can increased distractibility and hyperactivity symptoms, it is therefore important to explore sleep hygiene in ADHD patients.
CIRCADIAN RHYTHM SLEEP-WAKE DISORDERS PREDICT SHORTER TIME TO RELAPSE OF MOOD EPISODES IN EUTHYMIC PATIENTS WITH BIPOLAR DISORDER: A PROSPECTIVE 48-WEEK STUDY

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Introduction: Circadian rhythm dysfunction has been considered to be common in bipolar disorder (BD) and plays an important role in mood dysregulation in this disorder. However, no study has investigated whether circadian rhythm dysfunction would affect the clinical course of BD. The aim of this study was to test the hypothesis that circadian rhythm dysfunction could be a predictor of relapse in euthymic BD patients.

Materials and methods: One hundred and four euthymic BD outpatients diagnosed according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) participated in this prospective follow-up study from August 2014 to April 2015. At the baseline of this study, the subjects were asked to answer questionnaires including demographic variables and clinical descriptive variables of bipolar disorder. The diagnoses of circadian rhythm sleep-wake disorders (CRSWD) were made based on participants’ sleep logs for more than 4 weeks, according to the International Classification of Sleep Disorders, third edition (ICSD-3). The BD symptoms of the subjects were evaluated using the Montgomery-Åsberg Depression Rating Scale (MADRS) and Young Mania Rating Scale (YMRS) scores every 4 weeks throughout the 48-week study period. Relapse of BD was defined when one shows the scores of these scales higher than the cut-off points (MADRS ≥13 and YMRS ≥7). The primary outcome of this study was time to relapse of mood episodes.

Results: There were 34 subjects (32.4%) who met the criteria for CRSWD at the baseline. According to the sub-categories of CRSWD defined in this study, 27 patients met the criteria for delayed sleep-wake phase disorder, 6 patients met the criteria for non-24-hour sleep-wake disorder, and 1 patient met the criteria for irregular sleep-wake rhythm disorder. Of the total 104 subjects, 51 (49.0%) subjects experienced relapse during the 48-week follow-up period. Multivariate Cox hazard regression analyses revealed that two or more previous mood episodes within the past year and comorbidity of CRSWD were significantly associated with the time to relapse of mood episodes.

Conclusions: Comorbid CRSWD, mainly delayed sleep-wake phase disorder, could be a significant predictor of relapse in BD patients.
**Introduction:** Post-traumatic stress disorder (PTSD) and acute stress disorder (ASD) are characterized by excessive anxiety, including hyperarousal and sleep disorder symptoms, upon exposure to life-threatening stressful events such as a disaster, a traffic accident, or violent experiences. Suvorexant is an orexin receptor antagonist used for the treatment of insomnia; orexin is a neuropeptide that maintains the arousal state. This study is a preliminary investigation of the effect of suvorexant on patients with sleep disorders diagnosed with PTSD or ASD.

**Materials and methods:** Participants, including 5 patients recently diagnosed with a sleep disorder, and either PTSD or ASD, were administered suvorexant at X hospital. We used the Japanese version of the post-traumatic symptom scale (PTSS-10: range 0-10) for assessing PTSD or ASD symptoms (these include, sleep disturbances, nightmares, depression, startle reactions, tendency to isolate from others, irritability, emotional lability, guilt, fear about traumatic scenes, and bodily tension) before, and one month after treatment with suvorexant. Wilcoxon signed-rank test was performed to compare PTSS-10 scores, before and after treatment. Participant data was confidentially managed to ensure identity protection.

**Results:** Participants included 2 men and 3 women, between the ages of 20-50 years old. Two participants were diagnosed with PTSD, and each of them was examined about 7 months after the respective traumatic event; their symptoms worsened just before the examination. Three participants were diagnosed with ASD, and were examined at 7-22 days after the respective traumatic event. Four participants had traffic accidents, and 1 participant experienced a major earthquake. All of the participants reported sleep disturbances and emotional lability before treatment. Four participants reported nightmares, another set of 4 reported startle reactions, and a third set of 4 participants reported fear about traumatic scenes. All participants were administered suvorexant, at 15 mg/day, from the first day of the examination. Before treatment, mean PTSS-10 score was 5.6 ± 0.5. One month after treatment, mean PTSS-10 score was 1.4 ± 1.1. PTSS-10 scores significantly decreased after treatment (P < 0.05), although 1 participant reported that the nightmares worsened during the week immediately after treatment. Another participant reported experiencing excessive sleepiness in the morning.

**Conclusions:** Suvorexant could potentially be effective as a treatment for patients with sleep disorders with PTSD or ASD. Nevertheless, since patient symptoms can improve without intervention, future studies using a placebo control test are desirable.

**Acknowledgements:** This study was supported by Saiseikai Fukuoka General Hospital, Fukuoka, Japan. We would like to thank Editage (www.editage.jp) for English language editing.
Introduction: While cognitive behavior therapy for insomnia is considered as an efficacious treatment for insomnia and increasing studies also supported its effect on treating comorbid psychiatric conditions, it remained unclear on which specific changes induced from CBT-I was related to improvement in the psychiatric conditions. We here investigate the relationships between change of mood symptoms with change of sleep-wake behaviors after CBT-I.

Materials and methods: All participants (n=24, aged 18-70, 70% female) were all attending routine clinical psychological services for mental health conditions at a community out-patient clinic of a public hospital. They were recruited if they had significant insomnia symptoms, determined by an insomnia severity index score >8, with a comorbid mental health condition, diagnosed by psychiatrist. The CBT-I treatment was rendered by a clinical psychologist, on an individual basis. There were 3-8 sessions, each session for around 30-60 minutes, separated by 1-3 weeks. Treatment component includes Stimulus control therapy, sleep restriction therapy, relaxation training, and psychoeducation regarding homeostatic and circadian factors affecting sleep and wake condition. Participants completed the ISI, Depression Anxiety Stress Scale, and sleep diary at the referral, pre- and post-treatment day for evaluation of treatment impact on sleep quality and negative mood.

Results: Results from paired-sample t-tests showed that, compared to baseline performance at the date of referral, after the treatment, participants had significantly improved insomnia symptoms, t(22)=4.155, p=.002, cohen's d=1.21, depressive symptoms, t(22)=2.787, p=.011, d=.56, anxiety symptoms, t(22)=2.488, p=.021, d=.52, and stress symptoms, t(22)=2.635, p=.015, d=.55. Improvement of insomnia symptoms was found to correlate with improvement in depressive, r(22)=-.694, p=.012, anxiety, r(22)=-.769, p=.003, and stress symptoms, r(22)=-.773, p=.003. In addition, a decreased variability of wakeup time measured by sleep diary was also found to correlate with improvement in depressive, r(22)=-.654, p=.011, anxiety, r(22)=-.684, p=.007, and stress symptoms, r(22)=-.800, p=.001.

Conclusions: While our findings inclined to suggest that improvement of depressive, anxiety and stress symptoms from CBT-I seem to be correlated with improvement in insomnia symptoms and a more regulated wakeup time among patient with comorbid insomnia and mental health condition, we called for future CBT-I intervention study, especially randomized control trials for further verification of the mechanism underlying CBT-I impact on comorbid mental health condition.
INVESTIGATION ON THE STATUS OF SLEEP DISORDER OF PERINATAL DEPRESSION IN FENGTAI DISTRICT OF BEIJING

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Objective: To understand the sleep disorder of pregnant women in perinatal depression.

Materials and methods: Through the intelligent Beijing City Maternal and Child Health Hospital of Fengtai hospital (digital) platform, for perinatal maternal, outpatient (including the city of Beijing, Fengtai District 13 maternity hospital midwifery institutions and 31 community health agencies) patient health questionnaire depression assessment scale (PHQ-9), to evaluate the psychological status. Screening depressive state (PHQ-9 score ≥ 5) pregnant women, to investigate and analyze the situation of the sleep disorder.

Results: From May 2013 to November 2016, intelligent platform statistics, outpatient network PHQ-9 evaluation of perinatal pregnant women 36505, which measured depression (PHQ-9 score ≥ 5 points) of the 5097 pregnant women, depression ratio of 14%. PHQ-9 by 9 four entries, third of which are in sleep disorders, are as follows 5097 sleep disorder depression in pregnant women: the number of no sleep problems for 1349 people, the proportion is 26.47%; the number of days of sleep disorder was 2110, the proportion was 41.40%; more than half the number of days of sleep disorder was 1097, the rate was 21.52%; the number of almost every day of sleep disorder was 41 people, the proportion is 10.61%.

Conclusions: The sleep disorder of pregnant women in perinatal depression is prominent, and the sleep problems should be paid more attention.

Acknowledgements: Thanks to the leadership of maternal and Child Health Hospital of Fengtai Institute for intelligent platform establishment and psychological out-patient work support, actively support thanks to Beijing City Maternity Hospital Fengtai District 13 Midwifery Institutions and 31 Community Health Agencies for outpatient PHQ-9 questionnaire investigation.
INVESTIGATION OF SLEEP AND COGNITIVE FUNCTIONS ON FIRST EPISODE DRUG-NAIVE NON-AFFECTIVE PSYCHOTIC PATIENTS

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Introduction: Various lines of clinical findings have suggested the presence of some abnormalities in macro or micro structural parameters of the sleep in schizophrenic patients. Meanwhile, data are inconclusive mainly due to some confounding factors such as the heterogeneity of the disorder, drug regimen for the treatment, duration of the illness or the age of the patients. There are a few numbers of studies in the literature that has been conducted on drug-free first episode psychotic patients. It has been recently implicated that that sleep spindles may be an important electrophysiological parameter in schizophrenia. In addition to sleep disturbances, cognitive impairments have been reported as one of the cardinal features related with the disorder. Based on this knowledge, we aim to investigate sleep parameters, sleep spindles and neuropsychological profile of the first episode drug-naive psychotic patients.

Materials and methods: The study sample consists of 21 first episode drug naive psychotic patients and 21 healthy volunteer participants that are similar according to their age and year of education. Polisomnography recordings were conducted for two subsequent nights and a neuropsychological test battery was administered. The sleep spindles were detected visually.

Results: According to the results of the study, patient group's sleep latency was increased and N2 % was decreased significantly. In addition, sleep efficiency index was tended to decrease. Among sleep spindle parameters, spindle density and individual spindle duration was reduced in patient group. Low scores of neuropsychological tests in patient group which are sensitive to attention, information processing, executive functions, learning and memory support the idea that there is a global cognitive deterioration from the early course of the disorder. Our analysis demonstrates that PANSS negative scores are negatively correlated with N3 % and positively correlated with N1 %. On the other hand, positive symptoms are correlated negatively with sleep latency and N2 %. The neuropsychological test scores revealed that the severity of negative symptoms were negatively correlated with verbal learning, flexibility, verbal fluency and semantic organization. Sleep latency is negatively correlated with recall and learning scores. In addition, the severity of PANSS was negatively correlated with spindle amplitude.

Conclusions: The study shows that the first episode psychotic patients may have problems in initiating and maintaining sleep. Furthermore the spindle density and duration are lower in patients group in comparison with the healthy controls. The neuropsychological test results indicate a global cognitive deficit. These results are hopeful for understanding the pathophysiology of schizophrenia.
**INTRODUCTION**: Major depressive disorder (MDD) often co-occurs with anxiety and insomnia. Repetitive transcranial magnetic stimulation (rTMS) may be particularly beneficial in treating depression with the comorbid symptoms. This study aimed to determine whether rTMS combined with venlafaxine, a dual serotonin-norepinephrine reuptake inhibitor, could enhance the clinical efficacy and improve polysomnographic (PSG) and fractional anisotropy (FA), a measure of white matter integrity of the brain in depressed patients with comorbid anxiety and insomnia.

**MATERIALS AND METHODS**: In this single-blind, randomized, sham-controlled trial, 19 patients with MDD and significant comorbid anxiety and insomnia were received a total of 20 sessions of sham (n = 8) or active high-frequency rTMS (n = 11) combined with venlafaxine for 8 weeks. The severity of depression, anxiety and insomnia was measured over time. Polysomnography (PSG) and FA values were evaluated at baseline and endpoint.

**RESULTS**: Active rTMS-treated patients displayed significantly greater improvement not only on depression at endpoint, but also on anxiety and insomnia over time compared to sham rTMS-treated patients. Active rTMS markedly increased total sleep time, time spent in rapid eye movement (REM) stage and fractional anisotropy (FA) in the right anterior cingulate gyrus, bilateral medial frontal gyri and right inferior occipital gyrus. Time spent in REM was negatively correlated with the severity of depression and anxiety.

**CONCLUSIONS**: While additional rTMS enhances antidepressant efficacy, it also robustly reduces comorbid anxiety and insomnia. The multiple psychotherapeutic effects of rTMS may be associated with the improvement on microstructural abnormalities of the frontocingulate system (clinicaltrials.gov, NCT01370304).

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**REM Behavior Disorders**  
**Board #049: P2 - Monday**  
**CLINIC CHARACTERISTICS AND NEURODEGENERATIVE RISK IN IDIOPATHIC REM SLEEP BEHAVIOR DISORDER: STUDY IN 58 PATIENTS**

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**Introduction:** REM sleep behaviour disorder (RBD) is a REM parasomnia characterized by abnormal behaviours emerging during REM sleep in relation with unpleasant dreams. RBD can be classified as idiopathic (IRBD) when neurological disease, relevant motor or cognitive complaints do not exist, or secondary when it is associated with a neurological disorder the introduction of certain drugs or alcohol withdrawal. RBD can precede the onset of the motor or cognitive symptoms by several years and longitudinal studies have shown that most of patients diagnosed with IRBD develop the motor and cognitive features of a neurodegenerative disease, particularly the synucleinopathies as Parkinson disease (PD), Lewy bodies dementia (LBD), or multiple system atrophy (MSA). Our Objective is to establish polysomnographic characteristics and clinical correlation in a cohort of patients with REM Sleep Behavior Disorder (RBD).

**Materials and methods:** A descriptive analysis was performed with data from polysomnography study (PSG) and clinical history from all consecutive IRBD patients diagnosed and followed-up in our Sleep Disorder Unit from January of 2012 to January 2017. The correlation between quantitative and qualitative variables was performed with different statistical analysis according to the results. Using the Kaplan-Maier method we estimated the disease-free survival rate from neurodegenerative syndromes.

**Results:** 58 patients, 48 men and 10 women, with a median age at estimated RBD onset of 61.5 years, median age at diagnosis of RBD of 67.7 years, and the average of evolution time of RBD of 8.5 years. Estimated risk of conversion was 48.8% (20% after 5 years, 68% after 10 years and 94.6% at 15 years). Emerging diagnoses were PD in 17 patients, LBD in 11, MSA in 2 and mild cognitive impairment (MCI) in 8. 70% of patients didn’t have self-awareness of abnormal sleep behaviors and 81% had unpleasant dream recall. The median age at diagnosis of IRBD diagnosis was 66 years and the median follow-up was 7 years. We analyzed different data and there are differences, but not statistically significant, between PSG characteristics in patients with and without neurodegenerative disease.

**Conclusions:** It is important to detect and study RBD early in a Sleep Disorder Unit. It is necessary to know specific characteristics of RBD because it is an early pathological event in the synucleinopathies and it is relevant to design potential interventions with neuroprotective agents.
**Introduction:** REM sleep behavior disorder (RBD) precedes, in approximately 80% of cases, the development of synucleinopathies, such as Parkinson's disease (PD), therefore it is likely considered to reflect a prodromal stage of PD. We analyzed the differences of polysomnographic variables between the patients of idiopathic RBD without PD and RBD accompanied with PD.

**Materials and methods:** We retrospectively reviewed the results of 50 patients with only idiopathic RBD (RBD-PD) and 42 patients with RBD and PD (RBD+PD) who underwent full night polysomnography (PSG) because of the abnormal behavior during sleep from January 2010 to December 2016 at our sleep center.

**Results:** Demographic variables, including age, sex, and body mass indexes, etc., were not significantly different between the groups. REM sleep latency was significantly prolonged ($p=0.009$) and REM sleep efficiency was more diminished ($p=0.02$) in the RBD+PD group compared to the RBD-PD group. The tonic and phasic muscle activities during REM sleep were not significantly different between the groups. Sleep latency, sleep efficiency, indices/hour of arousals, awakenings, respiratory parameters, and periodic leg movements were similar in both groups.

**Conclusions:** The generation of REM sleep itself is more likely to be impaired in the RBD+PD group compared to the RBD-PD group, although the degree of REM without atonia was not significantly different. Otherwise, there were no further PD-inherent differences in the PSG parameters.
ABNORMAL ACTIVITY IN THE REWARD SYSTEM IN PARKINSON’S DISEASE PATIENTS WITH RAPID EYE MOVEMENTS SLEEP BEHAVIOR DISORDER

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Introduction: Rapid Eye Movement (REM) sleep Behaviour Disorder (RBD) is a parasomnia observed in up to 60% of PD patients. A greater risk of impulse control disorders (ICD) has been reported in PD with RBD, suggesting an impairment of the mesocorticolimbic pathway in these patients. The aim of this study was to explore the mesocorticolimbic reward system in Parkinson’s disease (PD) patients with and without REM sleep behaviour disorder (RBD).

Materials and methods: Sixty-six participants were included: 22 PD with RBD (PD-RBD); 22 PD without RBD (PD-noRBD) and 22 healthy volunteers, age- and sex-matched. RBD was diagnosed by video polysomnographic recording according to the ICSD-3 criteria. Subjects with ICD, depression or apathy were excluded. We compared brain activation in the three groups using a functional MRI paradigm named “monetary incentive delay task”. The latter explore the reward system during anticipation and reception of a monetary reward. Brain activation was measured by the BOLD effect, voxel by voxel in the whole brain and in regions of interest (ROI) within the reward system. ROIs are chosen from independent whole brain analysis: midbrain, striatum, insula, anterior cingulate cortex (ACC), orbitofrontal cortex (OFC).

Results: In whole brain analysis, reward system was found to be less activated in PD-RBD patients compared to PD-noRBD and controls, when a reward was anticipated or received. Significant differences were observed in the ACC, the parahippocampal gyrus, and the caudate (p < 0.001). ROI analysis showed lower activation of reward system in PD-RBD group during the two different phases of reward. During monetary anticipation, caudate nucleus, insula, ACC and OFC were less activated in PD-RBD group than both PD-noRBD and healthy control (p< 0.03). For reward outcome, nucleus accumbens and OFC were less activated in PD-RBD group (p< 0.02) compared to the other groups. No differences were observed in the pattern of activation of the reward system between PD-noRBD and healthy controls.

Conclusions: The present study found a hypoactivation of the mesocorticolimbic reward system in PD patients with RBD compared to those without RBD and healthy controls. These abnormalities may play a role in the increased risk for ICD observed in PD patients with RBD, further supporting the notion of an association between RBD and ICD in PD.

Acknowledgements: This work was supported by a grant from the NEURODIS foundation.
**Introduction:** Patients with idiopathic REM sleep behavior disorder (IRBD) is known to be a strong predictor of the development of synucleinopathies, including Idiopathic Parkinson’s disease. Neuropsychiatric symptoms are common in patients with Parkinson’s disease however the symptoms have not been properly evaluated in IRBD. We aimed to evaluate the symptom profile in patients with drug-naïve IRBD patients with Symptom Checklist-90-Revision (SCL-90-R).

**Materials and methods:** Consecutive drug-naive patients with video-polysomnography-confirmed IRBD who visited KyungHee University Hospital at Gangdong sleep clinic between Jan, 2009 and Nov, 2016 were reviewed. Age- and sex-matched healthy volunteers from the same region as the IRBD patients served as controls. Questionnaires evaluating sleep (Pittsburgh sleep quality index, PSQI and Epworth sleepiness scale, ESS) and depression (Beck depression inventory-II, BDI-II) were performed along with Symptom Checklist-90-Revised (SCL-90-R) in IRBD patients and the controls.

**Results:** Twenty patients with IRBD and 20 age-and sex matched controls were analyzed. Mean age of IRBD patients was 58.5 years old, and 55% of them were male. Mean disease duration was 55.1 months, and the symptom frequency was 3.7 days per week. Patients with IRBD showed higher PSQI score than the controls (5.7±2.2 vs 3.2±1.4, p< 0.0001), but other sleep questionnaire and BDI-II scores were similar between the two groups. Phobic anxiety (p=0.009), anxiety (p=0.02), interpersonal sensitivity (p=0.011), psychoticism (p=0.013), hostility (p=0.014) and anxiety (p=0.049) were higher among IRBD patients. Among IRBD patients, after adjusting age, Interpersonal sensitivity and hostility positively correlated with the disease duration (r=0.463 and 0.518 respectively).

**Conclusions:** The result of our study demonstrates that comorbid psychosomatic distress is higher in patients with IRBD, which was associated with disease duration.

**Acknowledgements:** None
Introduction: REM sleep behavior disorder (RBD) is a complex parasomnia with a strong association with α-synucleinopathy, such as Parkinson disease (PD). Though much research suggests that over 80% of patients with idiopathic RBD (iRBD) may eventually develop a neurodegenerative disorder in 10-20 years, little is known regarding the early behavioral sign of underlying neurodegeneration in RBD patients. The present study used two sensitive behavioral measurement tasks to examine eye tracking and closed-loop manual control abilities in iRBD patients and to examine their relationship with clinical motor symptoms and other predictive marker of PD, such as tonic electromyographic (EMG) activity.

Materials and methods: Twenty-six iRBD patients (7 females and 19 males, mean age±SD: 69±8) and twenty-four demographically-matched healthy controls (11 females and 13 males, mean age±SD: 65±4) participated in this study. Clinical motor symptoms of Parkinson's disease were assessed using the Unified Parkinson's Disease Rating Scale (UPDRS). Eye tracking ability was assessed with a task in which participants used their eyes to track a moving target with its speed (16-24°/s) and moving direction (0°-360°) varied unpredictably from trial to trial, and manual control ability was assessed with a task in which participants used a joystick to control a moving target to keep it centered on the display.

Results: Compared to healthy controls, iRBD patients showed longer pursuit eye tracking initiation latency and larger tracking direction-tuning noise (t ≥ 1.98, p ≤ 0.05). In addition, they also showed worse manual control precision and smaller response amplitude (t ≥ 2.05, p < 0.05). Healthy controls' manual control precision, response amplitude and delay were all significantly correlated with pursuit eye tracking gain (Pearson's r: 0.49-0.57, p < 0.05) whereas no such correlations were observed in iRBD patients (r ≤ 0.22, p ≥ 0.19). The manual control performance in both iRBD patients and healthy controls showed significant correlation with the clinical motor symptoms evaluated by UPDRS scores (Spearman's ρ: 0.39-0.51, p < 0.05). Several measures of iRBD patients' eye tracking ability (i.e., pursuit eye tracking initial acceleration: r = -0.58, p < 0.05; pursuit eye tracking gain: r = -0.46, p = 0.065; and tracking direction-tuning anisotropy: r = -0.62, p < 0.01) were also highly correlated with their tonic chin EMG activity.

Conclusions: Our study is the first one that systematically examined how fundamental eye tracking and manual control abilities used in essential daily visuomotor control tasks such as driving correlate with clinical motor symptoms and early predictive marker of PD in iRBD patients. Our sample of iRBD patients showed impairments in eye tracking, manual control, as well as the link between eye tracking and manual control compared with healthy controls. iRBD patients' manual control performance is associated with their clinical motor symptoms of PD, and their eye tracking ability corresponds to an early predictive marker (i.e., tonic chin EMG activity) of PD. These findings suggest that both eye tracking and manual control abilities may serve as potential prodromal behavioral markers that can be used for the early detection of neurodegenerative disorder.
DIFFERENCES IN REM MUSCLE ACTIVITY AMONG PATIENTS WITH PARKINSON´S DISEASE RELATED REM SLEEP BEHAVIOUR DISORDER AND PATIENTS WITH SUSPECTED OSA. CHILEAN EXPERIENCE WITH SINBAR MONTAGES

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Introduction: REM sleep behavior disorder (RBD) is a parasomnia due to an excessive muscle activity during REM sleep, expressed clinically as acting out of dreams, potentially injurious behaviors to patient or bedmate and high risk of subsequently developing alpha-synucleinopathy. RBD diagnosis is based on clinical history and confirmation of REM without atony (RWA) in polysomnography.

SINBAR method quantifies pathological phasic and tonic EMG activity during REM sleep scoring records of mentalis and flexor digitorum superficialis (FDS) muscles. With this montages, validated normative values were established to define RWA in patients with idiopathic RBD and Parkinson´s disease related RBD (RBD-PD). Cutoff of abnormal EMG activity were established comparing to healthy controls.

However, in clinical practice other sleep disorders can increase electromiographic activity in REM sleep due to secondary arousals, making it difficult to analyze records. In this study we compare PSG records using SINBAR montages in patients with RBD-PD patients with suspected OSA patients.

Material and methods: We analyze retrospectively PSG records of 12 PD patients with less than 5 years of evolution, in their usual pharmacological treatment, who complaint of suggestive symptoms of RBD. Their were compared with 18 patients who performed polysomnography to study a probable OSA.

PSG records were reviewed by a neurologist with experience in sleep disorders. Their were performed in sleep laboratory, with usual sensors and scoring performed according to AASM recommendations.

Quantification of tonic, phasic and "any“ (either phasic or tonic) EMG activity in REM sleep was made in 3 miniepochs (for phasic and "any“ types) and 30 sec-epochs (for tonic activity). Artifacts due to movements, snoring or arousals were excluded. Finally a percentage of epochs or miniepochs with positive muscle activity in REM sleep were obtained for each record.

Results: No significant differences were observed in age (65.42 ± 11.30 versus 56.6 ±15.36) and in the male: female ratio among patients with RBD-PD and those with suspected OSA.

For any type of EMG activity in REM sleep, patients with RBD-PD had a significantly higher percentage of positive epochs. (phasic: 15.22 ± 12.7% versus 6.16 ± 6.99% [p=0.0003], tonic: 10.31 ± 11.33% versus 0.44 ± 0.59% [p=0.002], "any": 16.21 ± 13.07% versus 4.18 ± 5.88% [p=0.016]).

In the RBD-PD group 58.33% of patients versus 5.5% in the suspected OSA group had >15% positive miniepochs with "any“ activity.

The apnea-hypopnea index was significantly lower in the group of RBD-PD. Sleep efficiency was lower in the group of patients with Parkinson´s disease. No significant differences were observed in other variables of PSG.

Conclusions: Our study shows that patients with RBD-PD have an significantly increase in all types of spontaneous motor activity in REM sleep. To our knowledge this is the first study comparing these variables with suspected OSA patients.

This suggests SINBAR montages are useful in clinical practice to differentiate patients with RWA respect to other disorders that increase motor activity in REM sleep.

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Introduction: Neurodegeneration starts decades before the clinical diagnosis, offering an opportunity to detect and manage individuals in preclinical stages. REM sleep behavior disorder (RBD) is a parasomnia in which approximately half of patients who develop a neurodegenerative disorder are diagnosed with dementia. A systematic assessment of the evolution of cognitive alterations has never been performed in this population. Here, we describe the progression of cognitive decline and identify the predictive values of cognitive tests in three groups of RBD patients defined at their last follow-up as: disease-free, Parkinson’s disease (PD), or dementia with Lewy bodies (DLB).

Materials and methods: Patients (n=109) underwent polysomnography, neurological, and neuropsychological assessments. We used linear mixed-model analyses to compare the progression of cognitive performance on tests between the three groups in a three-year prodromal period. We also compared the proportions of patients with clinically impaired performance (z scores of -1.5). In addition, patients who developed DLB were pair-matched according to age, sex, and education to healthy controls (2:1), and receiver operating characteristic curves were performed to identify the psychometric properties of cognitive tests to predict dementia.

Results: At follow-up, 38 patients (35%) developed a neurodegenerative disease: 20 PD and 18 DLB. Cognitive performance changes through years were strongly associated with later development of dementia. Impairments in attention and executive functions and in learning and memory were noticeable two to three years before diagnosis, and one year preceding diagnosis in visuospatial abilities. The Trail Making Test (part B), Verbal Fluency (semantic), and Rey Auditory-Verbal Learning Test (total, immediate and delayed recalls) were the best predictors for dementia (area under the curve > 0.90).

Conclusions: Progression of cognitive decline in late prodromal stages identify DLB in RBD patients. Some cognitive tests detect RBD patients at imminent risk of dementia and might be used to assess the effectiveness of intervention trials to prevent cognitive deterioration in this population.

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ENVELOPE ANALYSIS OF ELECTROMYOGRAM IN REM SLEEP BEHAVIOR DISORDER PATIENTS

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Introduction: Clinical manifestations of REM Behavior Disorder (BRD) include REM sleep without atonia (RWA) characterized by maintenance of muscle tonus associated to intense and frequent phasic motor events during REM sleep episodes. The diagnosis of RBD includes the enaction of dreams, i.e. the patient displays complex vocal and motor behaviors during REM sleep that may reflect dream content and the polysomnographic recording of RWA. There is a growing interest in RWA, as it has been considered a prodromal manifestation of neurodegenerative alpha-synucleinopathies such as Parkinson’s disease. Current clinical diagnostic procedures include the visual inspection of polysomnographic record and categorization of electromyographic (EMG) events. Automated (computer based) strategies has been proposed to assist in EMG scoring to maximize diagnostic accuracy. Here we apply envelope analysis to EMG records obtained in healthy subjects and RBD patients. Envelope analysis give qualitative information regarding the underlying mechanism of signal generation.

The mathematical properties of CVE distribution may help to obtain an unbiased scoring of electromyographic (EMG) events during sleep. The numeric value acquired by CVE is a reporter of the temporal structure of recorded elements, where phasic or pulsatile events adopt high CVE values and can be unequivocally discriminated from non pulsatile intervals. The amplitude of the envelope (AE) of EMG is directly related to muscle tonus. We propose that characterization CVE and AE may help to assist in identify RWA.

Materials and methods: Polysomnographic records of healthy patient (n=10) were obtained from ambulatory video-polysomnography (v-PSG), that includes EEG, EMG, EOG and respiratory parameters. Polysomnographic records of RBD patients (n=10) were obtained from three sources: open databases (physionet.org), a collaborative project with Universitäts Klinikum Tübingen and ambulatory v-PSG of patients with suspected RBD. Manual EEG scoring was performed at 30 second time resolution (epochs). Muscle tonus and phasic activity were evaluated in three different muscles: chin and bilaterally in flexor digitorum superficialis (forearm).

Results: Whole night 30-second epochs of chin and forearms EMG were projected in a CVE vs. AE phase portrait. The portrait was mapped to discriminate high AE (high tone) and high CVE (phasic or twiches) epochs respect to low AE and CVE (low muscle tone and non-pulsatile) epochs of the EMG. REM sleep epochs of healthy subjects cluster around a minimal amplitude and non-pulsatile region of the CVE vs AE phase portrait. Chin EMG exhibit higher amplitude as compared to forearm EMG, and both presented sporadic phasic events. REM sleep epochs of RBD patients exhibit a scattered distribution with increased density in the high AE and CVE region. The ratio of (high AE+high CVE)/(low AE + lowCVE) epochs was obtained for healthy and RBD patients. Ratios obtained for chin EMG among healthy patiens ranged form 0.2 to 0.4, in contrast that of RBD patiens were always >1.

Conclusions: Envelope analysis may be a powerful tool in assisting RBD medical diagnosis.

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Introduction: It is increasingly known that REM Sleep Behavior Disorder (RBD) in Parkinson's disease (PD) patients may be associated with a more malignant clinical phenotype. Despite its prognostic value, the diagnosis of RBD in PD is often challenging because of mild forms that may go unnoticed. Recent diagnostic criteria, including a quantitative measure of REM sleep without atonia (RSWA), have been defined mainly based on idiopathic RBD population referred to a sleep disorder center for their parasomnia. We aim to ascertain whether current diagnostic criteria for RBD are appropriate in PD population consulting a movement disorder center, and to assess the role of each criterion in a large cohort of patients with PD.

Materials and methods: One-hundred-eleven PD patients (M=67; mean age: 65.8±8.5 yrs) consecutively evaluated at three movement disorder centers were enrolled. All patients underwent a detailed sleep-focused interview followed by a full-night video-polysomnographic (vPSG) recording. Without a gold standard, latent class models were applied to create an unobserved ("latent") variable. The observed variables used in these models were: 1) history of dream-enactment behaviors 2) Video-PSG-documented REM sleep-related motor behaviors and 3) RSWA according to the proposed cut-off derived from the SINBAR scoring method (i.e. ≥27% of 30-s REM sleep epochs contain any chin EMG activity combined with phasic EMG activity in bilateral Flexor Superficialis Digitorum). Sensitivity analysis were also realized with an alternative RSWA cut-off derived from the Montreal scoring method (i.e. ≥30% of tonic 30-s REM sleep epochs and/or ≥15% of 2-s REM sleep mini-epochs containing phasic activity). Finally, we assessed the respective diagnostic performance of each diagnostic criterion for RBD.

Results: According to the best LCM-derived model, RBD was diagnosed in patients having either "history" or "video" with RSWA; or showing both "history" and "video" without RSWA. In those patients, the criterion "history" showed 85.5% of sensitivity, 95.2% of specificity, 96.7% of PPV and 80% of NPV, with a Cohen's K of 0.78. The criterion "video" showed 88.4% of sensitivity, 95.2% of specificity, 96.8% of PPV and 83.3% of NPV respectively, with a Cohen's K of 0.81. The criterion "RSWA" showed 94.2% of sensitivity, 88.1% of specificity, 92.9% of PPV and 90.2% of NPV, with Cohen's K of 0.83 using the SINBAR cut-off. Using the Montreal cut-off, RSWA showed a sensitivity of 88.4%, a specificity of 88.1%, a PPV of 92.4% and a NPV of 82.2% with a Cohen's K of 0.75. The concomitant presence of both "history" and "video" showed 73.9% of sensitivity, 100% of specificity, 100% of PPV, 80% of NPV and Cohen's K of 0.68.

Conclusions: Results of the best latent classes-derived model for diagnosis of RBD in PD were consistent with the current RBD diagnostic criteria. Moreover, the diagnostic criterion "RSWA" showed the highest sensitivity, reducing the risk of false positive, and the concomitance of "history" and "video" reduced the risk of false negative, that it would be crucial in PD population frequently unaware of their RBD status.
APPLICATION OF MACHINE-LEARNING METHODS FOR IDENTIFICATION OF COGNITIVE MARKERS OF DEMENTIA IN REM SLEEP BEHAVIOR DISORDER

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Introduction: Idiopathic REM sleep behavior disorder (iRBD) is a major risk factor for dementia with Lewy bodies (DLB) and Parkinson’s disease (PD). In a recent study (Marchand et al. Sleep 2017), we identified cognitive tests at baseline that differentiate RBD patients who developed DLB from those who developed PD and healthy controls (HC). We aimed to apply machine-learning methods on this sample to examine its predictive value on later conversion subtypes, and their ability to discriminate HC and RBD patients who developed DLB.

Methods: Seventy-six iRBD patients were followed for a mean of 3.6 years. At follow-up, 16 patients developed DLB, 18 developed PD, and 42 were still disease-free (DF). We pair-matched for age, sex, and education each of our patients who developed DLB with two HC. All participants underwent at baseline polysomnographic, clinical, neurological, and neuropsychological exams. A supervised learning approach was implemented using an alternating decision tree (ADTree) classifier. Different classifications were carried out and for each one, a data cleaning, and permutation tests were conducted to assess the significance of the decoding accuracy (DA).

Results: The classifier differentiated RBD patients who developed DLB from HC (DA=0.88 +/-0.04; p=0.0001). No significant differences were found for the other comparisons (DLB vs. DF patients, DA=0.68 +/-0.08; p=0.057; PD vs. DF patients, DA=0.52 +/-0.10; p=0.443; PD vs. DLB patients, DA=0.63 +/-0.07; p=0.096).

Conclusions: Machine-learning methods allow identifying RBD patients at risk for dementia in a mean of 3.6 years before clinical diagnosis. Further studies with larger sample size are needed to assess the capacities of these methods to differentiate conversion subtypes in RBD.

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**Introduction:** Idiopathic REM sleep behavior disorder (iRBD) is a prodromal stage for Parkinson’s disease (PD) and dementia with Lewy bodies (DLB). Depressive and anxiety symptoms are frequent features in PD and DLB. Moreover, some studies suggest that depressive symptoms are associated with neurodegeneration in iRBD. This study aimed to investigate the subcortical and cortical gray matter (GM) volume correlates of depressive and anxiety symptoms in iRBD patients.

**Methods:** Forty-six polysomnographic-confirmed iRBD patients and 32 healthy controls (HC) underwent a 3-Tesla magnetic resonance imaging, neurological, and neuropsychological exams, and completed the Beck Depression Inventory Second Edition (BDI-II) and Beck Anxiety Inventory (BAI) questionnaires. iRBD patients were divided in subgroups based on the presence of clinically significant depressive (BDI-II total score > 13) or anxiety (BAI total score > 9) symptoms. We used voxel-based morphometry analysis on whole brain T1-weighted images to measure GM volumes in cortical and subcortical structures. We created general linear models to test our prediction of GM volume differences between groups. We also conducted multiple regression analyses in iRBD patients as a whole group with BDI-II and BAI total scores as independent variables and age, education, total intracranial volume, and mild cognitive impairment status as covariates. Significance threshold was set at p< 0.001 (uncorrected for multiple comparisons) with an extended threshold of 100 voxels.

**Results:** iRBD patients reported higher total scores on the BDI-II and BAI compared to HC. iRBD patients with clinically significant depressive symptoms showed reduced GM volumes in subcortical (amygdala, striatum) and cortical (frontal, parieto-occipital) regions compared to HC or iRBD without depressive symptoms. In iRBD patients, higher BDI-II total score was associated with reduced GM volumes in the right caudate nucleus and parieto-occipital regions. In addition, iRBD with clinically significant anxiety symptoms showed reduced GM volumes in the amygdala and hippocampal regions compared to HC or iRBD without anxiety symptoms. In iRBD patients, higher BAI total score was associated with reduced GM volume in the left amygdala.

**Conclusions:** Depressive and anxiety symptoms in iRBD patients are related to relatively distinct patterns of subcortical and cortical GM volumes loss. Further studies should investigate whether the progression of GM volume changes found in the present study are related to the evolution of mood symptoms or neurodegeneration in this population.

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CORTICAL AND SUBCORTICAL GRAY MATTER CHANGES IN DIFFERENT PRODROMAL PHENOTYPES OF DEMENTIA WITH LEWY BODIES

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Introduction: Dementia with Lewy bodies (DLB) is defined as a progressive cognitive decline with recurrent complex visual hallucinations, REM sleep behavior disorder (RBD), spontaneous features of parkinsonism, or fluctuating attention and cognition. Mild neurocognitive disorder with Lewy bodies (NCDLB) is a prodromal phenotype delineated using similar criteria as DLB but with presence of mild cognitive impairment (MCI) instead of dementia. RBD with concomitant MCI (RBD-MCI) is another prodromal phenotype at high risk for development of DLB. Whereas mild NCDLB patients sought clinical advice for cognitive concerns, RBD-MCI patients rather consulted for sleep-related concerns. We investigated the patterns of structural grey matter abnormalities in mild NCDLB and RBD-MCI patients in order to determine whether and to which extent prodromal neurodegeneration differs between these different clinical phenotypes of DLB.

Materials and methods: We acquired T1-weighted images under a 3-Tesla magnetic resonance imaging examination in 156 participants, including 27 patients with DLB, 45 patients with mild NCDLB, 17 patients with RBD-MCI, and 67 healthy elderly controls (HC). Voxel-based morphometry (VBM) analysis was conducted to investigate local grey matter volume and vertex-based shape analysis was done to assess subcortical shape. Significant results were considered at p< 0.05 (corrected for multiple comparisons).

Results: In comparison to HC, RBD-MCI patients showed reduced local volume mainly in the frontal lobe but also in the anterior cingulate cortex and insula (spreading to the superior temporal gyrus). Frontal clusters included the sensorimotor cortex, which spread to the superior parietal lobule, the frontal pole, and the middle and inferior frontal gyri. VBM and shape analysis revealed that mild NCDLB patients had decreased volume in the cerebellum, basal forebrain, and middle temporal lobe versus RBD-MCI patients, whereas RBD-MCI patients showed widespread shape contraction in all subcortical structures involved in the cortical-subcortical motor circuitry versus mild NCDLB patients (striatum, pallidum, thalamus). Common findings to all Lewy body disease patients (DLB, mild NCDLB, RBD-MCI) included decreased local grey matter volume in the insula and anterior cingulate cortex as well as abnormal shape in both putamina.

Conclusions: We found that patients with different prodromal DLB phenotypes differed neuroanatomically, with mild NCDLB patients affecting the cerebellum, basal forebrain, and temporal lobe and RBD-MCI patients affecting subcortical structures from the cortical-subcortical motor loop. Common findings to patients with Lewy body pathology (DLB, mild NCDLB, RBD-MCI) included decreased volume in the insula and anterior cingulate cortex and abnormal shape in the putamen. Future studies should follow these patients in order to identify which morphological abnormalities may serve as markers of future conversion to DLB in RBD-MCI patients.

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CORTICAL BASIS OF COGNITIVE IMPAIRMENT IN IDIOPATHIC REM SLEEP BEHAVIOR DISORDER

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Introduction: Idiopathic REM sleep behavior disorder (iRBD) is a major risk factor for Parkinson’s disease and dementia with Lewy bodies. From 33% to 50% of iRBD patients present with mild cognitive impairment (MCI) and these patients are at higher risk for developing dementia. We investigated the cortical abnormalities underlying cognitive deficits in iRBD patients with MCI (RBD-MCI).

Materials and methods: We acquired T1-weighted images using 3-Tesla magnetic resonance imaging in 52 patients with iRBD, including 17 patients with MCI, and 41 healthy controls (HC). Vertex-based cortical analyses of volume, thickness, and surface area were performed to investigate abnormalities of the cortical mantle. We also conducted correlation analyses in iRBD patients as a whole group between cortical metrics and cognitive performance (composite z score in three cognitive domains, namely attention and executive functions, learning and memory, and visuospatial abilities) and color discrimination.

Results: RBD-MCI patients had extensive cortical abnormalities in the frontal cortex that spread to the cingulate, sensorimotor, and temporal cortices compared to iRBD patients without MCI and HC. By contrast, iRBD patients without MCI had cortical thinning restricted to the frontal cortex only compared to HC. In patients, worse performance in attention and executive functions, learning and memory, and visuospatial abilities were associated with cortical abnormalities in cortical regions underlying these cognitive functions. Moreover, color discrimination loss was associated with cortical thinning and increased surface area in the cuneus.

Conclusions: Cognitive deficits in iRBD patients are associated with extensive cortical abnormalities. These abnormalities correlate with cognitive impairment and color discrimination deficit. Our results highlight the importance of distinguishing between subgroups of iRBD patients on the basis of their cognitive profile in order to better understand neurodegeneration in this population.

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REM Behavior Disorders
Board #096: P1 - Monday

AGE RELATED PROGRESSION AND HOMEOSTATIC SUSCEPTIBILITY OF REM-SLEEP BEHAVIORAL DISORDER SYMPTOMS IN A MOUSE MODEL FOR MULTIPLE SYSTEM ATROPHY

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Introduction: Multiple system atrophy (MSA) is a devastating neurodegenerative disease. One of the first specific symptoms is rapid eye movement sleep behavior disorder (RBD). RBD is clinically characterized by a loss of physiological muscle atonia during rapid eye movement sleep (REMS). Patients with RBD show elevated theta and delta power in the EEG during wake, as well as elevated theta and decreased beta power during REMS before they develop a synucleinopathy. Very recently we could show the presence of RBD-like symptoms for the first time in the PLP αSYN mouse model, a well-established mouse model for MSA overexpressing human alpha synuclein in oligodendroglia. In the present study, we assessed the age related progression of RBD features in our mouse model and performed qualitative and quantitative characterization.

Materials and methods: We performed chronic, longitudinal EEG recordings in freely behaving PLP αSYN MSA mice (MSA) and C57Bl6 (WT) control mice at 6 months of age. HD videos were recorded time-locked to the EEG recordings. 6 animals of each group underwent sleep deprivation (SD) for 6 hours by gentle handling.

Results: Video analysis of MSA mice revealed phasic muscle events during REMS; WT animals did not show phasic muscle activity during REMS. MSA animals showed a similar amount of REMS epochs without atonia at the age of 6 months, compared to MSA animals at the age of 10 months. MSA animals had elevated theta- and decreased beta-band power in the EEG during REMS, compared with age matched controls. In comparison with previously obtained data from young (3 months) and old (10 months) MSA animals, an age related decline of total power during wake became apparent. After SD, WT animals had a clear sleep rebound after termination of SD and showed increased slow wave activity (SWA); whereas MSA animals reacted only with minor compensatory responses to SD.

Conclusions: Sleep-related pathologies in the MSA mouse model become relevant after the first occurrence of neuroinflammation, but long before motor symptoms of MSA are present, strongly resembling the pathological progression of the clinical situation. These findings create a precise time window within the progression of the disease for drug studies applying sleep related phenomena of MSA as a biomarker for the evaluation of efficiency. A lack of compensatory potential after the homeostatic challenge of SD may partly explain the low quality of sleep being reported in MSA patients.

Acknowledgements: This study was funded by FWF SFB F4414
Introduction: REM sleep muscle atonia (RWA) and dream-enactment behavior (DEB) are subclinical symptoms of REM sleep behavior disorder (RBD), which is frequently associated with Parkinson's disease (PD).

Materials and methods: This study aimed to evaluate relationships between subclinical RBD symptoms and clinical characteristics of PD. We conducted overnight polysomnography in 145 patients with PD. DEB (motor behaviors and/or vocalizations other than comfort movement during REM) and increased RWA (IRWA; tonic and phasic chin EMG density ≥15% and ≥7%, respectively) were identified. Patients were categorized as clinical RBD (DEB and IRWA), subclinical RBD-DEB (DEB only), subclinical RBD-IRWA (IRWA only), or normal REM sleep.

Results: After adjusting for age, patients with DEB (clinical RBD and subclinical RBD-DEB) had higher Hoehn and Yahr Staging of Parkinson's Disease (H&Y) stages and Unified Parkinson's Disease Rating Scale (UPDRS) scores. RWA was associated with H&Y stage, PD duration, levodopa equivalent dose, cognition, and sleep structure in all patients. Patients with IRWA (clinical RBD and subclinical RBD-IRWA) had higher H&Y stages and lower Montreal Cognitive Assessment scores than patients with normal REM. The subclinical RBD-IRWA group had higher H&Y stages and UPDRS III scores than the RBD-DEB group but shorter PD duration and higher H&Y stages and UPDRS III scores than the clinical RBD group, in contrast to clinical findings.

Conclusion: Both DEB and IRWA were associated with severity of PD illness. DEB symptoms may fluctuate or disappear whereas RWA may continue to develop as PD progresses. Clinical RBD symptoms may become subclinical as parkinsonism increases.
RELATION BETWEEN DISEASE DURATION AND STRIATAL DAT-SPECT UPTAKE IN PATIENTS WITH IDIOPATHIC REM SLEEP BEHAVIOUR DISORDER

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Introduction: It has been recognized that patients with idiopathic rapid-eye-movement sleep behaviour disorder (iRBD) may develop neurodegenerative disease, particularly the synucleinopathies such as Parkinson’s disease and dementia with Lewy bodies. Some previous studies have reported that ¹²³I-2β-carbomethoxy-3β-(4-iodophenyl)-N-(3-fluoropropyl)-nortropane (¹²³I-FP-CIT) DAT-SPECT showed decline in striatal tracer uptake indicating progressive nigrostriatal dopaminergic dysfunction in patients with iRBD. Despite substantial progress in the understanding of iRBD and its biomarkers, a natural course of the disorder and how findings of its imaging biomarkers change over time are still not fully understood. Establishing objective standards for evaluating the disease progression process is desirable. Here, we aimed to investigate relation between the duration since the onset of iRBD and striatal uptake of ¹²³I-FP-CIT SPECT in our patients.

Materials and methods: We identified seventeen patients who were diagnosed as iRBD according to the criteria of the International Classification of Sleep Disorders and have undergone ¹²³I-FP-CIT DAT-SPECT at some point during the clinical follow-up at our sleep centre in Osaka, Japan. All patients denied experiencing motor, cognitive, or psychiatric symptoms with negative neurological signs on examination, and were free of any neurologic diseases other than RBD at the time of SPECT scan. The specific binding ratio (SBR) of ¹²³I-FP-CIT was semi-quantitatively calculated using DAT VIEW software (Nihon Medi-Physics, Tokyo, Japan) based on Bolt’s method. The non-specific uptake was estimated from a region of the brain devoid of DATs, taken as the reference region. For this study, we used SBR as the mean value of the right and left striatal SBRs. The association between the duration of iRBD and ¹²³I-FP-CIT uptake was assessed by applying the regression analysis.

Results: Patients were 14 men and 3 women with mean age of 76.3±4.3 years and mean duration since iRBD onset of 11.0±4.6 years. ¹²³I-FP-CIT binding in the striatum showed significant negative correlation with the duration since iRBD onset (P < 0.01). Neither age at the disorder onset nor age at SPECT scanning correlated with mean SBR of ¹²³I-FP-CIT.

Conclusions: Our results suggest that uptake of ¹²³I-FP-CIT DAT-SPECT decreases in proportion to the duration since the onset of iRBD. As the decrease of uptake did not necessarily parallel with clinical symptoms, ¹²³I-FP-CIT DAT-SPECT can be useful to monitor the underlying progression of nigrostriatal deficits. It could be used in estimating the future course of the disease, and contribute to discuss the most suitable therapeutic principle and management plan with each patient.
ACTIGRAPHIC SCREENING FOR THE RAPID EYE MOVEMENT SLEEP BEHAVIOR DISORDER IN CZECH POPULATION

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Introduction: The patients suffering of the rapid eye movement sleep behavior disorder (RBD) are in high risk of developing a neurodegenerative disorder, most frequently from the group of alpha-synucleinopathies, such as Parkinson’s disease (PD) or multiple system atrophy (MSA). The definitive diagnosis of RBD is based on polysomnographic investigation, which is costly and time consuming. Therefore the effort to identify cheaper screening tools. In 2007 the RBD screening questionnaire (RBDSQ) was developed and was already translated to several languages. Also actigraphy has been used in efforts to detect abnormal movements during sleep, including RBD. The aim of this study was to assess the validity and reliability of combined results of the Czech version of the RBDSQ and actigraphic recordings to results of polysomnography.

Materials and methods: High resolution actigraphic recording were performed along with polysomnographic recording in 14 RBD patients and 21 patients with other sleep diagnoses. The 10-item patient self-rating questionnaire (maximum total score 13 points) translated to Czech language was also used for screening purposes. We used an RBDSQ score of five points as a positive test result as suggested by the original publication of the scale.

Results: When using the actigraph, we encountered a significant difference in the percentage of immobile bouts. They were shorter than 1 minute on the left hand - 24.0 +/- 14.5% in controls and 38.0 +/- 14.5% in RBD patients (P = 0.03). This parameter alone has a cut-off of 31% a sensitivity of 0.61, and a specificity of 0.89. Notably, 16.7% of all subjects were discordant for both types of screening tools. Thus both RBDSQ and actigraphy has a combined specificity of 0.80 and a sensitivity 0.67, against the gold standard polysomnography.

Conclusion: Incorporating actigraphic screening for short immobile bouts provides objective, but limited data. However, it is more economical and easier to perform than standard polysomnography. Further studies in larger samples are necessary to estimate the eventual sensitivity of combined methods and general usefulness of actigraphy in RBD detection and thus identification of patients at high risk of developing a neurodegenerative disorder.

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REM sleep behavior disorder (RBD) is most closely associated with neurodegenerative disease. However, the confirmation of only RBD has not enough to differentiate each other among these diseases with α-synucleinopathy. We aimed to clarify the distinct point in the aspect of sleep disorders among three groups of RBD: idiopathic RBD, idiopathic Parkinson’s disease (PD) with RBD, and atypical parkinsonism with RBD. Patients with the complaint of dream enactment behavior (DEB) were consecutively recruited. These patients with RBD were classified into three groups as following: idiopathic RBD, PD with RBD, and atypical parkinsonism with RBD. Each patient completed a detailed clinical interview and a sleep questionnaire. All patients underwent standard overnight polysomnography (PSG).

Of 122 patients with the history of recurrent DEB, 92 were diagnosed to RBD and included as eligible subjects in this study. Among 92 patients of RBD, 25 were diagnosed to PD with RBD, 32 were atypical parkinsonism with RBD, and 35 were idiopathic RBD. Of 32 cases with AP-RBD, 15 were dementia with Lewy bodies, and 17 were multiple system atrophy. The mean ± SD AHI in atypical parkinsonism with RBD group, which was 16.2 ± 17.7 events/h, was significantly increased compared with that of PD with RBD and idiopathic RBD groups (respectively, 4.5 ± 5.9, 8.0 ± 13.4, p< 0.05). Supine AHI was significantly increased than lateral AHI in atypical parkinsonism with RBD group, though lateral AHI was not different between atypical parkinsonism with RBD group and other groups. PD with RBD group and atypical parkinsonism groups revealed the predominance of 100% supine position during sleep compared to iRBD group (respectively, 32%, 34%, and 12%).

Patients with atypical parkinsonism and RBD revealed higher proportion of AHI compared to PD with RBD and idiopathic RBD groups. RBD patients with parkinsonism (PD with RBD and atypical parkinsonism with RBD groups) showed a trend of 100% supine position although a proportion of positional OSA and supine position was not different between two groups.
REM Behavior Disorders  
**Board #073: P6 - Wednesday**  
**RBD IN PARKINSON’S DISEASE – PREDICTIVE VALUE OF MOTOR AND NON-MOTOR SYMPTOMS ASSESSMENTS: EXPERIENCE FROM AN INDIAN TERTIARY TEACHING HOSPITAL**

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**Background:** RBD (parasomnia during REM) occurs in about a third of patients with PD and may precede the development of motor symptoms in over 40% of patients. Various psychiatric symptoms manifest as nonmotor symptoms in PD and can complicate the disease. Although NMS occurs throughout the course of the disease, its correlation for the assessment of RBD is poorly studied. A cohort study of 150 PD patients using various motor and non-motor scales including RBD Scale were analysed. The present study aims to find the occurrence of RBD and to correlate it with various NMS in Parkinson’s Disease (PD) and severity of disease.

**Materials and methods:** This study is a hospital based study conducted on PD patients attending the Movement Disorder Clinic in our hospital. PD was confirmed according to United Kingdom Parkinson´’s Disease Society Brain Bank Diagnostic Criteria. Patients in all age groups are included for the study (drug naïve and on medication). Drug induced PD and patients with H/O drug intake of antipsychotic medications were excluded. Hoehn & Yahr Scale (H&Y) was used for disease staging and Movement Disorders Society Sponsored Revision Of The Unified Parkinson’s Disease Rating Scale (MDS-UPDRS) was used to determine the clinical severity after passing the certified course of MDS-UPDRS as per the rules of MDS. Following which all the patients are being assessed based on various Non Motor Rating Scales and RBD rating scales.

**Results:** Out of 150 PD patients analysed it was noted that the occurrence of RBD in PD was 40.67%. 8% had prodromal symptoms of RBD nearly 5-10 years before the onset of PD. There was a positive correlation between motor complexes and RBD (r=0.496, p=0.001) which implies that motor complexes predicts the assessment of RBD. Similarly various NMS when correlated with RBD revealed that NMS symptoms like autonomic, sensory, visual, hallucinations and neuropsychiatric manifestations especially depression had positive predictive value in the development of RBD.

**Conclusion:** This study concluded that the occurrence of RBD in PD is significantly high in Indian population and can be even present before the onset of PD. Various motor and non-motor symptoms can be used for the prediction of RBD. This holds importance in the early detection of RBD in PD patients which can lead to a significant role in therapeutic management, subtyping of the disease, good prognosis of disease, a better quality of life and significant reduction of burden over the caregiver.
A STRUCTURAL BRAIN NETWORK ANALYSIS FOR RAPID EYE MOVEMENT SLEEP BEHAVIOR DISORDER (RBD) PATIENTS

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Introduction: Rapid eye movement sleep behavior disorder (RBD) is a parasomnia and associated with neurodegenerative disorder such as dementia and Parkinson's disease. Previous studies reported that RBD patients showed alterations of brain structure. However, alterations of anatomical connections which could result from RBD has been poorly studied. In this study, we firstly attempted to investigate alterations of brain connections in RBD patients using brain network analysis.

Method:

Data acquisition and pre-processing
We recruited a total of 122 subjects, comprising 78 healthy subjects (age: 61.32 ± 6.44, female 28) and 44 RBD patients (age: 60.57 ± 6.43, female 15). Diffusion tensor imaging (DTI) data were collected using 1.5T MRI.

Network Construction
We segmented the cerebrum into 94 regions based on an automated anatomical labeling atlas 2 template. Two brain regions (nodes) were connected by an edge if the endpoint of a tract terminated within one node and the other endpoint terminated within the other node. In this study, we multiplied the number of fiber by average value of fractional anisotropy in all tract points to determine connection weights. The connectivity matrix was binarized by assigning one to entries above the threshold and zero under the threshold (0 to 12 with 0.25 interval).

Global Properties
Path length (PL) measures the degree of functional integration which is the ability to combine information from multiple brain regions. In the brain network, path length is equal to the number of edges in the path. Clustering coefficient (CC) describes the efficiency of local information transfer and is calculated as the number of existing connections between the neighbors of given node divided by the number of all possible connections. To assess the small-worldness, we calculated normalized CC ($\lambda = C/C_{\text{rand}}$) and PL ($\gamma = L/L_{\text{rand}}$) where $C_{\text{rand}}$ and $L_{\text{rand}}$ are CC and average PL of 100 matched random networks that preserved the number of nodes, edges, and node degree distributions of the brain networks. The brain networks were considered as a small-world network if $\lambda/\gamma > 1$. Small-world network was regarded as a network with optimized balance between functional integration and segregation than random network.

Statistical analysis
In this study, we computed the area under curve to determine between group differences in the network properties. It allowed of the precise comparisons of network properties avoiding bias of result due to choice of certain threshold. We used analysis of covariance with age, sex, and education as covariates to determine the statistical significance.

Results: In this study, structural brain networks of all subjects demonstrated small-world networks. We found that RBD group showed decreased PL and increased CC ($P < 0.05$). However, we could not observe differences in small-worldness between two groups.

Conclusions: In this study, we found a significantly decreased PL and increased CC in RBD patients using the brain network analysis. From this result, we may concluded that RBD patients exhibited overconnected brain network compared to healthy subjects.
INVESTIGATING BIOMARKERS FOR PREDICTING THE CONVERSION TO ALPHA-SYNUCLEINOPATHIES IN PATIENTS AFFECTED BY REM SLEEP BEHAVIOR DISORDER: A COMPREHENSIVE ANALYSIS OF CLINICAL, NEUROPSYCHOLOGICAL, NEUROIMAGING, AND CEREBROSPINAL-FLUID DATA

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Introduction: REM behavior disorder (RBD) is a sleep parasomnia manifesting with dream-enacting behaviours related to unpleasant dreams and loss of muscle atonia during REM sleep. RBD is actually considered a preclinical non-motor symptom of alpha-synucleinopathies, such as Parkinson's Disease (PD), Lewy-Body dementia (LBD), and Multiple System Atrophy (MSA).

Several efforts have been recently spent in order to find the more sensitive and specific biomarkers in RBD patients for predicting the clinical conversion to alpha-synucleinopathies, in order to set preventive strategies and prepare neuroprotective trials.

The aim of this study was to comprehensively explore different clinical, neuropsychological, neuroimaging, and cerebro-spinal fluid biomarkers in a population of idiopathic RBD (iRBD) patients diagnosed and followed at our Sleep Medicine Centre.

Materials and methods: We observed patients affected by idiopathic RBD (iRBD) diagnosed by video-polysomnography. Patients underwent at baseline history, clinical visit, neuropsychological testing, apoE genetic testing, striatal dopamine transporter brain imaging (DATScan), 2-deoxy-2-(18F)fluoro-D-glucose positron emission tomography ([18F]FDG PET), lumbar puncture for cerebrospinal-fluid (CSF) biomarkers analysis. We observed patients with a 6-month visit follow-up through 4 years in order to divide the population in converter to alpha-synucleinopathies (RBDc) and non-converter (RBDnc). Chi-Square analysis and odds ratios with 95% confidence intervals were calculated for each contingency table.

Results: Forty-five iRBD patients were included in the study and followed for 4 years between September 2012 and June 2017. Considering cerebrovascular risk factors, we documented in the whole group the more frequent presence of hypertension, followed by smoking and hypercholesterolemia. Considering all the biomarkers evaluated in the whole iRBD population we documented the more frequent alteration of cognitive testing, followed by decreased striatal dopamine transporter uptake, depression, constipation, focal cerebral hypometabolism at [18F]FDG PET, alexithymia, total-tau/beta-amyloid ratio, sleepiness, apoE4 polymorphism. At follow-up, 11 patients converted to alpha-synucleinopathies and were included in the RBdc group: 6 DLB, 4 PD, and 1 MSA. Therefore, at the 4-year follow-up 34 patients remained diagnosed as affected by iRBD (RBDnc). Comparing biomarkers obtained at baseline, we documented the significant prevalence of obesity, depression and sleepiness in RBdc compared to RBDnc. On the other hand, smoking and hypercholesterolemia were more prevalent in the RBDnc compared to RBdc group. Decreased striatal (mainly caudate) dopamine transporter uptake was more frequent in RBdc compared to RBDnc. Finally, hypometabolism at [18F]FDG PET in prefrontal, parietal and precunes cortices was more frequent in RBdc compared to RBDnc.

Conclusions: This study firstly considered several markers of neurodegeneration and cerebrovascular risk factors in a large population of iRBD patients. Although the prevalence of many markers of neurodegeneration was evident at baseline, in our analysis neuroimaging abnormalities, obesity, depression, and sleepiness represent the more significant biomarkers for predicting the conversion of iRBD patients to alpha-synucleinopathies. Conversely, smoking and hypercholesterolemia possibly represent protective factors against neurodegeneration in iRBD patients.

Acknowledgements: All the collaborators who are working at this project.
**Introduction:** We performed one study on four typical SNPs to identify whether the genotypic characteristics would participate in RBD in Parkinson’s disease (PD) patients.

**Materials and methods:** 105 PD patients’ genetic information was obtained. Four SNPs, rs33962975 (LRRK2), rs6812193 (SCARB2), rs11931074 and rs894278 of SNCA, were tested. Binary logistic regression analysis was used to determine the independent risk factors of RBD in PD patients and identify four SNPs association with RBD. SNPs, rs33962975 (LRRK2), rs6812193 (SCARB2), rs11931074 and rs894278 of SNCA, were tested. Binary logistic regression analysis was used to determine the independent risk factors of RBD in PD patients and identify four SNPs association with RBD.

**Results:** Overall, 84 of 152 PD patients (55.3%) were affected by RBD. PD+RBD patients presented a male predominance \( (p<0.001) \) and longer PD duration than PD-RBD group \( (p=0.046) \). After regression analysis, part I-III of UPDRS were associated with a 3.76-fold \( (p=0.001) \), 2.08-fold \( (p=0.043) \) and 2.51-fold \( (p=0.009) \) increased risk of RBD respectively. For non-motor syndromes, patients with more autonomic dysfunctions in PD patients were 7.43 times \( (p<0.001) \) risk of affecting RBD, especially for constipation \( (p=0.002) \). Moreover, logistic regression for SNPs analysis showed that patients with a lower score of olfaction were more incline to occur RBD with the mutation of rs894278 \( (OR 0.21 95\% CI: 0.06-0.72; p=0.013) \) whereas mutation-carrier patients of the other three genes variants didn’t show susceptibility to RBD in PD patients of hyposmia.

**Conclusions:** This study with clinical and genetic information would lay foundation for the later studies to explorer the precision management for a subtype of RBD together in PD patients.

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FAMILIAL AGGREGATION OF REM SLEEP BEHAVIOR DISORDER AND NEURODEGENERATIVE BIOMARKERS: A CASE-CONTROL FAMILY STUDY

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Introduction: Idiopathic REM sleep behavior disorder (iRBD) is regarded as a precursor of α-synucleinopathy. Although a positive family history of RBD was noted, the familial aggregation of RBD features is unknown and the biomarkers of α-synucleinopathy have never been investigated within families. Thus, we aimed to 1) investigate the familial aggregation of RBD and its core features; 2) compare the differences of the biomarkers of α-synucleinopathy between first-degree relatives (FDRs) of RBD probands (RBD-FDRs) and FDRs of age and sex matched controls (control-FDRs).

Materials and methods: All eligible RBD-FDRs and control-FDRs were invited to participate in this two-phase study at which all subjects underwent a face-to-face interview as far as possible (unavailable subjects underwent proxy reports or telephone interviews). We employed RBD Questionnaire-Hong Kong and RBD Single-Question Screen to measure RBD symptoms, which was further evaluated by video-polysomnography. We also employed a Scale for Outcomes in Parkinson’s Disease-Autonomic (SCOPA-AUT), Farnsworth-Munsell 100 Hue test, Olfactory Identification Test, the Unified Parkinson's Disease Rating Scale (UPDRS) part-III, and a set of neurocognitive tests to document the biomarkers related to α-synucleinopathy.

Results: A total of 347 RBD-FDRs (mean age: 63.2 ± 15.9 years; male%: 48.5%) and 286 control-FDRs (mean age: 61.1 ± 14.7 years; male%: 50.4%) were recruited up to the current moment (Feb 2017). For overall sample, higher rate of RBD-FDRs reported RBD symptoms compared to control-FDRs (15.0% vs. 5.6%, p < 0.01). Higher rate of parents of iRBD probands were diagnosed with Parkinson's disease and dementia compared to parents of controls (Parkinson's disease: 8.2% vs. 2.0%, p < 0.01; dementia: 17.3% vs. 5.9%, p < 0.05). As for face-to-face assessment, 173 RBD-FDRs and 155 control-FDRs were recruited. Higher rate of RBD-FDRs reported constipation (responded often or always on 5th item in SCOPA-AUT: 6.9% vs. 1.9%, p = 0.02), urinary dysfunction (mean SCOPA-AUT subscale score: 3.9 vs. 3.3, p = 0.03), and showed speed impairment of hand movement (mean UPDRS part-III score on finger taps, hand movement, and rapid alternating movement: 1.3 vs. 0.7, p < 0.01) compared to control-FDRs. Among FDRs who underwent video-polysomnography assessment, 4.8% (6/76) of RBD-FDRs were clinically diagnosed with RBD compared to none (0/49) of control-FDRs (p = 0.04). In addition, unaffected RBD-FDRs showed more increased tonic electromyography activity during REM sleep compared to control-FDRs (log transformed percentage: 0.17 vs. 0.08, p = 0.01). No differences in olfaction, color vision, and cognitive function impairment were found between groups.

Conclusions: The familial aggregation of RBD features were confirmed in the current study, which suggests that familial and genetic factors may contribute to the occurrence of RBD. Increased prevalence of constipation, urinary dysfunction, increased tonic electromyography activity, and motor function impairments were found in RBD-FDRs, which suggests that young RBD-FDRs may already harbor a series of biomarkers that may put them at high risk for future development of α-synucleinopathy.

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Introduction: Hyperechogenicity of the substantia nigra (SN) and abnormal 123-I Ioflupane dopamine transporter single-photon emission computed tomography (SPECT) imaging (DaTscan) are known as biomarkers of SN neurodegeneration. They may be helpful in the monitoring of idiopathic REM sleep behavior disorder (iRBD) patients and predicting early conversion to manifest synucleinopathy phenotype. It is not clear whether these biomarkers reflect the same neuropathological processes. Our goal was to investigate 1) whether SN echogenicity in iRBD patients is increased compared to healthy controls and 2) whether SN hyperechogenicity is associated with decreased dopamine transporter density measured by DaTscan.

Materials and methods: Fifty-five iRBD subjects (52M/3F; mean age 64.9±9.1 yrs) diagnosed according to The American Academy of Sleep Medicine Manual (AASM, 2015) were examined with the Movement Disorders Society Unified PD Rating Scale (MDS-UPDRS) and transcranial sonography (TCS). None of the RBD patients had overt signs of neurodegeneration, mean MDS-UPDRS-III score was 5.6±5.1. TCS was performed in 49 healthy controls (31M/18F; mean age 62.0±9.7 yrs). SN echogenicity was assessed by two methods: 1) SN hyperechogenic area was manually encircled and 2) SN echogenicity index was automatically calculated by CEREB B-Mode Assist software. The higher SN hyperechogenic area and echogenicity index from both sides were used for comparison with the controls. DaTscan examination was performed in 51 iRBD patients and correlations between the SN echogenicity area/index and corresponding striatal binding DaTscan index were calculated. Group differences between iRBD patients and healthy controls were tested using the Mann-Whitney U test. Correlations between SN echogenicity area/index and DaTscan striatal index were calculated using the Spearman coefficient.

Results: Mean SN hyperechogenic area in iRBD (0.12±0.09 cm²) was significantly larger compared to the control group (0.07±0.04 cm²; p=0.009). The SN echogenicity index was also significantly higher in the iRBD group (27.0±8.9) than in controls (23.8±7.9; p=0.002). Histogram analysis indicated that the SN hyperechogenic area in the iRBD group has a bimodal distribution; majority of patients had values comparable to those of healthy controls while the difference was driven by a subgroup with markedly high SN hyperechogenic area.

Analyzing DaTscan results, no correlation between striatal binding index and SN hyperechogenic area (r=-0.092, p=0.5) or SN echogenicity index (r=-0.23, p=0.1) was found.

Six iRBD subjects and none of the control subjects showed an enlarged hyperechogenic SN (area≥0.25 cm²). Based on the clinical evaluation of DaTscan, definite nigrostriatal degeneration was found in five iRBD patients. However, only one iRBD patient had abnormal findings on both, TCS and DaTscan.

Conclusions: Our results confirmed increased SN echogenicity in a subgroup of iRBD patients indicating that SN pathology may be detectable in the presymptomatic stage of synucleinopathy. The quantitatively evaluated data showed no correlation between DaTscan striatal index and echogenicity of SN evaluated by both methods (SN area and echogenicity index) suggesting that these biomarkers reflect different neuropathological processes in SN in iRBD patients.

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Introduction: Zonisamide, first launched as an anti-epileptic drug (Excegran® or Zonegran®), has been approved as a drug for Parkinson’s disease (PD) in Japan (Trerief®). Zonisamide ameliorates motor symptoms and improves activities of daily living in patients with advanced PD. In addition, it has been recently reported that zonisamide also improves the symptom of REM sleep behavior disorder (RBD) in some PD patients. In this study, we examined the effectiveness of zonisamide for RBD, by using a novel RBD model, Glra1^floxac/; Chat-Cre mice.

Materials and methods: In this study, we compared littermate offsprings of Glra1^floxac/; Chat-Cre mice and Glra1^floxac/ controls (n=8 and n=5 respectively; 12-18 weeks old males). An electrode cassette for EEG/EMG recording was implanted in the skull of each mouse. After one week recovery period, animals were moved to a recording cage. A cable tether was connected to the implanted electrodes, and animals were allowed to move freely. Signals were amplified through an amplifier (AB-611J, Nihon Koden, Tokyo, Japan) and digitally acquired using our custom software. Animals were allowed at least one week to adapt to the recording conditions prior to any EEG/EMG recording session, and handled daily to minimize nonspecific stress. For the pharmacological experiments, animals were habituated to intraperitoneal (saline) administration procedures at ZT2 (11:00 a.m.) during the acclimation period. Following the acclimation period, each animal was sequentially administered with zonisamide and clonazepam on separate experimental days with a three-day interval at ZT2. The order of injection was randomized. EEG/EMG data were evaluated and staged for 10 hours after drug administration by our custom sleep analysis software. The ratio of the temporal variance in EMG power during REM sleep and that during NREM sleep (REM/NREM EMG variance ratio) was used as index of abnormal REM-sleep muscle tone.

Results: Glra1^floxac/; Chat-Cre RBD model mice showed significantly higher REM/NREM EMG variance ratios (11.1) compare to control mice (0.98), while no abnormality in the sleep architecture was seen in either Glra1^floxac/; Chat-Cre or control mice. Zonisamide (20, 50, 100 mg/kg) significantly and dose-dependently reduced REM/NREM EMG variance ratio in Glra1^floxac/; Chat-Cre (9.2, 4.3, 2.5, respectively). Clonazepam (0.3 mg/kg) also reduced REM/NREM EMG variance ratio in Glra1^floxac/; Chat-Cre (7.6). Zonisamide and clonazepam did not change REM/NREM EMG variance ratio in control mice. Regarding sleep architecture in the RBD model mice, zonisamide (100 mg/kg) significantly reduced REM sleep time but did not change wakefulness or NREM sleep time, while zonisamide (20, 50 mg/kg) or clonazepam did not cause obvious changes in sleep time.

Conclusion: Zonisamide significantly reduces abnormal muscle tone during REM sleep in a mouse RBD model. Our results suggest that zonisamide may be useful for treating RBD symptoms.

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THE PROSPECTIVE STUDY OF NIGROSTRIATAL DOPAMINERGIC FUNCTION USING BY STRIATAL DOPAMINE TRANSPORTER IMAGING (FMT/PET) IN PATIENTS WITH IDIOPATHIC REM SLEEP BEHAVIOR DISORDER

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Introduction: In recent studies, some REM sleep behavior disorder (RBD) patients reported an increased risk to develop Lewy body-related diseases such as Parkinson's disease (PD) and dementia with Lewy bodies (DLB) and multiple system atrophy (MSA). Recent dopamine transporter SPECT and PET studies demonstrated decreased striatal dopaminergic innervations in some idiopathic RBD patients. Thus, we prospectively assessed a nigrostriatal dopaminergic function using by striatal dopamine transporter imaging in patients with idiopathic RBD and compared the finding with age matched healthy controls to clarify predictors of pathological neurodegenerative process of nigrostriatal dopaminergic neurons.

Materials and methods: Positron emission tomography (PET) with 6-[18F]-fluoro-meta-tyrosine (FMT) (FMT/PET), which can assess the level of the presynaptic dopaminergic nerve, were performed in 26 patients with idiopathic RBD (mean age 65.4±5.3 years, 22 male, 4 female), and 8 control subjects (mean age 62.4±5.0 years, 4 male, 4 female) to assess nigrostriatal function at baseline and after 1.3 to 5.3 years. RBD was diagnosed using diagnostic criteria of ICSD-2.

Results: At the baseline scan, there are a lot of individual variation in FMT uptake in putamen in idiopathic RBD patients. Idiopathic RBD patients, who developed PD in the follow up period, reduced putaminal FMT uptake at baseline. However, in this study, reduction rate of putaminal FMT uptake was not associated with constipation, olfactory dysfunction or impaired color discrimination.

Conclusions: PET imaging seems to be helpful in identifying patients with idiopathic RBD potentially at risk to develop PD, DLB, or MSA. However, further prospective follow up study of this RBD cohort is needed to clarify predictors of pathological neurodegenerative process of nigrostriatal dopaminergic neurons and be useful in studies of potential disease-modifying therapy in these patients.

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Introduction and Objectives: Fragmentary myoclonus (FM) is the manifestation of muscle activity characterized by brief asynchronous potentials, registered by the surface EMG during polysomnography. Excessive fragmentary myoclonus (EFM) is the form of FM, defined by pathologically increased presence of these potentials at the polysomnographic recording. A few studies demonstrate the EFM occurrence in neurodegenerative diseases. Because idiopathic REM sleep behavior disorder (iRBD) is considered as an early stage of neurodegeneration, we focused on this phenomenon in the group of patients with confirmed iRBD. The goal of the study was to chart the prevalence and quantify the intensity of EFM in patients with confirmed iRBD and perform comparison with a control group.

Methods: Polysomnographic records of 30 patients with confirmed diagnosis of iRBD and 15 controls with the history of no sleep disorders matched with age were analyzed. The patients were 3 women and 27 men of age 40-80. The controls were 2 women and 13 men of age 45-86. EMG potentials fulfilling criteria of minimal amplitude 50 µV and maximal duration 150 ms were identified as FM (ICSD-3, 2014). EFM was diagnosed by presence of 5 FM potentials per minute during at least 20 minutes of recorded non-REM sleep (AASM Manual, 2015). The intensity of EFM was quantified separately for each sleep stage by fragmentary myoclonus index (FMI) (Lins et al., 1993).

Results: There was found wide range FMI in iRBD patients (4.0-549.6; median 46.4) as well as in the controls (3.1-938.1; median 19.8). Twenty patients with iRBD (66.7%) fulfilled criteria for EFM, while only 4 subjects (26.7%) fulfilled the criteria in the control group (p=0.025). There was found different FMI distribution among sleep stages comparing both groups with significantly higher amounts in all sleep stages in iRBD (p=0.029). Approximately equal distribution of FM potentials was registered in relaxed wakefulness and all non-REM sleep stages with significantly higher amounts in REM (p< 0.001) in iRBD, while in the control group FM occurred less often in N3 than other sleep stages. FMI does not correlate with any selected clinical (age, duration of iRBD symptoms, Epworth Sleepiness Scale, Unified Parkinson Disease Rating Scale) and sleep parameters (sleep stages proportion, arousals, apnea-hypopnea index, periodic limb movements index).

Conclusions: Prevalence of EFM is significantly higher in the group of patients with iRBD (66.7%) compared to the controls (26.7%). There was found higher FMI in all sleep stages in iRBD with different distribution among sleep stages comparing iRBD patients and controls.

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A STUDY IN 184 CONSECUTIVE IDIOPATHIC REM SLEEP BEHAVIOR DISORDER PATIENTS IN A SINGLE JAPANESE CENTER

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**Introduction:** REM sleep behavior disorder (RBD) is characterized by the loss of the normal REM sleep skeletal muscle atonia, resulting in complex motor behaviors associated with dream mentation. Several lines of evidence indicate that idiopathic RBD (iRBD) is usually a manifestation of the prodromal stages of Parkinson disease (PD), dementia with Lewy bodies (DLB), or multiple system atrophy (MSA). The polysomnographical hallmarks of RBD include tonic/phasic loss of the skeletal muscle atonia of REM sleep (REM sleep without atonia; RWA). Clinical risk factors for conversion from iRBD to PD, DLB and MSA are important clues in order to establish strategy for neuroprotective trials against synucleinopathy. The aim of this study was to investigate clinical and PSG characteristic of Japanese patients with iRBD.

**Materials and methods:** The subjects were patients who came to Osaka Kaisei Sleep Medical Center, Osaka, Japan between June 2010 and May 2013. The diagnosis of RBD was made based on the International Classification of Sleep Disorders 3rd edition criteria (history of dream-enacting behaviors and video-polysomnography). In our RWA scoring based on The AASM Manual for Scoring 2.3, increased EMG activity was counted separately according to the EMG activity patterns; tonic EMG, phasic pattern, and combined EMG activities. If chin EMG activity was present for more than 50% of each 30-second epoch, that epoch was scored as tonic. Phasic EMG density was scored from the chin EMG and represented the percentage of 3 second mini-epochs containing EMG activity lasting 0.1 to 5 seconds. RWA epochs includes tonic, phasic and combined (tonic + phasic) type. We calculated the percentage of RWA, tonic REM, phasic and REM density.

**Results:** RBD was diagnosed in 206 patients (68.4±7.0 years old). Patients with neurological condition or taking antidepressants at the initial visit and those with inadequate PSG data were excluded from this study. One hundred eighty four patients were diagnosed as iRBD. There were 139 men and 45 women with a mean age of 68.4 ±6.7 years. The mean value of the proportions of RWA as a percentage of REM sleep was 49.9± 27.7%. The mean values of tonic REM percentage (30sec) , phasic EMG activity (3sec) and any activity (3sec) during REM sleep were 35.8±28.8%, 28.8±13.3% and 49.4 ±24.8%, respectively. We confirmed that six patients converted to DLB.

**Conclusions:** Percentage of tonic REM in Japanese patients with iRBD was lower than previously reported results from Western countries. Further studies with longitudinal assessment and testing thresholds in different race populations will reveal risk factors for neurodegeneration in iRBD.
Introduction: This study proposed a method of automatically classifying patients of REM sleep behavior disorder (RBD) based on convolutional neural network (CNN) using cardiopulmonary coupling (CPC) spectrum induced from a single-channel electrocardiogram (ECG).

Materials and methods: Nocturnal polysomnography (PSG) recordings were obtained during the sleep of 85 subjects (normal group: 52, RBD group: 33) at Samsung Medical Center (Seoul, Republic of Korea). Data were divided into training set of 68 subjects and test set of 17 subjects in order to train and test CNN. ECG-based CPC analysis was conducted using Embla CPC (Embla systems LLC, USA). And, CPC spectograms were used as input data of CNN to classify normal and RBD group. CNN has three layer structure (first layer: filter N. (80), filter size (2x3), activation function (rectified linear unit, RELU), pooling size (1x4); second layer: 40, 2x3, RELU, 1x4; and third layer: 16, 2x3, RELU, 1x4). Finally, all neurons are fully connected and learning process is performed through feedforward and back propagation algorithms.

Results: The classification performance showed sensitivity, specificity and accuracy of 80.0%, 85.7% and 82.3% for RBD, respectively.

Conclusions: The CPC-based method has the potential for automatically classifying RBD patients in a home environment without any other physiological signals.

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PHENOCONVERSION OF CZECH IDIOPATHIC REM SLEEP BEHAVIOR DISORDER PATIENTS

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Introduction: Idiopathic REM sleep behavior disorder (iRBD) is regarded as the initial stage of neurodegenerative diseases, especially synucleinopathies. The aim of this study was to evaluate the phenoconversion into parkinsonism and cognitive deficit in patients diagnosed with iRBD in our Centre.

Methods: This is a retrospective study comprising patients diagnosed with iRBD at the Sleep and Wake Disorders Centre, Department of Neurology and Clinical Neuroscience, Prague, before 2015. Conversion was explored from patients’ medical documentation, their repeated neurological examinations and structured interview. We were able to assess the development in 34 of these patients (26 males, 8 females).

Results: The median age of iRBD symptoms onset was 62 (41-83) years, the median age at iRBD diagnosis was 67 (46-83) years and the median follow-up was 5 (1-14) years. Of the 34 assessed patients, 11 (32.4 %) displayed symptoms indicating phenoconversion. Four subjects were diagnosed with Parkinson’s disease, three with Lewy body disease, one with multiple system atrophy and three had cognitive deficit which was not further specified. The ratio of patients who developed a defined neurodegenerative syndrome up to five years from the RBD diagnosis was 20.6 %. The median conversion time in those patients who developed parkinsonism or dementia was five years.

Conclusion: We confirmed a phenoconversion of iRBD to parkinsonism and dementia in Slavonic population proportionally similar to other iRBD cohorts.
Introduction: The aim of this research is to correlate the severity of REM atonia loss in idiopathic REM sleep behavior disorder (iRBD) with vestibular-evoked myogenic potentials (VEMP) scores, which provide an indirect measure of severity of VEMP alterations. Brainstem dysfunction in established Parkinson's Disease (PD) has been associated with a consistent VEMP impairment, with alterations reported even in the early stages of the disease. A dysfunction of complex neurotransmitter connections within the brainstem probably accounts for the pathophysiology of iRBD, which is thought to predate synucleinopathies, such as PD, by many years.

Materials and methods: Click-evoked cervical (cVEMP), masseter (mVEMP) and ocular (oVEMP) VEMPs were recorded in seventeen polysomnographically confirmed iRBD (11 M, aged 67.25±4.85 years) and ten matched healthy controls. The p1 peak latency, n1 peak latency and corrected amplitude were measured for all VEMPs. The severity of VEMP alteration was calculated through the VEMP score, a measure of rating of each VEMP recording, according to the degree of abnormality. REM atonia loss was visually assessed as the percentage of tonic 30-s epochs and that of 2-s miniepochs containing phasic chin EMG activity and of 3-s miniepochs containing any (either tonic or phasic) chin EMG activity. Furthermore, the automatic REM atonia index was assessed according to Ferri et al. Single and total VEMP scores were calculated for each patient and were correlated (Spearman) with the above visual and automatic REM sleep EMG parameters.

Results: Compared to controls, iRBD patients displayed a significantly higher rate of abnormal oVEMPs (50% versus 0%, p=0.02), mVEMPs (58.3% versus 8.3%, p=0.03) but not of cVEMPs (33.3% versus 0%, p=0.1). The most represented alterations seen in iRBD patients were the absence of the response for oVEMP and mVEMP and amplitude reduction for cVEMPs. In patients with preserved responses, the amplitude of mVEMPs and oVEMPs was significantly reduced (p<0.0001) and peak latencies of mVEMPs were significantly delayed (p<0.0001). VEMP score showed a significantly higher severity of alterations for mVEMP (p=0.02) and oVEMP (p=0.016) but not for cVEMP (p=0.17), compared to controls.

A significant correlation was found between tonic parameters and both the oVEMP score (rho=-0.734; p=0.001) and total VEMP score (rho=-0.618; p=0.032). Moreover, the parameter “any EMG chin” showed a significant correlation with the oVEMP score (rho=0.779; p=0.013) and the total VEMP score (rho=0.725; p=0.023). Conversely, no significant correlation was found between REM sleep phasic EMG parameters and VEMP scores.

Conclusions: The correlation between the severity of atonia loss and high VEMP scores may unveil the presence of a dysfunction within brainstem circuits shared by VEMPs and by structures involved in iRBD pathogenesis. Both phenomena may be considered as the neurophysiological expression of a neurodegenerative process affecting the brainstem.

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TRODAT SPECT IN IDIOPATHIC RBD PATIENTS

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Introduction: TRODAT is a marker that selectively binds to the presynaptic dopamine receptors (DAT) present in our brain. The loss of DAT correlates with that of dopaminergic neurons, being demonstrated in a very sensitive way in the images obtained by the examination, even in the initial phases of the condition. The reduction of these receptors’ density, in turn, is associated with the severity and progression of Parkinson Disease. On the other hand, normal images rule out the hypothesis of this disease.

Materials and methods: We have studied and selected retrospectively 6 patients who presented with clinical and polysomnographic diagnosis of IRBD, on treatment or not, during last year, to be submitted to a tomographic perfusional scintigraphy with TRODAT.

Results: 5 from 6 patients (84%) have abnormal test.

Conclusions: TRODAT-1 is a tropane derivative which, when labeled with meta-stable Technetium 99 (99mTc) crosses the blood brain barrier, has a high affinity for DAT and is captured by SPECT mode scintigraphy, producing a site-specific image of the DAT. It offers great advantages compared to other tracers, because it presents the same efficiency with much lower cost. The other tracers use isotopes such as [123I] for SPECT and [11C] and [18F] for PET, which have little availability in Brazil and cost at least 10 times higher when compared to 99mTc.

The reduction in DAT density occurs even before the onset of PD symptoms, since there is a 40 to 60% reduction in dopaminergic activity (uptake of DAT tracers) when the first symptoms appear and, with the evolution of the disease, the levels of uptake decrease by up to 90%. It is for this reason that the concentration of DAT in the evaluation of the loss of dopaminergic neurons in the striatum, more specifically in the putamen, has been shown to be a useful parameter both in the early diagnosis of PD and in the differential diagnosis with other diseases that induce extrapyramidal symptoms.

With this study we have tried to reinforce IRBD as a marker of neurodegenerative disease.
**Introduction:** REM sleep behavior disorder (RBD), which is likely to occur in the elderly, is characterized by dream-enactment behavior with REM sleep without atonia (RWA). Obstructive sleep apnea/hypopnea (OSAH) is frequently observed in the elderly and well known to deteriorate during REM sleep due to increased upper airway collapsibility. This study aimed to compare the prevalence and severity of OSAH between elderly patients with RBD and controls, and to investigate association of RWA with OSAH.

**Materials and methods:** Subjects were patients with idiopathic RBD (n=156) and randomly selected age-, sex- and BMI- matched control subjects (n=146) who performed nocturnal polysomnography with suspicion of sleep disorders other than RBD and OSAH from 2013 to 2016. Subjects who showed central sleep apnea >=5/hr and slept lateral position throughout the night were excluded. Prevalence and severity of OSAH were compared between the two groups, and relationship between the amount of RWA (phasic and tonic EMG activity) and severity of OSAH during NREM and REM sleep with supine position were investigated.

**Results:** Apnea-hypopnea index was lower in RBD patients than in the controls (7.8±10.6 vs. 17.5±15.9 /hr, P<0.001). Proportion of patients with AHI>=15/hr was also lower in RBD group (14.1 vs. 42.5%). In RBD group, subjects with OSAH>=15/h during REM sleep showed lower level of tonic and phasic EMG activity than those without.

**Conclusions:** OSAH is less frequently observed in RBD than in other sleep disorders. In RBD, dysregulation of muscle atonia can suppress REM sleep without atonia can suppress OSAH during REM sleep.

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DREAMING FREQUENCY IN REM SLEEP BEHAVIOR DISORDER PATIENTS: ANALYSIS OF QUESTIONNAIRE AND POLYSOMNOGRAPHIC DATA

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Introduction: REM sleep behavior disorder (RBD) is characterized by violent dream content, vocalization or sleep talking, and dream enactment behavior. We analyzed the dreaming frequency in patients with RBD compared with normal subjects.

Materials and methods: We analyzed 60 patients diagnosed with RBD and 75 patients diagnosed with normal subject who performed polysomnography and sleep related questionnaires between 2015 and 2016. The questionnaire included the usual patterns of sleep, lifestyle, history, and quality of sleep. We have divided into five stages of never, seldom, occasional, frequent, and very frequent according to the frequency of dreams through questionnaire about how often did you dream in the last two weeks. Among them, we divided into two groups, never, seldom, and occasional as a group with less frequent dream-recall and frequent, very frequent as a group with frequent dream recall.

Results: Comparing the data by univariate analysis, age, number of awakening during sleep, number of awakening during sleep due to urine problems, PSQI, BDI, ISI, wake up with refreshing feeling, combined disease, sleep talking and dreaming frequency were significantly higher in the RBD group and WASO was significantly lower in RBD group. In multivariate analysis, sleep talking and ISI (>8) were identified as factors affecting the REM sleep behavior disorder. We also analyzed the correlation between the number of dreaming and RBD. The odds ratio was 11 for frequent dreams and 13 for very frequent dreams, it was confirmed that RBD was affected with increasing dreaming frequency. There was no significant statistical difference except alcohol and caffeine consumption in gender difference. In the analysis based on 60 years old, there was no significant statistical difference in the dreaming frequency, and polysomnographic parameters and questionnaire showed statistical significance higher in the group over 60 years old.

Conclusions: It was confirmed that the dreaming frequency is higher in REM sleep behavior patients than in normal subjects. There was no difference in the parameters related to arousal or awakening on PSG. It can be caused by subtle cortical arousal that is not recorded in PSG and further study is warranted to reveal the mechanism of dreaming and REM sleep behavior disorder.
**DECREASE OF DOPAMINE TRANSPORTER CORRELATES COGNITIVE DECLINE IN RAPID EYE MOVEMENT BEHAVIOR DISORDER PATIENTS**

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**Introduction:** Rapid eye movement behavior disorder (RBD) is considered as a prodromal symptom of neurodegenerative alpha-synucleinopathies, such as Parkinson's disease dementia and dementia with Lewy Bodies. However, it has been reported that cognitive performances remain normal or only mildly declined in RBD patients. In line with the slight cognitive decline, brain imaging studies have found mild dopaminergic denervation of striatum in RBD patients. Although these findings suggest that cognitive decline might be related to pathological changes in dopaminergic system, it has not been well studied if dopaminergic pathology underlies apparent cognitive decline in RBD patients. Thus, to assess the association between the changes in cognitive function and dopaminergic denervation, we conducted a retrospective survey in RBD patients.

**Materials and methods:** Medical records of RBD patients, who visited the Sleep Clinic in Shiga University of Medical Science during March 1, 2016 to July 31, 2017, were reviewed and 19 patient records fulfilling following assessments were included in this study.

For cognitive assessment, Japanese version of Montreal Cognitive Assessment (MoCA-J) was used to better detect slight cognitive decline such that cannot be measured by conventional dementia scale. Dopaminergic denervation was semi-quantified by dopamine transporter ¹²³I-FP-CIT SPECT, followed by calculation of specific ¹²³I-FP-CIT tracer binding ratio (SBR) by DAT VIEW software (Nihon Medi-Physics, Tokyo, Japan).

To examine the risks underlying cognitive decline in RBD patients, association between MoCA-J score and other measures related to the disease were analyzed. Measures included age, body mass index (BMI), education years, disease duration, and SBR. The association were examined by multiple linear regression analysis with step-wise forward method.

**Results:** All patients were male, with a mean (SD) age of 72.6 (6.3) years, BMI of 24.8 (2.9) kg/m², education of 13.3 (3.0) years, and disease duration of 10.2 (5.2) years.

Mean (SD) MoCA-J score was 23.7 (3.3), and SBR was 4.13 (1.4).

Multiple regression analysis equation: MoCA-J score = 21.480 + 1.190 * SBR - 0.266 * disease duration ($R^2 = 0.587$, $p < 0.01$).

The standardized partial regression coefficients were 0.515 for SBR, and -0.418 for disease duration ($F = 11.359$, $p < 0.01$).

**Conclusions:** MoCA-J score was associated with SBR and disease duration in RBD patients, although it was not associated with age, BMI, or education years. This finding suggested that cognitive decline seen in RBD patients was not simple effect of aging, but it rather related to RBD process (disease years) and more specifically related to dopaminergic dysfunction (SBR). Although RBD is considered as a prodromal symptom of alpha-synucleinopathies, dopaminergic denervation might have already had negative impact on cognitive function in RBD patients.

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**INTRODUCTION**

Rapid eye movement (REM) sleep behavior disorder (RBD) is a parasomnia characterized by dream-enacting behaviors and loss of REM sleep atonia. Active dreams are more frequently reported after awakening from phasic REM sleep than after tonic REM sleep. Furthermore, dream-enacting behaviors in patients with RBD occur more frequently during phasic REM sleep than during tonic REM sleep. Therefore, we postulate that RBD-related vigorous behaviors are associated with abnormally increased activation of the motor cortex during phasic REM sleep. To test this hypothesis, we analyzed EEG spectral power during tonic and phasic REM sleep in patients with idiopathic RBD (iRBD).

**Materials and methods:** Thirteen polysomnography-confirmed iRBD patients and 10 controls were analyzed in this study. We recorded 21-channel scalp EEG with two-channel electrooculography. EEG data during sleep was segmented into 3-s mini-epochs and we selected 30 mini-epochs for both tonic and phasic REM sleep. Phasic REM sleep was scored based on the presence of at least two consecutive REMs within a mini-epoch. Tonic REM sleep was selected when there was no eye movement. For power spectral analysis, we performed fast Fourier transforms and calculated relative power of five frequency bands: delta (2-4 Hz), theta (4-8 Hz), alpha (8-12 Hz), sigma (12-15 Hz), and beta (15-30 Hz). We performed repeated-measures analysis of variance (ANOVA) to determine the effect of REM sleep states (tonic and phasic), regions of interest (frontal, central, parietal, and occipital), and groups (iRBD and control).

**Results:** Significant interaction effects between REM sleep state and group were observed in relative power of alpha ($F_{1,21} = 6.075, P = 0.022$), sigma ($F_{1,21} = 11.616, P = 0.003$), and beta ($F_{1,21} = 14.644, P = 0.001$) bands. Post-hoc analysis demonstrated that in patients with iRBD, relative power in alpha, sigma, and beta bands was significantly decreased in central and parietal regions during phasic REM sleep compared to tonic REM sleep. Conversely, a significant difference between phasic and tonic REM sleep in the control group was only noted in beta-band power in the central region. In alpha and sigma frequencies, there were no significant changes in spectral power between phasic and tonic REM sleep in the control group.

**Conclusions:** We found that patients with iRBD are characterized by more pronounced EEG desynchronization during phasic REM sleep than controls. Significant decrease in alpha-to-beta power during phasic REM sleep supports the notion that pathological motor cortex activation contributes to dream-enacting behaviors in patients with iRBD. Further research will be needed to understand the clinical significance of the altered EEG activity with regard to neurodegeneration.

**Acknowledgements:** None
DETERMINANTS OF DECREASED CARDIAC UPTAKE IN 123I-MIBG SCINTIGRAPHY IN PATIENTS WITH IDIOPATHIC REM SLEEP BEHAVIOR DISORDER

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Introduction: Decrease in cardiac iodine-123 metaiodobenzylguanidine (123I-MIBG) radioactivity has been reported in patients with idiopathic REM sleep behavior disorder (RBD) as well as in Lewy body diseases (LBD), namely Parkinson's disease (PD) and dementia with Lewy bodies (DLB). Pathological studies revealed that reduced cardiac 123I-MIBG uptake represents degeneration of the cardiac sympathetic nervous system and this finding is considered one of the early signs of Lewy body pathology. However, it remains unclear how this imaging biomarker changes with natural course of iRBD. This study aimed to investigate the possible determinants of cardiac 123I-MIBG radioactivity in our iRBD patients.

Materials and methods: We studied 52 iRBD patients (44 men and 8 women, 69.3±7.1 years of age at the time of the investigation) with disease duration of 7.8±6.0 (range: 1-30 years) who presented themselves to our sleep center by using cardiac 123I-MIBG scintigraphy. Diagnosis of RBD was based on the criteria of the International Classification of Sleep Disorders (3rd ed.). All patients were free from motor, cognitive, or psychiatric symptoms and neurologically intact on examination, and not suffering from any neurological disorders other than RBD at the time of 123I-MIBG scintigraphy. The heart-to-mediastinum uptake ratio (H/M ratio) was calculated by dividing the count density of the left ventricular ROI by that of the mediastinal ROI according to the standard method. The association between the age of onset, the duration of iRBD, and the age at the time of 123I-MIBG scintigraphy versus the early and late H/M ratio was assessed by applying the regression analysis.

Results: The early and late H/M ratios of cardiac 123I-MIBG uptake were 1.49±0.21 (range 1.1 - 2.0) (institutional normal value 2.0 - 2.8) and 1.36±0.28 (range 1.0 - 2.8) (institutional normal value 2.0 - 3.0), respectively. Both of the early and late H/M ratios showed significant negative correlations with the age at the time of 123I-MIBG scintigraphy (P < 0.01), but not with the duration of iRBD. There was weak negative correlation between the early H/M ratio and the age of iRBD onset (P < 0.05).

Conclusions: The results of cardiac 123I-MIBG radioactivity correlated more closely with the age at its examination rather than the duration of iRBD may indicate increased age as an important factor to inform cardiac sympathetic nerve degeneration among our iRBD patients. Taking into account very low cardiac 123I-MIBG uptake in most of the patients, one could interpret this to mean that underlying Lewy body pathology of the cardiac sympathetic nervous system had been almost full-blown in the early stage of iRBD.
Background and purpose: Rapid eye movement sleep behavior disorder (RBD) has been reported to have association with neurodegenerative disorders, in particular, alpha-synucleinopathies. In this study, we aimed to investigate whether finger-tapping performance in idiopathic RBD patients is associated striatal dysfunctions and resting-state sensorimotor network abnormalities, by combining the results of motor task performances, resting-state functional MRI (rs-fMRI) and 123I-FP-CIT SPECT.

Methods: Eighteen patients with idiopathic RBD (16 PSG-confirmed and two probable cases) were included. The diagnosis of RBD was made based on ICSD-3. 16 cases were video-PSG confirmed by reference to the %RWA of more than 30%. The diagnosis of two probable cases were made based on thorough interview by certified sleep specialist. The judgement of “idiopathic” was performed by neurologists based on their examination. Twenty age-matched healthy controls (HC) were also included. During finger-tapping task session, participants were instructed to tap their index finger and thumb as rapidly and as widely as possible during 15 seconds. Mean amplitude (mm), peak open and peak close speed (m/s) were recorded using a magnetic sensing finger tapping device. For the evaluation, maximal distance (mm) between the thumb and index finger was recorded, and each mean value was divided by the distance in order to eliminate potential confounding factors of hand size. Through this correction, %amplitude, peak open speed index and peak close index were then calculated. When either of these parameters in idiopathic RBD patients is less than two standard deviations of that of HC, these RBD patients were classified as “poor performer”. For the 123I-FP-CIT SPECT, quantitative analyses were based on volumes of interest (VOI). Dopamine transporter (DAT) activity was calculated by the specific binding ratio (SBR) in the striatum, caudate, anterior and posterior putamen to the non-specific uptake measured in the cerebellum. The asymmetry index was calculated as |R-L|/((R+L)/2). In rs-fMRI session, whole-brain scans were acquired with a gradient echo planner imaging (EPI) on a 3T MR scanner. Functional images were preprocessed and analyzed with the functional connectivity toolbox CONN.

Results: Six idiopathic RBD patients were classified as poor performer group. %amplitude, open speed index and close speed index were 80.7±14.3%, 0.012±0.002 and 0.015±0.002 in each in HC, whereas those of poor performer group were 54.5±3.7%, 0.010±0.001 and 0.010±0.001. The mean SBR in posterior putamen was lower in these six patients compared with HC (1.22±0.29 vs 1.58±0.26 respectively, p=0.052). The SBR asymmetry index in the posterior putamen was significantly higher in poor performer of RBD compared with HC (0.20±0.10 vs 0.06±0.069 respectively, p=0.027). In poor performer group, diminished functional connectivity were identified between the right caudate nucleus and right SPL, left caudate nucleus and bilateral SPL, left caudate nucleus and left primary sensory cortex, and left SPL and left supplementary motor area, compared to HC.

Conclusion: Striatal dysfunctions and diminished resting-state functional connectivity were found in idiopathic RBD patients with poor finger-tapping performance, possibly reflecting their underlying neurodegeneration.
Introduction: RBD, a parasomnia characterized by loss of normal atonia and dream-enactment during REM sleep, is the strongest prodromal marker of neurodegenerative synucleinopathy. Some studies suggest RBD has a risk factor profile that differs from Parkinson’s disease and Dementia with Lewy bodies. However, evidence so far has been limited. This study investigated associated risk factors and comorbid conditions for possible REM sleep behavior disorder (RBD) in a large population of Canadian adults.

Materials and methods: 30,097 subjects aged 45 years or more were recruited between 2012 and 2015 across Canada by the Canadian Longitudinal Study on Aging (CLSA). Symptoms of dream enactment were screened using the RBD1Q. To increase the probability of RBD in screen positives, we then excluded all subjects with symptoms of apnea, possible parkinsonism and childhood onset dream enactment (considered more likely to be non-REM parasomnia). Assessment of risk factors was performed with regression analysis adjusted for age and sex.

Results: 11.06% endorsed symptoms of dream enactment. After removal of confounds, the prevalence of possible RBD was 3.18% (95%CI: 2.99%-3.39%). Adjusted for age and sex, regression analysis showed that pRBD was associated with male sex (OR=1.97 [1.72, 2.25] ) and lower education (secondary school: OR=1.77 [1.36, 2.31] ). pRBD patients were more likely to be retired (OR=1.22 [1.02, 1.46] ), and to have retired due to health issues (OR=1.459, 95%CI: 1.205, 1.767). pRBD patients endorsed higher prevalences of heavy drinking (OR=1.38 [1.17, 1.63] ), smoking (past smoker: OR=1.22 [1.060, 1.400] , current smoker: 1.571 [1.241,1.987] ) and were less active (OR=0.982 [0.968, 0.997] ). Furthermore, scores of life stratification and self-rated social standing were negatively associated with pRBD (OR=0.989 [0.981, 0.996] and 0.917 [0.879, 0.957] ). Subjects with pRBD were also more likely to self-rate as having poor health (OR=1.128 [1.016, 1.252] ), and scored higher in psychological distress (OR=1.065 [1.051, 1.079] ). Among the co-morbid conditions, anxiety disorder (OR=2.241 [1.845, 2.722] ), depressive disorder (OR=2.078, [1.774, 2.434] ), post-traumatic stress disorder (OR=3.193, [2.552, 3.994] ) and the use of antidepressants (OR=2.711, [2.211, 3.309] ) were strongly associated with pRBD. No association was found with age (OR=0.994, [0.987, 1.000] ).

Conclusions: This very large community-based study suggested several sociodemographic, behavioural and lifestyle factors, for RBD. pRBD was also closely associated with mental illness; it is unclear if mental illness-associated pRBD is a sign of prodromal synucleinopathy, or reflects a separate dream-enactment syndrome. Further follow-up of this cohort will allow prospective assessment of the role of these risk factors in development of neurodegenerative synucleinopathy.

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Restless Legs Syndrome (RLS)
O10: Restless legs syndrome (RLS/WED) oral abstract presentations

VALIDATION OF AN AUTOMATIC SCORING ALGORITHM FOR THE ANALYSIS OF PERIODIC LIMB MOVEMENTS ACCORDING TO THE WASM2016 GUIDELINES

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Introduction: Periodic Limb Movements (PLMs) are objective physiological markers related to the diagnosis of several conditions, including Restless Legs Syndrome or Periodic Limb Movement Disorder. Recording of this activity is thus recommended as part of the standard clinical polysomnographic (PSG) montage. Manual scoring of these events by sleep clinicians, however, is very time-consuming and prone to errors. The development of automatic detection methods is therefore of clear interest, saving costs and reliably speeding up the scoring process.

Materials and methods: We have developed an automatic detection algorithm for the scoring of limb movements in PSG recordings. The tool follows the scoring criteria according to the last version (November 2016) of the World Association of Sleep Medicine guidelines (WASM2016). Robust artifact rejection techniques were implemented in the software, which in addition is able to dynamically adjust its detection thresholds to changing signal baseline levels. We have validated the software using a database of 209 clinical recordings, including both in-hospital (n = 44) and ambulatory PSGs (n = 165). The respective list of PLMs was obtained according to the aforementioned WASM2016 guidelines. Diagnostic indices for PLMs during sleep (PLMS) and wakefulness (PLMW), and the Periodicity Index also during sleep (PIS) and wakefulness (PIW) were calculated, and compared to the respective indices derived from the clinical expert’s scorings. Analysis was repeated recalculating the PLM series by skipping respiratory related candidate leg movements (CLMr). A CLMr was scored when the event would overlap with an interval from 2.0 s before to 10.25 s after the end of a respiratory event.

Results: Squared correlation coefficients (R²) between the automatic and the manual indices were obtained for PLMS (R² = 0.989), PLMW (R² = 0.964), PIS (R² = 0.948), and PIW (R² = 0.951). When considering the non-respiratory related PLM series the respective values were 0.991, 0.961, 0.947, and 0.952. All the indices showed statistical significance. Pairwise index comparisons at the recording level were performed using the Wilcoxon signed rank test. With the null hypothesis of differences equal to zero the obtained p-values were p = 0.328 (PLMS), p < 0.01 (PLMW), p = 0.197 (PIS), and p = 0.072 (PIW). When excluding CLMr from the PLM series the respective values were p = 0.195, p < 0.01, p = 0.182, and p = 0.058. Therefore no relevant differences were found for all the diagnostic indices (if α = 0.05) except for PLMW. Further one-sided statistical analysis for PLMW revealed that the paired differences were not relevant anymore when assuming a deviation equal to -0.6 (p = 0.12, PLMW/manual - PLMW/auto, for a reference PLMW/manual distribution of 27.55 ± 23.19).

Conclusions: Automatic scoring of PLMs with our algorithm has shown good reliability when confronted to clinical manual scorings. The slight (probably acceptable) divergences found in the case of the PLMW index were associated to the increased presence of significant signal artifact during wake periods. These results support the validity of the developed algorithm to help increasing the clinician’s speed and reliability when scoring PLMs.
Restless Legs Syndrome (RLS)
O10: Restless legs syndrome (RLS/WED) oral abstract presentations

CIRCADIAN VARIATION OF FLEXOR WITHDRAWAL AND CROSSED EXTENSOR REFLEXES IN RESTLESS LEGS SYNDROME

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Introduction: A circadian fluctuation is evident in restless legs syndrome (RLS) with the pronounced appearance of RLS symptoms in the evening. The aetiology of RLS is unknown however previous research suggests a state of spinal hyperexcitability in these patients. The theory of RLS spinal hyperexcitability in the evening is not fully supported by the evidence of current reflex derived findings and knowledge gained from further study of other reflexes may provide enhanced theories of RLS pathology. The objective of the current study was to assess the circadian variation in spinal excitability in RLS patients based on flexor withdrawal reflex (FWR) and crossed extensor reflex responses.

Materials and methods: The FWR was elicited on 12 RLS participants and 12 healthy control participants in the evening (PM) between 20:00 and 22:00 and again the following morning (AM) between 6:30 and 8:00. FWR and crossed extensor reflex response magnitudes were measured electromyographically and kinematically (leg and foot movements).

Results: Both the FWR and the crossed extensor reflex showed a circadian rhythm in RLS participants but not control participants. Changes in ankle (median FWR PM: 16.0° vs AM: 2.8°, p=0.042; crossed extensor reflex PM: 0.8° vs AM: 0.2°, p=0.001) and hallux (median FWR PM: 5.0° vs AM: 1.3°, p=0.012; crossed extensor reflex PM: 1.4° vs AM: 0.5°, p=0.019) angles were significantly larger and ankle angular velocity (median FWR PM: 38.8°/s vs AM: 13.9°/s, p=0.049; crossed extensor reflex PM: 2.4°/s vs AM: 0.5°/s, p=0.002) was significantly faster in the evening compared to the morning in RLS participants, for both reflexes. No significant differences for any of the assessed variables were observed between RLS participants and controls.

Conclusions: The FWR and the crossed extensor reflex show a circadian rhythm in RLS participants suggesting an evening increase in spinal excitability. As the FWR and the crossed extensor reflex share afferent circuitry, the increase in both FWR and crossed extensor reflex responses indicate the afferent circuitry in the dorsal horn of the spinal cord as a possible site of dysfunction in spinal excitability in RLS patients. We hypothesize that this dysfunction may be due to a possible nocturnal form of central sensitization at the afferent circuitry in the dorsal horn of the spinal cord in RLS patients.
Introduction: The Willis-Ekbom Disease (WED) is a common neurological, sensorimotor disorder that affects 5 to 10% of the world’s population. The WED’s manifestations significantly interfere with sleep quality in more than 70% of patients. The symptoms vary considerably in frequency from less than once a month or year to daily and severity from mildly annoying to disabling. Birth cohort studies bring the possibility of conducting a research with a temporal window that begins at birth and extends to the present, representing an opportunity that may help us to understand the mechanisms that lead to WED. In this preliminary results, we will evaluate the prevalence, quality of sleep and excessive daytime sleepiness with the presence of WED in patients of a birth cohort in Ribeirão Preto, Brazil.

Materials and methods: The study population came from a larger study called COBRAS (COortes BRASileiras) and started in the 1970’s with the initial objective of studying the development of live births in the region of Ribeirão Preto, São Paulo, Brazil. Firstly, a cross-sectional study of this population was carried out to evaluate sleep quality (Pittsburgh Sleep Quality Index - PSQI), sleep time, sleepiness (Epworth scale) and anthropometric data such as weight, height, BMI and blood pressure. For the probable diagnosis of WED, a unique question was used, which brings together the core issues of WED diagnosis: "When you try to relax in the evening or sleep at night, do you ever have unpleasant, restless feelings in your legs that can be relieved by walking or movement?" This strategy has already been shown to have a sensitivity and specificity of 100 and 96% respectively.

Results: Of 1580 people interviewed, 47 answered yes to the single question. The mean age and standard deviation were 33 +/- 7.6 years. The estimated prevalence was 3% of WED. Concerning the gender, there was no statistically significant difference between the males and females (p = 0.50) and neither regarding the total sleep time among patients with and without WED (p = 0.95). There was no significant association between the presence of arterial hypertension (p = 0.39) and WED nor obesity (p = 0.5). No significant difference was observed with excessive drowsiness (Epworth> 10 points) among patients with WED versus non-WED (p = 0.89). Among those who had poor sleep quality (PSQI> 5 points), they had two times the risk of having WED as a diagnosis (OR = 2.00, 95% CI, 1.08 - 3.75) than those who had good sleep quality (PSQI < 5 points) (p = 0.03).

Conclusions: WED is a common disorder which affected 3% of our population. However below that expected for the Brazilian population, which is 6.4%. This result probably is due to the cohort population is composed of young individuals. WED has an impact on the quality of sleep of these patients.

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Introduction: Restless leg syndrome (RLS) is a sensorimotor sleep disorder characterized by an urge to move, that occurs or worsens at rest, more towards evening and is relieved by activity. The prevalence of RLS during pregnancy is 2-3 times more than in the general population, affecting about 15-25% of pregnant women. This study aims to estimate the prevalence of RLS in pregnancy in South Indian population and its association with serum ferritin levels.

Materials and methods: In a prospective study from February to August 2016, 325 pregnant women were enrolled. Subjects were grouped as RLS positive (49 subjects) and controls (276) based on the one-on-one interview and were followed 6 months later by telephonic interview.

Results: The subjects’ mean age was 25.15 ± 3.86 years and ranged from 18 to 38 years. The mean BMI of the study population was 26.22 ± 5.31 kg/m² and the mean gestational age was 30.21 ± 8.4 weeks. The prevalence of RLS was 15.1% (49 subjects). The distribution of age, BMI, comorbid conditions such as diabetes and hypertension were similar in the two groups. The number of hours of sleep was significantly less in the RLS positive group (7.93 Vs 7.5 hours; p value=0.017). Of the 49 RLS positive subjects, 3, 6 and 40 subjects were in their first, second and third trimester of pregnancy respectively. Thirty RLS positive women were primigravida. The levels of haemoglobin (mean value of 11.5 ± 1.6 versus 11.4± 1.3 gm/dl; p value =0.73), oral iron supplements (mean value of 69.4± 43.3 versus 63.3 ± 37.4 mg of elemental iron per day; p value= 0.37) and serum ferritin (mean value of 37.6 ±36.0 versus 36.2 71.8 mcg/L) and baby’s birthweight ( 2.67±0.6 versus 2.86± 0.6 kilograms) did not differ significantly between the RLS positive and control groups. Forty-five women reported complete resolution of RLS symptoms, while 2 women had persistent RLS symptoms, six months after delivery. Two women were lost to follow up.

Conclusions: The prevalence of RLS in Indian pregnant women is 15.5%. The RLS was undiagnosed in this population previously. RLS was more prevalent in the third trimester of pregnancy. Neither multiparity or low serum hemoglobin or ferritin were associated with RLS in pregnancy. The presence of RLS did not adversely affect the outcome of pregnancy or the baby’s birthweight.

Keywords: Restless leg Syndrome, pregnancy, serum ferritin

Acknowledgements: None
Restless Legs Syndrome (RLS) characterizes by uncomfortable sensations in the extremities - predominantly in the legs. Previously, we presented data showing that RLS associates with low mental health-related quality of life (MCS) in men (OR=1.47, P=0.03) and women (OR=1.55, P<0.01), and with low physical health-related quality of life (PCS) among men (OR=1.89, P< 0.01). Moreover, we showed that RLS is associated with depression in men (OR=2.78, P< 0.01) and women (OR=1.72, P=0.02). RLS symptoms occur or increase in intensity when the body is at rest and at night making sedentary activities and sleep difficult. Because sleep disturbances are linked with psychosocial distress, it is likely that our previous findings are due to poor quality of sleep. Furthermore, sleep disturbances have been found to be a significant clinical comorbidity to migraine.

Previous studies on comorbidities to RLS are lacking a validated method for RLS identification. Moreover, it has been shown that the uses of anti-depressant medication provoke or exacerbate RLS symptoms, which may have caused overestimation of comorbidities to RLS.

The objective of this study was to investigate the mediating role of quality of sleep in the associations between RLS and low MCS, low PCS, and depression, respectively. Further, to examine the association between RLS and migraine (with or without aura) in a population that is not biased by any medications.

Material and methods: Complete data, including the Cambridge-Hopkins RLS questionnaire, the 12-item short-form standardized health survey (SF-12), the Major Depression Inventory (MDI), quality of sleep two weeks prior to RLS assessment, smoking status, alcohol consumption, and highest achieved educational level were available for 12,286 participants, while information on migraine experience was available for 7,907 participants, enrolled in the Danish Blood Donor Study from May 1, 2015 to May 1, 2016.

Mann-Whitney U-test for non-normally distributed data and T-test for normally distributed data as well as multivariable logistic regression models were applied. Analyses were conducted separately for men and women.

Results: 7.2% women and 4.5% men suffered from RLS. Participants with RLS were more likely to report poor quality of sleep (men, OR=2.62, P< 0.01; women, OR=1.94, P< 0.01). Moreover, we showed that RLS is associated with depression in men (OR=2.78, P< 0.01) and women (OR=1.72, P=0.02). RLS symptoms occur or increase in intensity when the body is at rest and at night making sedentary activities and sleep difficult. Because sleep disturbances are linked with psychosocial distress, it is likely that our previous findings are due to poor quality of sleep. Furthermore, sleep disturbances have been found to be a significant clinical comorbidity to migraine.

Previous studies on comorbidities to RLS are lacking a validated method for RLS identification. Moreover, it has been shown that the uses of anti-depressant medication provoke or exacerbate RLS symptoms, which may have caused overestimation of comorbidities to RLS.

Conclusions: RLS is associated with reduced MCS and PCS, depressive symptoms, and migraine with aura among otherwise healthy individuals. Quality of sleep seems to mediate the association between RLS and both low MCS and depressive symptoms to some extent.

Acknowledgements: All involved with the Danish Blood Donor Study.
Restless Legs Syndrome (RLS) is a sensorimotor disease that disturbs the sleep of 5 to 15% of population, and 12.95% of runners. Researches show us that exercises trigger interleukines (IL). IL-6 is more sensible among IL released after exercises. Another research shows that IL-6 raises more in RLS runners than in non RLS runners after running. When we see the number of runners increase each year, it raises the suspect: is there relationship between severity RLS and IL-6 levels?

**Objective:** Is there relationship between severity of RLS and IL-6 levels?

**Method:** Sixty six nonprofessional athletes were investigated. The IRLSSG five questions about diagnosis of RLS and ten questions about severity of RLS were applied for researchers (SBRF, DJLF). IL-6 was analised in the basal time, after the marathon run and 72hrs after.

**Results:** We found 10.60% of these athletes completed the requirement of RLS diagnosis. 57.14% of runners had mild-moderate RLS. 28.57% had severe-very severe RLS. The medium levels of IL-6 observed were:

a) mild-moderate RLS group: basal : m= 3,585 (SD=6.6097) , pos marathon : m=100.95 (SD=76.9757), after 72hrs :m=19.8 (SD=20.8505) (p≤0.05).

b) Severe-very severe RLS: basal= m=5,31 (SD=64.2840), pos marathon : m=188.81 (SD=179.3788) and 72hrs: m=36.815 (SD=51.66829) (p≤0.05).

**Conclusion:** Physical exercises stimulate IL-6 and return to basal levels after 72hrs. This mechanism is necessary to recover the metabolic and inflammatory environment control after endurance exercise. When this mechanism is broken, several diseases can appear, one of these is RLS. The dynamic of IL-6 seems like more compromised in severe RLS. The group was composed of marathon runners but only in severe group IL-6 was more elevated than in mild-moderate group. These results could suggest relationship between level of IL-6 and severity of RLS.

**Acknowledgements:** The authors gratefully acknowledge the athletes for their patience as well Gianni M.S. dos Santos for help with statistic analysis.
Year after year the streets are awoke early on Sundays for the sound of thousand of sneakers trying to spend less time for each kilometer. Each one has one desire. Some run for health, others for diminish their time in the running, and anothers just for fun. Together with the run, it grows up the interest in study the sleep in these athletes. The research showed that 12.96% of runners have Restless Legs Syndrome (RLS).

**Objective:** Could endurance resistance exercise play a protective role in RLS?

**Materials and methods:** We study 66 nonprofessional runners. The researchers (SBRF and DJLF) applied a questionary about physical activity (run: 5, 10, 21 and 42km), cycling, workout, swimming; how long; how many times for week). The questions were made using the International Restless Legs Syndrome Study Group (IRLSSG) five criteria diagnosis RLS; the severity of RLS was tested using: “severity questionary of IRLSSG”.

Results: There were 66 nonprofessional runners. The age range 25 to 74 years old (medium 43.25 (DP 11.72). 10.60 % has RLS. 42.86% has RLS before begin to run. 71.43% improves with run the symptoms and start to increase when stop running.

**Conclusion:** The data show that RLS runners have higher levels of IL-6 than runners without RLS. And the resistance exercise stimulates IL-6. Besides these high levels, endurance exercise produce relief of symptomatology and these athletes refer worst when they stop running. Probably there is a mechanism that envolves RLS and IL-6, and endurance resistance exercise plays a protective role in RLS.

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Restless Legs Syndrome (RLS)
Board #061: P2 - Monday
PSYCHO-BEHAVIORAL PROFILE OF PARKINSON’S DISEASE PATIENTS WITH RESTLESS LEGS SYNDROME/WILLIS-EKBM DISEASE

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Introduction: Impulse Control Disorders (ICDs) have been observed in patients with idiopathic Restless Legs Syndrome/Willis-Ekbom Disease (RLS/WED) treated with dopaminergic drugs. Nevertheless, untreated patients with idiopathic RLS also display increased impulsive choices compared to controls. In the present study we aimed to determine whether RLS/WED could be associated with a specific psycho-behavioral profile and ICDs in Parkinson’s disease (PD).

Materials and methods: Seventy-one consecutive PD patients were screened for the presence of RLS/WED in a cross-sectional study. Sleep features were evaluated during one in-lab attended video-polysomnography. The frequency of ICDs according to standard criteria, together with a broad range of psycho-behavioral features assessed by the Ardouin Scale of Behavior in PD, were compared in patients with RLS/WED (PD-RLS/WED, n=28) versus without RLS/WED (PD-noRLS/WED, n=43).

Results: The two groups were comparable for age, sex ratio, occurrence of REM Sleep Behavior Disorders, and disease severity. PD patients with RLS/WED reported significantly more ICDs than those without RLS/WED (53% versus 27.9%, p=0.02), especially compulsive eating disorders, and a different psycho-behavioral profile with more hyperdopaminergic behaviors. There was no between group difference for total levodopa equivalent dose (LED) and Dopamine agonists LED. However, the durations of both disease and dopaminergic treatment were longer in the RLS/WED group. Propensity score analyses controlling for age, gender, dose and duration of treatment, showed that RLS/WED was an independent predictor of ICDs in PD (OR=3.85[2.36;6.50]).

Conclusions: ICDs and hyperdopaminergic behaviors are more frequently reported in PD-RLS/WED compared to PD-no RLS/WED, regardless of dopatherapy dose and duration, suggesting that RLS/WED per se could be a risk factor for impulsive behaviors in PD.
Restless Legs Syndrome (RLS)  
Board #062: P2 - Monday  
LONG-TERM TREATMENT OF RLS/WED WITH THE SELECTIVE GLUTAMATE AMPA-RECEPTOR ANTAGONIST PERAMpanel  

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Introduction: Perampanel is a selective, noncompetitive AMPA receptor antagonist approved for the treatment of partial seizures. A previous report on 20 RLS patients showed a significant improvement of symptoms at a mean dose of 3.8 mg/day over 2 months¹. We report here on an 18-month follow-up of these patients.

Materials and methods: Patients participating in this follow-up had previously participated in a two-month, open label study that included an immobilization test and polysomnography. Both responders and nonresponders from the short-term treatment study were asked to participate in this follow-up phase. Perampanel was administered as monotherapy at a flexible dose between 2 – 6 mg/day over 18 additional months. Severity was assessed every two months using the IRLS, CGI, and Augmentation Severity Rating Scales (ASRS). At the end of the treatment, a multiple suggested immobilization test (mSIT) was performed. The main outcome was therapeutic response, defined as a 50% improvement in both IRLS scale and mSIT. Augmentation was evaluated by means of the ASRS and m-SIT.

Results: Out of 20 patients who had initially completed the short-term phase¹, 17 agreed to participate in the long-term treatment phase, and 12 (70.5%) completed the 18-month treatment period. As reported previously, IRLS score improved during the short-term treatment phase from a mean±SD: 23.7±4.2 to 11.5±5.3 ¹ and at the end of the 18-month follow up period was 13.6±6.2 (mean (SD) dose of 4.2 mg/day). Nine (53%) patients were full, and three (17%) were partial responders. No cases of definite augmentation were observed. Main reasons for discontinuation were dizziness (2), irritability (1), and lack of efficacy (2).

Conclusions: These data suggest that perampanel exerts long-term therapeutic effects on RLS symptoms in most patients. If confirmed by future controlled studies, the AMPA-R antagonist perampanel might become a promising alternative to existing dopaminergic treatments. Pathophysiologic implications will be discussed in detail.

Reference:
¹ Garcia-Borreguero D, Cano I, Granizo JJ. Treatment of restless legs syndrome with the selective AMPA receptor antagonist perampanel. Sleep Med. 2017;34:105-108
Restless Legs Syndrome (RLS)
Board #063: P2 - Monday

PREDICTIVE VALUE OF THE SCIT AND THE MSIT IN THE DIAGNOSIS OF RESTLESS LEGS SYNDROME IN CHILDREN WITH LEG DISCOMFORT

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Introduction: Diagnosis of restless legs syndrome (RLS) in children is based on clinical history with no objective test. In adults two limb EMG based tests have been developed, the Suggested Immobilisation Test (SIT), where patients lie immobile for one hour at 2100, and the multiple SIT (mSIT), administered 2 hourly from 1400 - 2200. Both measure Periodic Limb Movements (PLMs) using objective criteria. The Suggested Clinical Immobilisation Test (SCIT), a clinic based observational tool, has been developed for children. The SCIT measures self-reported sensory symptoms during 5 minutes of seated immobilisation with simultaneous video to analyse movements. Neither the mSIT nor SCIT has been formally evaluated to diagnose paediatric RLS.

Aims: To assess the predictive value of the mSIT and SCIT to diagnose paediatric RLS.

Materials and methods: Participants aged 6-11 years with clinical RLS and similarly aged controls participated in the SCIT and modified mSIT at 1400, 1600 and 1800h. During each test, EMG and sensory symptoms were recorded with simultaneous video. EMG was analysed using AASM scoring criteria to generate a PLM Index (PLMI). Differences in sensory scores and PLMI between cases and controls were analysed across time points using mixed between-within subjects ANOVA tests. Preliminary data are reported here.

Results: Three RLS cases (2 male and mean age 10.0 SD 0.87) and three healthy sibling controls (2 male and mean age 8.2 SD 1.70) participated. There were no statistically significant differences for sensory scores or PLMI for either test. While the PLMI change did not differ between cases and controls for the mSIT, there was a relative increase in PLMI between cases and controls in the SCIT. F(1,4)=0.497, p=0.520, n²p=0.110 with higher values at each time point for cases, and an increase in PLMI for cases between time points, F(1,4)=2.073, p=0.223, n²p=0.341. There was also an almost significant effect for time for PLMI in the SCIT, F(1,4)=6.462, p=0.064, n²p=0.618. Children with RLS often exhibited prolonged tonic contraction of muscles during the test that were not seen in the controls but did not meet scoring criteria.

Conclusions: It is too early to make any conclusions about the diagnostic accuracy of the tests. EMG scoring may need to incorporate prolonged tonic contraction.

Acknowledgements: Thank you to all the children and their families for participating in this study and for their continuing support of the research. Thank you to my supervisor, Dr Catherine Hill, for all of her support during this study.
Restless Legs Syndrome (RLS)
Board #064: P2 - Monday
PERIODIC LIMB MOVEMENT DURING SLEEP IN OBSTRUCTIVE SLEEP APNEA: DOES THE SEVERITY OF APNEA MATTER?

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**Introduction:** Pathophysiology of periodic limb movements during sleep has been an enigma. These are frequently seen among patients with sleep apnea. This study was done to compare the periodic limb movements between habitual snorers and those with obstructive sleep apnea (OSA). Further, effect of severity of apnea was analyzed in periodic limb movement during sleep.

**Materials and methods:** This study involved 297 subjects: 38 habitual snorers and 261 having diagnosis of Obstructive Sleep Apnea diagnosed after in-lab attended polysomnography (Alice-5: Philips Respironics). Patients with RLS, those on Psychotropics, having Parkinson’s disease were excluded from the study. Scoring of the data was done following standard guidelines. Periodic limb movement during sleep was scored using American Academy of Sleep Medicine 2013 guidelines. Respiration related limb movements were not included in the study. For the sake of analysis, subjects with OSA were divided into three categories- mild, moderate and severe.

**Results:** Habitual snorers were younger (45.1±16 years) compared to patients with OSA (51±10.9years). Nearly three fourth of the subjects in both groups were males. Snorers and OSA groups were comparable with regards to proportion of sleep stages, yet OSA group has worse sleep efficiency (85% vs 93% in Snorers), higher arousal index (15.5 vs 4.8 in Snorers) and higher PLMS index (45.3 vs 20 in Snorers). Constitution of OSA group was as follows: 66 subjects had mild OSA, 55 moderately severe OSA and 138 severe OSA. These groups were different in terms of proportion of N2 stage of sleep, apnea-hypopnea index, mean SpO2, minimum SpO2 and desaturation index. Although, PLMS index was higher in moderately severe OSA groups, as compared to other two groups, it did not reach statistical significance.

**Conclusions:** Severity of chronic intermittent hypoxemia does not have any influence of periodic limb movements during sleep.
Introduction: Restless Legs Syndrome (RLS) is one of the most common neurological disorders. Adult prevalence of moderate to severe RLS in the European population is about 2.7%. The key characteristics, including severe sleep disturbance and restlessness in the evening and night, have substantial impact on normal daily activities. Given the high prevalence in the general population, the low awareness of the disease, and how RLS affects people’s lives, this study set out to evaluate the socio-economic impact of RLS across different EU healthcare systems.

Materials and methods: The RLS care pathway was mapped in order to identify the unmet needs of patients as well as the underlying causal factors. The authors describe the patient’s journey through the healthcare systems in three countries (DE, FR, IT) as well as the barriers to optimal treatment. Based on these data the cost of differences between adequate and inadequate treatment were calculated and the burden of the lack of awareness of RLS, inadequate diagnosis and treatment, as well as the resulting societal cost was unveiled.

Results: This analysis finds RLS to be a significant personal and social burden, the second most costly neurological disease in the healthcare systems analysed. The authors foresee substantial economic impacts well beyond what may be anticipated from current epidemiological figures in the literature when adequate diagnosis and treatment of RLS will be in place.

Conclusions: Education about RLS is urgently needed to increase expertise of healthcare professionals on how to diagnose and manage RLS. Equally important the search into the cause(s) of RLS and for new treatment strategies have to be intensified in order to reduce suffering and substantial societal cost.

Acknowledgements: This study was generously supported with grants from Vifor Pharma, UCB Biopharma SPRL, The European RLS study Group and the combined European RLS patient organizations of Europe.
Restless Legs Syndrome (RLS)
Poster 6

RESTLESS LEGS SYNDROME IN IRANIAN CHILDREN WITH MAJOR BETA THALASSEMIA

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Introduction: Major thalassemia is a chronic inherited and debilitating disease. Management of sleep-related disorders such as Restless Legs Syndrome (RLS) improves quality of life in these patients. The aim of this study was to assess prevalence and characteristics of RLS in children with major beta thalassemia.

Materials and methods: This case-control study was conducted on 39 children (< 18 years old) with major thalassemia and 39 healthy children in Qazvin, Iran during 2014-2015. Data were collected through validated questionnaire for diagnosis and scaling severity of RLS (by International Restless Legs Syndrome Study Group, IRLSSG) and Children’s sleep habits questionnaire. Data were analyzed using Independent student T-test, chi-square test, and Pearson’s correlation coefficient.

Results: Of 39 major thalassemia patients, 23 (58%) were girls and 19 (48%) were under 12 years old. RLS frequency was 36.8% in patients under 12 years old and 5.2% in the control group (P: 0.016). RLS was more frequent in girls under 12 years old (P: 0.01). RLS frequency was 38.4% in patients 12-18 years old and 25.6% in the control group (P> 0.05). Among 12-18 years old patients, RLS was significantly associated with body mass index and caffeine intake (P< 0.05). Daily performance and school performance in all major thalassemia children was significantly lower than the control group.

Conclusions: RLS was found to be more frequent in children with major thalassemia. RLS was associated with decreased daily and school performance. Diagnosis and management of RLS should be considered in children with major thalassemia.

Acknowledgements: The authors wish to thank the participants of the study and the staff of the Center for Clinical Research at Qazvin Children Hospital, affiliated to the Qazvin University of Medical Sciences.
Restless Legs Syndrome (RLS)
Board #084: P6 - Wednesday
SEVERE PERIODIC LIMB MOVEMENTS IN CIRRHOSIS OF THE LIVER

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Introduction: The study was initially intended to determine the prevalence and severity of central sleep apnea in patients with cirrhosis compared to heart failure patients counterparts.

Materials and methods: A prospective study of thirty eight consecutive ambulatory patients with stable end stage liver disease (13 patients) or severe heart failure with reduced ejection fraction (24 patients) underwent full night attended polysomnography to determine the prevalence and severity of central sleep apnea, a condition commonly found in heart failure patients. The etiologic mechanisms contributing to cirrhosis (10 patients were proven by biopsy) were viral in two patients and alcoholism in 11 patients. At the time of the study all patients had been abstinent for at least 3 months.

Results: Surprisingly, patients with cirrhosis did not have central sleep apnea but exhibited severe periodic limb movement during sleep (PLMS) with average index of 39 per hour of sleep compared to 13 in the congestive heart failure counterpart. The average associated arousal indices were 8 and 1 respectively. There was significant correlations between the severity of the PLMS and serum bilirubin (r=0.73, p=0.004) and blood ammonia level (r=0.74, p=0.017) both of which are neurotoxic. The level of creatinine, hemoglobin and ferritin were essentially normal and had no correlation with the PLMS severity.

Conclusions: A subset of patients with cirrhosis is known to develop hepatolenticular degeneration resulting in rigidity, dystonia and hypokinesia due to neurotoxicity of various chemicals that accumulate in the blood. It remains to be determined whether PLMS could be an early sign of Parkinsonian syndrome and whether early detection and treatment can have an impact on the outcome. A randomized clinical trial to treat PLMS in patients with cirrhosis might provide the answer to this hypothesis.
Introduction: Periodic limb movements during sleep (PLMS) are thought to occur both in primary and secondary forms associated with several medical disorders and medications. Their clinical significance is uncertain due to a poor correlation between the frequency of PLMS and markers of daytime sleepiness. In addition restless legs syndrome (RLS) may not always be present, making treatment decisions challenging. Recent studies have suggested PLMS may increase the risk of cardiovascular disease by means of nocturnal hypertension. This study aims to evaluate the aetiology of PLMS in subjects with PLMS index (PLMI) ≥15/hour, and the effects of PLMS on sleep architecture, markers of sleepiness and hypertension.

Materials and methods: We conducted a retrospective case note review of consecutive adults undergoing in-laboratory diagnostic polysomnography in a tertiary sleep laboratory. Subjects with less than 2 hours sleep or a RDI >5/hour were excluded. A PLMS cohort, defined as PLMI ≥15/hour, was compared to a randomly selected control cohort (PLMI ≤15/hour and RDI ≤ 5/hour). Subjects were characterised by the presence of known secondary causes of PLMS, physician diagnosed RLS and the presence of concurrent cardiovascular disease. Polysomnographic variables, Epworth Sleepiness Score (ESS) and blood pressure measurements were collected from the diagnostic sleep study.

Results: There was no difference between the PLMS cohort (n=65) and control cohort (n=66) regarding gender (PLMS 48% male vs control 36%, p=0.22). The PLMS cohort was older than the control cohort (all values displayed as: median (IQR)); (PLMS 43 years (32, 61) vs control 36 years (28, 47), p=0.02). As expected, the PLMI was higher in the PLMS cohort (PLMS 30.8/hour (21, 43) vs control 2.3/hour (0.6, 8.0), p=0.00), as was the PLMS arousal index (PLMS 6.6/hour (3.9, 9.2) vs control 0.8/hour (0.1, 1.8), p=0.00). There was no difference between cohorts with regards to ESS (PLMS 9 (5, 13) vs control 9 (5, 13), p=0.9); sleep efficiency % (PLMS 84% (77, 89) vs control 81% (74, 89), p=0.49) or WASO% (PLMS 13% (7, 20) vs control 16% (9, 23), p=0.16). There was a weak negative relationship between PLMI severity and sleep efficiency (r=-0.268, p=0.03), but no correlation with ESS. A recognised secondary cause was identified in 53% (n=35) of the PLMS cohort; 80% (n=28) of which included a PLMS associated medication. Physician diagnosed RLS was present in 15.4% (vs control cohort 4.5%, p=0.07). Significantly more subjects in the PLMS cohort were hypertensive on the day of polysomnography (defined as SBP>140mmHg & DBP >90mmHg) compared to the control cohort (n (%): PLMS 35 (53.8%) vs control 5(7.6%), p= 0.000).

Conclusions: A large proportion of the PLMS group had an identified secondary cause. The presence of PLMS did not impair sleep architecture nor contribute to daytime sleepiness as measured by ESS. PLMS appear to be associated with hypertension in our study, though age differences may be a confounding factor.

Acknowledgements: Dr Andrew Kyoong, Kate Galloway, Sarah McCormick, Sara Vogrin.
Introduction: An evening state of spinal hyperexcitability has been proposed to be a possible cause of evening increases in restless legs syndrome (RLS) symptoms however the aetiology is unknown. Spinal hyperexcitability, indicated by a positive Babinski sign (plantar reflex), may be caused by a loss in supraspinal inhibition. Thus the objective of the current study was to investigate, by assessing the plantar reflex, if there were diurnal changes in spinal excitability in RLS participants compared to healthy controls.

Materials and methods: Thirteen RLS participants and 13 healthy control participants’ plantar reflex responses were assessed electromyographically and kinematically in the evening (PM) and the morning (AM) using a specialised Babinski reflex hammer.

Results: RLS participants showed a circadian variation in plantar reflex responses whilst control participants did not. RLS participants evening ankle angle changes were larger (median PM: 7.91°; AM: 6.79°, p=0.03) and faster (median PM: 2.40°/s; AM: 2.14°/s, p=0.00) compared to morning responses. In addition RLS participants displayed significantly smaller changes in ankle angle (median PM RLS: 7.91°, control: 25.66°, p=0.04; AM RLS: 6.79°, control: 20.96°, p=0.02) and significantly slower ankle movements (median PM RLS: 2.40°/s, control: 6.68°/s, p=0.04; AM RLS: 2.14°/s, control: 6.42°/s, p=0.01) in the evening and the morning as well as significantly lower lateral gastrocnemius maximum amplitude in the morning (median AM RLS: 0.03mV, control: 0.08mV, p=0.04) compared to control participants.

Conclusions: The current study supports the theory of RLS circadian fluctuations in spinal excitability. An unexpected finding was decreased plantar reflex responses in RLS participants compared to healthy control participants. However this finding does support the theory of mechanical hypoesthesia in RLS patients.
**Restless Legs Syndrome (RLS)**
**Board #068: P2 - Monday**

**PREVALENCE AND IMPACT OF RESTLESS LEGS SYNDROME IN EPILEPSY**

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**Introduction:** Restless legs syndrome (RLS) is a frequent sleep disturbing entity in general population. Sleep is a key factor for management of patients with epilepsy (PWE). Coincidence of sleep disorders with epilepsy could counter effective management and control of seizures. Our aim was to investigate the prevalence and impact of RLS in epilepsy.

**Materials and methods:** Patients with proven epilepsy diagnosis were invited to participate in this study. A control group of subjectively healthy subjects with no history of epilepsy was also included. PWE underwent a thorough sleep interview to reveal sleep symptoms, important epilepsy variables were obtained. RLS was diagnosed based on 4 clinical diagnostic criteria proposed by IRLSSG. In some PWE one night of polysomnography (PSG) combined with full electroencephalography (EEG) montage was obtained. PSG was scored according to recommended standards (AASM scoring manual v.2.0) of which periodic limb movements in sleep (PLMS) index (PLMSI) was obtained. Hamilton’s depression (HAMD) and anxiety (HAMA) rating scales were used for psychoemotional assessment. T-test, Chi-square and Spearman’s correlation tests were utilized for statistical analysis.

**Results:** Overall, 165 PWE were enrolled in this analysis, F-47.9%, mean age - 35.5 years. Control group (CG) profile: n=100, F-61%, mean age - 33.7 years. In Epilepsy group (EG) we found prevalence of RLS at 20.6% (34), while in CG RLS was found in 8% (8) (p< 0.01). 81 PWE underwent PSG-EEG studies. On PSG 23.5% of PWE had PLMSI 5/h and more, and 14.8% had PLMSI 15/h and more. Nocturnal seizures (NS) were reported by 59.5% of PWE. NS were higher in number in RLS, compared to non-RLS subgroups of EG: 69.7% vs. 56.8% (p>0.05). There was a significant positive correlation between RLS and awakening before nocturnal seizure, with Spearman’s r=0.26 (p< 0.01), and also for PLMSI>=5/h and PLMSI>=15/h we found r=0.385 (p< 0.01) and r=0.297 (p< 0.05) respectively. We did not find any association between seizure frequency and occurrence of RLS per recent month (4.13 in non-RLS vs. 2.06 seizures in RLS) or year (40.7 vs. 22.2) (p>0.05). In EG, PWE with RLS had higher HAMA (60.6% vs. 28.3%) and HAMD (51.5% vs. 26.8%) scores (p< 0.01).

**Conclusions:** RLS is significantly more prevalent in epilepsy patients than healthy individuals. Interestingly, PWE with RLS and also PLMS were more prone to wake before nocturnal seizures than non-RLS/PLMS PWE. Nocturnal seizures although not significant were reported more frequently in PWE and RLS. It seems that presence of RLS does not influence seizure frequency both per recent year and month. PWE and RLS had significantly higher chances to have clinically important anxiety and depression levels. To the best of our knowledge this is the first study to correlate RLS and epilepsy bringing together clinical parameters of both conditions and PSG data.
Restless Legs Syndrome (RLS)
Board #085: P6 - Wednesday
FREQUENCY OF RESTLESS LEG SYNDROME (RLS) IN PARKINSON’S DISEASE - EXPERIENCE FROM AN INDIAN TERTIARY TEACHING HOSPITAL

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Background: Prevalence estimates of RLS in PD have reported to range between 7 to 19.5% in various studies. Although NMS occurs throughout the course of the disease, its correlation for the assessment of RBD and RLS is poorly studied. The present study aims to find the occurrence and frequency RLS in Parkinson’s Disease (PD) and to correlate it with severity of disease and NMS symptoms.

Materials and methods: This study is a hospital based study conducted on PD patients attending the Movement Disorder Clinic in our hospital. PD was confirmed according to United Kingdom Parkinson’s Disease Society Brain Bank Diagnostic Criteria. Patients in all age groups are included for the study (drug naïve and on medication). Drug induced PD and patients with H/O drug intake of antipsychotic medications were excluded. Hoehn & Yahr Scale (H&Y) was used for disease staging and Movement Disorders Society Sponsored Revision Of The Unified Parkinson's Disease Rating Scale (MDS-UPDRS) was used to determine the clinical severity after passing the certified course of MDS-UPDRS as per the rules of MDS. Following which all the patients are being assessed based on REM Sleep Behaviour Disorder Screening Questionnaire (RBDSQ) and Restless Leg Syndrome Rating Scale.

Results: A total of 150 PD patients were analysed using various motor and non-motor scales. The occurrence of RLS was 21.33%. These symptoms when correlated with motor and non-motor symptoms had significant correlation(r=0.496, p=0.001).

Conclusion: This present study attempts to bring out the significance of early detection of RLS in Parkinson’s disease and its importance towards the management of the disease.
ASSOCIATION OF BTBD9 AND MAP2K5/SKOR1 WITH RESTLESS LEGS SYNDROME IN CHINESE POPULATION

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Introduction: Genetic factors play an important role in the pathogenesis of RLS. Linkage studies identified eight suspected genetic loci accounting for RLS. In addition, genome wide association study (GWAS) showed that several single nucleotide polymorphisms (SNPs) were associated with the risk of RLS, including MEIS1, BTBD9, PTPRD, MAP2K5, TOX3, and Intergenic region of 2p14. A low prevalence of RLS is reported in Asian countries in comparison to Caucasian population, suggesting different racial factors in RLS.18-24 Three studies from Asian population (Korean and Taiwan of China) confirmed the association of BTBD9, MEIS1 and PTPRD with RLS in Asian population.17,25,26 However, two studies from Taiwan of China only focused on certain types of RLS patients, for example, RLS with migraine or renal dysfunction associated RLS. It remains unknown whether the genetic risk factors of all primary RLS are the same as certain types of RLS. Thus, in this study, we selected 20 SNPs within the above six suspected RLS risk genetic loci (MEIS1, BTBD9, PTPRD, MAP2K5/SKOR1, TOX3, and Intergenic region of 2p14) to further test the relationship of these genetic risk factors with primary RLS in Chinese population.

Materials and methods: A total of 116 RLS patients and 200 controls were recruited and the diagnosis of RLS was based on the criteria of International RLS Study Group. Polymer chain reaction (PCR) and sequencing were used to detect 19 single nucleotide polymorphisms (SNPs) in six genetic loci (MEIS1, BTBD9, PTPRD, MAP2K5/SKOR1, TOX3, and Intergenic region of 2p14).

Results: Our study found that one SNP increased the risk of RLS in Chinese population: rs6494696 of MAP2K5/SKOR1 (odds ratio [OR] = 0.09, p < .0001, recessive model). A further meta-analysis of RLS in Asian population found that two SNPs of BTBD9 increased the risk of RLS: rs9296249 of BTBD9 (OR = 1.44, p = .000, T allele), rs9357271 of BTBD9 (OR = 1.38, p = .021, dominant model).

Conclusions: Our results suggested that BTBD9 and MAP2K5/SKOR1 are associated with RLS in Asian population. Unfortunately, we did not replicate the association of MEIS1, PTPRD, TOX3/BC034767 and Intergenic region of 2p14 with RLS. Heterogeneity of ethnic origin and small sample size might account for the differences of our results with others. More large RLS cohorts are needed to explore the genetic risk factors for RLS in Asian population in the future.

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Restless Legs Syndrome (RLS) 
Board #069: P2 - Monday

PROSPECTIVE STUDY OF RLS IN BLOOD DONORS. A REAPPRAISAL

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Introduction: Blood donations have been associated with Restless Legs Syndrome (RLS) in the literature. However, in a previous study for the identification of RLS in blood donors a significant association of RLS symptoms and ferritin serum levels was not found (*). In this prospective study, the new fifth IRLSSG criteria, the urge to move the legs, has been included, to assess all clinical symptoms in this population.

Materials and methods: Participants of the previous study were contacted by phone, and an interview including anthropometric measurements was performed. For the assessment of RLS we asked five questions RLS-related symptoms 1) Do you have uncomfortable or unpleasant sensations in the legs such as laying down or sitting? 2) Does movement such as walking or stretching relieve the unpleasant sensations in the legs partially or totally? 3) These unpleasant sensations during rest or inactivity only occur or are worse in the evening or night? 4) Do you feel an urge to move the legs when lying down or sitting? 5) Do the unpleasant sensations prevent you from sleeping?

Results: Currently we have recruited 86 of the initial 179 blood donors. Forty six women (53.5%), and 40 men (46.5%); mean age: 47.36 +/- 10.96 years and mean BMI: 26.68 +/- 4.85 Kg/m². Thirty-five participants (40.7%) remain regular blood donors (≥2 donations/year), 22 (25.6%) are sporadic donors (<2 donations/year), and 29 (33.7%) withdrew blood donations. Seventeen participants (19.8%) had at least one positive answer in the RLS questionnaire [1 (1.2%) 1 positive answer, 1 (1.2%) 2 positive answers, 2 (2.3%) 3 positive answers, 13 (15.1%) 4 positive answers]. The first question had the highest number of positive answers, 16 (18.6%), followed by question number four, with 15 positive answers (17.4%). Positive answers for questions one and two were more frequent and statistically significant in women compared with men [11 female (68.8%) vs 5 male (31.3%) (p=0.048)] as well as question three [10 female (71.4%) vs 4 male (28.6%) (p=0.041)]. We did not find any gender differences for question number four [9 positive answers in women (60%) and 6 men (40%) (p=0.2)].

Among those seventeen participants with at least one positive answer, 9 (52.9%) answered positively to the last question, showing the clinical impact of RLS symptoms. No association between blood donation, neither regular (p=0.3) nor sporadic (p=0.9), and the number of RLS symptoms was found in our series.

Conclusions: The preliminary results of the updated prospective study did not show any association between blood donations and the presence of RLS symptoms. Women had more unpleasant sensations relieved by movement and worsened by rest. Nevertheless, there were no gender differences in the urge to move the legs during rest.

Acknowledgements: Thanks to all participants, and the Blood Donation Unit of Gregorio Marañón University Hospital.

Restless Legs Syndrome (RLS)
Board #086: P6 - Wednesday

RESTLESS LEGS SYNDROME / WILLIS EKБOM DISEASE IN BARIATRIC SURGERY PATIENTS

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Introduction: Iron deficiency occurs in approximately 51% of patients following bariatric surgery. Iron deficiency is a risk factor for restless legs syndrome/Willis Ekбom Disease (RLS/WED); yet this disease has not been systematically studied in the bariatric surgery population. Our objectives were to prospectively analyze presence and severity level of RLS/WED in patients before and after undergoing bariatric surgery for weight loss.

Materials and methods: Consecutive adult patients scheduled for bariatric surgery for the treatment of obesity between October 2014 and February 2016 were enrolled. Subjects completed validated questionnaires to assess presence and severity of RLS/WED (Cambridge-Hopkins Questionnaire 13 and International Restless Legs Syndrome Study Group Rating Scale (IRLS)) during baseline and follow-up visits.

Results: In 121 total subjects, 81% were females. Mean body mass index was 45.8 (SD +/- 7.7). Baseline RLS/WED was present in 21.5% (26/121) of patients with a mean IRLS score of 15.7 (SD +/- 8.8).

Three months following surgery, an additional 16.8% of subjects who presented for follow-up had developed RLS/WED (16/95); at 6 months an additional 13.2% (7/53); and at 12 months an additional 13% (6/46) had developed RLS/WED.

Pre-surgical hemoglobin was below 12.0 g/dL in 6.2% (7/113). At baseline, 33% (40/121) of subjects were on a proton pump inhibitor and 41.3% (50/121) were on an antidepressant. Sleep studies were performed in 53% of patients (64/121) and 91.1% were diagnosed with obstructive sleep apnea. Of the 43 subjects who underwent in-lab polysomnography, mean periodic limb movement index was 19.4/h (SD +/- 33.8).

Conclusions: Bariatric surgery patients may be at higher risk for RLS/WED than the general population and their disease may be unrecognized. Long-term follow-up to identify new or worsening cases will be important, particularly given high risk for iron deficiency in this population. Routine screening for RLS/WED should be considered in bariatric surgery patients.
Restless Legs Syndrome (RLS)
O22: Restless legs syndrome (RLS/WED) and movement disorders oral abstract presentations

EXECUTIVE AND VISUOSPATIAL DYSFUNCTION IN PRIMARY RESTLESS LEGS SYNDROME IN SOUTHERN CHINESE

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Introduction: Some epidemiological studies supported that RLS was associated with cognitive deficits while some did not. The association of cognitive dysfunction with RLS was suggested as partly due to insomnia or depression which was commonly seen in RLS. In addition, RLS is sometimes presented as one symptom of neurodegenerative diseases (e.g. Parkinson’s disease, Alzheimer’s disease, etc) which develop cognitive impairment to some degree during the disease course. The association of sleep disorders (RLS or REM sleep behavior disorder) with poor cognitive function in neurodegenerative diseases is supported by some studies, but not all. So it is important to investigate whether RLS is associated with cognitive dysfunction and which cognitive profile is mostly affected. Therefore, we conducted a case control study to investigate the cognitive function in RLS patients.

Materials and methods: A total of 40 RLS patients and 40 controls, matched with age, sex and educational level, were evaluated by detailed cognitive function assessments, including Chinese version of mini-mental status examination (MMSE-C), clock drawing test (CDT), Auditory Verbal Learning test (AVLT), Rey-Osterrieth Complex Figure (CFT) and Stroop Color Word Test (SCWT).

Results: There were statistical differences of time completing Card C and Interference Index of Stroop Test and CFT (Card C time: 102.36±17.12 vs. 87.08±7.73, p=0.032; Interference Index: 3.39±0.38 vs. 2.90±0.15, p<0.0001; CFT: 24.05±9.28 vs. 33.74±1.59, p=0.005). Statistical differences were also found in CDT (3-score method: 2.07±0.80 vs. 2.90±0.38, p=0.005; 5-score method: 3.36±1.46 vs. 4.85±0.53, p=0.004; 16-score method: 10.13±3.94 vs. 13.98±1.79, p=0.003; 30-score method: 17.54±8.75 vs. 26.20±3.98, p=0.0032).

Conclusions: Our study found disturbed cognitive function involving executive and visuospatial domains in Chinese primary RLS which appeal more investigation to reveal possible mechanism underlying this phenomenon. Statement of Significance: It is controversial about the relationship between RLS and cognitive dysfunction. This is the first study to investigate cognitive dysfunction of primary RLS in Chinese population. In this 1:1 matched case-control study, we demonstrated that executive and visuospatial functions were disturbed in Chinese primary RLS.

Acknowledgements: None
Restless Legs Syndrome (RLS)  
Board #070: P2 - Monday  
RESPIRATORY-RELATED LEG MOVEMENTS ARE ASSOCIATED WITH SEROTONERGIC ANTIDEPRESSANTS BUT NOT BUPROPION  

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Introduction: Respiratory-related leg movements (RRLMs) are contractions of the anterior tibialis occurring at the termination of respiratory events. Respiratory events terminating with such a leg movement produce larger heart rate increases than events without a leg movement, suggesting that RRLMs may potentially be a marker for the increased cardiovascular risk associated with obstructive sleep apnea (OSA). Selective serotonin reuptake inhibitors (SSRIs) and venlafaxine, but not bupropion, increase the risk for periodic limb movements of sleep (PLMS). However, it is not known whether a similar effect occurs with RRLMs, as scoring guidelines specifically exclude RRLMs from the scoring of PLMS.

Materials and methods: Patients were selected from a database of over 5000 questionnaires completed prior to overnight polysomnographic studies at Massachusetts General Hospital between 2011 and 2014. Those taking only bupropion without other antidepressants, who had completed either a full-night diagnostic study or split-night study with apnea-hypopnea index of at least 10 events per hour (n=32), were identified first (due to the relatively low number of patients meeting these criteria). Patients taking SSRIs without other antidepressants (n=31) and controls not taking any antidepressants (n=31) were then matched to the bupropion group based on the type of study, concurrent psychotropic medications (specifically benzodiazepines, anticonvulsants, and antipsychotics), age, and gender. Patients were excluded who underwent full-night CPAP titrations, were using more than one antidepressant (including sleep medications such as trazodone or doxepin), or were using a dopamine agonist medication. There were no significant differences between groups for self-reported medical conditions predisposing to PLMs, such as kidney disease and seizures. RRLMs were scored according to World Association of Sleep Medicine (WASM) 2016 standards for recording and scoring leg movements in polysomnograms, which recommends scoring movements occurring within 2 seconds before to 10.25 seconds after the termination of a respiratory event. PLMs were scored by sleep technicians and rescoring as needed during the scoring of RRLMs. Variables including subject characteristics, number of PLMs, and number of RRLMs were compared using Student t tests and analysis of covariance.

Results: Patients using SSRIs had significantly greater PLM and RRLM indices than controls (p=0.003 and p=0.005, respectively) or patients using bupropion (p=0.01 and p=0.02, respectively). However, for RRLMs this difference was limited to participants who underwent split-night studies and not in those with full-night diagnostic studies. The total RRLM index correlated with total AHI (r=0.667), arousal index (r=0.716), and PLM index (r=0.544). Regression analysis did not show an effect of medication use, age, gender, or sleep stage on RRLM.

Conclusions: The greater number of RRLMs and PLMs in the SSRI group may contribute to treatment-emergent sleep disruption often seen with SSRI use. Fragmented sleep and elevated autonomic nervous system activation associated with increased RRLMs in OSA patients taking SSRIs might also limit the tolerability and effectiveness of antidepressant treatment, as well as increase the risk for cardiovascular disease. Bupropion may thus be a more optimal antidepressant option in those patients who are treated for OSA with positive airway pressure therapy.
Restless Legs Syndrome (RLS)
O22: Restless legs syndrome (RLS/WED) and movement disorders oral abstract presentations
SLEEP AND RESTLESS LEGS SYNDROME IN ADOLESCENTS WITH IDIOPATHIC MUSCULOSKELETAL PAIN

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Introduction: Idiopathic musculoskeletal pain (IMP) affects children and adolescents and has a negative impact on quality of life. Sleep problems and psychosocial aspects appear to be involved in the etiopathogenesis of IMP, though this association is not fully established. Restless legs syndrome (RLS), periodic limb movements (PLM), and various sleep problems have been reported in adults with chronic musculoskeletal pain. However, there are still no reports in children and adolescents with IMP. The objective of this study was to assess the presence of RLS, PLM and sleep disorders in female adolescents with IMP through a specific questionnaire and polysomnography (PSG), and to compare these data in health adolescents without pain history.

Materials and methods: Twenty-six adolescents diagnosed with IMP followed in a pain outpatient clinic of a tertiary hospital and 25 healthy controls matched by age and level of education were evaluated. We collected demographic and socioeconomic data, evaluated the RLS criteria according to the International Restless Legs Syndrome Study Group (IRLSSG), fill in the Sleep Disturbance Scale for Children (SDSC), and performed nocturnal PSG. Comparison between groups were performed using Student’s t-test or Mann-Whitney U test (P<0.05).

Results: The mean age of IMP adolescents was 13.9 ± 1.6 years; and controls was 14.4 ± 1.4 years. One adolescent in the control group (4%) and nine patients with IMP (34.6%) presented criteria for RLS (p = 0.011). There was no difference in family history of RLS between groups. There wasn’t any significant differences in SDSC scores between groups in all components: disorders of initiating and maintain sleep (p = 0.290), sleep breathing disorders (p = 0.576), disorders of arousal (p = 0.162), sleep-wake transition disorders (p = 0.258), disorder of excessive daytime somnolence (p = 0.594), and sleep hyperhidrosis (p = 0.797). The neurophysiologic, respiratory and PLM parameters were similar between both groups. Three adolescents with IMP (11.5%) presented RLS and PLM simultaneously, which was not observed in the controls.

Conclusions: Female adolescents with IMP present criteria for RLS more frequently than healthy adolescents. There were no differences in sleep disorders according to the questionnaire and the PSG.

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Restless Legs Syndrome (RLS) oral abstract presentations

POLYSOMNOGRAPHIC FINDINGS IN RESTLESS LEGS SYNDROME (RLS) PATIENTS WITH SEVERE AUGMENTATION

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Introduction: An increasing number of RLS patients with severe augmentation due to dopaminergic therapy are currently reported in Germany. With L-DOPA 68% of RLS patients may develop augmentation depending on dosage and the duration of the studies. Polysomnographic (PSG) data of augmented RLS patients are scarce.

Aim of the study: In this context, we aimed to present the PSG characteristics of patients with severe augmentation.

Methods: We enrolled in the study consecutive RLS patients who presented clinically relevant augmentation and underwent a PSG examination in the acute phase. Demographical and clinical data together with the administered medication the day before the PSG examination was collected. All patients underwent one night video-polysomnography. Patients with a sleep efficiency of <30% were excluded from the study due to invalid data.

Results: 91 consecutive inpatients of the Paracelsus-Elena Hospital fulfilling inclusion criteria were included in the study: 42 women (46.15%) and 49 men (53.85%) with a mean age of 62.49 ± 12.99 years. The severity of RLS on the IRLS was 31.6 ± 4.8. The PSG investigation revealed a reduced sleep efficiency of 70.77 ± 13.99%, a prolonged sleep latency of 27.75 ± 32.09 min and a reduced amount of slow wave sleep of 9.63 ± 10.9%. The periodic limb movements index (total PLMI) was high with 53.04 ± 42.21, for wakefulness (PLMW): 91.23 ± 59.98, vs sleep (PLMS): 37.38 ± 53.49. During PSG 76 (84.44%) patients were still under dopaminergic medication.

Conclusions: This study objectively showed the markedly reduced quality of sleep in RLS patients with severe augmentation and the increased number of leg movements, although medication was not withdrawn at the night of PSG. Dopaminergic medication seems to increase PLM and restlessness during augmentation.
Restless Legs Syndrome (RLS)
Board #071: P2 - Monday
SERUM FROM PATIENTS WITH RESTLESS LEGS SYNDROME AFFECTS LEG MUSCLE ACTIVITY IN BTBD9 KNOCKOUT MICE

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Introduction: A certain number of patients with idiopathic restless legs syndrome (RLS) have a genetic basis, and variants in Btbd9 are known to confer a significant risk of RLS. RLS is also more frequently experienced by hemodialysis patients compared with the normal population. However, little is known about how Btbd9 and hemodialysis could potentially be related to the pathophysiology of RLS. We investigated leg muscle activity of Btbd9 knockout (KO) mice during sleep after the administration of serum from idiopathic or renal RLS patient to investigate whether some uremic substances and Btbd9 would relate with pathogenic mechanism of RLS symptoms. In addition, we evaluated the efficacy of rotigotine, a dopaminergic D1- and D2-like receptors agonist, against the RLS symptoms in these mice.

Materials and methods: Seven-month-old male Btbd9 knockout (KO) mice and their wild-type littermates (WT) were used in this study. Electroencephalogram (EEG) and electromyogram (EMG) electrodes were implanted in the skull and gastrocnemius muscle in both legs, respectively. Human serum from healthy subject, idiopathic RLS patient, and patient with RLS secondary to end-stage renal disease was respectively mixed with the same volume, and these were intraperitoneally administrated into mice. After 4 hours of monitoring period, rotigotine (1 and 3 mg/kg) was subcutaneously injected into mice. Sleep data were captured and analyzed after these treatments.

Results: At baseline, KO mice showed an increased leg muscle activity during NREM sleep compared with WT mice, while leg muscle activity during wakefulness were similar in the two genotypes. With regard to the leg movement after human serum injection, serum from healthy subject did not affect leg muscle activity during NREM sleep in both WT and KO mice. Leg muscle activity during NREM sleep was increased in KO mice injected with serum from RLS patients with or without dialysis. Rotigotine treatment ameliorated this symptom.

Conclusions: These results strongly support the reports published previously which showed Btbd9 and dopaminergic system are linked to RLS. In addition, our results suggest that serum of patients with both idiopathic and renal RLS may contain any substances which lead to increase muscle activity other than uremic substances.
Restless Legs Syndrome (RLS)
Board #087: P6 - Wednesday

THE UNDERESTIMATED IMPACT OF NOCTURNAL LIMB MOVEMENTS. ISOLATED PLMD AND COMORBID RLS CAN PRESENT WITH SIMILARLY DECREASED SLEEP DEPTH AND ALTERED SLEEP EFFICIENCY

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Introduction: Both Restless Leg Syndrome (RLS) and Periodic Limb Movements in Sleep (PLMS) may contribute to non-restorative sleep and interfere on several levels with wake state and daytime functioning. If concurrent RLS, further impacts sleep architecture or worsens PLMS patients' daytime condition in general, does not seem to be unequivocally elucidated.

Methods: Polysomnography and structured daytime symptom assessments of 47 drug-free PLMS patients, allocated to isolated PLM disorder (PLMD) or co-morbid RLS subgroups respectively, were compared to 19 healthy good sleeper controls. Correlations between sleep quality (PSQI), fatigue (FSS), sleepiness (ESS), mood (HADRS) and sleep variables were explored descriptively.

Results: Although co-morbid patients showed worsened sleep quality, both patient groups showed similar sleepiness and affective symptoms. While significantly differing from controls, patients presented similarly increased light sleep (p=0.009), decreased slow-wave sleep (p=0.003) and lowered sleep efficiency (p=0.029). Altered sleep quality, fatigue and sleepiness were significantly correlated to decreased slow-wave sleep (all p<0.005) and sleep fragmentation (all p<0.005). Affective symptoms, fatigue and perceived sleep quality also correlated to PLM index (all p<0.005).

Conclusions: Sleep structure and efficiency were similarly impacted in isolated PLMD and in co-morbid RLS. RLS mainly worsened subjective sleep quality. Assumed that systematic treatment for isolated PLMD is currently not recommended, such results may question whether no or different-from-RLS treatment strategies are always compatible with optimal care in somnology.
Restless Legs Syndrome (RLS)
O10: Restless legs syndrome (RLS/WED) oral abstract presentations

USING THE BEHAVIORS INDICATORS TEST-RESTLESS LEGS (BIT-RL) TO DIAGNOSE
RESTLESS LEGS SYNDROME (RLS) IN ALZHEIMER’S PATIENTS WITH DEMENTIA AND
NOCTURNAL AGITATED BEHAVIORS (ADNA)

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Introduction: Objectives: In the nursing home environment evaluate use of the BIT-RL and determine
occurrence of RLS in Alzheimer Patients with nocturnal agitation (ADNA).

Background: RLS prevalence increases with age and lower iron status both characteristics of nursing home
patients with Alzheimer’s dementia. RLS prevalence estimates in this population range from 5 - 20% and
possibly higher for those with the diurnal pattern of increased nocturnal agitation that may be largely driven by
the circadian increase in RLS symptoms in the evening. RLS as a primarily sensory disorder requires subjective
report of symptoms for diagnosis, difficult for normal adults and not possible for significantly demented. Thus we
have ADNA patients driven to agitated behaviors by the RLS urge to move but not being able to describe this,
thus not receiving potentially effective treatment. The BIT-RL was developed to provide a behavioral observation
test serving to diagnosis RLS. It was well validated in older, non-demented patients. The challenge now is to
train staff and use this in nursing homes to identify ADNA patients and then explore efficacy of RLS treatments in
this population.

Materials and methods: In 10 nursing homes in Texas residents identified as having nocturnal agitated
behavior are evaluated using the BIT-RL. Identified nursing staff were trained in using the BIT-RL with results
compared to experts with this technique (e.g. Dr. Richards). The residents included in the study must have a
diagnosis of Alzheimer’s Disease, a family consent for participation and documentation of the nocturnal agitation
using the 29-item Cohen Mansfield Agitation Inventory (CMAI) modified for direct nighttime observation.
The BIT-RL has 2 parts: behavior indicators -direct observations for RLS behaviors (kicking, rubbing legs) and
clinical indicators - medical history or family informant interview, caregiver interviews and an interview as much
as possible with the ADNA patient.
The time for observation of each patient is determined from nursing records and interview with the nurses
indicating the time when most agitated behaviors occur between 6PM and usual bedtime. The Behavioral
Indicators data are obtained from planned 20 minutes of continuous observation of the subject at the determined
critical time.
All ADNA included in the study will be randomized to 8 weeks of treatment either with gabapentin enacarbil or
placebo. They will have the modified CMAI before treatment and again after treatment.

Results: This is the initial phase of a four-year study. About one ADNA patient a week has been entered into the
study since the last part of June. The number of ADNA diagnosed with RLS and the BIT-RL scores will be
reviewed for the 15 participants expected to have entered into the study by 30 Sept 2017. The staff training and
reliability have been established and this approach has been accepted in every one of the nursing homes without
objection documenting this process is practical for the nursing homes.

Conclusions: The BIT-RL can be successfully included with training as part of routine nursing staff operation to
diagnose RLS in patients with Alzheimer’s dementia and nocturnal agitation.
**Restless Legs Syndrome (RLS)**

**Board #072: P2 - Monday**

**RESTLESS LEG SYNDROME IN PATIENTS WITH CHRONIC KIDNEY DISEASE ON HEMODIALYSIS - DOES PERIPHERAL IRON STATUS MATTER?**

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**Introduction:** Restless leg syndrome (RLS) is a sensorimotor condition with symptoms comprising of an urge to move the legs which is usually but not always accompanied by uncomfortable and unpleasant sensations in the legs. The restlessness occurs or worsens at rest, in the evening or night than during the day and is relieved by activity. Sleep disorders such as sleep apnea, restless legs syndrome and periodic limb movement are frequent in chronic kidney disease (CKD). Among them, restless legs syndrome may affect up to 4.5% of patients not on dialysis and 20.3% in patients on hemodialysis. This study was done to estimate prevalence of RLS among patients with CKD on hemodialysis and to correlate the presence of RLS with peripheral iron status.

**Materials and methods:** Adults diagnosed with CKD and on hemodialysis were studied. Subjects with medical conditions leading to disturbed sleep at night such as congestive cardiac failure and asthma and confounders of RLS (peripheral neuropathy, leg edema) were excluded. Demographic details, co-morbid illness, the number of years diagnosed with CKD and on dialysis were noted. RLS was diagnosed based on five criteria given by the international RLS study group (IRLSSG). Severity of RLS was assessed by IRLS severity score. The presence of RLS was correlated with peripheral iron status.

**Results:** Mean age of 116 subjects was 50.7 ± 13.6 years. Seventy-nine (68.1%) were men. Mean BMI of the subjects was 22.02 ± 3.5 kg/m2. The subjects had CKD for a mean duration of 3.5 ± 3.2 years and were dialyzed for 2.5 ± 2.3 years.

Prevalence of RLS was 10.3% (12/116). Five subjects each had mild and moderate RLS by IRLS severity score and two had severe RLS. All 12 RLS patients were hypertensive. The characteristics of patients diagnosed with RLS were compared with those who were negative for RLS symptoms (control group). The distribution of socioeconomic status, BMI, smoking and alcohol use, comorbid conditions such as diabetes and hypertension were similar in the two groups. Though the number of hours of sleep was less in the RLS positive group it was not statistically significant (5.8 Vs 6.4 hours). Hemoglobin (9.5±1.5 Vs 8.6±1.6 gm/dl; p value= 0.06) and serum ferritin [874±640 Vs 496.2±502 ng/mL(p value 0.018)] were higher in RLS patients as compared to RLS negative CKD patients.

**Conclusions:** Prevalence of RLS in CKD patients was 10.3%. RLS was previously undiagnosed in this population. There is a fundamental misunderstanding about the relation of peripheral iron status and RLS. Normal peripheral iron levels do not indicate RLS in this CKD population which is probably related to abnormal brain iron status. Peripheral iron measures are of questionable validity to correlate RLS in patients on hemodialysis. Measures to early diagnosis and prompt treatment should be taken, as RLS is known to cause impairment of daytime functioning, disturbed sleep and increased mortality.
Restless Legs Syndrome (RLS)
Board #088: P6 - Wednesday
PARAMETERS OF IRON METABOLISM DO NOT PREDICT RESULTS OF RLS TREATMENT

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Introduction: A relation between RLS and iron deficiency is well established and iron supplementation has its place in therapeutic armamentarium. This relation is rather of causal nature with RLS being triggered by peripheral and/or central iron deficiency. The relation between iron metabolism and the course of RLS is not that clear. The aim of this study was to verify if any of peripheral parameters of iron metabolism predict clinical outcome of RLS treatment.

Materials and methods: It was a retrospective study. From a population of RLS outpatient department a subpopulation was selected, fulfilling following criteria:
1) non-iron deficient;
2) wide iron metabolism screening performed before initiation of treatment;
3) treatment with the same drug and the same daily dose (ropinirole, 2 mg),
4) at least 3 months observation after initiation of therapy.

Screening of iron metabolism included measurement of serum iron, ferritine, transferrin and soluble transferin receptor. Those measurements were then compared with initial RLS severity (measured with IRLS) and with improvement in IRLS after 3 months.

Results: There were 48 patients included in the study (mean age: 66.4; 8 men). Initial mean IRLS score was 21.5 points and mean improvement was 12.4 points. None of the iron metabolism parameters was correlated with the initial IRLS and its improvement. Values of iron parameters did not differ between subjects with mild-moderate and severe- very severe RLS. No difference was found between responders (improved by more than 50% in IRLS) and non-responders.

Conclusions: Peripheral iron metabolism assessment is valuable in terms of detecting iron-deficient subjects with RLS but it does not help in predicting the clinical outcome of the patients.

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Introduction: Periodic limb movements in sleep (PLMS) is a frequent condition, which is strongly associated with restless legs syndrome (RLS). However, PLMS has been scarcely assessed in the general population. Our aim was to measure the prevalence and factors associated with PLMS in two independent German population-based studies.

Materials and methods: Data were analysed from 1107 subjects (mean ± SD age: 52.9 ± 13.9 years, 54.1% men) in the SHIP-Trend study (Greifswald, Germany) and 248 participants (mean ± SD age: 57.5 ± 7.9 years, 50.4% men) from the BiDirect study (Münster, Germany) recruited from the general population. The study protocol included assessment of socio-demographic data, medical history, mental health, cardiovascular profile, and current medication. The PLMS-index (PLMI) was determined based on a single-night polysomnography in a sleep laboratory according to the AASM criteria.

Results: The median PLMSI was 6.3/h and 5.1/h in SHIP-Trend and in BiDirect, respectively. The prevalence of PLMSI > 15/h was 35.6% in SHIP-Trend and 36.8% in BiDirect. In multivariate models, age (OR = 1.05, 95% CI: 1.03 - 1.06, p < 0.001), male gender (OR = 2.22, 95% CI: 1.62 - 3.05, p < 0.001), RLS (OR = 2.30, 95% CI: 1.61 - 3.28, p < 0.001), physical inactivity (OR = 1.50, 95% CI: 1.10 - 2.05, p = 0.01), current smoking (OR = 1.54, 95% CI: 1.02 - 2.33, p = 0.04), antidepressant use (OR = 2.14, 95% CI: 1.15 - 4.00, p = 0.02), and diabetes (OR = 2.31, 95% CI: 1.49 - 3.58, p < 0.001) were significantly associated with PLMSI > 15/h in SHIP-Trend. In BiDirect, age (OR = 1.13, 95% CI: 1.08 - 1.18, p < 0.001), RLS (OR = 8.16, 95% CI: 1.99 - 33.55, p < 0.01), and BMI (OR = 1.11, 95% CI: 1.03 - 1.20, p < 0.01) were significantly related to PLMSI > 15/h. Even though hypertension, myocardial infarct, stroke, and lower glomerular filtration rate were more common in subjects with PLMSI > 15/h, these factors were not independent correlates of high PLMSI.

Conclusions: Clinically relevant PLMS is a frequent condition in the German population, especially among the elderly. Age, male gender, RLS, diabetes, antidepressant use, and higher BMI were independently associated with high PLMI in at least one of the two studies.
Restless Legs Syndrome (RLS)
Board #074: P2 - Monday
AUGMENTATION AND RISK FACTORS WITH LONG-TERM FOLLOW UP IN JAPANESE PATIENTS WITH RESTLESS LEGS SYNDROME

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Introduction: One of the most common and serious complication of dopaminergic treatment of restless legs syndrome (RLS) is augmentation. To prevent augmentation is the critical clinical issues for RLS treatment. Up to now, there have been a lot of studies about augmentation in RLS from the world, however, almost all the studies had been performed in Western countries. As for augmentation in Asian RLS patients, there have been only three studies: two drug trials and one observational study from Japan and Korea. In addition, the follow-up durations of these studies were not long, and these drug trials might not reflect our everyday practice. We, therefore, investigated Japanese RLS patients with longer duration of treatment in the real world practice setting.

Materials and methods: This study is retrospective assessment of RLS patients (N=42) with follow-up durations of longer than 18 months (range 19-139 months) at two urban sleep centers in Osaka, Japan from May 2004 to April 2014.

Results: The mean age of first visit was 63.5±14.1 years old and the estimated age of RLS onset was 47.9±16.7 years old. 28 (66.7 %) out of 42 patients were female. At initial evaluation, the mean International Restless Legs Scale score (IRLS score) was 22.0±5.9 (Korean study; 14.4±9.8), and 31 (73.8 %) of 42 had already visited other clinics before coming to our sleep centers and the number of clinics visited was 1.3±0.6. Augmentation developed in 4.8 % (2/42), and dosage of dopamine equivalent in patients with and without augmentation was 12.5 mg and 18.8 mg vs. 15.8±17.7 mg (Mean ± SD in all patients; 16.9±21.0 mg). In two RLS patients with augmentation, ferritin was 113.1 ng/ml and 114.1 ng/ml (normal value in Japanese women: 5-157 ng/ml) and the number of clinics before coming to our sleep centers was both three (without augmentation; 0.8±0.6).

Conclusions: Augmentation rate in our study of Japan is low to compare with previous Western and Asian studies. It can be attributable to racial difference, lower dosage of dopaminergic difference, and the level of ferritin.
Restless Legs Syndrome (RLS)
O22: Restless legs syndrome (RLS/WED) and movement disorders oral abstract presentations

BRIEF AROUSALS FROM SLEEP WHEN ASSOCIATED WITH LEG MOVEMENTS PRODUCE SIGNIFICANT HEART RATE INCREASES WHILE AROUSALS WITHOUT LEG MOVEMENTS PRODUCE MOSTLY MARGINAL HEART RATE INCREASES

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Introduction: The aim of this study was to determine the degree of heart rate (HR) change occurring after brief arousals associated with leg movements (LM) vs. those without LM in RLS patients and good sleeper controls. The brief or micro-arousals without full wakening are considered a significant component of sleep disruption. Studies have indicated that some but not all of these cortical arousals represent significant arousal event that induces significant cardiac activation. Periodic leg movements (PLM) have also been associated with heart rate increases suggesting it may be the arousal events with LM or PLM that have the more significant heart rate responses.

The question is the degree to which the autonomic activation occurs for arousals with and without LM. We hypothesized that the process producing arousals associated with LM would likely produce greater automatic activation, represented by HR increase. Thus, the HR increases should be greater for the arousal with LM than those without LM.

Methods: Data from 37 RLS and 26 control subjects were analyzed from the second of two nights of standard PSG recordings from consenting subjects as part of an IRB approved research. Arousals were marked as "with LM" if an arousal occurred within 0.5 seconds of the beginning or end of a LM. All other arousals were marked as "without LM". HRs were measured in a 15 beat window, 5 beats before and 10 after the beginning of each arousal. The average heart rate of the 5 beats before arousal were considered as the baseline, and the heart rates for each of the 10 beats after the arousal were expressed as percentages of the baseline.

Results: The percent increases in HR for arousals with LM vs. arousals without LM were compared using Wilcoxon signed rank test with a 5% significance level. Significantly greater HR increases were observed for arousals with LM as opposed to arousals without LM (Control: 41%±27% vs. 24%±13%, p = 0.000017; RLS: 23%±9% vs. 13%±11%, p = 0.00009). 79% of the arousals were associated with LM, 87% for RLS and 45% for controls. The averages and standard deviations of number of arousals with LM per hour of sleep were 28±32 for RLS patients and 7±4 for the controls.

Arousals with LM that were PLM had lower HR increases than those of arousals associated with non-PLM in RLS patients (21%±9% vs 28%±18%, p=0.017), suggesting that the arousals with the PLMS process have relatively less increased autonomic activity.

Conclusions: The arousals with significant heart rate increases indicating autonomic activation were observed to occur more for the arousals with LM than those without LM. This opens up the possibility of using LM without EEG to identify most of the sleep-disrupting arousal events involving increased autonomic activity considered potentially significant for health. The periodicity of LM does not appear to be useful for the identification of important LM, and the current challenge is identifying which LM are associated with such arousals.
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Introduction: Obstructive Sleep Apnea (OSA) has been recognized as an independent risk factor for the development and progression of atrial fibrillation (AF). OSA decreases patients' response to anti-arrhythmic medication, and decreases the success rate of surgical ablation of AF. OSA remains undiagnosed in many patients with AF. There is evidence that continuous positive airway pressure (CPAP) treatment decreases the activity of the sympathetic nervous system and oxidative stress, which play a crucial role in the development of AF. We aimed to determine the prevalence of undetected OSA among patients with AF, and to investigate the effects of CPAP therapy on measures of arrhythmia burden.

Materials and methods: Unselected consecutive patients presenting to arrhythmia clinics were recruited. We included adult males or females without previous diagnosis and/or treatment of OSA. All patients had stable drug therapy with either permanent or paroxysmal AF with atrial ectopy. Patients underwent ambulatory sleep studies for two consecutive nights. OSA was defined as an Apnea-Hypopnea-Index (AHI) $\geq 5$/hour of sleep. Patients with OSA were subsequently treated with CPAP therapy, and completed a formal CPAP titration study in a sleep clinic. A 24-h ECG holter was repeated after three months of CPAP treatment.

Results: Ninety-eight patients (72\% males) with AF were recruited. Eight-three percent met diagnostic criteria of OSA. Age ($p=0.007$) and male Gender ($p=0.011$) were the only predictors of OSA. Thirty-four patients completed three months of CPAP therapy and a 24-h follow-up ECG holter. In patients with permanent AF ($n=11$), CPAP had no significant effect on the mean heart rate. In patients with paroxysmal AF ($n=23$), CPAP significantly decreased atrial premature beat count/hour (median (IQR) 244 (1694) to 57 (202), $p=0.006$), and ventricular premature beat count/hour (median (IQR) 49 (118) to 5 (104), $p=0.01$).

Conclusions: Eighty-three percent of patients with AF have previously undetected OSA. CPAP treatment of OSA is associated with a significant decrease in the frequency of atrial and ventricular ectopy within three months. CPAP treatment of OSA may reduce the risk of AF recurrence.
OBSTRUCTIVE SLEEP APNEA IS HIGHLY UNDETECTED IN NON-OBESE PATIENTS WITH ATRIAL FIBRILLATION

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Introduction: Obstructive sleep apnea (OSA) is a sleep disorder associated with several cardiovascular morbidity. OSA is an independent risk factor for the development and progression of atrial fibrillation (AF). We aimed to estimate the prevalence of OSA in patients with AF, and to investigate the relation between obesity and OSA in these patients.

Materials and methods: We prospectively recruited unselected patients presenting to AF clinics. We included all adult patients, males or females, with no previous diagnosis or treatment of OSA. Patients' medical history and demographic characteristics were collected from medical charts. Patients underwent an ambulatory sleep study. Patients were diagnosed with OSA if they have an apnea-hypopnea-index (AHI)>5/hour. Obesity was defined as a body-mass-index (BMI) ≥30 kg/m².

Results: One hundred patients (70% males) with AF and unknown status of OSA were recruited. Mean age was 64±13 years. Mean BMI was 28.7 ± 5.8 kg/m² (range:17-47). Thirty-four percent of patients were obese. OSA was diagnosed in 85% of the population. Mean AHI was 22.79 ± 16/h. Fifty-five percent had an AHI≥15/h (moderate/severe OSA). Obesity was prevalent in 40% of patients with OSA. Statistical analyses showed a positive correlation between BMI and AHI (p=0.004). However, obesity was not a predictor of the presence of OSA in these patients.

Conclusions: OSA is present in 80% of non-obese, and in 97% of obese patients with AF. Obesity does not predict the presence of OSA in this population. The clinical characteristic features of OSA do not seem to reliably predict the presence of OSA. A low threshold for assessing sleep in patients with AF is merited.
CLINICAL AND POLYSOMNOGRAPHIC DIFFERENCES IN ELDERLY PATIENTS WITH OBSTRUCTIVE SLEEP APNEA (OSA)


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Introduction: Although sleep related complaints are common in the community, there is little information on the clinical and polysomnographic differences elderly patients with obstructive sleep apnea (OSA).

Aim: We aimed to compare the clinical and polysomnographic differences among elderly and middle aged patients with OSA.

Materials and methods: We retrospectively reviewed the polysomnography files of 216 (100 F/116 M) OSA patients (Apnea-Hypopnea Index >=5/hour) who underwent polysomnography between 2011 and 2014. The patients were divided into two groups: young-middle aged (< 65old) (group 1), elderly (>=65old) (group 2). We compared symptoms, comorbidities, and polysomnographic findings of the patients.

Results: There were 185 patients (82 F/103 M) in group 1 and 31 patients (18 F/13 M) in group 2. There was no difference in gender distribution, OSA-related symptom frequency and Epworth sleepiness scale in two groups (p>0.05). Statistically, hypertension, atherosclerotic cardiac disease, diabetes mellitus, depression, and COPD were more frequent in the group 2 (p=0.05, p=0.005, p=0.002, p=0.007, p=0.015, respectively). Although statistically nonsignificant in the group 2 patients, TST and sleep efficiency were lower whereas the AHI was more high and average oxygen saturation at sleep was lower and in the group 1 patients the arousal index was more high (p>0.05). There was no difference between the two groups in terms of mean apnea duration (p>0.05).

Conclusions: Although the number of elderly OSA is low in our study, we found that OSA patients had similar symptom and polysomnographic findings independent of age. Considering the accompanying diseases, it was thought that OSA should not be overlooked in elderly patients.

Acknowledgements:
Sleep Breathing Disorders
O09: Sleep breathing disorders oral abstract presentations

REM-ASSOCIATED SLEEP DISORDERED BREATHING: PREVALENCE AND CLINICAL SIGNIFICANCE IN THE HYPNOLAUS COHORT

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Introduction: Nocturnal respiratory events are usually more frequent and of longer duration in rapid eyes movement sleep (REM) compared with non-REM sleep (NREM), probably due to greater pharyngeal muscle relaxation and a reduction in the hypoxic and hypercapnic ventilatory response throughout. However, the prevalence and clinical impact of REM-related sleep-disordered breathing (REM-SDB) are still debated. The aim of this study was to determine the prevalence of REM-related sleep-disordered breathing (REM-SDB) in the general population and to investigate the associations between REM-SDB and hypertension, metabolic syndrome, diabetes and depression.

Materials and methods: 2074 home polysomnography (PSG) recordings from the population-based HypnoLaus Sleep Cohort (48.3% men, 59±11 years old, body mass index 25.6 ± 4.1 kg/m²) were analysed. The apnea-hypopnea index was measured during REM (REM-AHI) and non-REM (NREM-AHI) sleep. Regression models were used to explore the association between REM-SDB and hypertension, diabetes, metabolic syndrome and depression in the entire cohort and in subgroups with NREM-AHI ≤10/h and total AHI ≤10/h.

Results: The prevalence of REM-AHI ≥20/h was 40.8% in the entire cohort, 59.8% among subjects with NREM AHI < 10/h (n =1241), and 50.5% among subjects with a total AHI < 10/h (n=1047). An independent association between increasing REM-AHI and metabolic syndrome was found in the entire cohort and in both subgroups (p-for-trend=0.007, 0.004 and 0.0035, respectively). An association was also found between increasing REM-AHI and depression in the entire cohort and in the subgroup with NREM-AHI < 10/h (p-for-trend=0.026 and 0.013, respectively) and between increasing REM-AHI and diabetes (p-for-trend=0.017) in the subgroup with NREM-AHI < 10/h only. Although we found no association between REM-AHI and hypertension, diastolic blood pressure was positively associated with REM-SDB (p= 0.007).

Conclusions: REM-SDB was highly prevalent in our middle-to-older age population-based cohort and was independently associated with metabolic syndrome, diabetes and depression. These findings suggest that an increase in REM-AHI could be clinically relevant.
EFFECT OF SLEEP APNEA AND INSOMNIA ON THE ASSOCIATION OF DEPRESSION WITH QUANTITATIVE ELECTROENCEPHALOGRAM MEASURES (QEEG) IN ADULT MEN DURING SLEEP - THE MAILES STUDY

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Introduction: Quantitative EEG (qEEG) abnormalities are present in 80% of patients with psychiatric disorders. Small studies of resting, awake qEEG in patients with depression show variation in findings. Both increase and decrease in slow wave activity has been reported in depressed patients in addition to increased alpha and beta activity. We have previously shown co-morbid sleep apnea and insomnia have additive effects on depression prevalence and severity. We aimed to determine the effect of sleep apnea and insomnia symptoms on the relation between sleep qEEG parameters and depression in a large sample of community dwelling men.

Materials and methods: Data were drawn from a randomly-selected cohort of men aged ≥40y at recruitment (2002-5) in Adelaide, South Australia. Of the 837 men with no prior OSA diagnosis who underwent full in-home polysomnography (Embletta X100; 2010-11), the C3 EEG tracings in n=635 men with known depression status were subjected to quantitative power spectral analysis. PSG variables were log transformed to normalise the distribution for regression against AHI adjusted for age. EEG short and longwave densities consisted of alpha/sigma/beta and delta/theta waves respectively, and distinguished between stages (S2 v SWS v REM). The axes variation across the cohort determined by principal component analysis (PCA). Depression symptom scores were regressed onto log transformed short and longwave EEG measures adjusting for age, AHI, BMI, financial stress, insomnia symptoms, marital status and medication. A sensitivity analysis was performed using linear regression of depression scale scores to confirm findings.

Results: EEG measures were moderately correlated (median=0.5, r=0.2-0.8). PCA indicated 3 major axes of variation: (PC1) activity level, (PC2) REM vs SWS and (PC3) long v short. Linear regressions indicated associations with PC1 (p=0.003) and PC3 (p=0.05) indicating depression more prevalent in individuals with elevated shortwave densities. Repeating the analyses with short and longwave measures separately confirmed this conclusion. Short wave densities, irrespective of stage, were associated with depression while long wave were not. Other factors associated with depression in this analysis were elevated AHI (p=0.01), financial stress (p=0.002), having a partner (p=0.04), medication (p< 0.001) and insomnia (p< 0.001), but not age (p=0.21) nor BMI (p=0.78). EEG measures explain a greater proportion of the variance in outcome compared to AHI (full model R²=23.8%, excluding AHI R²=23.0%, excluding EEG R²=22.1%).

Conclusions: Depression was associated with increased fast wave activity in community dwelling men. After further adjustment for insomnia symptoms and AHI, long-wave (slow) activity was no longer associated with depression. qEEG from sleep studies may add useful information to AHI in identifying sleep apnea clinical phenotypes at-risk for depression. Power spectral analysis data are recorded in sleep studies although not routinely reported, and can be easily accessed using available algorithms.

Acknowledgements: Supported by funding from the National Health and Medical Research Council of Australia; the ResMed Foundation, the Freemason´s Foundation Centre for Men´s Health and the National Heart Foundation of Australia.
Introduction: OSA is a common condition characterized by recurrent occlusions of the upper airway during sleep, leading to nocturnal hypoxemia, cardio-metabolic stress and sleep disruption. Among AF sufferers, the prevalence of OSA can be as high as 80%.

Treatment of OSA with continuous positive airway pressure (CPAP) can lower the risk of AF progression and improve cardio-version and catheter ablation success rates. Despite these benefits, routine screening for OSA in AF patients is uncommon, as patients often fail to report daytime sleepiness or noticeable sleep disruption, or do not equate these symptoms with possible disorder.

AF is the most common arrhythmia worldwide, with prevalence rates varying from less than 0.5% in those 40 years or less to 6-12% in those 85 years or over. A quick, accurate, and easily administered screening test to identify individuals at high risk for OSA may aid clinicians in increasing the rate of diagnosis.

The STOP-BANG questionnaire (SBQ) and NoSAS score quantify OSA risk, while the Epworth SleepINESS Scale (ESS) is a measure of sleepiness, a common symptom of OSA. Acoustic pharyngometry (AP) measures pharyngeal minimum cross-sectional area (MCA), and represents a potential novel screening technique, as a narrow pharynx is associated with a greater risk of OSA. We evaluated the accuracies of AP, SBQ, and the NoSAS score as OSA screening tools in a cardiology clinic AF population. The home sleep apnea test (HSAT) has demonstrated comparable diagnostic accuracy to the gold-standard technique of polysomnography, providing a useful metric against which to assess screening tests.

Materials and methods: Two hundred and one consecutive patients with paroxysmal or permanent non-valvular AF were recruited from a community cardiology clinic in Richmond, British Columbia. AP measurements and SBQ, NoSAS and ESS questionnaires were administered, and patients referred for HSAT (Apnea Link) at local providers. The researchers conducting AP measurements were blinded to the results of the SBQ, NoSAS, and ESS questionnaires.

Results: HSAT results are available for one hundred eighty three subjects. Eighty-six percent of the cohort had OSA and fifty percent had moderate or severe OSA. AP was not useful in detecting moderate to severe OSA (ROC area = 0.506; 95% CI: 0.421 to 0.590, n=183). The SBQ and NoSAS score performed better, yielding ROCs of 0.646 (95% CI: 0.568 to 0.724, n = 182) and 0.680 (95% CI: 0.604 to 0.757, n = 183) respectively. Average ESS total score was low and similar between the two groups (Absent/Mild OSA: 5.8 (SD 4.0); Mod/Severe OSA: 5.9 (SD 3.4)) suggesting that many patients with OSA do not report daytime sleepiness.

Conclusions: Moderate to severe OSA was common in patients with AF (50%). AP was not useful as a screening tool to detect OSA in patients with AF, while the performance of the SBQ and NoSAS was modest. Given the high rates of OSA among AF patients, and the fact that patients with OSA typically do not report sleepiness, HSAT should be considered for all patients with AF.

Acknowledgements: Richmond Hospital Sleep Lab. and community sleep technologists.
Introduction: Obstructive sleep apnea/hypopnea syndrome (OSAHS) is increasingly becoming a health concern as it has been associated with a number of serious co-morbidities particularly of the cardiovascular system. OSA is related with obesity, as the prevalence of obesity increases, there is parallel increase in the prevalence of OSA as well. Few studies were done to evaluate the effect of obesity on airflow parameters in Pulmonary Function Test (PFT). The studies that were done to evaluate the effect of OSA on airflow parameters in PFT were controversial. No study was done to evaluate the effect of change in posture from sitting to supine in OSA and obese patients on PFT. The aim of this study to know the effect of obesity and OSA while changing posture from sitting position to supine position on the airflow parameters.

Materials and methods: 90 subjects were divided into two groups according to their BMI. Group1: non-obese (18.5-30 Kg/m2), and Group3: obese (30-40 Kg/m2). Subsequently those subjects were divided into OSA and non-OSA. Physical examination was done and questionnaire was given to the subjects prior to the procedure. Forced vital capacity maneuver was done for each subject at least 3 times and (FVC, FEV1, FEV1/FVC, FEF 25-75%, FEF 50%, FIF MAX and ERV) were derived from the flow volume curve obtained after expiratory effort.

Results: While comparing OSA with non-OSA subjects, it was found that there is significant change in FEV1, FEV1/FVC, FEF 25-75% and FEF 50% while changing posture from sitting to supine. It was noticed that only FEV1 has changed in obese patients while changing posture from sitting to supine position if it was compared to non-obese. While in supine position, all the parameters decreased in OSA patient in comparison to non-OSA patient except for FEF 50% and FEF 25-75%. The same findings were noted in erect position. In regards to effect of obesity, there was significant change of ERV in supine and erect positions.

Conclusions: Obesity per say has no role in altering lung functions or volumes, and any change that happens could be due to the consequences of obesity. On the other hand, obstructive sleep changes most of the lung function parameters.

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Sleep Breathing Disorders
Board #090: P6 - Wednesday

CAN 6-MIN WALK-TEST PREDICT SEVERITY OF OBSTRUCTIVE SLEEP APNEA SYNDROME?

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Introduction: When considering the benefits of the 6 minute walking test (6MWT) in research fields and the
need of treatment for moderate to severe obstructive sleep apnea (OSA) patients, research in this field is of
great advantage and may have a significant role in therapeutic grounds. Patients with moderate to severe OSA
were analyzed in Masih Daneshvari Hospital using the 6MWT.

Materials and methods: Absolute diagnosis was completed on 47 cases by a polysomnography test with
definite staging of the disease. staging of the disease correspondent to each case was entered as data into the
study. Patients were individually interviewed and data was saved onto appropriate checklists. The 6MWT was
then performed under standard criteria. Data collected were retrieved and used for analysis by SPSS 18
software.

Results: The mean age of cases were 54.4 years of age with a standard deviation of 13.3. 70.2% of cases were
male. The body mass index of the 47 patients displayed a mean of 33.73 kg/m3 (SD=6.2). In cases with
moderate to severe OSA, the male sex displayed correlation with high PCO2 and hypercapnia. Ages of patients
examined displayed reversed correlation with the distance in the 6MWT by observing the O2saturation (Sat) at
the end of the 6MWT, displaying direct correlation with the duration of O2 Sat < 90% during sleep. The BMI also
showed reversed correlation with the distance in the 6MWT. Similarly, the severity of the OSA had reversed
correlation with the expected distance in the test. However, patients with higher duration of O2 Sat < 90%
during sleep had a higher reduction in O2 Sat during and after the 6MWT. Patients with higher duration of O2 Sat
< 90% during sleep also completed less overall distance in the 6MWT (P values < 0.05 for all).

Conclusions: It seems that the 6MWT in patients with moderate to severe OSA may be beneficial in the
evaluation of the ability and activity tolerance and especially in the evaluating the duration of O2 Sat < 90% in
sleep. This may also aid future therapeutic goals and be beneficial in terms of examining improvements in
moderate to severe OSA patients.
THE EFFECT OF MANDIBULAR ADVANCEMENT DEVICE ON PHYSIOLOGIC PARAMETERS AND VOLUMETRIC MRI IN MILD TO MODERATE OBSTRUCTIVE SLEEP APNEA-A RANDOMIZED CONTROLLED TRIAL

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Introduction: Evaluating the effect of mandibular advancement device on AHI and MRI volumetric parameters in mild to moderate obstructive sleep apnea subjects in a population not evaluated before.

Materials and methods: This is a single blinded randomized controlled trial (registered in www.irct.org; IRCT2014071618509N1) in patients with mild to moderate obstructive sleep apnea (defined as AHI 5-14 and 15-29, respectively) referred to Imam Reza sleep center, Mashhad, Iran, 2016. OSA was confirmed by even full-night polysomnography or split-night test (Embla N7000, Natus, USA). Those with severe periodontal disease, advanced temporomandibular joint disease and edentulous subjects were excluded from the study. After explaining the design of study and signing written informed consent patients were enrolled in the study. In all subjects demographic characteristics (age, sex, BMI), data on the level of daytime sleepiness (ESS scale), sleep quality (PSQI score) and AHI number (PSG results) were gathered. Patients were randomly allocated to case and control groups.

In the case group a monobloc custom made mandibular advancement device with 2-6 mm mandibular advancement was used as the treatment of OSA. Magnetic resonance (MR) study with 3-dimensional measurement of airway volume in the supine position has been done in the intervention group. The instant effect of wearing MAD on the upper airway volume was assessed by a repeat MR study with the patient wore MAD device on the MR table. A sham device with no mandibular protrusion used for the patients in the control group. Subjects in both case and control groups were advised to use their device at least 5 nights a week. Late physiologic effects of using therapeutic and sham devices were evaluated by ESS and PSQI questionnaires 1 month after regular night time use. We also assessed reduction in OSA severity in terms of AHI by polygraphic sleep study (Apnea link plus, Resmed, USA) at the end of 1 month use with MAD wore at test night. Same protocol was used for evaluating response to treatment in the control group. As no therapeutic effect on airway volume had been considered for sham device MR imaging was not done in the control group. Results of ESS, PSQI and AHI before and 1 month after device use were evaluated according patients’ characteristics.

Results: After exclusion of 4 subjects not willing to participate in the study a total of 13 patients started the study whom were allocated to 9 and 4 subjects in case and control groups, respectively. PSQI decreased significantly after MAD in case group (from 9.11 ±3.8 to 4.11 to 1.5) (p=0.008). ESS score also improved in case group (8.0 ±7.9 to 3±2.3) (p=0.028). AHI improvement was not significant in both case and control groups (p-value> 0.05). Oropharyngeal volume increased in a nonsignificant manner (6059.44 to 6275.11 mm3) (p-value>0.05).

Conclusions: This preliminary study in an Iranian population showed improvement of subjective parameters 1 month after use of monobloc mandibular advancement device with no significant change in AHI and MRI volumetric measures. Further studies needed to objectively show MAD therapeutic effects in Iranian population.
**Introduction:** Hypopharynx is the area between the base of tongue (upper border of Epiglottis) and lower border of cricoid cartilage. Large number of sleep surgery failures occur as a result of less addressing of this area. Clearing the obstruction in this area is the key to achieve good results in OSA surgeries.

**Materials and methods:** The aim of this study was to find the role of Hypopharynx in obstructive sleep apnea and improve the results in sleep surgeries. Cases like failure after classic UPPP surgeries, no marked improvement in apnea/hyponea index after surgeries and no satisfaction after CPAP trial and CPAP failures were selected for the study. All these cases were then posted for sleep nasal endoscopy with Propofol drug induced sedation and assessed the level of obstruction. Interestingly there was significant collapse in Hypopharyngeal area like floppy epiglottis, huge tongue base pushing the epiglottis posteriorly, lingual tonsil and bilateral abductor paralysis causing vocal cords adduction. Address these areas is very important to improve the results after surgery. Coblation wand evac 70 and ultra sp wand from USA were used as main surgical tools. All these cases were treated with procedures like tongue base reduction and suturing, Epiglottopexy, suturing of epiglottis with tongue base, posterior cordectomy and lingual tonsillectomy respectively.

**Results:** All these cases were assessed post operatively with sleep study, pain after surgery, voice change and any history of aspiration. There was improvement in apnea/hyponea index and in quality of life after surgery in 90% cases. In two cases there were altered sensation of taste. Almost in all the cases pain was severe and this was managed with pain killers. In two cases there were a history of aspiration for liquids and not for solids especially in Epiglottopexy and suturing of epiglottis with tongue base. These case were followed for 3 months and there was good improvement in aspiration control. There was mild voice change in posterior cordectomy case.

**Conclusion:** Hypopharyngeal airway collapse is the main cause of failure in almost all cases of OSA surgeries. Pre operative proper Sleep Endoscopy is the most important tool to assess the exact site of obstruction. Multilevel Surgeries tailored to each patient is important to give good results. Areas like tongue base, Epiglottis and Vocal cords should be actively looked for and treated effectively to increase the outcome.

**Acknowledgements:**
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CARDIAC BIOMARKERS IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME AND HEART FAILURE WITH PRESERVED EJECTION FRACTION

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Obstructive: Sleep apnea syndrome (OSAS) is reported to be associated with hypertension, coronary artery disease, atrial fibrillation, and heart failure (HF). N-terminal proBNP (NT-proBNP), galectin - 3 and soluble ST-2 have been well-characterized for use in diagnosis and prognosis of HF. The impact of OSAS on these cardiac markers in patients with HF and preserved ejection fraction has not been well defined. The aim of this study was to investigate the association between NT-proBNP, galectin - 3, ST-2 level and OSAS severity in patients with obstructive sleep apnea syndrome and heart failure with preserved ejection fraction.

Materials and methods: A total of 52 consecutive patients with confirmed OSAS and HF with preserved ejection fraction and 38 patients with HF with preserved ejection fraction without OSAS (control group) were recruited in our study. All study subjects underwent overnight cardiorespiratory monitoring and echocardiography. The patients with OSAS were categorized according to their apnoea-hypopnoea index (AHI) as follows: mild (AHI = 5-15), moderate (AHI = 15-30), and severe (AHI > 30). Sensitive immunoradiometric assays were used to measure plasma NT-proBNP, galectin - 3 and soluble ST-2. Multivariable regression analysis was used to estimate the relationships between cardiac biomarkers and indicators of OSAS, adjusting for age, sex, and body mass index.

Results: The elevated NT-proBNP level was found in 32% of the participants. There was an increase in mean NT-proBNP as the severity of sleep apnea increased (increasing from a mean value of 142 ng/mL in the group with AHI < 5 to 312 ng/mL in the group with an AHI ≥ 30). NT-proBNP differs significantly only between patients with severe OSAS and controls. But no statistically significant relations between OSAS indices and NT-proBNP were observed in the adjusted regression model. Mean galectin-3 level was significantly higher in patients with OSAS compared to subjects without OSAS (p < 0.05) and in the severe OSAS group compared to the moderate and mild OSAS groups (p < 0.05). ST-2 level was significant increase in patients with OSAS (ST-2 > 36.7 ng/mL) compared to control group (ST2 < 23.1 ng/mL). Galectin-3 (p < 0.05) and ST-2 (p < 0.05) were connected with AHI after adjusting for other factors. Furthermore, galectine-3 was a significant predictor of OSAS severity.

Conclusions: The level of Galectin-3 and ST-2 are associated significantly with OSAS severity in comparison with NT-proBNP and can be used as a sensitive diagnostic and prognostic marker for cardiovascular abnormalities in patients with OSAS and HF with preserved ejection fraction.
THE PREVALENCE OF OBSTRUCTIVE SLEEP APNEA AT HYPERTENSION CLINIC: A THAI UNIVERSITY HOSPITAL EXPERIENCE

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Introduction: The JNC 7 has defined obstructive sleep apnea (OSA) as secondary cause of hypertension since 2003. The prevalence of OSA and hypertension is varied between 50-80% in the Western countries. There is limited data on the prevalence of hypertension caused by OSA in Asian setting.

Materials and methods: All patients treated at Hypertension/sleep clinic, Srinagarind Hospital, Khon Kaen University, were enrolled. Hypertension caused by OSA defined by having the apnea-hypopnea index more than or equal to 5 events/hour by polysomnography and no definite other causes of hypertension. The prevalence rate of OSA associated with hypertension was calculated. Characteristics of hypertension patients with OSA were analyzed.

Results: There were 726 hypertensive patients treated at our clinic. Of those, 324 patients had OSA (44.63%). The clinical characteristics of hypertensive patients with OSA were as follows; the mean age of all patients was 53.84 (S.D. 13.46), most patients were male (186 patients; 57.40%), the mean body mass index was 42.01 (S.D. 202.38), 47 patients (14.51%) had diabetes, 24 patients (7.41%) had dyslipidemia, 13 patients (4.01%) had GERD, 7 patients (2.01%) had NASH, 6 patients (1.85%) had history of hypertensive urgency, and 2 patients (0.62%) had stroke.

Conclusions: The prevalence of OSA in Thai hypertensive patients was 44.63%.
PREVALENCE OF OBSTRUCTIVE SLEEP APNEA AMONG ADULTS IN NORTH-WEST OF IRAN

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Introduction: Obstructive sleep apnea (OSA) is characterized by repeated episodes of complete or partial airflow cessation in the upper airway. This condition that is remained under diagnosed affects sleep quality and leads to excessive daytime sleepiness and fatigue. This study aimed to investigate the prevalence of OSA in adult population of Ardebil city located in North-West of Iran.

Materials and methods: In this cross-sectional observational study, 778 men and 791 women participated in a telephone interview based study in Ardebil city. The risk of OSA was estimated using validated Persian Berlin Questionnaire. The questionnaire includes three categories with 10 questions regarding snoring and apnea, sleepiness, chronic fatigue, hypertension and Body Mass Index (BMI). The ones with higher score in the two categories were defined as high risk for OSA. Collected data were analyzed by using t-test for continuous and chi-square test for categorical variables in high and low risks groups for OSA.

Results: Of the 1569 individuals, mean (SD) age of study participants was 36.6(12.1) years among them 791 (50.4%) were female. A total of (212) 13.5% reported snoring. The prevalence of high risk for OSA was (138) 8.8%. Mean BMI was significantly higher in the high OSA risk than the low risk (30.1 ± 4.8 vs. 25.4 ± 4.1Kg/m², respectively). Hypertension had statistically significant association with high risk for OSA. Men were diagnosed with higher risk for OSA. Risk of OSA increased significantly with aging in both sexes (p< 0.001)

Conclusions: OSA is common in the elderly population and increases with age. BMI and hypertension are also associated with high OSA risk in the studies region. Current findings warrant conducting population-based studies for investigation of OSA prevalence in the region and country.

Acknowledgements: We thank the individuals who participated in our study.
FREQUENCY OF OBSTRUCTIVE SLEEP APNEA SYNDROME (OSAS) IN SYSTEMIC SCLEROSIS PATIENTS

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Introduction: There is no sufficient data about quality of sleep and incidence of obstructive sleep apnea syndrome (OSAS) in systemic sclerosis (SSc) patients. In this study we were evaluated to frequency of OSAS in SSc patients and factors that may affect this condition.

Materials and methods: This study enrolled SSc patients from the pulmonary disease outpatient clinic between April 2015 and December 2016. 30 channel Polysomnography in hospital, Epworth sleepiness scale (ESS), body mass index (BMI) measurement, waist circumference and upper airway examination are performed. Concurrent measurements of lung function test, CO diffusion capacity (DLCO) and 6 minute walking test (6MWT) recorded.

Results: In this study accepted 38 patients that 35 female, mean age 51.3 ± 11.5 years. In SSc patients mean apnea-hipopnea index (AHI) is 11 ± 15 (median= 5.5), and OSAS frequency is 57.9%. Mild (n:13, 34.2%), moderate (n:6, 15.8%) and severe (n:3, 7.9%) OSAS was found in that patients. AHI showed correlation between age (p = 0.005, r=0.45), waist circumference (p = 0.01, r=0.42), BMI (p=0.14, r=0.40) and 6MWT (p=0.036, r=-0.35). There was no correlation between AHI and lung function parameters (p> 0.05).

Conclusions: Frequency of OSAS in SSc patients is high. Frequency of OSAS increased with older age, high BMI, and wide waist circumference in SSc patients.
Introduction: In adult studies, obstructive sleep apnoea (OSA) has been proven to be associated with elevated blood pressure (BP) which can be reversed by successful treatment of OSA. Cross-sectional and longitudinal studies in paediatric population has provided robust evidence to demonstrate childhood OSA is associated with BP abnormalities. However, there has been no well-controlled study to evaluate the usefulness of adenotonsillectomy (AT) in ameliorating cardiovascular disturbances in children with OSA. Conflicting results including improvement, worsening or no change in BP after treatment were obtained from previous studies. Therefore, this randomised controlled trial aimed to examine the effect of AT on BP in children with OSA.

Materials and methods: This was a preliminary analysis of a single-blind randomised controlled trial. The study involved 2 visits with a 7-month intervention period in between. Pre-pubertal non-obese children aged between 6-11 years who had moderate-to-severe OSA (obstructive apnoea hypopnoea index (OAHI) >=5/h) and adenotonsillar hypertrophy were recruited. The subjects were randomly assigned to either early AT group or watchful waiting (WW) group in a 1:1 ratio. Subjects allocated to the AT group underwent AT within 8 weeks after randomisation. Those allocated to the WW group were arranged to be reassessed 7 months after randomisation. The primary outcome of the study was twenty-four hour ambulatory BP. Linear mixed model was used to test for the differences in the changes of outcomes between groups.

Results: At the time of writing, 12 and 10 children with moderate-to-severe OSA were randomised into the AT and WW groups, respectively. One subject from the AT group was excluded because the parents refused surgery. Two subjects from the WW group defaulted for the follow-up visit and were excluded. A total of 11 children (8 boys/ 3 girls) and 8 children (4 boys/ 4 girls) of AT and WW groups were included in this analysis. The OAHI of the AT group dropped significantly from 12.8/h±5.5 to 2.9/h±2.9 (p < 0.001), whereas that of the WW group did not change significantly (from 18.8/h±9.5 to 12.3/h±6.8, p = 0.075) (p for visit*group = 0.004). The main finding was that the nighttime diastolic BP of the AT group dropped from 60mmHg±5 to 57mmHg±3 (p=0.099) whereas that of the WW group did not demonstrate significant change (62mmHg±8 c.f. 62mmHg±5, p=0.802) (p for visit*group = 0.362). Similar finding was obtained when the BP data were converted to z scores with reference to height and gender (AT group: 1.02±1.09 c.f. 0.36±0.72, p=0.062; WW group: 1.38±1.10 c.f. 1.33±0.64, p=0.888; p for visit*group = 0.252). Nighttime systolic, daytime systolic and diastolic BP did not show similar results.

Conclusions: This preliminary analysis showed that early AT could significantly reduce OSA severity in pre-pubertal non-obese children with moderate-to-severe OSA. Furthermore, it might also cause a reduction in diastolic BP.

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FEASIBILITY OF A MULTI-SITE OBSTRUCTIVE SLEEP APNEA BIOMARKER REGISTRY: THE CANADIAN EXPERIENCE

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Introduction: Obstructive sleep apnea (OSA) is a common disease characterized by recurrent collapse of the upper airway at night leading to sleep fragmentation and oxyhemoglobin desaturation. Patients with OSA are at risk of cardiometabolic disease and long term cognitive dysfunction. The ability to identify patients at particularly increased risk of these outcomes would be useful in directing more appropriate care. The main purpose of this multi-site OSA database is to determine whether circulating and urinary biomarkers (e.g., genetic, protein) may be useful in predicting these outcomes.

Materials and methods: Since the fall of 2016, three academic sleep programs in Canada (Vancouver, Calgary, Saskatchewan) have recruited adult patients with suspected OSA who are sent for an ambulatory study or in laboratory polysomnogram. Patients complete a comprehensive survey, have weights and heights measured; this information is linked to physiologic information from the diagnostic sleep studies. In addition, three validated cognitive tests are administered (Montreal Cognitive Assessment Test, Rey auditory recognition memory test, WAIS-IV digit symbol test.). Blood samples are also collected and centrifuged so that serum and DNA can be stored; samples are sent centrally to the University of Montreal Biobank. Urine samples are also stored.

Results: Thus far, we have been successful in harmonizing data collection instruments and surveys. As of May 2017, we have collected: survey data from 366 patients, blood samples from 251, cognitive testing from 231, and urine from 141. We should have over 600 blood samples by the end of 2017. In the future, we will link our databank with provincially available health databases to ascertain relevant health outcomes (e.g., stroke, kidney failure, cardiac complications).

Conclusions: We have confirmed the feasibility of multi-site data collection and central storing of biobanked samples. In the future, we hope to expand collection to multiple other sites across Canada.

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ADHERENCE TO TREATMENT IS ASSOCIATED WITH INITIAL INFORMED TREATMENT PREFERENCE IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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**Introduction:** Continuous positive airway pressure (CPAP) is an effective therapy for obstructive sleep apnea (OSA), but adherence is suboptimal leading to downstream health problems. Patient decision aids have been proposed to improve adherence by supporting patients and their clinicians to choose treatment options that match patient preferences. The objective of this study was to determine whether a previously developed decision aid could identify patients that would be adherent to treatment, and understand other decisional factors.

**Materials and methods:** Patients with recently physician diagnosed OSA were invited to participate in a web survey before they had decided on treatment, and were then followed up 6 months later. The baseline survey asked questions about their OSA, Epworth Sleepiness Scale (ESS), knowledge of treatment options, recommendations given by their doctor, initial treatment preference, and decisional conflict. They were then shown a patient decision aid that has previously been developed which provided information and evidence on treatment options and helped match their personal values with an option. They were then asked repeated questions on knowledge, preference and conflict. At 6 months, questions were asked about their initial treatment decision, what treatment they were currently using and their adherence to that treatment.

**Results:** 81 participants completed the baseline survey. Their mean age was 42 (SD 8), 77% were male, and mean BMI was 31.4 (SD 3.9). 57% reported moderate OSA (25% were not sure) and their mean ESS was 8.5 (SD 3.6). 66 (81%) completed the 6 month follow up questions. Initially 53% of patients preferred CPAP, 7% dental appliance, 14% none, and 25% were not sure. After the decision aid, 59% of patients changed their preference: 42% preferred CPAP, 46% dental appliance, 2% none, 10% were not sure. Knowledge and decisional conflict improved pre post decision aid. At 6 months, 42 (76%) patients reported they had initially obtained CPAP, yet only 22 (47%) used it for 4 nights per week for more than 4 hours. Those that preferred CPAP after reviewing the decision aid were more likely to adhere to CPAP at 6 months than those that did not (p=0.009). Adherence was also associated with lower decisional conflict (p=0.02).

**Conclusions:** This study provides preliminary evidence that informed treatment preference is associated with 6-month adherence. The findings provide a hypothesis that using a patient decision aid could better match patients to a treatment option that they are more likely to adhere to. Many patients received treatment that was discordant with their treatments preferences suggesting intentional non adherence. This discordance implies the decision aid did not influence initial treatment obtained suggesting the decision aid would need to be integrated in to clinical practice.

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MANDIBULAR ADVANCEMENT DEVICE FOR TREATMENT OF OBSTRUCTIVE SLEEP APNEA. COULD IT BE AN ALTERNATIVE IN PATIENTS WITH CPAP INTOLERANCE?

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Introduction: Obstructive sleep apnea (OSA) is a disorder caused by an obstruction of the upper airway during the sleep, leading to fragmentation, excessive daytime sleepiness and cardiometabolic disorders (1). Although continuous positive airway pressure (CPAP) is the first choice therapy, there are other options for those patients without CPAP tolerance, like mandibular advancement devices (MAD). This device induces mandibular advancement increasing cross-sectional areas and volume of the upper airway (2).

Objective: To evaluate the efficacy of MAD in patients with OSA who do not tolerate or refuse CPAP.

Material and methods: OSA patients treated with MAD were recruited from a sleep unit between 2016 and 2017. The following data were collected before and after the treatment with MAD: Epworth sleepiness scale, body mass index, apnea-hypopnea index (AHI), total number of apneas and hypopneas, average oxygen saturation, saturation time< 90% and oxygen desaturation index. All data was expressed as median and interquartile range (IR). A comparison of related parameters before and after MAD was performed. The Wilcoxon test was used when non parametric distribution was observed.

Results: Sixteen patients (12 men) participated in this study. The patient´s mean age was 58 ± 12 years. The average MAD advance was 6.26 ± 2,09 mm. The body mass index (BMI) before (26 ± 3 kg/m2) and after DAM (25 ± 3 kg/m2) did not present significant differences. The sleep respiratory parameters results are shown in table 1. 44% of the patients presented a reduction of AHI³ of 50% and 56% of the patients were cured of their OSAS. A post treatment apnea-hypopnea index of less than 10 is regarded as cured. All patients presented good tolerance to MAD and have excellent compliance.

Conclusions: In our study, MAD seems to be an effective strategy in patients who do not tolerate CPAP or do not have surgical criteria. However, further studies are needed to validate this strategy in this group of patients.

Bibliography:
Introduction: QT interval is an electrocardiograph parameter to evaluate myocardial repolarization. Prolonged QT interval is associated with arrhythmias and sudden cardiac death. An increase of QT has been reported in patients with obstructive sleep apnea (OSA). Apneic episodes during sleep in OSA patients are associated with QT prolongation due to increased vagal activity. Some studies have shown a relationship between Apnea Hipoanea index (AHÍ) and QT prolongation. An elongated QT could be expected in more severe patients.

Objective: Primary: To assess the characteristics of QT corrected interval (QTc) in patients with moderate severe OSA without cardiovascular comorbidity.

Secondary: To analyze if patients with prolonged QTc present greater comorbidity at 2-year follow-up.

Methods: Twenty-nine patients referred to the Sleep Respiratory Disorders Unit during the period April 2014-November 2015 were included. Patients with known heart disease or possible causes of prolonged QT interval were excluded. A polygraphic study and electrocardiogram (EKG) were performed in all patients. In each EKG, the QTc was calculated using the Bazzett's formula. Patients with AHÍ > 15 events / hour were selected. We reviewed the clinical history of the patients 2 years after their first study.

Results: We studied 29 patients, 26 men and 3 women. The mean age was 55 years (SD 10) and the body mass index (BMI) was 37 (SD 9). Mean AHÍ: 49 (SD 27) with an obstructive profile. When analyzing patients with a QTc ≥ 398" vs those with a QTc < 398", a significant difference was found. In the prolonged QTc group there was a higher AHÍ.

In the review of patients clinical records at 2 years after the first study, only one patient (QTc: 366", AHÍ 62 / h) presented with cardiovascular events.

Conclusions: Patients with longer QTc had a greater severity of sleep apnea. There was no increase in cardiovascular comorbidity in the sample studied.
CORRECTION OF SLEEP DISORDERS BY THE SENSOMOTOR CONTROL METHOD OF RESPIRATION IN PATIENTS WITH HYPERVENTILATION SYNDROME

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Introduction: There is a high incidence of sleep disorders among general therapy patients profile. There is a wide prevalence of respiratory disturbances in such sleep disorders as apnea. Also some authors noted a close relationship between sleep disorders, pain and mixed anxiety-depressive disorders, the structure of which includes a hyperventilation syndrome (HVS). However, any studies on the relationship between hyperventilation manifestations and sleep disorders weren't practically identified. At the same time there is a little information about the role of biological feedback in treatment of sleep disorders. The aim of this study was to make a comparative evaluation of the effectiveness of sleep disorders correction among patients with GVS by the sensomotor control method of respiration.

Materials and methods: 63 patients with HVS and signs of sleep disorders were recruited and divided into two groups. The first group (31 patients) received standard drug therapy and the original "Sensomotor control method of respiration", the second group (32 patients) received only standard drug therapy and self-restoration breathing. Characteristics of sleep disorders: difficulty falling asleep, superficial sleep, frequent awakenings, fatigue after a night sleep. The respiratory pattern correction was determined using the diagnostic complex "Diatrek-P" (the VolGMU proposal No. 34-2002 and No. 36-2002, October 25, 2002). The respiratory pattern changes were evaluated according to the following parameters: respiratory rate, expiratory and inspiratory length, respiratory pause length, inspiratory and expiratory coefficients.

Results: There were the next following sleep disorders distribution in groups: 38,7% of patients in the first group and 34,6% of the second group noted the difficulty falling asleep, superficial sleep was defined in 16,1% (1st group) compared with 18,7% in the control group, night awakenings due to pain were found in 12,9% and 15,6% in the first and second groups respectively. A daytime activity decline after sleep was noted in 58,1% of patients in the first group and, in the second - 53,1%. Initially, there was an respiratory indicators inversion in both groups with a tendency to increase the inspiratory length and decrease the expiratory length. Respiratory coefficients had the same changes. The therapy course led to significant sleep disorders decrease. Difficulty falling asleep decreased to 19,3% and 25% in the first and second groups respectively. The number of patients with superficial sleep decreased to 6,4% in study group and 12,5% in control group. Restoration of daytime activity level after sleep in the "Sensomotor control method of respiration" group had reliable indicators compared with the second group (p ≤0.05). Positive changes in respiratory parameters were revealed: an inspiratory length decrease, an expiratory length increase and a respiratory pause length increase. Significant differences between the first and second groups indicators evidence the high effectiveness of biological feedback method in HVS and sleep disorders therapy.

Conclusions: It is necessary to use a comprehensive approach to sleep disorders correction applying the extended range of respiratory pattern parameters including respiratory coefficients.
Sleep Breathing Disorders
Board #092: P6 - Wednesday
CORRELATION BETWEEN THE SEVERITY OF APNEA AND HYPOPNEA SLEEP, HYPERTENSION AND SERUM LIPID AND GLYCEMIC: A CASE CONTROL STUDY

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Introduction: The purpose of this study was to evaluate the correlation between the severity of obstructive sleep apnea (OSA) and the levels of blood pressure (BP), lipids and glucose, as intermittent hypoxia increases BP, changes the oxidative balance, and can induce the formation of free radicals and atherogenesis.

Materials and methods: 32 patients were evaluated about BP during wakefulness and sleep, total cholesterol and lipids, LDL (low-density lipoprotein), HDL (high-density lipoprotein), triglycerides, glucose and polysomnography. They were divided into four groups according to the respiratory events per hour of sleep (RDI): control group (RDI < 5), Group I (RDI 5-15), Group II (RDI 15-30), Group III (RDI > 30).

Results: There was no increase in BP in groups’ cases, the verification of systolic (p = 0.429) and diastolic (p = 0.475) BP in 24 h, systolic (p = 0.277) and diastolic (p = 0.143) BP during wakefulness, and systolic (p = 0.394) and diastolic (p = 0.703) BP during sleep in the control group. When implementing the Spearman correlation test, a correlation directly proportional to the severity of the disease was not observed. Regarding the level of serum total cholesterol (p = 0.092), LDL (p = 0.242), HDL (p = 0.517), triglycerides (p = 0.947), total lipids (p = 0.602) and glucose (0.355), there was no statistically significant difference between groups (p > 0.05 for all parameters).

Conclusion: There is no correlation between the severity of OSA and BP levels in 24 h, during daytime, during the sleep and serum levels of LDL and HDL cholesterol.

Acknowledgements: The Federal University of Alagoas - Brazil and all those who contributed to the development of this research.
EVALUATION OF OXIDATIVE STRESS MARKERS IN OBSTRUCTIVE SLEEP APNEA SYNDROME AND ADDITIONAL ANTIOXIDANT THERAPY: A REVIEW ARTICLE

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Introduction: The hypoxia and reoxygenation cycles in obstructive sleep apnea syndrome (OSAS) cause a change in the oxidative balance, leading to the formation of reactive oxygen species capable of reacting with other organic molecules impairing their functions. This study aimed to determine the best markers of oxidative stress in OSAS and what better antioxidant agent to be used to treat the disease.

Materials and methods: Searches were conducted in three different databases (PubMed, LILACS, SCIELO), using as descriptors the terms obstructive sleep apnea, oxidative stress, and antioxidant therapy. A total of 120 articles were found but only those considered of interest to the research were selected. Thus, 10 articles were included for further analysis regarding the biomarkers of oxidative stress in OSAS, and 6 articles to evaluate the antioxidant most often used for demonstration of efficacy.

Results: The thioredoxin, malondialdehyde, superoxide dysmutase, and reduced iron were the most commonly used biomarkers and showed a more consistent relationship between increased oxidative stress and OSAS. As antioxidant therapy, vitamin C and N-acetylcysteine (NAC) presented interesting results as a reduction of oxidative stress, which may become an alternative to the complementary treatment of OSAS.

Conclusions: This review’s findings agree mostly to measure that the markers of oxidative stress in OSAS may be a contributing aspect to assessment and monitoring of patient, and the antioxidant therapy appears to be beneficial in the treatment of OSAS.

Acknowledgements: The Federal University of Alagoas - Brazil and all those who contributed to the development of this research.
Sleep Breathing Disorders
Board #121: P3 - Tuesday

STOP-BANG QUESTIONNAIRE AS A SCREENING TOOL FOR OBSTRUCTIVE SLEEP APNEA

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Introduction: The STOP-Bang questionnaire is used to screen patients for obstructive sleep apnea (OSA). Its total score ranges from 0 to 8. The aim of this study is to analyze the accuracy of STOP-Bang questionnaire as a screening tool for OSA, as well as to evaluate the association between STOP-Bang scores and the severity of this disease.

Materials and methods: We performed a retrospective analysis of patients that performed sleep study in our health care unit, during a period of 16 months. Type III monitors were used and biometrical and clinical data were collected on first appointments. The STOP-Bang score was accessed and patients were classified for OSA risk based on their scores. Data was subjected to statistical analysis using SPSS®.

Results: 592 patients performed sleep study. 68.4% (n= 405) were males. The mean age was 59.84±13.46 years-old, mean body mass index (BMI) was 32.44±5.69kg/m² and mean neck circumference (NC) was 41.40±4.65cm. 90.7% (n = 537) of patients reported snoring, 58.8% (n: 348) reported witnessed apneas, 72.6% (n = 430) felt tired or sleepy during the daytime (mean Epworth Sleepiness Scale (ESS) score was 11.80±6.01) and 62% (n: 367) were being treated for high blood pressure. OSA was diagnosed in 85.3% (n= 505) of patients; 26.9% with mild OSA (n= 159), 22.6% with moderate OSA (n= 134), and 35.8% with severe OSA (n=212). The mean Respiratory Event Index (REI) was 29.62±28.88/hour, mean cumulative time spent below a saturation of 90% (CT90) was 28,52±32.38%. STOP-Bang score of 0-2 points was present in 5.7% (n = 34) of patients, considered with low-risk for OSA; score of 3-4 was present in 31.4% (n: 186), with medium-risk for OSA; score ≥ 5 was present in 62.8% (n: 372), with high-risk for OSA. The correlation between the STOP-Bang score and REI was moderate (r=0.546, p< 0.01), as well as its correlation with CT90 (r=0.391, p< 0.01). The sensitivity and specificity of STOP-Bang score ≥ 3 to detect moderate OSA (REI ≥ 15) were 98.27% and 11.38%, respectively, with a negative predictive value of 82.35%. The sensitivity of STOP-Bang score ≥ 3 to detect severe OSA (REI ≥ 30) was 99.53%, and the negative predictive value was 97.06%. High-risk STOP-Bang score (≥5) has a sensitivity to detect moderate and severe OSA of 80.36% and 87.19%, respectively, a negative predictive value of 69.91 and 87.91%, respectively. Using the ROC curve to compare ESS and STOP-Bang questionnaires on patients with severe OSA, these showed an area under the ROC of 0.617 and 0.769, respectively, which shows that STOP-Bang has higher discriminative value than ESS.

Conclusions: This study suggests that STOP-Bang questionnaire is a useful tool for screening patients for OSA. Due to its high negative predictive value, the STOP-Bang score appears to be useful to rule out severe OSA. This questionnaire may be very useful on clinical practice when it comes to evaluating the probability of OSA and, therefore, selecting patients eligible for sleep study as well as the type of monitor to be used.
Sleep Breathing Disorders  
Board #122: P3 - Tuesday  

EFFECTS OF HYPOGLOSSAL NERVE STIMULATION ON TONGUE STRENGTH AND ENDURANCE: PROSPECTIVE STUDY

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**Background:** Neuromuscular changes in patients with OSA might occur when treated with the application of unilateral THN. It was suggested that stimulating the hypoglossal nerve (N.XII) would reshape the tongue enough to enlarge and stiffen the oropharyngeal tract, eventually achieving complete or partial resolution of obstructive sleep apnea (OSA) (2).

**Objectives:** Our aim was to assess whether nightly long-term stimulation of the hypoglossal nerve (N. XII) or CPAP treatment could modify tongue strength and/or endurance and whether there is a difference in tongue strength and/or endurance between OSA patients compared to an age and sex-matched healthy control group.

**Materials and methods:** We prospectively measured tongue strength and/or endurance by The Iowa Oral Performance Instrument in OSA patients previous to any treatment and after 3 months of neurostimulation. We collected data of 28 male OSA patients (including 9 subjects treated with neurostimulation, and 19 subjects treated with CPAP) and 20 healthy controls. In the CPAP and healthy control groups, patients were divided each time into 2 subgroups according to their BMI.

**Results:** We did not find any influence of nightly stimulation of the hypoglossal nerve or of CPAP on tongue strength and endurance. We observed no influence of the BMI on tongue strength and endurance; obesity doesn't play a negative role in muscle capacity.

**Conclusion:** Although it can be theorized that a lack of supportive strength in the pharyngeal musculature is strongly contributive to the pathophysiology of OSAS, these difference could not be measured in awake patients.
OBSTRUCTIVE SLEEP APNEA AS PREDICTOR OF CARDIOVASCULAR RISK FACTORS IN MALE ADOLESCENTS WITH ESSENTIAL HYPERTENSION

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Introduction: It is known that obstructive sleep apnea (OSA) is highly prevalent in patients with cardiovascular diseases (CVD) and associated with an increased risk of cardiovascular mortality. OSA has been closely linked to hypertension and obesity as modifiable cardiovascular risk factors, and male as non-modifiable cardiovascular risk factor in adults. However, there is no knowledge about the relationship between sleep disordered breathing and cardiovascular risk factors in male adolescents with essential hypertension (EH). So, the aim of this study is to estimate cardiovascular risk factors profile in OSA and non-OSA male adolescents with EH.

Materials and methods: We examined 38 male adolescents with EH (18 OSA patients - the 1-st group, 20 non-OSA patients - the 2-nd group) aged 14-17 years. OSA was verified by overnight polysomnography in the sleep laboratory applying system GRASS-TELEFACTOR Twin PSG (Comet, USA) if apnea-hypopnea index was > 5/hr. Demographic and anthropometric data, including weight, height, waist circumference were routinely collected. Overweight and obesity were diagnostic if body mass index (BMI, kg/m²) ≥ 90 th and 95 percentile, respectively, for age and sex, using CDC definitions. 24-h ambulatory blood pressure (BP) monitoring was performed using monitor Oscar 2 for OXFORD Medilog Prima. Metabolic status, including triglycerides (TG), total cholesterol, HDL-cholesterol and fasting glucose, were routinely collected by a 12-h fasting blood test performed using an automatic analyzer MTC-330 (PZ CORMAY SA, Poland). All differences were considered significant at p< 0.05.

Results: OSA hypertensive boys did not significantly differ from non-OSA participants in age. But, there were statistically significant differences in anthropometric and metabolic features of the 1-st group. So, BMI was 28.9 ± 2.73 kg/m² in OSA patients and 23.1 ± 1.5 kg/m² in non-OSA adolescents (p < 0.05). Waist circumference ≥ 90 th percentile had 57% in the 1-st group and nobody in the 2-nd group. BP «nondipping» and «night-picking» types were found in OSA hypertensive boys only (37.8% and 8.2%, respectively). Total cholesterol level in the 1-rst group was 5.91 ± 0.24 mmol/L versus 3.88 ± 0.15 mmol/L in the 2-nd group (p< 0.05); fasting glucose level was 5.31± 0.43 mmol/L versus 3.7 mmol/L, respectively (p< 0.05). HDL-cholesterol and TG levels in the both groups no statistically significant differences.

Conclusions: The results of this study indicate for more cardiovascular risk if OSA in male adolescents with EH is present. This is due to the influence of sleep homeostasis disorder and chronic intermittent hypoxia both on daily BP profile and the metabolic measures. Given this fact, the pediatrician can form the CVD risk groups and correct the hypertensive therapy using CPAP (continues positive airway pressure) titration, thereby significantly reduce cardiovascular morbidity and mortality in adulthood.
**Introduction:** Sleep apnea syndrome is one of the most common sleep breathing disorder. Diagnostic method drug induced sleep endoscopy (DISE) is easy and safe examination that helps us to search for exact locality, severity and shape of the upper airways obstruction. In previous studies, use of DISE has changed type of surgery in 2/3 of cases. We suggest that success rate of surgery will increase with DISE too.

**Methods:** 48 patients with proved sleep apnea syndrome underwent surgical procedure at ENT department. In first group with 22 patients DISE was performed before surgery, in second group surgery was made without DISE. The polygraphy was performed before surgery and 6 months after surgery, apnea - hypopnea index (AHI) change, Sher´s criteria and subjective improvement were monitored.

**Results:** We achieved significantly better outcomes in group, where DISE has been performed before surgery - AHI improvement: 63,2% in DISE group vs. 51,6% in non-DISE group, Sher´s criteria: 67% % in DISE group vs. 40% in non-DISE group and subjective improvement: 85% % in DISE group vs. 81% in non-DISE group.

**Conclusion:** We conclude, the success rate of surgery increases with use of drug induces sleep endoscopy as compared to historical controls and though we recommend DISE before every surgical procedure for SAS.
Introduction: The orofacial myofunctional therapy (OMT) is a set of techniques and procedures that proposes to make modifications in the oropharyngeal muscles and in the orofacial functional patterns through isotonic and isometric exercises, as well as to direct the functions of breathing, chewing, swallowing and speech. Recent randomized studies using this technique in adult patients with obstructive sleep apnea (OSA) showed some positive results. Therefore, systematic reviews are required to achieve scientific evidence pointing to the effectiveness of OMT in OSA and snoring, seeking to direct the decision on therapeutic issues.

Objective: To systematically review and analyze the scientific literature on the effectiveness of OMT in adults with OSA and snoring.

Materials and methods: The main question of this review was: What is the effectiveness of myofunctional therapy in obstructive sleep apnea in adults? Search strategy: the searches were made at MEDLINE, Pubmed, Cochrane and Scielo databases using the descriptors: obstructive sleep apnea and myofunctional therapy; and oropharyngeal exercises; and speech therapy; and upper airway exercises. Selection criteria: Studies published from 2000 to 2017 that evaluated the treatment with isolated OMT in subjects with snoring or OSA, obligatorily with polysomnographic data, pre and post therapy. Data analysis described: authors names; year of publication; type of study; scientific biases (according to Cochrane); number of subjects; OSA severity; Therapy description; demographic, anthropometric and polysomnographic data; Epworth Sleepness Scale (ESS) and snoring information.

Results: From 124 articles, 29 seemed potentially relevant but only 7 studies were eligible according to the criteria of this review. Data from these studies were evaluated including two case reports (severe OSA), two clinical trials (mild and moderate OSA) and three randomized clinical trials blinded for the patients and for the polysomnographic analysis (2 of them studied mild and moderate OSA and 1 studied the three severity degrees of OSA). Six studies showed decrease in the apnea and hypopnea index (AHI), five studies showed improvement in the minimum SpO2 and in the ESS and four studies reported improvement in snoring.

Conclusions: This systematic review has shown that there are still few randomized studies. The analyzed studies have shown that the effectiveness of OMT in patients with OSA refers mainly to partial reduction of AHI, partial improvement of SpO2, ESS index and snoring. New randomized controlled clinical trials with a greater number of subjects should be performed to confirm the effectiveness of this therapeutic technique.

Keywords: Obstructive sleep apnea, snoring, myofunctional therapy, speech therapy, oropharynx.
Sleep Breathing Disorders
Board #100: P4 - Tuesday
ELECTROMYOGRAPHY ANALYSES DURING DISE: APPLICABILITY IN HYPOGLOSSAL NERVE STIMULATION

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Introduction: Hypoglossal nerve electrical stimulation (HNS) is described as an alternative treatment to obstructive sleep apnea (OSA) to prevent the pharyngeal collapse during sleep, especially for patients with moderate to severe OSA who didn’t adapt to CPAP. One of the most difficult decisions for the HNS in Imthera model is related to titration or the selections of the electrodes activation. The measurement of the muscles activity using surface Electromyography (sEMG), a non-invasive evaluation tool of recording and analysis of the muscles myoelectric signal, should allow clarifying this kind of choice. This study aimed to verify the different possibilities of HNS by the analyses of the suprathyroid and masseter muscles responses using sEMG during drug induced sedated endoscopy (DISE), seeking the applicability of this technique in the titration procedures, bringing new investigative data to this topic.

Materials and methods: Case report of a moderate OSA patient, 48 years old, male, implanted with electrodes in the hypoglossal nerve trunk (Imthera), right side. Polysomnography data proves successful HNS treatment in the last 12 month. In regard to a snoring complain, DISE with Propofol was performed to evaluate the activation effect of each electrode in the mechanism of airway collapse. Simultaneously, sEMG of the suprathyroid and masseter muscles were recorded bilaterally. All the registers were obtained in RAW signal and analyzed in rectified signal (RMS). The data refers to the average values obtained in microvolts using Miotol (Miotec®), 8 channels, 16-bit resolution; 2000 samples per channel per second; noise < 2 LSB; 20-500 Hz filter; software Miotec Suite version 1.0. Basal sEMG register was obtained before DISE in resting condition, with closed lips, and with maximum voluntary contraction test (MVC), significant asymmetry > 20%. Ethical approval: 1964298 a (PUC/SP)

Results: Basal sEMG showed: low, symmetrical electric activity to suprathyroid and masseter during resting condition; asymmetry with greater electrical potential at right during MVC for suprathyroid (> 29%) and masseter (19%).
During DISE: at rest low electrical potentials in masseter and suprathyroid. During electro-stimulation the responses of the suprathyroid muscles increased up to MVC, asymmetrically, higher at the right side (>20%). The original stimulation channels showed reduction of the electric potential magnitude as the stimulus continues, probably due to the accommodation muscular response. Testing the other channels, the best EMGs response associated with visual exam during DISE defined the titration.
The sEMG also demonstrated co-activation of the ipsilateral masseter simultaneously to electrostimulation. Left masseter remained close to the resting condition.

Conclusions: The sEMG analyzes successfully directed the selections of electrode activation, improving the airway during DISE. The sEMG findings demonstrated asymmetry of electrical potentials for the suprathyroid, with greater ipsilateral activity prevailing on the stimulated side. Systematic records of ipsilateral masseter muscle activity were found synchronized with the HNS, showing the recruitment of other muscles besides the genioglossus.
This data provides highlights about HNS muscle responses, which can contribute to titration and to help in determining the optimal site for stimulation cuff placement.

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**Introduction:** Sleep apnoea in pregnancy is known to adversely affect birth outcomes. Whether in utero exposure to maternal sleep apnoea is associated with long-term childhood consequences is unknown.

**Materials and methods:** Population-based longitudinal study of singleton infants born during 2002 to 2012 was conducted using linked birth, hospital, death, developmental, and educational records from New South Wales, Australia. Maternal sleep apnoea during pregnancy was identified from hospital records. Outcomes were mortality and hospitalisations up to age 6, developmental vulnerability in the 1st year of school (aged 5-6), and performance on standardised tests in the 3rd year of school (aged 7-9). Cox proportional hazards and modified Poisson regression models were used to calculate hazard and risk ratios for outcomes in children exposed to maternal apnoea compared to those not exposed.

**Results:** 209 of 626,188 singleton infants were exposed to maternal sleep apnoea. Maternal apnoea was not significantly associated with mortality (Fisher's exact p=0.48), developmental vulnerability (adjusted RR 1.29; 95% CI 0.75-2.21), special needs status (1.58; 0.61-4.07), or low numeracy test scores (1.03; 0.63-1.67) but was associated with low reading test scores (1.55; 1.08-2.23). Maternal apnoea significantly increased hospitalisations in the 1st year of life (adjusted HR 1.81; 95% CI 1.40-2.34) and between the 1st and 6th birthdays (1.41; 1.14-1.75). This is partly due to admissions for suspected paediatric sleep apnoea.

**Conclusions:** Maternal sleep apnoea during pregnancy is associated with poorer childhood health. Its impact on developmental and cognitive outcomes warrants further investigation.

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RESPIRATORY SYMPTOMS ARE MORE COMMON AMONG SHORT SLEEPERS INDEPENDENT OF OBESITY


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Introduction: Sleep length has been associated with obesity and various adverse health outcomes. The possible association of sleep length and respiratory symptoms has not been previously described. The aim of this study was to investigate the association between sleep length and respiratory symptoms and whether such an association existed independent of obesity.

Materials and methods: This is a multicenter cross-sectional population-based study performed in 23 centers in 10 different countries. Participants (n=5079, 52.3 % males) were adults in the third follow-up of the European Community Respiratory Health Survey (ECRHS) III. The mean ± SD age was 54.2 ± 7.1 (age range 39-67 years). Information was collected on general and respiratory health and sleep characteristics.

Results: The mean reported nighttime sleep duration was 6.9 ± 1.0 hours. Short sleepers (< 6 hours per night) were n= 387 (7.6%) and long sleepers (≥ 9 hours per night) were n=271 (4.3%). Short sleepers were significantly more likely to report all respiratory symptoms (wheezing, waking up with chest tightness, shortness of breath, coughing, phlegm and bronchitis) except asthma after adjusting for age, gender, body mass index (BMI), center, marital status, exercise and smoking. Excluding BMI from the model covariates did not affect the results. Short sleep was related to 11 out of 16 respiratory and nasal symptoms among subjects with BMI ≥30 and 9 out of 16 symptoms among subjects with BMI < 30. Much fewer symptoms were related to long sleep, both for subjects with BMI < 30 and ≥30.

Conclusions: Our results show that short sleep duration is associated with many common respiratory symptoms and this relationship is independent of obesity.
SLEEP APNEA AWARENESS AMONG PEDIATRICIANS IN POLAND, PRELIMINARY RESULTS OF AN ONLINE SURVEY

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Introduction: Obstructive sleep apnea syndrome is estimated to affect up to 5% of children. With only 300 to 400 polysomnographies performed yearly in pediatric population in Poland, most of children suffering from OSA remain still undiagnosed. The aim of this study is to investigate awareness of OSAS among pediatricians in Poland, and preliminary results are presented hereinafter.

Materials and methods: Randomly selected pediatricians participated in the survey posted on online social media (konsylium24.pl) available only for registered physicians. The survey consisted of three sections. Section one included multiple choice questions concerning most important risk factors, symptoms, first line treatment method and diagnostic tools. Section two was composed with single choice questions which consider: previous experience with patients with OSA, where to direct patients with suspected OSA, and polysomnography availability. Third section included demographic information such as: main work place, age group, work experience.

Results: We analyzed reports of 54 physicians. 92% of survey participants have chosen adenoid hypertrophy and 76% marked obesity as one of OSA risk factors. 30% marked snoring as main symptom. 39% think that CPAP is a first line treatment whilst 59% have chosen AT&T. 30% have never suspected OSA in a patient they treated. 35% of participants have never treated a patient who was already diagnosed with OSA. 39% of doctors that took part in the survey ask questions considering OSA when parents are concerned about their children's sleep quality and 37% does it when the patient has OSA risk factors. 59% of participants knows where to direct patient to perform a sleep study. 31% of participants marked that there is a sleep lab in 30km range from their work place, 33% doesn't have sleep lab in proximity. 46% of pediatricians answered that parents rarely report sleep problems that affect their children.

Conclusions: There is still a lack of awareness considering OSA in Poland. As polysomnography availability is limited, and therefore screening performed by pediatrician is more important. Nevertheless, significant opportunities exist to OSAS detection rate in pediatric primary care.
OSAS SEVERITY: DEPENDING ON AHI, APNOE LENGTH, ODI, SAO2MIN, MEAN SAO2, SAO2< 90% OR < 88%, ARTERIAL PCO2 OR A COMBINATION OF SOME OF THESE PARAMETERS?

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Introduction: The association of Obstructive Sleep Apnea Syndrom (OSAS) with cardiovascular diseases as coronary heart disease (CVD), hypertension, stroke, arrhythmias, heart failure and metabolic disease as diabetes II is well documented. Results of correlations with different parameters of OSAS as Apnea-/Hypopnea-Index (AHI), Oxygen-Desaturation-Index (ODI), minimal Oxygen saturation (SaO2min), mean Oxygen saturation (mean SaO2) or time with oxygen saturation below 90% (SaO2< 90%) or lower than 88% (SaO2< 88%) are controversy. The results of ESADA 2014 (EuropeanSleepApneaDatadase) concluded a link between AHI and CVD but confirmed a link between CVD and ODI. We found no study dealing with correlation of apnea length and extent of desaturation. It is not easy to understand why the number of apneas are of higher interest than the effect of apnea on consecutive oxygen desaturation. Why should an AHI of 30/h with an average length of 15 seconds be more severe than an AHI of 10/h with an average length of 100 seconds without regards to oxygen saturation? And PCO2? Oxygen uptake decreases during apneas. But this is only one component of gas exchange. The other component is CO2 elimination - a parameter that has so far been neglected but has the greatest significance in prognosis in emergency situations.In a pilot study we compared all the mentioned parameters together with cardiovascular und pulmonary function with the target for better characterising the degree of OSAS with the intention of a better prognostic Assessment of the further course of OSAS once diagnosed.

Methods: 10 patients with severe but up to attending in the sleep lab untreated OSAS according to AASM polysomnographic criteria - with special consideration of AHI, ODI, apnea length, SaO2min, mean SaO2 and time of SaO2< 90% and < 88%.Additionally extensive lung function measurement (bodyplethysmography, oxygen transfer DLCO-technique, breathing muscle strength P0.1,Pimax, P0.1/Pimax, blood gas analyses, spiroergometry, ECG and echocardiography were performed.

Results: There was no correlation of clinical degree with only one of the measured parameters.Despite the small number of patients examined the impression is that the arterial oxygen saturation is of primary importance for further prognosis. It seems necessary to create a new index for staging the degree of OSAS with the possibility of a better decision regarding necessary therapeutic measures to be recommended.

Table 1 Evaluation of differentiated indices and proposed classification of OSAS severity

Conclusions: The early staging of severe OSAS is important to avoid the well known sequelae of untreated OSAS. This must be beyond the consideration of a single factor as AHI or oxygen saturation alone. It is is of great importance for each individual patient in view of his individual survival chance and the economic burden regarding any not treated but treatment needing OSAS patient.
Introduction: The SERVE-HF study reported a risk of cardiovascular death associated with adaptive servo-ventilation (ASV) used against predominant central sleep apnea in patients with chronic heart failure with reduced left ventricular ejection fraction (LVEF). In May 2015, we adopted a safety procedure in our 32 patients equipped with ASV since 2006. It led to ASV removal in four patients due to ≤45% LVEF. At the end of the procedure we noted eight cases of death. This 25% high mortality rate led us to study these cases.

Materials and methods: In this case series study the study population was derived from our database of patient follow-up from the sleep unit of our cardiovascular department.

Results: All deceased patients but one had cardiac disorders but only one matched the SERVE-HF patient profile, one who died from cancer. Five patients had suffered a stroke, four of whom were with permanent atrial fibrillation at ASV initiation. Four patients had been receiving ASV for predominant central sleep apnea and four for mixed sleep apnea. Six patients died prior to our procedure including two patients who died several months after ASV cessation, one from ventricular fibrillation and one from respiratory infection. The other cases, i.e. with ongoing ASV, consisted in one case of end-stage heart failure with asystole, two cases of cancer and one case of suicide. Two patients who had shown no contra-indications to ASV died several weeks after their safety procedure, one from cancer and one from pulmonary and renal disorders. In the four patients with ASV removal after our safety procedure and due to LVEF ≤45%, alternative solutions were as follows: continuous positive airway pressure ventilation in two cases, nocturnal oxygen therapy in one case and cardiac resynchronization therapy in one case.

Conclusions: In this series no obvious relationship became apparent between sleep apnea or ASV and death. Cardiovascular deaths were not predominant. Further study will be required to clarify the risks associated with ASV in patients with cardiovascular disease.
Introduction: The majority of today's buildings continue to rely mostly on electric lighting rather than adopting active daylighting solutions. Designers and building developers have the tendency to favor technological advances in lighting fixture efficiency rather than using daylight as a means of illumination.

Materials and methods: A pilot study was conducted with the goal to examine the impact of daylight, or lack thereof, on general health and wellbeing as well as sleep quality, was undertaken. preliminary results indicate a distinct association between daylighting and the presence of windows and general health status as well as sleep quality. Sleep was measured using standard sleep questionnaire as well as actigraphy.

Results: An association was found between daylight, or lack thereof and indicators of health as well as sleep quality.

Conclusions: Building standards should require certain levels of daylight throughout the work space as well as certain duration of exposure to these daylight levels.
Introduction: Obstructive sleep apnea (OSA) is a condition associated with numerous metabolic, cardiovascular and endocrine comorbidities. It is characterized by intermittent hypoxemia and sleep fragmentation that directly affect metabolic processes in the body and might have a negative impact on bone mass and trabecular microarchitecture. The purpose of this study was to determine the differences in bone turnover markers, bone mineral density (BMD) and trabecular bone score (TBS) in patients with newly diagnosed OSA compared to healthy individuals.

Materials and methods: A total of 28 male patients with average age of 53.2 years, diagnosed with OSA (apnea-hypopnea index (AHI) 40.5±18.1 events/h), underwent a full-night polysomnography and blood sampling for bone turnover markers. Lumbar spine (L1-L4) BMD and TBS, femoral neck and total hip BMD were measured using dual energy X-ray absorptiometry. All findings were compared to 21 healthy controls matched in age and body mass index (BMI).

Results: Statistical analysis showed significantly lower lumbar spine (L1-L4) TBS values in OSA group compared with control group (1.24±0.17 vs. 1.42±0.13, P=0.001), while lumbar spine (L1-L4), femoral neck and total hip area BMD and T-score showed no significant difference. Patients with OSA had statistically higher values of serum total alkaline phosphatase (ALP-T), bone-specific alkaline phosphatase (ALP-B), osteocalcin (OC), amino pro-peptide of type 1 collagen (P1NP) and beta-CrossLaps (beta-CTx) compared with control group. Significant positive correlations were found between AHI and ALP-T (r=0.386, P=0.042), as well as ALP-B (r=0.563, P=0.001) and P1NP (r=0.474, P=0.011), while significant negative correlation was found between AHI and lumbar spine (L1-L4) TBS values (r=-0.493, P=0.007).

Conclusions: Our study showed that lumbar spine TBS is significantly lower in OSA patient group compared to controls, while total bone turnover metabolism is heightened.

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ASSOCIATION BETWEEN AIR POLLUTION AND SLEEP DISORDERED BREATHING IN CHILDREN

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**Introduction:** Similar to other diseases of the respiratory tract, sleep disordered breathing (SDB) may be exacerbated by particles suspended in the air. Air pollution may have an impact on incidence and severity of SDB in children. The aim of this study was to examine the association between the exposure to different air pollutants and SDB symptoms in children.

**Methods:** In this cross-sectional study, parents from children attending first grade in several elementary schools throughout Chile were included. Data about clinical and family-related SDB risk factors, and the pediatric sleep questionnaire (PSQ) were obtained. Air pollution and meteorological data were obtained from the Chilean online air quality database.

**Results:** A total of 564 children (44.9% males) aged (median) 6 y (5 - 9 y) were included. Prevalence of SDB based on PSQ was 17.7%. When examining air pollutants and conditions, higher ozone (O\(_3\)) levels (\(\beta = 0.006, 95\% \text{ CI} 0.002-0.010, p = 0.01\)) and higher humidity (\(\beta = 0.005, 95\% \text{ CI} 0.002-0.007, p < 0.001\)) were significantly associated with higher PSQ scores. Higher O\(_3\) levels (OR = 1.693, 95% CI 1.409-2.035, \(p < 0.001\)), and higher humidity (OR = 1.161, 95% CI 1.041-2.035, \(p = 0.008\)) were associated with increased odds of wheezing-related sleep disturbances, even after adjusting for demographic variables. Lower temperature was a significant predictor of snoring at least >3 nights/week, following adjustment for demographic and household variables (OR = 0.865, 95% CI 0.751-0.997, \(p < 0.05\)).

**Conclusions:** SDB is significantly associated with some air pollutants such as O\(_3\). In addition, meteorological conditions such as humidity and temperature may be also associated with SDB-related symptoms.
Introduction: Sleep disturbances, due to their nature and complexity, require careful examination of the patient. These studies allow to determine the type and severity of the disorder. In addition to the laryngologist, very often patients should also be consulted by other specialist doctors, facial and facial surgeon and pulmonologist.

Materials and methods: A total of 1637 patients were examined at the MML Medical Center. During the subject examination, medical surveys and evaluations on Epworth’s sleepiness scale were used. At the upper respiratory tract examination, endoscopic visualization was used, with the option of image recording. In order to objectify the obtained results, a complete examination of the fiberoendoscopic diagnostics was conducted with the film documentation and the polysomnography during a medical sleep. Very helpful in the diagnosis of respiratory tract also turned out to be three-dimensional 3D computer tomography.

Results: Our research methods have allowed for accurate assessment of upper airway anatomy disorders, which may have caused obstructive airflow during sleep. A total of 1637 patients were examined at the MML Medical Center. During the subject examination, medical surveys and evaluations on Epworth’s sleepiness scale were used. At the upper respiratory tract examination, endoscopic visualization was used, with the option of image recording. In order to objectify the obtained results, a complete examination of the fiberoendoscopic diagnostics was conducted with the film documentation and the polysomnography during a medical sleep. Very helpful in the diagnosis of respiratory tract also turned out to be three-dimensional 3D computer tomography.

Conclusions: The study allowed us to make a very precise assessment of the space and structure that are the direct cause of sleep disorders and their type and severity. This is very important when planning the scope and type of surgery and performing preoperative and postoperative comparative studies.

Acknowledgements:
Purpose of the study: Influence of neuropsychological factors on acceptance and compliance with CPAP and effect of CPAP on these factors.

Materials and methods: 42 consecutive patients with an AHI > 20 SAS have been included. They were offered a CPAP treatment. Patients were asked to perform a habituation with CPAP. For patients who have accepted CPAP, the efficacy of CPAP has been verified by a polysomnography (PSG). Epworth Sleepiness Scale (ESS), fatigue (PTS), insomnia index (ISI), Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) were performed before proposing CPAP and repeated after 3 months of CPAP. Psychological tests evaluating the locus of control for the evolution of their health (MHLC) and of attribution of control of events (IPC) and tests evaluating the executive functions (verbale fluency and Stroop) were performed and repeated after 3 months of CPAP treatment. Compliance (duration of use per day) was measured after 3 months.

Results: Our cohort included 32 men and 10 women, mean age was 56 ± 12 years old, BMI 33 ± 6 kg/m2, AHI 39.6 ± 20. Thirty-two patients accepted the treatment and 10 refused it. At baseline, the proportion of men and women, the severity of OSA were no different between both groups. Acceptants and non acceptants differed for Mini Mental State examination MMSE (29.1 ± 1 vs. 29.7 ± 1, p. 0.033), IPC powerful others (17.2 ± 8 vs. 9.9 ± 5 P = 0.004), and MHLC chance (16.8 ± 6 vs. 13.2 ± 4 p. 0.035). High Insomnia index was found as a predictor of acceptance (ISI: beta = -0.488, p. 0.032). The CPAP improves significantly, fatigue (12 ± 8 vs. 8 ± 9, p. 0.026), Insomnia index (ISI: 12.4 ± 5 vs. 6.8 ± 6, p. 0.004), and executive functions (Stroop) test P 0.006. The mean compliance after three months was 6.6 hour/day ± 2.

Conclusion: A low insomnia index is a factor that negatively impacts the acceptance of CPAP therapy. Patients refusing CPAP have a lower tendency to attribute control of events to powerful people and also lower attribute to the chance for the evolution of their health comparatively to acceptant patients. CPAP improves fatigue, insomnia index, and executive functions after 3 months.
Introduction: Asthma, which is common in childhood, can cause various sleeping problems. However, the evidence-based nursing practice for the prevention of sleep problems in children with asthma is not clear. To perform a systematic review on evidence-based nursing practices related to sleep problems in children with asthma, and to determine the effects of such interventions on sleep-related health outcomes.

Materials and methods: We used the following topic search strategy to identify relevant articles on the electronic databases MEDLINE, Science Direct, CINAHL, Scopus, and Clinical Key: “asthma” AND “sleep” AND “child” OR “nursing” OR “evidence based”. We evaluated them according to the PRISMA systematic compilation checklist. The latest search was in May 2017. We included evidence-based studies and randomised controlled trials that based on sleep problems in children aged 1-18 with asthma. All studies were evaluated by three researchers. Three authors independently selected the trials, assessed trial quality and extracted the data. The quality of the work was assessed with Jadad scale.

Results: One hundred and forty seven studies were identified, among which twelve studies were selected. The studies are mostly from 2017 (n: 4), the smallest sample group in the study is composed of 10 children and the largest sample group is composed of 22,478 children. The age of children participating in the study varies between 1-18 years. Both the questionnaire (n: 8) and the national and international validity of asthma and sleep scales (n: 12) and clinical evaluations (n: 3) were used in diagnosing asthma and sleep problems in the studies.

Conclusions: To reduce the frequency and severity of sleep problems in children with asthma is supposed to be firstly observe medical treatment, to provide asthma control, to take nighttime sleep in sufficient time, to prevent obesity, family support and environmental hygiene.
Sleep Breathing Disorders
O16: Sleep breathing disorders oral abstract presentations

WHOLE GENOME SEQUENCE ASSOCIATION ANALYSIS OF SLEEP-DISORDERED BREATHING TRAITS IN TRANS-OMICS FOR PRECISION MEDICINE (TOPMED)


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Introduction: Sleep-disordered breathing (SDB) is associated with increased risk of cardiovascular disease and mortality. There is a limited understanding of the bases for differences in patterns of overnight hypoxemia across individuals. The genetic architecture of SDB in humans is largely unknown, despite significant heritability. Further understanding may help elucidate mechanisms influencing obstructive sleep apnea and oxygenation as well as identify individuals at increased morbidity risk.

Materials and methods: We performed a Whole-Genome Sequence Analysis (WGSA) in the TOPMed Consortium using the Apnea Hypopnea Index (AHI) and complementary measures of overnight oxyhemoglobin saturation (SpO2): average and minimum SpO2 and the percentage of the sleep episode with SpO2 < 90% (Per90). WGSA single-variant and gene-based analyses included pooled samples with deep (>30×) sequence coverage of 71.7 million variants from the Cleveland Family Study (507 African-Americans, 486 European-Americans) and the Framingham Heart Study (459 European-Americans). We used mixed effect models adjusting for age, sex, BMI, cohort, and self-identified ancestry with empirical kinship to account for relatedness and population structure. Gene-based test variants were comprised of adverse coding mutations (e.g. stop loss) with strong predicted functional consequences (fathmm-MKL score >0.9).

Results: Heritability based on genetic variants at all frequencies was estimated at 0.29 (AHI), 0.44 (average SpO2), 0.20 (minimum SpO2), and 0.24 (Per90). AHI was associated near DIP2C and CLRN1-AS1 (rs75429350 p = 4.13 × 10^{-8}; 3:150545337_T/G p = 4.87 × 10^{-8}). Average SpO2 was associated near SNX3 (6:108585281_A/G p = 1.12 × 10^{-8}) and C2orf73 (rs73931770 p = 4.03 × 10^{-9}). Minimum SpO2 associations included regions near ADAM3A (rs150052514 p = 8.27 × 10^{-10}) and rs148168881 (chr13q33 intergenic, p = 6.62 × 10^{-9}). Per90 was associated with the AK5 region (rs201266006 p = 1.12 × 10^{-8}). Secondary population- and sex-specific single variant analyses included an association between AHI and 12:8091955_T/C in females (SLC2A3 region, p = 7.74 × 10^{-11}). PCSK9 and CHAF1B were significantly associated with minimum SpO2 in pooled gene-based analyses (Proprotein convertase subtilisin/kexin type 9, p = 1.19 × 10^{-5}; Chromatin assembly factor I, subunit B, p = 2.92 × 10^{-6}). ESRRG was associated with the AHI (Estrogen related receptor gamma, p = 1.21 x 10^{-6}). Secondary gene analyses included an AHI association with KLHL1 (kelch like family member 1; European males p = 1.7 x 10^{-10}).

Conclusions: These are the first WGSA analyses performed on sleep traits. Preliminary results suggest that novel loci are associated with SDB traits. Work is ongoing to characterize non-coding functional regions and extend these analyses using four additional studies with objective sleep recordings in TOPMed Phases 2 and 3 (n > 10,000).

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Introduction: There remains an important and unmet need for fully effective and acceptable treatments in obstructive sleep apnea (OSA). At present, there are no approved drug treatments. Dronabinol has shown promise for OSA pharmacotherapy in a small dose-escalation pilot study. Here, we present initial findings of the PACE (Pharmacotherapy of Apnea by Cannabimimetic Enhancement) trial, a fully-blinded parallel groups, placebo-controlled randomized trial of dronabinol in patients with OSA.

Materials and methods: By random assignment, 73 adults with moderate-to-severe OSA received either placebo (N=25), 2.5mg dronabinol (N=21) or 10mg dronabinol (N=27) daily, one hour before bedtime for up to 6 weeks. Each subject completed laboratory polysomnography (PSG), maintenance of wakefulness testing (MWT), the Epworth Sleepiness Scale (ESS) and the Treatment Satisfaction Questionnaire for Medication (TSQM) at baseline and every 2 weeks during treatment.

Results: At baseline, overall apnea/hypopnea index (AHI) was 25.9±11.3, ESS score was 11.45±3.8, MWT mean latency was 19.2±11.8 min, body mass index (BMI) was 33.4±5.4 kg/m² and age was 53.6±9.0 years. These baseline variables as well as the number and severity of adverse events, and treatment adherence (0.3±0.6 missed doses/week) were equivalent among all treatment groups. MWT sleep latencies, gross sleep architecture and overnight oxygenation parameters were unchanged from baseline in any treatment group. In comparison to placebo, 10 mg/day dronabinol reduced AHI by 13.2±4.0 (p=0.001) and ESS score by 2.5±1.2 (p=0.04) points. The lower dose of dronabinol reduced AHI by 9.7±4.1 (p=0.02) but did not change ESS score. Considering subjects who completed the full 6-week protocol, 0 of 17 of those randomized to receive placebo (N=25) were “responders” -- defined as a final on treatment AHI ≤ 15 and a treatment-related reduction in AHI of ≥ 50% from baseline. In contrast, 6 of 39 subjects receiving dronabinol were responders (p=0.03 versus placebo). In comparison to non-responders who received dronabinol, responders were younger (47.8±11.6 versus 54.8±5.9; p=0.03). Black subjects (4 of 15) were more likely (p=0.05) to be responders than white subjects (1 of 22). Baseline AHI, BMI, ESS and MWT scores did not differ between responders and non-responders, but responders exhibited more severe (p=0.04) REM AHI (55.5±17.3) than non-responders (37.0±19.7).

Conclusions: These findings support the therapeutic potential of cannabinoids in patients with OSA. In comparison to placebo, dronabinol was associated with lower AHI, improved subjective sleepiness and greater overall treatment satisfaction. Moreover, substantial inter-individual variation in treatment response was observed among subjects, with the response being greater among younger subjects, black subjects and subjects with prominent REM-related breathing disorder. Larger scale clinical trials will be necessary to clarify the best potential approach(es) to cannabinoid therapy in OSA.

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Introduction: Type 2 diabetes (T2D) is a metabolic disease of high prevalence associated with high cardiovascular morbidity and mortality. Obstructive sleep apnea (OSA) is a prevalent condition, and constitutes a risk factor for T2D. However, the association between OSA and T2D has not been studied in the Chilean adult population.

Materials and methods: With data from the National Health Survey 2010, the risk of OSA was obtained in subjects ≥ 18 years, using a clinical prediction rule (CPR) based on the variables of the STOP-Bang Questionnaire (Habitual snore, Daytime somnolence, Respiratory pauses observed, Hypertension, BMI > 35 kg/m2, Age > 50 years, Neck circumference ≥ 43 cm in Men and ≥ 41 cm in Women). Each positive response was assigned a value of 1. With the total score the subjects were classified as LOW (< 3), MEDIUM (3-4), and HIGH Risk (≥ 5). By means of the self-report of diseases the antecedent of T2D was obtained and with the results of fasting glycemia, the undiagnosed subjects were detected. To study the association of OSA risk with T2D, we constructed a logistic regression model adjusted for gender, age, body mass index, educational level, residence zone, self-reported sleep duration, history of COPD and family income level. We used a significance level of p < 0.05 and the SPSS Software (v22) for statistical analysis.

Results: The total sample analyzed was 5,069 subjects, with an average age of 47.7 (±17.9) years, 60% of whom were women. Of the total sample, 4,234 (83.5%) met the requirements of the CPR, being classified as LOW 2,496 (59%), MEDIUM 1,378 (32.5%), and HIGH risk 360 (8.5%). Of the total sample, 535 (11.9%) were classified with T2D. According to the results of the regression model, the MEDIUM risk of OSA has an OR = 1.48 (1.12 - 1.97; p = 0.01), and the HIGH risk has an OR = 1.95 (1.30 - 2.94, p< 0.001).

Conclusion: According to our results, the MEDIUM and HIGH Risk of obstructive sleep apnea are an independent risk factor for type 2 diabetes in the Chilean adult population.
SLEEP DISORDERED BREATHING IN PREGNANT WOMEN WITH GESTATIONAL DIABETES

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Introduction: Respiratory Sleep Disorders (RSD) are often found in pregnant women as a result of weight gain, edema, hormonal changes and hyperemia. This may lead to the narrowing of the upper airways and consequently increase the resistance to the airflow, causing cardio-metabolic changes such as gestational diabetes and hypertension. Obstructive Sleep Apnea (OSA) has been associated with preeclampsia, intrauterine growth retardation and preterm delivery. The aim of this investigation was to identify the association between pregnant women with gestational diabetes and OSA.

Methods: A prospective study were performed and the data were collected from 20 pregnant women with gestational diabetes. Subject completed a sleep study level III in order to estimate the prevalence of RSD.

Results: The sample had the following baseline features: 36.20±4.95 years, 29.87±7.04 gestational weeks, Body Mass Index (BMI) = 28.73±5.60 kg/m², 85% with snoring and no relevant daytime sleepiness assessed through the Epworth score. Five participants were diagnosed with OSA: Apnea Hypopnea Index (AHI) = 14.96 ± 7.32 (events/hour of recording), AHI in supine = 18.98±7.66, minimum oxygen saturation (SpO2) = 88.88±2.27% and mean SpO2 = 93.20±4.24%. None of the women presented secondary complication during pregnancy or delivery associated to OSA.

Conclusion: This study suggests OSA is prevalent in pregnant women with gestational diabetes. It was also noted that the higher BMI the higher AHI. Further well-designed studies are warranted to get more consistent data.
**IMPACT OF INTERMITTENT HYPOXIA ON CARDIOVASCULAR REMODELING IN A MURINE MODEL OF SLEEP APNEA: EFFECT OF AGE**

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**Background:** Intermittent hypoxia (IH) is the principal injurious factor involved in the cardiovascular morbidity associated with OSA and this link could be influenced by ageing. The objective of the present study is to assess the role of ageing in the early cardiovascular structural remodeling induced by IH in a mice model of OSA.

**Materials and methods:** We investigated cardiovascular remodeling in C57BL/6 female mice exposed to IH vs. normoxia conditions (8 weeks), in young mice (6 weeks old, n=20) and aged mice (17 months old, n=20).

**Results:** In young mice exposed to IH we observed an intima-media thickening (median 52.7 µm vs 49.4 µm, p=0.01, adjusted by animal body weight) without lumen perimeter changes, elastic fiber network disorganization (mean 8% vs. 0.9%, p=0.01) and fragmentation (median 7 breaks vs. 4 breaks, p=0.05), collagen (median fibrotic area 4.7% vs. 1.1%, p< 0.01) interlaminar accumulation. This vascular remodeling was not observed in aged mice under IH conditions. Furthermore, left ventricular perivascular fibrosis (median fibrotic area 0.4% vs. 1.3%, p< 0.001) and hypertrophy (median left ventricle weight to body weight ratio 4.4 vs. 4.2, p=0.03) were increased by IH in young mice, but not in aged mice.

**Conclusions:** The results of the present study suggest that the cardiovascular remodeling induced by IH is influenced by age, indicating that cardiovascular deleterious effect associated to IH could be higher in young population.

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ADHERENCE AND ACCEPTANCE OF A TELEMEDICINE MONITORING SYSTEM FOR OSA PATIENTS TREATED WITH CPAP

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Introduction: The adherence to CPAP treatment in OSA patients is still not optimal therefore it is still a clinical problem. New telemedicine monitoring systems can improve adherence, but this has not been clearly demonstrated. Primary outcome of our study was to assess PAP adherence (hours of use per night and percentage of days of use) after 1, 3 and 6 months in a group of patients undergoing telemonitoring compared to standard care group. Secondary outcome measures included subjective sleep quality, patient’s satisfaction and side effects.

Materials and methods: randomized controlled trial that compared standard care CPAP treatment versus CPAP treatment by a telemedicine monitoring system (EncoreAnywhere, Philips Respironics). We included 30 patients (mean age 53.3±9.5 yrs) with moderate to severe OSA (mean apnea hypopnea index (AHI) 45.3± 21). Patients were randomized to receive CPAP either in a standard care (SC) way or with telemedicine (TM) that consisted of an autotitrating PAP machine that transmitted data (adherence, leaks, residual AHI) daily to a website that was reviewed by clinical staff. If problems were identified from information from the website, the patient was contacted by telephone as necessary according to defined criteria.

Results: 16 patients were randomized to TM group and 14 to SC group. After 1 month, mean PAP adherence was significantly greater in the TM group (379 min per day) versus the SC group (324 min per day; mean difference = 55 min, p< .05). Percentage of days of use for more than 4 hrs at 1 month was 89.7% in the TM group and 60.8 % in the SC group (p < .05), 92% vs 74.8% at 3 months and 93.3% vs 73.4% at 6 months. Significant independent predictors of adherence was the use of telemedicine (p< .001). On average, we calculated a significant reduction of the number of visits per patients in the TM group compared with the SC group (5 vs 9, p< .05). Patients satisfaction was significantly superior in the telemedicine group (p< .05).

Conclusions: PAP adherence and satisfaction were improved using a web-based telemedicine system implemented at the initiation of treatment and used for long-term monitoring compliance.
Introduction: Drug-induced sleep endoscopy is a mode of investigation that is gaining increasing popularity as part of the objective assessment of patients with obstructive sleep apnea. This led to our centre recently undertaking DISE for all pre-operative OSA patients as a complementary tool to awake nasoendoscopy with Müller’s maneuver.

Objective: The objective of our study is to review the DISE cases performed in our centre, compare DISE findings with awake nasoendoscopy with Müller’s manoeuvre and examine for advantages and pitfalls of DISE in the management of OSA.

Materials and methods: We carried out a retrospective review of our first 38 consecutive cases of DISE performed for pre-operative assessment of OSA patients within Tan Tock Seng Hospital, Singapore. DISE was carried out in our centre by sedating each patient to a bispectral index of 50-70; which elicited active snoring and an oxygen saturation level which mimic what was seen during their polysomnography. DISE examination findings were collected in a standard format using the VOTE classification. This data was then compared with findings of awake nasoendoscopy with Müller’s maneuver (MM) and analyzed. Surgical notes and clinical follow up were also reviewed to evaluate the impact DISE had on our clinical practice.

Results: The patients in our study ranged from 21 to 60 years old (Average 47). The racial profile of our patients was 89% Chinese, 5% Indian, 3% Malay and 3% Caucasian. Average AHI and BMI were 43.7 (11.1 - 108.9) and 25.9 respectively.

We found that DISE was more sensitive in picking up surgically important airway obstruction as compared to awake nasoendoscopy with Müller’s maneuver. At the level of velum, DISE showed that 89% of our patients had 75-100% airway collapse, while MM only showed 37% had this extent of airway collapse. At the level of tongue base, DISE showed that 84% of our patients had 50-100% airway collapse, while MM only showed 26% had this extent of airway collapse.

A review of our DISE data revealed that the commonest site of Grade 2 (75-100%) airway collapse was at the level of velum (up to 89%), followed by tongue base (50%), epiglottis (up to 39%) and oropharynx (13%). These findings on DISE contributed to surgical planning for the patients in our centre.

Conclusions: In our study, drug induced sleep endoscopy recorded substantially higher levels of airway collapse as compared to assessment using awake nasoendoscopy with Müller’s manoeuvre. The review of our DISE cases revealed the commonest site of airway collapse to be the velum followed by the tongue base in our local population. DISE enhanced our practice by guiding surgery and clinical outcomes in several cases.
ADENOTONSILLECTOMY FOR MILD OBSTRUCTIVE SLEEP APNOEA IMPROVED ATTENTION IN CHILDREN - A RANDOMISED CONTROLLED STUDY

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Background: The first-line treatment for childhood OSA is adenotonsillectomy (AT). However, there has been no controlled study to evaluate the effectiveness of AT in ameliorating neurocognitive disturbances in children with mild OSA.

Aims and objectives: To compare the effect of early AT versus watchful waiting (WW) on attention in children with mild OSA.

Methods: This was an interim analysis of a single-blind randomised controlled trial. The study involved 2 visits with a 7-month intervention period in between. Pre-pubertal non-obese children aged 6-11 years who had mild OSA (obstructive apnoea hypopnoea index (OAHI) between 1/h and 5/h) and adenotonsillar hypertrophy were recruited. The subjects were randomly assigned to either early AT group or watchful waiting (WW) group in a 1:1 ratio. The primary outcome of the study was the omission T score in Conners’ continuous performance test (CPT), which is an objective measure of attention.

Results: Twenty-five children were randomised into each arm. Four and eight subjects defaulted follow-up visit and were excluded from the AT and WW groups respectively. In the AT group, there was significant improvement in OAHI from 2.1/hr (IQR 1.4-3.2) to 1.1/hr (IQR 0.3-2.0) [p=0.035], which was accompanied by a modest but significant improvement in CPT omission T score from 44.7 (IQR 43.0-49.9) to 44 (IQR 42.9-45.3) [p=0.017]. Such improvement was not observed in the WW group.

Conclusions: This interim analysis showed that early AT could lower OSA severity and improve attention in pre-pubertal non-obese children with mild OSA.

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LIMITATIONS OF THE APNEA-HYPOPNEA INDEX FOR ASSESSING THE CLINICAL SEVERITY OF OBSTRUCTIVE SLEEP APNEA IN CHILDREN

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Introduction: The obstructive apnea-hypopnea index (OAHI) is the most widely used measure for the diagnosis and severity assessment of pediatric obstructive sleep apnea (OSA). However, OAHI may not map well onto the clinical severity of OSA in children, especially for those with a low or normal OAHI.

Materials and methods: We reviewed the medical records of children aged 2 to 13 years who completed a polysomnographic (PSG) examination at the Boston Children's Hospital for evaluation of OSA between January 2012 and June 2014. We assessed the correlation between the overall clinical impression of OSA severity and the numeric OAHI severity on the PSG. We identified parameters that significantly correlated with the clinical severity of OSA.

Results: We analyzed 649 sleep studies. In those with a clinical impression of mild OSA, 46.7% had a normal OAHI (< 1.5/hour). We found that patients with an OAHI< 1.5 were likely to be diagnosed as mild OSA and recommended treatment if at least 2 of the following 4 factors were present: obstructive respiratory disturbance index ≥2; respiratory arousal index ≥1.5; snoring documented during the PSG; and end tidal CO₂ >50 mmHg for >20% of the total sleep time. Patients with a mild OAHI category (1.5-4.99) were likely to be recommended treatment as moderate OSA if the nadir O₂ saturation was < 92%.

Conclusions: The OAHI is useful but has significant limitations when it is low or normal. In children with an OAHI< 1.5, other parameters should be taken into consideration for a prompt diagnosis and treatment of OSA.

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**Introduction:** Sleep disordered breathing (SDB) is common in children and ranges from primary snoring (PS) to obstructive sleep apnoea (OSA) and is thought to represent a spectrum of SDB from mild to severe. Distinction between PS and OSA is made by polysomnography (PSG) evaluation; an obstructive apnoea-hypopnoea index (OAHI) ≥1/hr is taken to be diagnostic of OSA and those who snore but have few or no events (OAHI < 1/hr) are referred to as PS. Previously PS was considered to be a benign condition but in recent years a growing body of evidence suggests that school-aged children are also at risk of cognitive and behavioural deficits. Whether similar deficits are also evident in pre-school children with PS and OSA remains to be fully tested. This study reports on the baseline cognitive outcomes in children 3-5y with PS (OAHI < 1/hr) and those with mild-moderate OSA (OAHI 1-10/hr) prior to treatment with adenotonsillectomy.

**Materials and methods:** The Pre-School OSA Tonsillectomy Adenoidectomy Study (POSTA) is a multi-centre randomised controlled trial undertaken to evaluate whether IQ deficits in pre-school children with mild-moderate OSA are corrected by adenotonsillectomy. Alongside this group, children who are primary snorers, with an OAHI < 1/hr and clinical symptoms of OSA, have also been studied in a similar manner. Children aged 3-5y referred to ENT for assessment of OSA symptoms were screened by clinical evaluation and with the paediatric sleep questionnaire (PSQ). Those with positive PSQ results underwent baseline PSG testing and neurocognitive assessment using the Woodcock- Johnson III—a cognitive assessment instrument validated in this age group. In this study, baseline data is compared for those children recruited to POSTA, with OAHI 1-10/hr and those children not meeting criteria with PS [OAHI < 1/hr].

**Results:** 88 children have been enrolled in the study and complete data is available on 71 children. The mean (SD) age = 48.5 (8.0) mths and range = 31-69 mths. BMI ranged from 13.5-24.2kg/m² with a mean of 16.3 kg/m². There was a normal distribution of WJIII-GIA scores (70-143 with a mean (SD) = 104.6 (13.9)). There was no significant difference between the two subgroups of OAHI of < 1 (n=33) and those with OAHI of 1-10 (n=38). Even when subdivided into those with an OAHI of < 1(n=33), OAHI of 1-5 (n=31) and an OAHI of >=5 (n=7) there was no significant difference in BMI, age, PSQ or general cognitive functioning. There was a significant difference between OAHI groups in clinical assessment of tonsil size (p=0.007). There was some skewing of the data towards a higher BMI in the higher OAHI group but numbers were small. ANOVA using BMI and clinically evaluated tonsil size was able to predict the higher OAHI group (p=0.002).

**Conclusions:** This study shows no significant cognitive differences between PS and mild or moderate OSA as classified by OAHI in this preschool age group.

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THE EFFECT OF SMELL ON THE SLEEP QUALITY, RESPIRATORY PATTERN AND MERIDIAN OF ADULTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME

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Introduction: The treatments modalities for obstructive sleep apnea syndrome (OSAS) contain risks and poor compliance for either surgical or non-surgical options. So, alternative treatment for OSAS have been investigated for decades. Stimulation of trigeminal olfaction could strengthen lateral pharyngeal wall of upper airway, hence it may be able to improve the severity of OSAS.

Materials and methods: Essential oil Phalaenopsis Bellina was used. We analyzed the result of Sleep Quality, Respiratory Pattern via polysomnography, and Meridian before and after aromatherapy between investigated and controlled group.

Results: From 2015/9 to 2016/6, 30 participants joined the study. 20 people were OSAS patients and 10 people were controlled group. Improved sleep efficiency and Mean SaO2 with Increment of REM and Meridian expression were noted after essential oil delivery with statistical significance.

Conclusions: Essential oils Phalaenopsis Bellina as aromatherapy on OSAS showed improved sleep efficiency, elevated Mean SaO2 and more harmonic Meridian expression. Further investigation should be launched for a larger sample size and for the other essential oils.

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DIFFERENCES IN THREE-DIMENSIONAL CRANIOFACIAL ANATOMY BETWEEN RESPONDERS AND NON-RESPONDERS TO MANDIBULAR ADVANCEMENT SPLINT TREATMENT IN OBSTRUCTIVE SLEEP APNEA PATIENTS

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Introduction: To assess the differences in craniofacial anatomical structures between responders and non-responders to mandibular advancement splint (MAS) treatment in obstructive sleep apnea (OSA) patients.

Materials and methods: 105 OSA patients were retrospectively recruited to investigate whether any differences exist in the anatomical structures of the upper airway, mandible, maxilla, soft palate and tongue at baseline between responders and non-responders to MAS based on NewTom3G imaging. Data from 64 eligible patients were included in the study. All patients were provided with an adjustable acrylic MAS that was activated at 75% of the patients' maximum protrusion. Patients were instructed to titrate the splint until the maximum comfortable limit was reached. Follow up polysomnography (PSG) tests were done to assess OSA status with the MAS in situ. The patients were considered a responder if they achieved an apnea-hypopnea index (AHI) < 10/hour with MAS, and a non-responder with an AHI ≥ 10/hour. Several airway and craniofacial measurements were undertaken to compare responders vs non-responders to MAS.

Results: There were 42 responders and 22 non-responders to MAS. There were no significant differences in the anatomy of the upper airway between responders and non-responders (P=0.17-0.97). The length of the maxilla of the responders, 52±3.9 mm, was significantly shorter than that of non-responders, 54.8±4.4 mm (T=-2.65; P=0.01). The maxillomandibular enclose size of the responders, 4675.4±533.2 mm², was significantly smaller than that of the non-responders, 4993.8±588.6 mm² (T=-2.19; P=0.03). The tongue area on the mid-sagittal plane of the responders, 3263.9±384.3 mm², was significantly smaller than that of non-responders, 3484.9±442.1 mm² (T=-2.08; P=0.04). After controlling for the effect of BMI, however, there was no longer a significant difference in the tongue area between responders and non-responders (F=2.39; P=0.13).

Conclusions: OSA patients with a short maxillary length, a smaller maxillomandibular enclose size, and a small tongue area may respond better to MAS treatment than patients with a longer maxillary length, a larger maxillomandibular enclosure size, and a large tongue area. However, after controlling the effect of BMI, there no longer was a significant difference in the tongue area between responders and non-responders.

Acknowledgements: We would like to thank Dr. Peter Cistulli and Dr. Kate Sutherland for their contribution to this study.
Introduction: Sleep-breathing disorders, SBD, gave patients with high loop-gain much more risk on the development of cardiovascular, new-growth lesions and airway diseases. Intermittent hypoxia in SBD had chance to arise angiogenesis under vascular endothelial growth factor, VEGF. To update current research finding on these associations, an evidence-based research and medical education practice on improving material of presentation was performed in 2017.

Materials and methods: An evidence-based medicine, EBM, searching for articles in PubMed, 2012/Jan/1 to 2017/Jun/1, with keywords as "sleep-breathing disorder", "sleep apnea syndrome", "upper airway resistance syndrome", "angiogenesis", "VEGF" and "loop gain". Then further stratifying the results by "airway diseases", "bronchospasm" and "intermittent hypoxia". Clinical trial and meta-analysis articles were initially referred, but, if there was no update randomized clinical trial, studies on human in sleep lab/center of university based hospital would be accepted for analysis.

Results:
[1] Epithelium of both upper and low airways had to be stretched to produce effective short-term rostral fluid shift on thorax and neck levels and long-term extra-cellular matrix (ECM) stiffness.
[2] Bronchospasm that might develop much more frequently in asthma or chronic obstructive pulmonary disorder had direct effect on airway smooth muscles and the surrounding ECM jamming, the permeability and the local angiogenesis would be introduced under signals conducted by integrins-VEGF receptors, and attention on trend of much angiogenesis would develop in lower ECM stiffness while bronchodilatation in loose architecture sounding the airway smooth muscle.
[3] For low loop gain persons with SBD, vagus nerves affective and effective signals still stimulated myocardium, esophageal and diaphragmatic smooth muscles via the nucleus tractus solitarius under bronchospasm-bronchodilatation cycles, and raised intermittent hypoxia probability while upper airway resistance significantly amplified.
[4] Study results on the correlation in rostral fluid shift and low airway resistance fluctuation in supine position after prolonged sitting without lower limbs stretch activity might be different in findings and conclusion while bronchospasm and loop gain both have ECM and angiogenesis effects clinically.

Conclusions: To make a comprehensive understanding of angiogenesis in sleep-breathing disorder patients with associated bronchospasm and loop gain differences, medical education on these interesting topics still need our well-produced materials in the future. Focus on well-designed randomized clinical trial to test on therapies on control angiogenesis in low loop gain high vagal tone patients is needed.
Introduction: Pediatric obstructive sleep apnea syndrome has obvious hereditary, although genetic basis remains largely unknown. Identifying the genes and pathways associated with obstructive sleep apnea (OSA) can help to expand our understanding of the risk factors for the disease as well as provide new ideas for potential treatment. Therefore, we investigated the association of gene Apolipoprotein E (ApoE), PAIRBOX-p63, Interferon regulatory factor6 (IRF6) with pediatric obstructive sleep apnea syndrome by “transmission disequilibrium test (TDT)” and “whole genome sequencing”.

Materials and methods: 30 non-obese OSA children (Male: 23, body mass index [BMI] = 18.92±3.34 kg/m²; mean AH1=11.55±12.46 events/hour) was diagnosed by ICSD-3. We got the 30 patients and their parents' permission, patients and parents' peripheral blood was drawn after the diagnosis of OSA was confirmed. 9 single nucleotide polymorphisms (SNP) of the ApoE (rs429358, rs7412, rs405509, rs440446), PAIRBOX-p63 (rs4488809, rs10937405), IRF6(rs2235371, rs642961, rs77542756) were analyzed. Haplotype-sharing TDT (HS-TDT) and whole genome sequencing was applied to analysis the association.

Results: All 9 SNPs showed no significance. Haplotype-sharing TDT (HS-TDT) was applied to analysis the association between a disease-susceptibility locus and chromosome regions but showed no significance. Meanwhile the whole genome sequencing of the OSA children shared the same genome type mutation could be found in the genes TP63 and chromosome X "HTR2C" in all our subjects.

Conclusions: Our study showed no associated of Han Chinese pediatric OSA in different SNP. But the Genome wide study showed pediatric OSA of Taiwanese may be associated with TP63 and chromosome X. But the pathogenic pathway between OSA and craniofacial development remained a mystery and still needed further study to find out.

Acknowledgements: Appreciate department of Child Psychiatry and Sleep Center, Chang Gung Memorial Hospital and University for supporting our research.
Introduction: Maxillary expansion is an effective treatment for naso-respiratory obstruction and sleep disordered breathing. With the advent of TAD (temporary anchorage device) to improve force distribution, transverse expansion of the maxilla has become reliable. There are three main methods of maxillary expansion for the older adolescent and young adult: 1. Micro-implant assisted rapid palatal expansion (MARPE), 2. Surgical assisted rapid palatal expansion (SARPE), and 3. Distraction osteogenesis maxillary expansion (DOME). This study compares the biomechanical stress distribution of the craniofacial complex with the three methods using finite element method (FEM).

Materials and methods: CT images of a skull were reconstructed using the software AVIZO (VSG Inc., Burlington, MA, USA). Subsequently the reconstructed geometry was exported to the software Solidworks (Solidworks Corporation, USA) for the construction of finite element (FE) models. Anatomical structures including teeth, skull, periodontal ligaments, intermaxillary, zygomatic-maxillary, frontal-zygomatic suture and zygomatic-temporal suture were modeled. The verification of FE models were done by comparing the outcomes from FE activation and clinical cases (n=4 for MARPE and SARPE; n=6 for DOME).

Results: Results from FE correlate significantly with clinical outcome, with regards to maxillary transverse expansion. (The correlation coefficient: SARPE: R²=0.998; MARPE: R²=1.00; DOME: R²=0.859). Under the same amount of expansion(10mm), MARPE shows the highest stress distribution over the pterygoid plates (35.62MPa) and nasal-maxillary suture (67.43MPa). Zygomatic complex widening was observed in the model of MARPE with the peak stress of 7.941MPa. Nasal floor expansion accompanying maxillary expansion was the greatest in DOME (13 mm), followed by SARPE (10 mm) and MARPE (8.6 mm). There is less dentoalveolar changes, as compared to nasal floor changes in DOME.

Conclusions: Using finite element analysis, distraction osteogenesis maxillary expansion (DOME) demonstrate lower stress distribution over key sutures, while showing the most expansion at the nasal floor, with the least changes in naso-maxillary complex, particularly the dentoalveolar segment.
Introduction: Tinnitus is a common complaint in otologic clinics. The sensation of ringing, roaring, pulsatile or clicking sounds emanating from the ears without an external noise source is often described by tinnitus patients. Tinnitus is commonly a result of dysfunction of the auditory system anywhere along the pathway. It isn't a condition itself but a symptom of an underlying condition, such as age-related hearing deterioration, ear disorders, or problems with a central nervous origin, such as acoustic neuroma. Tinnitus is hard to treat and bothersome. Thus, a better understanding of the relationship between tinnitus and underlying disease may assist in earlier diagnosis and treatment of tinnitus.

The relationship between sleep apnea and auditory dysfunction has been investigated by few studies. Sleep apnea may cause hypoxia and hemodynamic changes during episodes of apnea and lead to cerebral blood flow insufficiency. This may cause ischemic injury to the inner ear, which is supplied by a single terminal artery (labyrinthine artery). The formation of oxidative stress and inflammatory response due to chronic nocturnal hypoxia also plays a role in the development of auditory dysfunction and demonstrates a more marked tinnitus in sleep apnea patients.

As the temporal relationship between sleep apnea and tinnitus has not been studied in a population-based cohort, we have evaluated whether sleep apnea increased the risk of the development of tinnitus in a population without significant comorbidities by conducting a nationwide population-based study.

Material and methods: We conducted a retrospective nationwide population-based cohort study to compare patients newly diagnosed with sleep apnea with age-, sex- and comorbidity-matched individuals between January 1, 2000 and December 31, 2011. We excluded patients who were diagnosed with sleep apnea younger than age 20, those who had antecedent hearing loss, Meniere’s disease, vestibular schwannoma, or tinnitus. The study endpoint for both cohorts was the diagnosis of first tinnitus.

Results: Based on the current nationwide study, the incidence of tinnitus was 16.8 per 1,000 person-years among patients with sleep apnea, which was much higher than in those without sleep apnea (12.3 per 1,000 person-years). After adjustment for age, sex, and comorbidities, the sleep apnea cohort had a greater overall risk of developing tinnitus (adjusted HR 1.37, 95% CI 1.25-1.50; \( p < 0.001 \)). Regarding the comorbidities, age and chronic kidney disease in sleep apnea subjects seemed to be independent predictors for further tinnitus events in the sleep apnea cohort.

Conclusion: This study demonstrates that patients with sleep apnea are at an increased risk of developing tinnitus. The bidirectional relationship between sleep apnea and tinnitus awaits further exploration. However, a recommendation for tinnitus screening for sleep apnea patients or a sleep apnea questionnaire for idiopathic tinnitus patients is suggested.

Acknowledgements: The study is based on data from the National Health Insurance Research Database, provided by the Bureau of National Health Insurance, Department of Health, and managed by the National Health Research Institutes.
Intervention: Microvascular complications from diabetes mellitus represent a considerable part of morbidity in the general population. Among these complications, diabetic retinopathy (DR) is one of the major health issues in developing and developed countries because it forms the leading cause of visual impairment and blindness in working-age adults. It has been reported that an estimated 346 million people had diabetes by 2008, and one-third of them eventually developed DR.

Most well-known risk factors for development and progression of DR belong to what is known as "triple H," which includes hyperglycemia, hypertension, and hyperlipidemia. Accordingly, medical intervention and lifestyle modifications such as achieving a well-controlled blood glucose, blood pressure, and lipids are reasonable methods for reducing the risk of DR. In addition, one emerging modifiable risk factor is sleep apnea, which may lead to DR through the assumptive mechanisms of chronic intermittent nocturnal hypoxemia, arousal and surges in sympathetic activity, and, consequently, microvascular damage from transient blood pressure changes. West et al. reported that OSA was strongly associated with DR, including subclassifications of maculopathy and microaneurysm, and similarly Shiba et al. reported a higher incidence of sleep-disordered breathing and nocturnal hypoxia in patients with proliferative DR. Both were small-sized (n = 240 and 166, respectively) case-control studies. On the contrary, Schober et al. performed a multicentered observational study comprising more than 500 individuals and did not find a correlation between sleep apnea and DR. However, there still has been no nationwide population-based study investigating the long-term effects of sleep apnea on DR, so we conducted a nationwide population-based cohort study to assess the relationship between sleep apnea and DR.

Materials and methods: A nationwide population-based cohort study was conducted using data from Taiwan National Health Insurance Research Database. Subjects with newly diagnosed sleep apnea between 2000 and 2011 were selected. We excluded subjects who were diagnosed with sleep apnea younger than age 20, those who had antecedent DR, or those who were lost to follow-up. A comparison group without antecedent DR and sleep apnea was selected from the dataset with a 1:4 ratio by incidence sampling with the same age, sex and comorbidities of the study subjects. The included comorbidities were diabetes mellitus, chronic obstructive pulmonary disease, hypertension, myocardial infarction, chronic kidney disease, asthma, ischemic stroke, depression, dyslipidemia, and obesity.

Results: In this study, there were no significant differences regarding the incidence of DR in patients with and without sleep apnea. After adjustment for age, sex, and comorbidities, no association between sleep apnea and DR development (adjusted HR 1.02, 95% CI 0.85-1.21; p = 0.867) was seen. Age ≥ 45 (adjusted HR 1.69, 95% CI 1.08-2.64; p = 0.023), duration of diabetes mellitus (per year) (adjusted HR 1.25, 95% CI 1.20-1.29; p < 0.001), and hypertension (adjusted HR 1.62, 95% CI 1.11-2.38; p = 0.013) were independent predictors for further DR events in patients with sleep apnea.

Conclusions: This large population-based study demonstrates that patients with sleep apnea are not at an increased risk of developing DR. Further investigation is needed.
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\textbf{Introduction:} The phenomena of periodic cycles of vascular engorgement on the nasal cavity mucosa that alternate between right and left sides are termed the "nasal cycle (NC)." We have already reported that nasal cycle duration during sleep is longer than in wakefulness (Kimura et al. Laryngoscope, 123:2050-2055, 2013). And it is speculated that nasal cycle is influenced by postural change, change of autonomic nerve activity and sleep stage. Purpose of this study is to clarify the mechanism of nasal cycle during sleep using Polysomnography (PSG).

\textbf{Materials and methods:} We utilized PSG and portable rhinoflowmeter (Rhinocycle, Rhinometrics, Lynge, Denmark), measuring airflow independently through each nostril during sleep on 9 healthy subjects.

\textbf{Results:} 
1. NC was found in eight of nine patients during PSG, and, furthermore, NC was found during sleep in seven of nine. 
2. In two of nine cases, NC with the postural change was found. As for one, NC with the postural change was found in awake state and another one during REM sleep. 
3. In seven all cases which we found NC during sleep, NC was found during REM sleep, and, however, there was no case in slow wave sleep. 
4. The NC tended to be found in REM sleep for the sleep latter half, and, furthermore, in REM sleep which duration showed longest.

\textbf{Conclusions:} We speculated that the NC was associated with a function of the REM sleep. Further study needed to clarify the relationship between nasal cycle and brain function during sleep.
Introduction: The syndrome of sleep apnea appears to be one of the most spread forms of sleep disorders. Sleep apnea is a disorder in which there is a break or pause (apnea) in breathing during sleep.

Materials and methods: Total of 48 patients with sleep apnea were examined at the age of 38-65. According to sleep questionnaire ESS and MBI were determined in all the patients. For differential diagnostics of sleep apnea PSG was carried out using Dr. Sagura Medizintechnik P59 polygraph. PSG investigation was performed accompanying by full video synchronized recording. For CPAP therapy CPAP(IPAP) Machine was used.

Results: According to the questionnaire all the patients have a high rate of night sleep disorders. Epworth Sleepiness Score (20-22, maximum 24) and body mass index (BMI) overall maximum (31-45>31). The patients were characterized by night sleep disorder, loud snore, headache, apathy, the problems of concentration, excess daytime sleep.

PSG has shown that the patients with both obstructive sleep apnea (OSA) 38 and central sleep apnea (CSA) 10 are characterized by significant decrease in sleep architecture, which results in full absence of the NREM3 stage of sleep (superficial sleep), the increase of REM stage, frequent EEG and EMG awakenings and defragmentation of sleep as a whole. It should be noted that a separate part of OSA patients (both women and men) was characterized by clearly expressed REM behavioral disorders. Central sleep apnea was characterized by relative low index of snore SI (80-120) and relative high indices of the Sp02 (87-93) in case of obstructive sleep apnea (SI>200, Sp02-(36-91).

At the background of CPAP therapy the first significant effect was received after 2 hours resulting in the regulation of respiration and snore index. The progressive increase of Sp02 within the limits of 92-95%. Sleep architecture considerably changed, EEG and EMG awakenings sharply decreased, NREM stages increased, in rare cases NREM3 stage was noted, sleep defragmentation significantly decreased.

Conclusions: Thus, Sleep Apnea (both CSA and OSA) is characterized by significant disorder of sleep architecture. At the background of CPAP therapy a significant improvement of sleep architecture and the regulation of symptomomplex characteristic of sleep apnea take place.
Introduction: Longer apneas during sleep in patients with obstructive sleep apnea (OSA) lead to more profound desaturations. The aim of our study was to search for factors related to apneas longer than 1 minute in patients with severe OSA.

Materials and methods: We performed retrospective analysis of data of patients with severe OSA (n=50) and divided them equally in two groups: group 1 - with one or more apneas longer than 1 minute, and group 2 - without apneas longer than 1 minute. We searched for factors related to longer apneas. We measured two groups of factors: predisposing - age, sex, weight, body-mass index, neck circumference, Mallampati score, smoking status, presence of co-morbidities; and consequential - Epworth sleepiness score, quantity and indices of different breathing events during sleep.

Results: We found no significant differences in factors considered predisposing to longer apneas between the two groups. There were differences in some of the factors considered consequential. In group 1 we found strong correlation with the quantity of obstructive apneas (OA) with duration 50-59 seconds (Spearman's rho = 0.625, p< 0.001), moderate correlation with the quantity of OA with duration 40-49 seconds (Spearman's rho = 0.505, p< 0.001) and moderate negative correlation with the lowest saturation registered throughout the night (Spearman's rho = -0.481, p< 0.001).

Conclusions: We found that patients with more OA longer than 40 seconds throughout the night tend to make OA longer than 1 minute and to have more profound desaturations.

Acknowledgements: None
Introduction: There is no straightforward correlation between the severity of obstructive sleep apnea (OSA) and its symptoms. Excessive daytime sleepiness (EDS) is one of the main features of this disorder and it's commonly measured with the Epworth sleepiness scale (ESS). The aim of our study was to search for factors that increase subjective daytime sleepiness in patients with severe OSA.

Materials and methods: We performed retrospective analysis of data. Patients with severe OSA (n=50) were divided in two groups: group 1 (n=21) - patients without EDS and ESS less than 10 points; group 2 (n=29) - patients with EDS and ESS 11 points or more. We comparatively analyzed patient's characteristics such as age, sex, weight, body-mass index (BMI), neck circumference (NC), Mallampati score, smoking status and presence of co-morbidities, and polygraphic measures such as apnea/hypopnea indices (AHI), quantity of different apneas and oxygen saturation.

Results: We found that patients in group 2 are more overweighted (mean 127.52 kg compared to 104.29 kg in group 1; p< 0.003) with higher BMI (mean 41.06 compared to 33.65 in group 1; p< 0.001) and NC (mean 46.80 compared to 44.60 in group 1; p< 0.062). They have higher AHI (mean 69.79 compared to 54.86 in group 1; p< 0.008) and oxygen desaturation index (median 60.00 compared to 52.05 in group 1; p< 0.02), lower average saturation (median 87% compared to 90% in group 1; p< 0.05) and higher percentage of time with saturation less than 90% (mean 66.69% compared to 51.86% in group 1; p< 0.06).

Conclusions: Our results could lead to the conclusion that patients with severe OSA and EDS are more overweighted, have higher AHI and lower saturation throughout the night.

Acknowledgements: None.
EFFECTS OF CONTINUOUS POSITIVE AIRWAY PRESSURE THERAPY ON LEFT VENTRICULAR DIASTOLIC FUNCTION IN PATIENTS WITH SEVERE OBSTRUCTIVE SLEEP APNEA (CPAP-OASIS): A RANDOMIZED, SHAM-CONTROLLED CLINICAL TRIAL

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Introduction: Obstructive sleep apnea (OSA) is associated with hypertension and left ventricular (LV) diastolic dysfunction. Continuous positive airway pressure (CPAP) therapy may decrease LV loads and improve myocardial oxygenation. However, conclusive data are lacking for the benefits of CPAP on LV diastolic function.

Materials and methods: This 3-month, randomized, sham-controlled trial analyzed 52 patients with severe OSA. Patients were randomly assigned (1:1) into parallel groups to receive either CPAP or sham treatment for 3 months. The main investigator and patients were masked to the trial randomization. The primary endpoint was change of early diastolic mitral annular (e′) velocity over the 3-month trial period. Secondary endpoints were pulse wave velocity (PWV), 24-hour ambulatory blood pressure (BP) and variables of ventricular-vascular coupling at 3 months. This study is registered on ClinicalTrials.gov, NCT 01854398.

Results: The baseline characteristics did not differ between the CPAP and sham-treated groups except for a higher body mass index and a higher prevalence of dyslipidemia and statin use in the CPAP group. The CPAP-treated group showed a lower baseline e′ velocity than did the sham-treated group. After 3 months follow-up, CPAP treatment significantly increased the e′ velocity, and was greater than the sham treatment (0.65±1.70 versus -0.61 ± 1.85 cm/s; p = 0.014). In addition, the PWV, 24-hour mean diastolic BP, night-time diastolic BP, arterial elastance index and ventricular-vascular coupling index at 3 months follow-up decreased significantly in the CPAP group.

Conclusions: In patients with severe OSA, CPAP treatment for 3 months improved LV diastolic function more than sham treatment, and was accompanied by improvements in arterial stiffness and ventricular-vascular coupling.

Acknowledgements: We thank the patients who participated in this trial and their relatives; ResMed for providing research equipment; and all physicians and research staffs for their hard work and enthusiasm.
Introduction: Patients with obstructive sleep apnea syndrome (OSAS) have impaired responses to inspiratory resistive loading during sleep. This may be due, in part, to a change in the upper airway sensation. Therefore, we hypothesized that patients with OSAS have diminished upper airway sensation due to snoring.

Materials and methods: A total of 53 participants were selected based on clinical evaluation and polysomnography. Two-point discrimination was measured with modified calipers in the tongue and soft palate.

Results: A total of 10 participants were included in the control group, 12 participants in the simple snoring group, and 27 participants in the OSAS group. There were 12 patients in the impaired sensation group of the OSAS group. On comparing polysomnography, patients with impairment of their palatal sensory input in two-point discrimination (TPD) had a more protracted duration of the longest snoring episode than those with simple snoring and normal sensation. Patients with decreased sensory input in TPD had longer average duration of snoring episodes and relative snoring time than those with simple snoring and normal sensory input in cold uvular TPD. Comparison of the cold uvular TPD for normal sensation and impaired sensation in patients with OSAS after treatment showed a different trend.

Conclusions: Impaired sensation of the soft palate was correlated with the longest snoring episode duration, average snoring episode duration, and relative snoring time. It is helpful in detecting the early stage of neural degradation in OSAS patients by assessing snoring components of polysomnography and TPD in the soft palate.
Sleep Breathing Disorders
Board #099: P6 - Wednesday
RELATIONSHIP BETWEEN SLEEP DISORDERED BREATHING AND CORONARY ARTERY CALCIUM IN ISCHEMIC STROKE PATIENTS

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Introduction: Obstructive Sleep Apnea (OSA) is associated with increased risk of stroke and cardiovascular mortality. In ischemic patients, the major cause of death during follow-up is coronary artery disease. Coronary calcium score (CAC) is a score measured from quantification of calcified plaques with chest computed tomography. CAC has been shown to be associated with future risk of myocardial infarction and cardiovascular mortality. Several studies showed the positive correlation between sleep apnea and CAC in normal population, which may be contributed by progressive worsening of atherosclerosis. We evaluated the association between severity of OSA and CAC in patients who had ischemic stroke.

Materials and methods: This study enrolled patients who were admitted due to acute ischemic stroke. A total of 23 patients who underwent coronary multichannel CT and polysomnography (within 2 years after the stroke event) were included. We investigated polysomnography findings and their relationship with CAC.

Results: The average of calcium score was 208.0±279.2. Body mass index (BMI) was 24.5 ±3.0. Mean apnea-hypopnea index (AHI) was 47.5±28.2. Spearman’s rank correlation coefficients between clinical and polysomnography measures and CAC were as follows: BMI, r = 0.45, p < 0.05; AHI, r = 0.48, p < 0.05. Correlation between CAC and variables from each sleep stage and sleep position was also identified: Apnea index during supine position, r = 0.43, p < 0.05, apnea index during NREM sleep and AHI during REM sleep and supine position (r = 0.54, p < 0.01; r = 0.49, p < 0.05, respectively). O2 saturation nadir during obstructive sleep apnea in REM sleep was negatively correlated with CAC (r = -0.54, p < 0.05).

Conclusions: A relationship between coronary atherosclerosis burden (measured by CAC) and severity of obstructive sleep apnea was identified in our study. Treatment of OSA may improve risk of coronary events in patients with ischemic stroke.

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ASSOCIATION BETWEEN DESATURATION INDICES AND COMORBIDITIES IN PATIENTS WITH OSA- A CROSS SECTIONAL STUDY

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Introduction: Obstructive sleep apnea (OSA) is characterized by episodic, complete or partial nocturnal cessation of breathing with associated oxygen desaturation. It is also a known risk factor for systemic illnesses like hypertension, ischaemic heart disease and stroke. A major mechanism which triggers many of the systemic complications of OSA is hypoxemia which is measured in the hypopnea index component of the apnea-hypopnea index (AHI) and oxygen desaturation index. In the present study, we have attempted to find the association between various OSA indices and prevalent comorbidities among patients evaluated in Sleep Clinic.

Materials and methods: Consecutive patients who underwent evaluation in Sleep Clinic for suspected OSA over two years were included. Clinical and demographic data were compiled along with comorbidity profile. Association between OSA indices [Apnea Index (AI), Hypopnea Index (HI) and Oxygen Desaturation Index (ODI)] and comorbidities was computed. Statistical analysis was done using descriptive statistics for demographic data. Association between comorbidities and OSA indices was assessed using two sample t tests.

Results: One hundred and eighty nine symptomatic patients who underwent sleep study for suspected OSA were included. Out of these, 183 were confirmed to have OSA based on an AHI cut-off of >5. Further analysis has been done only in patients with OSA. There were 129 (66.8%) male and 64 (33.2%) female patients. Age range was 20-85 years (Mean ± SD-52.3±12.4). Mean BMI and neck circumference were 32.8 kg/m² and 41.3cm respectively. Symptoms of OSA were snoring (94.8%), excessive daytime sleepiness (73.7%) and witnessed apneas (67%). Based on AHI, severity of OSA was mild in 31 (16.9%), moderate in 53 (28.9%) and severe in 99 (54%) patients.

Hypertension (48.6%) was the most common comorbidity followed by diabetes mellitus (31.7%), ischaemic heart disease (16.4%), hypothyroidism (10.9%) and stroke (6%). Multiple co-morbidities were present in 65 (35.5 %) patients.

Mean HI was significantly higher among hypertensives (21.4 vs 16.6, p=0.014). In addition, mean ODI was higher among hypertensives (42.6 vs 34.4, p=0.05) and diabetics (46.9 vs 34.7, p=0.008). The frequency of IHD and stroke was higher in patients with a higher HI and ODI, but this did not attain statistical significance (p=>0.05). However, there was no significant association between AI and any of the above co-morbid illnesses.

Conclusions: The present study has revealed that comorbidities like hypertension and diabetes are strongly associated with the occurrence of hypoxemic as opposed to apneic events in patients with OSA. This fact re-emphasises the need to reinforce the use of CPAP and monitor for development of co-morbid illnesses especially in patients with a high HI and ODI.

Acknowledgements: Sleep technologists at our Sleep Clinic
**Introduction**: Positive airway pressure (PAP) adherence in obstructive sleep apnea (OSA) patients in the literature is reported at only 50-70%. However, adherence may differ between clinical populations and research studies as patient motivation, education and follow-up may be different. In our University-affiliated sleep center, OSA management routinely includes education, mask-fitting and follow-up with a sleep physician. Behavioral/educational interventions (PAP desensitization provided by a CBT-I specialist, PAP-NAPs and additional mask fittings targeting technical difficulties) are available but are resource intensive. This study examined the current PAP adherence in a clinical population.

**Materials and methods**: We retrospectively analyzed adherence in 119 consecutive subjects diagnosed with moderate to severe OSA (AHI4%>15/hour) over a 5 month period between 10/01/2015 and 02/01/2016 at the Mount Sinai Integrative Sleep Center. PAP adherence was obtained in all subjects 1-3 months after OSA diagnosis. ‘Adherent’ subjects were defined as using PAP for > 4 hours/night on at least 70% of nights.

**Results**: 97 of 119 (82%) patients with OSA received a prescription for PAP. The remainder of the subjects opted for a dental device or did not return for CPAP titration. In the 97 subjects AHI4=39.9±30/hr, ESS=6.7±5.2 and age = 59±16yrs. Overall PAP adherence was 223±184 minutes per night. 59% (n=57) were PAP adherent (328±121 minutes per night). Among non-adherent subjects (n=40) 31 had zero PAP use and only 11 patients had some usage (90±55.38 mins per night). No significant differences were seen between adherent versus non-adherent subjects for diagnostic AHI4% (43.7±31.6/hr versus 34.4±24.9/hr), subjective sleepiness (ESS 6.4±4.9 vs 6.9±5.7) or age (60±15 vs 58+/16). Adherent patients returned for follow-up visits more often (96% vs 15%).

**Conclusions**: PAP adherence in our clinical population is similar to that reported in the literature. Non-adherence was associated with significantly lower follow-up visits; however insurance requirements mandating a follow-up visit to retain the PAP device could explain why adherent patients returned for follow-up visits. While a significant proportion of OSA patients showed zero PAP use, among those who used PAP the usage was high. PAP adherence appears to have a predominantly bimodal distribution, with 91% of subjects having either >4hrs/night use or zero use.
Introduction: Obstructive sleep apnea (OSA) is a common cause of hypertension. Continuous positive airway pressure (CPAP) has been shown to reduce cardiovascular consequences. It also improves quality of life (QOL) and depressive symptoms in OSA patients after 6 months of treatment. This study aimed to evaluate the short-term effects of CPAP therapy on QOL in OSA associated hypertensive patients.

Materials and methods: Newly diagnosed OSA associated hypertension patients treated at Hypertension/sleep clinic, Srinagarind Hospital, Khon Kaen University, were enrolled. The SF-36 questionnaire was distributed to all eligible patients; before and after CPAP titration therapy. The duration of CPAP therapy was between 3-5 days. All domains of QOL were compared in individuals before and after CPAP treatment by using Wilcoxon sign rank test.

Results: There were five patients who eligible and completed the study protocol. The median age of all patients was 56 years with median BMI of 27.88 kg/m2. Three patients were male (60.0%). In terms of OSA symptoms; all patients had daytime sleepiness and snoring, three patients had reflux esophagitis, two patients had history of hypertensive crisis. The median nocturia was two times. The medians of baseline and post CPAP treatment apnea-hypopnea index were 37 and 2.2 events/hour. Mental health domain was significantly increased after CPAP treatment from 26.62 to 40.00 (p value 0.043).

Conclusions: The short-term CPAP therapy improved mental health in OSA associated hypertensive patients.
Sleep Breathing Disorders
Board #115: P5 - Wednesday

NO CORRELATION BETWEEN CBC FINDINGS AND OSAS BUT CORRELATION BETWEEN BODY MEASUREMENTS AND OSAS

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Introduction: This study aimed to investigate the relationship between platelet count, mean platelet volume (MPV), neutrophil, lymphocyte, neutrophil to lymphocyte ratio (n/l), mean corpuscular volume (MCV), body weight, height and body mass index with obstructive sleep apnea syndrome (OSAS) and disease severity.

Materials and methods: A total of 172 patients were included in the study. 81 (47.1%) were female and 91 (52.9%) were male. The mean age of the patients was 51.28; while the mean age of the women was 53.16 years and the mean age of the men was 49.60.

Patients were divided into two groups according to apnea-hipopnea index (AHI). Apnea-hipopnea index < 5 was assumed as normal, while AHI ≥5 was assumed as OSAS. Also patients with OSAS were divided into three groups according to disease severity from mild to severe.

Complete blood count (CBC) values of group with normal total AHI and group with OSAS were statistically compared.

Results: There was no statistically significant difference between presence of OSAS and platelet count (p: 0.321). There was no statistically significant difference between presence of OSAS and MCV (p: 0.342). There was no statistically significant difference between presence of OSAS and neutrophil count (p: 0.559). There was no statistically significant difference between presence of OSAS and lymphocyte count (p: 0.998). There was no statistically significant difference between presence of OSAS and n/l ratio (p: 0.270). There was no statistically significant difference between presence of OSAS and MPV (p: 0.871). There was no statistically significant difference between presence of OSAS and height (p: 0.996).

A statistically significant difference was found between presence of OSAS and body weight (p: 0.000).

Conclusions: In other studies CBC findings like MPV, n/l ratio were correlated with OSAS and disease severity. In our study there was no correlation. Therefore, further prospective data is needed.
OBSTRUCTIVE SLEEP APNEA SYNDROME AND FACIAL DYSMORPHISMS IN PAEDIATRIC AGE

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Introduction: Children with facial dysmorphism (FD) have a higher incidence of obstructive sleep apnea syndrome (OSAS), due to anatomic and functional changes in the airway. This condition may be asymptomatic, so systematic screening with polysomnography (PSG) is essential.

Objectives:
1) Assess the severity of OSAS diagnosed by PSG in children with FD;
2) Compare the results of PSG with a control group (CG).
3) Compare the symptoms perception with a CG.

Methodology: A retrospective and comparative study was performed (January 2013-December 2016), with a review of PSG records and laboratory questionnaire answers relative to common symptoms in OSAS. The following variables of PSG were evaluated: sleep efficiency (SE), arousal index (AI), apnea/hypoapnea index (AHI), oxygen desaturation index (ODI) and respiratory distress index (RDI). The laboratory questionnaire assessed symptoms perception through the following variables: snore, respiratory pauses, difficulty of breathing, difficulty to fall asleep, arousals, sweating, oral respiration, headache, irritability, excessive daytime drowsiness, concentration difficulty. CG patients with no description of FD were chosen randomly. Descriptive and comparative analysis was performed (α=5%) (SPSS® 21.0).

Results: Thirty-four patients (52.9% males) were included in FD group, with a median age of 8 years (Y) (0.3-18); 34 patients (70.6% males) were included in CG, with a median age of 7.5(1-16)Y. Statistically significant differences were observed only in SE (p=0.009), lower in patients with FD. Mean values were higher in the FD group (RDI=11.5, AHI=8.8, ODI=14.7, IA=8.8), compared with CG (RDI=5.6, AHI=2.6, ODI=5.9, IA=5.9). No statistically significant differences were observed between groups relatively to symptoms perception, except for respiratory pauses (p=0.029), which was lower in FD group.

Conclusions: Patients with FD had a higher severity of OSAS compared to CG, with equal or even lesser perception of symptoms. These results reinforce the importance of a systematic and objective evaluation of sleep disturbances, through a PSG, in patients with risk factors for OSAS, such as FD.
HYPOCAPNIA HAS MINIMAL INFLUENCE ON GENIOGLOSSUS MUSCLE AFTER-DISCHARGE ELICITED BY AROUSAL FROM SLEEP IN HEALTHY INDIVIDUALS

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Introduction: Ventilatory after-discharge, which is the sustained elevation of ventilation following the removal of an excitatory stimulus, occurs during sleep. However, when hypocapnia is present ventilatory after-discharge is inhibited and hypoventilation occurs. Genioglossus after-discharge also occurs during sleep and has been demonstrated in obstructive sleep apnea (OSA) patients following arousals that terminate obstructive events. The effect of hypocapnia on genioglossus after-discharge has not been assessed. The relevance is that post-arousal after-discharge of the dilator muscles may protect against further upper airway collapse in OSA. However, if arousal induced hypocapnia inhibits dilator muscle after-discharge then the airway may be more likely to collapse following the return to sleep. This study investigated the interaction between genioglossus after-discharge and CO2 in healthy individuals by comparing genioglossus activity following arousals induced during hypocapnia and normocapnia.

Materials and methods: 24 healthy individuals (6 female) slept with a nasal mask and ventilator. Sleep (EEG, EOG and EMG), ventilation (pneumotachograph), end-tidal CO2 (PETCO2) and intramuscular genioglossus EMG were measured. Participants fell asleep on minimal continuous positive airway pressure (CPAPmin - 4cmH2O). The mean PETCO2 on CPAPmin during the first 5 minutes of NREM (excluding NREM 1) was designated the participant’s eucapnic NREM level. Hypocapnia was induced by increasing inspiratory pressure support until PETCO2 was ≥2mmHg below the eucapnic NREM level. To produce normocapnia supplemental CO2 was added without changing ventilator settings. Arousals were elicited via auditory tones during the hypocapnic and normocapnic conditions, which were interchanged throughout. Genioglossus EMG following arousal was then compared during hypocapnic and normocapnic conditions using repeated measures ANOVAs. Significance was set at p< 0.05.

Results: 11 participants (4 female) aged 21.5 ± 4.2 years, with a BMI of 22.8 ± 2.9 kg/m² provided data. By design pre-arousal PETCO2 (mean ± SD) was significantly less during hypocapnia (40.7 ± 2.4) compared to normocapnia (43.8 ± 2.9), with differences maintained post-arousal. The number of useable arousals per participant did not differ between hypocapnia (7.4 ± 3.4) and normocapnia (6.7 ± 2.7). After-discharge, defined as a significant increase in genioglossus activity above pre-arousal levels, occurred on the breaths following the return to sleep post-arousal. For tonic genioglossus activity, after-discharge occurred on the first four breaths following the return to sleep, irrespective of CO2 condition. For peak genioglossus activity, after-discharge occurred on the first breath following the return to sleep during hypocapnia and the first six breaths during normocapnia. However, when the peak activity on each of the first 10 breaths following the return to sleep was directly compared between CO2 conditions, no significant differences were observed. Genioglossus activity did not fall below pre-arousal levels in either condition.

Conclusions: Post-arousal genioglossus after-discharge occurs following arousal from sleep in healthy individuals. When hypocapnia occurs there is only minimal impact on genioglossus after-discharge. Future studies should assess whether genioglossus after-discharge improves upper airway patency. If these results extend to individuals with a tendency for upper airway collapse during sleep, then arousal terminating obstruction may be advantageous, as dilator muscle activity will be increased despite arousal induced hypocapnia.
Sleep Breathing Disorders
Board #102: P6 - Wednesday
EFFECTS OF PHYSICAL ACTIVITY ON QUALITY OF LIFE AND SLEEP QUALITY IN CPAP USERS

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Introduction: OSA patients with ideal CPAP treatment may keep diurnal disturbances as daytime sleepiness and fatigue. We hypothesized that physical activity would improve sleep quality and quality of life.

Aims: To evaluate the quality of life and sleep quality in moderate and severe OSAS patients in adequate CPAP treatment.

Methods: In a prospective case-control study, 60 adults, out of which 19 OSA patients under adequate CPAP treatment, were invited. All participants realized polysomnography for OSA diagnosis. All subjects realized a sequence of Pilates exercises under supervision, once a week during a 12-week period.

The questionnaires PSQI, ESS, SF-36 and IPAQ were applied before and after intervention. Results were described and compared between the groups and the moments.

Results: PSQI results showed impaired sleep in both groups, with similar improvement after intervention for both groups. Daytime sleepiness (ESS) reduced more significantly in CPAP users. The physical activity questionnaire (IPAQ) showed increase in time spent with activities in both groups; however CPAP group had greater gains. Quality of life (SF-36) improved for both groups, CPAP users showing significant higher improvement for limitation due to physical aspects, vitality and limitation due to emotional aspects.

Conclusion: Physical exercises based on the method Pilates showed improvement of sleep quality and of life in all participants. However, CPAP users experienced a greater improvement in some aspects as daytime sleepiness, limitation due to physical aspects and emotional aspects; thus, we suggest to include programs of physical activity in the therapeutic approach.
**Introduction:** Perception of syntax construction is fundamental for acquisition of reading and writing. OSA may influence neurocognitive development, thus delaying this ability.

**Aims:** To evaluate the ability of syntaxis in OSA children.

**Materials and methods:** OSA children 4 to 11 years old were evaluated by the Test of Syntax Consciousness: grammatical judgment (GJ), grammatical correction of agrammatical sentences (GC), grammatical correction of agrammatical and nonsemantic sentences (AS) and words categorization (WC); containing 55 items, each one pointing as 1, scored in accordance to their age. Children with altered psychological assessment or audiological alterations were excluded.

**Results:** 35 children, mean age 6.71 years, were included, 10% with mild, 45% moderate and 45% with severe OSA. Regarding Test of Syntax Consciousness, median total score was 34.34, distribution of scores was 15.25 GJ, 6.53 GC, 6.03 AS and 6.53 WC, with the lowest scores for GC. Thus, eight children showed low ability of metasynstaxis.

**Conclusions:** We observed a high frequency (22.86%) of linguistic disabilities in OSA children. More studies should include linguistic abilities and their development as part of possible neurocognitive delay in OSA children.
Level I vs Level III PSG in Diagnosis of Sleep Related Breathing Disorders

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Introduction: Level I PSG is Gold Standard but having its own limitations. The objective of this study is to analyse the efficacy of Level III PSG as a Screening Tool in assessment of select SRBD patients in Indian subcontinent population where High Cost and Infrastructure is a big challenge resulting in non detection of this lethal disease and huge burden on the society at large.

Materials and methods: Randomised prospective study among patients with High Pretest probability of OSA without any comorbidities and where there is no clinical suspicion of any Sleep Disorders other than Obstructive Sleep Apnoea. This category of patients were divided into two groups and Level I study was carried on in one group and Level III was performed in the second group. The AHI score, the Apnoea Index, Hypopnoea Index, Average saturation, Lowest SpO2 were compared between the two groups.

Results: The result is comparable between the two groups and no statistically significant difference obtained between the data from two groups.

Conclusions: The Level III Polysomnography is a highly sensitive, cheap and easy device as a screening tool for selected OSA candidates with comparable results with that of classic Level I PSG.
GENDER CHARACTERISTICS IN A LARGE ROMANIAN COHORT OF PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: Obstructive sleep apnea (OSA) represent a serious widespread disease with significant comorbidities and mortality. Despite a variable prevalence in the literature, OSA is characterized by a higher frequency in men. Data from literature are contradictory and dependent of methodology and ethnically selected population.

Materials and methods: We retrospectively (2005-2017) analyzed 829 patients with OSA. After exclusion of other sleep pathologies (insomnia, circadian rhythm, hypoventilation syndromes, central and mixed sleep apnea, upper airway resistance syndrome), other cardiovascular, respiratory, metabolic acute/uncontrolled pathologies, we compared male vs female patients regarding demographics, OSAS symptoms, comorbidities and sleep studies: polygraphy (PG) and polysomnography (PSG) as needed. SPSS 20 (Chi test, T-test).

Results: 1870 screened; 829 patients (M:F=2.66:1.00) with OSAS analyzed. Mean parameters: age 54.38±12.76, Epworth sleepiness score 8.3±4.75, BMI 32.86±6.85 kg/m², diagnostic AHI 43.32±25.53/h. They were properly PAP titrated. The most frequent comorbid diseases were hypertension and chronic rhinitis. At presentation, the male patients were significantly older (57.70±13.42 vs 53.13±10.08, p=0.002), thinner (body mass index 32.4±6.49 vs 33.98±7.63 kg/m², p=0.002), with some OSA symptoms in a higher percent (observed apnea, headache, nightmare, all p< 0.05) and with a higher pack-year index (26.16±19.53 vs 19.6±17.4, p=0.001) than women, how were accused more frequent fatigue, decreased alertness, nycturia, nocturnal dyspnea (all p< 0.05). There were no significant differences between genders regarding Epworth sleepiness score, OSA severity and comorbidities. Men have a less favorable response to positive pressure treatment (post-titration AHI 8.42±11.94 vs 6.68±10.68, p=0.003) without having indication of a significantly higher PAP values.

Conclusions: This data are more or less similar with some other literature findings but knowledge about these distinct gender-related differences in features of a Romanian OSA cohort may contribute to an increased awareness, diagnosis and treatment in our country in order to reduce consequences of this disease.
**Introduction:** Electrical auricle stimulation (EAS) is a new noninvasive method for treatment of obstructive (OSA) and central sleep apnea (CSA) syndrome. It was developed and introduced by prof. Zoltan Tomori and prof. Viliam Donic research team in 2014 in Kosice, Slovak republic. (EAS) can match and in some aspects even exceed CPAP potential and offers more comfort. In addition, this method probably can also treat CSA, where CPAP and hypoglossal nerve stimulation methods are not effective. Scientific background: In 1991, Tomori’s team published an article “Reversal of apnoea by aspiration reflex in anaesthetized cats” (Eur Respir J 1991; 4: 1117-25). This paper presented the power of a respiratory reflex and its ability to interrupt apnoea in an animal model during sleep. Prof. Colin Sullivan - inventor of CPAP, credited this work, by his personal letter addressed to Tomori. Inspired by positive results, Gert de Vos and Zoltan Tomori submitted a patent “Resuscitation device and method for resuscitation” based on stimulation of the nasopharynx, subnasal and auricular regions. This patent was granted in worldwide countries including USA and Europe. Applying this principle, we introduced the EAS. Our hypothesis is that EAS reflexly activates the brainstem inspiratory generator for restarting breathing in humans. This process eliminates airway obstruction, resulting in resumption of ventilation.

**Materials and methods:** The EAS device applies an electrical stimulus to the auricle, at a low impedance point, upon cessation of breathing. The algorithm has an in-build stimulation delay of a few seconds. 40 male OSA/CSA patients were enrolled with broad selection criteria (BMI< 40 kg/m²). Nights with stimulation ON were compared to nights with stimulation OFF, with particular focus on changes in apnea/hypopnea index (AHI), based on attended polysomnography.

**Results:** Stimulation for one night was efficacious (improvement of AHI >30%) in 18 out of 40 patients (from 47+-20 to 22+-15, p< 0.01; -53%), followed by a trend towards lower AHI (from 26+-15 to 21+-11, p=0.11). Accelerometry did not reveal unusual motion during stimulation ON. Responders reported to feel better or similar compared to CPAP treatment, while EAS was perceived as more comfortable. Baseline characteristics did not differ between responders and non-responders. Besides the results on 40 male patients presented here, several patients are sleeping with EAS system at home, some for over two years. Their AHI, overall health and wellbeing has improved. However, the first generation of EAS was big, heavy to transport and required laptop during the whole night. Therefore the miniaturized EAS second generation has been created, allowing patients to sleep with just a wearable device. Comparison and features of the first and second generation of EAS devices will be demonstrated.

**Conclusions:** EAS is feasible and allows treatment of OSA/CSA, without induction of typical arousals. Moreover, EAS is experienced as more comfortable than CPAP. Hence, these promising results warrant a prospective study to evaluate short and long-term effects. The second generation EAS device wearable by the patient, not connected to any bedside devices, could easily be distributed to Sleep centers worldwide for multi centre study.
A REVIEW: QUESTIONNAIRES FOR SCREENING PEDIATRIC OBSTRUCTIVE SLEEP APNEA

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Introduction: Pediatric Obstructive Sleep Apnea (OSA) not only cause sleep distances during night, but also can negatively affect children's academic and behavior performance in daytime. Pediatric OSA is an under-diagnosed disorder, which need more awareness from clinicians and parents. The standard diagnosis tool is polysomnography (PSG). Considering the high cost and inaccessible of PSG, other screening tools are in need to detect pediatric OSA.

Materials and methods: A literature search for original researches was completed through PubMed and Medline with the key search terms. Articles were included if they met the following criteria: (a) population ranged from 0-18 years old. (b) Validation against standard PSG. (c) Articles were published in English. Case reports, letters, published reviews and personal opinions were excluded. The sensitivity and specificity were recorded and compared.

Results: 16 articles were selected. 7 questionnaires were described, including OSA-18, Pediatric sleep questionnaire (PSQ), Tucson Children’s Assessment of Sleep Apnea Study questionnaire, I’M SLEEPY questionnaire and Pediatric Sleep Survey Instrument (PSSI), OSA-6 and Hong Kong children sleep questionnaire (HK-CSQ). OSA-18 is most widely used, followed by PSQ and OSA-6. The versions of other languages of these three questionnaires have been validated. The sensitivity and specificity of OSA-18 were (24.6%-40%) and (40.9%-73%) in different age group. PSQ had the best sensitivity (72%-88%) and specificity (78%-86%) in reports. The sensitivity and specificity of HK-CSQ were 75.4% and 80.5% in Chinese population. I’M SLEEPY has a high sensitivity (82%) and a modest specificity (50%).PSSI had a sensitivity of 0.94 and a specificity of 0.76 in 5-10 years old children.

Conclusions: PSQ can be used as a screening method, while OSA-18 can be used as an indicator of quality of life in pediatric OSA patients. Considering the different characteristic of infant and adolescent, more studies are needed to identify the applicable age range of these questionnaires.

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THE IMPACT OF A TELEMEDICINE MONITORING ON POSITIVE AIRWAY PRESSURE IN NAÏVE OBSTRUCTIVE SLEEP APNEA PATIENTS’ OUTCOMES: A RANDOMIZED CONTROLLED TRIAL

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Introduction: Untreated Obstructive Sleep Apnea (OSA) can lead to high morbidity, such as reduced cognitive function and increased risk of accidents, and it is associated with diseases such as systemic arterial hypertension, metabolic syndrome, acute myocardial infarction, stroke. Multimorbidity implies to change organization of care and follow-up.

Objective: We prospectively assessed adherence using daily telemonitoring of naïve Positive Airway Pressure (PAP) OSA patients’ data and other associated clinical parameters of cardio-metabolic risk during six months. The ultimate goal of this pilot trial will be to develop an effective, extensible and cost-effective system to promote improved adherence to CPAP patients, as well as monitor clinical parameters (HR, hypertension, glycaemia, and oximetry) of frequently associated OSA co-morbidities.

Materials and methods: In a single center, 33 naïve PAP adult patients with moderate to severe OSA were randomized in two groups: standard care consisting in first week and weekly, if necessary, first, third and sixth month consultations and those with daily telemonitoring information (i.e., adherence, air leak, residual AHI) plus standard care. If problems were identified from information from the website, the patient was contacted by telephone and eventually by a consultation of a homecare technician. Subjects who used PAP for at least 6 hours per night for at least 90% of the days monitored were regarded as adherent. We also analyzed the correlation between adherence and cardio-metabolic clinical parameters.

Results: 32 patients were enrolled, 16 were randomized to telemedicine and 17 to standard care. The mean age was 56, 2 yr., mean AHI was 39, 4 events/hr., and 57% of patients were male. Only after 1 month, mean PAP adherence was significantly greater in the telemedicine arm versus the standard arm. After 3 mo. PAP adherence in the telemedicine arm was almost total sleep time (7h34) versus 5h58 in the standard arm. But after 6 months, there was no difference between the two groups. Additionally, we analyzed cardio-metabolic clinical parameters with PAP adherence and independent predictors of PAP adherence.

Conclusions: Early PAP adherence can be improved with the use of a web-based telemedicine system at the beginning of the treatment. Standard Care implied much more resources and time-consuming. This trial demonstrates that good PAP adherence occurs during the first few days and was predicted by the correction of the interface problems in the first two weeks of treatment, greater AHI, severity as measured by both AHI and TC90, greater Epworth Sleepiness Scale score, greater Body Mass Index (BMI) and by the presence of comorbidities as hypertension and diabetes at baseline. Cardio-metabolic diseases and inherent clinical parameters significantly improved with total sleep time PAP adherence associated with body mass control and an exercise regular program.

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OSA PATIENTS SUSCEPTIBLE TO DECREMENTS IN VIGILANCE DEMONSTRATE A GREATER PREVALENCE OF “LONG DURATION” EEG AROUSALS

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Introduction: Obstructive sleep apnoea (OSA) patients commonly report decreases in sustained attention when performing activities such as the Psychomotor Vigilance Task (PVT). These impacts however are subject to large inter-individual variability and usual PSG measures do not readily explain these variations in PVT outcomes. Recent studies have suggested the presence of OSA patients “resilient” to the impacts of the disorder while other OSA patients are more “susceptible” to these same impacts. The EEG arousal criteria treats all arousal events as being of similar consequence despite a wide variety of differences in duration and intensity. The aim of the study was to examine the EEG arousal characteristics between “resilient” (OSA-R) and “susceptible” (OSA-S) OSA patients.

Materials and methods: This was a retrospective study of patients undergoing polysomnography (PSG) for the primary suspicion of OSA but otherwise were free of risk factors for neurocognitive impairment. Patients were excluded if they had a history of smoking, hypertension, diabetes mellitus, down syndrome, hypothyroidism, high alcohol consumption, cardiac & respiratory failure, head trauma, depression, stroke or use psychoactive medications. Patients also completed PVT, SF-36 and FOSQ just prior to their PSG. PSGs were scored according to the AASM 2012 guidelines. EEG arousal indices were calculated for EEG arousals with durations of >3sec (standard), >5sec, >7sec, >10sec. OSA patients were classified as OSA-R or OSA-S by K means clustering of the 1/RT PVT scores.

Results: Forty patients were classified as OSA-R and twenty-five classified as OSA-S. PVT results for OSA-R and OSA-S respectively were: mean 1/RT (mean±SEM: 2.8±0.3 vs 2.1±0.3), lapses (8±6 vs 49±31) and mean 1/Slowest 10% RT (1.6±0.6 vs 1.0±0.3). There were no differences in age (52±16 vs 56±14), BMI (32.8±9.3 vs 34.4±8.9), subjective sleepiness (9±5 vs 11±6) or AHI (25.4±27.7 vs 27.4±24.3). No differences between the two groups were found in sleep statistics such as: total sleep time (OSA-R vs OSA-S: 340±69 vs 324±71 min), sleep efficiency (74.3±13.6 vs 70.9±15.3%), EEG Arousal Index >3sec (25.5±20.0 vs 30.3±20.1), EEG Arousal Index >5sec (18.3±13.5 vs 26.3±20.1) or sleep stage proportions (N3%: 13.5±9.9 vs 13.2±9.7; R%: 20.9±8.0 vs 17.3±17.5). Differences were observed in EEG Arousal Index >7sec (13.3±10.0 vs 20.7±16.0 p < 0.048) and EEG Arousal Index >10sec (7.9±6.7 vs 13.0±10.8 p < 0.043). Differences in FOSQ scores were observed in total score (OSA-R vs OSA-S: 15.2±3.1 vs 12.0±3.6 p < 0.001), activity (3.1±0.6 vs 2.4±0.8 p < 0.001), general productivity (3.5±0.5 vs 2.7±0.7 p < 0.001) and vigilance (3.1±0.7 vs 2.2±0.8 p < 0.001). Differences in normalised SF36 scores were observed in emotional functioning (OSA-R vs OSA-S: 46.1±12.5 vs 36.4±18.9), social functioning (42.7±10.3 vs 29.4±14.7) and the mental component score (42.5±11.8 vs 34.7±13.9 p < 0.03).

Conclusions: OSA patients deemed susceptible to the impacts of the disorder had greater EEG arousals of “long duration” than their resilient counterparts. Similarly these same susceptible OSA patients also had greater reductions in quality of life and functional outcomes. The use of non-standard PSG measures may provide a better explanation for variations in sustained attention tasks by OSA patients.
Introduction: Shared Decision Making (SDM) has emerged as a best practice clinical approach to collaborative patient care. The Shared Decision Making Tool (SDMT) is used when there are multiple medically reasonable options from which to choose. Clinicians share the best available evidence, options and information including the likelihood of possible side effects about each of the reasonable treatment options available for a child. In turn, patients/parents share information about their values, preferences, concerns, and the context of the condition and care in their daily lives. Together, a plan is developed that is the best for the individual patient and their family. Decision aids/shared decision making tools are one way to implement SDM into clinical practice. These are evidence-based tools that have been shown to consistently improve patient/parent knowledge, increase involvement in decisions, decrease uncertainty about the choice, and improve compliance. Input from multiple stakeholders (e.g. patients, parents, clinicians) is required to produce high quality decision aids/SDM tools. However, despite the increased use of SDM tools (SDMTs), there are no published tools for the management of children with persistent and infant obstructive sleep apnea (OSA).

Objectives: To describe and validate a SDMT for children with persistent and infant OSA.

Materials and methods: Single-blind randomized controlled trial for children with OSA referred to a multidisciplinary Upper Airway Clinic for persistent and infant OSA. We evaluated consecutive patients. The study group used the SDMT while the control group did not. Measures of decisional conflict (SURE, CollaboRATE and decisional conflict) were measured before and after the clinical visit.

Results: We assessed 50 families: 24 in the study group and 26 in the control group. Demographics were similar between groups (mean age=9.4 (control) vs 8.2 years (study) (p=0.52), 35% female). The previsit Decisional Conflict Scale (DCS) score was 42.7 for the control group and 40.8 for the study group (p=0.38); the post visit DCS score was 13.3 for controls and 6.1 for the study group (p=0.034). The improvement in the DCS score was greater in the SDM group, particularly for the values clarity subscore (p=0.048). Both groups had high scores (representing low decisional conflict) after their clinical visit for the SURE scale (3.8 for control and 3.95 for study, p=0.37).

Conclusions: The use of the SDMT for children with persistent and infant OSA improved patients' feeling of participation in the decision making process more than was seen for controls and those using the SDM tool had a greater improvement in values clarity than did those in the control group. However, regardless of which method was used, the patients had low decisional conflict after their clinical visit.

Acknowledgements: William B. Brinkman, MD, MEd, MSc
TRANSIENT NIGHTTIME CARDIAC MUSCLE INJURY IN PATIENTS WITH SEVERE OBSTRUCTIVE SLEEP APNEA SYNDROME

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Introduction: Troponin elevation in healthy subjects after intensive exercise has been described (Neymair GI. Am J Cardiol 2001; 87:369), due to increased exercise-induced myocardial strain and to catecholamine-induced vasospasm (Higgins JP. Clin Invest Med 2003; 26:133). Our purpose is to detect any elevation in troponin blood levels before and after sleep in patients with obstructive sleep apnea (OSA).

Materials and methods: A blood sample was tested for cardiac troponin-I (cT-I) levels at 30 min before sleep and at 15 min and at 3 hours after morning awakening in patients with symptoms suggestive of OSA who underwent a full-night diagnostic polysomnography. The patients should not have any history or any electrocardiographic or echocardiographic evidence of coronary artery or any other cardiac disease including arterial and pulmonary hypertension.

Results: We report our results from 45 consecutive patients who fulfilled the above criteria (27 males; age 47±14 years; BMI 31±9 kg/m²) with newly diagnosed OSA [apnea-hypopnea index (AHI) ≥ 5 events/hour). Patients were diagnosed as having mild (n=9), moderate (n=19) and severe (n=17) OSA. Fluctuations in cT-I were observed but without any consistency and significance in patients with mild and moderate OSA. In contrast, 15 of the 17 patients with severe OSA exhibited consistently a significant elevation in morning cT-I [from 0.02±0.02 ng/ml (before sleep) to 0.08±0.04 ng/ml (after awakening); p< 0.001] followed by a recovery to normal limits after 3 hours (0.03±0.01 ng/ml; p< 0.001).

Conclusions: It is concluded that patients with severe OSA present a significant morning elevation in cT-I blood levels which resolves within 3 hours. This finding may imply myocardial wall strain due to OSA-related hypoxia, sympathetic stimulation or release of inflammatory mediators, while its prognostic value merits further research.
Introduction: Temperature is essential in biological processes. Our hypothesis is that during sleep the body temperature can modify the sleep stages and vice versa.

Objective: Validate the characterization of sleep stages by temperature using a infrared thermography.

Materials and methods: We studied by conventional polysomnography 11 subjects (4 women) for suspected sleep apnea (n = 2) and for CPAP titration (n = 9). Simultaneously, a thermal image (high sensitivity R300 infrared thermographic camera) was collected. Software was developed for the processing of information (6 readings by second), reduction of “thermal noise”, selection of areas of interest (forehead, nose, ear, orbicular and labial) and looking for the prediction formulas and the pattern detection of sleep stages. Predictive rules were established for each sleep stage: N1 (1,073 rules); N2 (1,021 rules); N3 (1,110 rules); REM (416 rules); Awake (1,388 rules). Data mining and bootstrapping techniques were used to obtain the results.

Results: Age 59.8 ± 11.1 years, body mass index 30.6 ± 8.1 kg/m² and Epworth Sleepiness Scale was 8.1 ± 7.0. The average of Apnea-Hypopnea-Index (AHI) was 46.0 ± 20.3. We performed 274,964 samples and we applied multiple predictive rules with the following results (expressed as percentage and 95% confident interval)

STAGE N1: Sensitivity 88.2% (87.9-88.4); Specificity 98.5 (98.4-98.5); Accuracy: 96.6 (96.5-96.7); (+) Likelihood Ratio 58.0 (56.1-60.0); (-) Likelihood Ratio 0.12 (0.12-0.12).

STAGE N2: Sensitivity 91.1% (90.9-91.4); Specificity 96.9 (96.8-96.9); Accuracy: 95.7 (96.6-96.5); (+) Likelihood Ratio 29.0 (28.3-29.6); (-) Likelihood Ratio 0.09 (0.09-0.09).

STAGE N3: Sensitivity 93.5% (93.3-93.7); Specificity 98.7 (98.7-98.9); Accuracy: 97.7 (97.7-97.8); (+) Likelihood Ratio 72.8 (70.3-75.4); (-) Likelihood Ratio 0.07 (0.06-0.07).

REM SLEEP: Sensitivity 91.3% (90.8-91.7); Specificity 99.6 (98.5-99.6); Accuracy: 99.0 (99.0-99.1); (+) Likelihood Ratio 212.2 (200.1-225.1); (-) Likelihood Ratio 0.09 (0.08-0.09).

AWAKE: Sensitivity 94.6% (94.4-94.7); Specificity 96.7 (96.7-96.8); Accuracy: 96.0 (96.0-96.1); (+) Likelihood Ratio 29.0 (28.3-29.7); (-) Likelihood Ratio 0.06 (0.05-0.06).

Conclusions: The measurement of the temperature in the face by using a infrared telethermography is useful to characterize the sleep stages and has a high validity. This technique opens promising possibilities to characterize the sleep stages without using the conventional polysomnography.
VALIDITY AND COST-EFFECTIVENESS ANALYSIS OF PEDIATRIC HOME RESPIRATORY POLIGRAPHY FOR THE DIAGNOSIS OF OBSTRUCTIVE SLEEP APNEA: RATIONALE, DESIGN, AND METHODOLOGY


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Introduction: Obstructive sleep apnea (OSA) in children is a highly prevalent condition associated with neurobehavioral, cardiovascular, and metabolic morbidities. However, most of children with OSA remain undiagnosed. Diagnosis of OSA requires conventional polysomnography (PSG). PSG is time-consuming, inconvenient, and expensive, and is not readily available across centers, which generates a diagnostic accessibility problem. Home respiratory polygraphy (HRP) has been proposed to reduce costs and facilitate the diagnostic process. However, evidence supporting the validity of HRP is still scarce, and does not allow for widespread implementation of HRP for the diagnosis of childhood OSA.

Objectives: Primary: To establish the diagnostic and therapeutic decision validity of HRP compared to the findings obtained with PSG in the sleep laboratory in children with clinically suspected OSA.

Secondary: a) Analyze the cost-effectiveness of the HRP versus PSG.
   b) Evaluate the impact of therapeutic interventions based on HRP results when compared with PSG findings at six months after treatment using sleep, health, and quality of life questionnaires.
   c) Analyze the validity of the determination of a series of proteins in urine, alone or in combination, to establish the diagnosis of OSA and to evaluate its modification after the treatment.
   d) Analyze the cost-effectiveness of HRP vs. PSG in the treatment of OSA.

Materials and methods: Design: Randomized, prospective, multicenter, double blind and crossover trial. The study will include 320 children (ages 2-14 years), both sexes, with clinical suspicion of OSA.

Measurements: All participants with clinical suspected OSA and referred to the sleep units will answer the following questionnaires and be evaluated for:
   a) clinical history;
   b) Anthropometric variables: weight, height, body mass index, neck circumference and percentile;
   c) Chervin questionnaire, quality of life and clinical questionnaires and comorbidity;
   d) PSG in the sleep laboratory at the beginning of the study and its repetition after six month of treatment;
   e) HRP at home;
   f) Quantitative unbiased proteomic urine analysis and
   g) Cost-effectiveness variables.

ANALYSIS: Data from HRP and from full PSG will be compared as follows:
   1) Agreement of results according to the different apnea-hypopnea index by using ROC and Bland-Altman analyses;
   2) The concordance of the diagnosis and treatment decisions when using clinical findings and data from PSG or HRP at home,
   3) All data will be analyzed independently by participating hospitals according to the Cohen Kappa method,
   4) A diagnostic paradigm based on proteomic defined variables and
   5) A cost-effectiveness analysis of the different diagnostic and therapeutic procedures.

Interest of the study: The main interest of this study is:
   a) It constitutes the biggest study on HRP validation carried out to date.
   b) Is a multicenter study that includes eleven university hospitals in Spain.
   c) A cost-effectiveness analysis is made for both diagnosis and treatment decisions.
THE EFFECTS OF POSTURE AND MANDIBULAR ADVANCEMENT ON NASAL RESISTANCE AND OBSTRUCTIVE SLEEP APNEA TREATMENT OUTCOME WITH A NOVEL ORAL APPLIANCE THERAPY DEVICE

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Introduction: Oral appliance therapy is the leading alternative to continuous positive airway pressure in the treatment of obstructive sleep apnea (OSA). However, treatment efficacy is often poor in people with high nasal resistance. The physiological effects of changes in body position and mandibular advancement on nasal resistance in people with OSA remain unclear. We have recently shown that a new oral appliance therapy device that incorporates an opening to the oral cavity (Oventus, O2Vent T) to allow breathing through the device airway minimizes pharyngeal pressure swings during sleep. This may be therapeutically beneficial including for patients with high nasal resistance. Accordingly, this study aimed to:
1) assess the effects of body position and mandibular advancement on nasal resistance in OSA and
2) the efficacy of the O2Vent T device in OSA patients including in those with high nasal resistance.

Materials and methods: To date, seven individuals with OSA (AHI range 5.4-63.3 events/h) have been studied in our sleep physiology laboratory (4 males, aged 35-78 years, BMI: 24-35 kg/m²). To quantify nasal resistance using gold standard methodology, participants were instrumented with a choanal pressure transducer (Pcho), nasal mask and pneumotachograph. Awake nasal resistance (Pcho/flow@200ml/s) was quantified during 5 minutes of quiet nasal breathing in the following 5 positions (order randomized): seated and supine (with and without mandibular advancement) and lateral (without mandibular advancement). Standard split night in-laboratory polysomnography was also performed with and without oral appliance therapy (order randomized).

Results: Awake nasal resistance tended to increase from seated, to supine, to lateral body positions (2.5±0.7, 3.6±1.2, 4.3±1.6 cmH2O/ml/s, respectively). Mandibular advancement did not systematically alter nasal resistance in either the seated (3.1±0.9 cmH2O/ml/s) or supine positions (4.7±2.1 cmH2O/ml/s). Oral appliance therapy reduced the median supine non-REM AHI from 34.4 [5.1, 55.0] to 7.0 [3.1, 22.7] events/h sleep, p=0.03). Two patients had high nasal resistance (>3 cmH2O/ml/s). The non-REM supine AHI reduced by 33% in one of these patients and by 40% in the other.

Conclusions: Preliminary findings indicate that nasal resistance is posture dependent in OSA. Increases in nasal resistance of 33±17% from seated to supine in OSA patients are greater than those reported in healthy non-OSA individuals (< 10%). The novel oral appliance device with built-in oral airway significantly reduced OSA severity including comparable reductions in people with high nasal resistance.

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Sleep Breathing Disorders  
Board #104: P6 - Wednesday  
OBSTRUCTIVE SLEEP APNEA-HYPOPNEA SYNDROME AND SNORING DISEASE: ABOUT 79 CASES

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Introduction: Snoring disease represents the main indication to perform a polygraphy in order to confirm or exclude an associated obstructive sleep apnea-hypopnea syndrome (OSAHS).

Materials and methods: We conducted a retrospective study, over 3 years (2014-2016), including patients hospitalized for snoring disease with probable associated OSAHS, in whom we performed a polygraphy or polysomnography.

Results: A total of 79 patients were concerned. There was a female predominance (63%), the mean age was 43 years and the average of consultation was 5 years. The most frequent comorbidities encountered were high blood pressure in 39% of cases, diabetes in 16%, asthma or COPD in 8%, active smoking in 8%, and depression in 4% cases.

Diurnal symptoms were represented by sleepiness and morning fatigue (67%), cognitive disorder (35%), morning headaches (34%), irritability (25%) and libido troubles (4%). Nocturnal symptoms were represented, in addition to snoring in all patients, by apnea in 66% and urination disorders in 39%. Patients suffered from obesity in 51% of cases.

The physical examination noted big tonsils (6 cases), nasal septum deviation (6 cases), macroglossia (5 cases), long soft palate (3 cases), retrognathia (1 case), and a flaccid tetraplegia in one case associated to amyotrophic lateral sclerosis disease.

The prevalence of OSAHS was 80% of patients with snoring disease, with a slight male predominance (83% of men vs 78% of women).

A dietetic treatment was indicated in all cases of light to moderate OSAHS(40 cases).

A CPAP treatment was indicated in all cases of severe OSAHS (23 cases). A chirurgical treatment of an ORL disease was proposed in 7 cases. Other patients with snoring disease, but without associated OSAHS were redirected to their referent doctor.

Conclusions: This study emphasizes the fact that snoring disease is a sensible but not specific signe of OSAHS. However, this should not stop the screening of this pathology which remains a public health problem in Morocco.
Introduction: Prefabricated adjustable thermoplastic mandibular advancement devices (PAT-MADs) are a practical short-term treatment for obstructive sleep apnoea-hypopnoea syndrome (OSAHS) in patients who have failed or refused continuous positive airway pressure (CPAP) therapy.

Objective: To assess the effectiveness of a new professionally-fitted PAT-MAD in patients with OSAHS in Morocco.

Materials and methods: Twenty-four adults with mild, moderate or severe OSAHS were fitted with the PAT-MAD (BluePro®; BlueSom, France). Respiratory parameters (apnoea-hypopnoea index (AHI), oxygen desaturation index (ODI)) and daytime sleepiness using the Epworth Sleepiness scale (ESS) were assessed before and after treatment. Adverse events were recorded.

Results: Mean treatment duration was 106.3 ± 73.4 days. Mean AHI score decreased from 21.4 ± 7.4 to 9.3 ± 4.1 after treatment (p < 0.0001) (mean reduction of 57.0 ± 12.3%). Mean ESS and ODI also decreased at EOS (from 10.4 ± 2.8 to 7.3 ± 2.3, mean reduction 30.3 ± 12.2%, p=0.0001; and 7.0 ± 6.9 to 4.7 ± 4.0, mean reduction 30.5 ± 25.0%, p=0.2, respectively). Treatment was considered to have been successful in 22 patients (91.7%) who had mild OSAHS or an AHI score of ≤5 at the end of the study. The device was well-tolerated.

Conclusions: This new PAT-MAD appears to be effective at reducing respiratory parameters and improving daytime alertness in patients with OSAHS. Long term studies in a larger number of patients are warranted to assess the long-term efficacy, retention and side-effects of this device.
MEDIAN PALATOPLASTY IN MANAGEMENT OF MIDLINE THICK PALATE, A MISSED CAUSE OF OBSTRUCTIVE SLEEP APNEA (OSA)

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Introduction: There are many causes of failure of UPPP in management of OSA, the most important is the presence of multilevel obstruction. We reported 14 cases having increased midline palatal thickness.

Materials and methods: 14 cases having OSA were enrolled in this study, six have failed UPPP beside eight had no previous surgery. OSA diagnosis was made by history, examination, polysomnography (PSG), wake endoscopy and CT scan. The level of obstruction was determined by sagittal CT scan or scout lateral view neck. We measured the thickness of the palate (12-18 mm) and the distance to posterior pharyngeal (3-7 mm) and compared to normal control (7-10 mm and 1-14 mm respectively). Surgery: Median palatoplasty was done through midline palatal incision dissection and excision of midline thick fibro-fatty tissue, the muscles were sutured to increase their tone, the mucosa was closed.

Results: Marked subjective & objective improvement occurred in 10 cases (71%) - partial improvement in 2 cases (14%) and 2 cases were not improved (14%).

Conclusions: Midline thick palate should not be missed as a cause of OSA, it may lead to UPPP failure. It is diagnosed by sagittal CT. It is treated by excision of the thick fibro-fatty tissue and muscle suturing.
**Introduction:** Lateral pharyngeal wall collapse and splinting possibilities at the hypopharyngeal level is one of the limitations in sleep surgery. Options to splint include hyoid suspension which gives temporary improvement, maxillary mandibular advancement which is aggressive and technically difficult and expansion sphincter pharyngoplasty with limited effect at this level gained by superolateral traction on lateral pharyngeal walls. We propose to gain benefit from maximal anterior traction on the soft palate in transpalatal advancement pharyngoplasty in gaining maximal tension on the lateral pharyngeal walls including the hypopharyngeal level.

**Materials and methods:** Thirty patients (out of 563 patients in the duration between 2012 and 2015) were diagnosed to have OSA on the basis of level one sleep study and who refused CPAP or had CPAP failure were subjected to propofol induced sleep endoscopy and the levels of collapse were both the retroplatal space and the lateral pharyngeal wall including the hypopharyngeal level. These patients were managed by transpalatal advancement pharyngoplasty. Sleep study was repeated 6 months later.

**Results:** We had 70 percent cure rate (AHI below 5). All the remaining cases did improve but had residual events more than five and managed by oral myofunctional therapy. We had three cases complicated by oronasal fistulae; two managed conservatively and one managed by palatal flap.

**Conclusions:** Transpalatal advancement pharyngoplasty is an effective method to splint the lateral pharyngeal walls at the hypopharyngeal level.

**Acknowledgements:** IASSA
ROLE OF STATIC VERSUS DYNAMIC TONGUE BASE EVALUATION IN DECISION MAKING IN TONGUE BASE SURGERY IN OBSTRUCTIVE SLEEP APNEA PATIENTS

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Introduction: Multilevel surgery for sleep apnea patients is gaining popularity among sleep surgeons palatal level collapse remains the commonest but tongue base collapse is not uncommon. Drug induced sleep endoscopy is the best to detect dynamic tongue base collapse either high or low in our view the mean criticism of this evaluation tool is neglecting static tongue position sleep surgery is a practice of limitations what we are trying to do is to attack these limitations to get a better surgical outcome and a more confidential patient counselling sometimes we see bulky tongue with high friedman stage during office examination and when we do sleep endoscopy we find this tongue is not sharing in obstruction the question is that will management of this bulky tongue improve outcome??? This what we tried to answer.

Materials and methods: We compared mean AHI reduction for two groups of patients who were diagnosed as obstructive sleep apnea patients based on level one sleep study and who failed or refused CPAP all these patients had friedman tongue position three or two during office examination but had no tongue base collapse during sleep endoscopy..the first group (20 patients) (retrospectively collected) were managed according to sleep endoscopy findings by palatal surgery alone the second group (20) patients were managed by palatal surgery and midline glossectomy..all surgeries were done by the author in Man´s ours university hospital.sleep study was repeated 6 months postoperatively.

Results: Mean AHI reduction was 74% for the first group and 84% for the second group

Conclusions: Midline glossectomy improves outcome of sleep surgery in patients with friedman tongue position two or three even if tongue base collapse is not evident during sleep endoscopy..this can be explained by tongue palate interaction which is difficult to detect while looking at the airway from behind during sleep endoscopy or can be due to some known limitations of sleep endoscopy..so static tongue position must be incorporated into decision making while planning sleep surgery.

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CLINICAL SCREENING OF OBSTRUCTIVE SLEEP APNEA IN MONGOLIAN OBESE PATIENTS: A HOSPITAL-BASED CASE-CONTROL STUDY

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Introduction: According to estimates 17.6% of men and 26.4% of women in Mongolia were obese in 2013 (body mass index (BMI) ≥30 kg/m²). It has been suggested that obstructive sleep apnea (OSA), characterized by involuntary cessations of breathing during sleep, is both an important cause and consequence of obesity.

Materials and methods: We recruited 35 obese hospitalized patients (mean age: 51.94±15.93 years, male/female ratio: 17:18) referred to departments of internal medicine in five general hospitals in Ulaanbaatar, Mongolia, and 35 normal weight (18< BMI< 25) age- and gender-matched subjects living in the local area. Each subject was assessed for sleep apnea risk factors using the Berlin Questionnaire (BQ) and Global Physical Activity Questionnaire (GPAQ). Blood pressure, fasting blood glucose, and various anthropometric metrics (BMI, triceps skinfold, and circumference of the neck, chest, waist, hip, and thigh) were measured according to Framingham Heart Study protocols. Alcohol and tobacco consumption, and sleep behaviors including pillow usage, were also assessed.

Results: A BQ score indicating a “high-risk” of sleep-apnea was found in 19 (54%) of obese patients and 6 (17%) of matched normal-weight subjects (OR=5.74, p< 0.01). Twenty-six (74%) of obese patients and 9 (26%) of normal weight subjects were snorers (OR=8.36, p=0.001). Pillow use was significantly associated with high-risk BQ score (OR=15.75, p< 0.01). Among obese patients, neck circumference and systolic blood pressure were positively also associated with high-risk BQ score (p< 0.05).

Conclusions: These findings indicate a significant association between obesity and OSA in Mongolian adults. To prevent complications including coronary events, diabetes mellitus, metabolic syndrome, and daytime sleepiness due to comorbid sleep apnea syndrome, BQ combined with assessment of snoring, neck circumference, and blood pressure should be considered for screening of OSA in obese patients.
OSAS QUESTIONNAIRE TO SCREEN FOR FITNESS TO DRIVE EVALUATED IN SLOVAKIA

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Introduction: Validation of fitness to drive in applicants for a driving license, with a special concern regarding OSAS accompanied by excessive daytime sleepiness, became mandatory under new EU legislation in January 2016. The aim of the study was to translate and validate the recommended Questionnaire to screen for OSAS (Q-OSAS) in Slovakia.

Materials and methods: The translated Q-OSAS was administered to 311 Slovak patients before a planned overnight polysomnography. The diagnostic accuracy of the Q-OSAS in OSAS with an apnea-hypopnea index of 15 or more was evaluated by calculating the area under the ROC curve.

Results: The sensitivity and specificity of the cut-off at 10 points for the Q-OSAS was 57% and 67%, respectively, with an increase of sensitivity and a decrease of specificity with a lowering of the cut-off values. Excluding the Epworth Sleepiness Scale (ESS) score from the final statistics yielded the best sensitivity (77%), specificity (50%), and an area under the ROC curve (0.637) for the cut-off value of 8 points (an equivalent of 10 points with the full version of the Q-OSAS).

Conclusions: The Q-OSAS is an acceptable screening tool to facilitate the screening of subjects potentially at risk of moderate and severe OSAS for the fitness to drive. However, in the Slovakian population we suggest a modified two-step interpretation: Subjects with a score of 8 and above and/or an ESS score over 10 have to be recommended for PSG evaluation in the sleep center.

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**Introduction:** Obstructive Sleep Apnea (OSA) is considered a major health problem associated with increased cardiovascular morbidity and mortality and the risk of car accidents. Continuous Positive Airway Pressure is recognized as the Sleep Apnea first line treatment. Home Respiratory Care Companies (HRCC) are responsible for providing this therapy and evaluate treatment related issues, with the objective of maximize adherence. This investigation aim to evaluate the effect of HRCC performance in Sleep Apnea patient's satisfaction, therapy adherence and treatment outcomes.

**Materials and methods:** A questionnaire was developed to characterize the sample in social and demographic dimension, clinical status, adherence to therapy, company performance and patient satisfaction with the HRCC. These questionnaires were applied to all Sleep Apnea diagnosed patients, using Continuous Positive Airway Pressure therapy for more than 6 months, attended in Respiratory Department between January and November of 2013. Adherence was verified by consulting the domiciliary equipment memory card. We also review the institutional clinical process. IBM SPSS 20 was used for statistical analysis, as well as software AMOS for structural equations analysis.

**Results:** The sample consisted of 191 individuals, mostly men, with mean age 62 ± 9.9 years. Most patients had severe Sleep Apnea, and adherence registration showed that 73,1% properly complied the treatment. The majority of the sample reported good adaptation to treatment in the first week, and recognized the HRCC performance role. The interface adjustment was the main provided service. A quarter of patients never received any call from the HRCC and only 9.4% had the first visit after one month of treatment. Patients ranked the HRCC service as "helpful", followed by "effective", and give greater importance to kindness / friendliness of staff. On a scale from 0 to 100, HRCC related satisfaction was 62.2 ± 20.3. We found positive correlations between the HRCC performance on the first visit, general satisfaction and adherence to treatment. Explanation on equipment handling and interface adjustments were also related to adherence. Furthermore, adherence was related to symptoms improvement.

**Conclusions:** In general, Sleep Apnea patients are satisfied with the performance of Home Respiratory Therapy companies. The HRCC performance is related to treatment adherence and treatment outcomes, proving them a central role in sleep apnea patients treatment. It seems necessary a standardization of HRCC protocols, since differences in the performance were found.

**Acknowledgements:** To my husband and coworkers, thank you.
Introduction: Epidemiological studies of Obstructive Sleep Apnea (OSA) have consistently found a very strong male predominance of this disorder. More recently, several studies have reported a male-to-female ratio closer to 3:1, and indicate that women may present with different clinical features and have different polysomnographic patterns of OSA compared to men. Polysomnographic studies show a REM predominance to obstructive events and milder disease in women compared to men. Women are also more likely to have flow limitation, which can manifest as an upper airway resistance syndrome. The gold standard diagnostic tool for OSA is overnight polysomnography (PSG); however, appropriately used, in-home level III studies have an advantage in terms of lower costs and earlier access. Most research evaluating level III portable monitoring has been performed in men or in a mixed population with small numbers of women. This investigation focuses on evaluating the importance of a PSG, regarding results and treatment choice, when a nível III sleep study is already been performed, in women specifically.

Materials and methods: We collected data from 30 women who made the nível III sleep study and PSG with less than 6 months interval and analyzed it using SPSS 14.0.

Results: The studies of thirty women were analyzed, with mean age of 56.43 ± 7.1 years. The most common symptom was snoring and daytime sleepiness. Mean Apnea-Hypopnea Index (AHI) in domiciliary study (nível III) was 8.47/h and corrected at 80% sleep efficiency was 10.43/h. Nine out of 30 women showed a postural predominance in supine position. Polysomnography data presented a mean AHI and RDI of 10.7/h and 13.0/h, respectively, with a mean sleep efficiency of 75.9%. 33.3% presented results with prevalence in REM sleep. None of the women had AHI compatible with severe sleep apnea in the nível III study, but 3 had severe results in the PSG. Therapy with APAP was proposed to 15 women, but 5 showed no compliance to the treatment; 2 underwent postural treatment along with more 3, with good results.

Conclusions: In our female population, we found AHI values from PSG and Home sleep study (nível III), when corrected to 80% sleep efficiency, to be comparable. Although we know that women have "special sleep status", mainly regarding REM sleep, the results in PSG are very close with nível III study, and apparently have no effect on the treatment choice.
PREVENTING LEAKAGE CAUSED BY MOUTH OPENING DURING SLEEP USING NASAL CPAP THERAPY COMBINED WITH AN ORAL SHIELD DEVICE (SOMNIPAX™)

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Background and objective: It is widely agreed, that first line treatment of obstructive sleep apnea (OSA) is nasal continuous positive airway pressure (nCPAP). Over the past years an increasing number of mask types has been established. Current evidence suggests, that nasal masks should be first choice, when differentiating between oronasal (ONM) and nasal masks (NM). Nevertheless ONM are often used to prevent oral dryness resulting from mouth opening during sleep.

The aim of the current study was to prevent mouth leakage during nCPAP therapy with an enoral shield device (NMS) additionally to NM.

Methods: Cross-sectional, prospective, randomized, unblinded study. Patients with OSA and established nCPAP or nBiPAP - therapy using nasal masks and complaining about mouth dryness underwent three full polysomnographies (PSG) (Alice 5™; Phillips Respironics™) using NM, ONM, NMS in a randomized order. The applied airway pressure was identical in all three measurements. Mask leakage was documented continually. Sleep quality was assed using an analogue scale and a questionnaire.

Results: 31 patients were randomized, 29 could be analysed (17 men, 12 women; average age 59,5 (35; 79) years; mean body mass index 33,1 kg/m² (26,7; 54,9), patient underwent three PSG with airway pressure applied by NM, OMN and NM plus oral shield device(NMS). There was a highly significant difference regarding RDI between OMN (mean 8,5/ h ±6,7) and NM/NMS (mean 2,6/ h ±2,3; 2,7/ h; ±2,6) (p=0,000) and regarding the leakage OMN (mean 39,7 l/min ±12,4) NM (34,6 l/min ±9,4) and NMS (33,1 l/min ±9,6) (p=0,011). Furthermore analysis of sleep quality (NREM3) also favoured NM and NMS (p = 0,02). However, there were no significant differences between NM and NMS in any objective outcome. Subjective assessment of sleep quality showed adventage in some patients in the NMS group.

Conclusion: Our data showed a consistent advantage for NM and equally for NMS. Therefore, NM should be the first choice in the treatment of patients with OSA. The examined oral shield device can be offered to patient with mouth opening during sleep to achieve additional comfort, without affecting the effectiveness of nCPAP - Therapy.
THE RISK OF OBSTRUCTIVE SLEEP APNEA IN A BRAZILIAN BIRTH COHORT: PRELIMINARY RESULTS

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Introduction: Obstructive Sleep Apnea (OSA) is a prevalent disease. A Brazilian study estimated the prevalence of OSA in the adult population in 32.8%. The most frequent signs and symptoms of OSA are snoring, apnea, excessive sleepiness, nocturia, cognitive impairment, depressive symptoms, difficulty concentrating, sexual impotence and morning headache. Birth cohort studies bring the possibility of conducting research with a temporal window that begins at birth and extends to the present, representing an opportunity that may help us to understand the mechanisms that lead to OSA. In this preliminary results, we will evaluate the quality of sleep, excessive daytime sleepiness, and the presence of obesity and high blood pressure in a population stratified by risk of OSA.

Materials and methods: The study population came from a larger study called COBRAS (COortes BRASileiras) and started in the 1970’s with the initial objective of studying the development of live births in the region of Ribeirão Preto, São Paulo, Brazil. Firstly, a cross-sectional study of this population was carried out to evaluate the risk of OSA, sleep quality (Pittsburgh Sleep Quality Index - PSQi), sleepiness (Epworth scale) and anthropometric data such as weight, height, BMI and blood pressure. To stratified the risk of OSA, the STOP-BANG questionnaire was used. It consists of the evaluation of eight domains (Snoring, Tiredness during daytime, Observed apnea, high blood Pressure, Body mass index, Age, Neck circumference and Gender).

Results: Out of more than 5000 individuals, 1560 were interviewed so far. The mean age and standard deviation were 33 ± 7.6 years. Of these, 1239 (78.4%), 270 (17.1%) and 51 (3.2%) were, respectively, a low, intermediate and high risk for OSA. We observed a worse quality of sleep in the population with a high risk of OSA compared to low and intermediate risk (p < 0.001), and the intermediate risk population versus the low-risk population (p < 0.001). An increased of daytime sleepiness was associated with an increased risk for OSA (p < 0.002). Individuals with excessive daytime sleepiness have a higher risk for AOS - OR (Confidence Interval ± 95%) = 2.07 (1.11-3.86). We observed an increase in the proportion of individuals with High Blood Pressure (HBP) associated with increased risk for OSA (p < 0.001). People with HBP have greater risk for high risk for AOS - OR (Confidence Interval ± 95%) = 10.1 (5.12-19.92). An increase in the proportion of individuals with obesity was associated with an increased risk for OSA (p < 0.001). Obese people have a higher risk for high risk for AOS - OR (Confidence Interval ± 95%) = 33.16 (17.64-61.98).

Conclusions: The presence of poor sleep quality, excessive daytime sleepiness, HBP and obesity are associated with an increased risk for OSA.

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Introduction: Numerous studies suggest that insulin resistance and diabetes type 2 represent important risk factors in the development of obstructive sleep apnea (OSA), as well as OSA being one of the risk factors for type 2 diabetes. The main goal of this study was to assess the risk for OSA in patients with type 2 diabetes and to evaluate overall health-related quality of life among all enrolled patients.

Materials and methods: A total of 466 patients with type 2 diabetes (mean age 66.3 years) were consecutively enrolled in this cross-sectional study during the examination at Regional Centre for Diabetes, Endocrinology and Metabolic Diseases of University Hospital of Split. STOP questionnaire (Snoring, Tiredness, Observed, Pressure; STOP) was used in the evaluation of the risk for OSA, while excessive daytime sleepiness was assessed with the Epworth Sleepiness Scale (ESS). Additionally, all participants completed widely used Short Form-36 (SF-36) questionnaire which measures health-related quality of life across eight physically and emotionally based domains.

Results: Statistical analysis showed that 312 (67%) participants had increased risk for OSA (STOP score ≥2), and they had higher body mass index (BMI) (29.6±5.1 vs. 27.02±4.35 kg/m², P< 0.001), higher neck circumference (38.2±5.0 vs. 37.07±3.7 cm, P=0.003), and higher ESS score (6.5±4.5 vs. 3.99±3.27, P< 0.001) compared to the patients without risk for OSA. In addition, HbA1c values in patients with increased risk for OSA were 8.0±1.81 %, while in patients without risk for OSA they were 7.7±1.79 % (P=0.074). Patients with increased risk for OSA had significantly lower SF-36 scores (P< 0.001 for each of 8 domains). Moreover, overall STOP score showed negative correlation with every domain of the SF-36 survey (P< 0.001).

Conclusions: Our study showed that high percentage of patients with type 2 diabetes have increased risk for development of OSA, and those patients have significantly decreased health-related quality of life.

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REM-DEPENDENT OSA IS ASSOCIATED WITH GREATER DAILY SLEEPINESS THAN POSITION-DEPENDENT OSA

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Introduction: Obstructive Sleep Apnoea (OSA) is characterized by recurrent episodes of apneas or hypopneas during sleep leading to intermittent hypoxemia and arousals. A few distinct phenotypes of OSA can be recognized. Among others, position-dependent phenotype (apneas occurring in the supine sleep position) and REM-dependent phenotype (apneas occurring during REM stage of sleep) are recognized. Excessive daily sleepiness is the leading complaint of patients with OSA and may be easily assessed by Epworth Sleepiness Scale (ESS). The aim of the study was to compare REM-dependent and position-dependent OSA patients in relation to their clinical variables, ESS included.

Materials and methods: The study included N=1863 consecutive patients, who were referred to Sleep and Respiratory Disorders Centre with presumed diagnosis of OSA. Following polysomnography (PSG) examination 369 patients were allocated into 2 groups: REM-dependent group (n=111) and position-dependent group (n=258).

Results: REM-dependent group had two and a half times lower median I IQR (p< 0.001) of Apnoea-Hypopnea Index (AHI) compared to position-dependent group, yet day-time sleepiness measured as percentage of ESS score (by percentage scored on ESS) was higher (37.5% vs 33.3%; p=0.024). There were no statistically significant differences between group regarding sex and age.

Conclusions: As patient suffering from REM-dependent OSA present with much higher day-time sleepiness than the position-dependent OSA patients, it may be reasonable for physicians to introduce CPAP treatment in this group at lower level of AHI.

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INTRODUCTION: Oral appliances such as the mandibular advancement device (MAD) have not been deemed fully therapeutic in moderate to severe obstructive sleep apnea (OSA). As such, we conducted a pilot study to investigate augmentation of the MAD by pharmacotherapy in these patients. The objectives of this study were: 1) to investigate the feasibility of combined treatment by MAD with pharmacotherapy in patients with moderate to severe OSA; 2) to estimate the treatment effects of MAD only and MAD with pharmacotherapy; and 3) to differentiate these treatment effects according to respiratory event frequency (apnea-hypopnea index).

MATERIALS AND METHODS: A prospective, placebo-controlled, blinded crossover study of 11 subjects with moderate- severe OSA was conducted. Treatment was a MAD plus placebo medication for two weeks, followed by a combination regimen of ondansetron (24 mg/day) and fluoxetine (10 mg/day) with continued use of the MAD for another two weeks. The primary outcome measure was Apnea-Hypopnea Index (AHI).

RESULTS: Paired samples t test indicated: AHI MAD (19.1 ± 4.8) was significantly lower than the AHI baseline (33.4 ± 3.3) and AHI MAD + Drug (14.4 ± 3.0) was significantly lower than the AHI baseline. Specifically, NREMAHI MAD (13.9 ± 4.1) was significantly lower than the NREMAHI baseline (29.8 ± 3.5) and NREMAHI MAD + Drug (9.6 ± 2.3) was significantly lower than the NREMAHI baseline. Although not statistically significant, AHI MAD + Drug was lower than AHI MAD. Both variables AHI MAD and AHI MAD + Drug were highly correlated r=0.8, p< 0.05. No significant differences among treatment modalities were found when assessing AHI in various sleep positions and REM stage sleep.

CONCLUSIONS: Combination of pharmacotherapy and oral appliance may be a viable option in treating patients with moderate-severe OSA.

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VITAMIN D LEVELS IN MIDDLE-AGED PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA SYNDROME

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Introduction: Vitamin D (Vit D) insufficiency has been implicated in the pathophysiology of numerous diseases. Obstructive sleep apnoea syndrome (OSAS), a disorder associated with increased cardiovascular and cerebrovascular morbidity, has been associated with lowered Vit D levels, but reports are inconclusive. Aim of the study is to evaluate the association between serum 25-hydroxyvitamin D [25(OH)D], a marker of Vit D status, and anthropometric and sleep characteristics of OSAS patients, and to compare those levels between OSAS patients and non-apnoeic controls.

Materials and methods: Consecutive subjects who had undergone polysomnography and pulmonary function testing were divided into controls (apnoea-hypopnea index, AHI < 5/h) and OSAS group (AHI ≥ 5/h). Serum concentration of 25(OH)D was determined using a commercial radioimmunoassay kit.

Results: A total of 169 subjects (135 men) were included. OSAS patients (n=139) significantly differed from non-apnoeic controls in terms of age (53.9±12.8 vs 44.9±12.8 years, p=0.002) and body mass index (BMI) (35.9±6.9 vs 29.9±6.8 kg/m², p<0.001). Serum 25(OH)D levels were lower in OSAS patients (17.8±7.8 vs 23.9±12.4 ng/ml, p=0.019). In OSAS patients, levels of serum 25(OH)D were negatively correlated with sleep stages transitions (r=-0.205, p=0.028), AHI (r=-0.187, p=0.045), oxygen desaturation index (r=-0.234, p=0.011) and percentage of sleep time with oxyhaemoglobin saturation < 90% (r=-0.172, p=0.041). In contrast, they were positively correlated with average oxyhaemoglobin saturation during sleep (r=0.179, p=0.033), forced expiratory volume in 1 sec (r=0.207, p=0.037) and oxygen partial pressure in awake (r=0.197, p=0.029).

Conclusions: Vit D levels were lower in OSAS patients compared with non-apnoeic controls. Several indices of OSAS severity also correlated with Vit D levels.

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Introduction: Obstructive sleep apnea syndrome (OSAS) is associated with systemic inflammation and increased risk of cardiovascular and chronic kidney disease. Cystatin C (Cyst C) is a novel biomarker of both latent renal damage and cardiovascular disease. Aim of the study was to measure serum levels of Cyst C, as well as IL-8 and CRP in otherwise healthy OSAS patients.

Materials and methods: 84 individuals examined with polysomnography for OSAS symptoms without known comorbidities were prospectively recruited.

Results: According to apnea hypopnea index (AHI) subjects were divided in two groups: OSAS group (AHI>5/hour, n=64) and controls (AHI<5/hour, n=20), which were age- and BMI-matched. Cyst C levels were higher in OSAS patients vs. controls (1176.13±351.33 vs. 938.60±245.83 ng/ml respectively, p=0.017) while serum IL-8 and CRP levels did not differ significantly. A positive correlation was found between Cyst C levels and respiratory disturbance index (RDI) (r=0.240, p=0.039), percentage of time with oxygen saturation < 90% (r=0.290, p=0.02) and a negative correlation with average oxygen saturation during sleep (r=-0.291, p=0.012). After adjustment for age and BMI, RDI was the only independent predictor of Cyst C (β=0.256, p=0.039).

Conclusions: Cyst C serum levels are increased in OSAS patients without comorbidities, suggesting an increased renal and cardiovascular disease risk.

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SLEEP BRUXISM IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: Obstructive sleep apnea and sleep bruxism are both related to arousal events, therefore, there could be a positive relationship between these two disorders. The aim of this study was to estimate the incidence of sleep bruxism (SB) in patients with previously diagnosed obstructive sleep apnea (OSA) and to examine the relationship between sleep bruxism and sleep architecture.

Materials and methods: A total of 44 subjects with OSA participated in this study, distributed in the study group (22 patients) and the control group (22 patients). The subjects were selected from the population of patients with previously diagnosed OSA who underwent full-night polysomnography in the Split Sleep Medicine Center, Split, Croatia during 2016. Patients with self-reported sleep bruxism were recruited in the study group, while the control group consisted of patients who did not report sleep bruxism and they were matched for age (±5 years), gender and apnea/hypopnea index (AHI). Full-night polysomnographic recordings were analyzed once again for all subjects, according to the American Academy of Sleep Medicine criteria for SB.

Results: The results of this study have shown significantly higher rate of SB in the population of patients with OSA and self-reported SB (95% vs. 55%, P = 0.02) compared to the control subjects. There was higher incidence of SB episodes during the NREM sleep stage than in REM sleep stage (84% vs. 16%, P < 0.001), while there was the highest incidence of SB episodes during the N2 sleep stage (77%). Longer SB episodes showed tendency to appear more often during NREM than during REM sleep stages (42.4 ± 67.8 s vs. 13.6 ± 19.0 s, P = 0.024).

Conclusions: Based on the results of this study, it was determined that the presence of OSA significantly increased the risk of SB in the same patient. Incidence of SB was significantly higher in patients with OSA and self-reported SB than in those patients who did not report SB, although in those patients the incidence of SB was still significantly high. Therefore, it is necessary to use objective methods such as full-night polysomnography for diagnosis of SB, especially in patients with OSA.

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THE EVALUATION OF RISK FOR OBSTRUCTIVE SLEEP APNEA IN A POPULATION OF DENTAL PATIENTS

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Introduction: Undiagnosed and untreated obstructive sleep apnea (OSA) may progress and cause numerous comorbidities, increasing the risk for cardiovascular and metabolic diseases. OSA patients often suffer excessive daytime sleepiness leading to more motor vehicle accidents and they have lower quality of life. The aim of this study was to assess the risk for OSA in a population of dental patients using the STOP questionnaire and to evaluate the presence of the excessive daytime sleepiness using Epworth Sleepiness Scale (ESS).

Materials and methods: A total of 247 dental patients, 102 men and 145 women, average age of 40, were surveyed during their regular visit in the Dental Clinic Split, Croatia. All of the included participants voluntarily completed the STOP questionnaire and the ESS which were used to assess the risk for OSA and excessive daytime sleepiness.

Results: The results of our study indicated that 68 (27.5%) patients had the increased risk for OSA according to the STOP questionnaire score (STOP≥2). In the study population there were 47 (19%) participants who suffered excessive daytime sleepiness (ESS score ≥9). Among participants at risk for OSA (STOP≥2) there were 20 out of 68 (30%) participants who suffered excessive daytime sleepiness (ESS score ≥9), while there were 27 out of 179 (15%) those suffering excessive daytime sleepiness in the group with no risk for OSA (STOP< 2) (χ²=6.058, P=0.014). According to the STOP questionnaire there were 44 (17.8%) participants with hypertension, 17 (6.8%) with diabetes mellitus, 6 (2.4%) suffering depression, 21 (8.5%) asthma and 53 participants with gastroesophageal reflux disease.

Conclusions: This study demonstrated the presence of risk for OSA in a population of dental patients. Doctors of dental medicine could provide simple and valuable screening service to their patients and refer those at risk for OSA to the certified sleep medicine center for further diagnostic and therapeutic procedures.

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THE CRANIALFACIAL FEATURE OF CATATHRENIANOCURNTAL GROANING): COMPARING WITH NORMAL VALUES AND OSAS

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Introduction: Catathrenia(nocturnal groaning) is moved to the chapter of sleep-related breathing disorder in ICSD-3. Yet its feature unlike that of obstructive sleep apnea (OSA). The present research was to compare the cranialfacial differences between the patients with catathrenia and OSA.

Materials and methods: 22 patients of catathrenia (7 males and 15 females, aged from 22 to 69 years old) were recruited in the study as Catathrenia Group, who had been diagnosed through whole night polysomograpy in qualified Sleep Disorder Centers. 66 patients of OSAS, matched by age and gender (matching proportion 1:3), were carefully selected from the database of Department of Orthodontics, Peking University Hospital of Stomatolgy and consisting OSAS Group. Cephalograms and dental models were taken in both groups. Comparisons between the two groups were done to detect the differences between catathrenia and OSAS. Meanwhile, cephalometric measurements in Catathrenia Group, both in the upper airway and craniofacial structures, were compared with normal values of Chinese, for which previous studies were consulted.

Results: As for airway related measurements, Catathrenia Group showed more enlarged upper airway and higher hyoid bone than normal people, especially than OSAS Group. As for craniofacial parameters, Catathrenia Group was found with larger upper and lower jaws and more flat mandibular angle than OSA Group. Evan compared with normal values Catathrenia Group was found with more inclined upper incisors. As for the teeth alignment and occlusion, upper and lower arch length and upper arch inter-first molar width (P< 0.05) were found increased, overbite and PAR index (P< 0.05) yet decreased in Catathrenia Group compared with OSAS Group.

Conclusions: On the contrary of obstructive type, Catathrenia patients showed many anatomical advantages, including wider airway, larger skeleton and better occlusion.

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DETERMINING THE MANDIBULAR NORMAL RANGE OF MOTIONS IN YOUNG ADULTS: A GUIDE FOR DIAGNOSIS AND TREATMENT OF PATIENTS WITH MANDIBULAR ADVANCE DEVICES

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Introduction: The degree of mandibular protrusion is one of the key therapeutical choices of the treatment of patients affected by OSAS with Mandibular advancing devices (MAD). The aim of this study was to determine the range of mandibular maximum protrusion at 4 different anterior vertical opening (interincisal distances: 2, 5, 8, 11 mm).

Materials and methods: 175 students of Dentistry of the Universidad Alfonso X Madrid, aged 19 to 23 years (mean 21,3, SD 1,7, 92 female and 82 male) were selected for the study. All the subjects were asymptomatic for Temporomandibular Disorders, according to the Research Diagnostic Criteria/ Temporomandibular Disorders RDC/TMD, RDC /TMD. One investigator performed the measurements of the maximum protrusion range with 4 different George Gauge bite forks: 2 mm, 5 mm, 8 mm and 11 mm of interincisal vertical opening were taken into consideration. Statistical analyses were done with SPSS (Statistical Package for the Social Sciences) on version 17 and the STAT on version 11.

Results: Mean value for maximum protrusion were: - 12,5 mm with the 2 mm bite fork (n 175, range 11,5 to 15,5 mm; SD 0,81 mm), - 12,0mm with the 5 mm bite fork (n 175, range 10 to 14,5 mm; SD 1,08 mm); - 11,3mm with the 8mm bite fork (n 75, range 9 to 15,5 mm; SD 1,50); -9,9 mm with the 11mm bite fork (n 75, range 4,5 to 14 mm; SD 1,88 mm). As expected, the maximum protrusion is reduced significantly with the increase of vertical dimension from 2 mm (maximum protrusion: 12,5 mm) to 11mm (maximum protrusion: 9,9 mm).

Conclusions: The knowledge of the normal ranges of mandibular movements can be important for diagnosis the MAD treatment of patients affected by OSAS. The study of the maximum protrusion at different mandibular vertical distraction on a larger population may lead to a better customization and design of mandibular advance devices.

Acknowledgements: Orthoapnea
**Introduction:** To evaluate the use of overnight home pulse oximetry (PO) in moderate (AHI≥15) or severe (AHI≥30) obstructive sleep apnea (OSA) screening. To assess if outpatient overnight PO could be used to select patients for hospital polysomnography (PSG) for further OSA evaluation.

**Materials and methods:** Patients in Vilnius University Santariskiu Klinikos Pulmonology and Allergology department with suspected SA during 2014-2017 were investigated. A prospective study was performed. Patients with suspected SA at first were examined by performing overnight home PO. Inclusion criteria for full PSG was oxygen desaturation index (ODI) ≥ 15. ODI was considered as number of times per hour of sleep that the blood’s oxygen level dropped ≥4% from baseline. When hospitalised, all patients underwent PSG. Daytime sleepiness (DS) using Epworth sleepiness scale (ESS) was also evaluated.

**Results:** A total of 66 patients were investigated (male 88%), mean age 57±11 yrs. Majority of them were diagnosed with moderate (16.7%) or severe (77.3%) OSA. The sensitivity of pulse oximetry at ODI ≥ 15 was 93.9%, with the specificity 42.9%. Likelihood ratio of being diagnosed with OSA - 1.64. We found that ODI has statistically significant correlation with AHI (AUC 0.87, R=0.554, p< 0.001). Highest sensitivity of 81.8% and specificity of 85.7% was with ODI value 19.4.

In our study we didn’t find any relation between AHI>15 and ESS (sensitivity 60%, specificity 20%, AUC 0.31). When combining ODI>15 and ESS>10, the sensitivity was 66.7%, specificity 80%, likelihood ratio 3.3.

**Conclusions:** Our study shows that ESS together with overnight home pulse oximetry, a simple and sensitive diagnostic test, could be used as a screening tool for moderate and severe OSA.
CAUSES OF DEATH IN SLEEP APNOEA PATIENTS TREATED WITH POSITIVE AIRWAY PRESSURE

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**Introduction:** The patients with sleep apnoea have decreased life expectancy (in average 8-18 years shorter). This work focuses on causes of death in sleep apnoea patients treated with positive airway pressure (continuous - CPAP or bi-level - BiPAP) and their comorbidities.

**Material and methods:** The work analyzes interval 1/2002-6/2017, the subjects in our group were the patients of Sleep laboratory of Department of Pulmonary Diseases and Tuberculosis, Olomouc. Inclusion criterion was positive airway pressure therapy, exclusion criteria were presence of motor neuron disease (palliative therapy with BiPAP) or absence of sleep apnoea (therapy with BiPAP in global respiratory insufficiency without sleep apnoea). The information about causes of death was acquired from our medical documentation, documentation of general practitioners or from documentation of hospitals where the patients had died. The acquired data had been statistically analyzed.

**Results:** Our sleep laboratory takes care of more than 2000 patients. In the analyzed interval died 71 patients treated by positive airway pressure. 11 patients had been excluded - 6 patient because of presence of motor neuron disease, 5 patients because of global respiratory insufficiency with absence of sleep apnoea. In analyzed group were 60 patients, 2 treated with BiPAP, 58 with CPAP; 44 males (73,3%), 16 females (26,7%), sufficient compliance (more than 5 hours of average therapy use per night) had been documented in 44 patients (73,3%). Average age of death was 65,2 years (range 37-88), average length of therapy use was 3,2 (0,2-10) years, average BMI 36,4 (24,4-54,8), average apnoea-hypopnoea index 50,8. The most common main death cause was pulmonary disease - 31,7%, followed by cardiac failure with or without myocardial infarction - 28,3%, malignancies 26,2%, other causes - 5 patients, in 3 patients was not possible to find out the cause.

**Conclusions:** Our patients treated with positive airway pressure died 13 years before average life span expectancy in the Czech Republic. The high incidence of pulmonary diseases was probably caused by patient selection in Department of Pulmonary Diseases. The obesity is probably one of the main risk factors in patients with sleep apnoea. The sleep apnoea is serious disorder with comorbidities leading to premature death.

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APNEA CHARACTERIZATION BY MEANS OF SUPRASTERNAL PRESSURE, RESPIRATORY INDUCTANCE PLETHYSMOGRAPHY AND OESOPHAGEAL PRESSURE: A COMPARATIVE STUDY

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Introduction: Characterization of apneas by respiratory effort monitoring is crucial for the diagnosis of sleep disordered breathing (SDB). The aim of this study was to investigate the use of suprasternal pressure (SSP) measured using the PneaVoX® sensor (CIDELEC, France) for respiratory effort monitoring in comparison to esophageal pressure monitoring (Pes) and to Respiratory Inductance Plethysmography (RIP) in SDB patients.

Materials and methods: Diagnostic polysomnography (PSG) was performed in 32 patients (27 males) with suspected SDB. PSG included respiratory effort monitoring by Pes, RIP, and PneaVoX® sensors. The PneaVoX® is a non-invasive two-fold sensor that measures tracheal sounds and SSP. A reference scoring for sleep apnea detection was carried out according to AASM rules. Characterization of apneas was performed solely based on Pes, RIP, and PneaVoX signals by two independent scorers (A, B).

Results: When comparing characterization of apneas with PneaVoX with those of Pes there was a concordance of 99.0% for obstructive (OA), 94.0 % for central (CA), and 92.1 % for mixed apneas (MA) for scorer A and 99.6 %, 75.8 %, and 97.7 % respectively for scorer B. When comparing apneas characterized by RIP to apneas characterized by Pes there was a concordance of 98.9% for OA, 92.5% for CA and 80.5 % for MA for scorer A and 98.7 %, 71.4 % and 85.8 %, respectively, for scorer B.

Conclusions: Suprasternal pressure had a higher agreement with Pes than with RIP with a slightly better matching between SSP and Pes than between RIP and Pes. The PneaVoX® is a reliable sensor for respiratory effort monitoring and could be used as a surrogate sensor of respiratory effort for sleep apnea characterization.

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TYPE 2 DIABETES MELLITUS IN INDIVIDUALS WITH OBSTRUCTIVE SLEEP APNEA: SHOULD SCREENING BE CONDUCTED?

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**Aims:** Obstructive Sleep Apnea (OSA) is a common and often underdiagnosed condition in Singapore. Type 2 Diabetes Mellitus (T2DM) and OSA are inextricably linked, sharing similar risk factors and complications. National health statistics indicate that in 2010, 11.3% of the population aged between 18 and 69 had Diabetes. We investigate the incidence of T2DM in a population with polysomnography (PSG) proven OSA.

**Methods:** A 5-year (2011-2015) retrospective electronic medical records review of patients with PSG proven OSA was conducted. Patient demographics, body measurements, respiratory disturbance index (RDI), and most recent random blood glucose (RBG) were collected. Patients with moderate (RDI 15-30) and severe (RDI >30) RDI were included in the study. SPSS statistics v22 was used for univariate and multivariate logistical regression analysis. The study was approved by the institution ethics review board.

**Results:** There were 1951 individuals with moderate to severe OSA, 84.16% were male. The median age was 46 years (range 15-89). 519 and 1067 individuals with moderate and severe OSA respectively had data available for analysis respectively. Individuals were considered to be diabetic if RBG was more than 11.1mmol/L. It was found that 22.9 (n=119) of individuals with moderate OSA and 24.5% (n=261) of individuals with severe OSA had diabetes as per the criteria. Furthermore, the odds of individuals with severe OSA having diabetes was 1.09 (p=0.50) compared to those with moderate OSA, implying a statistically insignificant difference between the two subgroups. Multivariate logistical analysis also revealed that age (p< 0.05) and body mass index (p< 0.05) were statistically significant in determining whether individuals were likely to have diabetes.

**Conclusions:** Our study revealed that a significant proportion of individuals with moderate to severe OSA were predisposed to having T2DM, approximately two times the incidence of the general population. We noted that majority of our study participants were males, with no statistically significant difference in incidence between the moderate and severe OSA subgroups. Hence, we propose that formal diabetic screening should be undertaken in all individuals with PSG proven moderate to severe OSA.
Introduction: Moderate-to-severe OSA patients present autonomic nervous system (ANS) dysfunction that contributes to cardiovascular consequences. However, less is known about ANS regulation in mild Sleep Breathing Disorders such as Upper Airway Resistance Syndrome (UARS). The objective of this study was to compare UARS and OSA ANS responses to autonomic challenges, such as resting, deep breathing, Valsalva maneuver and stand position using ANSAR technique.

Materials and methods: Forty patients were studied: 20 UARS and 20 moderate-to-severe OSA (AHI > 20 events/hour) patients matched for age and gender. UARS criteria were presence of sleepiness (Epworth Sleepiness Scale ≥ 10) and/or fatigue (Modified Fatigue Impact Scale ≥ 38) associated with Apnea/hypopnea index (AHI) ≤ 5 and Respiratory Disturbance Index (RDI) > 5 events/hour of sleep and/or more than 30% of total sleep time with flow limitation. All patients underwent clinical evaluation and ANSAR testing. ANSAR estimates autonomic response to challenges by analyzing respiratory signal, blood pressure and ECG responses to standard ANS challenges. It does provide an accurate estimate of heart rate variability combining both time and frequency domains techniques.

Results: During ANSAR resting baseline, OSA patients presented higher mean heart rate (p = 0.03), higher sympathetic and parasympathetic measures (p = 0.03 and p = 0.002), lower autonomic variability (p = 0.01), higher systolic and diastolic blood pressure compared with UARS group (p < 0.01). During deep breathing challenge, OSA patients presented higher mean heart rate (p = 0.04), higher systolic and diastolic blood pressure (p = 0.01 and p = 0.02), while UARS patients presented higher autonomic variability (p = 0.04). During Valsalva challenge, UARS presented higher autonomic variability (p = 0.01) and higher parasympathetic tone (p = 0.03). Finally, during stand position challenge, UARS patients presented a parasympathetic trend (p = 0.01) compared with OSA who presented with higher systolic blood pressure response (p = 0.002).

Conclusions: UARS ANS responses to autonomic challenges differ from OSA particularly in parasympathetic branch. OSA patients had sustained higher blood pressure and lower autonomic variability after challenge, when compared to UARS patients.

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LONG TERM ORAL APPLIANCE THERAPY IMPROVES DAYTIME FUNCTION AND MOOD IN UPPER AIRWAY RESISTANCE SYNDROME PATIENTS

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Introduction: Upper Airway Resistance Syndrome (UARS) is suspected in individuals with excessive daytime sleepiness, fatigue and sleep fragmentation due to increased respiratory effort. UARS can negatively impact daytime function and decrease quality of life. There is no well-established treatment with good compliance for the disorder. The objective of the study was to evaluate the long term effects of an oral appliance on the clinical symptoms, respiratory sleep parameters, sleep quality and sustained attention in patients with Upper Airway Resistance Syndrome (UARS) compared with placebo.

Materials and methods: This study was a randomized placebo-controlled clinical trial. Thirty UARS patients were randomized in two groups: placebo and oral appliance groups. UARS criteria were the presence of sleepiness (Epworth Sleepiness Scale ≥10) and/or fatigue (Modified Fatigue Impact Scale ≥38) associated with an apnea/hypopnea index (AHI) ≤5 and a respiratory disturbance index (RDI) ≥5 events/hour of sleep, and/or flow limitation in more than 30% of total sleep time. All patients completed the Pittsburgh Sleep Quality Index (PSQI), the Functional Outcomes of Sleep Questionnaire (FOSQ), the Beck Anxiety and Depression Inventories, underwent full-night polysomnography, the Multiple Sleep Latency Test (MSLT) and the Psychomotor Vigilance Test (PVT). Evaluations were performed before and after 1.5 years of treatment.

Results: Respiratory disturbance index (RDI), number of respiratory effort related arousal (RERA), percentage of total sleep time with flow limitation and arousal index decreased after 1.5 years of oral appliance treatment (p=0.04, p=0.02, p=0.001 and p=0.04 respectively). PSQI total score improved (p=0.03), severity of depression symptoms decreased (p<0.01) and mean reaction time in the PVT, based on the first measurement taken at 8a.m. was significantly decreased (p=0.03) at the end of the protocol.

Conclusion: The oral appliance was effective in decreasing respiratory events in UARS patients. 1.5-years of oral appliance therapy for UARS also improved sleep quality and sustained attention, and decreased the severity of depression symptoms.

Acknowledgments: AFIP (Associação Fundo Incentivo à Pesquisa), Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and (CAPES).
EFFECT OF CRANIOFACIAL MORPHOLOGY ON RHINOSPIROMETER AND RHINOMANOMETRY

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Introduction: To observe the difference of nasal respiratory function between skeletal Class I, skeletal Class II and skeletal Class III patients.

Materials and methods: By the craniofacial morphology, 46 healthy adults were divided into 3 groups, including skeletal Class I group(n=18), skeletal Class II group(n=14) and skeletal Class III group(n=14). The difference of craniofacial morphology was investigated by cephalometric analysis. The difference of nasal respiratory function was investigated by rhinospirometer and rhinomanometry. The relationship of craniofacial morphology and nasal respiratory function was investigated by correlation analysis. Because of the most data distribution was not similar to normal distribution, the nonparametric tests (Kruskal-Wallis test) was used to investigate the difference between 3 groups. The nonparametric tests (Kolmogorov-Smirnov test) was used to investigate the difference between each 2 groups. The Spearman rank correlation analysis was to investigate the relationship between the craniofacial morphology and nasal respiratory function.

Results: The difference of dominant lateral inspiratory capacity (P=0.003) was statistically significant between the 3 groups. In comparison of each 2 groups, the difference between skeletal Class I group [-0.82 (-1.23,-0.56) L] and skeletal Class III group [-1.44(-1.83,-1.28) L] was statistically significant (P=0.001). No significant difference was found between skeletal Class I group and skeletal Class II group. And No significant difference was found between skeletal Class II group and skeletal Class III group either. The difference of inspiratory nasal partitioning ratio (iNPR) (P=0.003) and 150 Pa bilateral nasal resistance (P=0.036) between the 3 groups was statistically significant. The difference was also shown in the skeletal Class I group and skeletal Class III group. In the correlation analysis, the nasal respiratory function indexes were mainly related to the vertical bony index. Dominant lateral expiration capacity and 150 Pa nasal expiratory resistance was related to MP-SN (r=-0.337, P=0.022; r=0.512, P=0.018) and MP-FH (r=-0.401, P=0.006; r=0.596, P=0.004) 150 Pa nasal inspiratory resistance was related to MP-FH (r=0.552, P=0.009).

Conclusions: Craniofacial morphology may have effects on nasal respiratory function.

Acknowledgements: The National Natural Science Foundation of China(81400062); Chinese Sleep Research Society Youth Scientific Research Fund (2014-03).
**Introduction:** During sleep physiologic, movement-related and respiratory arousals may happen. We investigated whether the number, duration and amplitude (microstructure) of respiratory arousals (RA) correlate with polysomnography-related disease severity in patients with sleep-disordered breathing.

**Materials and methods:** Full-night polysomnography (PSG) recordings of 20 patients (9 female; age 27 - 80 years; BMI range 20 - 40.5 kg/m²) with sleep-disordered breathing (SDB) were visually analysed. The respiratory disturbance index (RDI) ranged between 5.6/h - 130.4/h and the arousal index (AI) ranged between 11.3/h and 64.5/h in the examined individuals. Based on the built-in software of the PSG-device, the number, duration and amplitude of each RA were visually registered. A total of 2600 respiratory arousals were analysed. A possible correlation of the RA microstructure variables and RA number during each individual’s sleep period to the RDI and AI was tested using the Spearman’s rho coefficient.

**Results:** A very weak correlation was found between RDI and both RA duration (r = 0.075) and amplitude (r = 0.138) as well as between AI and both RA duration (r = 0.12) and amplitude (r = 0.179). On the contrary, the number of PSG-recorded RA was quite strongly correlated with RDI (r = 0.651; p < 0.002).

**Conclusions:** Individual RA amplitude and duration (microstructure) may not be influenced by SDB severity. Nonetheless, the number of RA is quite strongly correlated with SDB severity. As a result, it may be that central nervous system RA pattern generation is quite robust in each individual and may not be influenced by the frequency of RA generation or other factors related to SDB severity.
**Sleep Breathing Disorders**  
**Board #107: P6 - Wednesday**  
**SCREENING AND COMPREHENSIVE EVALUATION FOR SRBD, PERFORMED BY DENTISTS IN EVERYDAY CLINICAL PRACTICE**

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**Introduction:** The role of the dentist in screening patients at risk for sleep disorders and treating those diagnosed with sleep apnea is well positioned. The purpose of this study is to introduce the methods of screening and detailed evaluation of the risk of developing sleep apnea in dental patients.

**Materials and methods:** Methods of screening using questionnaires such as ESS, STOP-BANG test and other questions are presented in this study. Once it has been determined that a patient is at risk of sleep apnea, a trained dentist can and should perform a clinical recognition and must be acquainted with the clinical findings that may indicate the risk for sleep apnea. A detailed evaluation assessing wide variety of factors not only in the oral cavity, but also extraoral - the TMJ, muscles, the head and neck posture, the organs of upper airways aims to focus the dentist's attention to a possible higher risk of sleep apnea.

**Results:** Studies have shown that when a dentist is properly trained to evaluate for a sleep disorder by methods of screening and clinical recognition, the chances of uncovering one rapidly increase.

**Conclusions:** Becoming aware of conditions involving the head and neck that may indicate an increased level of risk for sleep apnea and higher understanding of those conditions is essential for optimum patient care and may lead to improved quality of life for dental patients.
THE ROLE OF MANDIBULAR ADVANCEMENT DEVICE AMONG BRAZILIAN MINERS WITH OBSTRUCTIVE SLEEP APNEA

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Background: Obstructive sleep apnea syndrome (OSAS) is a prevalent disorder among workers, and it leads to an increased risk of occupational accidents. There is a lack of studies evaluating the effectiveness of mandibular advancement devices (MAD) among workers.

Aim: To evaluate the effectiveness of a MAD in the treatment of obstructive sleep apnea in miners.

Methods: The study comprised 80 miners suffering from OSAS with a history of nonadherence to positive airway pressure therapy who were treated with a MAD. Sleep and respiratory parameters were evaluated. Polysomnography exams were performed before and after treatment. Informed consent forms and ethics approval were obtained. Data were analyzed using descriptive and inferential statistics (SPSS 15.0, p < 0.05).

Results: Before treatment the mean AHI was 16.4 ± 13.0 events/hour. After the MAD titration, 51.2% of the patients showed an AHI < 5/h and 83.3% presented an AHI < 10/h (p < 0.05). There was a significant reduction in microarousals from 12.0 ± 10.5 events/hour to 8.0 ± 7.9 events/hour (p < 0.001) and the therapy also showed a significant reduction in snoring events (p < 0.001). The minimum oxygen saturation showed a significant improvement, it increased from 84.0% to 86.9% (p < 0.05). There were also significant changes in baseline REM sleep duration that increased from 12.2 ± 5.2 to 14.6 ± 5.9 during total sleep time (p < 0.05).

Conclusions: It was observed that treatment using MAD was effective in reducing obstructive events which were evaluated through the AHI and minimum oxygen saturation. It was also observed a significant improvement in REM sleep, microarousals and snoring.

Key-words: oral appliances, obstructive sleep apnea, miners, effectiveness
Introduction: While obstructive sleep apnea (OSA) is highly prevalent among patients with resistant hypertension (RHTN) nearly fifty percent of OSA patients, even those with long standing OSA do not develop hypertension. The former group often never seek help for sleep issues in contrast to the latter. The aim of this study is to evaluate clinical as well as polysomnographic features that differentiate these groups.

Materials and methods: Clinical and overnight Polysomnographic details of consecutive patients diagnosed to have RHTN (Group-I) without any identifiable cause on extensive workup from the Hypertension clinic, Cardiology services were compared with patients diagnosed as non-hypertensive OSA (Group-II), recruited from the Comprehensive sleep disorders clinic, under Neurology services at our center. The study period was 3 years (2011-2014).

Results: A total of 56 out of 62 patients with RHTN and 79 out of 123 non-hypertensive OSA patients from the clinic, underwent PSG. Both groups were age matched [45.83±13.14 vs 45.02±45.02 years, p=0.71 respectively] and males were significantly more in group II [35(62.50) vs 68(86.59) [p = 0.002]. Patients in Group II were significantly more obese and more sleepy than those in group I [mean BMI = 24.01±3.98 vs 28.51±4.06 respectively, p=< 0.001] [Mean Epworth sleepiness scale score 6.79±4.67 vs 15.78±6.22 respectively, p= < 0.001]. Restless legs syndrome was significantly more frequent group I than in group II [16(28.57) vs 11(13.92), p = 0.05]. On PSG, group II patients were found to have more severe OSA [mean AHI 21.96±19.38 vs 43.55±30.79, p=< 0.001] while REM dominant OSA was seen in a significantly higher proportion of patients in Group I patients [29(53.70) vs 28(35.44), p = 0.051].

Conclusions: Patients with RHTN who have OSA, may frequently present without daytime sleepiness and obesity and a majority of them have REM dominant OSA.
Sleep Breathing Disorders
Board #115: P4 - Tuesday
PORTABLE SLEEP MONITORING FOR THE DIAGNOSIS OF OBSTUCITIVE SLEEP APNEA - MYTH OR REALITY: EXPERIENCE FROM A TERTIARY CARE CENTRE OF NORTH INDIA

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Introduction: Polysomnography (PSG) considered the gold standard tool for diagnosis of OSA (Obstructive Sleep Apnea), is expensive, labour-intensive and requires specialized resources. Portable sleep monitoring (PSM) with its wider availability and cost effectiveness, appears to be a promising diagnostic tool in the under-resourced developing world. The study aimed to determine the feasibility and diagnostic accuracy of PSM (Stardust II device) in a resource limited setting.

Materials and methods: The study compared Type-I supervised PSG with PSM (Type III study) for technical reliability and diagnostic accuracy in suspected OSA. Patients were also interviewed about their opinion and acceptance for undergoing a supervised PSG and an unsupervised PSM study.

Results: Sixty three adult patients (65.7% males, mean age: 48.7 ± 10.7 years; body mass index: 31.6 ± 4.9 kg/m2) were enrolled. Twenty eight (44.4%) patients opted out of the study due to reluctance in undergoing PSM. Almost 50% of the patients also expressed their concerns over their safety in unsupervised use of these PSM devices. Technical acceptability criteria were met by all laboratory-based PSGs, and 88% of PSM studies. There was high signal failure rate with almost 17.4% signal loss PSM studies warranting repetition of these studies, out of which about 6% was data loss due to inaccessible data downloads from recordings. The negative predictive value of PSM to exclude OSA was 93.55% (area under curve (AUC) = 0.87). The diagnostic accuracy values with PSM were 68.5%, 80%, and 91.4% in mild, moderate and severe OSA respectively. Although strong correlation was observed between PSM-AHI (apnoea-hypopnoea index) and PSG AHI (r >0.85, p=< 0.001), however, severity-wise analysis revealed poor correlation in mild and moderate groups (p=0.6 and p=0.8 respectively) with strong correlation in the severe group (p=< 0.001). The Bland-Altman concordance analysis demonstrated relatively small dispersion for PSM study as compared with PSG analyses and showed an overall strong agreement between AHI values (Cronbach’s coefficient of 0.952).

Conclusions: The current scenario of sleep medicine in India offers less scope for use of PSM devices. Patients showed reluctance in performing a home-based unsupervised study on their own, while insisting on a more accurate diagnosis by PSG, without unwanted loss of data recording as well as the possibility of wastage of time in a PSM diagnostic study. Moreover, PSM showed very poor sensitivity and specificity in mild and moderate OSA, limiting its use mainly to detect only severe cases with clinically significant disease. The poor feasibility of a home-based unattended type III study due to possible factors like socioeconomic status, educational backgrounds, psychological dependence over the health care facilities, safety concerns, etc. along with its limited diagnostic value in mild to moderate symptomatic disease, might affect its widespread use for diagnosis of OSA in a high burden country like India.

Acknowledgements: Dr. Mansi Gupta, Dr. Jagdish Chandra Suri Department of Pulmonary, Critical Care & Sleep Medicine, Vardhaman Mahavir Medical College & Safdarjung Hospital, New Delhi.
**Introduction:** To evaluate the adherence and the effect of CPAP treatment in long-term outcomes in patients with moderate to severe sleep disordered breathing (SDB) after an ischemic stroke.

**Materials and methods:** We identified patients included in the Acute STroke Registry and Analysis of Lausanne (ASTRAL) between January 2010 and September 2014 who had a polysomnography after an ischemic stroke for suspected SDB. We compared demographic, clinical and evolution (functional outcome, recurrent cerebrovascular events and death) of patients without significant SDB (apnea/hyponea index, AHI, < 15/h: SDB -), patients with AHI ≥ 15 events/h who refused CPAP treatment or for whom adherence to CPAP was poor in the follow-up (SDB +/- CPAP -) and SDB patients effectively treated by CPAP (SDB +/- CPAP +).

**Results:** We analyzed data from 101 patients (age 68.5 ± 11.1 years, 84.1% men) who had a PSG after a mean of 98 days (range 29-158) post-stroke: 25 SDB-; 48 SDB+/CPAP-; 28 SDB+/CPAP+. Baseline characteristics of the three groups were similar in terms of age and gender distribution, but patients in the SDB+CPAP+ group had a higher BMI than patients in the SDB- group (29.5±3.9 vs. 27.1±4.3, p=0.049). The severity of SDB measured by the AHI was the only factor independently associated with good CPAP compliance among all SDB+ patients. A trend towards lower mRankin score was observed at 12 months in the SDB+CPAP+ group compared to the non-treated SDB+CPAP- group (0.89±0.83 vs. 1.46±1.44, p=0.058), and the percentage of patients with a favorable outcome (mRankin score 0-2) was significantly higher in the CPAP treated group (96.4% vs. 79.2%, p=0.046). In the multivariable analysis of factors associated with a higher risk of stroke recurrence and mortality, atrial fibrillation was independently associated with increased risk (odds ratio 4.32, 95% CI: 1.51-12.33, p=0.006), and the use of CPAP with a significant reduction (odds ratio 0.13, 95% CI: 0-0.86, p=0.031). Event-free survival analysis (stroke recurrence and death) performed after 2-year follow-up using the Kaplan-Meier test showed that patients in the SDB+CPAP+ had significantly higher cardiovascular survival and Cox proportion hazard model including variables of interest identified CPAP treatment as significantly associated with survival time (p=0.025).

**Conclusions:** This observational study shows that CPAP treatment in stroke patients with moderate to severe SDB is associated with better functional outcomes and lower rates of recurrence and death at 2 years follow-up. However, long-term compliance to treatment is low in this population.

**Acknowledgements:** Ligue Pulmonaire Vaudoise
Introduction: Obstructive sleep apnea (OSA) syndrome is one of the most common sleep breathing disorders with significant consequences. The present study aims to determine prevalence of risk of OSA in the general population of Gachsaran, Iran.

Materials and methods: From 2014-2015 by random-cluster-sampling, 1054 adult subjects were selected from the urban region of Gachsaran. The age range of the sample was from 20 to 85 years. Assessment was carried-out using the Berlin questionnaire, a valid scale that determined those at “high risk” and “low risk” for OSA symptoms.

Results: There were 306 (29.03%) out of the 1054 subjects with a mean age of 46.6±15.7 years and a body mass index (BMI) of 26.1±4.3 at high risk for OSA (men 19%; women 10.03%); 502 (47.6%) suffered from snoring with a higher frequency among men (51.5%). From those who snored during sleep, 127 (12%) reported a breathing pause more than once per week. Subjects considered at high risk had a clinical history of diabetes (16.32%) and heart failure (14.3%).

Conclusions: Prevalence of symptoms and risk of OSA and associated factors in Gachsaran are noticeable. Considering the adverse effects of this condition on quality of life, further research in an effort for early diagnosis and treatment are recommended.

Acknowledgments: The authors wish to express their gratitude to all who participated in this study.
Sleep Disorders in Women with Polycystic Ovary Syndrome: The Influence of Obesity and Hyperandrogenism

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Introduction: Polycystic ovary syndrome (PCOS) is the most common endocrinopathy among women of reproductive age. Higher levels of testosterone (hyperandrogenism) in PCOS patients are related to obstructive sleep apnea (OSA). The aim of the study was to evaluate the sleep of polycystic ovary syndrome (PCOS) subjects, with and without hyperandrogenism, in comparison with a healthy control group, and examine the effects of hyperandrogenism and obesity on sleep parameters.

Materials and methods: A total of 55 volunteers were recruited to participate in the study. Sonographic, clinical and biochemical parameters were used to diagnose PCOS and hyperandrogenism. The evaluation of sleep quality was made using questionnaires and polysomnography. Frequency of obstructive sleep apnea (OSA) was also compared between the groups.

Results: The study revealed that women with PCOS presented poorer sleep, increased snoring and higher risk of OSA. In addition, after adjustment for confounding factors, rapid eye movement (REM) sleep time was found to be lower than in the control group. The effect of hyperandrogenism, characterized by higher free testosterone levels, did not have any effect on subjective or objective sleep quality. OSA was only diagnosed in the PCOS group.

Conclusions: Our results indicate that PCOS impairs subjective and objective sleep quality, due to a reduction in REM sleep stage time in women affected by the disease. Obesity showed an effect on sleep related parameters but hyperandrogenism had no effect. Only the PCOS group had any OSA diagnoses.

Acknowledgements: AFIP, CNPq
Introduction: Adenotonsillectomy is considered the first-line treatment for children with obstructive sleep apnea (OSA). However, children with small tonsils may not experience the same benefit from adenotonsillectomy as the children whose tonsils are hypertrophy. In China, tonsillectomy is not commonly performed for the children whose tonsils are below grade 2 tonsils (according to Brodsky grading scale). However, whether small tonsils contribute lateral pharyngeal wall obstruction is unsure by routine examinations. This observation has led to increased interest in the role of drug induced sleep endoscopy (DISE) in evaluating the need of tonsillectomy in pediatric OSA with small tonsils.

Material and methods: This is a retrospective case series of children undergoing DISE at a tertiary pediatric hospital from March 2015 to December 2016 who had adenoid hypertrophy, but without tonsil hypertrophy (below grade 2 tonsils according to Brodsky Grading Scale). Tonsillectomy was performed if there was tonsillar obstruction in DISE. Adenoidectomy was performed for all the children. Children with adenoid hypertrophy only who didn’t undergo DISE were included in control group. The nocturnal oximetry monitor and cardio pulmonary coupling were performed in both DISE and control group in the 6th month and the 1st year after surgery. Wilcoxon matched-pairs signed-ranks tests were used to compare AHI and oxygen saturation nadir before and after surgery. Children were excluded if they had a pre-adenotonsillectomy, syndromic disorder, craniofacial deformity, or neurologic impairment.

Results: The study included 126 children, 56 (44.4%) with grade 2 tonsils and 70 (55.6%) children with grade 1 tonsils. They had a mean age of 5.7±3.2 years (range 2.8-10.4) and mean BMI of 15.7±5.5 kg/m². The unexpected identified DISE findings were the regions of tonsillar obstruction occurred in 57 (45.2%) children, 44 (78.6%) from grade 2 tonsils and 13 (18.6%) from grade 1 tonsils. DISE directed tonsillectomy was performed for 57 patients. Adenoidectomy was performed for all 126 children and control group. There was a significant improvement in AHI (P< 0.05) and saturation nadir (P< 0.05) in both DISE group and control group in both the two follow-ups after surgery. But the AHI was better improved in DISE group compared with control group 1 year after surgery (P< 0.05).

Conclusion: DISE is a good way to judge whether tonsillectomy is necessary for pediatric OSA with small tonsils. These children may benefit from DISE for identification accurate sites of upper airway obstruction in longer follow-up.
Introduction: Identification the sites of obstruction in upper airway is crucial to guide the therapeutic decision. Besides adenoid hypertrophy and tonsil hypertrophy, other different sites and causes may be responsible for the obstruction in pediatric obstructive sleep apnea (OSA). Drug induced sleep endoscopy (DISE) is presently considered as the capable way to show what really happens in the upper airway during sleep. It is uncertain how much difference there is between awake and sedated endoscopy in the upper airway in children. The goal of our research was to compare the degree and patterns of upper airway obstruction detected by DISE versus endoscopy in awake children.

Materials and methods: This is a retrospective case series of children undergoing DISE at a tertiary pediatric hospital from March 2015 to December 2016 who underwent subsequent surgery to address OSA. Awake endoscopy was routinely performed in clinic. DISE was performed before adenotonsillectomy. The difference of site, pattern and degree of obstruction in upper airway was analyzed between DISE and awake endoscopy.

Results: The study included 173 children with a mean age of 5.9±3.9 years (range 2.6-10.6), and mean BMI of 16.1±5.7 kg/m². The awake state findings were different dramatically from the sleep situation. The degree of velum, tonsils, tongue base and supraglottis obstruction was significantly (P < 0.05) increased at DISE in comparison with that recorded during the awake endoscopy; the degree of nasal obstruction and adenoid obstruction were similar in both techniques (P >0.05). The pattern of the obstruction was similar in DISE and awake endoscopy. Two (1.16%) occult laryngomalacia were found in our research.

Conclusions: DISE is a useful tool in revealing sites of collapse in upper air way, which are unlikely to be detected in awake endoscopy.
Introduction: Sleep-disordered breathing (SDB) in women is probably under-diagnosed, but its actual prevalence using current diagnostic criteria is relatively unknown. It is also unclear whether clinical conditions associated with SDB differ by gender or by hormonal status in women. The aim of this study was to assess the prevalence of SDB and associated comorbidities in pre- and post-menopausal women compared with men.

Materials and methods: The subjects of the population-based HypnoLaus Sleep Cohort underwent polysomnography in their home environment and had extensive phenotyping for diabetes, hypertension, metabolic syndrome and depression.

Results: 2121 subjects (age 40-85 [59 ± 11] years old; BMI 25.6 ± 4.1 kg/m², 51.7% women (70% post-menopausal) were included. SDB prevalence with an AHI of >5/h, >15/h, and ≥30/h, respectively, was 83.8%, 49.7%, and 22.0% in men, 35.1%, 8.6% and 1.3% in pre-menopausal women, and 71.6%, 29.4%, and 10.1% in post-menopausal women.

In contrast to men and post-menopausal women, SDB in pre-menopausal women was not associated with age, neck circumference and snoring. In multivariable adjusted regression models SDB severity was significantly associated with hypertension in women (p=0.007), post-menopausal women (p=0.048) but not in men (p=0.065), with diabetes in men (p=0.021) but not in women (p=0.853) or in post-menopausal women (p=0.725), with metabolic syndrome in men (p=0.002), women (p< 0.001) and post-menopausal women (p< 0.001), and with depression in women (p=0.007) but not in men (p=0.853) or post-menopausal women (p=0.061).

Conclusions: The prevalence of SDB in this unselected cohort was high, particularly in men and post-menopausal women. SDB was independently associated with hypertension and depression exclusively in women, whereas an association with diabetes was present in men only. These findings highlight the importance of taking both gender and women's hormonal status into account when investigating and treating SDB.
ADHERENCE TO UPPER-AIRWAY STIMULATION IN THE TREATMENT OF OBSTRUCTIVE SLEEP APNEA

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Introduction: Selective upper-airway stimulation (sUAS) is a novel therapy for patients with obstructive sleep apnea (OSA). It has been reported recently, that the average use of CPAP therapy of 3.3 hours per night had no effect on the prevention of recurrent serious cardiovascular events in a patient cohort of more than 1,300 patients¹. The aim of this study was to analyze the therapy adherence of patients with OSA to the comparatively new treatment modality of sUAS and to identify possible reasons for non-adherence.

Material and methods: Patients from two University Hospitals in Germany who received a sUAS device (Inspire Medical Systems, Maple Grove, MN, USA) were included. Data collection included demographics, body mass index (BMI), Apnea-Hypopnea Index (AHI), Oxygen Saturation and Desaturation Index (ODI) and Epworth Sleepiness Scale (ESS). Patients answered a questionnaire on the topics: subjective sensation of the stimulation, use of the different functions, possible side effects and an inventory for the description of the attitude to UAS treatment (modified from²). The daily use of the sUAS therapy was evaluated by analysis of the implanted pulse generator (IPG).

Results: 102 Patients with a mean age of 56.6 years and a mean BMI of 29.4kg/m² were included in the study. The mean pre-implantation AHI of 32.8/h could be reduced to 12.6/h (p< 0.001). On average patients were in month 10 post implantation. Analysis of the IPG resulted in a usage per night of 5.7 hours on average. Patients declared to use the sUAS on 6.8 nights per week. The attitude towards UAS treatment resulted in strong agreement towards the statement “UAS reduces the problems caused by my sleep apnea”, agreement towards “UAS improves my health”, agreement towards “UAS improves my quality of life”, strong agreement towards “UAS is the best treatment for my sleep apnea” and strong agreement towards “I can use the UAS as expected for me”.

Conclusion: The analysis of the patient adherence to upper-airway stimulation in the treatment of obstructive sleep apnea resulted both in the objective and in the subjective evaluation in high values.

References:
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CLINICAL USE OF CENTRAL SLEEP APNEA INDEX ON COMMENCEMENT OF AUTOMATIC POSITIVE AIRWAY PRESSURE TO PREDICT THE PRESENCE OF CARDIOPULMONARY DISEASE ASSOCIATED WITH UNSTABLE VENTILATORY CONTROL

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Introduction: An emergence of Central sleep apnea (CSA) is associated with neurologic disorders, congestive heart failure, and initiation of continuous positive airway pressure (CPAP). CSA which occurs after initiation of CPAP is called as complex sleep apnea syndrome (CompSAS). Given that cardiovascular diseases which are associated with ventilatory instability are also related with CompSAS, we wondered if it is possible to predict the presence of such cardiovascular and pulmonary diseases in patients with obstructive sleep apnea (OSA), often undiagnosed or neglected, through CSA index (CAI). The aim of this study was to examine 1) the association between CAI on automatic CPAP and cardiopulmonary diseases which are known to be related with high loop gain and 2) to evaluate the clinical usefulness of CAI on automatic CPAP (APAP) to predict such diseases in OSA patients.

Materials and methods: Data from 152 patients who visited Seoul National University Hospital out-patient clinic between October 2014 and October 2016 for snoring and/or suspected sleep apnea were retrospectively analyzed. All patients completed a questionnaire regarding demographic information, disease history, and medication history. Other patient characteristics, including height and weight, were obtained. Of 152 patients, 97 patients who were diagnosed with OSA following PSG examination and were completed APAP titration were involved in the final analysis. A nocturnal polysomnography (PSG) was performed using the EmblaTM N 7000 to acquire baseline and follow-up sleep parameters. APAP titration and treatment were performed using ResMed S9 AutoSet™ CPAP. We defined hypertension (HTN), atrial fibrillation, coronary artery disease, and/or cardiomyopathy, as cardiovascular disease. Chronic obstructive pulmonary disease, bronchiectasis, restrictive lung disease were defined as pulmonary disease. Individuals who have cardiovascular or pulmonary disease or both were classified as cardiopulmonary disease group. If one has no cardiac or pulmonary disease, the individuals were considered as no cardiopulmonary disease group. Well-controlled HTN and non-pathologic arrhythmia were excluded from the category of cardiopulmonary disease.

Results: Twenty-five participants (25.8%) were classified as cardiopulmonary disease group. CAI was higher in the cardiopulmonary disease group than in the no cardiopulmonary group, although it was not statistically significant. Total apnea-hypopnea index (AHI), arousal frequency, and degree of oxygen saturation were similar between two groups. In APAP use groups, CAI was significantly higher in the cardiopulmonary disease group than in no cardiopulmonary disease group. In addition, cardiopulmonary disease group showed a higher percentage of APAP used days > 4 hours compared to the no cardiopulmonary disease group, which reveals the cardiopulmonary disease group has a higher APAP compliance. Other variables including mean pressure, leak pressure, total AHI, and used days did not differ between two groups. ROC analyses revealed that only CAI from APAP use significantly predicted the cardiopulmonary disease with 72.2% sensitivity and 70.0% specificity (cut-off value=0.55; AUC=0.672; P value= 0.020), but neither AHI at baseline PSG nor AHI on APAP predicted the presence of cardiopulmonary diseases.

Conclusions: CAI after APAP titration could be useful for the prediction of the presence of cardiopulmonary diseases associated with unstable ventilator control in patients with sleep apnea.
LONGITUDINAL EFFECTS OF PERIODIC BREATHING ON CEREBRAL OXYGENATION IN TERM AND PRETERM BORN INFANTS

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Introduction: Periodic breathing is common in infants, but is thought to be benign. The aim of our study was to assess the incidence and impact of periodic breathing on brain tissue oxygenation index (TOI) in infants born at term and preterm over the first 6 months after term equivalent age.

Materials and methods: 24 preterm infants (born at 27-36 weeks gestational age) and 19 infants born at term were studied with daytime polysomnography in quiet sleep (QS) and active sleep (AS) and in both the prone and supine positions at 2-4 weeks, 2-3 months and 5-6 months post-term corrected age with continuous recording of TOI (NIRO-200 spectrophotometer). Periodic breathing episodes were defined as ≥3 sequential apnoeas each lasting ≥3s. % change in TOI was only calculated during episodes of periodic breathing which were free of movement artifact with the 30 s prior to the episode onset being defined as baseline and the nadir reached during the entire episode.

Results: In preterm infants a total of 164 individual episodes of periodic breathing were recorded in 19 infants at 2-4 weeks, 62 in 12 infants at 2-3 months and 35 in 10 infants at 5-6 months. In term infants a total of 64 individual episodes in 10 infants (1 with 35 episodes), 24 in 6 infants at 2-3 months and 7 in 4 infants at 5-6 months. There were no differences between sleep states or position for any of the variables measured and so data were combined. The amount of time spent in periodic breathing fell with postnatal age in both preterm infants: 6.9 ± 2.4% at Study 1, 3.6 ± 1.8% at Study 2 and 1.3 ± 0.6% at Study 3 and term infants: 2.6 ± 1.8% at Study 1, 0.4 ± 0.2% at Study 2 and 0.3 ± 0.2% at Study 3. Mean duration of episodes was longer in term infants at 2-4 weeks (81 ± 13s vs 54 ± 4s, p< 0.05) and at 5-6 months (48 ± 11s vs 31 ± 2s, p< 0.05). The nadir in TOI was significantly less in the term infants at 2-3 months (-5.6 ± 0.8% vs -12.3 ± 1.1%, p< 0.001) and at 5-6 months (-8.3 ± 1.6% vs -12.7 ± 1.3%, p=0.09).

Conclusions: Periodic breathing was more common in infants born preterm and despite episodes being longer in the term group, falls in cerebral oxygenation were greater in the preterm group. The clinical significance of this on neurodevelopmental outcome is unknown and warrants further investigations.
OVERWEIGHT AND OBESITY ARE ASSOCIATED WITH ARTERIAL STIFFNESS AND CENTRAL SYSTOLIC BLOOD PRESSURE IN CHILDREN WITH SLEEP DISORDERED BREATHING

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Background: The prevalence of obese children with sleep disordered breathing (SDB) is increasing. Both obesity and SDB are independent risk factors for adverse cardiovascular outcomes. Arterial stiffness is an early sign of cardiovascular disease. Pulse wave velocity (PWV) depends on arterial compliance and is a marker of arterial stiffness. Central aortic pressure is a better predictor of cardiovascular outcome compared with peripheral blood pressure (BP). Applanation tonometry of the radial artery provides a non-invasive estimation of central aortic systolic blood pressure (cSBP), through identification of the second systolic peak on the radial artery pulse waveform. We aimed to determine PWV and cSBP in overweight/obese and healthy weight children with SDB and non-snoring healthy weight controls.

Material and methods: Children (3-18y) with SDB (overweight/obese [BMI z-scores ≥ 1.65], n=48; healthy weight n=44) referred for clinical assessment of SDB and healthy weight non-snoring controls recruited from the community (n=38) underwent overnight polysomnography. Pulse transit time (PTT) was calculated from the top of the R wave on the electrocardiogram to the 50% point on the pulse wave recorded by photoplethysmography. The distance from the sternal notch to the fingertip, which corresponds to the distance travelled by the pulse wave (rx) was measured. PWV = rx/PTT cSBP was calculated using applanation tonometry in a subset of children >8y (n=55). The radial artery pulse waveform was calibrated to brachial systolic and diastolic blood pressure measurements assessed by an automated cuff. The late systolic peak was identified from three representative waveforms and the average used to calculate cSBP. PWV and cSBP were compared between groups using one-way ANOVA and Bonferroni post-hoc tests, during wake and sleep. Stepwise multiple linear regressions determined whether heart rate, obstructive apnoea hypopnoea index (OAHI), systolic (SBP) and diastolic (DBP) blood pressure, age, gender, height and BMI Z-score, were significant determinants of PWV. Correlations between cSBP and OAHI, and with the BMI Z-score were determined using Pearson Correlations.

Results: Overweight/obese SDB group had higher PWV (mean cm/s (SD); wake: 366 (35); sleep: 345 (18)), compared with the healthy-weight SDB group (wake: 261 (37), p=0.002; sleep: 261 (18), p=0.005), and non-snoring controls (wake: 235 (32), p=0.002; sleep: 233 (10), p<0.001). The healthy-weight SDB group had higher PWV compared with controls (p=0.03). During both wake and sleep, the BMI Z-score was the strongest predictor of PWV (wake: Std β = 0.64; sleep: Std β = 0.66; p<0.001 for both) followed by height (wake: Std β = 0.23, p<0.001; sleep: Std β = 0.20, p=0.001), SBP (wake: Std β = 0.15, p=0.01; sleep: Std β = 0.14, p=0.02), and OAHI (wake: Std β = 0.12, p=0.04; sleep: Std β = 0.14, p=0.02). Age, heart rate and DBP were not significant determinants of PWV. cSBP had a weak association with OAHI (r=0.31, p=0.02) and a moderate association with BMI Z-score (r=0.54, p=0.04).

Conclusions: We demonstrate that overweight/obesity substantially worsens the cardiovascular sequela of SDB, highlighting the imperative to treat obesity and SDB in children early to reduce the risk of future cardiovascular disease.
Introduction: Computational fluid dynamics (CFD) is often used in studies to understand the correlation between mandibular protrusion and widening of the airway lumen. The result can be applied to calculate for the amount of protrusion required in order for patient to have a treatment effect with oral appliance. This study uses CFD to evaluate upper airway flow field characteristics of obstructive sleep apnea (OSA) patients treating with oral appliance and to validate the aforementioned calculated mandibular protrusion requirement (optimum adjustment distance for the oral appliance). This helps doctors on the adjustments of the oral appliance which reduces number of revisits required by the patient.

Materials and methods: This study included twenty adult OSA patients with apnea-hypopnea index (AHI) between 15 and 30. Two scans of patients´ upper airway region were taken using cone beam computed tomography (CBCT) scanner; first scan is with a natural occlusion position followed by a second scan which a bite fork was used to protrude patient´s mandible. CFD was used to simulate airway flow field characteristics and a database along with calculation algorithm from the previous study were used to calculate for the optimum adjustment distance. CFD calculation uses finite volume method to get required information on Navier-Stokes equation. After patient fitted with optimally adjusted oral appliance, comparison was made between simulated and polysomnography (PSG) results for validation. Finally, each airway flow field characteristics and the reliability of the method used to calculate for optimum adjustment distance were evaluated.

Results: This study combines medical images and bite fork to get models on the airway and related muscles and structures before and after mandibular protrusion. CFD is used to analyze each model for airway flow field characteristics and to calculate for the optimum adjustment distance of the oral appliance. After patient fitted with optimally adjusted oral appliance, the result shows the protrusion of the mandible widened the airway lumen with reduction of stenosis; airway flow field characteristics also changed with reduction in air pressure difference and in airflow rate which is consistent with reduction of stenosis. When comparing simulated results and PSG results on patient fitted with optimally adjusted oral appliance, the results are consistent with each other where patients´ AHI reduced significantly (7 or lower). This result further shows the reliability and validity of the calculation.

Conclusions: This study shows by combining medical images, CFD and database analytics, it is possible to calculate for the optimum adjustment distance of oral appliance used for the treatment of snoring or OSA. It also provide valuable information to doctors on the adjustments of oral appliance and ultimately reduces number of revisits required by the patient.
VIRTUAL SURGERY AND SIMULATION ANALYSES ON UPPER AIRWAY OF OBSTRUCTIVE SLEEP APNEA PATIENTS

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Introduction: Maxillomandibular advancement (MMA) is one of the treatment methods used for treating patients diagnosed with obstructive sleep apnea (OSA). Many studies are done to evaluate the effectiveness of the MMA and among the methods used, computational fluid dynamics (CFD) is one of the most common and effective method. This study uses CFD and solid mechanics techniques to simulate MMA on OSA patients and compare the simulated upper airway conditions with actual post-surgical upper airway conditions. The purpose of this study is to provide patient's pre-surgical and virtual post-surgical upper airway conditions to surgeon before actual surgery.

Materials and methods: Sixteen adult OSA patients with average BMI of 22.7, and average apnea-hypopnea index (AHI) of 40.8 are included in this study. Using pre- and post-surgical images of the patient from computed tomography (CT) scanner to reconstruct patient’s head and neck and structures including maxilla, mandible, airway, neck muscles, soft tissues and their appearances; and use optimal material analysis method to match the post-surgical appearance and find anisotropic material properties of the muscles. Use the obtained muscle material properties and mandibular advancement distance, solid mechanics technique is used for solid part (maxilla, mandible, muscles) of virtual surgery simulation. Solid mechanics calculation uses finite element method: advancement of mandible moves muscle and related structure and hence changed the morphology of the airway, especially the pharyngeal area. To run simulation with fluid dynamics technique, apply average normal inspiration volume of 500ml/sec to the pre-surgical, virtual post-surgical, and actual post-surgical upper airway models of the patient. Finite volume method is used in fluid dynamics to get required information on Navier-Stokes equation. Finally, use computational fluid dynamics to simulate and observe three aforementioned upper airway flow field characteristics and to evaluate the reliability of virtual surgery simulation.

Results: This study combines medical images, CFD and solid mechanics to obtain pre-surgical, virtual and actual post-surgical morphologies of the airway and related structures; using calculation to obtain neck muscle material properties and apply the information using solid mechanics technique for virtual surgery which simulated the morphologies of the airway and related structures. Computational fluid dynamics analyzes the models for flow field characteristics of the airway, the result shows the difference in virtual and actual post-surgical morphologies is 3% and the difference in virtual and actual post-surgical simulated inspiration pressures is within 3% which shows a high degree of reliability on the virtual surgery simulation.

Conclusions: This study shows by combining medical images, CFD and solid mechanics techniques, a virtual surgery simulation is possible to provide information for surgeons to evaluate patients’ upper airway before actual surgery.
EVALUATION OF EFFECT FOR OBSTRUCTIVE SLEEP APNEA PATIENTS TREATED WITH SOFT-HARD PLASTIC MANDIBULAR ADVANCING ORAL APPLIANCE

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Introduction: To detect the subjective and objective effect for Obstructive Sleep Apnea/Hypopnea Syndrome (OSAHS) patients treated with soft-hard plastic mandibular advancing oral appliance and find a new type mandibular advancement oral appliance being high effective, easy to adapt and short making time.

Materials and methods: 45 patients (10 Snoring and 35 OSAHS) being diagnosed by polysomnography (PSG) were treated with soft-hard plastic mandibular advancing oral appliance being exploited recently. Chief complains were asked and PSG were checked again after one month or more than one month. Chief complain and PSG indexs were compare before and after one month or more than. Statistics analyses in PSG index were done in SPSS 13.0.

Results:
1. 39 cases had follow-up information after treatment. 11 cases had a follow-up PSG. 28 cases wear the oral appliance more than 5 hour per night;
2. Snoring and OSAHS cases had lower snoring, good sleeping and hadn't paroxysmal dyspnea, excessive daytime sleepiness. Average AHI for 11 OSAHS were 21.6 time/hour, from (27.4±27.3) to (5.8±5.2). The lowest arterial oxygen desaturation (lowest SaO2, %) increased 6.0% and there was statistical significant.
3. 36 cases were adapted to the oral appliance. Side effect would be disappeared during 3 day to 3 weeks and there weren't side effect for long time. 2 case felt temporomandibular pain significantly after wearing oral appliance during one night, but felt well after ceasing wearing oral appliance;
4. This type of oral appliances were fit to the teeth and mucous membrane well and didn't loose from the teeth during night in 36 cases. The oral appliance had been split in the region of occlusal pad but still could be used after respairing.
5. Advantages for this type of oral appliance were making simply, short making time (just 2.5h after obtaining the reconstructed bite wax wafer), easy to wear or take off, shorting the treating time on dental chair.

Conclusions: Soft-hard plastic mandibular advancement oral appliance was an efficient appliance, and being worth to popularization and application in clinic work.

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Sleep Breathing Disorders
Poster 2

SLEEP APNEA RELATED TO PROLONGED QT INTERVAL WHEREAS SLEEP HYPERAROUSAL RELATED TO ELONGATED TP-E INTERVALS, BOTH REGARDLESS OF ACUTE AUTONOMIC IMPACTS

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Introduction: To investigate if acute automatic impacts of obstructive sleep apnea (OSA) or hyperarousal associated with electrocardiac disturbances during ventricular repolarization.

Materials and methods: Natural-logarithm-transformed power values of heart rate variability (HRV) parameters along with values of heart-rate corrected QT interval (QTc), the interval between peak and the end of T wave (Tp-e), and Tp-e/QTc ratio, calculated from first one 5-min arousal-free electrocardiography segment in pre-sleep-wakefulness (AWK), non-rapid-eye-movement stage 2 (N2), slow-wave (N3), and the latest rapid-eye-movement (REM) sleeps as retrieved from polysomnographic data of 101 otherwise healthy males (43.5±7.9 yrs, 26.7±3.3 kg/m²; 17.7±18.3 and 33.0±17.6/hr in apnea-hypopnea (AHI) and arousal indices (AI), respectively).

Results: By linear regression, QTc and Tp-e of all subjects at various stages was found related to AHI and AI, respectively. While systolic, diastolic and mean arterial blood pressures at waking up were all lower in low arousals subgroups than the other two counterparts, no blood pressure differences were found among three subgroups based on AHI. Similar fluctuations of each HRV parameter were found across various stages among three subgroups categorized by AHI or AI values. QTc at AWK, N2 or N3 was greater in severe OSA than control (468±40 vs 431±39; 469±46 vs 430±40; and 472±50 vs 434±41 ms; p= 0.01, 0.01, 0.02 respectively), whereas Tp-e sequentially shorter from high, middle to low arousal subjects at AWK, N2 and N3 (117±15, 107±16; 116±13, 108±15, 105±15; 117±14, 109±14, 107±16 ms; p=0.00, 0.01 or 0.02 respectively) with similar Tp-e/QTc in both subgrouping. Notably, values of QTc, Tp-e and Tp-e/QTc ratio, not following HRV’s dynamic pattern, presented consistent over stages.

Conclusions: Severe OSA or hyperarousal subjects likely have a higher risk for ventricular arrhythmia around the clock related to prolonged repolarization and/or depolarization periods of ventricles which probably resulted from long-term detrimental effects rather than acute autonomic impacts.
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Introduction: Previous research has found high prevalence of depression occurred in OSA. The mechanism of the relationship between obstructive sleep apnea and depression is complex and remains unclear. The study was conducted to explore the possible predictors (including shared daytime sleepiness symptom, fragmentation of sleep, or repeated episodes of hypoxia) for OSA patient suffering depression symptoms.

Materials and methods: The subjects in present study were obtained from the PSG database of Sleep Center of Taipei Medical University Hospital between 2010 and 2017. All the patients had one night of clinical PSG and requested to fill out self-rating scales for daytime sleepiness (ESS), sleep quality (PSQI), and mental-health (BDI-I). The exclusion criteria were (a) age under 18; (b) presence of other sleep disorders, such as RLS, PLMD. The associations between depression and OSA were analyzed using multiple linear regression analysis.

Results: Of 3740 OSA patients were included for final analyses. 15% of OSA patients were classified as co-occurring depressive mood using the BDI-I. In linear regression analysis, counts of awakening on PSG (β=-.045, p=.003), percentage of REM (β=-.044, p=.005), excessive daytime sleepiness (β=.181, p< .001), and sleep quality (β=.439, p< .001) were associated with BDI scores in OSA patients. was related to depression symptoms among OSA patients. The findings suggested depressive mood in OSA patients was probably affected by the excessive daytime sleepiness which might be caused by sleep fragmentation. Furthermore, disruption of REM sleep in OSA might undermine their ability to overcome emotional distress, raising the risk for depression.
IMPACT OF ADENOTONSILLECTOMY ON PHARMACOTHERAPY IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER AND ADENOTONSILLAR HYPERTROPHY

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**Introduction:** Attention deficit hyperactivity disorder (ADHD) is a common behavior disorder that affects school age children. Approximately 5-7% of school-age children worldwide are diagnosed with ADHD. The pathophysiology of ADHD is complex, with some sleep disorders frequently reported as co-morbid conditions. These include obstructive sleep apnea (OSA), periodic limb movement disorder, and enuresis. OSA is a leading co-morbid condition to ADHD, and may even be a main contributor as repetitive hypoxemia and hypercapnia at night is associated with cognitive dysfunction during the day. Concurrently, adenotonsillar hypertrophy is a leading cause of OSA in children. Treatment of OSA via adenotonsillectomy (AT) has shown to improve ADHD symptoms. A limitation of current literature on the effect of AT on children with adenotonsillar hypertrophy and ADHD is the reliance on questionnaires such as Conners' Rating scales and test of variables of attention (TOVAs) to assess ADHD symptomatic improvement. As ADHD pharmacotherapy is implemented for behavioral treatment failure, changes in medication use allows for the assessment of an “hard outcome”. We use a population-based database to characterize the change in ADHD pharmacotherapy after AT in children with co-morbid ADHD and adenotonsillar hypertrophy.

**Material and methods:** Subjects with adenotonsillar hypertrophy with attention-deficit/hyperactivity disorder who underwent adenotonsillectomy were identified between January 2012 and December 2013 using Taiwan's National Health Insurance Database. Changes in prescription of methylphenidate (MPH) for treatment of ADHD was followed for one year after adenotonsillectomy. We defined the date of intervention as the date when AT was performed. Follow up data for the next 12 months was obtained. The change of ADHD medication use was compared to average daily doses of ADHD medication in the 3 months prior to surgery. Discontinuation of ADHD medication was defined as total cessation of MPH (IR-MPH or OROS-MPH). Decrease in ADHD pharmacotherapy was defined as decrease in dosage of 50% or more MPH. Increase of ADHD pharmacotherapy was defined as increase in dosage of 50% or more MPH. No change of ADHD pharmacotherapy was defined as positive or negative changes under 50% of baseline medication dosage.

**Results:** 3301 pediatric patients underwent adenotonsillectomy during the study period. 7.6% of them had co-morbid ADHD and was on mehylphenidate (MPH). In this cohort, adenotonsillectomy decreased MPH usage starting at 4-6 months post-operatively (p< 0.001). 1-year after adenotonsillectomy, MPH was discontinued in 61% of the subjects, and its dosage was reduced by more than half in 16% of the subjects.

**Conclusion:** For children with ADHD and adenotonsillar hypertrophy, adenotonsillectomy effectively decreases need of ADHD pharmacotherapy, where 61% of the patients were weaned off methylphenidate (MPH). Based on this study, presence of adenotonsillar hypertrophy needs to be evaluated in children with ADHD. If adenotonsillar hypertrophy associated with OSA contribute to ADHD symptoms, adenotonsillectomy can significantly decrease the need of ADHD pharmacotherapy. Prospectively, pediatric patients with ADHD and adenotonsillar hypertrophy would benefit from a pre-operative sleep study for the diagnosis of OSA, followed by a correlation of the impact of treating pediatric OSA in patients with ADHD.
Introduction: The clinical benefit of bibloc over monobloc appliances has not been established in randomized trials treating obstructive sleep apnoea (OSA). We hypothesized that the two types of appliances are equally effective in treating moderate to severe OSA.

Materials and methods: We performed a blinded, multicenter, randomized, controlled, prospective, parallel-group trial including patients aged 18 years or older who had moderate-to-severe OSA. Patients were randomly assigned to receive either a bibloc or a monobloc appliance with the intention to protrude the mandible 75% of the individual maximal protrusion capacity. At baseline a one-night respiratory polygraphy was done without any respiratory support. The polygraphy was iterated with the appliance in place at a 6-week follow-up. The primary outcome was the absolute change in the apnoea-hypopnea-index (AHI) from baseline to the 6-week follow-up, analysed in the per-protocol population. All patients who received an appliance were included in the safety analysis. This trial is registered with ClinicalTrials.gov, number NCT02148510, and approved by Uppsala Regional Ethical Review Board, Sweden (#2014/021).

Results: We recruited patients from three dental specialist clinics in Sweden; enrolment of 302 patients was done between March 2014 and April 2016; 146 randomized to bibloc and 156 to monobloc appliance. Twenty-three patients in the bibloc group and 17 in the monobloc group were withdrawn due to reasons like appliance could not be fitted, lack of compliance, adverse events or non-valid follow-up polygraphy i.e. a per-protocol group of 123 bibloc and 139 monobloc treated patients. The mean change of AHI from baseline to 6 weeks of treatment was -13.8 (95% CI -16.1 to -11.5; p < 0.001) in the bibloc group and -12.5 (95% CI -14.8 to -10.3; p < 0.001) in the monobloc group. The mean difference was not significant between the groups (-1.3 (95% CI -4.5 to 1.9). The most common adverse event in the orofacial region was upper airway infection followed by complaints from various parts of the mouth, jaws and teeth.

Conclusions: Bibloc and monobloc appliance treatment was equal in their effects in treating OSA as measured by at home polygraphic respiratory measures and the appliances were associated with a similar degree of adverse events.

Acknowledgements: Funding from Uppsala-Örebro Regional Research Council and Vastmanland County Council, Sweden.
DOES TONGUE BASE OBSTRUCTION AND CIRCUMFERENTIAL VELAR COLLAPSE ON SLEEP ENDOSCOPY AFFECT THE OUTCOME OF ADVANCED PALATOPHARYNGOPLASTY PERFORMED ALONE FOR MODERATE TO SEVERE OBSTRUCTIVE SLEEP APNEA?

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Introduction: Although drug-induced sleep endoscopy (DISE) is an accepted method to localize upper airway obstruction, it is not known whether tongue base obstruction as identified by DISE must be treated to achieve sufficient Apnea-Hypopnea Index (AHI) improvement. We wished to compare outcomes for unilevel (upper) versus multilevel DISE collapse patterns in a patient cohort that only underwent modern palatopharyngoplasty. Our hypothesis was that not all tongue base level obstructions on DISE must be treated.

Materials and methods: Case series retrospective analysis was performed for 38 patients with moderate to severe OSA undergoing advanced palatopharyngoplasty surgery for OSA by a single sleep surgeon (Ofer Jacobowitz). Patients underwent DISE immediately prior to surgery, and regardless of tongue base obstruction presence or absence underwent upper pharyngeal surgery alone consisting of expansion sphincter pharyngoplasty, lateral pharyngoplasty and or transpalatal advancement pharyngoplasty. Outcome was measured by polysomnography or home study. Comparison of AHI outcome was performed for those with complete tongue base obstruction to those without and also for patients with circumferential collapse of velum versus those without this pattern.

Results: The group consisted of 29 males and 9 females, with an average age of 47.0 ± 12.5 years, a baseline severely elevated AHI of 44.9 ± 21.3/hr, a BMI of 32.3 ± 4.9 kg/m², a Friedman tongue position score of 2.4 ± 0.6, and a tonsil size of 1.5±0.9 Eleven patients (29%) had multilevel, complete tongue base obstruction and nineteen (50%) had no obstruction. These two groups were similar in age, body mass index, AHI, but the complete tongue base obstruction group had smaller tonsils and higher tongue position. The post-operative success rate and AHI in the group without tongue base obstruction were not significantly different from those of the complete obstruction group (68%;17.4±11.0 vs. 73%;15.4±20.5, p=1.00). Seventeen patients (45%) had circumferential collapse of velum. The postop AHI was higher for patients with circumferential collapse (23.6±15.8 from 55.3±22.1 vs.10.5±9.94 from 36.4±16.7, p< .0001), but both groups had clinically and statistically significant AHI reductions.

Conclusions: In this single surgeon series, patients with multilevel obstruction on DISE, treated with palatopharyngoplasty alone had similar AHI outcome as those with unilevel obstruction. Multilevel surgery may be not be needed or tongue base surgery may be reserved to a second stage in some patients with multilevel DISE obstruction pattern. Circumferential collapse of the velum, however, was associated with a higher residual AHI.

Acknowledgements: Orange Regional Medical Center and New York Eye and Ear Infirmary of Mount Sinai
MORTALITY AND USE OF PSYCHOTROPIC MEDICATION IN SLEEP APNOEA PATIENTS: A POPULATION-WIDE REGISTER-BASED STUDY

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Introduction: Chronic uses of psychotropic medication have been associated with negative health consequences including increased mortality. We aimed to evaluate all-cause mortality in relation to the use of benzodiazepines, antidepressants and antipsychotics in obstructive sleep apnoea (OSA) patients and matched controls.

Materials and methods: Patients with a diagnosis of OSA and no pre-index use of psychotropic medication (n = 38,735) compared with control subjects (n = 75,941) matched on age, gender, marital status and community location. We used national register data to obtain information on diagnoses (the Danish National Patient Registry), mortality (the Central Person Register), and psychotropic medication use (the Danish Register on Medicinal Product Statistics).

Results: All-cause mortality was higher in patients with OSA as compared to control subjects. Mortality hazard ratios were increased for OSA patients and controls, respectively, prescribed serotonergic antidepressant drugs (HR=1.808 (SD=0.015), P<0.001; HR=2.607 (0.158), P<0.001 in controls), tricyclic antidepressants (HR=1.846 (0.166), P<0.001; HR=2.087 (0.172), P<0.001), benzodiazepines (HR=2.590 (0.040), P<0.001; HR=3.705 (0.085), P<0.001), benzodiazepine-like drugs (HR=1.980 (0.087), P<0.001; HR=2.227 (0.083, p<0.001), first-generation antipsychotics (HR=2.894 (0.268), p<0.001; HR=1.210 (0.509), NS), and second-generation antipsychotics (HR=2.069 (0.182), p<0.001; HR=1.355 (0.171), NS), as compared with no drug use. Interaction analysis suggested similar or slightly lower mortality associated with selective serotonin reuptake inhibitors, benzodiazepines and second-generation antipsychotics in OSA compared with controls taking comorbidity into consideration.

Conclusions: All-cause mortality was higher in OSA patients and especially controls treated with benzodiazepines, antidepressants or antipsychotics than in untreated controls. The findings are not controlled for psychiatric co-morbidity and part of the results may be attributable to confounding by indication, but the results raise the possibility that uses of psychotropic medication may cause health consequences.

Acknowledgements: NA
### Introduction
As part of the evaluation of scales and questionnaires validation, it is important to study the degree of relationship between the subjective indicators of sleep quality with the PSG indicators such as sleep architecture, sleep phases latencies; even indicators of sleeping disorders.

### Materials and methods
To determine the correlation between CISQ and PSG. In a sample of 94 patients with OSA diagnosed by PSG to whom CISQ was applied; It is a new instrument for the evaluation of sleep quality integrated by 20 items. The higher the score in the CISQ the lower the quality of sleep. A Spearman correlation was used to determine the relationship between CISQ and PSG; a value of $p < 0.05$ as the cut-off point of significance.

### Results
The worst quality of sleep was associated with an increase in the N1 phase ($-0.214, p < 0.038$); ($P < 0.001$), the more severe the apnea symptom a lower oxygen level was detected ($-0.351$, $p < 0.001$), more rapid eye movement sleep ($0.222, p < 0.032$), increased sleep apnea index ($0.355, p < 0.001$) and snores number ($0.263, p < 0.01$).

### Conclusions
The subjective indicators of sleep quality and the symptoms of OSA correlated with the severity of PSG indicators of sleep respiratory disorders.

### Keywords
OSA, CISQ, PSG
CLINICAL PROFILE AND RELATED FACTORS OF OBSTRUCTIVE SLEEP APNEA SYNDROME IN INDONESIAN ADULTS

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Background: Obstructive sleep apnea (OSA) is a recurrent episodes of upper airway collapse either partial or complete during sleep. This causes the gas exchange and sleep disorders. Characteristics of obstructive sleep apnea syndrome in Indonesia remain unclear. This study want to show the characteristics of obstructive sleep apnea patients based on polysomnography report in Jakarta, Indonesia.

Methods: The study involved patients with suspected OSA investigated with polysomnography (PSG) type III including continuous recordings of nasal airflow by thermistor, oximetry, body position detection, and vibration sound detection at some sleep department in Jakarta, Indonesia. The sleep report were used to assess characteristics of OSA based on Apnea-Hypopnea Index (AHI), AHI in supine and non-supine position, average oxygen saturation, Oxygen Desaturation Index (ODI), snoring time and number of snoring episodes. Results were analyzed using Pearson test, Spearman test and Kolmogorov-Smirnov test.

Results: 54 subjects were included, 47 subjects were diagnose with OSA with AHI score $\geq 5$. Most OSA subjects aged 68.1% are adults (41-65 years), 74.5% were men and 55% subjects are obese (BMI $\geq 30$). The PSG result showed that mild OSA was 31.5%, moderate OSA was 22.2%, and severe OSA was 33.3% and based on sleep position 71.8% OSA are in supine position, severe ODI (33.3%), median (minimum) average SaO2 was 94.5 (70.6), mean (SD) sleep duration was 434.3 ($\pm$67.88) minutes with mean snoring time 26.18% ($\pm$16.03) of total sleep duration. There is significant differences between the OSA severity and the BMI classified ($p=0.006$). BMI significantly correlated with AHI ($p = 0.001; r = 0.444$), average oxygen saturation ($p = < 0.001; r = -0.470$), ODI ($p = 0.002; r = 0.405$), and number of snoring episode ($p = 0.044; r = 0.276$).

Conclusion: Obstructive sleep apnea is highly prevalent in adult (41-65 years), and increased with body mass index. There are correlation between BMI with AHI, average oxygen saturation, ODI, and number of snoring episode.

Keywords: Obstructive sleep apnea, adults, characteristics, body mass index, AHI, ODI, average oxygen saturation, snoring.
Introduction: Many studies have demonstrated that the patient with OSA showed relatively high prevalence of atherosclerotic neurovascular disease and cardiovascular disease. No studies have addressed the quantitative analysis of carotid arterial calcification on upper airway CT which often obtains on OSA patient. The purpose of our study is to evaluate the additional value of upper airway CT in patient with obstructive sleep apnea (OSA) for predictor of cardiovascular disease by quantitative analysis of carotid arterial calcification.

Materials and methods: This study included 333 consecutive patients who underwent polysomnography and upper airway CT between March 2011 and October 2016. The subjects were divided into three groups based on the results of apnea-hypopnea index (AHI): mild (AHI< 15), moderate (AHI 15-30), and severe (AHI ≥ 30). The carotid arterial calcifications on each upper airway CT were quantified using the modified Agatstone scoring method. The carotid arterial calcium score were divided into 4 groups (0-10, 11-100, 101-400, >400, respectively). The differences of clinical characteristics including age, sex, BMI, comorbid disease (hypertension, diabetes, smoking, dyslipidemia, etc.), SpO2, ESS, and carotid arterial calcium score between the 3 groups were analyzed.

Results: Carotid arterial calcium score showed positive correlation with AHI (P< 0.05). Severe AHI group (AHI ≥ 30) showed larger number of subject with severe carotid arterial calcification than that of mild or moderate group.

Conclusions: Additional analysis of carotid arterial calcium scores on upper airway CT on OSA patients may be providing information of subclinical atherosclerosis as predictor of cardiovascular disease.
Simple Snorers Report More Severe Psychiatric Symptoms Than Obstructive Sleep Apnea Patients and Healthy Control

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Introduction: Patients with sleep disordered breathing are known to have severe psychiatric symptoms than good sleepers. The aim of this study was to compare the difference of psychiatric symptoms among obstructive sleep apnea (OSA), simple snoring (SS), and healthy control (HC).

Materials and methods: A total 386 participants (260 patients with OSA, 75 patients with SS, and 51 HC) completed self-report questionnaires including the Symptoms Checklist-90-Revised (SCL-90-R) and underwent nocturnal polysomnography. The scores of nine primary symptom dimensions and three global distress indices of the SCL-90-R were compared among the three groups controlling for age, sex, and BMI.

Results: Patients with OSA or SS reported more severe psychiatric symptoms than HC. Compared to patients with OSA, subjects with SS manifested more severe obsessive-compulsive (p = 0.008) and depressive (p = 0.031) symptoms, global severity index (GSI, [p = 0.039]) and positive symptom distress index (PSDI [p = 0.009]). Further regression analyses in suspected OSA patients revealed that Pittsburgh Sleep Quality Index score was associated with GSI (B = 0.06, p = 0.039) and PSDI (B = 0.07, p = 0.017), and decreased REM sleep proportion was associated with PSDI (B = -0.03, p = 0.032).

Conclusions: This study indicated that patients with suspected OSA suffer from more severe psychiatric symptoms than HC. Psychiatric symptoms were more severe in SS group than OSA group and associated with subjective sleep quality rather than apnea-hypopnea index.

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Introduction: SWS is thought, by some investigators, to play an important role in cerebral restoration and recovery in humans and to be involved in the maintenance and consolidation of sleep. Our aim was to see if SWS protects patients from Sleep Disordered Breathing (SDB).

Materials and methods: Data was accessed for 1020 patients who presented from Sept 2011 to Oct 2016 with symptoms of sleep disordered breathing (SDB). Selected subjects had undergone level-1 Overnight Polysomnography study with Split night protocol. The PSG records were manually scored and revalidated by a senior sleep specialist. Subjects were divided into OSA, UARS and combined OSA + UARS groups. UARS was labelled when the patients had following features: Variation in oronasal flow amplitude and variation in thoraco-abdominal excursion leading to RERAs (Respiratory Effort Related Arousals) & Inspiratory nasal flow flattening measured by pressure transducer.

Results: SWS was present without any effect on severity in 25.1% patients of OSA, 23.8% patients of Combined OSA+UARS group and 33.3% patients of UARS group. SWS was very brief in 10.69 % patients of OSA, 3.8% patients of Combined OSA+UARS group.30.6% of OSA, 32.3% of combined OSA+UARS and 33.3% of UARS group of patients did not achieve SWS. SWS was protective in 33% patients of OSA, 40% of combined OSA+UARS group and 33.3% patients of UARS group. OSA worsened in SWS in 0.44% of cases of OSA

Conclusions: In those patients of sleep disordered breathing who achieved SWS in pre-CPAP period, at least 1/3rd of them were protected/largely protected of OSA/UARS.
Introduction: Studies suggest that African-Americans slept worse objectively and subjectively than Caucasian-Americans.

Materials and methods: We analysed to see the difference between two races in terms of respiratory and sleep stage variables out of the pooled data from 100 African patients matched to 100 Indian patients based on Age (±1year), gender & BMI rounded to whole digits who had undergone overnight complete polysomnography at Apollo Sleep Disorder Institute & Advanced Sleep Disorder Institute, Delhi

Results: Majority of patients were in 3rd to 6th decades for both the groups. Indian females represented 15% while Africans 24% of study population. Despite similar mean BMI, MPT (Mallampati Score) & ESS (Epworth Sleepiness Score) were somewhat higher in Africans. The most commonly affected age group of Africans had only 39 % heavy to very-heavy snoring vs 51% Indians, 14 % maintained >90% SO2 vs 8 % of Indians while >75 % SO2 was maintained by 59 % of Africans vs 46 % of Indians. AHI of >30/hr was found in 48% of Africans vs 58 % of Indians. SWS was very short to absent in 49 % and protective in 23 % of Africans vs 34% and 29% of Indians respectively.

Conclusions: Occurrence of SDB and REM sleep characteristics were almost similar in both the groups. These potential differences must be investigated further. SDB, MPT and ESS in Indians were significantly higher with BMI matched Africans.
THE ASSOCIATION BETWEEN OBSTRUCTIVE SLEEP APNEA AND ALZHEIMER’S DISEASE: A META-ANALYSIS PERSPECTIVE

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Introduction: Alzheimer’s disease (AD) and obstructive sleep apnea (OSA) are highly prevalent, chronic conditions with intriguing, yet poorly understood epidemiological overlap. To date, the amount of OSA syndrome present in patients with AD across literature remains unknown.

Materials and methods: Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, search of medical literature via PubMed was carried out in July 2015. We included any study reporting prevalence of OSA in AD. Exclusion criteria were as follows: (1) case reports, reviews, meta-analysis, or animal studies; (2) non-AD studies (e.g., studies on other dementia or mild cognitive impairment (MCI) patients); (3) non-OSA studies (e.g., studies on sleep fragmentation or central sleep apnea); (4) interventional studies and (5) duplicate material. For each study, the total number of AD patients and number of AD patients with OSA was extracted. When possible, similarly this approach was implemented for healthy control subjects’ data. These data allowed us to calculate an odd ratio (OR) for each study and subsequently an aggregate measure using the Biostat’s statistical package. For the analysis, random effect model was selected a priori.

Results: The results of our quantitative meta-analysis suggest that the aggregate odds ratio for OSA in AD vs. healthy control was 5.05 and homogeneous. This reflects that patients with AD have a five times higher chance of presenting with OSA than cognitively non-impaired individuals of similar age. Moreover, these data suggest that around half of patients with AD have experienced OSA at some point after their initial diagnosis.

Conclusions: The additive impact of progressive changes in sleep quality and structure, changes in cerebral blood flow and the cellular redox status in OSA patients may all be contributing factors to cognitive decline and may further aggravate AD progression. It is hoped that the high OSA rate in AD patients, as suggested by the findings of our meta-analysis, might provide a sufficient clinical incentive to alert clinicians the importance of screening patients for OSA in AD, and stimulate further research in this area.

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Sleep Breathing Disorders
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TEST-RETEST RELIABILITY OF CEREBRAL CORTEXTHICKNESS ANALYSIS USING FREESURFER IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: The aim of this study was to evaluate test-retest (intra-rater) reliability of FreeSurfer-based cortical thickness analysis using MRIs from obstructive sleep apnea (OSA) patients and healthy volunteers, and to demonstrate the effect of the resulting reliability on the group difference in the cortical thickness.

Materials and methods: Twenty six patients with OSA and 24 healthy controls were included in this study. 3D T1-weighted (T1w) images were obtained using 3T MRI. To evaluate the reliability, we performed a standard FreeSurfer pipeline, consisting of a motion correction, inhomogeneity correction, intensity normalization, skull stripping, pial and white surfaces generation, and extraction of cortical thickness measures. Intraclass correlation coefficient (ICC) was used to measure and to statistically analyze the intra-rater reliability. Moreover, to determine the effect of the reliability on the group difference in the cortical thickness, a statistical analysis was performed using a general linear model on cortical thickness.

Results: Our test-retest reliability of global and regional mean cortical thickness measurements were very high. Compared with the healthy controls, the mean cortical thickness in OSA patients was decreased in the supramarginal, superior parietal, superior temporal, precuneus, lateral occipital gyri in the left hemisphere, and in precuneus and insula in right hemisphere (P < 0.05), and the mean cortical thickness in OSA patients was increased in the bilateral medial orbitofrontal, postcentral, precentral gyri, and left rostral middle frontal and parahippocampal gyri.

Conclusions: Though we did not use the optimal T1w protocol (MPRAGE) to analyze cortical thickness, our cortical thickness measurements guaranteed the excellent test-retest reliability. Therefore, it suggests that our findings in the mean cortical thickness analysis between the OSA and control groups can consistently be reproducible by other researchers.

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PREDICTION OF OSA SEVERITY BASED ON SLEEP BREATHING SOUND USING SUPPORT VECTOR MACHINE

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Introduction: Although polysomnography (PSG) is a standard test for obstructive sleep apnea (OSA), there is still a problem of underdiagnosis because of its high cost and insufficient test facilities. Thus, a repetitive OSA screening test would be effective. The purpose of this research is to develop a OSA screening method based on sleep breathing sound using a prediction model.

Materials and methods: Breathing sounds were recorded from subjects with witnessed snoring or sleep apnea during PSG. Based on the Apnea-Hypopnea Index (AHI), the subjects’ sound data were divided into four-OSA severity classes. We proposed two novel methods:

1. the total transition probability of approximated sound energy in time series;
2. the statistical properties derived from the dimension-reduced cyclic spectral density.

In addition, feature selection was conducted to achieve better results. Then, the classification model was trained using support vector machines and evaluated using leave-one-out cross-validation.

Results: The proposed method demonstrated 79.52 % accuracy for the four-class classification task. Additionally, it demonstrated 98.0 % sensitivity, 75.0 % specificity, and 92.78 % accuracy for OSA subject detection classification with AHI threshold 5.

Conclusions: The results show that our proposed method can be used as part of an OSA screening test, which can provide the subject with detailed OSA severity results from only breathing sounds.
**Introduction:** Subjects with insomnia or obstructive sleep apnea (OSA) had more abnormal sleep state perception compared to those without insomnia or OSA. However, few studies have performed the sleep state perception in subjects with OSA. We hypothesized that severity of OSA would affect the sleep perception among patients with OSA. We investigated the potential factor or conditions to affect sleep state perception in subjects with OSA.

**Materials and methods:** Five hundred and fifty four subjects with OSA were recruited from the tertiary sleep center. A negative sleep perception group was defined as follows: patients who underestimated their sleep time by at least two hours, compared to their respective objective sleep time based on polysomnographic data. A correct sleep perception group was defined as follows: patients who did not overestimate.

**Results:** Of 554 participants, 154 (28.3%) subjects had negative sleep perception. Gender (female, OR = 1.9, 95% CI = 1.2 -3.1, $p = 0.009$) and depression (OR = 1.5, 95% CI =1.0 - 2.3, $p = 0.040$) were related with negative sleep perception.

**Conclusions:** Negative sleep perception in subjects with OSA is not related with OSA severity in itself.
THE RELATIONSHIP BETWEEN THE CLINICAL CHARACTERISTICS AND LUNG FUNCTION IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME

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**Introduction:** Obstructive sleep apnea (OSA) which is one of the risk factors of the mortality related with cardiovascular diseases has difference incidence depending on sex. But, it is difficult to find study of difference between sex. We investigated difference between sex and factors related with apnea-hypopnea index (AHI).

**Materials and methods:** We checked the clinical characteristics of 243 patients performed polysomnography through reviewing medical records retrospectively. and factors related with AHI in 86 patients performed pulmonary function test (PFT).

**Results:** Among 243 patients, 192 patients (79.0%) were diagnosed with OSA. OSA patients had significantly increased value of weight, body mass index (BMI), neck circumference, waist circumference and Epworth sleepiness scale (p=0.008, p=0.019, p=0.019, p=0.015, p=0.025). BMI and waist circumference (p=0.044, p=0.041) were significantly increased in men. But, women didn't have significant anthropometric parameters. Nadir oxygen saturation during sleep were significant parameter in common. Forced expiratory volume in one second (FEV1) was significant parameter in men doing PFT (p=0.008). By multiple regression analysis, Mallampati class and FEV1 (p=0.046, p=0.030) were significant factors in men. But, FEV1 was much higher in OSA than in non-OSA.

**Conclusions:** Factors related with OSA between sex had difference, and FEV1 among the parameters of PFT is significant.

**Acknowledgements:** none
Introduction: If real-time monitoring technique is available, which provides individualized information on the obstruction site (i.e., retropalatal or retroglossal area) and patterns (i.e., antero-posterior, lateral, or circumferential collapse) of the upper airway in patients with obstructive sleep apnea (OSA), it would be instrumental in clinical practice. First, it might help differentiate a central apnea from an obstructive one in combination with full polysomnography (PSG) or out-of-center sleep testing. Moreover, it may provide guidance in selecting obstruction site-specific treatment modalities such as upper airway surgeries, possibly leading to the rise in success rates of such modalities. The electrical impedance tomography (EIT) is a non-invasive imaging technique which can monitor the lung ventilation status in patients receiving mechanical ventilation. In our previous study, simulated upper airway obstruction by swallowing maneuver was successfully identified using the EIT. We recently evaluated the efficacy of the EIT for detection of the upper airway closure at the retroglossal level, and also its safety in OSA patients as well as in healthy subjects.

Materials and methods: Seven healthy subjects with no history of witnessed apnea (6 males, age 25.1 ± 1.6 yr, body mass index 24.2 ± 3.1 kg/m²) and ten OSA patients (10 males, age 41.6 ± 9.4 yr, body mass index 26.1 ± 2.4 kg/m²) underwent a simultaneous PSG and upper airway EIT during natural sleep; sedatives (zolpidem, 5 or 10 mg) were used as needed. Sixteen small Ag-AgCl electrodes were attached along the lower face, which reflected the upper airway at the retroglossal level. The boundary shape of attached electrodes was obtained using a 3D scanner and was used for the reconstruction of EIT images. Signals from PSG and EIT were synchronized, and both data were compared during baseline respiration and respiratory events such as obstructive hypopnea and apnea.

Results: No adverse device effects including skin lesions and cardiac arrhythmia were observed. In seven healthy subjects, no respiratory events occurred and no significant changes in EIT data were observed. By contrast, significant increases in electrical conductivity within the upper airway region were observed during obstructive apnea, and also during obstructive hypopnea with a lesser degree in all OSA patients.

Conclusions: The EIT may be a safe and efficacious real-time monitoring technique to identify upper airway closure during natural sleep in OSA patients.
DEVELOPING A NOVEL SURGICAL APPROACH TO THE BASE OF TONGUE TO TREAT OBSTRUCTIVE SLEEP APNEA: MIDLINE LINGUAL SEPTAL APPROACH

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Introduction: Continuous positive airway pressure (CPAP) is a standard treatment modality for obstructive sleep apnea (OSA), which acts as a “pneumatic splint” against the collapsing pharyngeal wall. Although its efficacy is much superior to other therapies such as oral appliances and upper airway surgeries, its low compliance has been an obstacle to manage OSA patients. If biocompatible implants embedded in the pharyngeal wall or the tongue can fight against the negative pressure in the pharyngeal lumen (as an “internal tissue splint”), they might overcome the problem of CPAP (i.e. low compliance) while achieving equivalent efficacy of CPAP. Several implant-based functional surgeries using a stitching fiber or a hook have been attempted, but were restricted to the midline area through a rather blind approach, in the fear of damaging the intricate anatomy of the tongue. We have discovered that the lingual septum can be a safe surgical plane for approaching the base of tongue (named, “midline lingual septal approach (MLSA)”), and confirmed that an exposed area via MLSA can be safely manipulated.

Materials and methods: Pathways of the lingual artery and the medial branch of hypoglossal nerve inside the tongue as well as feasibility of MLSA were investigated using ten cadavers. Five mixed-breed dogs were operated via MLSA, and the exposed basal tongue area were ablated using radiofrequency (20W) at multiple points. Postoperative complications including pain, bleeding, infection, swallowing difficulty, and vocalization problem were evaluated for 4 weeks postoperatively.

Results: Lingual septum was exposed by incising a lingual frenulum. The hyoid bone and the base of tongue were easily approached via MLSA. The medial branch of the hypoglossal nerve crossed the lingual artery in lateral-to-medial direction at the anterior end of the hyoglossus muscle. However, the hypoglossal nerve lied lateral to the lingual artery and hyoglossus muscle behind this cross point, which was approximately 1.5 cm apart from the hyoid bone. Among the five dogs that received radiofrequency ablation at the base of tongue via MLSA, a single dog showed transient swallowing difficulty which disappeared at postoperative 2nd day. No other significant postoperative complications were observed in all dogs.

Conclusions: The MLSA might be a safe and minimally invasive approach into the base of tongue.
ASSOCIATIONS BETWEEN OBSTRUCTIVE SLEEP APNEA AND ENDOSCOPICALLY PROVEN GASTROESOPHAGEAL REFLUX DISEASE

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Introduction: Obstructive sleep apnea (OSA) is believed to be an important risk factor for gastroesophageal reflux disease (GERD). However, the association between OSA and GERD has been incompletely characterized. The aim of this study was to assess the relationship between OSA and GERD by performing both polysomnography (PSG) and esophagogastroduodenoscopy (EGD).

Materials and methods: The enrolled patients underwent both PSG and EGD from October, 2003 to July, 2015 at Seoul National University Bundang Hospital. All patients were checked EGD and divided into a “no-GERD group” and a “GERD” groups according to the Los Angeles (LA) classification. In addition, the GERD symptoms were also recorded.

Results: A total of 216 patients were enrolled. Ninety-nine patients (45.8%) were in the no-GERD group, 68 (31.5%) were in the minimal-change GERD group, and 49 (22.7%) were in the GERD LA-A/B group. The OSA-related findings were worse in the GERD LA-A/B group than in the no-GERD group: the apnea-hypopnea index was 33.6±25.5 versus 22.0±17.2 (p=.01), the longest apnea duration was 50.7±24.0 s. versus 41.6±23.3 s. (p=.03), the lowest oxygen saturation was 80.2±7.9% versus 83.2±7.5% (p=.02), and the oxygen desaturation index was 25.1±22.4 versus 16.1±15.5 (p=.01), respectively. Sleep efficiency was significantly worse in patients with GERD symptoms (81.2±10.8%) than in those without GERD symptoms (85.1±11.4%) (p=.03).

Conclusions: Endoscopically proven GERD was associated with more severe OSA. GERD symptoms were also associated with deteriorated sleep quality.
Introduction: Metabolic syndrome (MS) is defined as cluster of cardiovascular risk factors: diabetes mellitus, abdominal obesity, high cholesterol and arterial hypertension. Obstructive sleep apnea syndrome (OSA) is considered to be an independent cardiovascular risk factor. Severity of OSA measured by apnea/hypopnea index (AHI) may play an important role in presence of MS and other cardiovascular risk factors. Aim of this study was to evaluate the influence of severity of OSA on presence of MS, other cardiovascular risk factors and atherosclerosis measured by intimomedial thickness of arteria carotis communis (CIMT) in patients with obstructive sleep apnea syndrome.

Materials and methods: Medical history according to presence of cardiovascular risk factors as gender, age, obesity (body mass index), arterial hypertension, nicotinism, hyperlipidemia, hyperhomocysteinemia, diabetes mellitus and atrial fibrillation were noted. The occurrence of cardiovascular diseases as myocardial infarction, stroke and coronary heart disease was registered. All patients were evaluated by overnight polysomnography, the doppler sonography was done to measure CIMT.

Results: We prospectively enrolled 173 patients. Mild obstructive sleep apnea syndrome (AHI 5-15) was diagnosed in 55 patients. Moderate to severe obstructive sleep apnea syndrome was present in 55 patients (AHI > 15). According to PSG evaluation, in 63 patients no sleep disordered breathing was diagnosed (AHI < 5). We detected, that the value of CIMT and frequency of MS statistically significantly correlated with the value of AHI. By correlation analysis we found significant positive correlation between AHI and CIMT. Multivariate linear regression analysis proved, that the only independent cardiovascular risk factors significantly associated with AHI were diabetes mellitus and body mass index.

Conclusions: We found significant increase of frequency of MS and value of CIMT in conjunction with increasing AHI in patients with obstructive sleep apnea syndrome. The only independent variables significantly associated with AHI were obesity and diabetes mellitus.

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NEW CLINICAL SIGN IN THE DIAGNOSIS OF OSA: EK SIGN

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Introduction: Obstructive sleep apnea (OSA) is suspected in the presence of symptoms such as snoring, early daytime sleepiness. Grading systems were reported in the past using palatal and tongue positions, tonsil size and BMI to evaluate the success of surgery. We defined EK sign (El Chater and Koka sign) as the presence of horizontal wrinkling of soft palate and base of uvula and we tried to evaluate its predictive value for OSA in snoring patients and also evaluate the effect of the effective treatment of OSA (CPAP) on this sign.

Materials and methods: We reviewed the clinical data of 69 snoring patients presented between 2012 and 2014 at Sleep laboratory, Medical Centre, Aubervilliers, France. All patients underwent oropharyngeal examination for the presence of EK sign. The clinical history, ESS, age, sex, BMI were noted and diagnostic polygraphy was carried out.

Results: Forty-two patients were male and 27 patients were female; age ranging from 22 to 74 yrs. The BMI ranged between 21 and 48. The ESS was 4 to 14 (median 10). There was no significant correlation between age, sex, and EK sign (p>0.05). EK sign was positive in 0% in snorers without OSA, 12% in mild, 47% in moderate, 64% in severe OSA. EK sign significantly correlated with the severity of OSA (7% if AHI< 15; 58% if AHI≥15, p<0.01). EK sign was positive in 25 patients and all 25 are apneic; positive predictive value is 100%; specificity of 100%. Negative predictive value and sensitivity were 27% and 44% respectively. Of 25 EK sign positive patients, 2 had MAD and 23 had CPAP treatment; the latter with a mean follow-up of 35 months. The adherence to CPAP was 3 to 8 hours per day (median 5 hours). EK sign persisted despite CPAP treatment.

Conclusions: Wrinkling of uvula and soft palate (EK sign) is a strong clinical predictor of OSA with a positive predictive value of 100%. Histological changes such as muscle atrophy, neuronal demyelination, increased collagen and elastic fibers in extracellular matrix in the pharyngeal soft tissues including soft palate in apneic individuals were reported. These histological changes may result in morphological alterations of soft palate and contribute to the occurrence of EK sign.
Sleep Breathing Disorders
Board #123: P4 - Tuesday

MICROBIOLOGICAL FINDINGS IN PEDIATRIC OSA

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Introduction: Obstructive sleep apnea in children is defined as a disorder of breathing during sleep characterized by obstruction of the upper airways that disrupts normal ventilation during sleep and sleep structure. The cause in otherwise healthy non-obese children is adeno-tonsillar hypertrophy. The exact cause of adeno-tonsillar hypertrophy is not clear, but association with chronic or recurrent infection and thus with microbiologic findings in the pharynx is accounted. Pharyngeal flora contains a wide range of bacteria, including commensals and also potential pathogens. The aim of the study was to determine the microbiological profile of the upper respiratory and digestive tract in children with sleep related disorders caused by adeno-tonsillar hypertrophy and the potential relevance of bacterial colonization for the development of the disease. The research included commonly occurring flora, obligate and potential pathogens. Susceptibility to antibiotics was tested in positive cases.

Materials and methods: A group of 37 children with adeno-tonsillar hypertrophy indicated for surgery were followed in a prospective study. All patients were preoperatively indicated for an overnight sleep monitoring by limited polygraphy. At the beginning of each surgical procedure the sample of tissue was taken. A total of 49 samples was collected, 32 from adenoids and 17 from tonsils. All samples were examined for the presence of common pharyngeal pathogens.

Results: The most common microbiological finding was normal bacterial flora that means normal bacterial colonization of the mucous membranes. But nearly two-thirds of the samples contained a potential pathogen. The most frequently present bacteria were Streptococcus pyogenes group A, beta-hemolytic Streptococci group C and Staphylococcus aureus. All strains of beta-hemolytic Streptococci have been well sensitive to penicillin. The resistance to erythromycin has been detected in twenty percent. The strains of Staphylococcus aureus have revealed good susceptibility to cefoxitin and co-trimoxazol. Postoperative polygraphic results confirmed high efficacy of the surgical treatment.

Conclusion: Microbiological profile of common bacteria in the pharynx with adeno-tonsillar hypertrophy is not different from the findings in healthy subjects. Limited effect of antibiotics and good efficacy of surgery may be explained by the forming of biofilms on the mucous surface. The territorial status of antibiotic resistance is still favorable.
PREVALENCE OF UPPER RESPIRATORY TRACT INFECTIONS IN HABITUALLY SNORING AND MOUTH BREATHING CHILDREN

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Introduction: The aim of the study was to investigate the prevalence of upper respiratory tract infections (URI) - as indicated by rhinosinusitis (RS), ear infections (EI), and antibiotic consumption - in a general pediatric population and evaluate the relationship between these conditions and habitual snoring and mouth breathing during sleep.

Materials and methods: A population-based cross-sectional study was performed in three medium-sized Polish cities from 2011 to 2015.

Results: 4837/6963 questionnaires (69.5%) were completed, returned and analyzed. Habitual mouth breathing during sleep (MB) was reported in 907 (18.7%) children and habitual snoring (HS) in 290 (6.0%). 230/290 (79.3%) of children with HS were also MB. Both HS and MB were more prevalent in boys than in girls (p=0.027 and p< 0.0001, respectively) and neither was associated with BMI (p=0.11 and p=0.07, respectively). Habitual snoring and habitual mouth breathing were highly associated with more frequent bouts of rhinosinusitis, ear infections, and antibiotic use (p< 0.0001 for each parameter).

Conclusions: Higher rates of rhinosinusitis, ear infections, and antibiotic consumption were similarly associated with HS and MB. As MB is over three times more prevalent in the pediatric population relative to HS, MB rather than HS should be considered a leading symptom indicating a risk for URI.

Acknowledgements: This study is a part of a sleep breathing disorders screening program conducted annually since 2010 in a few Polish cities, supported by the Healthy Sleep Foundation in Poland. The authors thank the Wielka Orkiestra Swiatecznej Pomocy (Great Orchestra of Christmas Charity) Foundation for supporting the screening program.
EFFECTIVENESS AND EFFICIENCY OF THE PROSOMNUS® [IA] SLEEP DEVICE FOR THE TREATMENT OF OBSTRUCTIVE SLEEP APNEA - THE EFFECTS STUDY

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Introduction: This study evaluates the effectiveness of a new MAD (Prosomnus® [IA]) fitted with a compliance tracker in a population of patients with mild to severe obstructive sleep apnea (OSA). Long term effectiveness was measured using home sleep testing (HST), validated sleep and quality of life questionnaires, and consumer sleep trackers.

Estimating the mean disease alleviation (MDA) of a treatment is critical for evaluating outcomes when comparing known treatment modalities. Confirming compliance is also important to institutions that regulate and license commercial drivers. As MADs become mainstream treatment for sleep apnea it is important to demonstrate effectiveness, the combination of efficacy and compliance. Treating the patient with a CAD/CAM custom appliance, the ProSomnus® [IA] sleep device, can optimize comfort and efficacy to ensure excellent compliance.

Materials and methods: Patients with AHI between 5 and 50, ages of 18-75 were selected from a population presenting to a multidisciplinary sleep center for treatment of OSA. IRB approval was obtained for the study and all patients were given informed consent. Patients were given HSTs using the Alice NightOne and the Beddit sleep tracker for monitoring total sleep time and providing a sleep quality score. Patients were treated with the ProSomnus [IA] that was fitted with the Dentitrac compliance chip. Compliance was calculated on the 4hr/night 5 day/week standard for CPAP. Patients were given two quality of life surveys the Pittsburgh Sleep Quality Index (PSQI) and the Functional Outcomes of Sleep (FOSQ).

Measurements: 2 nights of HST were averaged before OAT began (PRE) and at the point of symptom reduction (POST). PSQI and FOSQ surveys were taken at (PRE) and (POST). Beddit data was averaged for 2 weeks before patients started treatment PRE and two weeks after, POST.

Results: 27 of 40 patients have been recruited for this study. Two patients that have completed the first treatment outcome will be discussed here. Patient 1, male, 54, BMI of 26, AHI(PRE) at 23, (POST) of 6.0, and PSQI(PRE) 5, (POST) 4, FOSQ(PRE) 35, (POST)38, and Beddit(PRE)47, (POST)75 and a compliance level of 83%. Patient 2, male, 55, BMI 25, AHI(PRE) at 22, (POST) of 1.2, and PSQI(PRE) 4, (POST) 2, FOSQ(PRE) 32, (POST) 37.5, and Beddit(PRE)40, (POST)92 and a compliance level of 93%.

Conclusion: Early results demonstrated the ProSomnus [IA] successfully treated patients with OSA, from an AHI of 23 to 6 (patient 1), and AHI 22 to 1.2 (patient 2). Quality survey data mirrored this improvement along with the Beddit data, showing nearly a 2x improvement in sleep quality score. Patients that are monitored and are involved with their treatment and use a CAD/CAM custom MAD, ProSomnus [IA], were able to achieve high levels of compliance, 83% and 93% respectively, measured by the Dentitrac.
DURATION OF CENTRAL APNEAS MODULATES THE SEVERITY OF THE RELATED DESATURATION EVENTS

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Introduction: Sleep apnea is a common public health problem characterized by breathing cessation events that can lead to intermittent hypoxemia. Currently used severity metric apnea-hypopnea index (AHI) is based on frequency of the events incorporating all events with equal weighting, despite of differences in their duration and type. Breathing cessation event duration and type is known to affect the severity of the related desaturation (Kulkas et al 2017, Peppard et al 2009). Lengthening of hypopneas and obstructive apneas induce more severe desaturations and obstructive apneas induce more severe desaturation than hypopneas of similar length. Similar information on the connection between central apnea duration and the severity of desaturation events is not available. To remedy this lack in knowledge we aimed to investigate the severity of desaturation induced by central apneas.

Materials and methods: Type 1 diagnostic polysomnographies recorded at the Princess Alexandra Hospital, Brisbane, Australia of 395 patients with suspected OSA (220 males and 175 females) were analyzed. Central apnea events followed by desaturation events were included into the analysis. Characteristics of desaturation events (duration, area and depth) associated with central apnea events were evaluated in different durational categories, central apnea duration 10-15s, 15-20s, 20-25s, 25-30s and >30s. Mixed model analysis adjusted for gender, sleep stage (nonREM vs. REM), sleeping position (non-supine vs. supine), age and BMI, was performed to assess the connection between the severity of desaturation events and duration of central apnea events.

Results: Out of the 395 patients 96 males and 60 females had central apnea events. Number of analyzed central apnea events followed by desaturation event was 1749. There were 457, 557, 331, 243 and 161 events in central apnea durational categories of 10-15s, 15-20s, 20-25s, 25-30s and >30s, respectively. In the mixed model analysis after adjusting for confounders increasing duration of central apneas increased statistically significantly the duration (p< 0.001), area (p< 0.001) and depth (p< 0.001) of the associated desaturation events.

Conclusions: As hypothesized longer central apnea events caused more severe desaturation events than the shorter ones. Current diagnostics do not take into account the detailed characteristics of the breathing cessation and desaturation events, although there is known variation in the event characteristics. These differences should be taken into account when estimating the physiological burden caused by central apnea events and the related cardiovascular risk by giving more weight to longer events in the overall estimation of the severity of sleep apnea.

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Kulkas A, Duce B, Leppänen T, Hukins C, Töyräs J 2017 Severity of desaturation events differs between hypopnea and obstructive apnea events and is modulated by their duration in obstructive sleep apnea Sleep Breath. in press
OBSTRUCTIVE SLEEP APNEA AND MALIGNANT MELANOMA - A CLINICAL CASE

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Introduction: Obstructive sleep apnea (OSA) is a well-known public health problem owing to its high prevalence and the numerous consequences of the disorder, including excessive daytime somnolence, cognitive impairment and consequently traffic accidents. Metastatic cutaneous melanoma accounts for the majority of skin cancer deaths due to its aggressiveness and high resistance to current therapies. The link between OSA and intermittent hypoxia (IH) with cancer development has been very recently discovered. Most experimental data have been obtained using melanoma tumour models. IH is likely to be associated with an increase in growth rate, incidence, progression and mortality of cancer.

Materials and Methods: Report a clinical case.

Results: Male, 60 years-old. Former smoker. A history of obesity, high blood pressure, depression and OSA diagnosed in 2015, under continuous positive airway pressure (CPAP), with good adherence. Patient described the appearance of a cutaneous lesion in the left shoulder at the posterior level, beginning in 2014. It was excised in October 2015. It was a BRAF positive ulcerated malignant melanoma (MM). Patient lost follow-up in consultation. Three months later (January 2016) he returned for continuation of the study having been staged. On suspicion of left-sided laterocervical secondary lesions, in March 2016, the surgical margin was enlarged and subcutaneous nodules of the clavicular (negative for malignancy) and juxtaclavicular regions were excised showing 2 malignant melanoma metastases in the lymph nodes. Therefore it was performed left cervical removal in May 2016, which confirmed metastization. Initiated treatment with anti-BRAF / anti-MEK agents (vemurafenib and Cobimetinib). In November 2016, homolateral cervical and axillary recurrence were observed, presenting a massive cervical mass that caused bulging of the region. Patient with pain complaints at the cervical level and movement limitation with difficulty in nocturnal adhesion to CPAP (1-2 hours per night). In December 2016, total cervical removal, left parotidectomy and left axillary removal were performed, all ganglia massively metastasized. Due to progression under anti-BRAF / anti-MEK therapy, immunotherapy with nivolumab was initiated. Limited to comply with CPAP since November 2016. In February 2017, there was rapid progression of the disease with the appearance of a massive, fast-growing contralateral cervical mass. The patient died in April 2017.

Conclusion: An increased cancer aggressiveness and mortality have been recently reported among patients with OSA. IH, a hallmark of OSA, enhances melanoma growth and metastasis in mice. In this case it was a patient with evidence of MM prior to the diagnosis of OSA, with cervical and axillary progression despite good adhesion to CPAP. He suspended CPAP therapy during the course of the disease, with the disease massively metastasized to the contralateral cervical chain within 3 months. Since IH is related to the progression of neoplasias, we believe that discontinuation of CPAP treatment may be related to a more rapid and aggressive progression of melanoma, despite poor prior prognosis. The authors question the pertinence of the dermatologic screening of patients with SAS as well as the screening of SAS in patients with a diagnosis of melanoma.
THE INFLUENCE OF OBESITY AND OBSTRUCTIVE SLEEP APNEA ON IGFBP-1 AND LEPTIN LEVELS

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Introduction: Obstructive sleep apnea (OSA) is associated with hormonal alterations that increase the risk for insulin resistance (IR) and alterations of insulin-like growth factors (IGFs) proteins that circulate in the tissues. The pathophysiologic mechanisms that link OSA, IR and IGFs are unclear and are frequently confounded by obesity. The aim of this study is to investigate the independent role of apneas and obesity on plasma insulin-like growth factor binding protein 1 (IGFBP-1) and leptin.

Materials and methods: We studied 111 untreated OSA patients (95 males; mean age 55.0±13.2 years). Patients were divided into two groups according to apnea-hypopnea index (AHI). Patients with AHI<20 (first group; n=33; 15 non-obese and 18 obese patients), and patients with AHI>20 (second group; n=71; 19 non-obese and 52 obese patients). Plasma leptin and IGFBP-1 levels were determined by ELISA kit.

Results: Patients of the first group had increased leptin (p=0.009) and increased IGFBP-1 (p=0.009) levels in comparison with the patients of the second group. In the first group, non-obese patients had increased IGFBP-1 (p=0.01) and decreased leptin (p=0.02) in comparison with obese patients. In the second group, non-obese patients had decreased leptin (p=0.008) in comparison with obese patients. Between non-obese patients of the two groups only IGFBP-1 was different (p<0.001).

Conclusions: Obesity is associated with decreased IGFBP-1 and increased leptin. OSAS is associated with decreased IGFBP-1 levels.
INFLAMMATION MARKERS IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME WITH OR WITHOUT METABOLIC SYNDROME

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Introduction: The metabolic Syndrome (MB) is defined as the correlation between risk factors of metabolic origin (central obesity, insulin resistance, dyslipidemia, elevated blood pressure) some of which are also associated with obstructive sleep apnea syndrome (OSAS). MB and OSAS are associated with increased inflammation markers. The aim of the study is to compare the inflammation markers between patients with OSAS without MB and patients who represent both syndromes and determine whether the increase in inflammatory markers in patients with OSAS are attributable to coexistent MB.

Materials and methods: We studied 131 patients (110 males) with a mean age of 55 ± 12.4 years, body mass index 34.3 ± 11.2 kg/m2 and with an apnea-hypopnea index 44.7 ± 26.3 episodes/hour. Of these 75 had MB (according to the ATP III criteria) and 56 did not have MB. The average apnea-hypopnea index in patients with OSA and MB was 43.9 ± 25.4 episodes/hour while in those who had only OSA was 42.9 ± 26.4 episodes/hour. As inflammation markers in both groups were measured C-reactive protein, fibrinogen and ferritin levels.

Results:

Patients with OSA and MB
 Patients with OSA
C-reactive protein mg/dl
(normal values 0-6 mg/dl)
5.5±5.6
5.1±5.5
fibrinogen I mg/dl
(normal values 200-400 mg/dl)
418.6±91.7
417.9±116.3
Ferritin mg/ml
(normal values 30-230 mg/ml)
164.0±146.9
105.8±98.6*
*: p<0.01.

Conclusions: The inflammatory markers in patients with OSA are increased despite of the coexistence or not of the MB. Only ferritin seems to be increased if both syndromes coexist.
ASSOCIATION BETWEEN FUNCTIONAL RESTRICTION AND EMPLOYMENT BY USING THE WHODAS 2.0 IN MALES WITH OSA

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Introduction: Several lines of evidence suggest a significant impact from obstructive sleep apnoea on the general health and occupational function of patients. This study aimed to explore the functional impairments related to employment status among male patients with severe obstructive sleep apnoea.

Materials and methods: Recruited from the Taiwan Data Bank of Persons with Disability between July 2012 and January 2016, a total of 4,653 male patients with severe obstructive sleep apnoea, aged between 18 and 65 years, were classified into either employed or unemployed groups (3,608 and 1,045, respectively). Differences between the groups in age, educational level, urbanization level of residence, and functional domains, assessed by the World Health Organization Disability Assessment Schedule 2.0, were examined.

Results: Logistic regression analysis indicated that four functional domains of the disability assessment schedule, specifically mobility, getting along, life activities, and participation, were significantly associated with employment status.

Conclusions: Unemployed male patients with severe obstructive sleep apnoea were older, less educated, and had more impairment in specific domains of functioning. Restriction in physical activity and impaired social role, rather than cognitive impairment for male patients with severe obstructive sleep apnoea may account for their employment status.
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**Aim of investigation:** We conducted a clinical cross-sectional study to evaluate the association between low-sleep quality and the presence of painful temporomandibular disorders (TMD).

**Methods:** A total of 144 TMD patients (51 males and 93 females, mean age of 33.60 ± 13.40 years) were evaluated. Based on Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), all patients were diagnosed, and assigned to one of three groups: myofascial pain group (Group 1), arthralgia group (Group 2), and mixed type group (Group 3). All patients completed questionnaires regarding jaw pain intensity, psychological status, and sleep quality with visual analogue scale (VAS), Symptomatic Check List (SCL)-90R, Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and STOP-BANG. The obtained data was statistically analyzed.

**Results:**
1. Among the SCL-90R items, the score of somatization, anxiety, paranoid ideation, and psychosis were significantly higher in Group 1. In addition, initial VAS score of Group 1 was higher than those of the other two groups.
2. We found that significantly more overall self-reported sleep dysfunction, and higher PSQI and ESS scores in Group 1 than in Group 2 and 3.
3. PSQI score was positively correlated with the presence of almost all of SCL-90R items, excepting for hostility, in Group 1.
4. In the logistic regression analysis, Group 1 showed higher ratios for psychological distress, and insomnia compared with Group 3, whereas, Group 2 more likely to have bruxism.

**Conclusions:** Poor quality of sleep may facilitate nociceptive processing and increase myofascial pain. The biologically and psychologically interrelated association between low sleep quality and pain, especially muscular pain, may be complex and requires further research.

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**Importance of the Nursing Role at the Beginning of Treatment with CPAP**

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**Introduction:** The role of specialized nursing in sleep apnea syndrome is essential to ensure adequate health education for the patient and a good support that facilitates compliance with CPAP. Studies have shown that compliance at the start of treatment is a predictor of long-term compliance. For this reason, it would be useful to closely monitor the patient in the first stage of treatment.

**Objective:** To assess the scope of nursing performance in patients with SAHS in their first stage of CPAP treatment.

**Materials and methods:** Retrospective descriptive observational study. 80 patients with SAHS were studied, 40 attended the nursing consultation one month after starting treatment (G1) and the other 40 did not attend (G2). The 2 groups were subsequently evaluated between 3 and 8 months from the start of treatment through a telephone questionnaire. The variables studied were: gender, age, AHI, Epworth, objective compliance, side effects and SAHS grade awareness. The statistics used were measures of central position and distributions of t-student and X2.

**Results:** A total of 80 patients were studied, 40 of them G1, of which 23 (57.5%) were men and 17 (42.5%) women and 40 G2, of whom there were 31 (77.5%) men and 9 (22.5%) women. There were no significant differences between those assessed by nursing and gender (p 0.094). The average age of G1 was 63.2 years with an SD 11.5, and the mean G2 age was 62.4 years and SD 11. The study was conducted from March 2015 to October 2016. The median age was 63 years, and the AHI was 38. Patients in the G1 group had higher compliance (average 5.96 and SD 1.87) than the G2 group (mean 4.1 and SD 2.54, p 0.014). Epworth was also lower in G1 than in G2 (average G1 5.2, SD 2.7, mean G2: 7.25 SD 4.1, p 0.027). Regarding the side effects 29 (72.5%) G1 patients had no side effects compared to 6 (15%) G2 with a p 0.000. There was no significant evidence between nursing performance and SAHS grade awareness, p 0.258.

**Conclusions:** The nursing consultation of the Sleep Respiratory Disorders Unit of the Ramón y Cajal Hospital in patients who have started treatment with CPAP has a great positive impact in compliance, in the clinical improvement evaluated with Epworth and in a lesser occurrence of effects Secondary, increasing the possibility of a good control of the disease in the long term.
MANDIBULAR ADVANCEMENT DEVICE IN PATIENTS WITH SLEEP APNEA SYNDROME. COULD IT BE A GOOD ALTERNATIVE EVEN IN SEVERE CASES?

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Introduction: Although continuous positive airway pressure (CPAP) is the first choice therapy, mandibular advancement devices (MAD) may be a good alternative even in severe patients. It is useful to evaluate the results in these patients to improve management in those with intolerance to CPAP.

Objective: To evaluate the effectiveness of MAD on different grades of obstructive sleep apnea in patients with intolerance to CPAP.

Material and methods: 16 patients with OSA treated with MAD between 2016 and 2017 were included. The following data were collected before and after the treatment with MAD: Epworth index, body mass index, apnea-hypopnea index (AHI), total number of apneas and hypopneas, average oxygen saturation, saturation time< 90% and oxygen desaturation index. All data was expressed as median and interquartile range (IR). A comparison of related parameters before and after MAD was performed. The Wilcoxon test was used when non parametric distribution was observed.

Results: Of the 16 patients, 12 (75%) were men. The mean age was 58 ± 12 years. The average MAD advance was 6.26 ± 2.09 mm. There were 7 patients with AHI < 20 and 9 with AHI ≥ 20. In both groups the body mass index (BMI) before and after DAM did not present significant differences. The patients with AHI ≥ 20 experienced a major decrease of AHI (median decrease in AHI: 24 ± 14) than patients with AHI < 20 (median decrease in AHI: 5.7 ± 7.48), p 0.035. The median advance in the group with AHI < 20 was 5.33 ± 1.03 mm and the median advancement in the group with AHI ≥20 was 7.25 ± 2.4 mm, (p 0.13). 85% (6/7) patients with AHI< 20 and 50% (3/6) of patients with AHI≥20 were cured of their OSAS. A post treatment apnea-hypopnea index of less than 10 is regarded as cured. 66% (3/9) patients with AHI≥ 20 had a 50% decrease in AHI compared to 14% (1/7) in the AHI < 20 group.

Conclusions: In our study, MAD treatment for patients with intolerance to CPAP is an effective strategy and especially promising for the severe OSA group who are at greatest risk for developing comorbidities.
**Introduction:** The Epworth Sleepiness score (ESS) is a widely used measure of subjective daytime sleepiness and has been shown to predict compliance as well as symptomatic and physiological improvement with CPAP therapy in patients with OSA. However, the ESS score has been shown to correlate poorly with OSA severity when compared to the Mean Sleep Latency (MSL) on Multiple Sleep Latency Test (MSLT). Current treatment guidelines recommend a more aggressive investigation and management approach in patients with high ESS scores (>9). Many OSA patients with low ESS under report their somnolence and may miss out on potentially helpful OSA treatment. We postulate that compared to the ESS, sleep onset latency on an overnight PSG may correlate better with MSL on MSLT as well as sleep apnea severity, and may allow these patients (low ESS(< 10) but short sleep onset latency on PSG(< 10mins)) to be better risk stratified.

**Aims and objectives:** To assess the relationship between ESS, sleep onset latency (SOL) on overnight PSG and MSLT mean sleep latency. In a separate analysis, SOL is compared with ESS in their predictive value for OSA severity as defined by AHI and nadir SpO2.

**Methods:** This is a retrospective analysis of all MSLTs and diagnostic PSGs undertaken at a single tertiary center from 2010 to 2016. 293 MSLT with preceding overnight PSGs were reviewed in the first analysis. 5037 diagnostic PSGs were reviewed in the second analysis.

**Results:** In a multivariate analysis, short SOL on overnight PSG is a better independent predictor for short MSLT mean sleep latency compared to high ESS. (OR 3.25 vs 1.96, ROC-AUC 0.64 vs 0.55, p=0.03) Compared to high ESS, short SOL on overnight PSG is less sensitive (53.8% vs 75.6%) but more specific (73.7% vs 35.3%) for predicting patients with significant objective daytime sleepiness on MSLT.

In the secondary analysis, short SOL on overnight PSG remained an independent predictor of severe OSA (OR 1.15 p=0.035) and low SpO2 nadir (SpO2< 80%, OR 1.27 p< 0.001) when controlled for ESS, Age, Sex and BMI.

**Conclusion:** Short SOL on overnight PSG is better than high ESS for predicting objective daytime sleepiness as measured by MSLT. Short SOL on overnight PSG is also an independent predictor of severe OSA and severe SpO2 desaturations. Patients without subjective EDS (ie ESS< 10) but with short SOL on PSG should be investigated and managed as per patients with significant EDS, as they are likely to have under recognised daytime somnolence and more severe OSA. Further studies to characterise this group of patients with low ESS and short SOL on PSG specifically with regards to their compliance and CPAP treatment response are indicated.
PERCENTAGE OF APNEA/HYPOPNEA TIME FROM TOTAL SLEEP TIME VARIES SIGNIFICANTLY IN PATIENTS WITH SEVERE OBSTRUCTIVE SLEEP APNEA

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Introduction: Obstructive sleep apnea (OSA) is a common nocturnal breathing disorder characterized by complete (apnea) and partial (hypopnea) breathing cessations during sleep inducing severe public health and socio-economic consequences. Currently, diagnosis of OSA is based on clinical symptoms, especially excessive daytime sleepiness, and apnea-hypopnea index (AHI). AHI provides a limited overview of the breathing cessations frequency during sleep and has several other shortcomings. Longer breathing cessations and deeper desaturations have been suggested to be more harmful than shorter and shallower ones and these individual event characteristics are completely ignored by AHI. To address this, we investigated whether the percentage of apnea/hypopnea time from total sleep time (%AHT) differs between patients having severe OSA (AHI ≥ 30) and whether the ratio of overnight durations of apneas and hypopneas is related to %AHT.

Materials and methods: The patient population studied consisted of 358 males and 102 females diagnosed to have severe OSA after full overnight polysomnography conducted at the Sleep Disorders Unit, Loewenstein Hospital, Raanana, Israel. Statistical significance of the correlation between AHI and %AHT was evaluated using Pearson correlation. Furthermore, patients were discriminated into seven different categories based on %AHT: 10-20%, 20-30%, 30-40%, 40-50%, 50-60%, 60-70%, and >70%. Total overnight durations of apneas and hypopneas were calculated and statistical significance of differences in the ratios of these durations between %AHT categories was assessed based on Mann-Whitney U test. All statistical analyses were performed using SPSS (version 20, SPSS Inc., Chicago, IL, USA) software and p < 0.05 was considered to be the limit for statistical significance.

Results: %AHT increased with increasing AHI (p < 0.001). However, AHI explained only 52.6% from this increase (R²=0.526). In this patient cohort, variation in %AHT was large, ranging from 13.6% to 76.3% with a median of 37.9%, despite of the fact that all patients were diagnosed to have severe OSA (median (range) AHI: 50.9 (30.1-170.2)). Median values of ratios of apnea and hypopnea overnight durations were 0.84, 0.92, 1.36, 1.68, 5.22, 20.33, and 126.85 in the %AHT categories of 10-20%, 20-30%, 30-40%, 40-50%, 50-60%, 60-70%, and >70%, respectively. The ratio was statistically significantly higher in category 30-40% than 20-30%, in category 50-60% than 40-50%, in category 60-70% than 50-60%, and in category >70% than 60-70% (p<0.001).

Conclusions: AHI explains roughly a half of the variation seen in %AHT in patients with severe OSA. It can be assumed that the health consequences of OSA are not similar in patient having %AHT of 15% compared to patient with %AHT of 75% albeit both of them are diagnosed to have severe OSA and can have same AHI. These patients often have also very different apnea/hypopnea duration-ratio. Therefore, more accurate metrics for severity estimation of OSA are needed and they should contain information on the duration of breathing abnormalities.

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Introduction: Positional Obstructive Sleep Apnea (POSA) has been conventionally defined by the Cartwright criterion i.e., supine ≥2 times the non-supine severity. An alternative criterion based on the overall divided by the non-supine (NS) severity was used as enrollment criterion for a POSA research study. This study compares the two criteria with a range of Overall/NS-AHI thresholds.

Materials and methods: This retrospective analysis was conducted with studies acquired using the Sleep Profiler-PSG2™ (Advanced Brain Monitoring, Carlsbad, CA). The self-applied, in-home recordings were made with electroencephalography acquired from three frontopolar, airflow using a nasal cannula and pressure transducer, head movement/position by actigraphy, snoring with an acoustic microphone, pulse from the forehead and finger, wireless wrist oximetry, and thorax and abdomen effort by respiratory induced plethysmography. The 73 females and 69 males had a mean age of 45±13.5 years and body mass index of 32±7.2. The same technician performed a focused review of the full disclosure recordings on the cloud-based portal to confirm the sleep staging accuracy, insert apnea or hypopnea events when the amplitude of the airflow signal was extremely low, or remove events due to artifact/movement (average of 12.7±4 minutes per record). OSA severity was measured using the 3% desaturation rule with total sleep time and AASM2012 criteria for the apnea-hypopnea index (AHI) and total recording time with a oxygen desaturation index (ODI-3%). POSA prevalence was based on 142 records with an AHI>5 (16 with an AHI≥5 and ODI-3%≥ 5). The Cartwright and Overall/NS-AHI criteria (with thresholds of 1.3, 1.35 and 1.4) were compared for both AHI and ODI-3%. Sensitivity and specificity was based on the reference standard the NS severity ≥25% the overall severity.

Results: Strong correlations were observed between Overall/NS-AHI and Cartwright ratios derived from AHI/ODI-3% measures (r=.86/.90, p< 0.00001). POSA prevalence decreased as the Overall/NS-AHI thresholds increased (i.e., 1.3, 1.35 and 1.4) for both the AHI (58%, 62% and 63%) and ODI-3% (58%, 56%, and 52%), respectively. By comparison, the POSA prevalence by Cartwright was AHI=65% and ODI-3%=57%. Based on a 25% reference standard across all subjects, the AHI sensitivity|specificity was .93|.71 for Cartwright compared to 1.00|1.00, .99|1.00, and .93|1.00 for the Overall/NS-AHI thresholds. For ODI-3%, the sensitivity|specificity was .92|.87 for Cartwright versus 1.00|.96, .99|.96, and .93|1.00 for the Overall/NS-AHI thresholds. The sensitivity|specificity by Cartwright compared to the Overall/NS-AHI thresholds for 5>AHI< 15 = .95|.87 versus 1.00|1.00, 1.00|1.00, .89|1.00; for 15>AHI< 30 = .93|.67 versus 1.00|1.00, .97|1.00 .97|1.00; and for AHI>30 = 91|.81 versus 1.00|1.00, .97|1.00 and .96|1.00. Comparisons of Cartwright to the Overall/NS-AHI thresholds for the ODI-3% yielded a sensitivity|specificity of .88|.95 versus 1.00|1.00, .97|1.00, .91|1.00 for 5≥ODI-3%< 15; 1.00|.74 versus 1.00|.89, 1.00|0.89, .95|1.00 for 15>ODI-3%≤30; and 91|.81 versus 1.00|1.00, 1.00|1.00, and .94|1.00 for ODI-3%>30.

Conclusions: A strong correlation was observed between the Cartwright and Overall/NS-AHI ratios, both estimated POSA prevalence >60% by AASM2012 criteria and >55% by ODI-3%. When the NS was >25% the overall severity, the sensitivity and specificity of Overall/NS-AHI was superior to Cartwright across both measures and all ranges of OSA severity.

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Sleep Breathing Disorders
Board #103: P2 - Monday

AGREEMENT BETWEEN AUTO-SCORED VS. EDITED UNATTENDED IN-HOME POLYSOMNOGRAPHY

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Introduction: Auto-scored in-home polysomnography accuracy can be impacted by the signal quality associated with self-application. This study evaluated when the auto- and edited-findings were equivalent.

Materials and methods: This retrospective analysis was conducted in 218 consecutive Sleep Profiler-PSG2™ studies (Advanced Brain Monitoring) that included 54% males, mean age 45±13.5 years, and BMI 31±7.0 kg/m². Patients self-applied a forehead worn device to affix three frontopolar electroencephalography (EEG) sensors and nasal cannula, a wireless wrist oximeter, and thorax/abdomen RIP belts. After watching a 5-min video, patients briefly practiced affixing the device. During the night voice messages alerted the patient if the SpO2 sensor probe was not affixed and up to four times/night when the cannula was misplaced. Auto-scored staged sleep and detected OSA severity using methods to emulate the AASM2007 criteria with a 4% desaturation (AHI2007) and AASM2012 criteria with a 3% desaturation (AHI2012). The same technician performed a review to confirm the sleep staging accuracy, insert apnea or hypopnea events during periods with airflow or SpO2 loss, or remove events due to artifact/movement.

Failed studies included those with recording times with < 50% airflow, < 90% SpO2 and/or < 90% good EEG in all three channels. The impact of editing on auto-scored results was evaluated by stratifying non-rejected studies into three groups;
1) “High Quality” i.e., airflow≥90%, three EEG≥90% and WristOx≥95% (n=156),
2) “Marginal EEG” i.e., only one EEG≥90% (n=24), and
3) “Airflow/SpO2” with airflow 50-89% or SpO2 90-95% (n=26) of recording time.

Results: The PSG2 failure rate of 5.5% resulted from 8 records with extensive airflow loss and 4 records with EEG loss. For the remaining 206 studies, the percentage with study times ≥6, ≥7 and ≥8 h were 91%, 71% and 44%, respectively. The percentage of sleep times ≥4, ≥5 and ≥6 h was 84%, 74% and 46% for auto-staging, and 90%, 79% and 55% after editing. The median time to edit the records was 10-min (Inter-quartile range 10-15); increased data loss did not significantly impact editing time. Editing decreased the percent-time Stage N1 by 2.9±4.7% and increased REM by 2.1±5.1%. High Quality studies had significantly greater edited sleep time vs. Marginal EEG and Airflow/SpO2 (p< 0.001, 6.37±1.27, 5.28±1.49, 4.82±1.39 h, respectively). Comparisons of the edited vs. auto-scored AHI2007 resulted in sensitivity, specificity, PPV and NPV agreements exceeding 0.95 for clinical cutoffs ≥5, ≥10 and ≥15 in the High Quality and Marginal EEG groups. For the Airflow/SpO2 group, the accuracy values were >0.90 for AHI≥5 and 1.00 for AHI>15. The accuracy measures with AHI2012 exceeded 0.95 for clinical cut-offs ≥10 and ≥15 in High Quality studies, with lower specificities in the Marginal EEG group (i.e., 0.75 and 0.86 for cut-offs≥10 and ≥15), and compromised accuracies with the Airflow/SpO2 group.

Conclusions: With AHI2007 and 4% desaturation, edited and auto-scored OSA severities were equivalent across all clinical cut-off and quality group. With AHI2012 and 3% desaturation, the auto-scored OSA severities were reliable with clinical cut-offs>10, except when airflow or SpO2 loss exceeded 10% or 5% of recording time.
Introduction: Our previous study has shown that obstructive sleep apnea (OSA) events could be induced following stimulation of cerebral insular cortex (Hc) in rats. The current study is to investigate the effects of different stimulation frequencies of the habenular (Hb) on OSA induced by stimulation of Hc.

Materials and methods: After OSA was induced by stimulating the insular cortex (Ic) with concentric stimulating electrodes at 100Hz in rats, the Hb was stimulated at different frequencies (50Hz, 120Hz, 130Hz and 280Hz). The changes of apnea events and electromyography (EMG) of the genioglossus were compared before and after stimulation of the Hb.

Results: With stimulation of the Ic at 100Hz apnea events was successfully induced with disappearance of EMG of the genioglossus. After stimulation of the Hb at 130 Hz, apnea events disappeared with significantly increased genioglossal EMG. However, such a change failed to be found at the stimulation frequencies of 50Hz, 120Hz, and 280Hz.

Conclusions: Stimulation of Hb at the frequency of 130Hz could effectively inhibit OSA events induced by stimulation of Ic in rat.

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THE RELATIONSHIP BETWEEN THE SEVERITY OF OBSTRUCTIVE SLEEP APNEA SYNDROME AND PREVALENCE OF DEPRESSION

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Introduction: This study is aimed to investigate the relationship between the severity of obstructive sleep apnea syndrome (OSAS) and the prevalence of depression.

Materials and methods: Eighty-eight patients with OSAS were divided into mild, moderate, and severe OSAS groups according to their apnea-hypopnea index (AHI) and minimal oxygen saturation at night. The Zung Self-rating Depression Scale (SDS) was used to evaluate depression and its severity in all subjects. A standard score ≥50 indicated depression. The prevalence of depression was made among the three OSAS subgroups.

Results: The total prevalence of depression was 42/88 (47.7%) in all OSAS patients. The incidence of depression in the mild, moderate, and severe OSA groups was 11.9%, 38.1%, and 50.0%, respectively. In the 42 patients who both OSA and depression, increased SDS scores were associated with an increased body mass index (BMI), AHI, and lower minimal SaO2 at night. The prevalence of depression increased when OSAS became more severe.

Conclusions: The severity of OSAS was positively correlated with the prevalence of depression.
INTERACTION BETWEEN SEVERITY OF OBSTRUCTIVE SLEEP APNEA AND GENDER ON THE LEVEL OF HEMOGLOBIN

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Introduction: Obstructive sleep apnea (OSA) and gender are both associated with the level of hemoglobin (HB). Little is known regarding the relationship between the severity of OSA and gender on the level of HB. We aimed to examine their interaction effects on the level of HB in this work.

Materials and methods: A total of 859 participants with suspected OSA were included. All participants underwent overnight polysomnography (PSG) followed by examining the levels of hemoglobin and erythropoietin (EPO) in the morning.

Results: Of all patients, 626 (72.9%) had OSA (an apnea-hypopnea index (AHI) ≥ 5/h); 306 (35.6%) were women (age 46.7 ± 12.9 years, body mass index (BMI) 25.5 ± 4.0 kg/m²), 523 (64.4%) were men (age 45.0 ± 11.7 years, BMI 26.2 ± 4.1 kg/m²). ANOVA analysis revealed a significant interaction between AHI and gender on HB after adjusting for age, BMI, current smoking, drinking, and percentage of time spent in sleep below 90% oxygen saturation (F=6.87, p< 0.01). For men, there were no differences in the level of HB among three groups with different levels of AHI (< 5/h, habitual snoring; 5-30/h, mild-moderate OSA; ≥ 30/h, severe OSA). For women, the level of HB in patients with severe OSA was significantly higher than those with habitual snoring and mild-moderate OSA. A cumulative association with AHI level and HB was only obtained in women (p< 0.05 for linear trend), not in men.

Conclusions: The results provide a novel evidence of mediated interaction between AHI and gender on the level of HB. The increasing severity of OSA is independently associated with a higher level of HB in women, but not in men.
THE ROLE OF POLYSOMNOGRAPHY IN DIAGNOSIS OF PEDIATRIC SLEEP PROBLEM: EXPERIENCE OF ONE CHILDREN’S HOSPITAL IN TAIWAN

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Introduction: Sleep problem in children, which could not be overlooked, is relatively rare than adults. Polysomnography (PSG) play an important role in pediatric sleep problem, and is an accepted standard method to assess sleep problem in children.

Materials and methods: We retrospectively collected and reviewed the medical records of children (< 18 years old) undergoing PSG due to sleep problem from April 2015 to October 2016.

Results: A total of 233 patients (153 males and 80 females) undergoing PSG were collected. The apnea & hypopnea index (AHI) of these 233 patients was as follows: the AHI was 0-5 in 166 patients, AHI was 5.0-10 in 33 patients; and AHI was over 10 in 33 patients. The final diagnoses in 153 male patients are as follows: 5 other sleep-related breathing disorder (3.27%), 74 obstructive (48.37%), 4 central (2.61%), 25 limb movement sleep disorder (16.34%), 45 snoring (29.41%), 1 sleep seizure (0.65%), 3 sleep terrors (1.96%), 8 insomnias (5.23%), 5 parasomnias (3.27%), 3 narcolepsy (1.96%), 6 hypersomnias (3.92%). The final diagnoses in 80 female patients are as follows: 11 other sleep-related breathing disorder (13.75%), 38 obstructive (47.5%), 4 central (5.00%), 12 limb movement sleep disorder (15%), 26 snore (32.50%), 2 sleep seizure (2.50%), 2 sleep terrors (2.50%), 11 insomnias (13.75%), 5 parasomnias (6.25%), 1 hypersomnias (1.25%).

The management of these 233 patients is that: operation with adenoidectomy and tonsillectomy in 11 patients (4.72%), continuous positive airway pressure (CPAP) in 1 patient (0.43%), and medical treatment or observation in 190 patients (81.55%).

PSG may help detect significant sleep related problem and application of the PSG results is useful for therapeutic decisions in children.

Conclusions: Majority cause of the children with sleep problem is obstructive sleep apnea syndrome (OSAS) (48.07%), and could be managed with medical treatment and observation. Only 4.72% of pediatric OSAS required surgery in our study.

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A MULTICENTER PILOT STUDY ON THE INDICATIONS OF THE NEGATIVE PRESSURE SLEEP THERAPY SYSTEM FOR THE TREATMENT OF OBSTRUCTIVE SLEEP APNEA

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Introduction: The objective of this study was to evaluate the indications of a noninvasive oral negative pressure therapy (ONPT), the iNAP® sleep therapy system (iNAP®).

Materials and methods: The iNAP® was designed to decrease airway obstruction by forming negative pressure within the confined space in the oral cavity and stabilizing the soft tissues around pharynx, thereby preventing sleep-disordered breathing for obstructive sleep apnea (OSA) patients.

A multi-center, single-arm, prospective and evaluator-blind study was planned to determine the efficacy and safety in the target group driven by the data of a previous feasibility study of the iNAP®. After obtaining consent from patients, patients engagement ability with the novel iNAP® devices were firstly checked. Clinical assessments were then performed to evaluate upper airway patency, which were followed by a baseline PSG to further confirm patients' eligibility for the study. Patients who had OSA, defined as the AHI between 10~60, as diagnosed by a baseline polysomnography (PSG), body-mass index (BMI) ≤28 Kg/m² and who met all the entry criteria were enrolled and treated with the new ONPT during the following treatment PSG assessment. Clinical success was defined as apnea-hypopnea index (AHI) reduction of >50% and treated AHI < 20. Safety was carefully monitored during the entire study.

Results: An overall of 50 patients had signed the informed consent and 34 were enrolled in this multicenter clinical study; among which, 27 were evaluable, 22 were male and 5 were female, with an average BMI and the age of 24.4 ± 2.4 kg/m² and 43.6 ± 9.1 years, respectively. The BMI spanned by patients evenly among the range of 18.5~24.9 kg/m² and 25~28 kg/m², with only one patient that was far thinner than the others, below 18.5 kg/m². The mean baseline AHI was 27.0 ± 11.8, air leakage time corrected efficacious treated AHI was 14.8 ± 11.9, the mean AHI reduction was -37.5% ± 58.6%. In summary, fourteen (14) out of 27 patients were clinically successfully treated; the iNAP® could reach clinical success treatment for 2 out of 4 mild OSA patients, 6 out of 13 moderate OSA patients and 6 out of 10 severe OSA patients; and, the treatment success rate was as high as 51.85%. Besides, by looking into the responder cohort closely, a remarkable decrease of treated AHI to a level of 5.8 ± 3.6 and the mean AHI reduction was high up to -77.5% ± 13.2%.

Conclusions: This novel ONPT, iNAP® Sleep Therapy System, could reach clinical success treatment for more than half of the mild, moderate to severe OSA patients. More excitingly, this excellent treatment success rate was reached in a much more comfortable way. No SAE occurred during the entire study period. This investigational product seems to be well tolerated and highly effective for an alternative treatment for adults with OSA.

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Reduction in Parasympathetic Tone During Sleep in Children with Mild Sleep-Disordered Breathing

M.-C. Lopes, C. Guilleminault, D. Poyares, Y.-P. Wang

Introduction: Sleep disordered breathing (SDB) in children is associated with neurobehavioral changes such as hyperactivity, hypersomnolence, learning disabilities, and aggressive behavior. It has been shown that these symptoms may also occur with low apnea hypopnea index (AHI). Snoring associated with flow limitation and increase in respiratory rate during sleep in children might also be associated with similar complaints. A sign of abnormal sleep is the increase in cyclic alternating pattern rate in these cases, even if the AHI is lower than 1 event/hour. Changes in autonomic nervous system have been described in adults and in children with Obstructive Sleep Apnea (OSA). The aim of this study was to investigate the heart rate variability during sleep in children with mild SDB.

Materials and methods: 10 children and adolescents with chronic snoring and Apnea Hypopnea Index < 1, associated to high Respiratory Index, and 10 controls matched for age, gender and Tanner stage were monitored following one night of habituation in the sleep laboratory. CAP was analyzed according to standard international rules. HRV was performed in each sleep stage. The Time and Frequency Domains were calculated for each 5-minute period. Central tendency measures were expressed as mean and standard deviation. Two-way ANOVA for repeated measures followed by Bonferroni post-hoc test was used to analyze the differences in HRV and sleep stages considering two main factors: 1- (group) SDB children and controls, and 2- (sleep stage) stage 2, SWS (NREM), and REM sleep. The level of significance for the variance analyses was set at p£ 0.01. Correlations between HRV parameters and RDI were performed by a means of Spearman Correlation test.

Results: All patients were chronic snorers. The parents of children reported hyperactivity, irritability, impulsivity, and/or depressed mood in 8 out of 10 patients. None of them fit the criteria for obstructive sleep apnea syndrome (OSA) based on polysomnography (AHI> 1). The time Domain analysis showed significant higher values of NN50 and pNN50 in control children compared to those noted in snorers in all sleep stages. When Frequency Domain analysis is considered, we found a significant decrease in total power for all sleep stages and an increase in LF/HF (a sympathetic index) for stage 2 NREM and REM sleep, in the chronic snorer group. There were significant inverse correlations between the RDI and: NN50 for all sleep stages [stage 2: R= -72, p=0.01; SWS: R= -62, p=0.01; REM sleep: R= -51, p=0.01]; pNN50 during sleep stage 2 NREM sleep (R= -51, p=0.01), and total power during SWS (R= -44, p=0.04). Arousal index per hour inversely correlated with NN50 during sleep stage 2 NREM sleep (R= -59, p=0.01) and SWS (R= -55, p=0.01).

Conclusion: Reduction in parasympathetic tone was found by changes in patients group. It may represent an autonomic impairment during sleep in children with mild SDB. Reduction in HRV in children with chronic snore can be associated to possible increase in cardiovascular risk in adulthood. Our study indicated that children with chronic snoring have important parasympathetic tone changes during sleep.
AN OLDER PEOPLE'S DISEASE IN A CHILD - A CASE REPORT OF OBSTRUCTIVE SLEEP APNEA AND ARTERIAL HYPERTENSION TREATED BY CONTINUOUS POSITIVE AIRWAY PRESSURE

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Introduction: Obstructive sleep apnea syndrome (OSAS) is found in about 1-5% of children, most common in ages 2 to 6 years, in part caused by tonsillar hypertrophy. However, as obesity became a global epidemic, it is now recognized as a significant contributor to OSAS. Early recognition and treatment of children with persistent OSAS is required to prevent long-term morbidity. The management of these children is frequently complex and a multidisciplinary approach is required as most of them have additional risk factors for OSAS and comorbidities.

Case report: A 4-year-old boy presented to our pediatric sleep clinic with history of severe nocturnal snoring and sleep apnea. He had a history of overweight since one year-old, but he was otherwise healthy and normally developed. On examination, the patient's BMI Z-score was 6.3. No dimorphisms were identified. Oral examination revealed a normal tongue, Friedman/Mallampati tongue position grade III-III; and a normal palate with no micrognathia or maxillary retrusion. Lab tests revealed insulin-resistance (HOMA-IR=6.24) and hypercholesterolemia (total cholesterol 202 mg/dL). The patient underwent an overnight diagnostic polysomnography (PSG). Sleep architecture was fragmented, with 17.2 arousals per hour of total sleep time (TST). The patient had a total of 114 respiratory events with an overall apnea-hypopnea index (AHI) of 15.3 events per hour of sleep. The minimum oximetry value was 88%, and the percentage of time spent with oxygen saturation ≤89% was 1.7% of TST. He was submitted to a adenotonsillectomy (AT) with improvement on PSG results but he persisted with residual OSAS (AHI of 6.2 events/hour of sleep). On follow-up appointments the obesity issue persisted (maximum BMI Z-score 6.6) and his condition deteriorated with appearance of high blood pressure, confirmed by a 24-hour ambulatory blood pressure monitoring (ABPM). Studies that excluded secondary arterial hypertension were performed. It was prescribed continuous positive airway pressure (CPAP) at pressure of 5 cmH2O (titrated to 6 cmH2O on mensal follow-ups) and enalapril. At follow-up, he had an acceptable anthropometric evolution (BMI Z-score decreased to 5.8) and the PSG had a notorious improvement (AHI 1.4/hour of sleep). The follow-up ABPM had also improved.

Conclusions: Although AT is the first line treatment for children with OSAS, improvement in objectively documented outcomes is often inadequate and a substantial number of children have residual disease. According to literature, only 27.2% had a post-AT AHI less than 1 hour/TST and 21.6% had post-AT AHI greater than 5/hour TST. From the last group 59% of these fulfilled obesity criteria. Weight loss should be strongly encouraged. However, this takes time and effort, and while this is done, NIV therapy may be prescribed to obese patients who have residual OSAS following AT, in order to prevent possible co-morbidities. Finally, we must point out that this is a worrying case report where we can see a pre-school aged child with usual older people co-morbidities, caused by a preventable disease manageable with healthy life style habits.
Sleep Breathing Disorders
Board #115: P6 - Wednesday
CORRELATION BETWEEN OBSTRUCTIVE SLEEP APNOEA SYNDROME AND COGNITIVE IMPAIRMENT IN ATRIAL FIBRILLATION PATIENTS

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Introduction: Obstructive Sleep Apnea Syndrome (OSA) appears to be involved in the cognitive decline. Atrial fibrillation (AF) may produce multiple cerebral ischemic areas due to microembolic phenomena and transient hypoperfusion, eventually leading to a progressive cognitive impairment and even to acclaimed vascular dementia. In the same time, OSA is common among patients with atrial fibrillation.

The aim of this study was to evaluate the prevalence of cognitive impairment in patients with AF and OSA.

Methods: We studied 82 patients with a history of non valvular AF and 40 homogenous controls in sinus rhythm (SR). All subjects underwent anamnesis, physical examination, cardiorespiratory monitoring during sleep (CRMS). The cognitive function was assessed using the Mini-Mental State Examination (MMSE).

Results: A total of 122 patients (64.4% were men), were included in the study. The mean age of participants were 66.5, and the mean baseline MMSE score was 27.7. Based on the CRMS 78 (64%) of patients had OSA with a mean of apnea-hypopnea index equal to 27.5±17.1 (mean ±SD), 62% of them being with AF. The comparison between patients with AF and OSA and patients with AF without OSA, showed a lower index of MMSE score (24±2.3 vs. 26.8 ± 1.5, p< 0.01).

Conclusion: Association of OSA an FA rises the probability for cognitive decline. Frequently coexisting OSA components in AF patients from primary care setting should encourage more active search of OSA and cognitive impairment in patients with documented AF.
**Introduction:** The sleep period is characterized by the sleep cycle occurring at 90 min intervals encompassing Non-REM and REM sleep. While deep sleep (Stage 3/4 Non-REM) is more pronounced during the first third of the night, REM sleep is most prominent during the last third of the night. Many patients discontinue positive airway pressure (PAP) therapy during the early part of the sleep period leaving REM OSA untreated. This is clinically relevant as REM OSA, as opposed to NREM OSA, is independently associated with hypertension and metabolic risk. Upper airway stimulation (UAS) of the hypoglossal nerve is an alternative treatment for moderate to severe OSA. The implanted UAS device may eliminate adherence issues associated with PAP therapy. We assessed the impact of UAS on REM OSA and adherence in the Stimulation Therapy for Apnea Reduction (STAR) trial cohort at 60 months.

**Materials and methods:** 126 participants were enrolled in a multicenter prospective phase III trial evaluating the efficacy of UAS in patients with moderate to severe OSA (AHI 20-50). Polysomnography (PSG) was performed at baseline, 12 months, 36 months, and 60 months post-implantation of the UAS system (Inspire Medical Systems, Minnesota, USA). Overnight PSG assessed overall AHI and AHI during REM and NREM sleep. Adherence was assessed by asking patients if they used UAS therapy every night since the last assessment period.

**Results:** Of the 126 participants successfully implanted, 97 (77%) completed the 60-month follow-up evaluation per protocol. Voluntary PSG was completed in 71 patients at 60-month follow-up. Overall the mean AHI decreased from baseline to 12 months (32 ± 18.5 to 15.3 ± 16.1*) and remained stable at 36 months (11.3 ± 13.8*) and 60 months (12.4 ± 16.3*). A similar effect of UAS was found for REM and NREM AHI, with slightly greater reductions in REM AHI: Baseline REM AHI 28.9 ± 17.4 to 14.7 ± 16.1* (12 months) to 7.7 ± 12.8* (36 months) to 10.6 ± 15.6* (60 months); Baseline NREM AHI 32.3 ± 12.6 to 15.3 ± 16.8* (12 Months) to 11.5 ± 14.3* (36 months) to 12.5 ± 16.5* (60 months). Adherence data at 60 months indicated that 80% of patients reported using UAS therapy nightly.

**Conclusions:** UAS effectively treated REM OSA that is most prominent in the last third of the sleep period. Subjective adherence data suggests that patients are utilizing UAS therapy on a nightly basis. Objective adherence data is needed to determine actual hours of nightly use. These data are available in the STAR trial cohort and are currently being analyzed. The duration of treatment and efficacy of treatment in both Non-REM and REM sleep have important implications for mitigating cardiovascular and metabolic risk associated with OSA during REM sleep.

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INDICATORS OF OUT-PATIENT BLOOD PRESSURE MONITORING IN HYPERTENSIVE MEN WITH MODERATE-TO-SEVERE OBSTRUCTIVE SLEEP APNEA

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Introduction: Hypertension in obstructive sleep apnea (OSA) is characterized by higher values of blood pressure (BP), in particular in diastolic blood pressure (DBP) during the day, disrupted circadian patterns and high BP variability. The aim of this study was to analyze the data of daily monitoring of blood pressure in men with hypertension and moderate-to-severe OSA.

Materials and methods: 195 men aged 22-64 years with newly diagnosed and untreated hypertension (office BP ≥140 and 90 mmHg) divided into two groups. 1-st group consisted of 100 men (42,6±0,8 years) with moderate and severe OSA (apnea-hypopnea index ≥15, mean AHI 33,7±2,0); 2-nd group - 95 men (39,8±0,8 years) with mild OSA (AHI 5-15, mean AHI 5,7±0,4) and without OSA (AHI < 5). All patients underwent 24-hour multifunctional monitoring using ‘Kardiotehnika-07’ portable monitors (Inkart, St. Petersburg, Russia). We recorded: BP (Korotkoff and oscillometric methods), electrocardiogram (12 leads), reopneumogram (2 leads), aktigram, as well as during sleep blood oxygen saturation (SpO2) and oronasal airflow.

Results: The patients in 1-st group had higher average body mass index (35,9±0,5 vs. 32,7±0,5 kg/m², p< 0.001), oxygen desaturation index (29,3±2,3 vs. 6.7±0,9, p< 0.001), nighttime DBP (76,5±1,5 vs. 71,6±1,2 mm Hg, p=0.01), lower the minimum value of SpO2 (77.4±1.0% vs. 85.5 ± 0.4%, p < 0.001) and average value of the dipping ratio (nighttime/daytime BP ratio) for systolic BP (77.4±1.0% vs. 85.5 ± 0.4%, p < 0.001) and for DBP (12±1,0% vs. 16.5±1,0%, p< 0.01). The analysis of the patients' circadian patterns revealed that 40% and 47% patients in 1-st and 2-nd groups respectively were dippers in SBP, 39% and 34% were non-dippers, extreme dippers were 9% and 14%, 12% and 5% had nocturnal hypertension. For DBP dippers were 41% and 38% patients in 1-st and 2-nd group respectively, nondippers - 39% and 34%, nocturnal hypertension was observed in 9% and 3%. The differences in all cases were not statistically significant. Extreme dippers in DBP were more frequently detected in the 2-nd group (38% vs. 20%, p< 0.05). In both groups the average values of blood pressure variability was consistent with generally accepted standards, while the value of pulse pressure was greater than the norm, there were no between-group differences.

Conclusions: In the analyzed sample of male patients with newly diagnosed hypertension and moderate-to-severe OSA we found no statistically significant differences in most of the indicators, which can be obtained by performing out-patient BP monitoring, though statistically significant differences in mean nighttime DBP could be seen, supposing that the changes described above were determined in patients who had already suffered from undetected hypertension, which resulted in organ damage and the presence of associated clinical conditions.

Acknowledgements: Nil.
Sleep Breathing Disorders
Board #116: P6 - Wednesday
FOLLOW-UP STUDY ON A NON-SURGICAL APPROACH FOR PAEDIATRIC SLEEP APNOEA CAUSED BY ADENOIDAL HYPERTROPHY

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Introduction: Sun’s sequential therapy (SST) was developed based on the integration of clinical practice and Chinese herbal medicine. It has been used for nine years in clinical settings for paediatric sleep apnoea caused by adenoidal hypertrophy. Several studies have proven the efficacy of this herbal therapy on the improvement of adenoid size, sleep apnoea (indicated by AHI) during sleep, and nocturnal hypoxia.

Materials and methods: Children with obstructive sleep apnea caused by adenoidal hypertrophy were consecutively recruited in outpatient clinic. All included subjects had been diagnosed with moderate-to-severe adenoidal hypertrophy and recommended with surgeries. Patients or their parents had refused surgical removal, but were voluntarily received SST for treatment. We retrospectively analysed the clinical efficacy of SST by a 2-year follow-up study. The following variables were recorded and analysed: size of adenoid, symptom severity, recurrence of symptoms, duration of treatment, subjective sleep quality, and if they eventually underwent any operations. Data were collected at baseline, 6 months, 12 months, and 24 months.

Results: At the end of this study, 244 children (age 2-10 years) were included in this follow-up study. At the 2-year follow-up, only 18 (7.4%) of the children eventually received surgical interventions, while 226 (92.6%) of the children have avoided surgeries because of relieved or diminished symptoms.

Conclusions: This is the first follow-up study to investigate efficacy of SST. This study shows that non-surgical approach is promising and herbal sequential therapy outcome has a very good prognosis.
**Introduction:** It's known that obstructive sleep apnea (OSA) is a highly prevalent condition. Recent literature estimates that OSA affects approximately 27% of men and 9% of women. However, there are little studies about gender characteristics of sleep patterns in OSA. Thus, we tested the hypothesis that middle-aged adults gender-related differences of sleep pattern are performed.

**Materials and methods:** We examined 93 participants with OSA (38 women and 55 men, aged 50-55 years). OSA was verified by overnight polysomnography in the sleep laboratory applying system GRASS-TELEFACTOR Twin PSG (Comet, USA) if apnea-hypopnea index was > 5/hr. The patients were distributed into 3 categories according the AHI score obtained by PSG: mild OSA (n=37, 15 women and 22 men), moderate OSA (n = 25, 10 women and 15 men), and severe OSA (n = 31, 14 women and 17 men). Demographic and anthropometric data were routinely collected. All differences were considered significant at p< 0.05.

**Results:** OSA men did not significantly differ from OSA women in age and body mass index. There were statistically significant gender differences in sleep pattern characteristics. In mild OSA, wake awaking sleep onset (WASO) was less in 3.8 times in men than women (p< 0.05), and REM-sleep was below in 1.43 times, respectively, p< 0.05. In moderate OSA sleep latency was higher in 2.2 times in women than men (p< 0.05), WASO was less in 1.86 times in men than women (p< 0.05), and REM-sleep was below in 1.26 times, respectively, p< 0.05. In severe OSA sleep latency, WASO, sleep efficiency, REM and 3 stage of the sleep were less in men more significantly than women.

**Conclusions:** Thus, sleep pattern in men significantly differs from that in women at identical severity of OSA. We noted that gender related differences are higher prevalence of sleep fragmentation ("the alpha-delta sleep"), increase of aerosals, decrease of REM-sleep in men than women.
Cognitive Evaluation in Patients with Obstructive Sleep Apnea Syndrome

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Introduction: Cognitive disorders were described in patients with poor sleep quality. Obstructive sleep apnea syndrome (OSA) is a natural condition that allows and favors the study of cognition in people affected by the disease, since it is possible to separate individuals with different degrees of sleep fragmentation, changes in their macrostructure, efficiency, arterial saturation, and different levels of education.

Objective: To evaluate possible differences in cognitive impairment (measured by validated instruments) in people with different degrees of OSA (evaluated by full-night polysomnography).

Materials and methods: A cross-sectional study with 200 patients over 18 years of age, attended at the Botucatu Medical School’s sleep clinic, sent for polysomnographic examination conducted between 2015 and 2017. The outcomes were based on the cognitive performance tests: Scales of similarities, verbal fluency, Go-No-Go, and metaphorical proverbs. The interest exposure was the diagnosis of sleep apnea and, as potential confounders: schooling, arterial hypertension, smoking, age, weight and psychiatric disorders evaluated by the Montgomery and Hamilton scales. The analysis of the association between the presence of sleep apnea and cognitive performance was analyzed by the non-parametric Mann-Whitney and Chi-square tests, after verification of potential confounders.

Results: Subjects with OSA have a more fragmented sleep, with% values of time in N1 and N2 significantly higher (Apnea = 76 x No Apnea = 67; p < 0.001), with% of time in N3 significantly lower (7,4 x 15,7; P < 0.001), with more nocturnal awakenings (26,4 x 14,7; p < 0.001) and with a longer sleep time with oxygen saturation below 92% (21,6% x 1,6%, p < 0.001). In the absence of confounders, the comparison between subjects with and without sleep apnea did not reveal significant differences between these two groups in relation to cognitive performance on the similarity scale (Apnea = 34% x No Apnea = 30%; p = 0.673), Go-No-Go scale (43% x 40%; p = 0.660), in the more metaphorical proverbs scores (34 x 33; p = 0.935), less metaphorical proverbs (32 x 33; p = 0.851) and in the general score (66 x 68; p = 0.914). Analyzes made with SPSS V21.0 software. When associating degrees of apnea with cognitive performance, no significant differences were observed between the absent, mild, moderate and severe groups. In addition, stratification was made between subjects according to schooling (elementary / high school education) and no significant difference was found.

Conclusions: Cognitive and emotional assessment data, as well as those of the sleep structure from people with OSA when compared to the control group, showed that there was no significant difference. It should be noted that the findings refer to people with basic education and secondary education and can not be generalized to different levels of education. Mood and anxiety disorders were not confounding factors. Based on the data, one may suspect that in the studied group, sleep fragmentation did not worsen intellectual performance, or that the chosen instruments were not sensitive enough to distinguish people with cognitive disorders.
PREVALENCE OF OBSTRUCTIVE SLEEP APNEA IN PATIENTS WITH ACUTE STROKE

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Introduction: Stroke or Cerebrovascular Disease is a serious neurological disorder and is the second leading cause of death globally. Apart from the well-known modifiable risk factors for stroke like diabetes, hypertension and ischemic heart disease, Obstructive Sleep apnea (OSA) is emerging as an independent and eminently modifiable risk factor. The reported prevalence rate of OSA in stroke patients in various studies ranges from 30-80%. This prospective study was undertaken over a period of 20 months to determine the prevalence of OSA in newly diagnosed stroke patients.

Materials and methods: Consecutive patients with stroke were classified based on imaging findings (ischemic and hemorrhagic) and severity (based on the National Institutes of Health Stroke Severity scale). Patients who were conscious and clinically stable were included. Those who were on life support, had seizures, bulbar palsy or decompensated organ failure were excluded. Clinical data comprising a checklist of OSA symptoms, Epworth Sleepiness Scale (ESS), anthropometric measurements and upper airway assessment was compiled. Level 3 Polysomnography (PSG) was performed in all included patients during the course of their hospital admission.

Results: Among 109 patients with acute stroke screened for OSA, 104(95.4%) consented to undergo a Level 3 PSG and were included in the final analysis. There were 67 (64.4%) male and 37 (35.6 %) female patients in the study group. Mean age of these patients was 60.9± 13.2 years (range- 25-88 years), mean BMI was 25.94±3.7 Kg/m² and mean neck circumference was 37.5±3.8cm.

Out of the 104 patients included, 92(88.5%) had ischemic stroke, 9(8.7%) had hemorrhagic stroke and 3(2.9%) had transient ischemic attack (TIA). Symptoms of OSA namely; snoring, excessive day time sleepiness and witnessed apneas were reported by 37 (35.6%), 32(30.8%) and 19(18.3%) patients respectively. An ESS score of > 10 was recorded in 87(83.7%) patients.

Seventy four (71.2%) were diagnosed to have OSA on PSG [based on an Apnea hypopnea index (AHI) cut-off of 5 per hour], of whom 40 (54%) patients did not report classical symptoms of OSA. Severity of OSA was further graded as mild, moderate and severe based on AHI. Thirty four (32.7%) patients had mild OSA, 20(19.2%) had moderate and 20(19.2%) had severe OSA. It was noted that there was no correlation between the type, site and severity of stroke and OSA.

Among the other co-morbid illnesses in patients with stroke, the frequency of diabetes was significantly higher in patients with stroke and OSA than among those without OSA. (p-0.035)

Conclusions: Prevalence of OSA was high in patients with stroke as has been demonstrated in the literature as well as in the present study. In addition, the prevalence was independent of the type, site and severity of stroke. Thus, OSA itself is an independent risk factor for stroke in addition to its association with other risk factors for stroke like diabetes, hypertension, hyperlipidemia and ischemic heart disease.

Acknowledgements: Sleep technologists-Ms. Divya Davis and Ms.Vijayalakshmi.
**Introduction:** Obstructive sleep apnea (OSA) has been associated with the Alzheimer’s Disease (AD) neurodegeneration. This study aimed at identifying the preclinical alterations of sleep, neuropsychological, cerebrospinal-fluid, and 2-deoxy-2-(18F)fluoro-D-glucose positron emission tomography ([18F]FDG PET) in OSA patients.

**Materials and methods:** Patients admitted to our Sleep Medicine Centre for suspected OSA underwent a protocol counting full-night polysomnography, CSF AD biomarkers analysis, neuropsychological assessment, and 18F-FDG PET. At the end of the study protocol, patients were divided into two groups: moderate-severe OSA patients and mild OSA patients.

**Results:** We documented the significant reduction of CSF beta-amyloid42 levels coupled with the significant increase of CSF total tau (t-tau) and phosphorilated tau (p-tau) concentrations in OSA patients compared to mild OSA. Moreover, we documented in moderate-severe OSA patients the significant reduction of 18F-FDG uptake in Broadman areas 7 and 31 (owing to the precuneus and posterior cingulate, respectively) compared to mild OSA patients. Moreover, moderate-severe OSA showed the reduction of sleep efficiency, slow wave sleep and REM sleep compared to mild OSA patients. Finally, moderate-severe OSA patients showed the alteration of memory (Rey-Osterrieth Complex Figure Recall and Rey Auditory Verbal Learning Recall) and attention (Stroop Test) tests compared to mild OSA patients. Considering the correlation analysis in the moderate-severe OSA group, we found the significant mutual interplay among sleep, CSF, 18F-FDG PET and neuropsychological data.

**Conclusions:** This pilot study documented that in moderate-severe OSA patients preclinical AD biomarkers modifications are present. Accordingly, reduced sleep quality and night-time hypoxia may be detrimental factors inducing AD pathology. Moreover, moderate-severe OSA patients showed neuropsychological, CSF and 18F-FDG PET biomarkers of preclinical AD pathology. In keeping with these findings, we stress the opportunity to start as soon as possible positive airway pressure treatment in moderate-severe OSA patients in order to stop the ongoing chain of events leading to AD neurodegeneration.
OBSTRUCTIVE SLEEP APNEA IN PATIENTS WITH *HELCOBACTER PYLORI* INFECTION

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**Introduction:** Association of obstructive sleep apnea (OSA) with a variety of diseases has been increasingly reported in recent years. The present study aimed to investigate the prevalence and the risk for obstructive sleep apnea in patients with *Helicobacter Pylori* (*H. Pylori*) infection.

**Materials and methods:** One hundred and sixty two patients with dyspepsia were recruited in this case-control study at two general hospitals in Sanandaj and Hamedan in west of Iran, from May 2014 to Jun 2015. Using enzyme-linked immunosorbent assay IgG serologic test for *H. Pylori* diagnosis, we enrolled eighty one patients with positive IgG and eighty one matched control patients with negative IgG to the study. All the patients were invited to fill out the Berlin Questionnaire in order to identify those who are at risk for the sleep apnea syndrome.

**Results:** Logistic regression analysis showed a greater risk of OSA in patients with *H. Pylori* infection (OR=2.123, \(p=0.05\)).

**Conclusions:** Although the study does not disclose the causality, OSA may be associated with *H. Pylori* infection and patients with a positive IgG serologic test may be more susceptible to be in a group with higher risk for OSA.

**Acknowledgements:** We are thankful to our colleagues in Clinics of gastro-intestinal diseases in Sanandaj and Hamedan that greatly assisted the research.
Sleep Breathing Disorders
Board #134: P5 - Wednesday

SPONTANEOUS AROUSAL RELATED EXPIRATORY MOUTH LEAK DURING CPAP TITRATION PREDICT NON-ADHERENCE IN OSAS PATIENTS

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Introduction: The aim of this study is to compare expiratory mouth leak (EML) during CPAP titration in the adherent and non-adherent OSAS patients.

Materials and methods: Retrospective analysis was done in 106 moderate-to-severe OSAS patients (age: 54.3 ± 13.1 [mean ± SD] years, body mass index [BMI]: 27.1 ± 4.7 kg/m²) who received a full-night CPAP titration with PSG recording between 2010 and 2016. They were divided into adherence (n=71, Female: 5; 7%) and non-adherence groups (n=35; Female: 3; 8%) according to the cut-off criteria (an average CPAP usage >= 4 hours per night for the first 30 nights or until first follow-up). Sleep and respiratory variables were scored for the PSG data of diagnosis and CPAP titration according to the standard criteria. For the data on the CPAP titration night, EML was scored as ‘truncated’ expiratory CPAP flow with a nasal mask. EML Period (EMLP) was assessed as the percentage of total sleep time. In addition, 2 types of EML with arousal (spontaneous arousal [SpAr] related EML and EML pre SpAr) were counted and index per hour of sleep was calculated.

Results: Adherence and non-adherence groups did not differ for age, sex, and BMI. Adherence group used CPAP significantly longer (5.4 ± 0.9 hours per night) compared to non-adherence group (2.5 ± 1.1 hours per night) (p< 0.001) although CPAP pressure did not differ between the two groups. Two groups did not differ for sleep and respiratory variables on the diagnostic PSG and CPAP titration nights. However, SpAr related EML occurred more frequently in non-adherence group (2.52 ± 1.90 hours per night) than in adherence group (1.40 ± 1.43 hours per night) (p=0.003) although no significant difference was found for other types of EML with arousal and EMLP.

Conclusions: Frequency of spontaneous arousal related expiratory mouth leak can be associated with a low CPAP adherence in OSAS patients.

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**THE EVALUATION OF RESULTS OF EXPANSION SPHINCTER PHARYNGOPLASTY BY ACOUSTIC PHARYNGOMETRY**

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**Introduction:** We mainly aimed to find answers to the following questions.  
i) Could we predict the success of expansion sphincter pharyngoplasty (ESP) with preoperative acoustic pharyngometric (AP) analysis in patients with sleep apnea?  
ii) Could we interpret the results of ESP by AP postoperatively?

**Materials and methods:** Between October 2015 and July 2016, CPAP intolerant patients with obstructive sleep apnea, who referred to Hacettepe University ORL Department were included into our study. Candidates for ESF between 18 and 65 constituted our study group. Cases with hypertrophic tonsils (Mallampati 3/4), cases with significant tongue base pathology (Cormack Lahane 3/4), and cases with previous history of pharyngeal surgery were excluded.

All patients were analyzed by AP preoperatively and postoperatively. Polysomnography was repeated postoperatively for all of the cases. Preoperative (pre) and postoperative (post) apnea hypopnea index (AHI), pre and post minimal cross-sectional area (MCA). The difference between preAHI and postAHI, the difference between preMCA and postMCA were calculated. Median value of difference of MCA was used to divide the cases as less widened ones and more widened ones. The success was accepted in cases with reduction of AHI > %50 and postAHI < 20.

**Results:** 35 patients (26 male, 9 female with a mean age of 41.8±8.3) who had ESP were included into our study. Mean preBMI was 28.7±3.8 and mean postBMI was 28.4±4 with no significant difference (p:0.17). PreAHI (29.6±16.3) was found to be reduced to 18.2±18.1 and this improvement in AHI was found statistically significant (p< 0.001). MCA was found to be significantly (p< 0.001) increased postoperatively (preMCA: 1.13±0.4, postMCA: 2.7±0.4). 22 patients respond to ESP well while 13 were accepted as unsuccessful. Mean preMCA was 1.18±0.5 among responders while this mean was 1.06±0.4 for non-responders. The difference between these values was not significant (p:0.5)

We divided the cases into two group according to the median of the difference of the MCA (1.12 cm²). Success rate was found to be 45.5% in < 1.12 group with a mean AHI difference of 10.4±20.5; while success rate was 54.5% with a mean AHI difference of 12.2±14. The success rates (p:0.96) and improvement of AHI (p:0.98) were not statistically significant between the groups. Improvement of AHI and difference of MCA was not found correlated (p< 0.001).

**Conclusions:** AP is not suitable for predicting surgical success after ESP surgery and for selection of patients who will be successful.
VALIDATION OF THE MEDIBYTE PORTABLE MONITOR FOR THE DIAGNOSIS OF SLEEP APNEA IN PEDIATRIC PATIENTS

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Introduction: The prevalence of sleep apnea in children ranges from 1.2% to 5.7% and is increasing with the increase in childhood obesity. Overnight, attended, in-laboratory polysomnography (PSG) is considered the gold standard in the diagnosis of sleep apnea. However, PSG is expensive, time consuming, technically complex, and requires the patient to be at the laboratory. Sleeping in an unfamiliar environment can materially affect sleep behaviors, and this concern increases when patients are children. Moreover, there can be significant delays in diagnosis and treatment of sleep apnea in pediatric patients due to limited availability and access to PSG. Timely diagnosis and management of pediatric sleep apnea is critical to prevent progressive associated comorbidities. These factors highlight the urgent need for portable sleep monitors (PM) validated for use in pediatric patients.

Materials and methods: A consecutive series of pediatric patients referred to the University of Illinois Sleep Science Center wore the MediByte PM while simultaneously undergoing a PSG. Data acquired from the PM and the PSG were blinded and scored separately. The apnea-hypopnea index (AHI) was calculated using sleep time for the PSG, and recording time for the PM. The PM AHI was calculated using both manual and autoscoring functions of the PM.

Results: Out of 95 PM studies, 10 studies had to be excluded mainly because the subjects could not tolerate having both studies done simultaneously. Additionally, 15 studies failed because there was less than 4 hours of interpretable PM data. The remaining 70 subjects had a median age of 10.8 years and a median body mass index z-score of 1.9. The AHI obtained by manually scored PM studies strongly correlated with the AHI obtained using the PSG (r=0.939, p<0.001). Using a cut-off of AHI ≥ 10 events/h, the manually scored PM had a sensitivity of 100% and a specificity of 98.4% to detect sleep apnea diagnosed by the PSG. The oxygen saturation obtained by manually scored PM studies showed significant correlation with that obtained using the PSG in the older age group (12 to 17 years) (r=0.699, p<0.001), but not in the younger age group (7 to 11 years) (r=0.183, p=0.240).

Conclusions: Although PSG is still recommended for the diagnosis of sleep apnea, PMs can play a great role in diagnosing moderate and severe sleep apnea especially in older pediatric patients.

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VALIDATION OF THREE-DIMENSIONAL AIRWAY IMAGING FOR SCREENING FOR SLEEP APNEA IN PEDIATRIC PATIENTS

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Introduction: The prevalence of sleep apnea in children ranges from 1.2% to 5.7% and is increasing with the increase in childhood obesity. Overnight, attended, in-laboratory polysomnography (PSG) is considered the gold standard in the diagnosis of sleep apnea. On the other hand, screening for sleep apnea is usually done using sleep questionnaires and by performing thorough clinical examinations. Timely diagnosis and management of pediatric sleep apnea is critical to prevent progressive associated comorbidities and radiographic airway analysis is an additional screening tool that can assist in this diagnosis.

Materials and methods: A consecutive series of 103 pediatric patients referred to the University of Illinois Sleep Science Center for a PSG had cone beam computed tomography (CBCT) scans taken at the department of orthodontics. The sample was divided into two age groups: age group 1 (7 to 11 years) and age groups (12 to 17 years). Three-dimensional linear, areal, and volumetric measurements were correlated with the apnea-hypopnea index (AHI) from the PSG separately for each age group. Additionally, the receiver operating characteristic (ROC) curve was used and the area under the curve (AUC) was calculated for all three-dimensional measurements using sleep apnea definitions of AHI ≥ 5 and AHI ≥ 10. Based on the results of the correlations and the AUC, sensitivity and specificity were calculated for measurements that were deemed promising in order to propose cut-off values for these measurements to predict AHI ≥ 5 and AHI ≥ 10.

Results: Out of 103 CBCT scans taken, 4 scans were excluded because of improper patient positioning. The remaining sample of 99 had a median age of 11 years, a median body mass index z-score of 1.8, and a median AHI of 2.7. In age group 1 (N=59) the only measurement that showed significant correlation with AHI was the nasopharyngeal volume (NPV) (rho = -0.363, p=0.005). Measurements with the largest AUCs were NPV and oropharyngeal cross sectional area (OCSA). Proposed cut-off values for NPV are 2400mm³ and 1600mm³ for AHI ≥ 5 and AHI ≥ 10 respectively. The measurement with the largest AUC was OCSA. Proposed cut-off values for NPV are 3500mm³ and 2700mm³ for AHI ≥ 5 and AHI ≥ 10 respectively. Proposed cut-off values for OCSA are 110mm² and 75mm² for AHI ≥ 5 and AHI ≥ 10 respectively.

Conclusions: Three-dimensional airway measurements can be valuable in evaluating the upper airway in pediatric patients. Contrary to findings in adults, the NPV might be of great importance when screening for sleep apnea. The OCSA might also be significant when screening for sleep apnea and this finding is similar to findings in adults.

Acknowledgements: We would like to thank the sleep physicians at the University of Illinois Sleep Science Center for their support of this project.
DO PEOPLE WHO BELIEVE THEY HAVE SLEEP APNEA HAVE THE MOST SYMPTOMS?

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Introduction: First author has created a website on Obstructive Sleep Apnea (OSA), in Portuguese language. Most of its visitors want to know more about OSA, even if some of them do not know if they really have the disease. We intended to evaluate how many persons who visited our website and our social network page believed to have OSA, if they had already searched for medical help and what role their symptoms have on this.

Materials and methods: All participants completed an online survey on our social network group and our online page. Statistical analysis was performed with Statistical Package for the Social Sciences (SPSS) version 22.0

Results: Three hundred and forty-five people completed our survey, mostly female (n=191). In our study, 41.7% of users thought to have OSA, 29.6% denied it and there were also still 28.7% uncertain. Epworth Test mean score was 8.287. Regarding those who could not exclude OSA or that thought to have it, only 45.3% had sought medical help. We found that people that suspected to have OSA had higher Epworth than others (mean score 11 versus 5 on people who denied it), with statistical significance (p< 0.001). People that got medical attention had higher mean Epworth Scores than those who did not (10 versus 7), and there was a positive correlation between seeking a medical opinion and having a higher Epworth score (p< 0.001). Focusing on OSA symptoms, people who thought to have OSA were more symptomatic (p< 0.001) and those individuals who actively sought medical help to diagnose OSA also had more symptoms than those who did not (p< 0.001).

Conclusions: There are still a lot of possible OSA patients without diagnosis and what causes this was not fully evaluated, but there is a clear relation between Symptoms/Epworth Score and actively seeking medical help.
Introduction:
There is a growing trend of people searching for health information online including about sleep disorders. First author developed a website on Obstructive Sleep Apnea (OSA) in Portuguese language, for patients and health professionals. We intended to understand how many people who visited this site were symptomatic.

Materials and methods: All users were requested to complete an online survey on our social network page. They were asked whether they had any of the typical symptoms of OSA and their answers were registered on a database. Statistical analysis was performed using SPSS software (Statistical Package for Social Sciences) version 22.0.

Results:
About 345 people completed this survey - 55.4% were female. They were divided into age groups and 55.2% were between 41 and 60 years old (20.6% between 41-50 years old and 34.6% between 51-60 years old). Over 92% of users reported at least one OSA symptom. The most common complaints were snoring (n=234), restless sleep (n=178) and fragmented sleep (n=158). Mean Epworth test score was 8.287 (SD = 2.13) and 28% users had a score higher than 10.

Regarding OSA symptoms, male sex had on average more symptoms (3 versus 2). This difference had statistical significance was statistically significant ($p< 0.002$). We could not determine a statistical significant difference between Epworth score and sex amongst both genders ($p=0.705$). We found a weak correlation between Epworth score and Body Mass Index ($p=0.260$), as well as with age ($p=0.107$), but both were statistically significant ($p< 0.001$ and $p=0.047$, respectively).

Conclusions:
There are more females searching online information of OSA but men referred mentioned more symptoms. Although mean Epworth score was lower than 10, we observed that there were still several individuals very symptomatic individuals, with high Epworth scores.

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THE NASAL CYCLES DURING SLEEP ON THE PATIENT WITH OBSTRUCTIVE SLEEP APNEA

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Background and objectives: The phenomena of periodic cycles of vascular engorgement on the nasal cavity mucosa that alternate between right and left sides are termed the "nasal cycle." It has been reported that nasal cycle duration during sleep is longer than in wakefulness by Kimura et al. They also reported that the reversal of cyclic phase during sleep tended to be associated with REM sleep and postural changes. In this study, we evaluated the nasal cycle on the patients with Obstructive Sleep Apnea (OSA).

Methods: We utilized the portable rhinoflowmeter measuring airflow independently through each nostril on 27 subjects with OSA aged 24 to 69 years diagnosed by polysomnography.

Results: 11 of 27 (40.7%) subjects with OSA presented a change of the cyclic phase during sleep. In 11 subjects, the mean number of cyclic phase reversals during sleep is 2.36±1.37 (the total number is 26). 11 of 26 (42.3%) reversals occurred associated with postural changes. 15 of 26 (57.7%) reversal occurred in stage W, and 10 of 26 (38.5%) reversal occurred associated with postural changes in stage W. The reversal of phase during sleep occurred in REM sleep is only 1 subject (2 of 26: 7.7%).

Considerations: 84.2% subjects showed nasal cycles in healthy subjects reported by Kimura et al. On the other hand, In OSA subjects, 40.7% subjects showed nasal cycles. The probability of nasal cycles occurring provably decreased in OSA subject. 11 of 16 Subjects (68.7%) with no nasal cycles during sleep was severe OSA, It was thought that nasal cycles was hard to come to occur so that seriousness rose.

The reversal of cyclic phase during sleep tend to be associated with REM sleep (68.8%) and postural changes (18.8%) in healthy subjects. In OSA subjects, the rate of association with REM sleep was 7.7%, and postural changes was 42.3%. It was revealed that the reversal in REM sleep decrease and the reversal associated with postural changes increased in OSA subjects.

It was considered that OSA patients present entirely different nasal cavity physiology from healthy subjects.
DETERMINING THE IMPACT OF VERTICAL DIMENSION ON THE MANDIBULAR RANGE OF MOTIONS IN YOUNG ADULTS: A CONSIDERATION FOR THE DESIGN AND THE CONSTRUCTION OF A MANDIBULAR ADVANCEMENT DEVICE

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Introduction: The aim of this study was to determine the impact of the increase of vertical dimension on the range of mandibular movements in young adults. According to literature, different anterior vertical openings have been used for the design of MADs and there is still no evidence on the impact of vertical movements on the capability of the patient to advance the mandible.

Materials and methods: The research was conducted on 75 students, aged 19 to 23 years (mean 21.3, SD 1.7, 37 female and 38 male). All the subjects were asymptomatic for Temporomandibular Disorders, according to the Research Diagnostic Criteria/ Temporomandibular Disorders RDC/TMD, RDC /TMD. One investigator performed all the measurements of the mandibular retrusion and protrusion with George Gauge using bite forks with different interincisal distances of 2mm, 5mm, 8mm and 11mm. Statistical analyses were done with SPSS (Statistical Package for the Social Sciences) on version 17 and the STAT on version 11.

Results: Mean value for maximum retrusion were: -5.0mm with the 2mm bite fork (n 175, range -3 to -8.5 mm; SD 1.33 mm), -5.5 mm with the 5mm bite fork (n 175, range -3 to -9mm SD 1.31mm), -6.4 mm with the 8mm bite fork (n 75, range -3 to -9 mm; SD 1.35mm) and -6.1mm with the 11mm bite fork (n 75, range -3 to -10mm; SD 1.70mm). Results show an higher value of maximum retrusion, increasing vertical dimension. This is expected, due to the clockwise rotation of the mandible described by the Posselt diagram. The values of maximum protrusion were: +7.0 mm with the 2mm bite fork(range 3.5 to 10,0 mm; SD 1.37 mm), 6.5mm with the 5mm bite fork( range 3 to 10 mm; SD 1.36 mm); 4.9mm with the 8mm bite fork (range 1.5 to 7,0 SD 1.48 mm) and 3.8mm with teh 11mm bite fork (range 0 to 7,5mm; SD 1.92mm). Results show the tendency, according to the Posselt diagram, to achieve less protrusion with the increase of vertical opening.

Conclusions: The increase of vertical opening, induce a clockwise rotation of the mandible as described by Posselt and this can reduce the degree of the advancement designed with a the MAD. Results suggest that minimizing bite opening may be useful to , increase maximum protrusion. We described the range of mandibular maximum protrusion and retrusion according to different vertical positions. A larger population study can aid an important information to customize MADs.
**STUDY OF SLEEP DISORDERED BREATHING IN CARDIAC PATIENTS REFERRED FOR CORONARY ARTERY BYPASS GRAFTING**

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**Introduction:** Sleep disorders especially sleep disordered breathing (SDB) are highly prevalent in patients with established cardiovascular disease. It is unclear whether abnormalities evident in the sleep of patient with cardiovascular disease are secondary to the sleep apnea, the cardiovascular condition, or it may precede the occurrence of them.

**Aim:** The aim of this study was to detect the presence of sleep disordered breathing as a co-morbidity in cardiac patients who were to undergo coronary artery bypass grafting (CABG).

**Subjects:** This study was conducted on thirty multivessel coronary artery disease (CAD) patients that were referred for CABG to the cardiology department, divided into 4 subgroups according to the severity of AHI.

**Methods:** All patients were subjected to full history taking, complete clinical examination, standard resting electrocardiogram (ECG), resting transthoracic echocardiogram, coronary angiography (CA) and lastly polysomnography (PSG).

**Results:** We had a range of 2-3 coronary vessels affection in the patients of this study, The mean vessel affection increased as the severity of AHI increased. In the sleep study, total sleep onset durations was affected and almost reached a statistical significance among the four studied groups (p=0.054).

The total obstructive apnea index (OAI) was positive in 29 of the patients and showed a clear statistical significance, which was present when comparing all groups of the study (p< 0.001). The total hypopnea index (HI) also showed a statistical significant difference was found among the four studied groups (p=0.022).

There were 23 patients (76.7%) who had a high snoring index ≥5 events/hr. A statistical significant difference was present among the four studied groups (p=0.003). The total range of arousal events per hour and increased as the AHI severity increased. A statistical significant difference was noted between all groups (p< 0.001).

**Conclusions:** The prevalence of SDB in MVD patients was more than those in the normal population. OSA is tightly linked to cardiovascular disease, and MVD patient with a suspicious history of SDB should be taken in consideration and a PSG study should be done.

**Keywords:** CABG, ischemic heart disease, Obstructive sleep apnea, Polysomnography, Sleep architecture.
SAFETY AND EFFICACY OF 6-MONTH USE OF SHAM-CPAP IN OBSTRUCTIVE SLEEP APNEA PATIENTS

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Introduction: The objective of this study was to verify the efficacy and safety of Sham-CPAP in a 6-month randomized clinical trial in patients with moderate to severe obstructive sleep apnea (OSA). A Randomized, double-blind clinical trial.

Materials and methods: Recently diagnosed OSA patients aged 35-65 years old with an apnea hypopnea index (AHI) ≥ 20 events/h were assessed by full polysomnography (PSG) and included in a randomized 6-month clinical trial of continuous positive airway pressure (CPAP) or Sham-CPAP treatment. Sham-CPAP was designed to deliver between 0.5 and 1.5 cmH2O positive pressure in the mask while maintaining the sensation of ventilation through adaptations to the system. We compared the anthropometric, polysomnographic, echocardiographic, and laboratory variables in patients treated with CPAP or Sham-CPAP throughout the 6 months of the study protocol.

Results: We analyzed 33 patients in the Sham-CPAP group and 39 in the CPAP group. No significant differences were found between the groups at baseline, with the exception of higher AHI and arousal index in the CPAP group. (31.5±11.3 Sham-CPAP vs. 49.3±24.7 CPAP and 25.3 ±11.9 Sham-CPAP vs. 35.9±19.0 CPAP, p< 0.001). The dropout rate was similar in both groups throughout the protocol (p=0.59). Normal end-tidal CO2 values were found in the mask during the Sham-CPAP titration in full-night PSG. The Sham-CPAP group showed a significant increase in diastolic blood pressure (DBP) and a reduction in total cholesterol and high density lipoprotein (HDL) at the six-month follow up (p< 0.001; p=0.04; p=0.01 respectively). Compliance was lower at the 6 month follow-up compared with the 1-month and 3-month periods in the Sham-CPAP group, there was no difference in the CPAP group. Blood tests showed a significant and progressive reduction in hemoglobin (Hb) and hematocrit (Ht) in the study group (p=0.005; p< 0.001 respectively).

Conclusions: The results support the use of Sham-CPAP as an effective placebo control in clinical trials in OSA patients in terms of compliance, blindness, and CO2 retention in the mask. However, Sham-CPAP seemed to be safe only until the third month of treatment due to increased blood pressure, increased BMI, reduced HDL.

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CLINICAL VALIDATION OF A DIAGNOSTIC PATCH FOR THE DETECTION OF SLEEP APNEA

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Introduction: Portable home sleep monitors are being increasingly utilized in clinical practice for diagnosing sleep apnea. Most type III home monitors are difficult for patients to set up and wearing the monitors is disruptive to patient's typical sleep pattern. The diagnostic value of an inexpensive easy-to-use light-weight flexible skin-adhesive patch (SomnaPatch) that is non-disruptive to sleep was evaluated in this study.

Materials and methods: Simultaneous polysomnography (PSG) and the diagnostic patch recordings were made in 179 subjects (mean age 54.0±13.6 y, 55% male) selected from the databases of patients previously tested with PSG to ensure even representation of the clinically important apnea-hypopnea index (AHI) ranges. The skin-adhesive diagnostic patch weighs less than one ounce and records nasal pressure, blood oxygen saturation, pulse rate, respiratory effort, sleep time and body position. To compare the apnea-hypopnea index of the diagnostic patch with polysomnography, the recordings were auto-scored with the Somnolyzer software (Respironics). Bland-Altman analysis was performed. Sensitivity, specificity and accuracy were calculated and receiver operating characteristic (ROC) curves were constructed for six AHI thresholds (5, 10, 15, 20, 25 and 30 events per hour). The rate of clinical agreement and positive likelihood ratio were calculated.

Results: Overnight recordings from 174 subjects were included in the analysis. All six ROC curves had area under the curve of over 0.9. Sensitivity, specificity and accuracy for the optimal threshold of AHI ≥15 were 0.86, 0.83 and 0.85 respectively. Positive likelihood ratio (LR+) was 7.4. Bland-Altman analysis showed that the bias was 0.9 events per hour and the limits of agreement were 18.1 and -16.1. The rate of clinical agreement between recordings with PSG AHI ≥30 and patch AHI ≥30 and was 84.7%. The rate of clinical agreement between recordings with PSG AHI < 30 and the patch AHI within (PSG AHI ±10) was 88.7%. The total rate of clinical agreement was 87.4% with 95% confidence interval of 81.4%-91.9%.

Conclusions: The new diagnostic patch offers excellent clinical value for detecting sleep apnea across all severity levels as compared with standard in-lab polysomnography.

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Sleep Breathing Disorders
Board #144: P3 - Tuesday
OBSTRUCTIVE SLEEP APNEA IN YOUNG, HEALTHY PATIENTS WITH SLEEP BRUXISM - THE PRELIMINARY STUDY

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Introduction: Sleep bruxism is medical term for repetitive jaw muscle activity, which is characterised by clenching or grinding of the teeth. The frequency of this disorder is reported to be between 8 to 31% in adults. The aim of our study was to assess the prevalence of obstructive sleep apnea (OSA) in young, healthy patients with sleep bruxism and no other significant medical conditions.

Materials and methods: 35 individuals with sleep bruxism were recruited into the study after professional dental examination. Exclusion criteria were serious medical conditions and patients aged over 55 years old. Sleep evaluation included an overnight polysomnography examination with video-registration. Polysomnograms were scored in 30s epochs according to standard criteria for sleep. The main parameters for analyzing the association between sleep bruxism and OSA were age, body mass index (BMI), bruxism episodes index (BEI), apnea-hypopnea index (AHI), oxygen desaturation index (ODI), average saturation, minimal saturation, saturation duration < 90%.

Results: Preliminary results of this study indicate that among 35 patients, mean age 33.9 (SD 10.33), mean BMI 21.89 (SD 3.26), 6 (17.14%) were diagnosed with obstructive sleep apnea. 50% of individuals suffered from mild obstructive sleep apnea (AHI 5-15/h), 33.33% and 16.66% of patients were diagnosed with moderate (AHI 15-30/h) and severe (AHI>30/h) OSA respectively. Mean ODI among patients with OSA was 17.51 (SD 13.33), mean average saturation 93.68 (SD 1.64), mean minimal saturation and saturation duration under 90% 85.16 (SD 3.06), 5.31 (SD 6.11) adequately. Further analysis revealed no significant difference in sex, age and BMI as risk factors for obstructive sleep apnea. Compared with individuals with severe bruxism (BEI>4/h), patients with mild bruxism (BEI>2 and <4/h) had an odds ratio of 0.16 (95% CI 1.46, 1.52) of developing OSA.

Conclusions: Preliminary results of this study support the hypothesis that sleep bruxism is at least partly linked with increased prevalence of obstructive sleep apnea and it is also strongly associated with bruxism severity and higher risk of developing OSA. The relatively young age of individuals and low BMI in this research also demonstrated this correlation. Further studies and improvement of therapy for sleep bruxism could lead to the reduction of prevalence of this disorder.
**Introduction:** Sleep disturbances are a heterogeneous group of diseases, including obstructive sleep apnea. The most common cause of the disease is impaired patency of the upper respiratory tract. Obesity is an important contributing factor in increasing the symptoms. During sleep, excessive tension in the muscles of the soft palate, tongue and back of the throat appears. The degree of their falling leads to snoring (discomfort) and periodic lack of airflow (apnea) through the upper respiratory tract, despite the respiratory tract movement of the chest. Obstructive sleep apnea has a severe negative impact on all systems, including cardiovascular effects - people with apnea exhibit increased sympathetic activity and high risk of developing hypertension, ischemic disease and arrhythmias, including persistent recurrent atrial fibrillation, ventricular arrhythmias and sudden cardiac death.

**Materials and methods:** The research material was a group of 30 patients with confirmed cardiovascular disease. Among cardiovascular diseases were hypertension, arrhythmias. In all patients after confirmation of sleep apnea, surgical treatment was performed: correction of soft palate by the Koblation method (90%) and Pillar method (10%), septoplasty with correction of nasal auricle (70%), reduction of tonsils by the Koblation method or by the harmonic knife (60%), tonsillectomy (26%), FESS (56%).

**Results:** In 28/30 patients after treatment, no sleep apnea was observed and no significant decrease in snoring or no improvement in general state. Two out of 30 patients were treated for the second stage of surgical treatment (after confirming the cause in the fiberoptic examination of the upper respiratory tract in sedation). One patient underwent tonsillectomy and correction of the root of the tongue by Koblation method. In the second patient, tonsil was reduced with palatine and palatoplasty with Pillar technique- in both cases improvement of general condition and lack of sleep apnea was obtained.

**Conclusions:** The primary diagnostic method used to assess severity and type of sleep apnea is polysomnography. Depending on the level of obstruction of respiratory tract causing breathing disorders, various surgical techniques are used. Sometimes reoperations are necessary.

**Acknowledgements:**
**Sleep Breathing Disorders**  
**Board #137: P5 - Wednesday**  
**DETECTING OF SLEEP APNEA IN HOSPITALIZED PATIENTS WITH ENDOCRIN DISORDERS**

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**Introduction:** Cardiovascular diseases are main risk factor of death and disability in patient with type 2 diabetes mellitus (T2DM), acromegaly, hypercortisolism, thyrotoxicosis. Sleep apnea (SA) plays an important role in development of cardiovascular complications in patients with different endocrine disorders. Screening for sleep apnea is not included in the standards of examination of patients with endocrinopathies. The aim of study was to estimate need of sleep apnea screening in patients with endocrine disorders.

**Materials and methods:** Simultaneous cross-sectional survey was done. Total of 282 patients, who were hospitalized in the endocrinology department, were included in the analysis. The Berlin Questionnaire (BQ) and Epworth Sleepiness Scale (ESS) were used to identify the high-risk group for SA. For validation of the SA, cardio respiratory sleep monitoring was performed on 88 with a validated device, the Watch-PAT 200. Statistical analysis was carried out using the SPSS version 22 for Windows. The data are presented as a median and interquartile interval.

**Results:** Among hospitalized patients 28.4% (n=80) were men, and mean age was 55 yrs [19;88]. There were 26.2% (n=74) patients with T1DM, 41.8% (n=118) with T2DM, 13.5% (n=38) with acromegaly, 6.4% (n=18) with thyrotoxicosis, 2.5% (n=7) with hypercortisolism, 1.8% (n=5) with hypothyreosis, 7.8% (n=22) with other endocrinology diseases. High SA risk was detected in 65.3% (184) of patients (T1DM - 43.2%)(32), T2DM-78% (92), acromegaly-76.3% (29), hypothyreosis-60%(3), thyrotoxicosis-66.7%(12), hypercortisolism-100%(7), other-59.1%(13).

Among patient with high SA risk 60% T2DM patients had moderate and severe stages of SA, 35%-mild stage, 5% did not have SA. In T1DM patients only 7.7% had severe stage of SA, no patients had moderate, 38.5%-mild stage and 53.6% had normal sleep breathing.

There was positive correlation between apnea/hypopnea index (AHI) and BMI 0.608 (p< 0.01), as well as the AHI and age 0.593 (p< 0.01).

We estimated the prevalence of SA (AHI>5) and severe SA (AHI>30) in groups with different SA risk as result of completing questionnaires (ESS/BQ):

- ESS ≤ 8 /BQ-high SA risk (n=15) - 15 patients with SA (100%), 7 (46.7%) with severe SA
- ESS ≤ 8 /BQ -no SA risk (n=7) - 6 patients with SA (85.7%), 2 (28.6%) with severe SA
- ESS ≥9 /BQ-no SA risk (n=9) - 5 patients with SA (55.6%), no patients with severe SA
- ESS ≥9 /BQ - high SA risk (n=50) - 38 patients with SA(76%), 13 (26%) with severe SA

- ESS ≤ 8 (n=24) - 23 patients with SA (95.8%), 10 (41.7%) with severe SA
- ESS 9-12 (n=11) - 25 patients with SA (80.7%), 8 (25.8%) with severe SA
- ESS 13-16 (n=13) - 10 patients with SA (76.9%), 3 (23.1%) with severe SA
- ESS >16 (n=12) - 8 patients with SA (66.7%), 2 (16.7%) with severe SA

**Conclusions:** The prevalence of sleep apnea in hospitalized patients with endocrine disorders is very high. However, the Berlin Questionnaire and Epworth Sleepiness Scale do not allow to assess completely the risk of sleep apnea in that category of patients.
Introduction: Maxillomandibular advancement (MMA) is the most effective surgical treatment for patients with obstructive sleep apnea (OSA). However, the perioperative management is crucial to keep patients safe from various critical complications. The aim of this study is to review the perioperative management of patients undergoing MMA.

Materials and methods: A retrospective review of medical records was conducted on OSA patients underwent MMA in Craniofacial Center, Chang Gung Memorial Hospital. The parameters monitored are clinical history, anesthetic evaluation before surgery, intraoperative events, anesthesia records, recovery room records and progression notes during admission. A comparison of polysomnographic indices before and 3 months after surgery is performed to examine the efficacy of MMA.

Results: Of consecutive 123 patients, aged 32(±9.8) and 80% were male. The BMI was 23.2(±3.2)kg/m². The Apnea-Hypopnea Indices were 31.06(±23.7) and 4.5(±7.6)/hr before and after surgery. The American Society of Anaesthesiologist (ASA) score was II in 114 and III in 9 patients. During surgery, hypotensive anesthesia with blood pressure of 50(±2.1)mmHg and HR 74(±7.9)/min were maintained. The average blood loss calculated during surgery was 929(±452)ml. All the patients were extubated in the operating room and kept in recovery room for observation before they were transferred to the ward. Patients stay in the hospital for 3(±1.4) nights before discharge. No patients required reintubation or emergent tracheostomy.

Conclusions: Following proper patient selection, meticulous anesthetic control, and precise surgical conduction, relief of intermaxillary fixation and endotracheal extubation can be a standard procedure. With comprehensive management, OSA patients undergoing MMA may experience a safe and non-critical perioperative care, and expeditious recovery.
THE ASSOCIATION BETWEEN EPISODES OF NOCTURNAL GROANING AND SLEEP CYCLES IN CATATHERENIA

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**Introduction:** Sleep related groaning (catathrenia) is characterized by episodes of expiratory monotonous vocalization during sleep. Although catathrenia had been classified as a parasomnia in the International Classification of Sleep Disorders (ICSD) 2nd edition, catathrenia was re-classified as one of normal variants in sleep related breathing disorders in the ICSD 3rd edition. We have reported the temporal relationship between episodes of nocturnal groaning (NG) and arousals. In addition we reported a stereotyped sequence from EEG arousals to nocturnal groaning events with or without the intervening sleep bruxism (SB) in catathrenia. SB is also known to have close relationship with EEG arousals. A previous study observed that SB index was observed to be highest during sleep cycles 2 and 3 and showed an increase before each REM sleep within each cycle. The aim of this study is to assess NG episodes in relation to sleep cycles and compare with SB, and then to clarify the pathophysiology of catathrenia.

**Methods:** The subjects were consecutive 23,052 patients who presented with sleep and/or wake problems at our sleep center between April 1998 and October 2014. Diagnosis of catathrenia was made based on ICSD-2 criteria. A total of 47 cases (0.20%) were diagnosed as catathrenia. Thirty-three of 47 cases who presented episodes of NG on video-PSG were studied. Among them, we analyzed twenty-four cases who had more than 80% of sleep efficiency and more than 3 sleep cycles.

**Results:** The mean age at presentation in 24 patients (13 men and 11 women) was 38±13.3 years. NG episodes were divided into 1 to 110 clusters and isolated types. In 5 of 24 cases (20.8%), NG was exclusively or predominantly observed during REM sleep (REM sleep cluster), but the other showed groaning during stage 1 and 2 (non-REM sleep cluster). In REM sleep cluster, 30.4% of NG episodes occurred at 2nd REM sleep. In non-REM sleep cluster group, NG episodes showed no relationship with sleep cycle.

**Conclusions:** Patterns of NG emergence in sleep cycle were divided into the two types: non-REM sleep cluster and REM sleep cluster. Catathrenia may not be caused by a single pathophysiology, and further study is needed to clarify the pathophysiology of catathrenia.
**Introduction**: Given the comorbidity-related to OSA and the potential additive effects of PLMs, we believe that long-term adherence to CPAP treatment is crucial. However, this has never been evaluated according to PLMs changes.

**Purpose of the study**: Periodic leg movements (PLMs) are found in 30% of patients suffering from OSA. Under CPAP, we observed that PLMs can increase, decrease or remain unchanged.

**Objectives**: to determine the effect of change of PLMs on long term adherence.

**Materials and method**: The patients were addressed to the sleep laboratory for snoring or sleepiness. A single PSG night has been performed before and after CPAP treatment. Medication used such as benzodiazepines and antidepressants, hypertension and diabetes and ferritin level has been collected. Depression, sleepiness and Restless leg symptoms were assessed by validated questionnaires.

**Results**: 160 patients were recruited with a severe OSA. 32.5% (52/160) patients had emerging PLM i.e. that appeared after the disappearance of respiratory events. By comparing patients with emerging-PLMs from others, we found that only the blood ferritin level was significantly different between groups (A and B). Moreover, after one year follow-up, comparison of proportion of patients who pursued the treatment at one year showed a significant difference between patients with emergent PLM (66%) and patients with no PLM, or who decrease or do not change under CPAP treatment (75%) P value 0.028. Predictive factor of PLMs’ evolution was diabetes and ferritin. Patients with a low ferritin level proved an increase of their PLMs after CPAP.

**Conclusion**: PLM emerging negatively impacts the CPAP’s long term adherence. Blood ferritin level is a predictor the evolution of PLM under CPAP therapy.
EFFECT OF TRANSORAL ROBOTIC SURGERY (TORS) ON OBSTRUCTIVE SLEEP APNOEA (OSA)

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Introduction: Obstructive sleep apnoea (OSA) is a common sleep disorder characterized by repetitive upper airway collapse, oxygen desaturation and arousals. Positive Airway Pressure (PAP) therapy is gold standard treatment. TORS is a novel technique for surgical resection of base of tongue and lingual tonsil.

Materials and methods: We did retrospective review of prospectively collected data of 30 OSA patients who underwent TORS in our tertiary care center. Inclusion criteria being all patients who were ≥ 18yrs of age with moderate to severe OSA (diagnosed on PSG), with CPAP intolerance/non acceptance and had evidence of obstruction during DISE and with no contraindication for surgery. Patients who did not undergo post-op PSG and those who had previous surgery were excluded. Primary outcome measures were pre and post-op AHI, arousal index, snoring, change in CPAP requirement, minimum oxygen saturation, ESS (Epworth Sleepiness Scale), comorbidities, quality of life, rate of surgical cure (AHI< 5/hr) and surgical success( fall in AHI by 20/hr or 50% reduction).

Results: Post TORS PSG's are being conducted. Our attempt is to do follow-up PSG 3 month's post-op. However some delays are inevitable since many of our patients are international mainly from African continent. Our preliminary data is encouraging with improvement in quality of life scores, AHI and ESS. A few patients have already gone off their antihypertensive medication and even CPAP. Full data on 30 patients will be presented at the time of conference.

Conclusions: TORS is an effective modality to consider in non- CPAP compliant severe OSA cases as well as mild to moderate OSA. However meticulous attention be paid to selection of the cases.
Introduction: Obstructive sleep apnea is a common chronic medical condition strongly linked with obesity. Obstructive sleep apnea has been associated with cardiovascular morbidity such as arterial hypertension, stroke and heart failure, but the majority of these studies were done in sleep laboratory populations of predominantly male subjects. We hypothesize that obstructive sleep apnea will be associated with arterial hypertension in both genders in the general population.

Methods: A sample of 2035 subjects were recruited as Polish part of a large Prospective Urban Rural Epidemiology Study at baseline. In year 6 of the study, the STOP-BANG questionnaire was included for a sample of 536 subjects. In addition to the STOP-BANG questionnaire, subjects were evaluated at home with a standardized questionnaire which included demographic data, cardiovascular morbidity history (myocardial infarction, hypertension, stroke). The STOP-BANG was evaluated as a three-category variable [low risk (0-2), medium risk (3-4), high risk (5-8)] as well as high vs a combination of low and medium risk. In addition, all subjects had their height and weight taken at the time of the visit as well as blood pressure readings and blood samples for clinical markers. Statistical analysis performed using SPSS. Following descriptive analyses, adjustment for confounding by age, sex, and BMI was completed through multiple logistic regression for binary outcomes (e.g. any hypertension) and multiple linear regression for continuous outcomes (e.g. blood pressure).

Results: Of the 536 subjects, 61.6% were female and the mean age was 59.8 years (SD=8.8). Overall, there was an even distribution of OSA risk based on the STOP-BANG (low=33.2%; medium=32.5%; high=34.3%). While the prevalence of hypertension was 47.6% overall, as the risk level based on STOP-BANG increased so did the prevalence of hypertension (low=25.3%; medium=48.0%; high=68.5%; p< 0.001). After adjustment for age, sex, and BMI, this association remained statistically significant (p< 0.001). In an analysis stratified by sex, this association persisted in females (p< 0.001) but not males (p=0.92). To complement these results, similar patterns were observed when considering the outcome of systolic blood pressure both overall and after stratification by sex through crude and adjusted analyses.

Discussion: The results show that, after adjustment for age, sex and BMI a high pretest probability of obstructive sleep apnea based on the STOP-BANG questionnaire was associated with arterial hypertension in a dose response fashion. This association was statistically significant among women, but not men.

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OUTCOMES OF UPPER AIRWAY SURGERY IN OBSTRUCTIVE SLEEP APNEA

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Introduction: Obstructive sleep Apnea (OSA) is defined as a sleep disordered breathing due to partial or complete obstruction of upper airways. This study aimed to investigate treatment outcomes and clinical complications of patients with Obstructive Sleep Apnea (OSA) who underwent upper airway surgery in clinical settings.

Materials and methods: All patients undergone upper airway surgery for OSA was called upon to enrollment in this follow-up study. Demographic characteristics, Epworth sleepiness scale (ESS), snoring, dry mouth, nocturia, improvement of high blood pressure, and complications of surgery including bleeding, infection, pain, and temporary voice change were recorded for participants at median 8 months after surgery. Twelve patients accepted to undergo follow-up polysomnography (PSG).

Results: Among a total of 41 participants, mean age was 44.2±11.6 years, and 33(78.6%) were male. In three (25%) of patients with follow-up PSG, mean Respiratory Disturbance Index (RDI) was decreased by 50%. The baseline and post-surgery RDI was 34±26.2/hr and 24.8±13.2/hr; respectively. Mean ESS pre-surgery was 9±4.5 with a 3.9±4.2 decrease postsurgery. Most of the participants reported improved snoring. More than half of the patients reported improvement of hypertension, dry mouth, nocturia, and sleep quality. The most common reported complications were temporary changes in voice and pain.

Conclusions: Surgery improved snoring, daytime sleepiness, and OSA-related problems. Improvement of RDI in a small subset of patients indicates importance of follow-up PSG after upper airway surgery and warrants further studies. Moreover, evaluation of the reasons of nonparticipation for undergoing follow up PSG requires more investigation.

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Sleep Breathing Disorders
Board #148: P3 - Tuesday

PREVALENCE OF METABOLIC SYNDROME AND RISK FACTORS OF OBSTRUCTIVE SLEEP APNEA AMONG LOCOMOTIVE DRIVERS

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Introduction: Screening risk factors of sleep apnea among drivers with safety sensitive jobs is considered an important issue in a safe transportation system. This study was conducted to assess risk factors of sleep apnea and metabolic syndrome (METS) among locomotive drivers.

Materials and methods: This was a cross-sectional study conducted in Baharloo Hospital, Tehran University of Medical Sciences, Iran. Study population included 281 locomotive drivers referred for their annual physical examination. Demographic characteristics, Epworth Sleepiness Scale (ESS) questionnaire, blood pressure, Body Mass Index (BMI), neck and waist circumferences, and laboratory measurements including Fasting Blood Sugar, Cholesterol, High Density Lipoprotein, and Low Density Lipoprotein were recorded for all study participants. METS was defined according to NCEP ATP III criteria. Blood pressure>=140/90 mmHg or history of drug use, BMI>35 kg/m2, age>50 years, and neck circumference >40 cm were defined as risk factors for obstructive sleep apnea (OSA-RFs). Data were analyzed by descriptive statistics and chi-square test.

Results: All participants were male with mean age of 43±10 years. METS was diagnosed in 53(21%) of drivers. A total of 166(59.9%) of the drivers had equal more than two OSA-RFs, of those 47(28%) had METS (p-value < 0.0001). No significant association was found between those with ESS>10 and OSA-RFs or METS.

Conclusions: Findings indicate that current studied locomotive drivers have high prevalence of OSA-RFs and METS. Sleep apnea is considered an important preventable risk factor for traffic accidents. Therefore, further research is warranted to re-evaluate current screening regulations for diagnosis of sleep apnea among locomotive drivers.

Acknowledgements: Authors would like to thank all participants of this study for their cooperation.
Introduction: Sleep apnea syndrome (SAS) is a sleep disorder characterized by breathing pauses during sleep. Apnea affects autonomic nervous functions, which leads to fluctuate heart rate. The most effective treatment for SAS is continuous positive airway pressure therapy (CPAP). It is known that long-term CPAP can reduce risks of lifestyle related diseases in SAS patients to almost the same level as healthy people. However, few studies have focused on the relationship between short-term CPAP effect and heart rate. E. Kufoy et al. report changes in heart rate and heart rate variability (HRV) in SAS patients in consecutive nights: the first night without CPAP, and the second night with CPAP. However, the heart rate changes during and shortly after CPAP operation has not been clarified. The present work investigates acute effect of CPAP on HRV in SAS patients in consecutive nights.

Material and method: Ten SAS patients underwent two sleep studies on consecutive nights and their PSG data were collected in the Nagahama City Hospital. In the second night with CPAP, it worked when apnea started. This data collection and analysis were approved by the Research Ethics Committee of the Shiga University of Medical Science hospital. Since HRV reflects autonomic nervous functions, typical HRV features, meanNN, SDNN, Total Power, LF, HF and LF/HF were used for evaluating the autonomic nervous functions during and shortly after CPAP operation.

- meanNN : Mean of heart rate interval.
- SDNN : Standard deviation of heart rate interval.
- Total Power : Variance of heart rate interval.
- LF : The power of the low frequency band (0.04Hz - 0.15Hz) in power spectrum density (PSD).
- HF : The power of the high frequency band (0.15Hz - 0.4Hz) in PSD.
- LF/HF : Ratio of LF to HF

HRV features were clipped during and 180 seconds after recovery from apnea. To investigate effect of CPAP, the Welch’s t-test was performed, which is a two-sample location test used for testing whether two populations have equal means or not. Statistical significance was defined as p< 0.05. We compared the HRV features between the first and the second night.

Results: In nine out of ten SAS patients, significant differences were confirmed in the HRV features during apnea between in the first night and the second night (p < 0.05). Additionally, in eight out of ten SAS patients, there are significant differences between the HRV features 180 seconds after recovery from apnea in the first night and the second night (p < 0.05). The HRV features fluctuated greatly during and 180 seconds after recovery from apnea and these results indicate that acute CPAP effect suppresses the fluctuations of autonomic nervous functions caused by apnea.

Conclusions: The present work showed acute CPAP effect on HRV in SAS patients.
THE EFFECT OF CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) ON OVERLAPPING AND NON-OVERLAPPING DEPRESSIVE SYMPTOMS IN OBSTRUCTIVE SLEEP APNOEA (OSA) USING LINEAR GROWTH CURVE MODELLING

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The assessment of depression in Obstructive Sleep Apnoea (OSA) is confounded by symptom overlap, making it difficult to determine whether Continuous Positive Airway Pressure (CPAP) ameliorates both overlapping and non-overlapping depressive symptoms in OSA. This study examined the effect of CPAP ameliorating overlapping and non-overlapping depressive symptoms, within the Hamilton Rating Scale for Depression (HAM-D), in a 12-week, single arm study using Linear Growth Curve Modelling (LGCM). At baseline, individuals endorsed proportionally more severe overlapping compared to non-overlapping, depressive symptoms. Both overlapping and non-overlapping symptoms significantly decreased over time, but with a greater decrease in the severity of overlapping than non-overlapping depressive symptoms. Critically, greater CPAP use was associated with a faster rate of decline, but in overlapping depressive symptoms alone. Therefore, overlapping HAM-D depressive symptoms are more responsive to CPAP treatment. Implications of these intriguing findings are discussed.
PRELIMINARY DATA OF A PROSPECTIVE STUDY ON THE EFFECTIVENESS AND COMPLIANCE OF A MANDIBULAR ADVANCEMENT DEVICE ALONE VERSUS A MANDIBULAR ADVANCEMENT DEVICE COMBINED WITH A SLEEP POSITIONING PILLOW IN THE TREATMENT OF MILD TO MODERATE SLEEP APNEA

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Introduction: Although continuous positive airway pressure treatment (CPAP) remains the primary intervention for moderate to severe obstructive sleep apnea (OSA), a wide array of therapeutic interventions exist for treating the milder sleep-related breathing disorders (SRBD). Oral appliances (in particular mandibular advancement devices - MAD) and positional therapy (PT) are the most frequently used in day-to-day practice as a result of their affordable pricing as well as their relative ease of use. To this day, only one prospective study design investigated the combined effects of MAD and PT in this specific patient population.

Materials and methods: 10 patients free from any sleep interfering drug treatment, without any major physical or mental co-morbid condition, presenting with mild to moderate OSA (5 ≤ AHI < 20) and co-morbid snoring, were enrolled in a prospective cohort study. The protocol consisted of a total of four nights of polysomnography (PSG) in an academic sleep lab. Inclusion was based on the first two consecutive PSG, the second night being a control night without treatment intervention. Afterwards, in a randomized cross-over design, patients spend two consecutive months using alternately one of both treatment configurations at home for one month, being either MAD alone (Somnofit®) or combined with a sleep positioning pillow (Posiform®). At the end of each month, they underwent respectively a third and fourth PSG under active treatment. Sleepiness, fatigue and sleep quality were assessed with the Epworth Sleepiness Scale (ESS), the fatigue severity scale (FSS), the Pittsburgh Sleep Quality Index (PSQI) and the Function Outcomes of Sleep Questionnaire (FOSQ) at baseline and after each month of treatment, alongside reported satisfaction and compliance ratings after each month of treatment.

Results: Significant reductions of apnea/ hypopnea index (AHI), apnea/ hypopnea index in supine position (AHI-S) and respiratory distress index (RDI) were observed between the control night and both intervention nights. Furthermore, a trend was observed in the reduction of AHI and RDI between both intervention nights (MAD alone versus MAD and PT) in favor of the combined treatment. In addition, we obtained a significant improvement in sleep quality impairment (Pittsburgh Sleep Quality Index - PSQI) as well as daytime fatigue (Fatigue Severity Scale - FSS) between the control night and both intervention nights. No particular treatment effects were observed on sleep architecture.

Conclusions: Significant improvement on both sleep-related respiratory variables and symptom scales were observed after one month of both treatment configurations compared to the control night. Furthermore, reported compliance and overall satisfaction of patients as well as bedpartners appeared to be high and comparable after both months of treatment.
CLINICAL CONTRIBUTIONS OF A SLEEP POSITIONING PILLOW IN THE TREATMENT OF POSITIONAL SLEEP APNEA

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Introduction: Continuous positive airway pressure (CPAP) remains a first choice treatment for both moderate and severe obstructive sleep apnea (OSA). Till present, there is however no clear consensus on optimal treatment interventions for milder sleep-related breathing disorders (SRBD) in general or for positional sleep apnea (POSA) in particular. While several therapeutic options are either relatively invasive and/or expensive (ex. oral appliance therapy, surgical treatment), positional therapy (PT) may still present as a valuable first-line intervention for POSA.

Materials and methods: 28 patients presenting with POSA were enrolled in a prospective cohort study. The protocol consisted of three nights of polysomnography (PSG) in an academic sleep lab. Inclusion was based on the first PSG. During a consecutive PSG, PT was provided by means of a sleep-positioning pillow (Posiform®). The third PSG was performed after one month of PT. Sleepiness, fatigue and sleep quality were assessed with the Epworth Sleepiness Scale (ESS), the fatigue severity scale (FSS), the Pittsburgh Sleep Quality Index (PSQI) and the Function Outcomes of Sleep Questionnaire (FOSQ) at baseline, and after one and at six month of PT alongside satisfaction and compliance ratings.

Results: Significant immediate treatment effects after one night and sustained after one month were observed by significant reductions of sleep in supine position ($p< .001$), sleep fragmentation ($p< .05$), apnea-hypopnea ($p< .001$), respiratory disturbance ($p< .001$) and oxygen desaturation ($p< .001$) indices. PSQI ($p< .001$), ESS ($p< .005$) and FOSQ ($p< .001$) also showed significant and persistent improvements. No particular treatment effects were observed on sleep architecture.

Conclusions: The combined and significant improvement on both sleep-related respiratory variables and symptom scales were observed after treatment initiation as well as one month follow-up of usage of a sleep positioning pillow. Furthermore, reported compliance and overall satisfaction appeared to be highly concordant both at one month and six months follow-up.
VENTILATORY NUDGE THERAPY USING PRESSURE PULSES FOR INSPIRATION REFLEX TRIGGERING IN CHEYNE STOKES BREATHING AND CENTRAL SLEEP APNEA

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Introduction: Sleep apnea is most commonly of obstructive origin (oSAS), resulting from upper airway collapse, and usually treated with continuous positive airway pressure (CPAP). A smaller proportion of patients suffer from mixed or even predominantly central sleep apnea as the maximal variant of Cheyne Stokes Respiration (CSR): here, central respiratory drive under brainstem control periodically ceases. This was often treated with anticyclic or adaptive servo ventilation (ASV), where ventilaton pressures are continuously adjusted by the external device to maintain breathing at constant amplitude. Despite frequently beneficial for the patients symptoms, a 2015 study indicated that ASV may increase mortality in patients with congestive heart failure and reduced systolic ejection fraction. As central sleep apnea is often associated with this condition, respiraton mode had to be changed in many patients, but this could not always be successfully achieved.

Respiration is controlled by the brainstem using many factors, including influences from chemoreceptors monitoring blood gases, mainly carbon dioxide partial pressure (pCO2) and less oxygenation (pO2), but also including influences from recent breath taking / apnea history, and also from mechanoreceptors in thorax, lung and airways.

Materials and methods: In 3 patients in whom for above mentioned reasons, a change of ventilation mode from ASV to continuous and bilevel positive airway pressure (CPAP or BiPAP) was attempted but not sucessful in reducing CSR-induced arousals as seen by polysomnography (PSG) monitoring during titration, the known influence of mechanoreceptors led us to also try ventilation settings which we intended to stimulate spontaneous active inspiration: using the standard commercial CPAP/BiPAP device, very low pressure pulses (3 mbar) and a relatively high minimal respiration frequency setting (above 15/min) was applied. The idea was to nudge mechanoreceptors with low amplitude pressure pulses and thus trigger active inspiration during the central apnea phases, reducing the BiPAP effect of undesired amplification of ventilation also during the hyperventilation phases of CSR, and to achieve this without periodically changing parameters and without passively driving ventilation using pressures high enough to override spontaneous respiration such as with ASV, as the latter may be one of the undesirable factors with respect to mortality.

Results: In one patient, the above ventilation mode resulted in triggering active inspiration during apnea phases, as verified with concurrent PSG. This residual respiration also reduced the intermediate hyperventilation phases of CSR and consecutive arousal reactions. In one other patient, triggering of inspiration was sometimes observed, but not consistent enough to be useful for the whole night. In another patient, no effect could be observed.

Conclusions: Our observations indicate that triggering of active inspiration with mechanical stimuli may be achieved during central apnea, with low amplitude pressure pulses being sufficient. The limited programing possibilities of current commercial devices seem insufficient to reliably achieve this in all patients. Research on steeper small positive pressure ramps, up to investigation of even negative pressure steps to deliver more effective triggering stimuli, may be worthwhile.
Introduction: Tonsillectomy is the most common single procedure performed on children in Australian hospitals. Surgical removal of the adenoids and/or tonsils is first line treatment for obstructive sleep apnoea (OSA) in children. OSA has become the most common reason for adenotonsillectomy and children with severe OSA are at higher risk of post-operative complications. However, >90% of children have surgery without having the severity of their OSA quantified, due to limited access to testing and a belief by surgeons that testing is not necessary. This study aimed to quantify complication rates and identify risk factors for post-operative complications after adenotonsillectomy in the state of Victoria, so as to inform evidence-based state-wide recommendations for peri-operative care.

Materials and methods: The Victorian Department of Health and Human Services provided data for children 0-18 years having adenoidectomy, tonsillectomy or both from 1 July 2010 to 30 June 2015. De-identified data was linked to the procedure dataset from the Victorian Admitted Episodes Dataset, the Victorian Emergency Minimum Dataset and the Elective Surgery Information System, and included private hospital data grouped as one provider. Data were analysed using Stata 14.0.

Results: Over the 5-year period, 59,008 patients had 61,281 procedures (0-4y 38%, 5-9y 36%, 10-14y 14% and 15-19y 12%). Half the procedures (49.5%) occurred in private hospitals, which had a greater proportion of children aged < 5 years (42% vs 34%, p< 0.001). Public hospitals performed 1-700 procedures each per year. Most procedures were performed as either a same-day procedure (27.8%) or with an overnight stay in hospital (69.8%), with fewer adenoidectomy patients staying ≥2 nights (0.6%) when compared to tonsillectomy and adenotonsillectomy patients (3.0%, p< 0.001). The in-hospital complication rate was 3.9% for all procedures, higher for tonsillectomy and adenotonsillectomy than for adenoidectomy alone (4.5% vs 1.9%, p< 0.001). 75 children (0.1%) required transfer to another hospital post-procedure, of whom 63% were aged under 5 years (p< 0.001) and 69% experienced an in-hospital complication. There was no difference in the transfer rate across procedure types (p=0.171), nor private/public status of the original hospital (p=0.235). For those experiencing a complication (n=2,402), children < 5 years were over-represented in the group requiring a transfer (3.4%) compared to the other age groups (1.2%, 1.6% and 1.7% respectively, p=0.010). Complications rose with increasing number of procedures performed per week in a centre, whereas the need for hospital transfer in patients with complications was highest in centres performing an average of ≤2 procedures per week. There were no deaths. There were 3,328 (5.4%) readmissions within 30 days, with 13.6% of these readmissions being from patients with multiple readmissions. Only 8% of readmissions occurred to private hospitals.

Conclusions: Small rates of significant complications occur in the large group of children undergoing adenoidectomy/tonsillectomy in Victoria. Age under 5 years is a risk factor for complications and inter-hospital transfer. Further analyses will reveal how other patient factors and casemix at each site affect complication rates, with important implications for service delivery.

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Sleep Breathing Disorders
O19: Sleep breathing disorders oral abstract presentations

IMPROVING QUESTIONNAIRE SCREENING FOR OSA IN CHILDREN

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Introduction: Symptoms of sleep-disordered breathing are common in children. Many children are referred to specialist services for assessment from primary care across the state, resulting in long waiting lists in tertiary centres. The OSA-18 is a validated disease-specific quality-of-life tool, consisting of 18 questions each answered on a 7-category Likert scale. We have previously shown that the OSA-18 is not suitable as a tool for waiting list triage (Walter LM et al. Sleep Breath 2016). We have now developed a simplified questionnaire, the OSA-11, with 11 questions answered on a 4-category Likert scale. The original wording of the OSA-18 was preserved. We aimed to examine the psychometric properties and predictive value of the OSA-11 for obstructive sleep apnoea (OSA) in a referred population.

Materials and methods: Consecutive children referred to the Melbourne Children’s Sleep Centre for polysomnography or overnight oximetry between 11 January and 31 May 2017 were identified from a database. Only children referred for diagnostic testing for OSA, with no major comorbidities, or aged >2 y were included. Exploratory factor analysis with varimax rotation was conducted using Statistica 13 -Statsoft. OSA was defined on polysomnography by an obstructive apnoea hypopnea index (OAHI) >1 event/h. Association with the presence of OSA was determined using ANOVA.

Results: 689 children were identified, and 423 (2.0-17.9 y, 43% female) met the inclusion criteria. 178 had polysomnography and 245 had overnight oximetry. Exploratory factor analysis using questionnaire data from all included children resulted in a 3 factor structure with factor scores >0.7 and Eigenvalues >1: snoring, breath holding, choking and parental concern child not getting enough air (4 questions); nasal symptoms (2 questions); and behaviour (2 questions). Three questions (mouth breathing, daytime sleepiness and concentration) did not reach this threshold. ANOVA identified 4 questions that were significantly independently associated with the diagnosis of OSA by polysomnography (OAHI>1/h): snoring, breath holding, choking, and parental concern. Mouth breathing became significant if only an OAHI>5/h was considered positive. Questions in the other significant factors identified in the factor analysis (nasal symptoms and behaviour) did not contribute significantly to the identification of OSA. In the sub-set of children with who had polysomnography, the prevalence of OSA was 50%. Mean total score on the 5 questions was 9.5 for those with OAHI< 1/h and 12.1 for those with OAHI>1/h (p< 0.001). 41/178 (23%) had a total score less than 9/20 for these 5 questions, with a sensitivity of 86% and negative predictive value of 73%. For detection of moderate/severe OSA (OAHI>5/h), sensitivity is 85% and negative predictive value 85%.

Conclusion: The new 11 item questionnaire with a 4-category Likert scale could be further improved by removing questions not identified as part of a factor structure. Five of the questions already show promise as a predictive instrument for OSA by polysomnography criteria and thus may be useful for triaging referrals for SDB in children. Further analysis will identify the utility of the OSA-5 in predicting abnormal oximetry.

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CIRCULATING LEVELS OF MICRORNA-210 AND MICRORNA-126 ARE INCREASED IN HYPERTENSIVE PATIENTS SUFFERING FROM OBSTRUCTIVE SLEEP APNEA: PILOT RESULTS

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Introduction: Obstructive sleep apnea (OSA; defined as repetitive closing of upper airways during sleep) represents an established risk factor for the development of other cardiovascular diseases. Prevalence of OSA in hypertensive patients ranges between 20-40% and it raises up to 80% in those with resistant hypertension (RH; defined as blood pressure above 140/90 mmHg while using 3 anti-hypertensive drugs including diuretics). The presence of OSA in hypertensive patients contributes to the fixation of elevated blood pressure and untreated OSA may be one of the factors responsible for improper blood pressure control. It is thus necessary to detect OSA in hypertensive patients with gold standard diagnostic method being overnight polysomnography (PSG). However, PSG is not commonly available and it is time-demanding both for the patients and PSG operators - identification of blood-based marker that would allow screening for OSA among hypertensive patients would improve and shorten OSA diagnostics and would enable timely initiation of therapy. microRNAs (miRNAs, miRs) represent emerging biomarkers in the field of cardiovascular diseases and the purpose of our study was to determine, whether circulating levels of selected miRNAs differ between hypertensive patients with and without OSA (non-OSA).

Materials and methods: Online databases were searched for miRNAs whose levels, based on the OSA pathophysiology, would be altered in the presence of the disease. Three candidates were identified: hypoxia associated miR-210, vascular remodeling associated miR-126 and heart damage associated miR-499. 10 consecutive patients with RH and history of snoring were enrolled (9 males, 1 female; mean age 63.8 ± 5.9 years). All patients underwent overnight PSG, electrocardiography and transthoracic echocardiography. Peripheral blood sampling was performed in the morning after the PSG. Total RNA was isolated using RNeasy Mini Kit (QIAGEN). Reverse transcription and real-time polymerase chain reaction were performed using TaqMan® reagents. Statistical analysis was performed using STATISTICA12 software and Mann-Whitney test.

Results: OSA was confirmed in 8 patients (prevalence in the study population 80%). Higher relative levels of circulating miR-210 (OSA vs. non-OSA; 12.97±0.48 vs. 11.27±0.41; p=0.045) and circulating miR-126 (OSA vs. non-OSA; 6.73±0.37 vs. 5.51±0.49; p=0.045) were observed in OSA patients; miR-499 levels did not differ significantly between the groups.

Conclusions: Relative levels of circulating miR-210 and miR-126 are increased in plasma of patients with resistant hypertension and OSA compared to those without OSA. Our results suggest use of circulating miRNAs in patients with resistant hypertension as a potential screening tool for OSA.

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**Introduction:** Patients with Obstructive Sleep Apnea-Hypopnea Syndrome (OSAHS), may have cognitive impairment, which usually underdiagnosed, negatively affecting their daily activities. The aim of this study was to assess the subjective perception of cognitive functioning of patients who suffer from OSA prior to treatment with CPAP employing the Maastricht Attention and Memory Checklist (MAC).

**Materials and methods:** The study population included 101 patients with OSAHS, diagnosed with polysomnography, who visited the outpatient Sleep Clinic of the University General Hospital of Larissa and General Hospital “Evangelismos” of Athens vs. 40 normal controls of the general population. All participants underwent a neuropsychological evaluation, including the MAC scale. Principal Component Analysis with Varimax Rotation was subsequently used to determine the existence of latent structures within the MAC.

**Results:** The majority of patients were males (52.5%), between the ages of 51-71 years (52.4%), secondary school graduates (53.5%). PCA revealed 5 distinct dimensions capturing 74.17% of the sample’s variance. These dimensions corresponded to distinct deficits in attention-deficit, focused attention and concentration.

**Conclusions:** Our results indicate that cognitive deficits in OSAS may be sequestered in endophenotypes corresponding to attention-deficit, focused attention and concentration. An expansion of our work in other neuropsychological measures is thus warranted.

**Acknowledgements:** We thank all the patients that they participaeted in this study.
Sleep Breathing Disorders
Board #122: P6 - Wednesday
APNEA BYE, FIRST APP TO TREAT SLEEP DISORDER BREATHING

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Introduction: Apnea Bye is the first app to treat sleep apnea and snoring. Apnea Bye is based on myofunctional therapy. Patient interacts with the Phone performing oropharyngeal exercises. The main advantage for this app is that provide feedback with the patient about the accuracy of the exercises, and the doctor is aware about the adherence of this exercises.

This therapy is based on three elements:
1) A comprehensive web page for patients with general information about the app. where they can unload it by them shelves.
2) There is another private web page for doctors who recommend the app to their patients and where medical information, accuracy and adherence in performing the exercises are recorded. Doctors are aware about their patients.
3) And the app where 11 exercises using oropharynx muscles involved in the origin in the apnea are pulled interacting with the phone and using its screen during half an hour in a day. All the exercises are recorded, and its efficiency during the procedure is informed to the patient.

At this moment only iphon 6S and 7 had the accurate technology to control the pressure of this muscles again the screen.

Material and methods: Prospective study , starting March 2017. Patients snorers diagnosed with apnea IAH<30, During the otolaryngology examination showed mainly oropharyngeal causes of the blockage. No prior surgery, no morbidity obesity, no severe temporomandibular joint dysfunction. All patients demonstrated willingness to perform exercises. Consent report were obtained from all patients. In case of patients younger than 18 years, it was obtained from their parents. IAh with prior polysomnography, BMI, snoring VAS, and sat pO2 were recorded pre and postintervention.

Results: Until now five patients have tested this therapy. The average Age was 35,5, 4 men one women. Average scores Pre therapy were IAH 25,5, BMI 24,1, VAS 9,1, SAT O2 PRE 90.2
Average scores After three months of using the app were, IAH 19,2, P =0.08 VAS 4,2, P 0.0015 , BMI 22,7
p=0.42 SATP O2 Post 95,2. P=0.02.
Understanding adherence on performing exercises half on an hour during 5 days of a week, the adherence was 100% in the five patients.
No complications were reported.

Conclusions: Although this is a small sample we understand this is a promising therapy for sleep disorders breathing. Further studies will be carried out with more patients.
THE RELIABILITY OF THE EPWORTH SLEEPINESS SCORE IN A SLEEP CLINIC POPULATION

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Rationale: Despite the Epworth Sleepiness Score (ESS) being widely used in the assessment of OSAS (Obstructive Sleep Apnea Syndrome), there are limited studies of its reliability in clinical practice. The aim of this study was to assess the reliability of the ESS in a clinical population undergoing assessment for OSAS.

Methods: This retrospective study included 133 patients who were referred to Middlemore Hospital sleep service on suspicion of OSAS between October and November 2014. The reliability of repeated measurements of ESS at up to three different points of the diagnostic pathway was measured: at the general practitioner's (GP) assessment, at the time of overnight oximetry and at assessment by a Sleep Physician. No treatment for OSAS was administered between measurements. Reliability was analysed using the Bland Altman method and Intraclass and Pearson correlation coefficients.

Results: There were 133 patients included in the study. The GP ESS were taken first. There was median 91 days until ESS was measured again at time of oximetry, then median 11 days until a final ESS was measured at specialist assessment. The results suggest good reliability of the ESS between the oximetry and specialist scores with an Intraclass Correlation coefficient (ICC) of 0.82, however poor reliability between the GP and oximetry or specialist scores with ICC of 0.34 and 0.31 respectively.

Conclusion: The reliability of the ESS is unproven in clinical settings. Our study shows that in this population there is significant variation in the score over repeated baseline measures. This may be interpreted as an effect of passage of time (oximetry and specialist clinic measurements being significantly closer together than GP and oximetry/specialist clinic measurements), or of the different clinical settings in which the score was measured. Clinicians should be aware of the limitations of ESS in clinical practice.
NOCTURNAL BLOOD PRESSURE DECLINE MAY BE MORE DISTURBED BY AHI (APNEA-HYPOPNEA INDEX) DURING REM SLEEP THAN DURING NREM SLEEP

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Introduction: Absence of blood pressure decline during nocturnal sleep, known as non-dipping, is one of the findings associated with sympathetic activation induced by obstructive respiratory events in obstructive sleep apnea (OSA) patients. This blood pressure non-dipping is a known risk factor for cardiovascular diseases. In rapid eye movement (REM) sleep stage, sympathetic activity increases abruptly. Therefore, obstructive respiratory events during REM sleep may have more profound effects on nocturnal blood pressure non-dipping than obstructive events during non-rapid eye movement (NREM) sleep. The purpose of this study was to see the association between obstructive events in REM sleep and nocturnal blood pressure decline.

Materials and methods: In this retrospective cross-sectional study, we evaluated 131 adults (44 women; age 50.2±14.6 years; BMI 25.0±3.2 kg/m²) who had polysomnography. Subjects who had been diagnosed and treated with hypertension, ischemic heart disease, arrhythmia or heart failure were excluded. During polysomnography, blood pressure was collected before light out (baseline) and after light on in the morning. Nocturnal blood pressure change was obtained by calculating the difference between morning blood pressure and baseline. REM-related OSA was defined as 'AHI in REM sleep' to 'AHI in NREM sleep' ratio of > 2.

Analysis of covariance model was used to determine the difference of nocturnal blood pressure decline between 'REM-related OSA group' and 'REM-nonrelated OSA group' after adjusting for potential confounders. Multivariable linear regression model was fitted to identify the association of 'AHI in REM sleep' with decline in nocturnal blood pressure while adjusting for potential confounders (significant level P ≤ 0.05).

Results: There were no significant differences in baseline blood pressure between REM-related and REM-nonrelated OSA group (systolic blood pressure 129.0 vs. 133.1, P=0.089, diastolic blood pressure 80.5 vs. 81.1, P=0.718). However, patients with REM-related OSA showed significantly less decline in systolic blood pressure during nocturnal sleep than patients with REM-nonrelated OSA (Estimated marginal means 0.53 vs. 6.35, P=0.049). In multivariable linear regression model, systolic blood pressure decline was independently associated with 'AHI in REM sleep' (parameter estimate 0.20, P=0.013). In contrast, age, sex, body mass index or 'AHI in NREM sleep' was not significantly associated with nocturnal blood pressure decline. (P > 0.1)

Conclusions: Nocturnal systolic blood pressure decline was negatively correlated with AHI in REM sleep, but not AHI in NREM sleep. Current result suggests that obstructive respiratory events in REM sleep may have clinical importance in blood pressure non-dipping.
EFFECT OF BOTH SIDE TONSILLOTOMY IN TREATMENT OF OBSTRUCTIVE SLEEP APNEA SYNDROME IN CHILDHOOD

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Introduction: Obstructive sleep apnea syndrome is often caused by hypertrophy of tonsillar tissue in childhood. The prevalence of OSAS in children is about 1-5%. The necessary is endoscopic ENT examination. Very important are parent’s anamnestic data often including audio or video recording of home sleeping with symptoms of OSAS. The only objective examination of sleep apnea syndrome is polygraphy and polysomnography. Recommended method of treatment OSAS for hypertrophy of the palatine tonsils is a both side tonsillectomy. The adequate method of the treatment should be a bilateral tonsillotomy in early childhood. The study was controlled by polygraphy before treatment and one or twice time after surgery.

Materials and methods: The 50 patients were examined in age 2-8 years old in Sleep Lab in Brno and Benešov Hospital. All patients had palate tonsils hypertrophy grade III and IV, that means to held more than 50 percent of the pharyngeal space. Sleep apnea and snoring were positive anamnestic symptoms of these children mostly with impairment swallowing of food caused by this palatal hypertrophy. We asked about problems with swallowing food, nocturnal enuresis, tiredness, hyperactivity during day, mumbling and snuffle. Surgery- both side tonsillotomy was done in general anesthesia. The value of AHI were in range 5,5 to 64. Both side tonsillotomy was made in the group of 50 children. 10 patients had adenoidectomy in one time in grade of adenoid tissue I- II. Tonsillotomy is shorter than tonsillectomy, the healing and paintfull after it mostly too. Effect of tonsillotomy on the incidence of apneas was already evident during the healing time and after healing usually apneas and snoring not described by children’s parents. The first polygraphy control of all 50 children was performed between 6 weeks and 3 months after healing. The second polygraphy control was performed between 6 to 12 months after surgery because of becoming snoring in 6 patients.

Results: No snoring was reported in early time after surgery. All patients improved breathing. Others monitored OSAS symptoms improved mostly too. All 50 children had PSG examination before and after surgical treatment. Mostly the weight of children increased because of removal of obstruction caused by hypertrophic tonsils. The first AHI values were zero after tonsillotomy in 48 patients (others two: 0,9 and 1,2). The second polygraphy examination increased AHI values in others two children (1,9 and 5,5). No more frequent relapses of palatal tonsils hypertrophy after tonsillotomy were reported (only 4% on one side during second year after surgery with snoring during inflammatory illness, no AHI more than 1).

Conclusions: Both side tonsillotomy reduces symptoms of OSAS in early childhood. Reduction of radicality surgical treatment does not change significantly the effect of sleep apnea syndrome treatment. Therapeutic effect at once after surgery was 96%. Therapeutic effect 6 and more months after tonsillotomy was 90%. The functional part of the palatine tonsils so important for correct immune system development stays in its place. Therapeutic effect of tonsillotomy in OSAS treatment is comparable with both side tonsillotomy.
THE EFFECT OF REGULAR FOLLOW-UP ON LONG-TERM COMPLIANCE WITH CPAP IN PATIENTS WITH OSA

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**Introduction:** To explore the effect of regular follow-up on long-term continuous positive airway pressure (CPAP) therapy compliance in patients with obstructive sleep apnea (OSA).

**Materials and methods:** This prospective study recruited a group of subjects from May 2009 to December 2013 who were diagnosed and had accepted CPAP treatment in Sleep Center of Guangdong General Hospital, and the patients were followed-up regularly for long-term through formulate follow-up schedule, follow-up content, inform patients actively and follow-up with specialist physicians, to explore the effect of the intervention measure on the long-term adherence in patients with OSA. The patients were diagnosed, had pressure titration and CPAP treatment through out of center sleep test. The subjects were followed-up for 1st, 3rd, 6th, 12th month, and twice each year regularly after accepting the CPAP treatment in Sleep Center by face to face follow-up with specialist physicians. Physicians followed-up the patients´ subjective signs, symptoms, CPAP adherence, patient education and side effect solutions. The patients were classified into good and poor compliance groups, and statistical analysis was done between the two groups.

**Results:** There were 77 cases enrolled until December 2015, only 73 patients completed the study. The patients were followed-up about 2-6 years, the average was (3.93±1.29) years, the compliance accounted for 54.8% (40/73), and the average compliance was (4.02±1.87) hours/night. The trend of the long-term compliance showed that there was a gradual increase within the first 3 months of CPAP treatment and then the compliance decreased; it then increased gradually after the first two years. The good compliance group showed that the compliance increased gradually in the initial 3 months, and then fell; from the first year to the 3rd year, the compliance was stable; after the 3rd year there was a drop and the compliance tended to increase again after the 4th year. The poor compliance group showed the compliance had a downward trend from the beginning of the first two years, then after a brief rise, the compliance decreased linearly. Multivariate analysis showed that long-term compliance was not associated with age, daytime sleepiness (ESS), oxygen desaturation index (ODI), anxiety, depression (P>0.05), etc. However, it was associated with the time of the titration treatment (P<0.001), the time of the flow monitored (P<0.01) and the number of the pressure titration within one week (P<0.05).

**Conclusions:** The increased compliance is related with the regular follow-up on long-term CPAP therapy compliance in patients with OSA, means patients with good compliance can made the compliance from down to up after regular follow-up. However, regular follow-up can’t change its falling trend compliance for those who had started with poor compliance, the intervention measure effect is not obviously. The study also showed that Long-term compliance can be predicted by the degree of cooperation with the initial diagnosis and treatment. It suggest that different management measures should be taken for patients with different initiate compliance.
CORRELATION ANALYSIS BETWEEN BODY CIRCUMFERENCE AND MUSCLE MASS OF MIDDLE-AGED KOREAN MEN AND SLEEP APNEA-HYPOPNEA INDEX

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Introduction: To examine the correlation between body circumference and muscle mass of patients with obstructive sleep apnea (OSA) and Apnea-Hypopnea Index. Subjects: 90 middle-aged Korean men (35 to 60 years old) mainly diagnosed with snoring and sleep apnea visited the sleep center to receive overnight polysomnography were selected.

Materials and methods: According to AHI severity, the subjects were divided into the three groups such as Normal-Mild (n=25), Moderate (n=23), and Severe (n=42) to calculate and compare the mean (M) and standard deviation (D) of variables such as body circumference, fat mass, and muscle mass between the groups. Differences in variables between the groups were compared by performing a One-way ANOVA and post-hoc test. In addition, the correlation between each body circumference, muscle mass and AHI was analyzed using Pearson’s correlation.

Results: The upper arm and thigh circumferences were not correlated with AHI as a single variable, but the Arm to Waist Ratio and Waist Ratio showed a significant negative correlation with AHI (p< 0.001), respectively. Skeletal muscle mass was not correlated with AHI as a single variable, but Skeletal muscle mass to body fat mass ratio (p< 0.01), skeletal muscle mass to weight ratio (p< 0.001), and skeletal muscle mass to BMI ratio (p< 0.001) were significantly negatively correlated with AHI, respectively.

Conclusions: There is a need to additionally consider the reduction of muscle mass as a risk factor related to OSA.

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FACTORS INFLUENCING ADHERENCE TO CONTINUOUS POSITIVE AIRWAY PRESSURE IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: Poor adherence to therapy with continuous positive airway pressure (CPAP) in patients with obstructive sleep apnea (OSA) is a major clinical problem. The aim of this study was to identify risk factors for and protective factors against discontinuation of CPAP.

Materials and methods: Data were derived from the Swedish quality registry Swedevox. Patients starting treatment with CPAP due to OSA between 1 July 2010 and 31 December 2016 and who attended to a follow-up visit after 460±322 days were included. Information about discontinuation of CPAP treatment was reported to the registry at a scheduled 1-year follow-up and also if the CPAP treatment was interrupted at another occasion. Date of death, when applicable, was derived from the Swedish Death Registry. Follow-up data until 10 March 2017 were available.

Results: Data from 21,080 patients (71.5% men) were obtained. Women were older (60.1±11.4 vs 56.9±12.4 years, p < 0.001), had a higher BMI (32.8±7.2 vs 31.8±5.8 kg/m2, p < 0.001), had higher Epworth Sleepiness Scale (ESS) score (10.6±5.1 vs 10.4±4.9, p < 0.001), and had more often used a humidifier from start of treatment (48.2 vs 42.1 %, p < 0.001) but had lower apnea-hypopnea index (AHI) (33.7±22.4 vs 37.5±21.8 events/hour, p < 0.001) and oxygen desaturation index (ODI) (32.0±22.7 vs 35.4±21.9 event/hour, p < 0.001) than men. In a cox-regression model, hazard ratio (HR) for discontinuation of CPAP treatment due to other causes than death, after adjusting for age at CPAP initiation, AHI, BMI and ESS, was 1.32 (95% confidence interval (CI) 1.20-1.45) for female gender and 0.83 (95 % CI 0.76-0.91) for use of a humidifier at initiation of CPAP treatment.

Conclusions: Female gender is a risk factor for discontinuation of CPAP in patients with OSA. Use of a humidifier has a protective effect against discontinuation.
**Sleep Breathing Disorders**

Board #124: P6 - Wednesday

**UPPER AIRWAY RESISTANCE SYNDROME: VALIDATION OF A DEFINITION BASED IN LONG TERM OUTCOMES**

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**Introduction:** Upper airway resistance syndrome (UARS) has been described more than 15 years ago and has been investigated in several studies; however, the definition has not been validated yet. The purpose of this study was to validate diagnostic criteria of UARS based on long-term outcomes.

**Materials and Methods:** The sample was derived from the 2007 São Paulo's sleep study cohort (2007). After 8 years, a total of 1,074 volunteers were invited to participate in the follow-up study, and 714 agreed. A total of 707 underwent polysomnography and answered the following questionnaires: Unifesp sleep questionnaire, Epworth sleepiness scale (ESS), Chalder fatigue scale, Pittsburgh sleep quality index (PSQI), World Health Organization quality of life (WHOQoL-bref), Beck anxiety and depression inventories (BAI and BDI). Inspiratory flow limitation (IFL) was manually scored and an IFL index $\geq 5.0\%$ of total sleep was considered positive for inspiratory flow limitation. UARS was defined by apnea-hypopnea index (AHI) $< 5$ events per hour and presence of inspiratory flow limitation ($IFL \geq 5.0\%$), mean oxygen saturation ($SpO_2 \geq 92\%$) and presence of daytime sleepiness ($\geq$ once a week) and/or fatigue (Chalder score $> 4$). Controls (CTRL) were considered as having AHI $< 5$, $SpO_2 \geq 92\%$, IFL $< 5.0\%$ and absence of fatigue and sleepiness complaints.

**Results:** From the 707 individuals longitudinally assessed, 593 presented AHI $< 5$ in baseline study. Of these, 71 (10.0%) were considered as having UARS (mean age of $35.1 \pm 0.7$ years and body weight of $66.0 \pm 1.6$ kg), and 249 (35.2%) met criteria for CTRL ($36.6 \pm 0.4$ years and $67.5 \pm 0.86$ kg). In the baseline, the UARS group presented more women (80.3% vs 54.2%), poor sleepers (PSQI $> 5$, 74.6% vs 31.4%), daytime sleepiness ($ESS > 9$, 57.7% vs 30.5%), and individuals with anxiety (BAI $> 11$, 47.6% vs 18.3%) and depression (BDI $> 11$, 65.6% vs 21.6%) symptoms. Baseline quality of life was significantly lower in the UARS compared to the CTRL group in all domains (physical, psychological, environmental, and social). Long-term analysis controlled for sex showed that UARS by itself was a risk factor for the development of anxiety symptoms (OR: 3.52, 95% CI: 1.34 - 9.18, p = 0.001) and depression symptoms (OR: 3.32, 95% CI: 1.01 - 10.97, p = 0.049). Moreover, UARS led to decreased quality of life in psychological domain (OR: 0.93, 95% CI: 0.86 - 0.99, p = 0.034). In the polysomnography, no changes were observed among the groups, with exception to the respiratory related arousal (RERA) index, which was higher in the UARS ($1.06 \pm 0.16$) compared to the CTRL group ($0.59 \pm 0.05$) in baseline assessment. UARS was also a risk factor for the increase in RERA index after 8 years (OR: 1.589, 95% CI: 1.14 - 2.22).

**Conclusions:** UARS patients after 8 years with no treatment, defined by the criteria above, presented worsening of mood and quality of life. UARS should always be investigated and treated to prevent long-term consequences.

**Acknowledgments:** AFIP (Associação Fundo Incentivo à Pesquisa)
CORRELATION OF SALIVARY RESISTIN LEVEL WITH OBSTRUCTIVE SLEEP APNEA SYNDROME IN PEDIATRIC SUBJECTS

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Introduction: OSA is considered to be closely related to systemic inflammation. Resistin has been shown as a measure of systemic inflammation. Salivary resistin sampling was easy and pain-free to collect and optimal for multiple sampling in children. Therefore, we aimed to evaluate the relationships among salivary resistin level, objective parameters of PSG, and subjective sleep symptoms.

Materials and methods: Sixty six children who attended our clinic during 1 year were enrolled prospectively and underwent systematic collection of clinical and polysomnographic variables. Salivary resistin were measured at 2 points which were at night before polysomnography (PSG) and in the early morning after PSG.

Results: The subjects (n=65) were divided into control (n = 25, AHI < 1) and OSAS (n = 40, AHI >1) groups. The level of salivary resistin after PSG in OSAS and control groups were similarly higher than those before PSG. The level of salivary resistin measurements between the two groups and also no significant difference in the salivary resistin measurements between the control and each OSAS subgroup. The salivary resistin measurements in the OSAS groups were not related to AHI, tonsil size, AN ratio, questionnaire, lowest oxygen saturation, and oxygen desaturation index.

Conclusions: The salivary resistin had no significant relationship with AHI, KMPESS, the lowest oxygen saturation, and ODI and exhibited diurnal variations regardless of OSA. However, there has been not yet consensus regarding the relationship between resistin and OSAS. Further studies should be pursued in future investigations.
ASSOCIATIONAL ANALYSIS BETWEEN SLEEP-RELATED VARIABLES AND SLEEP POSITIONAL DIFFERENCE OF APNEA-HYPOPNEA INDEX IN OBSTRUCTIVE SLEEP APNEA SYNDROME

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Introduction: Obstructive sleep apneas are likely to increase more in supine position. But, it is known that apnea-hypopnea index (AHI) is not associated with sleep position time in obstructive sleep apnea syndrome (OSAS). This study investigated how sleep-related variables associate with positional difference of AHI in patients with OSAS.

Materials and methods: A total of 313 men with OSAS were enrolled. Sleep positional difference of AHI (ΔAHI) was indicated that supine AHI (during supine position, sAHI) minus AHI. ΔAHI were partially correlated with the variables of demographic data, sleep structure, sleep position, sleep apnea, cardiovascular activity, age and body mass index (BMI). Partial correlation values were indicated by rp and p-value. Sleep position-related variables included supine position time (SPT), non-supine position time (NSPT), index of SPT (%; 100 x SPT / sleep position time, ISPT) and transitional index (number of positional changes per hour). Subjects were divided into two groups by score 5 of ΔAHI. A group with a ΔAHI of 5 or more was Positional OSAS Group (PG-OSAS; N = 135), and a group with less than 5 was Non-Positional OSAS Group (NPG-OSAS; N = 178). Two groups were compared with above variables by independent-T test.

Results: sAHI was higher than AHI (42.06 ± 25.61 vs. 34.11 ± 22.70, p = 4.02E-33). ΔAHI showed a very high correlation with sAHI (rp = 0.50, p = 7.32E-17). ISPT was most highly correlated with ΔAHI (rp = -0.64, 5.09E-45) followed by AHI (rp = 0.21, p = 2.57E-4), sAHI (rp = -0.13, p = 0.020), the difference of NREM-REM sleep average oxygen saturation (rp = 0.18, p = 0.001). Transition index showed a very high correlation with ΔAHI (rp = 0.31, p = 3.83E-8). PG-OSAS showed lower ISPT (58.16 ±16.07 vs. 86.31 ±16.45, p = 3.46E-39), higher transitional index (3.27 ± 2.24 vs. 1.82 ± 2.14, p = 1.59E-08), higher sAHI (52.84 ± 22.56 vs. 33.88 ± 24.80, p = 1.98E-11), non-significant AHI (35.96 ± 19.01 vs. 32.71 ± 25.11, p = 0.21), lower snoring percentage (22.35 ± 15.36 vs. 27.76 ± 18.87, p =0.007), and lower difference of NREM-REM sleep average oxygen saturation (0.09 ± 1.98 vs. 1.02 ± 2.33, p = 0.000251).

Conclusions: Sleep positional difference was significantly correlated with sAHI, but without AHI. It is suggested that both sAHI and AHI should be considered when analyzing the degree of sleep apnea in OSAS patients with larger portion of non-supine position time. The differences in NREM-REM sleep average oxygen saturation and ISPT were significantly greater than in the group with lower ΔAHI. This may mean that the group with higher ΔAHI is more likely to take a non-supine position to prevent severe hypoxia during REM sleep.

Acknowledgements: This study was supported by research fund of Seoul Konkuk University Medical Center
Introduction: To verify the reliability and validity of automated scoring and compare it to that of manual scoring for diagnosing obstructive sleep apnea using an Embletta X100 level 2 portable device.

Materials and methods: A total of 116 patients with suspected obstructive sleep apnea who had successfully received portable polysomnography with the Embletta X100 were examined. All polysomnography data were analyzed by automated and manual methods. Manual scoring was performed according to the revised American Academy of Sleep Medicine 2012 criteria. Automated scoring was analyzed using the automatic algorithm, which was updated with the American Academy of Sleep Medicine 2012 criteria. All parameters were evaluated statistically using correlation analysis and paired t tests.

Results: The apnea-hypopnea index for automated scoring and manual scoring with the Embletta X100 were moderately correlated (r = 0.76, P < .001). However, there was poor agreement (Bland-Altman plot, kappa = 0.34, 0.33, and 0.26; cutoff value = 5, 15, and 30), and the apnea-hypopnea index data were generally excessively underestimated based on diagnostic agreement and disagreement criteria. Furthermore, the apnea-hypopnea index severity (Kendall tau-b = 0.62) between automated and manual scoring lacked good concordance.

Conclusions: Automated scoring using the Embletta X100 was statistically moderately related to the manual scoring results. However, automated scoring tended to excessively underestimate the apnea-hypopnea index data compared to manual scoring. Thus, manual scoring by a sleep expert is essential for obstructive sleep apnea diagnosis with the Embletta X100.
Introduction: Many patients with coronary artery disease (CAD) have concomitant obstructive sleep apnea (OSA) and excessive daytime sleepiness (EDS). Depression is also common both in CAD and OSA. Less is known whether OSA contributes to depression in CAD patients, and whether continuous positive airway pressure (CPAP) treatment would improve mood in this group. The purpose of the current study was to identify correlates of moderate-to-severe depression in CAD patients following revascularization, and address the effect of CPAP treatment on mood in patients with comorbid OSA.

Materials and methods: Secondary analysis of the Randomized Intervention with CPAP in Coronary Artery Disease and Sleep Apnea (RICCADSA) trial, which was conducted in Sweden between 2005 and 2013. For the current protocol, 431 participants (mean age 63.9±8.5 years; 83% men, body mass index [BMI] 28.2 ± 4.1 kg/m²) with OSA (apnea-hypopnea index [AHI] ≥15/h) or no-OSA (AHI< 5/h) on cardiorespiratory polygraphy, who had answered Epworth Sleepiness Scale (ESS) and Zung Self-Rating Depression Scale (SDS) questionnaires at baseline and after one-year, were included. Patients with nonsleepy OSA (ESS score < 10) were randomized to CPAP or no-treatment, and patients with sleepy OSA (ESS score ≥10) received CPAP. Zung SDS score (range 20-100) of at least 50 was defined as depression (50-59 mild, 60-69 moderate, and ≥70 severe depression, respectively).

Results: Average Zung SDS scores at baseline were similar in OSA and no-OSA patients (54.0±6.7 vs 54.6±6.1; n.s). Overall, 80.4% of the OSA patients and 88.3% of no-OSA patients had depression (p=0.078) at baseline. Moderate to severe depression was observed among 15.4% in the OSA group, and 18.1% in the no-OSA group, respectively (n.s). In a multivariate logistic regression model, moderate to severe depression at baseline was significantly associated with female sex (odds ratio [OR] 2.4, 95% confidence interval [CI] 1.3-4.5; p=0.007), and ESS score (OR 1.1, 95% CI 1.0-1.2; p=0.041), but not with age, BMI and AHI. At the 1-year follow-up, improvement in mood (changing to better category of Zung SDS scores vs worsening/no-change) was predicted by CPAP-usage for ≥4 h/night (OR 1.7; 95% CI 1.1-3.0; p=0.052) adjusted for age, sex, and ESS score change from baseline.

Conclusions: In this revascularized cohort of patients with CAD, moderate to severe depression at baseline was associated with female sex and ESS score, independent of age, BMI and AHI. In the OSA group, good CPAP adherence was a significant predictor of improvement in mood after one year, adjusted for age, sex, and improvement in EDS. Adding interventions to improve CPAP compliance, and reduce EDS to standard clinical care of OSA may contribute to better mood in patients with CAD following revascularization.

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DETERMINANTS OF NONSLEEPY VS SLEEPY PHENOTYPES OF OBSTRUCTIVE SLEEP APNEA IN A REVASCULARIZED CORONARY ARTERY DISEASE COHORT

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Objectives: To investigate clinical and polysomnographic characteristics of nonsleepy vs sleepy phenotype of obstructive sleep apnea (OSA) patients in a revascularized coronary artery disease (CAD) cohort.

Materials and methods: Secondary analysis of the Randomized Intervention with CPAP in Coronary Artery Disease and Sleep Apnea (RICCADSA) trial. Participants were recruited between 2005 and 2010 in Sweden. For the current protocol, 399 patients with OSA (apnea-hypopnea index [AHI] >=15/h) on cardiorespiratory polygraphy (PG) underwent polysomnography (PSG) in hospital, in median 93 days after the revascularization, and 30 days after the initial PG at home. Technically adequate sleep recordings were obtained in 389 patients, of whom 5 excluded due to no-OSA (AHI>=5/h) on the PSG night. Remaining 234 nonsleepy (Epworth Sleepiness Scale [ESS] score < 10), and 150 sleepy (ESS score >=10) OSA patients constituted the final study population. Total sleep time (TST), sleep efficiency, sleep stages, arousal index as well as respiratory events and oxygenation indices were recorded; Chicago-criteria were applied for hypopneas. Baseline comorbidities, echocardiography measurements, and plasma levels of N-terminal pro-brain natriuric peptide (NT-proBNP) as well as proinflammatory cytokines (high-sensitivity C-reactive protein [hs-CRP], interleukin [IL]-6, IL-8 and tumor necrosis factor [TNF-α]) were measured.

Results: Compared to the sleepy phenotype, the nonsleepy OSA patients were slightly older (mean age 66.1 vs 62.7 yrs; p< 0.001) and less obese (mean body-mass-index [BMI] 28.4 vs 29.8 kg/m2; p=0.002), and demonstrated shorter TST (mean 369 vs 395 min; p=0.007) and less severe Oxygen Desaturation Index (ODI; 20.8/h vs 25.8/h; p=0.007) despite the same level of AHI (41.1 vs 42.0/h; n.s). No significant between-group differences were observed regarding sleep efficiency, delta sleep, and rapid eye movement (REM) sleep and AHI distribution during supine position and REM-sleep. Proportion of patients with left ventricular ejection fraction (LVEF) < 50% tended to be higher (15.7% vs 9.7%; p=0.078) in the nonsleepy OSA group, who had significantly more individuals with angiotensin-converting enzyme inhibitor treatment (48.5% vs 37.6%; p=0.037) and increased NT-proBNP levels (579 vs 337 pmol/L; p< 0.001). IL-6 levels were significantly higher in the sleepy phenotype (18.0 vs 7.8 pmol/L; p=0.023) while there was no significant difference regarding the hs-CRP, IL-8 and TNF-α levels at baseline. In a multivariate logistic regression model, natural logarithm of IL-6 predicted excessive daytime sleepiness (odds ratio 1.26; 95% confidence interval 1.05-1.50; p=0.011) adjusted for age, sex, BMI, TST, AHI, ODI, and NT-proBNP.

Conclusions: In this revascularized CAD population studied, the nonsleepy OSA phenotype had shorter sleep time, increased NT-proBNP and decreased LVEF, which might be related to increased sympathetic activation. IL-6 seems to be an important factor in mediating sleepiness through low-grade inflammation in CAD patients with concomitant OSA.

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CAN WE TRULY CHANGE FROM POLYSOMNOGRAPHY TO POLYGRAPHY IN OBSTRUCTIVE SLEEP APNEA? A COMPARISON BETWEEN THESE TO LEVELS OF SLEEP STUDIES IN A POPULATION OF PATIENTS WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: Polygraphy (PG) or polysomnography (PSG) - sleep studies level III and I, respectively, can be used to diagnose sleep apnea. The first focuses exclusively on respiratory parameters that are analyzed as if the entire study was done with the patient sleeping. The second involves a multi-parameter monitoring, in which respiratory variables are analyzed only during sleep, excluding wakefulness in the apnea/hypopnea index (AHI) and respiratory disturbance index (RDI) determination.

Aim: Determine whether PG is a viable and accurate alternative to PSG in the classification of OSAS.

Materials and methods: A total of 90 sleep studies (scoring performed by the same somnologist) with AHI/RDI>5/h were analyzed using the following methodology: conventional PSG scoring (according to AASM 2007) vs. scoring of the same exam as PG (the EEG was staged as sleep from the lights off to lights on). The scoring of respiratory parameters in this last exam was also performed according to AASM 2007. The OSAS was classified as mild, moderate and severe, according to the following values: AHI/RDI 5-14.9/h, 15-29.9/h and ≥30/h, respectively.

Results: Using PSG, we found that 33.3% of the exams were diagnosed as mild, 32.2% moderate, and 34.5% severe. For PG 1.1% were negative, 37.8% mild, 37.8% moderate and 23.3% severe. These differences were statistically significant (Wilcoxon test, p-value 0.000376). As we analyze sensitivity and specificity, we found that 10% of individuals with mild apnea were classified in other categories of the disease and 24% of those classified as mild through PG were actually moderate. In moderate OSAS the results were even less consistent: 24% of the exams in PG were classified as mild and 39% in PG were not truly moderate. In severe OSAS, 32% of the exams were erroneously classified as moderate in PG.

Conclusions: These results demonstrated that PG, although simpler and less expensive, did not classify accurately the severity of OSAS. Since the classification of severity is crucial in the therapeutic decision, the option of PG should be discussed as a method of diagnosis against these results.
Introduction: Obstructive sleep apnea syndrome (OSAS) prevalence increases with age. The elderly are referred more and more often to sleep units. However, the quality of sleep and the cost-effectiveness of polysomnography in older people are poorly understood.

Goals: To analyze the efficiency and structure of sleep, as well as the percentage of invalid polysomnography studies in a sleep unit in patients > 65 years and > 75 years compared to the rest of patients.

Materials and methods: In our retrospective descriptive observational study we reviewed polysomnographic studies performed consecutively between January 2012 and December 2015. The tests were divided into three age groups (< 65, 65-75, > 75). The symptoms, antecedents, anthropometric data and polysomnographic variables were evaluated. We excluded studies with a total sleep time < 180 minutes.

Results: Of the 1240 polysomnographies performed, 15.4% belonged to patients aged between 65-75 years and 4.0% to >75 years. 14.7% of the tests corresponding to patients between 65-75 years and 7.4% of the tests corresponding to the > 75 year-old group were not valid, compared to 4.5% of the tests corresponding to the < 65 year-old group (p < 0.001). There were no differences in gender or in degree of obesity between groups. Comorbidity increased with age, whereas symptoms of OSAS decreased, except for nocturia. Sleep latency, % N1, AHI and CT 90 increased with the age; however REM sleep and sleep efficiency decreased.

Conclusions: Although the percentage of tests is not very high in patients >65 years, polysomnography is effective and well tolerated by most patients. Age and OSAS severity may explain, in part, differences in sleep structure.
EVOLUTION OF SLEEP ARCHITECTURE AND LEVEL OF ALERTNESS MEASURED BY MWT IN APNEIC PATIENTS TREATED BY GENIOGLOSSUS STIMULATION (INSPIRE ® THERAPY)

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Introduction: Genioglossus stimulation (Inspire ® therapy) is a novel therapy for patients suffering of obstructive sleep apnea syndrome (OSAS). It has proven its efficacy in reducing apnea-hypopnea index (IAH) but the impact on sleep architecture and level of alertness has been poorly investigated. Thus the aims of this study were: i) to compare sleep architecture and level of alertness before therapy and 6 months after implantation and ii) to explore the relationship between changes in sleep architecture and in level of alertness, in patients with severe OSAS.

Materials and methods: Ten patients who received Genioglossus stimulation (Inspire ® therapy) were included. Treatment outcome was evaluated 6 months after surgery. Data collection included demographics, body mass index (BMI), Polysomnigraphic (PSG) parameters (apnea hypopnea index - AHI -, arousal parameter, and sleep patterns) and level of alertness (Epworth sleepiness score - ESS - and mean sleep latency on the Maintenance of Wakefulness Test - MWT -).

Results: The mean age was 52.0 years ± 9.4, all patients were male. Mean BMI was 28.8 kg/m² ± 3.3. The mean pre-implantation AHI of 46.7/h±12.2 is reduced to 14.5/h±8.9 at 6 months post-implantation (p < 0.001). A reduction of the arousal index (40.3/h±14.7 Vs 11/h±11.1, p< 0.001) and of the duration of Wake after sleep onset (WASO) (71.4min±32.4 Vs 53.4min±13.5, p=0.06) are observed. The sleep efficiency did not change during the observation period. The amount of time spent in N1-sleep is reduced from 9.7% at baseline to 3.7% at 6 months post-implantation (p=0.04). The amount of time spent in N2-, N3- and REM sleep did not change during the observation period. Level of alertness was improved with the ESS reduced from 15.9±3.5 to 10.0±6.1 (p=0.01) and the mean MWT latency improved from 25.0±12.8 to 36.8±7.0 (p=0.004). AHI improvement is not correlated to MWT scores changes but there is a significant relationship between WASO time and level of alertness (r=0.73, p=0.01). The more the WASO time was reduced, the less was the improvement on MWT scores.

Conclusions: Six months post treatment by Genioglossus stimulation (Inspire ® therapy) significant changes in sleep architecture in our patients are observed (amount time spent in N1-Sleep and WASO). The increase of WASO, but not the reduction of AHI, is associated with an improved level of alertness on MWT. This result suggests a complex relationship between reduction of AHI, sleep architecture change, and level of alertness in patients treated with nocturnal Genioglossus stimulation. Further studies are needed to investigate this relationship and to optimize Inspire ® therapy not only on the AHI reduction but also on sleep architecture.

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Sleep Breathing Disorders
Board #135: P1 - Monday

PAIN DRAWING CHARACTERISTICS AND RISK FOR SLEEP BREATHING DISORDERS IN AN OROFACIAL PAIN SERVICE

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Introduction: Subjects living with chronic pain are at risk for developing sleep breathing disorders (SBD). Altered sleep modifies the perception and reported intensity of pain. Many tools exist to evaluate pain, including validated scales and pain drawings. Pain drawings are associated to psychological profiles and prognostic variables in published studies on nociceptive lower back or peripheral pain. The utility of pain drawings in the orofacial pain area may be associated to disability, pain intensity, and risk for altered sleep. This study evaluates retrospectively the pain drawing characteristics (number of sites, number of muscles, surface pain drawing) of subjects presenting to an orofacial pain service and their association with risk for SBD, including daytime sleepiness and obstructive sleep apnea (OSA).

Materials and methods: An Institutional Review Board approved protocol was designed to perform the study. Records from subjects presenting to an orofacial pain service between November 2013 and March 2017, were reviewed and data extracted describing the pain characteristics (intensity, description, frequency, pattern, type), demographics, clinical diagnosis. All subjects completed SBD screening tools including the Epworth Scale, Stop Bang, Berlin questionnaires. Pain drawings were scanned and digitally standardized using Image J software. Measurements were done electronically on a group of five calibrated computers/screens. Analyses included descriptive statistics, frequency distributions, histogram, scatterplots, student t-test and ANOVA or non-parametric alternatives. Investigators were calibrated with 40 drawings until acceptable reliability (inter/intra examiner) was reached.

Results: Total number of subjects was 345. The majority of subjects were female (n=272), mean sample age 48.2 (46.2:50.2) 95%CI, 25% had constant pain, mean pain in the past six months was moderate 6.2 (5.9:6.5),95%CI. 47.8% reported no specific daily pattern to the pain. Clinical diagnoses were 56.5% muscular diagnosis, 19.1% articular, 15.4% inflammatory, 8.4% odontogenic, 23.2% neuropathic, 6.7% primary headache, 5.5% burning mouth syndrome (many were combined diagnoses). Pain drawing area was reported as the shaded proportion of total head and neck area. 160 subjects were at risk for SBD. The prevalence of suspected OSA was 40.8%. Reported painful sites, based on anatomic distribution, were a mean of 6.43 (5.8:7) 95%CI. Reported painful muscles, based on major muscular groups, were a mean of 6.44 (5.7:7.1). In general, pain drawings were focused to the areas of pain, with few exceptions. There was a significant association between self reported lack of quality sleep (dichotomous) and risk for SBD (p=0.01). There was a statistically significant trend between total pain surface and risk for SBD (p=0.07 test of trend), a marginal significant association between total pain surface and risk for daytime sleepiness (p=0.05), and a significant association between total pain surface and OSA (p=0.03: Berlin).

Conclusions: This study reported interesting trends and pilot associations between pain drawing characteristics and risk for SBD. Pain drawings in head and neck pain models may be useful tools to characterize subjects with comorbid OSA and detect daytime sleepiness. The high prevalence of subjects at risk for OSA in this cohort demands careful consideration of SBD screening in clinical pain practice.
USE OF NON INVASIVE VENTILATION TO TREAT SEVERE HYPOVENTILATION SYNDROME AND OBSTRUCTIVE SLEEP APNEA CASE

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**Introduction:** Hypoventilation syndrome (HS) is defined by the coexistence of obesity, daytime hypoventilation, and sleep-disordered breathing. It is known that 90% of patients also present obstructive sleep apnea syndrome (OSAS). Patients with HS, usually have more hospitalizations, morbidity and early mortality as well as poor quality of life. The use of noninvasive ventilation (NIV) is a useful therapeutic support method in the treatment of HS resulting in improved gasometric parameters, exercise capacity and quality of life. The aim of this study is to describe an unusual case of severe chronic hypoventilation syndrome associated with moderate OSAS (17 ev/h), hemodynamically stable and without significant signs of narcosis or complaints. **Materials and methods:**

**Results:** An 83-year-old, in a wheelchair, lucid, oriented, afebrile, with daytime somnolence and recurrent morning headache was hospitalized for treatment of chronic HS exacerbation. Pulmonary hypertension (PH = 65 mmHg), obese (BMI = 31 kg / m²), arterial gasometry (pH = 7.28, PO₂ = 69.4 mmHg, PCO₂ = 85 mmHg, total CO₂ = 36.2 mmHg / L, BE = 9.5 mmol / L and SaO₂ = 91.7%), SaO₂ in ambient air = 83%; Thoracic Tomography: bilateral pleural effusion and signs of atelectasis in bases; Spirometry = severe restrictive disorder with low terminal flows (FEF = 570 mL-21%, FEF₁ = 421 mL-23% and Tiffeneau index = 73%) ECHO (EF = 64%). Drug treatment included antihypertensive (AT₁ receptor antagonist, loop diuretic) anti-lipomiant, anti-coagulant. The use of VNI (Bi-level-BIPAP SYNCHRONY ™) in volume and pressure-assured (AVAPS) with adjustments every two days based on record of expired volumes and arterial blood gas analysis. The last parameters used were PS = 25, PEEP = 12, TV = 10 mL / kg, I: E = 2: 1, mandatory frequency of 16, associated with supplemental oxygen = 1.5 L / min) during the day 4 hours of use) and sleeping period (mean of 6 hours / night).

**Results:** There was a gradual improvement in the gasometric indexes as well as a report of an important improvement in somnolence and daytime headache. The first gasometry performed at dawn with the patient in the lying position showed pH = 7.28, PO₂ = 79.3mmHg, PCO₂ = 82.4mmHg, total CO₂ = 33.4 mmol / L, BE = 7.4 mmol / L and SO₂ = 94%) after 1 week of NIV. There was a significant improvement after 2 weeks of NIV use as demonstrated in the gasometry in the lying position (pH = 7.34, PO₂ = 73.3mmHg, PCO₂ = 70 mmHg, total CO₂ = 31.8 mmol / L, BE = 7.2 mmol / L and SO₂ = 94%) while in the seated position was observed (pH = 7.35, PO₂ = 73.3mmHg, PCO₂ = 59.3mmHg, total CO₂ = 27.8 mmol / L, BE = 4.1 mmol/L and SO₂ = 94%).

**Conclusions:** The use of NIV in AVAPS mode was effective in reversing respiratory acidosis and severe hypercapnia in a chronic severe HS patient.

**Acknowledgements:** University of Itaúna
PREVALENCE OF OBSTRUCTIVE SLEEP APNEA USING THE STOP-BANG QUESTIONNAIRE IN POLISH POPULATION

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Introduction: Obstructive sleep apnea (OSA) is a common disorder with still growing incidence. Although OSA can be present without clinical symptoms in most cases it is associated with clinical manifestations such as excessive daytime sleepiness, decreased concentration, unrefreshing sleep and fatigue. These symptoms among other factors are basis for screening questionnaires. STOP-BANG questionnaire includes eight dichotomous (yes/no) questions related to the clinical features of sleep apnea and physical examination. Patients can be classified for their OSA risk based on Stop-Bang score. In our study we analyzed the STOP BANG results in Polish subjects participating in the Prospective Urban Rural Epidemiology (PURE) study, which is an ongoing population cohort study of individuals from urban and rural communities from 21 countries.

Materials and methods: 613 subjects (227 men and 386 women) between 29 and 81 years old, participating in the PURE study filled the STOP-BANG questionnaire. Scores between 3-5 were considered as a moderate risk for OSA and scores between 6-8 as a high risk for OSA. In screened population 271 had STOP-BANG score 3 to 5 and 112 had score 6-8. Mean value of scoring in moderate risk group was 3.99 ± 0.91 and in high risk group 6.53 ± 0.63 Moderate risk scoring was observed among 92 men (40.53 % of all men) and 179 women (46.37% of all women). High risk scoring was observed among 59 men (25.99% of all men) and 53 women (13.73% of all women). Mean age of both sexes was similar in moderate risk group ( 60.7 in men vs 60.4 in women) as well as in high risk group (61.61 vs 61.19 respectively) Mean BMI in group with 3-5 score was 26.92±3.35 in men and 27.83 ± 5.89 in women while in high risk group 30.01±4.72 in men and 31.11 ± 6.83 in women.

Discussion: This is the first large scale study using this validated OSA screening tool in community based sample in Poland. Available epidemiological data assessing the prevalence OSA in different countries varies in methodology, size and characteristic of group chosen and therefore are hard to compare. Sensitivity of STOP-BANG for scores 3 and above is estimated about 84% in detecting any sleep apnea (AHI > 5 events/h), 93% in detecting moderate to severe sleep apnea (AHI > 15 events/h), and over 97% in detecting severe sleep apnea (AHI > 30 events/h). Corresponding specificities are about 56%, 43%, and 37%. Based on our results over half of adult Polish population is at moderate to high risk for OSA ( 66.52% of men and 60.1% of women). Low specificity of STOP-BANG limits its predictive value as a screening tool for OSA. Based on previous studies we can assume that half of our high risk group will be diagnosed for sleep apnea.

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**Introduction:** Systemic Inflammation has been documented in obstructive sleep apnea (OSA). However, information on childhood OSA and systemic inflammation is limited. This study aimed to document relation between OSA in obese children and inflammatory markers.

**Material and methods:** In this cross-sectional study we enrolled obese children (body mass index (BMI > 25 kg/m²) identified by screening in school or from pediatric outpatient services of our institution. We recorded demographic and clinical details, measured anthropometric parameters, performed body composition and took 2 ml blood for estimation of inflammatory cytokines such as interleukin (IL)-6, IL-8, IL-10 levels in all enrolled subjects. Polysomnography (PSG) was performed.

**Results:** A total of 110 children (mean age, male/female) were enrolled. OSA was documented by PSG in 40% of these children. We observed significantly high values of body mass index, waist circumference, % body fat, fasting blood glucose, total cholesterol, serum triglyceride, alanine transaminase, alkaline phosphate, fasting insulin and homeostatic model assessment– insulin resistance in children with OSA as compared to obese children without OSA. Inflammatory markers IL-6, IL-8 levels were also significantly higher in this group (p < .05). There was strong positive correlation of IL-6, IL-8, with BMI, apnea hypopnia index and fasting insulin.

**Conclusion:** Children with OSA have increased obesity, insulin resistance and systemic inflammation. This may predispose them to metabolic syndrome and diabetes in later life.

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**THE ASSOCIATION BETWEEN OSA (OBSTRUCTIVE SLEEP APNEA) AND ASTHMA**

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**Introduction:** Asthma and obstructive sleep apnea (OSA) are common pulmonary diseases worldwide. The simultaneous occurrence of asthma and OSA, referred to as Alternate Overlap Syndrome was considered a random coexistence in the past. Now, several studies have shown data supporting dual interaction between asthma and OSA. Hence, aim of the present study was to polysomnographically ascertain the prevalence of OSA and assess its implications in patients of asthma and compare it with patients of asthma without OSA.

**Materials and methods:** Thirty diagnosed patients of moderate to severe asthma of age ≥18 years presenting to outpatient clinic of Vallabhbbhai Patel Chest Institute, University of Delhi, India within a duration of one year (2016-2017) were screened for OSA using a self-reported questionnaire (STOP BANG questionnaire). These patients underwent detailed clinical and laboratory evaluation followed by Type 1 diagnostic polysomnography (PSG).

**Results:** Out of 30 asthma cases there were 14(46.6%) male patients and 16 (53.3%) female patients and the mean age of patients was 46 years. After polysomnography OSA of varying severity was found in 15 (50%) out of 30 asthma cases who were screened positive with sleep related questionnaire. Among 30 asthma cases there were 21 obese (70%) and 9 (30%) non-obese patients. Out of 21 obese patients 10 (47%) were found to have OSA and out of 9 non-obese patients 5 (55%) were found to have OSA. There were 15(50%) moderate and severe asthma cases each. In moderate asthmatics 6 out of 15 patients (40%) were diagnosed as OSA and in severe asthmatics 9 out of 15 (60%) were diagnosed as OSA. No correlation of OSA was found with parameters of PFT (pulmonary function test) (p value >0.05). It was found that sleep period, duration of time spent in REM (Rapid Eye Movement) and stage N3 sleep decreases while duration of time spent in stage N1, sleep latency to REM, PLMI (periodic limb movement index) increases significantly with the presence and severity of OSA. The overall sleep efficiency was poor between both the groups (asthma with OSA and asthma without OSA). No statistically significant difference could be found for sleep onset time, number of awakenings, sleep latency to N1, N2, N3 and wake after sleep onset (WASO) between the two groups. On analysis of pulse oximetry values the mean, lowest, wake, NREM and REM saturations were found to be on lower side in patients of asthma with OSA. The level of inflammatory markers (IL4, IL5, IL6, IL13, hSCRP) and FeNO was also done and no statistically significant difference could be found between the two groups. The patients of asthma with OSA fared poorly in asthma control test (ACT) questionnaire and quality of life questionnaire i.e SGRQ in comparison to those without OSA (p value < 0.01).

**Conclusions:** Our study indicates high prevalence of OSA among patients of moderate to severe asthma which leads to poor quality of life. This highlights the need of maintaining high index of suspicion in identifying patients suspected of having OSA among patients of moderate to severe asthma.

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EFFECT OF ADENOTONSILLECTOMY ON CENTRAL APNEA INDEX IN CHILDREN WITH OBSTRUCTIVE SLEEP APNEA

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Introduction: In children with Obstructive Sleep Apnea (OSA), polysomnogram often shows central apnea events. Central apnoea index (CAI) is defined as the number of central apneas per hour of sleep. CAI ≥1 is considered abnormal in children. In children with OSA, significant improvement in CAI has been reported post-adenotonsillectomy.

Aim: The aim of the study was to evaluate the change in CAI post-adenotonsillectomy in children with OSA and its relation to severity of OSA pre-adenotonsillectomy.

Methods: A retrospective data analysis was performed on children aged 1-16 years, who had overnight polysomnogram (PSG) for suspected OSA between the years 2007 to 2016, at KK Women's and Children's Hospital, Singapore. Children who were diagnosed to have OSA and underwent PSG before and after adenotonsillectomy were included in the study. Children with craniofacial abnormalities, neuromuscular diseases, underlying syndromes or known genetic conditions were excluded from the study. The PSGs were conducted and scored as per the American Academy of Sleep Medicine (AASM) scoring rules. Demographic details and polysomnographic data were analysed.

Results: A total of 128 children were studied. The mean (SD) age was 8.9 (3.9) years and 83 (64.8%) were males. Ethnicity wise, 67 (52.4%) were Chinese, 39 (30.4%) were Malay, 17 (13.3%) were Indians and 5 (3.9%) were of other races. 20 (15.6%) children had mild OSA, 23 (18%) had moderate OSA and 85 (66.4%) had severe OSA. BMI (median [IQR]) was 18.5 (16.5-22.5) in mild OSA, 22.3 (16.7-28.5) in moderate OSA and 24.3 (18.4-29) in severe OSA. The median (IQR) OAI pre-adenotonsillectomy was 4.3 (3.2-5.6) in mild OSA, 8.5 (6.7-9.8) in moderate OSA and 24.4 (16.3-38.5) in severe OSA. The median (IQR) OAI post-adenotonsillectomy was 2.6 (1.2-4.8) in mild OSA, 3.8 (3.3-9.6) in moderate OSA and 5.9 (3.3-16.1) in severe OSA. There was no significant difference in the median [IQR] CAI pre-adenotonsillectomy between the three groups (mild OSA: 0.4 [0.1-1.0], moderate OSA: 1.1 [0.5-2.1] and severe OSA: 0.7 [0.2-1.8], p=0.09). The median [IQR] CAI post-adenotonsillectomy also was not significantly different between the groups (mild OSA: 0.5 [0.2-1.3], moderate OSA: 0.6 [0.1-1.3] and severe OSA: 0.6 [0.2-1.5], p=0.79). The change in CAI pre and post adenotonsillectomy was not statistically significant in all three OSA groups.

Conclusions: The central apnea index (CAI) was within normal limits both before and after adenotonsillectomy, irrespective of baseline OSA severity. Moreover, the change in CAI after adenotonsillectomy compared to baseline was not significant, irrespective of pre-adenotonsillectomy OSA severity. Our data is inconsistent with the published literature and it remains to be determined whether potential influence of racial and genetic factors on control of breathing account for our observations.
Sleep Breathing Disorders
Board #113: P2 - Monday
SLEEP RELATED BREATHING DISORDER ASSOCIATED WITH ARNOLD CHIARI MALFORMATION TYPE I: A CASE REPORT

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Introduction: Arnold Chiari malformation type I (CM-I) is an extremely rare congenital disorder with a mere incidence 0.1 to 0.5%. Type 1 Chiari malformation was defined as elongation of the cerebellar tonsils (> 6 mm) below the foramen magnum. Mixed sleep related breathing disorder (SRDB) is an exceedingly uncommon CM-I complication with a prevalence of merely 8-10%. Central sleep apnea might be caused by dysfunction of the respiratory center, whilst hypopneas could be caused by compression of pontomedullary nuclei resulted in impairment of the pharyngeal and laryngeal muscle.

Materials and methods: A 32-year old male patient who presented progressive gasping and breathing cessation, especially during sleep time since two years ago. He had been experiencing headache and fatigue during daytime, hoarseness, also radiating bilateral hand paraesthesia. The patient's wife reported snoring during night.

Results: Initial neurologic examination revealed hypoesthesia along C6-C8 roots dermatome accompanied with valsava induced neck pain. A magnetic resonance imaging (MRI) scan revealed 9 mm cerebellar tonsils herniation below the foramen magnum in accordance with Chiari malformation type I. Flexible laryngoscopy confirmed a unilateral vocal cord palsy. Polysomnography showed poor sleep efficiency (14.16%), with 23 respiratory events consisting of 12 central apnea and 11 hypopneas, also apnea-hypopnea index (AHI) of 29.68/h. Patient underwent posterior decompression surgery, and he reported significant improvement in daytime headache and fatigue.

Conclusions: Central and obstructive sleep disorder breathing is uncommon in young adults. A precise investigation must be carried out to find possible pathologies.

Acknowledgements: Thanks to all supervisors in Neurology Department of Brawijaya University
Introduction: Obstructive Sleep Apnea (OSA) is common yet unrecognized medical problem with significant morbidity. It is commonly considered an Obesity related problem, although not uncommon in non-obese patients of Indian origin. Currently, the World Health Organization (WHO) Western BMI criteria is mainly used to classify obesity levels. Indian population has a different association between Body Mass Index (BMI), percentage of body fat and health risks compared to the western population. Due to these ethnic variations, applying the appropriate criteria - the WHO recommendation for appropriate BMI for Asian population - would be more suitable for identifying obesity in Indians, and hence to identify those at risk for OSA.

We aimed to explore the discrepancy that could arise by applying the WHO Western BMI criteria to the Indian population which might misclassify and exclude those who are at risk for obesity related OSA.

Materials and methods: This is a retrospective study of patients presenting to Nithra Institute of sleep sciences, Chennai, India, from May 2015 to May 2017. Patients who underwent sleep study and diagnosed with OSA were included. Data pertaining to demographics, BMI and severity of OSA were collected and analyzed. Patients were classified into different weight bands based on both the Western and Asian BMI criteria and compared. Stratification based on severity of OSA and its association with both the BMI classifications were also analyzed.

Results: During the study period, a total of 904 patients were suspected with OSA, out of which 787 patients underwent sleep study. Of these, 754 patients were diagnosed to have OSA and were included in the study. {626 Males (83%) / 128 Females (16.9%); mean age - 50.7 ± 28.6 years}. Out of the 754 patients, 735 (97.5%) patients were classified as overweight/obese as per Asian BMI whereas only 695 (92.2%) patients were classified as overweight/obese as per Western BMI classification. With respect to the association of the BMI categories with the severity of OSA, there were significant differences between the number of severe OSA patients (467) falling in each weight band of Asian BMI when compared to Western BMI - 10 patients (2.1%) in the normal weight category as against 30 (6.4%), 72 (15.4%) in the overweight category against 156 (33.4%), 327 (70%) in the obese/severe obese category as against 246 (52.7%) and 58 (12.4%) in the morbid obese category as against 35 (7.5%).

Conclusion: OSA is underestimated in Indian population in over 5% of cases when Western BMI criteria was applied. Using the appropriate Asian BMI for the Indian population, may help to identify obese patients and avoid missing out those at the risk for OSA.
Introduction: The purpose of this lecture is to propose a different approach to the nature of the breathing sleep disorders. The start of the nasal breathing sets an impulse genetically determined to aerate the face cavities, that in turn at their growth, will contribute to create an useful trafficable space from the air, during the middle face development, mainly from the toddler until the onset of adolescence.

Materials and methods: Nose function not only has a direct role in upper airway breathing, but also a long term impact on the development of the middle face because it allows the major forces which determine the size and development of the naso-maxillary process and maxillary sinuses due to the mechanotransduction system created by the strain and stress of the skull through strength of the muscles of the tongue, strong chewing and swallowing. Therefore, any disorder that causes permanent difficulty to nasal airflow may lead to mouth breathing, which in turn decreases the nasal airway growth stimulation of the sinus cavities, altering the development of the middle and inferior facial thirds.

Results: As a chronic situation this condition will end in the hypo development of the middle face and the required amplitude that the child and the future adult will need for a normal breathing, increasing the inspiratory effort through the day, the appearance at night of the sleep breathing disorders and finally the obstructive sleep apnea / hypopnea syndrome.

Conclusions: It is accepted that 60% of facial development occurs in the first four to six years of life. There is a real necessity to go further in the early diagnosis and to take preventive solutions through the creation of a multidisciplinary team of pediatricians, otorhinolaryngologists and orthodontic dentists that make this public health problem easier to treat or even desapear it at all. We propose the creation of a nosological entity that encompasses this concept under the term of "nasal obstructive syndrome in pediatrics"
Introduction: Polysomnography is the gold standard for the diagnosis of obstructive sleep apnea (OSA). However, cardiorespiratory studies (CR) have progressively been used as a substitute for PSG due to their lower cost, less time-consumption and simpler analysis. Our aim was to analyze the impact of using a CR study compared to a PSG in the diagnosis of OSA considering different pretest probabilities and to predict the impact on the decision to treat.

Materials and methods: A prospective, randomized and blind study was performed with 80 consecutive patients (71% male, mean age 52 [±14] years, mean BMI of 28,8 [±4,6] kg/m²) which were referred to our Sleep Medicine Center for a home polysomnography (79% because of clinical suspicion of sleep apnea). Two manual analysis of the same sleep study were performed by independent and blinded technicians, one analysis was made of the full exam and the other of only the respiratory parameters (as a cardiorespiratory study). Pretest probability for sleep apnea was determined with the STOP-Bang questionnaire, low was defined as a score 1-2, moderate as a score 3-4 and high as a score of 5-8. Decision to treat was defined as an apnea-hypopnea index (AHI) greater or equal to 15/h and an AHI greater or equal to 5/h associated with the presence of hypertension or tiredness/sleepiness. Statistical analysis was performed with SPSS V.24. Student's paired t test was used to compare mean AHI and oxygen desaturation index (ODI). Fischer's test was used to compare qualitative variables.

Results: Using PSG, OSA (AHI ≥5/h) was present in 75 patients (94%), 18 (23%) with mild, 24 (30%) with moderate and 33 (41%) with severe OSA. Using CR, OSA was diagnosed in less patients (84%) (p=0,002) and severity was wrongly classified in 56% of those with OSA mainly due to less severe disease (22%) (p>0,001). Mean AHI with PSG was 28,9 (±19,5)/h, higher than with CR (19,9 [±16,3]/h) (p>0,001), including in those with low (24%) (p=0,001), moderate (44%) (p>0,001) and high (32%) (p>0,001) pretest probability for OSA with mean AHI differences of -5,2 (±5,7), -9,6 (±5,1) and -10,8 (±7,0), respectively. ODI was not significantly different between PSG and CR with 20,1(±17,6)/h and 19,8 (±16,0)/h, respectively. Decision do treat OSA would be made in 71 patients (95% of those with OSA) with PSG, significantly higher (p>0,001) than with CR where only 63 patients (84% of those with OSA) would receive treatment. Decision to treat differed in 8 patients, who had low (50%) and moderate pretest probability (50%) for OSA of which 7 patients (88%) had mild OSA and 1 had moderate OSA (AHI= 25/h). Different decision to treat was significantly associated with a low and moderate pretest probability (p=0,036).

Conclusions: Cardiorespiratory sleep study failed to diagnose OSA in 10% and wrongly classified the severity in 56% by measuring a significantly lower AHI in all pretest probability groups. Decision to treat differed in 11% of the patients and was significantly associated with a low and moderate pretest probability.
**Sleep Breathing Disorders**  
**Board #128: P6 - Wednesday**  
**SHORT SLEEP DURATION IS ASSOCIATED WITH AN INCREASED PREVALENCE OF HYPERTENSION IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA**

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**Introduction:** Short sleep duration and obstructive sleep apnea (OSA) are both associated with an increased risk of hypertension. We aimed to explore whether polysomnography-determined sleep duration modifies the relationship between OSA and prevalent hypertension.

**Materials and methods:** A total of 7048 patients with apnea-hypopnea index (AHI) ≥ 5/h were recruited into this study (84.7% males, mean age = 45.34 ± 11.78 years). Hypertension was defined based either on direct blood pressure measures or on diagnosis by a physician. Patients with sleep duration ≤ 6 h were considered to be short sleepers. Logistic regression procedures were performed to determine the independent association between sleep duration and hypertension in patients with OSA.

**Results:** A 53.8% was found to have hypertension in total observed OSA patients. Considering patients with sleep duration more than 6 hours as reference (n=6032), the odds ratio (OR) (95% confidence intervals) for having hypertension was 1.54 (1.31-1.81) in short sleepers with OSA (n=1016) after adjustment for age, sex, body mass index, diabetes, current smoking, drinking, Epworth sleep scale, time in bed, sleep architecture, arousal index, AHI, and lowest-SaO2. In stratified analyses, the association of hypertension with short sleep duration was seen among sexes, younger and older ages, and both obese and non-obese patients with OSA.

**Conclusions:** Both OSA and hypertension are age-related illnesses. It is important to note that the average age of patients in our study was approximately 10 years younger compared to most of similar observational studies in Caucasian patients. Through this large cross-sectional study in 7048 consecutive Chinese patients with unique age, we obtained that short sleep duration is associated with an increased prevalence of hypertension in patients with OSA.
Sleep Breathing Disorders
Board #129: P6 - Wednesday

GENETIC, CLINICAL AND TREATMENT HETEROGENEITY OF THREE PATIENTS WITH CONGENITAL CENTRAL HYPOVENTILATION SYNDROME

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Introduction: Congenital central hypoventilation syndrome (CCHS) is a rare disorder characterized by sleep-related hypoventilation predominantly during NREM sleep. It’s caused by mutations in PHOX2B, in most cases due to heterozygous expansions of a 20-polyalanine tract on exon 3 (PARMs mutations). Usually the first symptoms appear in the neonatal period, but few cases have a late-onset (LO-CHS).

Material and methods: describe the clinical features, polysomnography (PSG) reports, genetic defects and treatment of 3 patients with CCHS.

Results:
Case 1 - a 13-year-old male who had neonatal central apneas leading to mechanical ventilation during the first 20 days of life. After extubation he presented hypercapnia and hypoxemia predominantly during sleep. PSG showed reduced flow, hypercapnia and hypoxemia. Genetic testing for PHOX2B revealed a short PARM mutation 20/25 which confirmed the diagnosis of CCHS. He is being treated with non-invasive ventilation (NIV) since neonatal period. His growth is normal and no cognitive deficits were found despite poor school performance.

Case 2 - a 9-year-old male who began mechanical ventilation 20 minutes after birth because of apneas. He was submitted to tracheostomy at 2-month-old due to ventilation dependency that currently maintains. He also presented macrocephaly with skull deformation and facial dysmorphism, ventricular septal defect and pulmonary stenosis, right bundle branch block, epilepsy, cognitive delay, strabismus, eating difficulties and poor weight gain. Genetic testing was positive for a short PARM mutation 20/26 in PHOX2B that confirmed the diagnosis of CCHS. Superior vena cava syndrome due to thrombosis in central venous catheter was diagnosed at 4 years old.

Case 3 - a 8-year-old female admitted to the intensive care at 9, 11 and 13 months suffering from severe hypercapnic respiratory failure during viral respiratory infections. She had hypercapnia during sleep that improved with wakefulness. CCHS was confirmed genetically (heterozygous insertion of an adenine at position 23, leading to a premature stop codon in exon 1 of the PHOX2B gene). Hypoventilation was observed by PSG, with no autonomic response to declining oxygen or increasing carbon dioxide values. The patient has been on NIV during sleep since 13 months of age, showing good growth and neurocognitive development.

Conclusions: In patients with shorter PARM mutations like 20/25 and 20/26 clinical abnormalities tend to be mild. Despite this, patient 2 has a more severe phenotype. Autonomic dysfunction in vasculature that can occur in CCHS may have precipitated thrombosis in this case. A greater awareness is required to diagnose LO-CHS that should be suspected in the presence of severe hypercapnia during respiratory infections and significant difference in CO2 between sleep and wakefulness. LO-CHS cases are usually related to PHOX2B PARM 20/24 or 20/25 genotypes. Our patient with LO-CHS has a mutation not previously described. Early diagnosis of CCHS and institution of adequate ventilatory support are crucial. Ventilation by tracheostomy is considered the safest way to manage these patients, but NIV with a mask has been proved effective as illustrated by the two children presented.
CASE OF OBSTRUCTIVE SLEEP APNEA WITH SLEEP WALKING

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Introduction: Obstructive sleep apnea is a frequently diagnosed sleep disorder in general population. It can occur in any age groups, and is related to increases in other medical and sleep comorbidities. Sleep walking, which is categorized as NREM-related parasomnia, is usually considered a normal developmental sleep phenomenon in children. But it can also occur precipitating factors such as sleep disorders causing frequent arousal, obstructive sleep apnea (OSA).

Materials and methods: A case of obstructive sleep apnea with somnambulism was diagnosed on January 2015, and was reviewed retrospectively.

Results: A 19-year-old high school student was diagnosed with OSA, and he had a history of sleep walking. The patient reported severe habitual snoring, breathing interruptions during patient’s sleep and complaints of daytime sleepiness. Also, his parents observed the patient’s frequent sleep walking episodes and complex behavioral symptoms during the night. The polysomnography (PSG) results demonstrated apnea-hypopnea index (AHI) of 15.3, frequently aroused movements in PSG video. The multiple sleep latency test (MSLT) study was normal except for shortened sleep latency of 3.3 min. Such shortened sleep latency may be accounted for OSA. After a continuous positive airway pressure (CPAP) treatment for his OSA and clonazepam for sleep fragmentation, the patient’s symptoms were improved and he was able to sleep without sleep walking and complex behaviors.

Conclusions: Disorders related to arousal can be precipitating factors of NREM parasomnia. Therefore, it is paramount that when the patient has frequent arousals from sleep, the clinician must obtain a detail history on another comorbid sleep disorders.
**Sleep Breathing Disorders**  
*Board #131: P6 - Wednesday*  
**DIFFERENCES IN SLEEP QUALITY AND CLINICAL CHARACTERISTICS OF PATIENTS STUDIED IN A SLEEP UNIT ACCORDING TO GENDER**

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**Introduction:** Patients referred to sleep units for the study of OSAS are mostly men. It is not known if there are differences in the structure of sleep according to gender, well established clinical differences or comorbidities. To analyze the differences according to gender, polysomnographic variables, clinical characteristics and comorbidities in patients referred to our Sleep Unit for suspected OSAS.

**Materials and methods:** In our retrospective descriptive observational study we reviewed polysomnographic studies that were performed consecutively between January 2012 and December 2015. Polysomnographic variables, clinical and anthropometric data and comorbidities were analyzed. These data were compared by gender using the corresponding statistical tests (Mann-Whitney test for quantitative variables, X-Square for qualitative variables).

**Results:** Our cohort consisted of 1337 patients (40% women). The mean age was 54 years, mean BMI was 32 kg/m2 and the mean Epworth Scale score was 11. Women had a lower weight than men (79 kg vs 86 kg, p < 0.001), and a higher BMI (32 kg / m2 vs 30 kg / m2, p < 0.001), with no differences in age or Epworth score. According to polysomnographic characteristics, it should be noted that women had a longer sleep latency (19.5% vs 16.5%, p < 0.05), but higher efficacy (80 vs 76, p < 0.001) and higher percentage of deep sleep (23% vs 20%, p < 0.001), with no differences in REM sleep. Focusing on the severity of OSAS, women’s overall AHI was lower (21 vs 27, p < 0.001), as was their AHI in supine position (24 vs 39, p < 0.001). As for symptoms, the percentage of apneas observed was lower in women (46% vs 66%, p < 0.001), while morning headache (68% vs 48%, p < 0.001) and dullness (61% Vs 51%, p < 0.05) were higher. There were no differences in the rest of symptoms such as snoring, nocturia, choking, drowsiness and ability to concentrate. Regarding comorbidities, there was a higher percentage of depression (35 vs 12, p < 0.001) and a lower incidence of ischemic heart disease (5% vs 11, p < 0.001) in women, with no difference in the percentage of arrhythmias, hypertension, heart failure, stroke, DM, DL or COPD.

**Conclusions:** Women referred for polysomnographic studies represent a high percentage in our unit (40%). In this large series of women, previous data on differences in OSAS symptoms (greater percentage of dullness and morning headaches) and comorbidities (higher percentage of depression) are confirmed with respect to men. We also found that sleep quality is somewhat better and OSAS less severe, with the same age and higher body mass index than in men.
EVALUATION OF A NEW SCREENING TOOL FOR OBSTRUCTIVE SLEEP APNOEA

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Introduction: Obstructive sleep apnoea (OSA) is a common disorder, with as many as 80% of the patients remaining undiagnosed. The need for simple screening tools for OSA is indisputable. STOP-Bang questionnaire is one of the most widely used and validated sleep questionnaires. The aim of this study was to evaluate the role of easy sleep apnoea predictor (ESAP) test, a simple neck grasp test previously described by Edmonds PJ and Edmonds LC as a screening tool for OSA and compare its' performance with STOP-Bang questionnaire.

Materials and methods: Prospective study of patients referred for unattended home sleep study with type 3 portable monitor in a Portuguese sleep clinic from July to December/2016. Demographic data, STOP-Bang questionnaire (SBQ) and easy sleep apnoea predictor (ESAP) test were assessed. A positive ESAP test was defined as the inability to place the hands around the neck and easily encircle the neck completely, as described by the authors. Contingency tables were used to evaluate screening tests performances.

Results: We evaluated 153 adult patients, 62.1% men, with mean (SD) age of 59.5 (12.8) years, BMI 31.5 (5.9) Kg/m² and epworth sleepiness scale 8.2 (5.3). Overall OSA prevalence [apnoea/hypopnoea index (AHI) ≥5.0/h] was 73.9% and moderate/severe OSA (AHI ≥15.0/h) was 40.5%. ESAP test was positive in 101 (64,7%) patients and SBQ ≥3 (intermediate and high risk patients) in 147 (96,1%). For the diagnosis of OSA (AHI ≥5.0/h) ESAP positive test and SBQ ≥3 showed respectively an accuracy of 72.5% and 77.8%, sensitivity of 76.1% and 100%, specificity of 62.5% and 15.0%, and a positive predictive value (PPV) of 85,1% and 76.9%. For the diagnosis of moderate/severe OSA (AHI ≥15.0/h) ESAP positive test and SBQ ≥3 showed respectively an accuracy of 62.7% and 44.4%, sensitivity of 85.5% and 100%, specificity of 47.3% and 6.6%, and a positive predictive value (PPV) of 52,5% and 42.2%.

Conclusions: The ESAP test is a very simple tool to use in the screening of obstructive sleep apnoea. ESAP positive test when compared with STOP-Bang questionnaire cut-off value of 3, showed similar accuracy, lower sensitivity but higher specificity and PPV for the diagnosis of OSA and moderate/severe OSA than SBQ. Because of its' simplicity and performance we consider ESAP test a useful tool for OSA screening.
AUTOMATIC ESTIMATION OF SLEEP AND WAKEFULNESS USING A SINGLE-CHANNEL EEG AND HOME POLYGRAPHY SIGNALS

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Introduction: The identification of total sleep time (TST) is crucial for Apnea and Hypopnea Index (AHI) calculation. In polysomnography (PSG), sleep/wake scoring implies the use of EEG, EOG and EMG, which are costly and time consuming. In type III home polygraphy (HPG), TST is overestimated due to the lack of electrophysiological recordings. The aim of this study is to assess the performance of an automatic sleep/wake estimation algorithm based on a single EEG channel in comparison with manual scoring of routine PSG.

Materials and methods: The study included 110 patients with an AHI between 0 and 50/h. None of these patients were under the effect of a medical treatment which could alter EEG signals. Each PSG was scored manually using AASM rules. The automatic sleep/wake scoring algorithm was based on a single lead EEG (FP2-A1) and the variability analysis of HPG signals (tracheal sounds, actimetry, light, respiratory inductive plethysmography). Optimal detection thresholds were derived for each signal using a training set. The automatic and manual scorings were then compared epoch by epoch considering two states (sleep/wake).

Results: Cohen's Kappa coefficient between the manual scoring and the proposed automatic algorithm was substantial (0.75) in separating wakefulness and sleep. The sensitivity (Sn), specificity (Sp) and the positive predictive value (PPV) for the detection of wakefulness were 80%, 95% and 81% respectively. For the detection of sleep, Sn, Sp and PPV are 95%, 80% and 95% respectively.

Conclusions: Automatic sleep/wake detection using a single lead EEG and HPG signals could be used as an efficient and cost-effective method for TST estimation.

Acknowledgements: Special thanks to the sleep laboratory technicians at the University Hospital of Angers.
Introduction: Obstructive sleep apnea is related to cardiovascular diseases. CPAP is the most effective treatment, but many patients do not use it every night.

Materials and methods: One hundred CPAP treated patients with moderate and severe sleep apnea were randomized to either withdrawal treatment for 5 days (n=50) or to continue with CPAP for 5 days (n=50). 24-hours blood pressure, arterial stiffness measured with pulse wave velocity and augmentation index, apnea-hypopnea index (Embletta), and Epworth sleepiness scale were measured at baseline and at follow-up after 5 days.

Results: Nocturnal systolic, and diastolic blood pressure was significantly higher in women who withdraw CPAP vs. control women. The systolic blood pressure difference was a mean (95% CI) of 6.4 (0.2 to 12.6) mmHg p=0.043, and diastolic blood pressure difference was 3.7 (0.1 to 7.4) mm Hg p=0.042. There was no difference in blood pressure in men who withdraw CPAP vs. controls. Augmentation index was higher in men who withdraw CPAP vs. controls 2.1 (0.01 to 4.2) p=0.049, and pulse wave velocity tended to be higher 0.30 (0.00 to 0.61) p=0.052. There was no effect on arterial stiffness in women. Apnea-hypopnea index and Epworth sleepiness scale were significantly higher in both women and men who withdraw CPAP.

Conclusions: Nocturnal blood pressure increases in women after CPAP withdrawal, and augmentation index increases in men as a sign of increased arterial stiffness increases after CPAP withdrawal. These gender differences are novel and needs attention.

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IMPORTANCE OF THE LINGUAL REEDUCATION BY THE TONGUE RIGHT POSITIONER ON THE UPPER AIRWAYS PERMEABILITY IN YOUNG ORTHODONTIC PATIENTS

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Introduction: Orofacial Myology therapy is known to induce a transverse expansion of the maxilla. It also increases nasal permeability and divides by two the number of hypopnea/apnea events per hour. Nevertheless, such treatment may be affected by low compliance, which may affect these results. Systematization of treatment with a well-tolerated device makes it possible to reinforce compliance. We wanted to verify that the lingual reeducation associated with the Tongue Right Positioner (TRP) induces the enlargement of the maxillary transverse direction, as well as the improvement of the nasal permeability and the pharyngeal diameter.

Materials and methods: 37 orthodontic patients 11.3 ± 2.4 years old were included in this study. All patients received TRP treatment for an average of 16.7 ± 2.1 months. Measurements of oro and velo-pharynx diameters from head radiographs and Peak Nasal Inspiratory Flow (PNIF) were carried out before TRP setting, the day of its removal and on average 7 months later. In parallel, we measured the maxillary molar/molar distance on dental casts performed before the TRP setting and after its removal.

Results: At the end of the TRP treatment, the anteroposterior diameters of the velo and the oropharynx increased significantly by 12.4% and 12.0%. In parallel, PNIF increased by 37.5% and the molar-molar distance increased by 3.9%. All these increases were remanent approximately 7 months after the TRP was deposited. All patients have completed their TRP treatment.

Conclusions: Lingual reeducation with a TRP increases and stabilizes transverse expansion of the maxilla and has rapid and persistent beneficial effects on nasal permeability and the anteroposterior diameter of the pharynx. Compliance to TRP treatment is high. The TRP device could be an interesting alternative for treating respiratory sleep disorders.
EFFECTS OF RENAL SYMPATHETIC DENERVATION ON APNEA-HYPOPNEA INDEXES AND ECG VARIATIONS FOR RESISTANT HYPERTENSIVE PATIENTS

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**Introduction:** Renal sympathetic denervation (RSD) is an effective management of drug-resistant hypertension. Discussions continue and data are being collected within controlled experiments in order to assess the efficiency of the RSD as a therapeutic method of sleep-related breathing disorders (SRBD).

**Materials and methods:** The effect of RSD on SRBD is evaluated utilizing data acquired in collaboration with the project "RELIEF" - "Renal Sympathetic Denervation for the Management of Chronic Hypertension" (FNUSA-ICRC, 2011-2012). Out of 28 subjects a study and a control group were formed. The study group underwent renal artery angiography in order to exclude stenosis and, in parallel, also underwent the RSD. For the control group only angiography to exclude stenosis was performed. Polysomnography (PSG) of all subjects was performed in the ICRC Cardiovascular Sleep Laboratory one day before the catheter intervention ("Measurement 1") and repeated after 6-9 months ("Measurement 2"). A digital PSG records were acquired and PSG reports followed AASM (American Academy of Sleep Medicine) methodology. During the PSG a three-channel ECG was continually recorded. The PSG records were evaluated by sleep specialists. Two aspects were studied, namely: (1) the effect of the RSD on apnea-hypopnea indexes (total, central, and obstructive) and (2) ECG changes occurring within SRBD.

**Results:** The RELIEF project made it possible to successfully recruit suitable groups of subjects for this PSG study. PSG results were obtained for 17 (60.7% of total involved) subjects in the study group and for 8 in the control group (28.6% of total). It proved useful that Measurement 2 followed Measurement 1 in approx. half a year (mean: 195 days, min: 178, max: 224). This period allowed detecting substantial differences in apnea-hypopnea indexes. All indexes for the subjects in the control group increased substantially after the above specified period. On the other hand, the apnea-hypopnea indexes for the study group seem to have different trends. The obstructive AHI seems to get lower with time while the central AHI seems to be growing. The total AHI for the study group seems to remain stable. Furthermore, some initial results were obtained for the ECG changes accompanying the SRBD. The recorded ECG amplitude and frequency characteristics were analyzed. A rather wide variability of ECG signals was detected.

**Conclusions:** It was established from the analysis of the PSG that for subjects who underwent the RSD the total AHI is not worsening as opposed to the control group subjects. Furthermore, the total AHI seems to remain stable for subjects who underwent the RSD as a result of opposite trends in obstructive AHI and central AHI. All this seems to be an interesting topic for further in-depth investigations.

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**Introduction:** Children with Prader-Willi syndrome have poor control of breathing during sleep with frequent central apneas that may be associated with obstructive sleep apnea, particularly in obese patients or during treatment with growth hormone. Current guidelines suggest do not start treatment with GH in PWS patients with OSA and/or severe obesity. In recent years it has been proposed the use of a decisional tool (POI-score) to modulate GH therapy. The score ranges from 0 to 15 and takes into account two polysomnographic parameters (SpO2 media and RDI), two ENT parameters (adenoid and tonsillar hypertrophy) and serum levels of IGF1. We report the data obtained through the application of the POI-score in a group of PWS patients initiating therapy with growth hormone.

**Materials and Methods:** Our study included 10 boys and 10 girls aged 1,6 (2,35) yrs with Prader-Willi Syndrome. 11 of them had a deletion of chromosome 15q11-13 and 9 maternal disomy of chromosome 15. The PSG, ENT evaluation and IGF1 detection in serum were performed in all patients before and 2 months after starting GH therapy. The data are reported as median (IQR). Non parametric paired signed test, chi-square and simple regression were use for statistical analysis.

**Results:** According to the POI-score value, 6 patients started GH therapy at a dose of 10 ug/kg/day, 11 at a dose of 20 ug/kg/day and 3 at a dose of 30ug/kg/day. After two months of therapy POI-score was increased in 9 and decreased in 5 patients. Patients with POIscores > 6 were 1 before and 6 after two months of therapy (p<0.05). The change in POI score was inversely related to age (< 0.02).

**Conclusions:** POI score can be considered as a useful decisional tool to modulate GH dose in children with Prader-Willi syndrome. Our results suggest to start with lower dose of GH in younger children.
VENTILATORY PARAMETERS AND FACTORS INVOLVED IN ADHERENCE OF THE CPAP/BIPAP™ USE IN OBSTRUCTIVE SLEEP APNEA

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Introduction: The adherence to treatment in OSAS is a recurrent challenge for both patients and health professionals. The aim of the present study was to analyse the ventilatory profile of CPAP/BIPAP™ users according to the severity of OSAS as well as to identify the main factors interfering in adherence to the non-invasive ventilation (NIV).

Materials and methods: Initially, there were selected 117 OSAS patients in use of NIV and the clinical characteristics obtained from polysomnography as well as the ventilatory data acquired from the technical records generated by the NIV device were analyzed. Furthermore, a semi-structured questionnaire, involving 45 patients, was applied to determine adherence factors such as type of masks, main symptoms related to discomfort and the levels of positive pressure during sleep.

Results: The apnea hypopnea index (AHI) was higher in males when compared to females (60.3 vs. 40.8 ev/h) associated with lower level of oxygen saturation (71.9% vs. 76.7%), as expected. The majority of subjects were male (56%) with an average age of women vs. men (58±14 vs. 65±11 years). Moreover, cardiovascular risk factors such as hypertension, obesity (40.3±5 kg/m²) and a sedentary lifestyle were present in 50% of all patients. Concerning the adherence to the treatment according to the degree of the OSAS, the patients with severe OSAS showed compliance (total of days used) significantly higher compared to the mild and moderate ones. Therefore, there was no difference related to the hours per night of treatment. The standard treatment for OSA mostly used was the auto continuous positive pressure in airways (Auto CPAP-APAP) with mean pressure of (10.8 ±2.2 cmH2O). The APAP device was more frequent when compared to the bilevel (BIPAP™) (77.7% vs. 22.2%). The mostly used mask was nasal in both genders. In relation to the main complaint and symptoms, 42.2% of all patients described the presence of some discomfort when using NIV, in which 46.6% was concerned with mask, 6.6% with device’s noise and 4.4% with reduction of mobility during sleep. Additionally, the main causes of treatment’s interruption were cough and superior airways’ congestion. The drowsiness (44.4%), snoring (26.6%) and fatigue (11.1%) were mostly described before treatment. Therefore, 97% of patients solved their symptoms after NIV use.

Conclusions: The identification of these factors are essential to health professionals in order to allow OSAS patients to keep up with the treatment.

Acknowledgements: University of Itaúna
**Sleep Breathing Disorders**  
**Board #137: P1 - Monday**  
**PREVALENCE OF SLEEP RELATED BREATHING DISORDER IN CHILDREN AND ADOLESCENTS OF SANTIAGO, CHILE, BY THE USE OF THE REDUCED PEDIATRIC SLEEP QUESTIONNAIRE**

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**Introduction:** In general, on OSA evaluation, a good history and physical examination are required. However, OSA may be not be diagnosed only based on clinical history or physical examination. The gold standard for the diagnosis of OSA is sleep laboratory-based polysomnography (PSG). Despite its diagnostic advantages, PSG is an expensive, time-consuming assessment. Considering the high prevalence of OSA and the need for prompt treatment, simpler screening tests seem to be urgently necessary.

As a screening option, several questionnaires have emerged as a possible screening tool for OSA, Chervin et al. developed and reported the validity and reliability of the PSQ. The study concluded that the PSQ showed an excellent sensitivity and specificity for identifying children with OSA, when applied to a group of referred snoring children and also to a group of controls. Vila et al. translated the PSQ into Spanish and determined its reliability by test-retest and internal consistency methods among a sample of 99 patients, concluding that the Spanish version of the PSQ could be a useful tool for epidemiological research.

The aim of this study was to investigate the prevalence of Sleep-Related Breathing Disorder (SRBD) in Children and Adolescents in Santiago, Chile, one of the most polluted cities in the world with a high rate of childhood obesity by the use of the Reduced Pediatric Sleep Questionnaire.

**Materials and methods:** Cross-sectional study. A total of 1035 surveys were carried out to parents of children and adolescents aged 4-19 from three different schools and one university clinic in Santiago, Chile in a period between June and December 2016.

197 surveys were eliminated for not following inclusion exclusion criteria. Age and gender were analyzed. This research has been approved by the Ethics Committee of the Universidad del Desarrollo, Santiago, Chile. The author has no conflict of interest to declare.

**Results:** The present study found a prevalence of 25.30% of Sleep-Related Breathing Disorder. There is a difference between gender, with a significant increase in the number of SRBD in males (p value). The highest prevalence of SRBD was at the group of school children.

**Conclusions:** There is a high prevalence of children and adolescents with SRBD in Santiago, Chile, especially in males with a slight predominance of school children. If SRBD is left untreated, it can be a cause of significant morbidity and could lead to growth failure, neurocognitive and behavioral abnormalities, and cardiovascular effects.

These results should serve to alert health professionals especially dentists and orthodontists about the importance of asking certain questions to their patients to perform a good anamnesis using this type of questionnaire that allows a selection of those patients which require other more specific diagnostic methods such as PSG and to keep in mind that many patients may have SRBD and therefore treatment therapies should be focused on improving that condition and not making it worse.

**Acknowledgements:** To Dr. Tania Hechenleitner and Dr. Juan Fernando Oyarzo for their help in the accomplishment of this study.
**Introduction:** Sleep apnoea is a known contributor to hypertension. HIV+ patients have been shown to be more prone to sleep apnoea at identical ages and body mass index (BMI) than HIV- controls. Under antiretroviral treatment, HIV+ patients gain weight, which may increase their risk of becoming hypertensive and developing sleep apnoea. In this study, we investigated the relationship between blood pressure, BMI and risk of sleep apnoea in 147 treated HIV+ patients and 200 controls from the general population in the Phuthaditjhaba municipality in South Africa.

**Materials and methods:** We enrolled 200 treated HIV+ patients from local clinics in Phuthaditjhaba and 200 controls from the neighborhoods surrounding the clinics. In 147 HIV+ patients and in all controls, we measured blood pressure, BMI and assessed the risk of sleep apnoea using the Berlin Questionnaire (translated in Sesotho). We then assessed in multivariate analysis the main effects of HIV status, BMI and scoring high risk of sleep apnoea as well as the interaction between these main effects on systolic blood pressure.

**Results:** The demographic composition of the two groups was comparable, mainly female (72%) and middle aged (average age (SD)= 43 (15)). The HIV+ patients had an average (SD) current CD4 count of 515 (248). They had a lower average BMI than the controls (average(SD)=24(6) vs. 27(6), respectively), and 10% of HIV+ patients scored high risk of sleep apnoea vs. 15% in the controls (p=0.13). Average (SD) systolic blood pressure was 133 (24) mmHg and did not differ between the two groups. In multivariate analyses adjusted for age, we found a main effect of scoring high risk of sleep apnoea on the Berlin Questionnaire ($\beta=38$, $p=0.0047$), no significant main effects of group or BMI, and a three-way interaction between scoring high risk of sleep apnoea, HIV status and BMI ($p=0.017$) whereby in HIV+ patients each increase in BMI was associated with an increased effect on systolic blood pressure compared to controls.

**Conclusions:** We found that in HIV+ patients and in controls, when adjusting for age, BMI and HIV status, systolic blood pressure increased with scoring high risk of sleep apnoea. In addition, we found that HIV+ patients' systolic blood pressure was more impacted by increases in BMI than in controls. Although HIV+ patients had overall lower BMI than controls, this suggests that weight gain in HIV+ patients may translate into a higher risk of developing hypertension than in controls. This may have implications for the future chronic care of HIV+ patients.

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EVALUATION OF THE FUNCTIONALITY OF THE USE OF REMOTE TELEMETRY FOR DISTANCE TITRATION OF THE PRESSURE OF A NEW PORTABLE NCPAP WITHOUT TRACHEA (AIRMONY)

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Introduction: The use of CPAPn is still the main therapeutic option in the treatment of OSAHS even as the level of treatment adherence is not high due to the discomfort of the system. Also, titration of the necessary pressure in the sleep laboratory is costly (logistically and financially), which justifies the development of new more cost-effective devices at the moment of qualifying the pressure and comfort when it is used as a treatment presented in this study (Airmony). The objectives of this study are analyze the functionality of the titration of a new nCPAP device without trachea (Airmony) by means of remote control (telemetry) with Bluetooth technology and the reception of remote data via internet (TCP / IP sockets) to a server registered to them.

Materials and methods: The titration is divided into 4 sessions (1 per patient) in the sleep laboratory, with Complete Nocturnal Polysomnography. The CPAP pressure without trachea Airmony is gaged through the telemetry system and the simultaneous reception of data collected by the device is evaluated. Four sessions (1 per patient) are repeated with the Airmony CPAP at the patients´ home, using the same methodology and the functionality of the system is analyzed remotely. To qualify the pressure, a Bluetooth-linked smartphone is used to CPAP Airmony which, via the Internet (TCP / IP sockets) sends the data to a server and then to the clinician´s PC that monitors the parameters and allows the NCPAP pressure to be gaged remotely. All information is sent in real time to an external server that allows analyzing all the information at a later date (air pressure, pressure setpoint, motor RPM, actual pressure 3 cm from the nose, air flow, temperature, position of the Head and oximetry).

Results: Results show a high system reliability both in the sessions performed with the patient in the sleep laboratory, as well as those performed at the patients´ home. This is achieved by means of remote certification of telemetry from the sleep laboratory while the patient is at home.

Conclusions: These results confirm high levels of reliability and functionality for remote titration using Airmony CPAP with the advantage of assessing the need for different pressures depending on the position of the patient´s head. This defines a new strategy in the monitoring and follow-up of the use of NCPAP with a cost-effective bidirectional telemetry system.
Background: The aim of this study was to evaluate the associations between objective sleep parameters of obstructive sleep apnea (OSA) and progression of subclinical cardiovascular disease as measured by the coronary artery calcium (CAC) score.

Methods: We reviewed the medical records of 214 patients who underwent both polysomnography (PSG) and repeated coronary artery computed tomography (CT) for screening purposes. For each participant, the first coronary CT scan was conducted within 12 months of PSG. Follow up CT was performed voluntarily. The CAC score was log-transformed to obtain normally distributed data.

Results: We evaluated potential associations between various sleep parameters by analyzing overnight-attended PSG and CAC score progression over time. ST90 (total sleep time of SaO2< 90%), CT90 (percentage of time of SaO2< 90%), and degree of mean oxygen desaturation were significantly correlated with CAC score progression even after adjustment for confounders (age, sex, DM, HTN, hypercholesterolemia, BMI, and smoking status) (estimate=0.004, p=.005; estimate=0.009, p< .001; estimate=0.026, p=.002; respectively). However, sleep efficiency, stage 3 sleep percentage, apnea hypopnea index (AHI), severity of OSA according to AHI, arousal index, respiratory disturbance index, lowest arterial oxygen saturation, mean apnea duration, and oxygen desaturation index were not significantly correlated with CAC score progression.

Conclusions: T90, CT90 and mean oxygen desaturation are significant predictors of cardiovascular disease progression. Coronary artery status should be monitored frequently in patients with hypoxemia during sleep.
Introduction: Obstructive sleep apnea (OSA) is a prevalent progressive sleep disorder with severe negative health consequences. Although there are known risk factors associated with the development of OSA, the definitive pathophysiological mechanism behind the upper airway collapse remains unclear. We hypothesize that traumatic snoring vibrations and tissue stretch cause neuromuscular injuries that in combination with other risk factors, trigger an upper airway collapse during sleep.

Materials and methods: In this project, we have analyzed neuromuscular injuries in the soft palate of 23 OSA/snorer patients with immunohistochemical and morphological methods and compared the findings with pharyngeal swallowing dysfunction, as measured with video-radiographic techniques. Fifteen non-snoring healthy subjects with normal swallowing function served as controls. A p-value ≤0.05 was considered significant.

Results: All muscle samples from the patients showed distinct signs of neuropathy i.e. lower axon density and Schwann cell area within nerve fascicles (p=0.001), and a higher proportion of missing axons within the Schwann cell lumen. The proportion of Schwann cells lacking axons was significantly higher in patients with swallowing dysfunction compared to patients without swallowing dysfunction (p=0.001). Moreover, nerve injuries were also reflected in the muscle tissue i.e. fiber atrophy and compensatory fiber hypertrophy. The mean fiber cross-sectional area was lower (p=0.024), the amount of connective tissue was greater (p=0.001), and the coefficient of variation for fiber size was higher (p=0.024) compared to controls. Interestingly, the tissue samples not only showed degenerative pathological features, but also signs of an abnormal regenerative and repair process.

Conclusions: We conclude that neuromuscular injuries in the upper airways of OSA/snoring patients correlate with pharyngeal dysfunction. Neuromuscular changes seem to have a greater role in development and progression of OSA than previously thought.

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THE RELATIONSHIP BETWEEN SEVERITY OF OBSTRUCTIVE SLEEP APNEA AND HEART RATE VARIABILITY

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Introduction: Obstructive sleep apnea syndrome (OSAS) is a prevalent disease in adults. Limited evidence regarding the effect of severity of sleep apnea and depression on heart rate variability (HRV) indices exists. Hence, we decided to focus on the association between HRV and severity of OSAS based on depression score.

Materials and methods: A total of 193 patients with confirmed OSAS were selected from a sleep clinic setting. A checklist for demographic data and self-administered questionnaires including the Pittsburgh Sleep Quality Index; Epworth Sleepiness Scale; Beck Depression Inventory; Snoring, Tiredness, Observed apnea, Blood pressure, Body mass index, Age, Neck circumference (STOP-BANG), and Gender questionnaire were filled in. We used two domains of HRV (e.g., frequency and time) estimation.

Results: The mean number of pairs of adjacent RR intervals (time between QRS complexes) differing by more than 50 ms in the entire analysis interval (NN50 count) was significantly different among various severity OSAS groups (µ = 2639.12 ± 478.98 for mild and moderate, and 2313.81 ± 670.54 in severe OSAS; P = 0.0200). In frequency domain, the indices were higher in severe OSAS patients. Statistically significant association was between HRV parameters (standard deviation of all RR intervals, mean of the standard deviation of all RR intervals for all 5-minutes segments, NN50 count, the NN50 count divided by the total number of all RR intervals, average total power, low frequency power) and OSAS severity.

Conclusions: There are some statistically significant differences between OSAS severity and parameters of HRV.

Acknowledgements: This study has been supported by the Tehran University of Medical Sciences.
Introduction: The main symptoms of obstructive sleep apnea (OSA) were snoring and breath-holding, causing repetitive nocturnal hypoxemia, hypercapnia and cardiovascular complications, which would affect the patient’s quality of life seriously. Obesity is one of the major causes of OSA, and OSA is one of the major causes of secondary hypertension. The purpose of this study was to investigate the efficacy on blood pressure of CPAP in the treatment of OSA patients with hypertension.

Materials and methods: According to the latest AASM standard, patients diagnosed as OSA with hypertension were included based on polysomnography (PSG), in sleep clinic from January 2016 to January 2017. All the subjects were divided into two groups based on body mass index (BMI): Obese group (BMI $\geq$ 28kg/m$^2$) and Non-obese group (BMI < 28kg/m$^2$). On the basis of pre-existing antihypertensive medications, Auto-CPAP (RES mart GI, BMC Medical Co. Ltd.) therapy was performed for 4 weeks ($>6h/night$). before and after the CPAP treatment, the 24h ambulatory blood pressure (24h ABP) were measured and compared.

Results: 43 individuals were enrolled in the study. Obese group included 26 patients (20 male and 6 female), with the mean age of (47.4±10.7) years old. Non-obese group included 17 patients (13 male and 6 female), with the mean age of (49.1±9.7) years old. The average apnea hypopnea index (AHI) in the two groups were: Obese group $54.9\pm27.5$ and Non-obese group $43.1\pm21.4$. There were no statistical difference in the gender composition, age and AHI. The 24h systolic blood pressure (SBP) and 24h diastolic blood pressure (DBP) on the baseline were 141.4±15.7/89.9±10.1mmhg(obese group) and 136.1±15.1/86.4±11.4mmhg(non-obese group), which were no differences in statistic analysis. After 4 weeks CPAP treatment, there was significant difference in 24h SBP, 24h DBP, daytime SBP, daytime DBP, nighttime SBP, nighttime DBP with the number of 132.7±13.4mmhg, 82.7±8.6mmhg, 134.9±15.2mmhg, 84.1±10.2mmhg, 124.2±14.2mmhg and 77.5±9.2mmhg (P $< 0.05$). In obese group, before treatment, 24h SBP, 24h DBP, daytime SBP, daytime DBP, nighttime SBP, nighttime DBP were 142.1±15.6mmhg, 90.5±9.9mmhg, 144.8±15.8mmhg, 92.8±9.8mmhg, 133.0±18.4mmhg and 82.0±12.9mmhg. After treatment, 24h SBP, 24h DBP, daytime SBP, daytime DBP, nighttime SBP, nighttime DBP were 132.8±13.6mmhg, 83.5±8.9mmhg, 135.9±15.6mmhg, 85.4±10.3mmhg, 121.6±12.5mmhg, 76.8±9.3mmhg. In non-obese group, before treatment, 24h DBP and daytime DBP were 86.7±12.0mmhg and 88.4±12.8mmhg, while after treatment the number went to 81.6±8.3mmhg and 82.1±10.1mmhg(P $< 0.05$).

Conclusions: Long-term CPAP treatment can effectively reduce blood pressure (BP) in hypertensive patients with OSA. CPAP can effectively reduce BP in obese group, however in non-obese group, only DBP decreased. Due to the limited number of samples, the effectiveness of treatment on CPAP in non-obese group may need further observation and discussion.

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LIPID PROFILE IN ACUTE ISCHEMIC STROKE: ASSOCIATION WITH SLEEP-DISORDERED BREATHING

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Introduction: Dyslipidemia and sleep-disordered breathing (SDB) are the risk factors for cerebrovascular diseases. Despite increasing evidence that chronic intermittent hypoxia, a key mechanism underlying SDB, is independently associated with dyslipidemia, the clinical evidence linking SDB with dyslipidemia is limited. The aim of this study was to explore the association of lipoprotein levels with SDB measures in patients with acute ischemic stroke.

Materials and methods: We prospectively enrolled 90 patients with acute ischemic stroke. Blood samples for the analysis of total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL) and low-density lipoprotein cholesterol (LDL), were obtained within 24 hours after the stroke onset in a fasting condition. Standard overnight polysomnography was used to assess SDB.

Results: Hypercholesterolemia was present in 52.2%, hypertriglyceridemia in 20.0% and SDB in 50% of the patients. In linear multiple regression analysis, apnea-hypopnea index (AHI) was the only independent variable significantly associated with TC (β=0.240, p=0.023) and LDL levels (β=0.220, p=0.039). Similarly, AHI (β=0.258, p=0.012) and diastolic blood pressure (β=0.204, p=0.047) were the only independent variables significantly associated with cholesterol ratio (TC/HDL). We failed to find any significant association of SDB measures with TG and HDL in linear multiple regression analysis.

Conclusions: Our results suggest significant association of SDB measures, especially of AHI, with TC, LDL and cholesterol ratio in patients with acute ischemic stroke. We failed to find such association with HDL and TG. SDB may represent a potential therapeutic target to improve dyslipidemia in acute ischemic stroke.

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PREDICTORS OF DAYTIME HYPERCAPNIA IN OBSTRUCTIVE SLEEP APNEA PATIENTS. EFFECT OF TREATMENT WITH NONINVASIVE POSITIVE PRESSURE VENTILATION

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Introduction: Daytime hypercapnia is common in obese patients with obstructive sleep apnea syndrome (OSAS) and is associated with serious complications. Aim of the study was to determine diagnostic predictors of hypercapnia among OSAS obese patients and to assess their long term survival under noninvasive positive pressure ventilation (NPPV).

Materials-methods: Retrospective analysis of 107 obese patients (BMI>30 kg/m²) with OSAS (Apnea Hypopnea Index, AHI>15/h) was performed. Excluded were patients with chronic obstructive pulmonary disease, restrictive respiratory disorders, hypothyroidism, and neuromuscular diseases. Height and weight measurements, medical history, spirometry, arterial blood gases, daytime sleepiness assessed by Epworth Sleepiness Scale (ESS) and sleep studies (attended polysomnography or polygraphy) were recorded, as well as the mode of home mechanical ventilation and interface, patients’ compliance with therapy over time and survival.

Results: Forty five (42%) individuals were hypercapnic in awake (PaCO₂>45mmHg) at baseline examination. Significant differences among hypercapnic and normocapnic OSAS patients were revealed in terms of BMI (46.36 vs. 42.03 kg/m², p< 0.05), pO₂ (62.6 vs. 67.83 mmHg, p< 0.05) and HCO₃ (31.35 vs. 25.22 mmol/l, p< 0.05). Other factors (age, gender, Forced Expiratory Volume in the first second - FEV₁%, Forced Vital Capacity - FVC%, FEV₁/FVC%, AHI, mean nocturnal SpO₂, ESS) showed no significant difference. Coronary heart disease was significantly more prevalent among hypercapnic OSAS patients (22.2% vs. 4.9%, p< 0.05). Biphasic mechanical ventilation modes were more prevalent in hypercapnic in comparison to normocapnic OSAS patients (84.4% used BPAP S, 11.1% BPAP S/T and 4.4% CPAP vs. 66.1%, 4.8%, 29%, respectively), as was full face mask use (90.2% vs. 67.2%), and supplemental nocturnal (in 71.1% vs. 42.9%) and daytime long-term oxygen therapy (44.4% vs. 12.9%). Discontinuation of NPPV was more often in men, younger patients, and patients with lower ESS. Survival did not differ between hypercapnic and normocapnic obese OSAS patients.

Conclusions: In OSAS patients, hypercapnia in awake is associated with obesity and daytime hypoxemia, in these patients heart disease is more prevalent. No difference was recorded in long term survival of patients under NPPV, whether hypercapnic or not.
SPONTANEOUS IMPROVEMENT IN BOTH OBSTRUCTIVE SLEEP APNEA AND COGNITIVE IMPAIRMENT AFTER STROKE

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Background: Knowledge available about the relationship between obstructive sleep apnea (OSA) and cognitive impairment after stroke is limited. The evolution of OSA and cognitive performance after stroke is not sufficiently described.

Methods: We prospectively enrolled and examined acute stroke patients without previously diagnosed OSA. The following information was collected:

(1) demographics;
(2) sleep cardiorespiratory polygraphy (PG) at 72 hours, day 7, month 3, and month 12 after stroke;
(3) poststroke functional disability tests at entry and at months 3 and 12; and
(4) cognition (attention and orientation, memory, verbal fluency, language, and visual-spatial abilities) using the revised Addenbrooke’s Cognitive Examination (ACE-R) at months 3 and 12.

Results: Of 68 patients completing the study, OSA was diagnosed in 42 (61.8%) patients. The mean apnea/hypopnea index (AHI) at study entry of 21.0 ± 13.7 spontaneously declined to 11.6 ± 11.2 at month 12 in the OSA group (p < 0.0005). The total ACE-R score was significantly reduced at months 3 (p = 0.005) and 12 (p = 0.040) in the OSA group. Poorer performance on the subtests of memory at months 3 (p = 0.039) and 12 (p = 0.040) and verbal fluency at months 3 (p < 0.005) and 12 (p < 0.005) were observed in the OSA group compared to non-OSA group. Visual-spatial abilities in both the OSA (p = 0.001) and non-OSA (p = 0.046) groups and the total ACE-R score in the OSA (p = 0.005) and non-OSA (p = 0.002) groups improved.

Conclusions: A high prevalence of OSA and cognitive decline were present in patients after an acute stroke. Spontaneous improvements in both OSA and cognitive impairment were observed. The authors and their family members state that there are no conflicts of interest regarding the study.
**Introduction:** The aim of the study was to find out whether obesity affects the probability of failure of continuous positive airway pressure therapy (CPAP) and how it relates to common respiratory parameters. In some patients diagnosed with obstructive sleep apnoea syndrome (OSAS) the apnoea/hypopnoea index (AHI) is decreased during CPAP treatment but hyposaturation persists. These patients should be treated by bilevel positive airway pressure (BiPAP).

**Materials and methods:** A cohort of 479 patients treated by CPAP for OSAS was evaluated. The data measured in sleep monitoring of the successfully treated group and of the group where CPAP had failed were compared. Subsequently, the predictive abilities of the monitored variables with respect to CPAP failure were assessed, both individually and in combination.

**Results:** All of the monitored parameters were statistically examine, if they showed mutual significant correlation. Particularly strong dependence was found between T90 and SaO2 and between AHI and AI. A combined model employing both T90 and BMI in order to predict CPAP failure brought only negligible improvement over T90 alone.

**Conclusions:** BMI shows a significant predictive ability of CPAP failure, although it was slightly outperformed by T90. The set of monitored variables included in our study does not allow for the CPAP failure to be predicted with clinically relevant reliability.
Obstructive sleep apnea syndrome (OSAS) is associated with cardiovascular complications. The neutrophil-lymphocyte ratio (NLR) has been shown to be a marker of inflammation, being elevated in patients with cardiovascular disease. Several studies have demonstrated the protective effect of positive airway pressure regarding cardiovascular risk, however, there are few studies evaluating its effect on the reduction of NLR. The aim was to evaluate the effect of positive airway pressure (PAP) therapy on neutrophil-lymphocyte ratio after 6 months of PAP.

This prospective study included 47 male patients. Patients with other sleep disorders, neuromuscular pathology, renal disease, thyroid pathology, heart failure, neoplasms, chronic inflammatory disease or prior PAP use were excluded. Basal NLR and after 6 months of PAP therapy (S9 Resmed®, Australia) were assessed. Patients had a mean age of 47.2 years. Twenty-two patients presented mild / moderate OSAS and 25 severe OSAS. The mean NLR was higher in the severe group (severe OSAS mean NLR 1.99; mild / moderate OSAS mean NLR 1.53 p < 0.05). After 6 months of PAP there was a significant reduction of NLR from 1.77 to 1.73 (p < 0.05), which was higher in the group of severe OSAS from 1.99 to 1.87 (p < 0.001).

The present study demonstrated that neutrophil-lymphocyte ratio changed significantly after 6 months of PAP therapy in OSAS patients, being the reduction greater in severe OSAS, supporting its cardiovascular protective effect. Our study has reinforced the importance of analytical cardiovascular evaluation as complementary tool of diagnosis/treatment response in OSAS patients.
Introduction: Several studies suggest an association between obstructive sleep apnea syndrome (OSAS) and systemic inflammation, oxidative stress and sympathetic nervous system activation. Recently, new inflammatory markers have emerged, namely the neutrophil-lymphocyte ratio (NLR). However there are few studies that evaluate the association between NLR and the severity of OSAS. The aim was to evaluate the association between the neutrophil-lymphocyte ratio and the severity of OSAS.

Materials and methods: A prospective study was performed at a tertiary-level hospital sleep center. Clinical, polysomnographic and laboratory parameters were analysed by calculating the ratio between absolute levels of neutrophils and lymphocytes and evaluating their association with the severity of OSAS.

Results: We included 72 male patients, mean age 46.4 years. Forty-five patients (62.5%) had mild / moderate OSAS and 27 patients (37.5%) had severe OSAS. The neutrophil-lymphocyte ratio (NLR) was significantly lower in patients with mild / moderate OSAS, presenting a mean of NLR: 1.68 ± 0.5, compared to patients with severe OSAS with an average of 2.39 ± 2.0 (p = 0.027). There was no statistical correlation between the NLR and the time with oxygen saturation below 90% (T90) or with the minimum oxygen saturation.

Conclusions: The present study showed an association between neutrophil-lymphocyte ratio and the severity of OSAS. Thus, this parameter can become a marker of disease severity, being obtained by a blood analysis of easy acquisition and low cost.
THE EFFECT OF EXTENDED WAKEFULNESS ON POSTURAL CONTROL IN OBSTRUCTIVE SLEEP APNEA AND HEALTHY CONTROLS

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Introduction: Impaired postural control is a risk factor for falls, which can lead to severe, and debilitating, musculoskeletal injuries. Numerous studies have established that extended wakefulness impairs postural control in healthy young and older adults. Recent research shows that OSA patients have poorer postural control compared to healthy individuals and that worse respiratory parameters (e.g., ODI, average SpO2%) are associated with decreased postural control. We examined if additional extended wakefulness would further compromise postural stability in OSA patients and control participants.

Materials and methods: 18 healthy controls (age 41.4±13.0 years, AHI=3.4±2.6) and 65 suspected OSA patients (age 48.9±13.1 years, AHI=23.0±23.1) performed posturography. Testing occurred 5 hours before (baseline), and 3 hours after extended wakefulness, at a time based on participant’s individual habitual bedtime (as determined by actigraphy and sleep diary). Posturography was performed standing on a force platform for 60s, with eyes closed. Posturography measures comprised velocities in the X and Y planes, average overall velocity, area of sway movement, and distance of movement of sway. Linear mixed models and correlations were used for analysis.

Results: The mixed models analysis showed there were no significant condition (baseline vs. extended wakefulness) by group (OSA vs. control) interactions, nor were there significant condition differences. There were significant group differences. The OSA patients had faster velocity in the Y plane (p=.002), along with faster overall velocity (p< .001), covered greater area (p=.007) and further distance of sway (p< .001). Both AHI and 3%ODI were significantly correlated to average velocity in the y plane (r=-.434, p=.005, and r=-.433, p=.005 respectively) and area of sway movement (r=.406, p=.008, and r=.461, p=.002 respectively).

Conclusions: These results are in agreement with literature demonstrating postural control impairments in patients with OSA compared to healthy control participants, but additional sleep deprivation did not result in greater postural impairment in either group. Postural impairment was significantly associated with OSA severity. This suggests that OSA patients may be at increased risk of falls, but requires further investigation.

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SIMPLE TELEMEDICINE INTERVENTION TO IMPROVE CPAP COMPLIANCE ON OSA PATIENTS TO MINIMAL (>4 H) AND OPTIMAL (> 5.5 H) USE: STUDY DESIGN (CPAP-RESCUE)

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Introduction: Telemedicine, the use of communication technologies for medical purpose is growing fast in the last years. In OSA telemedicine may be a promising tool over compliance in two particular groups of patient; 1) the non compliant to CPAP (less than 4 hours per day); and 2) the sub-optimal users (4 to 5,5h/d), as recent evidence suggests that clinical effects of CPAP treatment are mostly achieved with a use over 5,5 - 5,6 hours (Barbé, AJRCCM 2010; Martinez-Garcia, JAMA 2013).

The aim of this trial is to compare our simple telemedicine intervention versus usual care group to rescue and optimize treatment, as determined by improvements on CPAP compliance as well as efficiency (respiratory events) and effectiveness (clinical consequences). This simple telemedicine system has been proved feasible on habitual Internet users as well as limited Internet users.

Materials and methods: A prospective study were patients treated with CPAP for at least 3 months, after optimizing their initial CPAP treatment will be divided into 4 groups; Group 1) Rescue those with less than 4h/d compliance; Group 2) Optimize compliance on those with 4 to 5,5 h/d; using a telemonitoring intervention based on patients access to a especially designed mobile App, a 24-hour voice mail recorder for consultations and monitoring of the signals received from their CPAP devices during a 6-weeks period; two parallel control groups will follow usual care.

Main outcomes: CPAP compliance, residual events, and clinical consequences (Epworth Sleepiness Scale and 24-hour ambulatory blood pressure monitoring). And as secondary outcomes: morning BP, actigraphy (sleep efficiency) and nocturnal pulse-oximetry (pulse rate variability) will also be monitored during 1 week, assessments will be performed at the beginning and after 6 weeks of follow up. Quality of life and satisfaction questionnaires; as well as cost-analysis between groups will be analyzed.

Results: In an ongoing project we have demonstrated the feasibility of the procedures, a positive repercussion in cost as well as the advantages of mobile Apps compared to web-platforms (Suarez M.C. Sleep & Breathing Madison, 2017).

Conclusions: The results of this study may provide a new simple strategy to improve and optimize CPAP compliance on OSA patients, and may inform future policy decisions regarding implementation of telemonitoring in OSA treatment. This aspect is not only important in treating symptoms (minimum compliance) but also in achieving optimal compliance which has been previously related to positive cardiovascular outcomes among others (Barbé, JAMA 2012; Martinez-Garcia, JAMA 2013).

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NEUROCOGNITIVE IMPAIRMENT IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA BEFORE AND AFTER THERAPY WITH CONTINUOUS POSITIVE AIRWAY PRESSURE

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Introduction: Patients with obstructive sleep apnea (OSA) have cognitive impairment associated with functional changes in the brain substrate. However, previous studies have inconsistent findings related to the cerebral substrate involved and the effect of treatment with continuous positive airway pressure (CPAP) on this impairment. The present study aims to (i) to evaluate the spectrum of cognitive impairment in OSA patients, (ii) to observe changes on functional MRI (fMRI) in OSA patients, and (iii) the effect of CPAP therapy on neurocognitive impairment in OSA patients.

Materials and methods: 21 CPAP-naive moderate and severe OSA patients, and 10 healthy controls underwent cognitive testing using a standardized battery. They were also subjected to fMRI using a working memory task (n-back, 1- and 2-back). 15 OSA patients underwent repeat cognitive testing and fMRI after 3 months of CPAP.

Results: OSA patients had impaired global intellectual function and sleep quality. Other cognitive domains were normal. CPAP therapy led to improvement in sleepiness and sleep quality. OSA patients had underactivation of brain areas in both 1- and 2-back working memory tasks as compared to healthy controls. After CPAP treatment, there were increases in activation during both 1- and 2-back tasks, with the activation level during 1-back task exceeding that seen in controls.

Conclusions: OSA patients have brain activation deficit even without overt cognitive impairment in neurocognitive tests. With CPAP therapy, the brain activation during simpler task (1-back) exceeds healthy controls, indicating overcompensation.

Acknowledgements:
**Objectives:** This study evaluated the effect of bilateral nasal packing on respiration during sleep, using a newly developed pulse wave sensor, in postoperative patients with obstructive sleep apnea (OSA) who underwent bilateral endoscopic sinus and nasal surgery (ESS) under general anesthesia.

**Methods:** This observational study involved 32 patients with chronic sinusitis, nasal allergy, or septal deviation who underwent bilateral ESS under general anesthesia. We used a recently developed noninvasive method for measuring intrathoracic pressure that uses a pulse wave sensor (LS-330G, Fukuda Denshi Co., Ltd., Tokyo, Japan), where the sum of displacement of the pulse wave baseline and changes in pulse wave amplitude, which are influenced by inspiration and expiration, represents a change in intrathoracic pressure. We measured intrathoracic pressure and SpO2 using the LS-330G pulse wave sensor and a pulse oximeter, respectively, during the following time points: preoperatively, on postoperative day (POD) 1 with bilateral nasal packing, and on POD 5 after nasal packing was removed. The Ethics Committee of Teikyo University approved the study (Approval Number Teirin 15-146), and informed consent was obtained from all subjects. International Committee of Medical Journal Editors clinical trial registration number: R000027746.

**Results:** Significant changes were noted in intrathoracic pressure, estimated by the pulse wave sensor, between each time point, but no significant changes were noted in lowest SpO2. When age, BMI, total nasal resistance, preoperative AHI, and preoperative lowest SpO2 were included as independent variables in multivariate stepwise regression analysis to determine the relative incidence of each respiratory parameter on postoperative day (POD) 1, only preoperative AHI, and no other variables, significantly predicted the relative incidence of increased intrathoracic pressure on POD1 (t=2.46, b=0.81, p=0.021).

**Conclusions:** This newly developed noninvasive method for measuring intrathoracic pressure, by using a pulse wave sensor, detected changes in the perioperative respiratory condition of the patient while pulse oximetry did not. Otorhinolaryngologists should pay attention to the use of postoperative bilateral nasal packing in patients with OSA who underwent ESS under general anesthesia.
DIFFERENCES IN THE DURATION OF OBSTRUCTIVE SLEEP APNEA EVENTS AMONG HIGHLAND TIBETANS AND HANS AND LOWLAND HANS AT LOW ALTITUDE

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Introduction: Duration of obstructive and mixed apneas increased with altitude descent was found in one small sample study (n=6) among mild-moderate patients with obstructive sleep apnea (OSA). But, there were no studies exploring whether highland native Tibetans and Chinese Hans present prolonged duration of OSA events at low altitude compare to lowland residents.

Materials and methods: We retrospectively analyzed overnight polysomnography (PSG) records of 558 patients with OSA. The patients included 235 lowland Chinese Hans living at altitude below 1000 m, 181 highland Chinese Hans and 142 highland native Tibetans living at altitude above 3000 m. PSG examinations were carried out in Chengdu (altitude 500 m) after they arrived within 10 days.

Results: There were no significant differences in age, gender and apnea-hypopnea index (AHI) among three groups. No differences were obtained in the index (events/h) of central and mixed types of apnea events among three groups. The means of longest and average duration of obstructive apnea events were highland native Tibetan (80.9±57.3, 26.3±11.0 sec) > highland Chinese Hans (60.9±38.5, 23.9±9.0 sec) > lowland Chinese Hans (47.7±24.2, 21.1±6.0 sec). Percentage of number of patients with longest obstructive apnea events above 3 min reached at 5.6% in highland native Tibetans and 1.7% in highland Chinese Hans, whereas none in lowland Chinese Hans.

Conclusions: At low altitude, highland OSA patients had significantly prolonged duration of obstructive apnea events, particularly in the longest duration of apnea events, compared to lowland OSA patients. This may implicate that highland residents, especially for highland native Tibetans, may have aggravated OSA at low altitude in terms of the duration of OSA events.
OBJECTIVE SLEEP MEASURES IN SUBACUTE STROKE INPATIENTS ASSOCIATED WITH LEVELS/IMPROVEMENTS IN ACTIVITIES OF DAILY LIVING

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Introduction: We investigated if objective polysomnographic measures of prevalent sleep problems, such as sleep-disordered-breathing (SDB) and insomnia, are associated with activities of daily living levels in inpatients at rehabilitation units.

Materials and methods: Eligible inpatients, enrolled retrospectively and consecutively, underwent measures of one-night polysomnography, sociodemography, medical comorbidities, stroke characteristics, and Barthel Index (BI) scores.

Results:
Of 123 patients (61.6±13.1 years; 23.8±3.4 kg/m²; 33% female; 90.5±36.7 days post-stroke; 46.7±25.1 events/h in apnea-hypopnea index), 103 (92%) had moderate-to-severe SDB, and 24 (19.5%) had better continuous-positive-airway-pressure adherence. Diverse values were found for total sleep time (259±71 min), sleep efficiency (69.5±19.3%), sleep latency (24.3±30.9 min), and wakefulness after sleep onset (93.1±74.2 min). Admission and admission-discharge BI score changes were 33.8±23.2 and 10.1±9.2, respectively. National Institutes of Health Stroke Score (NIHSS, 10.2±5.6), available in 57 (46%) patients, negatively associated with admission levels and gains in BI scores (p< 0.001, =0.002, respectively) in a univariate analysis. In regression models with backward selection excluding NIHSS, age (p=0.025) and wakefulness after sleep onset (p< 0.001) were both negatively associated (adjusted R²=0.260) with admission BI scores. Comorbidity of hypertension, sleep latency, percentage of stage one non-rapid-eye-movement sleep, and desaturation events≥4% (p: < 0.001, 0.001, 0.021, and 0.043, respectively; adjusted R²=0.252) were negatively associated with BI score gains.

Conclusions: In addition to contributing polysomnography data essential for optimizing functional rehabilitation of subacute stroke patients, our data suggest that insomnia is likely a more influential factor than SDB for brain functional recovery.
IS THE RESPIRATORY STABILITY DURING SLEEP IN PATIENTS WITH SEVERE HEART FAILURE INFLUENCED BY THE NOCTURNAL OXYGEN LEVEL? A SUB-ANALYSIS OF THE PROST STUDY USING A NOVEL RESPIRATORY STABILITY INDEX


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Introduction: Many patients with heart failure (HF) are accompanied by obstructive and/or central (known as Cheyne-Stokes respiration) sleep disordered breathing (SDB). Patients with HF also show irregular rapid and shallow respiration which is believed to be evoked by pulmonary congestion even while they are awake. As some of such unstable respirations appear at the state of worsening HF, respiratory instability could be a key indicator of alteration of the state of HF. For this purpose, we proposed a new index named Respiratory Stability Index (RSI) which was attained from the inverse number of the standard deviation of respiration frequency distribution. With this index, we underwent the PROST (prospective study on respiratory stability through recovery process from deterioration of HF) study, which was a multicenter (8 Japanese institutes), prospective, observational cohort study measuring alteration of RSI from acute decompensated period to fully recovered period in HF patients. We have already presented the first result that RSI significantly increased as the clinical status of heart failure, especially congestive condition, improved (Takagawa, Japanese Circulation Society meeting 2017). As respiration is strongly influenced by the oxygen level, we tried to further study whether the oxygen level also influences the instability of respiration in HF.

Materials and methods: In PROST study, we enrolled 44 patients with acute decompensated HF. In the present subanalysis of PROST study, we analyzed 42 data sets in their deterioration period. Overnight RSI values were calculated from the respiration data collected using a portable polygraph (SAS-3200) and analyzed using custom made algorithm (Asanoi, J Cardiol, 2017). We compared the overnight mean oxygen saturation (SpO2) and the 3% oxygen desaturation index (3%ODI) with RSI. Furthermore, we evaluated the effect of oxygen inhalation on the relationship between these parameters and RSI values.

Results: RSI values and mean SpO2 values while the patients sleep during deterioration period were not significantly correlated (p=0.32). This negative relationship was not affected by oxygen inhalation at the time of data collection (p=0.38, 0.28, respectively). On the other hand, RSI values showed significantly correlation with 3%ODI (p=0.0003) regardless oxygen inhalation (p=0.04, 0.004, respectively).

Conclusions: Respiratory instability in severe HF patients may not be the result of mean oxygen desaturation but mainly caused by congestive state of the lung. As 3%ODI indicates respiratory irregularity with a low frequency accompanied by oxygen desaturation, the significant correlation between 3%ODI and RSI may suggest that the rapid and shallow type irregular respiration might not be a sole cause of decrease in RSI but worsening of central type SDB during deteriorated period would constitute some part of RSI change. Thus, RSI may correctly reflect the pulmonary congestive state regardless of the level of oxygenation.
Sleep Breathing Disorders  
Board #124: P2 - Monday  
METABOLIC PROFILE IN PATIENTS WITH MILD OBSTRUCTIVE SLEEP APNEA

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Introduction: Mild obstructive sleep apnea (OSA) is a highly prevalent disorder in adults. However, it is uncertain whether mild OSA has significant metabolic complications.

Objective: To evaluate the metabolic profile of patients with mild OSA compared to controls.

Materials and methods: Adults (18-65 years-old) of both genders with a BMI ≤35 Kg/m² were included. In the mild OSA group, patients with AHI score of ≥5 but ≤15 events/hour of sleep were included independent of symptoms. In the control group individuals with AHI < 5 events/h and Epworth Sleep Scale < 10 were included. Sleep questionnaires, Maintenance of Wakefulness Test (MWT) and full-night polysomnography (PSG) were collected in both groups. Anthropometric measurements and fasting blood samples were obtained for measures of fasting glucose, insulin, total-cholesterol with its sub-fractions (LDL, VLDL and HDL-c); triglycerides and triglycerides/HDL-C ratio. In addition, QUICKI and HOMA indices were also calculated.

Results: 43.5% of mild OSA patients had hypertension, 14% showed dyslipidemia and 56% had prediabetes compared to the control group. OSA group showed increased triglycerides (CG: 90.0 ± 51.9 vs. OSA: 140.3 ± 78.2mg/dL, p=0.004), and TG/HDL-c (CG: 1.9 ± 1.4 vs. OSA: 3.1 ± 2.0, p=0.05) after adjustments for age, gender, BMI and waist circumference. Independent of obesity (BMI< 30 Kg/m²), there was a negative correlation between total cholesterol and triglycerides with mean oxygen saturation (SpO2).

Conclusions: Our findings showed dysregulation in lipid profile after adjustments in the mild OSA group that was related to sleep hypoxemia. The high value of TG/HDL-c ratio suggests that it might be investigated as a marker of a detrimental metabolic profile in these patients.

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**EFFECTS OF MORPHINE ON THE PHENOTYPIC CAUSES OF OBSTRUCTIVE SLEEP APNEA**

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**Introduction:** Opioids are commonly used for pain management including acutely in the post-operative setting. Accidental deaths by non-illicit opioids have increased substantially in recent years. Deaths nearly always occur during sleep due to respiratory failure. Thus, people with sleep apnea may be at greater risk. There are 4 key causes of obstructive sleep apnea (OSA). A highly collapsible upper airway, poor upper airway muscle responsiveness during sleep, a low respiratory arousal threshold and unstable ventilatory control (high loop gain). Concerns are that opioids such as morphine may worsen OSA severity via respiratory depression and central reductions in neural drive to the upper airway dilator muscles. However, the effects of morphine on the key phenotypic causes of OSA have not been investigated. Accordingly, given the increasing rates of use and potential for harm, the aim of this study was to evaluate the effects of morphine on the 4 key causes of OSA.

**Materials and methods:** Twenty-one overweight OSA (mean AHI=23±17; range=7-67 events/h sleep) males, were studied on 2 separate nights according to a randomised, double-blind, cross-over design (ACTRN12613000858796). On one occasion patients received 40mg of MS Contin at ~5pm prior to sleep and on the other placebo (1 week wash-out between visits). During non-REM sleep transient reductions in CPAP (up to 3 mins) were delivered to induce inspiratory airway limitation/closure to allow for quantification of the 4 key phenotypic traits that cause OSA (i.e. upper airway collapsibility [Pcrit], genioglossus muscle responsiveness, respiratory arousal threshold and loop gain) at each visit. In addition, CO₂ was administered via nasal mask during therapeutic CPAP to achieve 5 and 7.5mmHg increases in end-tidal CO₂ from baseline to allow for quantification of hypercapnic ventilatory responses during stable non-REM sleep.

**Results:** Compared to placebo, 40mg of morphine did not change upper airway collapsibility as measured by Pcrit (-0.1±2.4 vs. -0.4±2.2 cmH₂O, p=0.58), genioglossus muscle responsiveness (-2.2 [-5.4 to -0.87] vs. -1.2 [-3.5 to -0.3] microV/cmH₂O increase in negative pharyngeal pressure, p=0.22), or arousal threshold (-16.7±6.8 vs. -15.4±6.0 cmH₂O, p=0.41), but did reduce loop gain (-10.1±2.6 vs. -4.4±2.1 dimensionless, p=0.04). Ventilatory and genioglossus muscle responses to elevated CO₂ were also diminished with morphine.

**Conclusion:** Consistent with recent clinical findings in which acute doses of 30 and 40mg of morphine do not systematically worsen OSA severity, 40mg of morphine did not change upper airway collapsibility, genioglossus muscle responsiveness to airway narrowing, or the respiratory arousal threshold in patients with predominately moderately severe OSA. However, in accordance with blunted chemosensitivity, 40mg of morphine did reduce loop gain and hypercapnic ventilatory responses during sleep. These properties may have paradoxical effects in OSA reducing unstable respiratory control in patients with high loop gain but potentially decreasing breathing and worsening blood gas disturbances in others. Identification of the physiological characteristics of patients most at risk of harm with opioids remains a priority. The effects of higher doses, long-term use, and responses in severe OSA patients require further investigation.

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**MORBUS CROUZON AND SEVERE OBSTRUCTIVE SLEEP APNOEA - CASE REPORT**

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**Introduction:** Crouzon syndrome (CS) is an autosomal dominant genetic disorder caused by mutation in the fibroblast growth factor receptor 2 genes. CS has a prevalence of 1:60 000 live births with male to female preponderance of 3:1. The syndrome is characterized by premature synostosis of coronal and sagittal sutures leading to facial dysmorphism, skull deformities and exophthalmos. Orofacial manifestations of this disease include maxillary hypoplasia, external nasal deformity and prognathism. Airway distress is a well described feature of this syndrome and both upper and lower airway obstruction may be present in the Crouzon syndrome. Due to airway obstruction as a result of anatomical midfacial hypoplasia, patients with CS are prone to obstructive sleep apnoea (OSA) with an estimated prevalence between 40 and 85%. For majority of patients, an individual treatment plan is necessary to make as CS often has different phenotypes and different severity of OSA. Current literature is limited due to rarity of cases especially of the first manifestation of OSA in adult patients with CS.

**Materials and methods:** In this case report, we have introduced an adult male patient with CS who was referred to our sleep laboratory with the suspicion of sleep disordered breathing.

**Results:** The patient was a 28 years old man who was diagnosed with CS at the age of 2. He complained of severe snoring, witnessed apnoeas and excessive daytime sleepiness (EDS) lasting for one year. Overnight polysomnography showed an apnoea-hypopnoea index (AHI) of 91.4 episodes/hour with oxygen desaturation index (ODI) of 91.0 episodes/hour. Episodes of second degree atrioventricular block were noticed on electroencephalography (EEG) at night. Nasal continuous positive airway pressure (CPAP) treatment with manual titration of therapeutic pressures was the first choice of treatment. Initially, the patient suffered from aerophagia but after adjustment of pressure settings AHI and ODI were effectively reduced to 8.8 and to 9.3 episodes/hour. Therapeutic CPAP pressure was 12.5 cmH$_2$O. There were no episodes of heart rhythm disturbances while on CPAP. The patient tolerated CPAP well, and at the control at 3 years his compliance with CPAP remained to be very good.

**Conclusions:** This case report demonstrates the first manifestation of severe OSA in a middle-aged male patient with Crouzon syndrome. Our findings suggest that nasal CPAP treatment was a useful treatment modality with improvement of nocturnal saturations, normalization of EEG and subjective reduction of daytime OSA symptoms. In line with literature we propose individualized therapy to obtain optimized results in OSA management for patients with Crouzon syndrome.

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The authors declare no conflict of interest in relation to this work.
Introduction: Obstructive sleep apnea (OSA) is a clinical syndrome characterized by repeated partial or complete upper airway obstruction during sleep. Elevated rates of psychiatric symptoms in individuals with OSA are commonly reported in recent data. The aim of this study was to observe psychiatric co-morbidity in these patients.

Materials and methods: Participants completed The Symptom Checklist 90-Revised (SCL-90-R). SCL-90 was given to all patients with obstructive sleep apnea, diagnosed with polysomnography in Sleep Disorder Department sequentially. This form was evaluated by one neurologist and one psychiatrist. Evaluating the subscales of Somatization, Obsessive-Compulsive thoughts, Interpersonal Sensitivity, Depression, Anxiety, Phobic Anxiety, Psychoticism, Paranoid Ideation, and Hostility; and then psychopathology levels were detected.

Results: One hundred eighty-four participants aged between 20 and 78 years old (mean 51.2±11.35) were included in this study; 139 (75.5%) of them were male and the remaining 45 patients (24.5%) were female. Somatization was detected in 100 (54.3%); anxiety in 68 (37%); obsession in 106 (57.6%); depression in 82 (44.6%); interpersonal sensitivity in 75 (40.8%); psychotic symptoms in 44 (23.9%); paranoid symptoms in 81 (44%); hostility in 73 (39.7%); phobic anxiety in 39 (21.2%) of the patients, who were evaluated with The SCL-90 Checklist.

Conclusions: It should not be forgotten that psychiatric findings can be added to the table as it is in other chronic diseases.
INTRODUCTION: Obstructive Sleep Apnoea (OSA) is the commonest sleep related breathing disorder with estimated prevalence of 2%-4% among adults. Prevalence of OSA is high among obese population. OSA is diagnosed by performing a sleep study measured as Apnoea Hypopnea Index (AHI) where AHI of ≥5/hour is diagnostic of OSA.

Bariatric surgery is performed with the aim of achieving weight loss and is usually recommended to individuals with a Body Mass Index (BMI) >40 kg/m² or to those with a BMI >35 kgm² associated with high risk comorbid conditions. It is advisable to screen all patients for OSA with a routine sleep study prior to bariatric surgery. Obesity is increasingly prevalent among Sri Lankans, and more and more patients are undergoing bariatric surgery. There is paucity of data globally as well as locally on the effectiveness of bariatric surgery over resolution of OSA.

OBJECTIVES: To assess the resolution of OSA in adult patients following bariatric surgery.

METHOD: We did overnight sleep studies (level 3 study or a Polysomnography(PSG)) on 34 patients awaiting bariatric surgery. OSA severity was measured with AHI, where AHI of 5-14, 15- 29 and ≥30 categorize as mild, moderate and severe OSA respectively. Patients who completed 6 weeks or more, post operatively were re-evaluated by a sleep study. Daytime somnolence was assessed by Epworth Sleepiness scale (ESS).

RESULTS: Of the total, 23 diagnosed with OSA (AHI>5/hr), of which, 8 are awaiting post-op evaluation, two were lost to follow up and 13 patients were re-assessed. There were 9 (70%) females. Mean age was 46.8 years (SD,10.4), 53.8% had hypertension, 38.5% had diabetes mellitus & and 7.7% had ischemic heart disease. Five and three patients had severe OSA (mean AHI,61.5 events/hr, SD,25.0) and moderate OSA (mean AHI, 21.8 events/hr ;SD,4.3) respectively.

Mean weight reduced from pre-operative 126.7 Kg (SD,22.6) to 98.9Kg (SD,18.0) post-operatively while mean BMI dropped from 48.6 Kg/m²(SD,6.7) to 37.5 Kg/m² (SD,6.0) (P< 0.001).

Mean AHI declined from 31.9(SD,28.9) to 12.4 (SD,11.9) (p< 0.01). OSA has completely resolved in 4 of 5 with mild OSA and 1 of 3 patients with moderate OSA. No resolution observed in the severe OSA category despite a statistically significant reduction of AHI (mean reduction of 41.6 events/hr; SD,29.0, p< 0.05). There was no evidence of significant influence by the presence of any chronic disease over mean BMI reduction or mean AHI reduction in this study sample.

Pre operatively eight had an ESS score of = >10, with two patients > 16. Post operatively ESS dropped below 10 among all, with improved daytime somnolence (p< 0.005).

CONCLUSION: Bariatric surgery seems to be effective in reducing AHI and resolution of OSA amongst mild and moderate OSA patients in this study sample.
BIMAXILLARY ADVANCEMENT AS ALTERNATIVE TECHNIQUE IN OUR OSAS COHORT

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Introduction: BiMaxillary advancement (BMA) is an effective alternative in the Obstructive Sleep Apnea Syndrome (OSAS) treatment, available for selected patients in our hospital. The primary endpoint is to describe the results obtained with this alternative technique.

Materials and methods: Prospective study of OSAS patients who underwent BMA between 2013-2015. The surgical indication was determined by a multidisciplinary committee. Polysomnography was performed both before and after surgery.

Results: We studied 20 patients, with a mean age of 40'75±8 years old, BMI 26'25±6. 10 patients were CPAP-intolerant and 10 asked for an alternative treatment. All the patients presented craniofacial abnormalities that were susceptible of surgery. Previous mean AHI of 38±15 decreased to 11'22±13'65 after surgery. 18 patients had an AHI decreased to less than 50% of the initial one, and 12 achieved AHI< 5. The entire cohort improved sleepiness and snoring. There were minor complications in 6 cases: epistaxis, dysphagia, longstanding pain, infection, and hematoma. A case of malocclusion required reintervention. A case of intolerance to osteosynthesis material required removal of the pieces. There was a case of long-term condylar remodeling with mandibular height loss.

Conclusions:
• BiMaxillary advancement surgery is an effective treatment for OSAS in our hospital in patients with retrognathia, micrognathia and retrusive profile.
• In more than half of the cases, OSAS is completely resolved with clinical improvement in all of the cases.
EFFECTS OF CPAP THERAPY ON BLOOD PRESSURE VARIABILITY (BPV) IN PEOPLE WITH COMORBID OBSTRUCTIVE SLEEP APNOEA (OSA) AND CARDIOVASCULAR DISEASE (CVD): SAVE TRIAL

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Introduction: Higher BPV over an extended period is associated with adverse CVD outcomes including cardiac dysfunction and serious macro- and micro-CVD events. Two small, non-controlled, studies found decreased visit-to-visit BPV with continuous positive airways pressure (CPAP) use. We aimed to determine whether CPAP reduced BPV compared to usual care in people with comorbid OSA and coronary or cerebral CVD.

Materials and methods: The SAVE study was an international, multi-centre, randomised, parallel group, open-label trial in which patients with moderate-severe OSA and established cardiac or cerebral CVD were randomised to CPAP or usual care. This sub-analysis included those participants with blood pressure (BP) measurements for ≥5 visits over the first two years (0 days, 1, 3, 6, 12 months and/or 24 months, post-randomization). BP measurements were taken in a resting, seated position in the clinic in duplicate (5 mins apart); the mean of BP duplicates was taken as the BP in each visit. BPV was defined as the standard deviation (SD) in BP across ≥5 (max. 6) clinic visits for each participant within the first 24 months post-randomization; both systolic and diastolic BPV were calculated. BPV was also calculated using the coefficient of variation (CV%), and the mean and maximum systolic and diastolic BP were ascertained for the CPAP and usual care groups. Data were assessed for normality and independent sample t-tests were used in this unadjusted analysis.

Results: Of 2717 eligible adults (45-75 years), 2381 (88%) met the inclusion criteria (≥5 clinic visits with BP data available). A small increase in systolic BPV, as measured using SD, was observed in the CPAP therapy group compared with the usual care group (n=1178; SBP SD mean difference 0.42 mm Hg, 95% CI 0.02 to 0.82 mm Hg; p = 0.039). Systolic BPV, as measured using coefficient of variation (%) was similarly increased in the CPAP group (mean difference 0.35, 95% CI 0.05 to 0.64; p = 0.022). There was a similar, but non-significant trend towards increased diastolic BPV in the CPAP group according to SD (mean difference 0.23 mm Hg, 95% CI -0.00 to 0.46; p = 0.052). This increase in diastolic BPV was significant when measured using CV% (mean difference 0.36, 95% CI 0.06 to 0.67; p = 0.018). Mean diastolic BP was slightly reduced in the CPAP group (mean difference -0.78 mmHg, 95% CI -1.44 to -0.13; p = 0.020), but no other significant between-group BP differences were evident.

Conclusions: CPAP produced a small increase in BPV, but this is unlikely to have had clinically relevant effects. These findings are in concordance with the main findings of the SAVE trial: neutral effects on cardiovascular and cerebrovascular endpoints.

Acknowledgements: This trial was funded by the National Health and Medical Research Council of Australia and others. SAVE ClinicalTrials.gov number, NCT00738179; Australian New Zealand Clinical Trials Registry number, ACTRN12608000409370.
MANAGEMENT OF OBSTRUCTIVE SLEEP APNOEA IN INFANTS

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Introduction: Obstructive sleep apnoea (OSA) in infants has a distinctive aetiology and therefore treatment compared with older children. There is a paucity of international data regarding management of OSA in infants. We aimed to investigate interventions used for treatment of OSA in infants < 24 months.

Materials and methods: This was a retrospective study in a tertiary paediatric hospital with a paediatric sleep laboratory. Participants included all infants aged 0-24 months at the time of OSA diagnosis by polysomnography (PSG) between July 2015 and December 2016. OSA was defined by an obstructive respiratory disturbance index (ORDI) >1/hr.

Results: 81 patients (44 M 37 F) were included. Mean (SD) age at OSA diagnosis was 6 (6) months; 51 infants < 6 months, 13 infants 6-12 months and 17 infants 12-24 months. Mean (SD) ORDI was 12 (11). Seventy-two (89%) infants had specific risk factors for OSA including craniofacial and airway abnormalities, a congenital syndrome or neurological condition and 15 (18%) had undergone surgery for upper airway obstruction prior to PSG. In 34 (42%) infants the treatment for OSA was surgical; the most common intervention based on age was jaw distraction in infants < 6 months and adeno-tonsillectomy in infants 6-12 and 12-24 months. 47 infants had non-surgical interventions; the most common were medication (19) e.g. anti-GOR drugs, nasal steroids, clinical observation (19), CPAP (15), supplemental O2 (9), positioning (5), a naso-pharyngeal tube (3) and/or high-flow nasal prong therapy (2). Of the 15 infants trialled on CPAP, 6 failed initiation and only 7/9 remained on CPAP at follow-up. Regarding subjective improvement in OSA post intervention, 8/44 parents reported no change in symptoms, 23/44 reported some improvement, 13/44 reported resolution of symptoms and no parents reported worsening. 24 patients had a post treatment PSG, of whom 3 had worsening OSA, 9 had no change in OSA severity, 9 had an improved ORDI and 3 had resolution of OSA.

Conclusions: In this cohort of infants with a high prevalence of co-morbidities, jaw distraction was the most common surgical intervention in patients < 6 months and adeno-tonsillectomy in patients 6-24 months. Medication and clinical observation were the most common non-surgical interventions. CPAP therapy in this population remains a challenge.
Sleep Breathing Disorders
003: Sleep breathing disorders oral abstract presentations

NASAL OBSTRUCTION DECREASE AFTER TWO YEARS OF PAP TREATMENT

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Introduction: Treating obstructive sleep apnoea (OSA) with Positive Airway Pressure (PAP) treatment is thought to produce nasal obstruction. This study was conducted to investigate the quantity of objective nasal measures and subjective nasal symptoms before and after two years of PAP treatment, and also to find out to what extent nasal obstruction influenced adherence to PAP treatment.

Materials and methods: 810 patients with obstructive sleep apnoea were investigated in the Islandic sleep apnoea cohort untreated at baseline and after two years of PAP treatment. The patients underwent Acoustic Rhinometry, a type 3 sleep study, filled out questionnaires, and were clinically examined.

Results: The nasal dimensions were larger after two years of PAP treatment, TMCA (Total minimal cross section area), med ± SD, baseline: 1.06 ± 0.31 vs. at two year follow up: 1.16 ± 0.33 (p< 0.001). The number of patients with nocturnal nasal obstruction, ≥ 3x week, were less after two years, 35 % vs. 24 % (p< 0.001), and patients with nasal mask or swift mask reported less nocturnal nasal obstruction compared to patients with full face mask 20 % vs. 27% (p< 0.001). The number of days on PAP was not different between the groups: never nocturnal nasal obstruction, only obstruction at baseline, only obstruction at two year follow up, and obstruction at both baseline and at follow up (p=0.085).

Conclusions: Patients´ nasal obstruction improved both objectively and subjectively after two years of PAP treatment. Nocturnal nasal obstruction did not influence PAP adherence. OSA patients should be encouraged to continue with PAP treatment when they experience nasal obstruction.

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Introduction: Since 2014, IFA3D Medical Solutions GmbH works only with digital Equipment to produce individual Products for Patients with sleep or breathing disorders. The complete workflow has change, since we use scanner, CAD-Software and 3D Printer to create individual medical Solutions.

Materials and methods: 3D Scanner; 3D CAD-Software; 3D Printer (Polyjet) with biocompatible Materials.

Results: Success rate 97%; more than 400 treated Patients; Reduction in Time and Material; better fit; no leakage; higher comfort.

Conclusions: Trend for the future; easier Realisation of individual wishes; no Impression required; more comfort for the Patient; Possibility of international Exchange.

Acknowledgements: Stratasys; Geomagic (3D Systems); Artec; Dreve; Institut für Anaplastologie Velten & Hering GbR
Introduction: Previous studies have shown that obstructive sleep apnea (OSA) patients have more upper airway soft tissue and craniofacial skeletal alterations compared with controls. These findings are based on clinical ear, nose, ant throat (ENT) evaluation, as well as objective assessments such as cephalometry, magnetic resonance imaging (MRI) and quantitative craniofacial photography. However, most studies have used clinical samples with high risk for OSA. It is unknown whether such assessments are useful in the general population. The aim of this study is to determine whether craniofacial or intraoral risk factors for OSA differ between clinical and general population samples.

Materials and methods: A total of 880 participants, 303 clinical patients and 577 volunteers from the general population, underwent digital photography (using a craniofacial and intraoral laser ruler) and polysomnography.

Results: The mean age +/- SD was 48±14 years; 51% were men and the average body mass index (BMI) was 28.4±5.7 kg/m2. OSA (AHI>10) was observed in 38.9% of the participants: 46.9% in the clinic sample and 34% in the population sample. After adjustments for OSA risk factors (age, BMI and gender), OSA patients in all samples showed higher Mallampati score, Maxillary-Mandibular relationship, cervicomental angles and tongue length compared to Non OSA. Facial axis, Vertical mouth open were higher in the population sample compared to the clinical sample. Face width, mandibular length, Mouth opening width, tongue length, tongue area, tongue thickness and tongue curvature were higher in the clinical sample compared to the population sample. OSA patients had higher Mouth opening width and tongue thickness than controls, only in the clinical sample.

Conclusions: This study show that craniofacial and intraoral photography identifies different craniofacial and soft tissue risk factors in OSA subjects from the general population compared to clinical patients.

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**Introduction:** Among the various etiological factors of obstructive sleep apnea syndrome (OSAS), transverse maxillary deficiency is being recognized as an important factor both in terms of the prevention and treatment of OSAS. However, few studies have demonstrated the relationship between surgically assisted rapid maxillary expansion (SARME) and the treatment of OSAS exclusively among adult patients. The objective of the present study was to assess the efficacy of SARME in adult patients with OSAS and with daytime sleepiness.

**Materials and methods:** A prospective study was conducted on 16 adults aged on average 40.23 years (sd: 10.23) with transverse maxillary deficiency and OSAS duly confirmed by whole-night polysomnography (PSG). Approximately 1 year and 2 months after surgery, a new PSG was performed and its values were analyzed statistically by the Wilcoxon test. The Epworth sleepiness scale (ESS) was also applied together with PSG and its values were also analyzed.

**Results:** We detected a reduction in the respiratory disorder index from 35.46 ± 38.54 to 16.07 ± 19.73 (mean: 54.68%, p=0.0013), a mean reduction of 56.24% in the apnea and hypopnea index (33.23 ± 39.54 to 14.54 ± 19.48; p=0.001), a reduction of micro-awakening and desaturation indices, in addition to an improvement of various PSG parameters. The ESS score showed an improvement from 12.50 ± 5.32 to 7.25 ± 3.53 (p< 0.001).

**Conclusion:** SARME was efficient in reducing OSAS by more than 50% of its initial values and in reducing daytime sleepiness to values within the normal range.

**Acknowledgements:** FAPESP
Introduction: It is well known that breastfeeding is superior to bottle feeding in several aspects; however, the protective effect of breastfeeding on the development and tonicity of facial structures can be decisive for the prevention of obstructive sleep apnea syndrome (OSAS) among both adults and children.

Materials and methods: A review of the literature revealed that bottle feeding causes changes in facial structures, especially a reduction of the transverse diameter of the maxilla and of the final length of the mandible in the anteroposterior direction. In parallel, several publications have demonstrated that the correction of transverse maxillary deficiency promotes a marked improvement of OSAS in both adults and children and that mandibular or maxillomandibular advancement surgeries are the most efficient for the treatment of OSAS in adults. Another negative aspect of bottle feeding is regression of the tongue, which becomes more posteriorized and with a raised dorsum compared to the tongue of breastfed babies. This more posterior positioning of the tongue is typically detected in adults with OSAS.

Results: Based on literature evidence, it was possible to determine a relationship between the changes in facial development promoted by bottle feeding and OSAS among children and adults. This evidence becomes clear when we consider that the more efficient techniques for the skeletal treatment of OSAS usually are corrections of deformities created, in general, by the use of bottle feeding. The incorrect positioning of the tongue characteristic of the use of a bottle is also another factor that probably interferes with the occurrence and severity of OSAS in adults.

Conclusions: There is evidence that breastfeeding has a protective effect against OSAS, mainly when compared to artificial bottle feeding.
Introduction: Obstructive sleep apnea (OSA) is a highly prevalent disease and due to the increasing demand for hospital sleep units, there has been growing interest in ambulatory models of care for patients with OSA. Since 2015, the Portuguese model determinate the reference to primary care units of OSA patients with CPAP compliance and efficacy and with no treatment complaints.

We performed a study to evaluate whether follow-up of patients undergoing treatment in the primary care units still remained stable after 18 months from discharge.

The primary outcome was the comparison of CPAP compliance objectively measured using the number of hour of CPAP use per night. The secondary outcomes were the change in percentage of nights with CPAP use more than 4h, the apnea-hypopnea index (AHI), the body mass index (BMI) and Epworth Sleep Scale (ESS) score.

Materials and methods: Study participants were discharged from the hospital sleep unit from May to October 2015. We reviewed the hospital process and reassessed patients at the present time with clinical features and CPAP data.

Results: We included 111 patients with a mean apnea-hypopnea index 38.2 ± 23.1/h, age 67.9 ± 9.8 years, 82% male, with mean CPAP use of 6.7 ± 3.3 years. The primary care follow-up mean period was 19.4 months. The CPAP compliance was 6.9 ± 1.2 hours per night in the sleep unit vs 6.9 ±1.3 hours per night in the primary care follow-up, with no significant mean difference (p=0.500). There were also no significant difference in the BMI (32.0 ± 5.1 kg/m² in the sleep unit vs 31.7 ± 7.5 kg/m² in the primary care follow-up; p=0.119), in the residual ESS score (4.2 ± 2.8 in the sleep unit vs 4.3 ± 5.6 in the primary care follow-up; p=0.916) or in the residual AHI (2.1 ± 1.4/h in the sleep unit vs 2.7 ± 4.1/h in the primary care follow-up; p=0.601). The percentage of nights with CPAP use more than 4h was significantly lower in the reassessment (97.7 ± 3.6 in the sleep unit vs 88.3 ±19.6 in the primary care follow-up; p< 0.001).

Conclusions: A 18 month follow-up of stable OSA patients disclosed similar CPAP compliance and efficacy in primary care and in sleep unit settings.
SEVERE OBSTRUCTIVE SLEEP APNEA AND BARIATRIC SURGERY: A CASE OF SUCCESS!

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Introduction: There is a relationship between Obesity and Obstructive Sleep Apnea (OSA) with the significant improvement or complete resolution associated with the weight loss. The bariatric surgery treatment of patients with OSA has been controversial and reserved for patients with higher body mass index (BMI) that integrate multidimensional approach on sleep therapy.

Materials and methods: The authors present a case report of a morbid obese patient with OSA that illustrates the strong impact of weight loss in the control of the disease.

Results: A 27 years old female patient referenced to our sleep unit due to excessive daytime sleepiness (ESS - Epworth Sleepiness Scale 12/24) and snoring. She was obese (151 kg; BMI of 55.5 kg/m²) and had smoking habits (10 cigarettes/day, 5 Smoking Pack Years).

It was performed an attended polysomnography (Level 1): apnea-hypopnea index (AHI) 132.4/h, respiratory disturbance index (RDI) of 137.9/h, T90 23.4%, oxygen desaturation index (ODI) 121.6/h. She adapted CPAP with nasal mask with a compliance of 4.2 h/night.

After one year with CPAP treatment, she was submitted to bariatric surgery and lost 61 kg (40.4% of initial weight) in 12 months with BMI 33.1 kg/m². She had no sleep complaints (ESS 0/24) and no cardiovascular disease.

A polysomnography was repeated and revealed an AHI 6.4/h, RDI 6.7/h, T90 0.1%, ODI 6.2/h. She stops CPAP treatment and maintain follow-up in pulmonology department.

Conclusions: This case reinforces the importance of weight loss in controlling OSA syndrome, even when the severity of sleep disorders is so pronounced.
Sleep Breathing Disorders
Board #152: P5 - Wednesday
OVERLAP OF OBSTRUCTIVE SLEEP APNEA (OSA) AND BRONCHIAL ASTHMA (BA): EFFECT ON ASTHMA CONTROL

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Introduction: OSA and BA are highly prevalent respiratory disorders that often co-exist. Multiple mechanisms have been postulated to explain this frequent coexistence, which is referred to as the 'alternative overlap syndrome'. Moreover, OSA is generally linked to worse asthma outcomes. The objectives of the study were first to assess the prevalence of OSA in a group of asthmatics, second to evaluate the potential risk factors underlying the development of OSA in these patients and third to determine the effect of this overlap on asthma control.

Materials and methods: Polysomnography was done for 45 asthmatics and 25 controls. Demographics, spirometry, comorbidities and clinical data collected. Asthma control was assessed according to the latest GINA guidelines.

Results: OSA defined by an AHI of ≥ 5 events/h was present in 29 (64,4%) asthmatics and 4 (16%) controls. Regression analysis revealed that high body mass index (BMI), coexistent gastroesophageal reflux disease (GERD) and asthma severity (FEV1%) are significant independent predictors for the development of OSA in asthmatics (p=0.03, 0.034 and ≤ 0.001 respectively). Moreover, the presence of OSA in asthmatic patients was significantly associated with worse asthma control (p≤0.001).

Conclusions: A high index of suspicion is warranted for the overlap of OSA and asthma, particularly in the presence of obesity, GERD, and in patients with severe asthma. Individualized therapy addressing these moderating factors is warranted for optimal health outcomes. Recognition and treatment of OSA in asthmatics is an important element in improving asthma control.
Introduction: Morning headache (MH) is often a symptom associated with obstructive sleep apnea syndrome (OSAS). There are also patients with MH but without OSAS. What is the importance of MH in the management of patients with OSAS and vice versa?


Results: The prevalence of MH in the general population is 5-7%, in patients with OSAS 11-74%. According to the literature, there are two types of MH: associated with OSAS and not associated with OSAS, the latter being included in The International Classification of Headache Disorders, 3rd edition (beta version). The principally criterion for establishing of the MH associated with OSAS is its resolution after OSAS treatment. MH that is not associated with OSAS is attributed to other forms of primary headache. It is possible that MH to be generated by both: OSAS and primary headache.

Conclusions: A detailed description of MH is important for excluding primary headache in the OSAS patients management. For the patients with MH, it is important to perform cardiorespiratory polygraphy to exclude OSAS.
Sleep Breathing Disorders

O11: Sleep breathing disorders oral abstract presentations

PREDICTING RESPONSE TO OXYGEN THERAPY IN OBSTRUCTIVE SLEEP APNEA PATIENTS USING VENTILATORY CHEMOREFLEX TEST DURING WAKEFULNESS

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Introduction: There is no satisfactory treatment for obstructive sleep apnea (OSA) as existing treatment options are either poorly tolerated or only partially alleviate abnormalities. Supplemental low-flow oxygen therapy has been shown to reduce hypoxemia and is relatively well tolerated by OSA patients. However, use is limited because the literature suggests that oxygen therapy may benefit only certain subsets of OSA patients. Recent experimental studies suggested that overnight physiological traits could be used to predict individual OSA response to non-CPAP therapies. In this study, we evaluated a potentially more clinically viable test- a 10-min awake ventilatory chemoreflex test in predicting individual OSA response to 2-months low flow oxygen therapy.

Materials and methods: OSA patients with apnea hypopnea index (AHI)>15/hr and who have refused or are intolerant to CPAP therapy were recruited. In the baseline visit, they were evaluated with awake ventilatory chemoreflexes (Modified Duffin Method) in the afternoon prior to the overnight PSG. Then subjects were treated with nocturnal oxygen treatment at a flow rate of 3 L/min via a nasal cannula via an oxygen concentrator. After two months, patients were reassessed with a second in-lab overnight PSG.

Results: Twenty OSA patients completed the study with an average age of 57.8 years, BMI of 31 kg/m² and baseline AHI of 32.6/hr. As primary outcome of interest, change of AHI significantly correlated with baseline ventilatory response threshold (VRT) (r=-0.48, p=0.04) and chemosensitivity (r=0.50, p=0.03) after 2 months oxygen treatment. In predicting a fall in AHI after oxygen therapy (change in AHI < 0), the area under the receiver operating characteristic curve (AUC) is 0.79 and 0.89 for VRT and chemosensitivity respectively. Importantly, when these two variables are combined in a logistic regression model, the prediction effect becomes stronger with a sensitivity of 0.92, specificity of 0.83 and AUC of 0.97. Based on data from 68 patients in three of our OSA studies, 25% of patients with OSA would be predicted to respond to oxygen.

Conclusions: Our awake ventilatory chemoreflex test could be considered as an applicable clinical tool to predict individual OSA response to oxygen therapy with high sensitivity and specificity. As a quick, cheap, and non-invasive daytime test, it provides a potential for a novel personalised medicine approach in selecting suitable OSA patients for targeted treatment. It is particularly important for those patients who reject CPAP therapy.

Acknowledgements: We would like to thanks all the staffs working at the Sleep Investigation Unit at Royal Prince Alfred Hospital who assisted in the completion of the project.
Introduction: Obstructive sleep apnea syndrome (OSA) affects 1 to 4% of the children, the gold standard treatment being adenotonsillectomy (AT). However, 10 to 35% of the patients submitted to AT remain with residual OSA. Drug-induced sleep endoscopy (DISE) may aid in the diagnosis of the levels of upper airway collapse (VAS) and thus, help in prediction of success or improve decision for best treatment.

Objectives: Evaluate the feasibility of drug-induced sleep endoscopy (DISE) in children with OSA and to correlate the research with OSA severity with apnea and hypopnea index (AHI).

Methods: Prospective study evaluating OSA children diagnosed by polysomnography, with indication of adenotonsillectomy (AT). They were submitted to DISE at the beginning of the surgery. The levels of obstruction were described by VOTE scale and associated to OSA severity.

Results: Out of 45 children, 7 had incomplete polysomnography data, 6 did not finish DISE due to hypersecretion and/or laryngospasm. 32 (20 male), mean age 7.5 years (3.25 - 9.92) and mean body mass index (Z-score) 1.24 (-2.06 - 10.42), completed all stages of evaluation. The mean AHI was 19.47 (2.9-54.8). DISE showed complete obstruction at the velopharynx in 15 (46.88%) patients and at oropharynx in 23 (71.88%), in 27 (84.32%) showed combined obstruction at velum and oropharynx. Complete obstruction of the tongue was observed in 9 (28.13%).

Conclusions: DISE can be considered an easy tool to evaluate other less common obstructive sites, but as there is manipulation of the airway, it must be realized in a safe environment. Unusual obstruction levels (tongue and epiglottis) were frequent, no significant association was found between obstruction of these sites and the severity of OSAS.
Introduction: OSA in children is associated to hypertrophy of the tonsils, tonsillectomy being the treatment of choice. Respiratory complications are described in up to 20% of the cases.

Objective: To identify risk factors for respiratory complications after adenotonsillectomy in children ≤ 12 years of age with obstructive breathing disorders and hypertrophy of the tonsils, as well as to identify the prevalence and severity of OSA in these children.

Methods: In a prospective study children, both genders, aged 2 to 12 years old, with complaints of respiratory disorders and hypertrophy and indication for adenotonsillectomy were randomized to full-night PSG in the pre- and pos-operative night. Independent t-test, t-dependent test, Mann-Whitney, Kruskal-Wallis and Chi-square tests were used to identify risk factors for respiratory morbidity after AT and severity of OSA.

Results: 82 children who performed AT were divided into 2 groups according to the presence or absence of respiratory complications. 16 (20%) children, 9 male, mean age 8.2 ± 2.4 years presented minor (SpO2 80-90%) and major respiratory complication (SpO2 < 80%, intra and postoperative bronchospasm and respiratory depression). Asthma, rhinopathy and attention-deficit were independent predictors of respiratory complications after AT. Among the medical interventions, 1 child performed continuous NBZ with a bronchodilator, 6 required airway repositioning and NBZ with supplemental O2, and 1 used narcan to reverse respiratory depression. OSA prevalence was 93% (76 children), 35% (26 children) were diagnosed mild, 41% (34 children) moderate and 20% (16 children) severe OSA. Clinical evaluation by questionnaire and otorhinolaryngological examination did not allow to stratify clinically children according to their severity, with the exception of GER.

Conclusion: Children with indication of AT due to obstructive breathing disorders have a high prevalence of OSA. Those who presented attention-deficit, asthma and rhinopathy developed more frequent respiratory complications after AT.
Introduction: Obstructive sleep apnea (OSA) is characterized by recurrent episodes of pharyngeal airway collapse and leads to repetitive hypoxia, generation of reactive oxygen species, and inflammation. Continuous positive airway pressure (CPAP) is recognized as the gold standard treatment for OSA. Previous reports on the effects of CPAP treatment are conflicting. We evaluated the association between liver and systemic inflammation markers and severity of OSA, and whether CPAP treatment improves inflammation.

Materials and methods: Twenty patients with severe (apnea hypopnea index, AHI: 37.6±6.6 events/h) OSA that was newly diagnosed using polysomnography were recruited. Patients received CPAP treatment for three months. The levels of liver enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST) and the levels of systemic inflammation markers high sensitivity C-reactive protein (hs-CRP) and neutrophils to lymphocyte ratio (NLR) were measured prior to and after three months of CPAP therapy.

Results: AHI was positively correlated with ALT (r=0.8175, p< 0.001), AST (r=0.8728, p< 0.001) levels, and hs-CRP (r=0.5918, p< 0.05). ALT, AST, hs-CRP levels, and NLR were lower post-CPAP compared to pre-CPAP (ALT: 21.5%, AST: 16.7%; p< 0.05) (hs-CRP: 30.0%, NLR: 19.0%; p< 0.01). Changes in ALT, AST, and hs-CRP levels between pre-CPAP and post-CPAP were calculated, and positive correlations between DALT (p< 0.01) and DAST (p< 0.05) with Dhs-CRP levels were observed.

Conclusions: Our study demonstrates that there is a positive correlation between liver and systemic inflammation and severity of OSA, that CPAP therapy in OSA patients produces clinical benefits, and that a reduction in liver enzyme levels is associated with a reduction in hs-CRP.

Acknowledgements: This study received an Invitation Research Grants from the Faculty of Medicine. Mr. Khanaphophon Wuttiumporn was supported by a Scholarship for Promotion of Education for Graduate Students in Medical Sciences, the Faculty of Medicine, and a Research Support Scholarship, the Graduate School, Khon Kaen University.
**Sleep Breathing Disorders**  
**Board #132: P2 - Monday**

**SEX-SPECIFIC PREVALENCE AND PREDICTION MODELS OF DYSLIPIDEMIA IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA**

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**Introduction:** Obstructive sleep apnea (OSA) is associated with dyslipidemia. Sex differences exist in OSA and may affect the prognosis of OSA. However, no study focused on sex differences in serum lipid/lipoprotein was performed. The study aimed to determine sex-specific prevalence and prediction models of dyslipidemia.

**Materials and methods:** In total, 2983 eligible suspected-OSA participants were recruited during 2007-2013. Overnight polysomnography parameters, biochemical indicators and anthropometric measurements were collected. Propensity score matching was used to match multivariate to make the groups more comparable. Logistic regression analyses were performed to identify variables independently associated with dyslipidemia for each sex.

**Results:** After matched for multivariate, male had more severe OSA, lower high-density lipoprotein cholesterol (HDL-C) levels, and higher percentage of hypo HDL-C than female, which sustained in subgroup analyses of patients with OSA. In male, obesity/central obesity and insulin resistance elevated the risks of dyslipidemia in TC, triglycerides (TG), HDL-C and low-density lipoprotein cholesterol (LDL-C), with OSA positively affecting dyslipidemia in LDL-C and TG. In female, except dyslipidemia in HDL-C influenced by central obesity and insulin resistance, the risks of dyslipidemia in other three lipids/lipoproteins increased with age and insulin resistance. Meanwhile, increased age and insulin were associated with specific dyslipidemia more in female than in male.

**Conclusions:** Male OSA were at higher risk of hypo HDL-C than female OSA. Obesity/central obesity and insulin resistance in both sex, along with age in female and OSA in male, play important role in specific dyslipidemia.

**Acknowledgements:** This study was supported by grants-in-aid from multi-center clinical research project from school of medicine, Shanghai Jiao Tong University (DLY201502) and Shanghai Shen-Kang Hospital Management Center Project of Shanghai (SHDC12015101).
Introduction: The associations between oral diseases and obstructive sleep apnea (OSA) have been reported in several cross-sectional studies. However, no current study measured the structure and composition of oral microbiota and evaluated their potential associations with perturbed metabolic profiling in pediatric OSA.

Methods and methods: An integrated approach combining metagenomics based on high-throughput 16S rRNA gene sequencing and metabolomics based on ultra-performance liquid chromatography coupled with quadrupole time-of-flight mass spectrometry and gas chromatography coupled with time-of-flight mass spectrometry were used to evaluate oral microbiome and urine metabolome.

Results: 16S rRNA gene sequencing revealed that oral microbiome composition in pediatric OSA was significantly perturbed when compared with normal control subjects. Moreover, metabolomics profiling revealed that a total of 57 metabolites were differentially expressed in urine of pediatric OSA and controls, of them, 5 were gut microflora-related metabolites. Correlation analysis reveals that several oral microbiome changes correlated with urinary metabolite perturbations in pediatric OSA, suggesting the initial equilibrium of oral microbiome and co-metabolism with the host were perturbed by OSA.

Conclusion: High-through sequencing revealed that oral microbiome composition and function were significantly altered. In addition, metabolomic analysis showed that some oral microbiota related metabolomic profiling was perturbed in pediatric urine. Further intervention studies are warranted to verify these findings and to explore the potential mechanisms.

Acknowledgement: This study was supported by grants-in-aid from multi-center clinical research project from school of medicine, Shanghai Jiao Tong University (DLY201502); Shanghai Sailing Program (17YF1414300) and Shanghai Shen-Kang Hospital Management Center Project of Shanghai (SHDC12015101).
CATATHRENA IS A SLEEP BREATHING DISORDER IN LARGE SAMPLE OF CHINESE PATIENTS

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Introduction: Catathrenia is a rare and little-understood disorder. ICSD-3 classifies catathrenia among the respiratory disorders and not as a parasomnia as in ICSD-2. The goal of our study is to investigate the clinical feature and the response to CPAP treatment.

Materials and methods: 49 patients diagnosed as catathrenia visited our sleep center from December 2009 to June 2016. The patients underwent clinical evaluation, physical examination, questionnaires, and maxillofacial check. All of the patients underwent a overnight polysomnography (PSG). 23 patients underwent a trial of CPAP (7-10cmH2O). Then we tried manual titration in 7 following patients. Groaning index (the numbers of the groaning events per hour) was used to evaluate the degree of catathrenia.

Results: Among 49 patients (31 female and 18 male, mean age 30.85±11.97y), we noticed that the patients had normal BMI (21.76±2.62Kg/m^2). The average onset age of the patients was 19.81±8.65. Their average AHI was 3.59±8.83events/h, ranging from 0 to 57.6 events/h, and 12.24% of the patients’ AHI was ≥5events/h. The groaning index in REM and NREM sleep stage was 39.31±44.39events/h and 6.74±8.5events/h respectively (p<0.01). 23 patients tried CPAP treatment, the groaning index decreased from 11.46±13.87events/h to 6.19±7.38events/h (p<0.01). 7 patients had manual titration, more effective when pressure went up.

Conclusions: Our study found that catathrenia mainly occur in young people with normal BMI. It is also more common in female. Catathrenia is a sleep related breathing disorder and response well to CPAP treatment.

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Sleep Breathing Disorders
O01: Sleep breathing disorders oral abstract presentations

RISK FACTORS OF OBSTRUCTIVE SLEEP APNEA SYNDROME IN CHINESE CHILDREN

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Introduction: To develop better strategies for screening and managing obstructive sleep apnea syndrome (OSAS), it is important to identify risk factors for the presence and severity in a clinical practice setting. The objective of our study was to identify independent risk factors of OSAS in children in a clinical setting. Our study enrolled a large age range of children and included the potential risks factors of OSAS based on literatures and our experience. We hypothesized that OSAS is associated with adenoid and tonsil size, obesity, allergic rhinitis (AR), premature and environmental tobacco smoking (ETS).

Methods: Children between 2-13 years old with snoring who came to the sleep center for polysomnography (PSG) were enrolled. A questionnaire including demographic data and information related to potential risk factors for sleep problem was completed by parents. The physical examination included measurements of height, weight, neck, waist and hip circumference and the visual evaluation of the tonsils. A fibrolaryngoscope examination of the adenoid was performed by an ENT specialist before the sleep study. BMI was adjusted for age and gender, and BMI>95th were considered obese. PSG were performed in the sleep center for all subjects. OSAS was defined according to PSG result if an obstructive apnea and hypopnea index (OAHI)>1.

Results: A total of 1578 subjects had both questionnaire data and sleep study. 1009 children had OSAS, and 701(69.5%) were boys. Univariate analyses showed that snoring>3 months, male, obesity, preterm breastfeeding, neck circumference, waist/hip ratio>0.95, adenoid hypertrophy, tonsillar hypertrophy were associated with OSAS. OSAS was not associated with AR, ETS, family history of snoring and parental educational level. Multiple regression analyses showed that male (OR=1.3, 95% CI:1.0-1.6), obesity (OR=1.7, 95% CI:1.3-2.3), breastfeeding (OR=1.7, 95% CI:1.3-2.3), waist/hip ratio>0.95 (OR=1.4, 95% CI:1.0-1.9), adenoid hypertrophy(OR=1.4, 95% CI:1.0-1.9), and tonsillar hypertrophy (OR=4.2, 95% CI:3.1-5.6) were associated with OSAS. Breast feeding is closely related to parental educational level.

Conclusions: The independent risk factors for OSAS in children included snoring>3 months, male, obesity, breastfeeding, waist/hip ratio>0.95, adenoid hypertrophy and tonsillar hypertrophy. The role of socioeconomic status (SES) on OSAS and the interaction between SES and breastfeeding should be further investigated.

A RETROSPECTIVE STUDY OF CPAP COMPLIANCE BETWEEN PATIENTS INducted IN SINGLE VERSUS GROUP SETUP

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Introduction: Factors influencing Continuous Positive Airway Pressure (CPAP) compliance in patients diagnosed with Obstructive Sleep Apnoea (OSA) includes disease severity, demographics, induction quality (CPAP setup) and post-setup support. CPAP setup is done either in single (one-hour appointment for one patient with one clinical physiologist) or group setting (six patients with one clinical physiologist and one patient-support worker during a two-hour session) in our Regional Sleep Service in University Hospital of South Manchester (UHSM). We conducted this retrospective analysis to determine any difference in compliance achieved and follow-up support required between patients attended single and group set-up within two years.

Materials and methods: Outpatients with OSA attended CPAP setup between 18/05/2012 and 25/03/2015 were identified from hospital electronic patient records and sleep service database. Their demographics, Apnoea-Hypopnea Index (AHI), Epworth Sleepiness Scale (ESS), CPAP usage per hour per night within two years after CPAP induction were collected retrospectively. Any patients required single set up for clinical reasons were excluded from the study.

Results: Two hundred patients, of whom one hundred patients attended single CPAP setup and one hundred patients attended group CPAP setup, were included in the study. Patients' demographics, AHI and ESS were comparable between groups. There was no statistical significant difference in mean CPAP machine usage per night at first three follow-ups between patients attended single setup and group setup (1st follow-up: 3.9 ± 2.5, 3.7 ± 2.2 hour/night p=0.677; 2nd follow-up: 4.2 ± 2.4, 4.4 ± 2.4 hour/night p=0.643; 3rd follow-up: 4.5 ± 2.7, 4.9 ± 2.7 hour/night p=0.409). Secondly, there was no significant difference in CPAP usage at 3 months (3.7 ± 2.4, 3.9 ± 2.2 hour/night, p=0.726), 6 months (3.7 ± 2.4, 4.2 ± 2.7 hour/night, p=0.456), 1 year (4.8 ± 2.6, 4.6 ± 2.3 hour/night, p=0.775) and 2 years after CPAP setup (4.8 ± 2.5, 5.2 ± 2.5 hour/night, p=0.474). Similarly, there was no significant difference in self-discharge rate (p>0.104) or patients' ability to maintain achieved compliance across groups (p>0.651). The number of follow ups required by patients to achieve a compliance of at least four, five and six hours per night were also comparable to those attended single setup (p>0.500). The number of follow ups taken by patients at six months, one year and two year points were also comparable among groups (p>0.234).

Conclusions: This study has demonstrated patients attended CPAP group setup could achieve the same compliance as those attended single setup within a two-year timeframe. Group setup was found to be more cost effective to induct patients without compromising their subsequent CPAP compliance as group setup requires less physiologist to induct the same number of patients. Group set-up may also reduce waiting time for treatment. Therefore, by reallocating resources from single setups to provide extra follow-up sessions for patients who showed initial poor compliance to CPAP usage may boost the overall CPAP adherence in the clinic.

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Introduction: We first aim to evaluate the effect of upper airway surgeries on both cardiovascular risk profiles (including glucose level, insulin resistance, lipids level and blood pressure) and global cardiovascular risk in OSAHS patients. Then, we studied the possible predictors for better changes in cardiovascular risk profiles.

Materials and methods: This study included OSAHS patients that had upper airway surgeries and were followed up after at least 6 months after the surgeries. The glucose, insulin resistance, lipids, blood pressure and Framingham global cardiovascular risk were compared between preoperative and postoperative. Then, the possible predictors of better changes in risk profiles and global cardiovascular risk after the surgeries were evaluated, and correlation tests were conducted to check whether there were correlations between changes of sleep breath parameters and changes of risk profiles.

Results: 120 patients were included in the glucose study, 89 in the lipid study, 117 in the blood pressure study, and 74 in the global cardiovascular risk study. The average follow-up time was 2.5 years. PSG parameters including AHI, ODI, CT90, mean oxygen desaturation, lowest oxygen desaturation and micro-arousal index all significantly improved after operation (P < 0.05). Fasting blood glucose (P < 0.001), HOMA-IR (P = 0.034), TC (P < 0.001), LDL-C (P = 0.001), apolipoprotein B (P < 0.001), systolic blood pressure (P = 0.004), diastolic blood pressure (P = 0.005) and age-adjusted global cardiovascular risk (P < 0.001) significantly decreased after the surgeries, while TG(p=0.086), HDL-C(p=0.601) showed no significant improvement. The changes in risk profiles were significantly correlated with improvements in some oxygen indexes (P < 0.05). In addition, improvements of risk profiles were larger in patients with preoperative specific metabolic abnormalities (P < 0.05).

Conclusions: Cardiovascular risk profiles and global cardiovascular risk showed improvements after upper airway surgeries, especially in those patients with preoperative certain profile abnormalities. The changes of metabolic parameters might be due to the improvements in oxygen saturation.

Acknowledgements: None.
ACCELERATED TUMOR GROWTH UNDER INTERMITTENT HYPOXIA IS ASSOCIATED WITH HYPOXIA-INDUCIBLE FACTOR-1-DEPENDENT ADAPTIVE RESPONSES TO HYPOXIA

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Introduction: Mounting evidence has revealed a causative role of intermittent hypoxia (IH) in cancer progression in mouse models of obstructive sleep apnea (OSA), but most studies have focused on the effects of IH following tumor implantation using an exposure to single IH frequency. Thus, we aimed to investigate 1) the initial effect of IH on tumorigenesis and 2) the influence of IH frequency on tumor growth, which was tested using pre-conditioning with IH (Pre-IH) and 2 different IH frequencies, respectively.

Materials and methods: Pre-IH was achieved by alternatively maintaining melanoma cells between normoxia (10 min, 21% O₂) and hypoxia (50 min, 1% O₂) for 7 days (12 cycles per day) before administering them to mice. The conditions for IH-1 and IH-2 were 90 s of 12% FiO₂, 90 s of 21% FiO₂, and 180 s of 21% FiO₂ (10 cycles/h), and 90 s of 12% FiO₂ and 90 s of 21% FiO₂ (20 cycles/h), for 8 h per day, respectively.

Results: Tumor growth was significantly higher in the Pre-IH group than in the normoxia group. In addition, the IH-2 group showed more accelerated tumor growth compared to the normoxia and IH-1 groups. Immunohistochemistry and gene-expression results consistently showed the up-regulation of molecules associated with HIF-1α-dependent hypoxic adaptation in tumors of the Pre-IH and IH-2 groups.

Conclusions: Our findings reveal that IH increased tumor progression in a frequency-dependent manner, regardless of whether it was introduced before or after in vivo tumor cell implantation.

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INTERMITTENT HYPOXIA PROMOTES TUMOR GROWTH IN AZOXYMETHANE AND DEXTRAN SODIUM SULFATE-INDUCED COLON CARCINOGENESIS MOUSE MODEL

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Introduction: Several experimental findings has revealed that intermittent hypoxia (IH), a widely used model that mimics O₂ saturation profiles with recurrent apneic events seen in patients with obstructive sleep apnea (OSA), promoted tumor progression and aggressiveness in mouse xenograft models. However, no studies examined whether IH may influence tumor incidence, growth, or malignancy in carcinogenesis models. Thus, we aimed to investigate the effect of IH on tumor in azoxymethane (AOM) and dextran sodium sulfate (DSS)-induced colon carcinogenesis mouse model.

Materials and methods: Thirty male, 8-week-old Balb/c mice were randomly divided into three groups: 1) Normoxia (N; n=10), 2) IH-1 (continuous exposure of IH; n=10), 3) IH-2 (late exposure of IH; n=10). On day 0, all mice were injected with AOM (10 mg/kg) intraperitoneally, and then mice in the IH-1 group were subjected to IH for 77 days. N group were maintained in a chamber with circulating room air for the same duration as mice in the IH-1 group. Mice in the IH-2 group were also maintained in the same condition with N group, but exposed to IH from 42 days after AOM injection to sacrifice. The conditions for IH were 90 s of 12% FiO₂ and 90 s of 21% FiO₂ (20 cycles/h), for 8 h per day. 2% DSS solution in distilled water was continuously supplied to mice for 7 days on day 7, day 28, and day 49, with two weeks interval between each DSS supply. Body weights of each mouse were measured three times per week.

Results: Colon length was significantly shorter in IH-1 group than in N and IH-2 groups (8.7 cm in IH-1, 10.4 cm in N, and 10.6 cm in IH-2; P=0.036). Total number of tumors did not differ across N, IH-1, and IH-2 groups (P=0.143). However, number of tumors more than 2 mm in size was 2.3-fold (P=0.006) and 1.6-fold (P=0.036) higher in IH-1 group than in N and IH-2 groups, respectively. There was no significant difference in all parameters between N and IH-2 groups.

Conclusions: Our findings reveal that IH promotes tumor growth in chemically-induced colon tumorigenesis mouse model.

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Introduction: The occlusion of the teeth is frequently overlooked in providing correct dental treatment. Symptoms of occlusal disease are often hidden from the practitioner when he or she are not properly trained. If not treated this could lead to intensifying of the pathological process and affect the neighboring anatomical structures. Such structures are the middle ear and the ear canal.

Materials and methods: Applying simple and focused questions such as existing questionnaires or adding questions to those used by the dentist as well methods of detailed evaluation of clinical findings in the maxillo-facial and oral region when taking a health history can easily bring to light factors, which show a correlation between bruxism and tinnitus.

Results: Bruxism is one of the most prevalent, complex, and destructive dental functional disorders. It is difficult to identify, especially in its early stages, because most patients are unaware of the habit. The effects of bruxism are multiple and diverse. They include temporomandibular joint pain and dysfunction, head and neck pain, muscle pain. The constant irritation of soft tissues can have an effect on the neighbouring anatomical structures. Such structures are the middle ear and the ear canal. Temporomandibular joint and the ear are connected through muscles, nerves and blood vessels. A problem in the one can affect the other. Most of the patients, who suffer from bruxism and tooth grinding complain of hearing high pitch sounds. This condition is called tinnitus.

Conclusions: Becoming aware of conditions involving the head, neck and the oral cavity that may indicate an increased level of risk for bruxism and tinnitus and higher understanding of those conditions is essential for optimum patient care and may lead to improved quality of life for dental patients.
THE FACTORS THAT AFFECT THE BETTER COMPLIANCE OF MANDIBULAR ADVANCEMENT DEVICE WHEN COMPARED WITH CONTINUOUS POSITIVE AIRWAY PRESSURE IN THE PATIENTS WITH MODERATE TO SEVERE SLEEP APNEA SYNDROME

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Introduction: Continuous positive airway pressure (CPAP) and mandibular advancement device (MAD) are two major standard therapies at least for the patients with mild to moderate sleep apnea syndrome (SAS). The compliance of MAD is reportedly better than CPAP though the removal of apnea or hypopnea is superior in CPAP. Though MAD can be effective in some patients with even moderate to severe SAS, the subjective and objective factors that affect the compliance of MAD compared with CPAP has not been clarified. Thus, the recognition of such factors would be important to facilitate use of MAD in such moderate-severe group of SAS.

Material and methods: We recruited 45 consecutive patients with SAS, whose apnea hypopnea index (AHI) from 20/h to 40/h. We randomly assigned those patients to the therapy with CPAP or MAD (Somnodent®) equipped with a compliance monitor to objectively evaluate usage time, and treated them for 2 months. At the end of the 2-month period, we evaluated the compliance of both devices and the sleep related parameters by portable polygraphy as well as the changes in subjective symptoms and any problems that disturbed to use each device using questionnaire. Then, devices were crossed over and treated for same period and re-evaluated at the end of the each therapy. We classified patients into 2 groups according to the usage; >4 hours on >70% of nights (CPAP (23/44), MAD (25/42)) and others, and analyzed the factors that affected the usage, trying to clarify the factors that influenced the compliance.

Results: Compared with baseline (28.5±5.2/h), AHI was improved both by MAD (to 8.7±7.4/h: p< 0.0001) and CPAP (to 4.2±4.8/h: p< 0.0001), though more improved by CPAP (p=0.0002). The excessive daytime sleepiness measured by Epworth sleepiness scale (ESS) and the frequency of nocturia (Baseline; ESS; 8.5±5.8, Nocturia; 1.4±1.1) were comparably improved by MAD (ESS, to 5.0±4.4: p=0.003, Nocturia; to 0.7±0.8: p=0.006) and CPAP (ESS; to 5.0±3.5: p=0.004, Nocturia; to 0.7±0.9: p=0.002 ). The feeling of fitting of the devices and the preference of the devices by the bedpartner assessed tended to be better for MAD. Except for the slightly higher AHI (30.0±5.7/h vs 26.2±4.0/h; p=0.04), the more painful oral situation (the existence of throat pain: 45.8% vs 11.8%: p=0.02) and the more improved snore (60% vs 27.8%: p=0.04) and the less disturbed sleep by MAD (0% vs 20%: p=0.02) significantly influenced the better MAD use, while the more subjective factors at baseline such as the young age (59.6±9.9 years vs 51.1±11.9 years: p=0.02), the more nocturia (1.8±1.2 vs 1.0±1.0: p=0.02), and the more subjective arousal (90.5% vs 65.2%: p=0.04) favorably affected to CPAP use.

Conclusions: Even in the patients with moderate to severe SAS, MAD could satisfactory improve SAS related symptoms. As the patients who experienced more improvement of subjective symptoms could comfortably use MAD better, we may use MAD more effectively even in the severer SAS when we pay more attention to such factors.

Acknowledgements: In this trial, MAD was provided by SomnoMed Ltd without any restriction.
MEMORY AND EXECUTIVE SCREENING FOR DETECTING OF COGNITIVE IMPAIRMENT IN OBSTRUCTIVE SLEEP APNEA

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Introduction: Obstructive sleep apnea (OSA) is commonly associated with cognitive dysfunction, which is more apparent in severe OSA and impairs the quality of life. However, clinical screening methods for such impairments in OSA are still limited. In this study, we evaluated Memory and executive screening (MES) for feasibility in assessing cognitive performance in OSA.

Materials and methods: Twenty-four non-severe and thirty-six severe OSA patients participated in this study. All participants underwent comprehensive, laboratory-based polysomnography (PSG) and completed assessments of cognitive functions by employing both MES and Beijing version of the Montreal Cognitive Assessment (MoCA-BJ).

Results: Both total MES scores and five recall scores of MES (MES-5R) were significantly lower in severe OSA group than those in non-severe OSA group. Severe OSA patients performed worse in memory sub-items related with MES-5R, especially in immediate recall. The sensitivity and specificity of MES for identifying OSA patients with cognitive impairment were 63.89% and 66.67% respectively for a cut-off value of < 92 out of 100 points. An optimal cut-off between non-severe and severe OSA was also set at 45 points (MES-5R) and at 0.94 points (MESratio). As a comparison, MoCA-BJ had similar sensitivity (61.11%) and specificity (66.67%).

Conclusions: MES is an acceptable tool for detecting cognitive dysfunction in patients with OSA. Sensitivity and specificity of MES were similar with those of MoCA-BJ. MES-5R and total MES scores can differentiate cognitive dysfunction of severe OSA from non-severe OSA.

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NUCLEATED RED BLOOD CELL COUNT IN OBSTRUCTIVE SLEEP APNEA PATIENTS

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Introduction: Nucleated red blood cells (NRBC) are normoblastic cells that failed to extrude their nuclei before exiting from bone marrow. In normal conditions there are not NRBC in circulating blood. Studies suggested that NRBC are increased in preterm or term neonates with fetal distress, intrauterine growth restriction, perinatal asphyxia, and hypoxic-ischemic encephalopathy. In adult's cancer, burns, congestive heart failure, acute and chronic anemia and other hematological disorders are associated with increased NRBC. Their presence in the peripheral blood has been associated with hypoxemia or infection in critical patients, owing to the high concentrations of erythropoietin. NRBC determination in surgical intensive care unit (ICU) patients has a prognostic power with regard to mortality. Also in cardiac intensive care patients the prevalence of NRBC is associated with higher ICU mortality. Our study is focused on obstructive sleep apnea (OSA) patients who have a complete or partial obstruction of upper airway. OSA is characterized by repetitive episodes of breathing and is associated with reduction of blood oxygen saturation. Our hypothesis is that NRBC can be increased in patients with OSA and correlated with severity of the disease.

Materials and methods: We included 11 OSA patients (9 men and 2 female, age 48.5 ± 14.0) in the study. After polysomnographic monitoring, blood was collected from patients. Total blood count and NRBC determination was evaluated with Sysmex 2000. Results are demonstrated as mean±SD. Spearman correlation analysis analysis were also performed.

Results: RBC count in OSA patients were 5.0 ± 0.7 10^6/uL, Hgb: 14.7±1.3 g/dL, Hct: 42.9±3.9 %, MCV: 85.7 ± 4.4 fl, MCH: 29.3 ± 1.4 pg, MCHC: 34.2 ± 1.7 g/dL. NRBC count in OSAS patients were 0.045 ± 0.01 10^3/ul. Spearman correlation analysis results with a linear correlation between (A-H)I and NRBC count (r=0.6742, p< 0.05). Minimum oxygen saturation was not correlated with NRBC count (r=0.08805, p>0.05).

Conclusions: In conclusion, our preliminary study suggested that increased NRBC count is associated with high AHI. It is possible to demonstrate that NRBC can be used as a marker for OSA severity.
THE COMPARISON OF POLYSOMNOGRAPHY, SLEEP APNEA SCREENING TEST AND CARDIOPULMONARY COUPLING IN THE DIAGNOSIS OF PEDIATRIC OBSTRUCTIVE SLEEP APNEA SYNDROME

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Introduction: To research into the relationship between clinical characteristics of pediatric OSAS and results of polysomnography (PSG), sleep apnea screening test (SAST) and cardiopulmonary coupling (CPC) respectively and to compare the diagnostic values of them for pediatric OSAS patients.

Materials and Methods: We recruited 47 pediatric OSAS patients aged between 2 to 12 from Jan 1 to Apr 25, 2017. All the patients’ symptoms were caused by adenotonsillar hypertrophy alone. They received PSG, SAST and CPC simultaneously and the results were compared with the degree of adenotonsillar hypertrophy (0 means adenoid obstructs less than 50% of posterior nares or palatine tonsils is graded as 2 or less; 1 means adenoid obstructs more than 50% of posterior nares and palatine tonsils is graded as 3 or more). Logistic regression was used to analyze the discrimination of different methods through receiver operating curve (ROC).

Results: All the 47 patients were aged 5.9±3.1 and they had a mean duration of disease of 14 months. The area under the ROC of oxygen desaturation index (ODI4) obtained by SAST and PSG were 0.8242 and 0.7895 respectively, indicating a good discrimination of adenotonsillar hypertrophy, of which SAST was better. The area under the ROC of lowest oxygen saturation (LsO2) obtained by SAST and PSG were 0.6494 and 0.6992 respectively, indicating a rather good discrimination, of which PSG was a little bit better. The area under the ROC of Apnea/Hypoventilation Index (AHI) obtained through CPC and PSG were 0.8214 and 0.8741 respectively, indicating a very good discrimination of adenotonsillar hypertrophy, of which PSG was better.

Conclusions: SAST and CPC were both convenient and cost-effective for patients. Both ODI4 from SAST and AHI from CPC are as accurate as those obtained from PSG, the gold standard, in the assessments of upper airway obstruction. We therefore conclude that SAST and CPC are of high diagnostic values and are good options for patients who will not or could not accept PSG.

Acknowledgements: We thank Dr. Jing Zhang from Department of Respiratory of Shanghai Children’s Medical Center for the instructions upon PSG.
Introduction: Whether the orthodontic treatment with premolar extraction and maximum anchorage in adults will lead to a narrowed upper airway remains under debated. The study aims to investigate the airway changes after orthodontic extraction treatment in adult patients with Class II and hyperdivergent skeletal malocclusion.

Materials and methods: This retrospective study enrolled 18 adults with Class II and hyperdivergent skeletal malocclusion (5 males and 13 females, 24.1 ± 3.8 years of age, BMI 20.33 ± 1.77 kg/m2). And 18 untreated controls were matched 1:1 with the treated patients for age, sex, BMI, and skeletal pattern. CBCT images before and after treatment were obtained. DOLPHIN 11.7 software was used to reconstruct and measure the airway size, hyoid position, and craniofacial structures. Changes in the airway and craniofacial parameters from pre to post treatment were assessed by Wilcoxon signed rank test. Mann-Whitney U test was used in comparisons of the airway parameters between the treated patients and the untreated controls. Significant level was set at 0.05.

Results: The upper and lower incisors retracted 7.87 mm and 6.10 mm based on the measurement of U1-VRL and L1-VRL (P < 0.01), while the positions of the upper and lower molars (U6-VRL, and L6-VRL) remained stable. Volume, height, and cross-sectional area of the airway were not significantly changed after treatment, while the sagittal dimensions of SPP-SPPW, U-MPW, PAS, and V-LPW were significantly decreased (P < 0.05), and the morphology of the cross sections passing through SPP-SPPW, U-MPW, PAS, and V-LPW became anteroposteriorly compressed (P < 0.001). No significant differences in the airway volume, height, and cross-sectional area were found between the treated patients and untreated controls.

Conclusions: The airway changes after orthodontic treatment with premolar extraction and maximum anchorage in adults are mainly morphological changes with anteroposterior dimension compressed in airway cross sections, rather than a decrease in size.

Acknowledgements: The subject was partly supported by National Natural Science Foundation of China (81470272) and the Seeding Grant for Medicine and Engineering Sciences of Peking University (BMU20140397).
Introduction: Obstructive sleep apnea-hypopnea syndrome (OSAHS) is an oxidative stress disease characterized by chronic intermittent hypoxia (CIH). Impaired mitochondria caused by CIH can be eliminated by mitophagy so as to avoid cell apoptosis. Although it was found that disturbances of mitophagy induced by CIH in cardiomyocytes could result in cell apoptosis, the effect of CIH on genioglossal mitophagy has not been reported. The current study was aimed to investigate the effect of CIH on mitophagy in genioglossus.

Materials and methods: One hundred male SD rats were randomly divided into two groups, normal control (NC) and CIH groups, with 50 rats in each group. The observation period lasted for 5 weeks. At the end of each week, 10 rats of each group were harvested for comparing mitophagy, mitochondrial structure and its function in genioglossus, cell apoptosis and genioglossal contractile function.

Results: Compared with NC group, in CIH group the levels of oxygen species (ROS), relative protein and mRNA of mitophagy, autophagy biomarker LC3-Ⅱ as well as autophagosomes were all significantly elevated during the first three weeks (all \( P < 0.05 \)) but they were all declined during the last two weeks (all \( P < 0.05 \)). No significant difference between NC and CIH groups was detected (all \( P > 0.05 \)) during the first three weeks in the following items:

a) mitochondrial ultrastructure under electron microscope,
b) mitochondrial function-associated mRNA,
c) activity of mitochondrial enzymes and content of ATP in genioglossus,
d) apoptosis signals such as Caspase-9, Caspase-12, Caspase-3 and scanning apoptotic cells,
e) genioglossus contractile properties. However, during the last two weeks the following abnormalities were observed in CIH group: a) damaged mitochondrial ultrastructure and mitochondrial dysfunction such as decrease in mRNA level and activity of mitochondrial enzymes as well as reduced content of ATP in genioglossus. Meanwhile, enhanced genioglossal cell apoptosis and genioglossal contractile dysfunction were also revealed.

Conclusions: Disturbances of genioglossal mitophagy could be induced by CIH and might be related to damaged mitochondrial structure, impaired mitochondrial function and decreased genioglossus contractile properties caused by CIH.

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ADIPONECTIN IMPROVED GENIOGLOSSAL MITOCHONDRIAL INJURIES INDUCED BY CHRONIC INTERMITTENT HYPOXIA

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Introduction: Genioglossal dysfunction plays an important role in the pathogenesis of obstructive sleep apnea. This study was aimed to investigate the effects of chronic intermittent hypoxia (CIH) on genioglossal mitochondria, the intervention role of adiponectin (Ad) and associated mechanisms.

Materials and methods: Forty-five adult wistar rats were randomly divided into three groups, normal control (NC) group, CIH group and CIH Ad group with 15 rats in each group. The rats in both CIH and CIH Ad groups were exposed to the same CIH environment (CIH 8h/d for 5 weeks), while the rats in NC were exposed to normal air only. In addition, the rats in CIH Ad group were injected with Ad (10µg, twice a week).

Results: Compared with NC group, the following genioglossal impairments were displayed in rats of CIH group: a reduced amount of mitochondria and type one fibers with structural injuries in mitochondria (p< 0.05). However, compared with CIH group, the rats in CIH Ad group, there is an increased amount of mitochondria and type one fibers with less structural injuries in mitochondria (p< 0.05). Compared with NC group, the LKB1-AMPK-PGC1-α pathway protein expression of genioglossum in CIH group was significantly lower and such a reduction in expression was less significant in CIH Ad group (p< 0.05).

Conclusions: CIH could induce impairment in genioglossal mitochondria while supplement of Ad could improve such genioglossal injuries possibly via modulation of AMPK pathway.

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THE STUDY OF POSITIVE AIRWAY PRESSURE VARIATION ON OSAHS PATIENTS WITH SUN'S SEQUENTIAL THERAPY

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Introduction: There are many causes of obstructive sleep apnea-hypopnea syndrome (OSAHS), in which the stenosis of upper airway is particularly important. The nasopharyngeal area is surrounded by bony structure, which can reflect the real conditions on the development of upper airway, as a result, the nasopharyngeal area plays a critical role of diagnosis and prediction in OSAHS patients. We found that the intervention of nasal cavity situation, will be able to make patients who treated with nasal continuous positive airway pressure (NCPAP) to achieve a better curative effect. The objective of this study was to observe the effect of Sun's sequential therapy (SST) on OSAHS patients with chronic simple rhinitis, including the NCPAP pressure and the subjective nasal conditions.

Materials and methods: All subjects were diagnosed with OSAHS with Nasal Obstruction (BiZhi) caused by heat in lung meridian in Traditional Chinese Medicine. Data were collected in subjects who met the inclusion criteria. A total of 31 male participants were enrolled in the study. The research group were given the Chinese herbal medicine 200 ml orally, bid×14 days, before the oral administration, the participants were asked to use the boiling steam steaming the nasal cavity. The pressure of NCPAP and the nasal obstruction Visual Analogue Scale (VAS) were recorded to achieve a better curative effect. The objective of this study was to observe the effect of Sun's sequential therapy (SST) on OSAHS patients with chronic simple rhinitis, including the NCPAP pressure and the subjective nasal conditions.

Results: Analysis of the group showed that the value of positive airway pressure was reduced from (10.452±2.263) cmH₂O pre-treatment to (9.194±2.064) cmH₂O post treatment (p<0.05); the nasal obstructive VAS score decreased from 6.194±1.731(pre-treatment) to 4.984±1.557 (7 days after treatment) to 3.968±1.335 (post treatment) (p<0.05). The effect of post treatment is more significant than that of pre treatment in the value of positive airway pressure titration and nasal obstruction VAS score (p<0.05).

Conclusions: SST can reduce the pressure of NCPAP and improve the subjective nasal ventilation in OSAHS with chronic simple rhinitis patients. While also indirectly reflected that during the NCPAP treatment co-use SST can increase the comfort level, so as to improve the compliance of patients who under the NCPAP therapy. mH₂O pre-treatment to (9.194±2.064) cmH₂O post treatment (p<0.05); the nasal obstructive VAS score decreased from 6.194±1.731(pre-treatment) to 4.984±1.557 (7 days after treatment) to 3.968±1.335 (post treatment) (p<0.05). The effect of post treatment is more significant than that of pre treatment in the value of positive airway pressure titration and nasal obstruction VAS score (p<0.05).

Acknowledgements: We appreciate Professor Shunchen Sun for his direction and help in this research.


Introduction: Adenoid hypertrophy and obesity are two factors affecting children Obstructive Sleep Apnea (OSA). According to our observation, however, the number of adenoid hypertrophy children in obese visiting our clinic is not too much. Our research was designed to investigate the Body Mass Index (BMI) and sleep related respiratory events features in adenoid hypertrophy children.

Materials and methods: Patients who were diagnosed as adenoidal hypertrophy in sleep clinic from January 2016 to January 2017 were enrolled. The BMI and sleep monitoring results were collected further. The enrolled cases were divided into adenoid hypertrophy without OSA group and adenoid hypertrophy with OSA group, based on the results of sleep testing. According to different age and gender, BMI of enrolled children were compared with the Chinese children, adolescents’ overweight, and obese screening body mass index (BMI) classification criteria for comparative analysis. The main component of respiratory events was determined by the percentage of hypopnea events (HI/AHI) and the percentage of apnea events (AI/AHI).

Results: 44 cases were enrolled in the study, in which 25 children were diagnosed as adenoid hypertrophy without OSA and 19 children were diagnosed as adenoid hypertrophy with OSA. In the group of adenoid hypertrophy with OSA, 11 boys and 8 girls were included, aging from 3 to 10. In the group of adenoid hypertrophy without OSA, there were 17 boys and 8 girls, aging from 3 to 9. The average BMI of boys with and without OSA were 15.79 and 16.26, with no differences between the two groups ($P > 0.05$). Neither there was in the average BMI of girls with and without OSA (15.29 and 16.51, $P > 0.05$). In all adenoid hypertrophy children, only the average BMI of 9-year-old girls was overweight, at 20.25. In 3-year-old, the BMI of both boys and girls were lower than the normal mean value, at 15.17 and 14.30 respectively. The BMI of other age levels were in the normal range. In adenoidal hypertrophy with OSA group, overweight was only observed in 5-year-old boys (average BMI of 16.93). In adenoidal hypertrophy without OSA group, overweight was only observed in 6-year-old boys (average BMI of 18.77) and 9-year-old girls (average BMI of 20.25). Regarding the respiratory events features, the average AHI of adenoid hypertrophy with and without OSA were 16.52/h and 1.51/h, respectively. Hypopnea took the major proportion in both OSA group and non-OSA group, with average percentage of 92% and 79% ($P > 0.05$).

Conclusions: Most of the adenoid hypertrophy children with and without OSA are not overweight in our research, which shows obesity may not be a key factor in some children suffering adenoid hypertrophy and associated OSA. The major proportion of respiratory events are hypopnea in both adenoid hypertrophy with OSA and adenoid hypertrophy without OSA patients, suggesting that hypopnea play an important role in adenoid hypertrophy and related OSA in children.

Acknowledgements: We thank the sleep center of south area of Guang’anmen Hospital for the supporting and cooperation in this study.
Objective: The low-throughput nature of manual scoring of sleep data is a major factor restricting the pace and potential of sleep research. Automated scoring approaches developed previously have failed to provide sufficient accuracy or ‘usability’ for sleep scientists lacking engineering or specialist computing expertise. Moreover, all previous approaches have only been validated on baseline data and no single approach has been validated for both animal and human data analysis.

Methods: We have developed a user-friendly platform for real-time automated scoring of polysomnography data, named Somnivore. Using a GUI-based approach in the Matlab™ platform we have deployed a support vector machine (SVM) to analyse features from polysomnography inputs (EEG, EMG, EOG, ECG, temperature, etc.) into the various sleep stages. The SVM is trained for each individual subject via a brief session of manual scoring. The system has been validated using mouse, rat, pigeon, cat and human data collected across a number of different treatments and genotypes and scored by members of collaborating laboratories from Australia, Europe and USA.

Results: With minimal training time, overall scoring agreement rates were consistently above 90% in all species and treatment groups. F-scores in all animal species were >0.9 for wake, >0.9 for NREM and >0.85 for REM. For human data, F-scores were >0.85 for wake, >0.35 for N1, >0.88 for N2, >0.85 for N3 and >0.91 for REM.

Conclusions: Somnivore provides accurate, reliable, high-throughput scoring and analysis of polysomnography data in a range of experimental situations from normal and genetically modified physiology to drug pharmacology, in both animal and human subjects.
VALIDATION OF A MULTI-SENSORY COMMERCIALY AVAILABLE WRISTBAND IN MEASURING SLEEP COMPOSITION AGAINST POLYSOMNOGRAPHY

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Introduction: Novel wearable devices claim to be able to measure sleep stage composition in addition to sleep/wake state by integrating information from multiple biosensors. We evaluated the performance of a multi-sensory wristband (Fitbit Charge 2) against polysomnography (PSG) in measuring sleep macrostructure in healthy adults.

Materials and methods: Standard PSG and Fitbit data were obtained from a single overnight recording at the SRI Human Sleep Research Lab in 22 adults (13 females; age, mean ± SD: 34.2±10.9y; body mass index, mean ± SD: 23.5±2.6kg.m⁻²). Participants were screened to be free from mental and medical conditions and absence of sleep disorders was confirmed with PSG. PSG and Fitbit sleep outcomes were compared using paired t-tests, Bland-Altman plots and epoch-by-epoch analysis (EBE).

Results: PSG outcomes indicated that participants spent, on average, 445±51min in bed, they had a sleep onset latency (SOL) of 15±12min, a total sleep time (TST) of 386±50min, a wakefulness after sleep onset (WASO) of 43±34min, and a sleep efficiency (SE) of 87±9%; they spent 35±17min in N1, 183±33min in N2, 72±19min in N3, and 95±26min in rapid-eye movement (REM) sleep. Fitbit significantly (p< 0.05) overestimated PSG TST by, on average, 12±23min, and PSG N1+N2 (“light sleep”) by 36±37min, and underestimated PSG N3 (“deep sleep”) by 19±31min. PSG-Fitbit discrepancies for WASO (6±15min) and REM sleep (4±24min) were not significant. EBE analysis indicated specificity in detecting wake at 0.57±0.15 and sensitivity in detecting sleep at 0.96±0.01; agreement in detecting “light sleep”, “deep sleep” and REM sleep were respectively, 0.81±0.07, 0.51±0.25, and 0.73±0.16.

Conclusions: Fitbit Charge 2 is among the first generations of sleep-trackers directed at assessing sleep stage composition, and it shows promise in detecting sleep macrostructure relative to gold standard PSG recordings under controlled laboratory conditions. Its performance needs to be further investigated under different settings (at-home, multiple nights) and within different populations in which sleep composition is known to vary (adolescents, elderly, patients with sleep disorders).

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ARE THERE ANY DIFFERENCES IN SUBJECTIVE AND OBJECTIVE SLEEP MEASUREMENT?

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Background: Insomnia and decreased sleep satisfaction are common in older adults. The purpose of this study was to analyze differences in sleep parameters between the subjective and objective sleep measurements in community-dwelling older adults.

Methods: 150 participants over 65 years old who were actively engaging in activities in the center, were recruited from a senior welfare center. Data from 103 subjects for 3 days (72 hours) were used for the final analysis. Level of sleep satisfaction was obtained using visual analogue scale (VAS). For the subjective nighttime sleep measures, the sleep log was used whereas the actigraph was used for the objective sleep measures.

Results: Sleep latency (p=.045), total bed time (p<.001), total sleep time (p=.004), number of awake (p=.004) and awake time (p=.045) were longer when measured with the actigraph than the sleep log. However, sleep efficiency (p=.001) was lower when measured with the actigraph than the sleep log. The number of subjects with insomnia due to low total sleep time was higher when measured with the sleep log than with the actigraph (p<.001). However, sleep satisfaction was better correlated with data obtained from the sleep log than the actigraph.

Conclusions: We found discrepancies in the subjective and objective sleep measurements. Older adults appear to report less sleep time than their actual sleep, resulting in higher incidence of insomnia in subjective measurements. Considering the fact that sleep satisfaction was better correlated with sleep log, subjective and objective measurements appear to be equally important in evaluating sleep disturbances in community dwelling older adults.

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AUTOMATIC SLEEP CLASSIFICATION USING ADAPTIVE SEGMENTATION REVEALS INCREASED NUMBER OF SLEEP STAGE TRANSITIONS

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Introduction: The golden standard for sleep classification uses manual scoring of polysomnography (PSG) with fixed 30 seconds epochs. This limits a detailed analysis of sleep pattern, structure and consequently detailed association for other physiologic processes. We aimed to develop a data-driven method that allows classifying sleep in smaller time-intervals to be used for the evaluation of detailed sleep structures. Furthermore, we aimed to investigate the number of sleep stage transitions using a data-driven method not limited by fixed epoch lengths.

Materials and methods: Using adaptive segmentation to define segment boundaries, and multinomial logistic regression to classify segments into the classical sleep stages, three new sleep stage classifiers were built; one with a start window of 3 seconds (L₃), one with 10 seconds (L₁₀) and one with 30 seconds (L₃₀). Initially, a central electroencephalographic (EEG) channel was used to segment into quasi-stationary segments. This was followed by classification based on features describing power in the clinical frequency bands in a central, an occipital and a frontal EEG channel as well as an electrooculographic (EOG) anti-correlation measure. The models were optimized using 19 healthy control subjects and validated on 18 healthy control subjects. For each sleep stage, a fragmentation measure was defined as the frequency of transitions from the given sleep stage to another divided by the number of hours spent in that sleep stage. The fragmentation measures were computed based on the manually scored hypnogram as well as on the automatic sleep staging from the three models.

Results: According to the manual scoring of 30 seconds epochs, the three models with start window lengths of 3, 10 and 30 seconds performed with accuracies of 0.68 ± 0.082, 0.69 ± 0.10 and 0.73 ± 0.10 on the validation data, respectively. Compared to the hypnogram, the fragmentation measures obtained using L₃ showed significantly more sleep stage transitions in all sleep stages. Using L₁₀ showed significantly more sleep stage transitions in REM, N1 and N2 sleep, and using L₃₀ showed significantly more sleep stage transitions in REM and N1 sleep and fewer in N2 sleep, as compared to the hypnogram.

Conclusions: The models developed classify according to the golden standard but independently of fixed epoch lengths enabling the models to reveal a more dynamic sleep. The results report that sleep contains more sleep stage dynamics and transitions than the golden standard reflects, especially in REM and N1 sleep. The model is generally applicable and may contribute to concise sleep structure evaluation, research in sleep control and improved understanding of sleep and sleep disorders.
AN EEG ENVELOPE CHARACTERIZATION SPACE FOR VISUALIZATION OF HUMAN SLEEP DYNAMICS IN NORMAL AND OSA PATIENTS

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Introduction: The analysis of a polysomnogram (PSG) requires a time demanding, visual pattern recognition rule-based procedure to categorize 30-second epochs according to their EEG morphological features. The discretized representation of the sequence of sleep epochs is represented by the hypnogram. We report here on a complementary method based on the coefficient of variation of the envelope (CVE) as calculated for the EEG delta band. An envelope characterization space is generated where points representing epochs are plotted. For each epoch its abscissa value is defined by the CVE of the delta band and its ordinate value by its mean amplitude. The locations of points in the plane provide an insightful visualization as epochs representing sleep states and stages are mapped into stereotyped regions.

Materials and methods: To illustrate the method, we present results of PSGs obtained from 10 non-OSA and 10 OSA patients. The EEG analysis was based in a sliding window procedure with 30-s span and 15-s steps. Each 30s-window was delta band-filtered (0.5 Hz-4 Hz) using the built-in fourth-order digital Butterworth filter of the R programming language. From this filtered signal (fs), the Hilbert transform was obtained (HTfs). The filtered signal envelope (fse) was then computed following a standard calculation: fse = √(fs^2 + HTfs^2). The mean (μ) and standard deviation (sd) of the fse as well as their ratio, the coefficient of variation of the envelope (CVE = sd/μ), were calculated for each 30-s window. We defined a normalized version of CVE, dividing it by √(4/π - 1) ≈ 0.523 to facilitate interpretation.

Results: W and REM epochs cluster on the lower left area of the graph, whereas NREM sleep stage 3 (N3) conforms a cluster on the upper left area. Since N3 is associated with restorative properties of sleep, this latter dense cluster can operationally define deep sleep. On the other hand, in patients with obstructive sleep apnea, this cluster shrinks remarkably or totally vanishes. On the other hand, fragmented sleep associated to sleep apnea is revealed as clusters in anomalous coordinates.

Conclusions: The envelope characterization space offers a synthesis of EEG dynamics facilitating distinctions between normal patterns and patterns related to fragmented sleep associated to sleep apnea.

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Introduction: We report on the cases of two patients with type I Chiari malformation (CM), as revealed by central sleep apnea (CSA) and chronic respiratory failure without any other neurological defect or pulmonary diseases.

Materials and methods: Case 1 was a 50-yr-old male patient, who showed central sleep apnea during sleep study. After BiPAP treatment, her arterial gas abnormality did not be normalized. When her PSG was reviewed and spontaneous hyperventilation was performed, it was found that she had a central respiratory insufficiency. The Chiari malformation was diagnosed by cranial MRI. After surgical procedure, she partly recovered either clinically or biochemically. Case 2 was a 54-yr-old female patient, who developed features of chronic respiratory failure and syringomyelia. She also received neurological surgery and recovered soon. However 3 months after the surgery, her respiratory failure was same and she still need the nocturnal BiPAP support.

Results: These two cases illustrate the main pathophysiological mechanism involved in CSA, namely a blunted chemical drive, which develop type 2 respiratory failure eventually.

Conclusions: Central sleep apnea can be the initial manifestation of Chiari malformation and can lead to a life-threatening condition. Treatment should include not only surgery but also nocturnal non-invasive ventilation support.
QUALITY ANALYSIS OF PEDIATRIC SLEEP TESTING FROM THREE HOSPITALS IN CHINA

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Introduction: As the developing of sleep medicine in China, more attention has been brought into pediatric sleep disorders. Not only the children's physical development, but also academic performance will be influenced by such diseases. Sleep testing is an essential tool in diagnosing and evaluating sleep disorders. Considering the characteristics of children, such as incomprehension and impatience, pediatric sleep testing meets more obstacles and challenges. Our study was performed to find out the whole quality of pediatric sleep testing, as well as the weak points need to be improved in the future.

Materials and methods: Pediatric sleep testing data were collected retrospectively from January 1st to December 31st in 2016. The sleep testing were performed by sleep centers/labs of three hospitals in China, with polysomnography(PSG), home sleep testing(HST) with electroencephalogram (EEG), HST without EEG or in-lab cardiopulmonary monitoring. The quality of sleep testing data was evaluated by an experienced technologist from the following aspects, including general information, procedure, signal failure, artifacts and patients' cooperation.

Results: 91 pediatric sleep testing were collected in total from three sleep centers/labs. The number of PSG, HST with EEG, HST without EEG and in-lab cardiopulmonary monitoring were 39, 3, 39 and 10, separately. End-Tidal/ Transcutaneous PCO₂ were performed simultaneously with PSG in 9 recordings. The age of the patients ranged from 2-year-old to 17-year-old, with the median age of 7 years old. There are more boys who received sleep testing than girls, with the number of 55(60.4%) and 32(35.2%) respectively. Of note, the gender information were not recorded in 4 cases. In PSG, the top three failure percentages of recording were in EEG (28.2%), nasal pressure(10.3%) and pulse oximetry(10.3%). In HST without EEG, the top failure percentages of recording were in abdominal belt(82.1%), followed by pulse oximetry(41.0%) and airflow(thermal sensor and nasal pressure, 20.5% each). Among the in-lab cardiopulmonary monitoring, the failure percentage goes to chest belt(50%), nasal pressure(30%) and thermal sensor(10%). In the in-lab sleep monitoring, calibrations were missed in two cases. The most common artifacts was ECG artifacts in EEG derivations. In addition, in the processes of monitoring, two children cried and struggled against the sensors and lines extreme hard in the midnight.

Conclusions: In pediatric sleep testing, the signals prone to dysfunction in thoracoabdominal belts, airflow(nasal pressure or thermal sensor) and pulse oximetry, which need to be strengthened. On one hand, more attention and managements are needed during the recording. On the other hand, new and simplified techniques, meeting the physical and mental features of children, are expected in the future.

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GEOMETRIC BROWNIAN MOTION (GBM) RANDOM PROCESS MODEL APPEARS TO BE AN EXCELLENT CHOICE FOR MODELING REALIZATIONS OF PERCLOS SIGNALS

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Introduction: The PERCLOS (PERcentage CLOSure) for one eye and a given time window of duration $T$ seconds (typically 20) is the total time where the eye is closed more than, say, 80% with respect to some reference maximum opening, divided by the window length. Since PERCLOS is recognized as an important indicator of drowsiness, several drowsiness monitoring systems, e.g. for drivers, use it as their unique or primary parameter. All these systems compute PERCLOS “now” based upon the (“past”) data in the window, so that an alarm may come too late to prevent an accident. It would thus be useful to predict future values of PERCLOS based upon this past data. Prediction implies having a model of the evolution of a “PERCLOS signal”. Given that the motion of the eyelids - governed by complex physiological phenomena - has a significant random part, one must treat each PERCLOS signal as a specific realization of some (underlying) random process (RP). Predicting future values of PERCLOS then requires having a proper RP model for the time evolution of PERCLOS. Here, we present such a model.

Materials and methods: Using a glasses-based system imaging one eye and developed in our group, we obtained PERCLOS signals from 17 healthy subjects who performed psychomotor vigilance tasks (PVTs) at 3 different states of sleep deprivation. Each of these $17 \times 3 = 51$ signals consists of 110 samples spaced by 5 seconds.

We investigated several RP models to model these realizations, and we found that the Geometric Brownian Motion (GBM) RP model constitutes an excellent choice.

RP $X(t)$ is said to be GBM if it satisfies the stochastic differential equation

$$dX(t)/X(t) = \mu dt + \sigma dW(t),$$

where $\mu$ and $\sigma$ are positive constants and $W(t)$ is a Wiener (random) process also called Brownian Motion.

For each realization, we determined whether or not GBM was a good model choice by applying the conventionally applied procedure of verifying that the logarithms of the ratios of successive values are normally distributed and uncorrelated in time.

Results: We found out that each of the above 51 PERCLOS signals passed the above pair of statistical model selection tests, so that GBM is a good model choice for each of these 51 signals.

Conclusions: We found that GBM is a good choice of model for all of our 51 PERCLOS signals. In general, for any signal that can be modelled by a GBM, there are methods (mainly found in finances) for statistically and usefully predicting its future values. Therefore, for all 51 signals considered, one could do such predictions.

While we showed that each of the 51 signals above can be modeled by a GBM, this is not a proof that all PERCLOS signals are necessarily produced by a GBM. However, our finding is a strong motivation for future research to examine whether there is a fundamental physiological and/or mathematical reason why all PERCLOS signals should be GBM.

Acknowledgement: We thank all persons in our group who helped with the collection of the data used in this study.
**Introduction:** Existing drowsiness monitoring systems appear to compute a level of drowsiness (LoD) at the present time based on data up to it. An LoD so produced is not the value of the LoD now. Even if it were, an alert based on it would generally come too late. It is thus paramount that future systems predict the value of the LoD some time-interval ahead in the future. Here, we show that one can produce excellent predictions a chosen number of seconds ahead.

**Materials and methods:** We recently showed that Geometric Brownian Motion (GBM) excellently models LoD signals. Here, for each LoD signal considered, we use two prediction approaches: we compute a GBM model either once for the whole signal, or repeatedly for the sub-signal corresponding to each position of a fixed-length, sliding window extending up to the present. Obviously, this requires that the corresponding (sub-)signal be GBM, i.e. that the logarithms of the ratios of successive values be normally distributed and independent.

**Results:** We used an eyeglass-based photooculographic system developed in our group that produces validated LoD signals. We had 17 healthy subjects perform PVTs at 3 different states of sleep deprivation, and got 51 signals, each with 110 samples produced every 5 sec. Each window is 55 sample long and stepped by 1 sample. Predictions are made 4 samples (20 seconds) ahead. For comparison, it takes a 60-mph truck 6 seconds to leave its lane.

Applying the above normality and independence conditions, we established that all 51 signals and 17 sub-signals - each in one randomly selected window for each of the 17 subjects - were all GBM. In operation, one would likely assume that all (sub-)signals are GBM (as established in studies such as this one). For each of the 51 signals, we proceeded as follows.

For the fixed model, we computed its parameters once using the full signal, and used them to compute directly all predicted values 4 samples ahead. For the adaptive model, we computed its parameters for each position of the window and used them to compute the (single) predicted value 4 samples ahead. In each case, we thus produced a prediction signal time aligned with the true signal.

We checked the prediction quality visually by comparing the predicted values and their 95% confidence levels to the known, true values: for both approaches, the predictions were all remarkably close to the truth. We did not notice significant difference between the fixed and adaptive approaches; however, the fixed one uses twice as many samples to compute the model and is not usable operationally.

**Conclusions:** The very preliminary work reported here indicates that the GBM appears useful for predicting future LoD values, including adaptively using a moving estimation window. The present work uses very short signals (110 samples), so that one should expect even better results in real operation, where the signals processed would be much longer, allowing for finer predictions.

**Acknowledgements:** We express our gratitude to our colleague researchers who helped collecting the data.
CUFF-LESS BLOOD PRESSURE ESTIMATION SYSTEM ENABLES CONTINUOUS MONITORING DURING SLEEP. HOW DO WE BELIEVE THAT ESTIMATION VALUES?

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Introduction: Conventional blood pressure (BP) measurement requires a cuff and a stethoscope in order to listen the Korotkoff sounds. However, this traditional method is not the best for the sleep research as cuff pressure may disturb the sleep. Cuff-less BP monitoring system is needed for the sleep research. BP can be estimated through the Pulse Transit Time (PTT) method by the optical sensor without the cuff pressure. The PTT based BP enables us to record over 8 hours continuously within a second data sampling. However, the PTT based BP value is concerned about the influences of heart rate changes because the PTT calculated with the heart rate. The purpose of this study is to validate the continuous BP value recorded from the finger with the optical sensor for the sleep research.

Materials and methods: We conducted treadmill testing using the Bruce protocol with 13 university students (male/female: 8/5). During the exercise and the recovery stage, BP, heart rate, and cardiac rhythm were recorded. The BP was measured with a cuff using auscultatory K sound every 1 or 2 minutes automatically (Tango+, Sun Tech, U.S.A).

The optical sensor (ALPS ELECTRIC CO., LTD, Tokyo, Japan, and Genial Light. co., LTD, Hamamatsu, Japan) was attached to the left index finger fixed with medical tape during the exercise. The data was sampled and stored continuously in the Windows PC within a second and the estimated BP value (Opt BP) was displayed on the screen simultaneously.

We compared the automatically measured BP (Auto BP) value and the Opt BP.

Results: In 9/13 subjects, the Opt BP was concordant with the Auto BP even though when the heart rate changes. The Opt BP also captured the BP changes caused by the exercise.

Conclusions: We validated the estimated BP value with optical sensor attached to the finger. The optical sensor and the estimated BP value captured the pulse changes caused by the exercise and these BP values were concordant with the cuff based BP recorded from the arm.

The optical sensor on the finger can be applied in sleep research. This cuff-less blood pressure estimation system can monitor BP changes during sleep continuously.
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During deep sleep neuronal activity of cortical neurons becomes highly synchronized resulting in high amplitude slow waves (SW) in the electroencephalogram (EEG). There is evidence that spike wave activity in epileptic patients with an activation of epileptiform discharges during sleep might be related to these sleep SWs. Recently it has been shown that sleep SW can be systematically manipulated by closed-loop time-locked acoustic stimulation during sleep: Stimulation time locked to the down-phase of SW reduces and stimulation time locked the up-phase of SW increases slow wave activity (SWA). Thus, we aimed at investigating whether spike-wave-activity can by systematically influenced by acoustic stimulation time locked to SW during sleep.

In 5 children diagnosed with childhood-epilepsies characterized by an activation of spike-wave-activity during SW-sleep (mean ± std, 9.8±2.0 years old), all-night high-density EEG were recorded, combined with real time SW detection. Throughout the night acoustic stimulation (pink 1/f noise, 50ms, ~50db) was performed in 5 min-blocks followed by 10 minutes of no stimulation (NOSTIM). In 2 patients tones were applied only time locked to the down phase (DOWN) of the detected SW, and in 3 patients either to the up (UP) or down (DOWN) phase alternately. The effect of acoustic stimulation on spike-wave activity was quantified by calculating the density of spike waves as spike wave index (SWI). The exact phase timing of slow wave stimulation was determined offline by allocating tone onsets to the slow wave cycle.

Acoustic stimulation during sleep was well tolerated by all patients, showing high sleep quality (sleep efficiency: mean ± std, 89.5±8.9) and no signs of clinical or non-convulsive electrogographic seizures. Offline quantification of slow wave stimulation revealed variable phase timing of tone onset relative to the slow wave cycle across patients. Our preliminary analysis shows that this variability systematically affects SWI: the more tones were applied after the onset of the EEG positive trend the more SWI was reduced after stimulation (Spearman's Rho=-0.74, p=.045). On the other hand, the more tones were applied after the onset of the EEG negative trend the more SWI was increased after stimulation (Spearman's Rho=-0.7, p=.056). As a result, in 3/5 patients SWI was reduced in NOSTIM after DOWN (mean -1% range: -9.4% to 9.6%) and increased after UP in 2/3 patients (mean +19.2%, range: -8.6% to 53.7%). Correspondingly, tones time locked to the down phase reduced SWA in 3/5 patients (mean -1.6% range: -6.6% to 1.4%), whereas tones time locked to the up phase increased SWA in 2/3 patients (mean 2.9% range: -5.3% to 8.3%).

These results provide first evidence that spike-wave-activity can by systematically influenced by acoustic stimulation depending on the exact timing of tone onset to the slow wave cycle. Thus, interacting with the ongoing SW by acoustic stimulation during sleep might provide a simple non-invasive tool to influence spike-wave-activity in epileptic patients characterized by an activation during slow wave sleep.

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ACTIGRAPHY AND POLYSOMNOGRAPHY: SIMILARITIES AND DIFFERENCES

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Introduction: Actigraphy and polysomnography (PSG) are evaluation methods used to study excessive daytime sleepiness (EDS), and PSG is considered gold standard. Actigraphy is a noninvasive objective method that measures movement through an accelerometer and various light frequencies and allows continuous measurement of sleep-wake activity for long periods. The parameters obtained in common by PSG and actigraphy are total in bed (TIB), total sleep time (TST), sleep efficiency (SE), sleep latency (SL) and wake after sleep onset (WASO).

The objectives of this study was to understand if there is agreement between parameters obtained by these 2 methods and verify if there is a difference in sleep-wake patterns at home vs laboratory (during PSG).

Materials and methods: Retrospective analysis of 29 patients who underwent a 1-2 week actigraphy study in the context of the Multiple Sleep Latency Test protocol for evaluation of EDS (January 2016-June 2017). This study was conducted at the Centro de Medicina do Sono, CHUC-HG. Actiwatch® (Philips Respironics, Inc) and Somnostream® PSG equipment were used.

Sleep monitoring and scoring was in accordance with the American Academy Sleep Medicine standards (AASM, 2016). Results of PSG and actigraphy were compared, making a distinction between actigraphy values obtained in the laboratory and at home. Statistical analysis of collected data (TIB, TST, SE, SL and WASO) was done using the IBM® SPSS® version24, using a paired t-test.

Results: Twenty-nine patients, 58.6% men; Mean age 41 years (sd 13Y); Mean BMI 26.6 (sd 4.4) kg / m²; regular intake of psychoactive drugs in 34.4%; EDS was principle symptom in 96.6%. A statistically significant difference was found in TIB (p < 0.001) and TST (p < 0.001), when we compared laboratory actigraphy and PSG. Mean values were higher in laboratory actigraphy. There was no statistically significant difference in the remaining parameters.

Comparing values obtained in home actigraphy with laboratory actigraphy, there was a statistically significant difference between TIB (p = 0.007) and WASO (p = 0.003), with mean values being higher at home. Regarding sleep efficiency and sleep latency no statistically significant differences between the two methods were found.

Discussion: Higher mean TIB values in laboratoty actigraphy vs. PSG may be related to monitoring period and other activities prior to the start of PSG. The higher mean TST values in laboratory actigraphy, vs. PSG, may be attributable to the inability to detect wake without movement at the beginning and / or end of the study. Differences found in the actigraphy values in laboratory and home may be related to the requirements imposed by PSG protocol, such as the need to stay in bed and absence of external stimuli during testing.

In view of ours results we conclude that actigraphy is a good tool to measure sleep latency and sleep efficiency for long periods in a home environment and these data should be considered when evaluating EDS.
RELATIONSHIP BETWEEN BRAIN ACTIVITY AND OCULAR MOVEMENTS DURING WAKEFULNESS AND DROWSINESS

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Introduction: Drowsiness is a physiological condition that is characterized by an uncontrollable desire to sleep and by impairments of performance. Among the different approaches for detecting drowsiness, the use of images of the eye, called photooculography (POG) seems to be the most suitable for many applications since it is objective and non-invasive. The goal of this study is to analyze the relationship between ocular parameters extracted from images of the eye (related to eyelids movements and pupil dilation) and the presence of different activities (alpha and/or theta) in polysomnographic (PSG) signals - considered to be the "gold standard" - during wakefulness and drowsiness.

Materials and methods: We conducted an experiment in which 27 healthy volunteers performed three visual Psychomotor Vigilance Tests (PVTs) under increasing sleep deprivation. During each test, we recorded PSG signals and POG images. For each 1-minute epoch, (1) we manually scored the PSG signals to determine the presence of alpha rhythm, theta activity, and slow eye movements, and we also computed a PSG-based level of drowsiness (LoD) which is our own version of the Karolinska Drowsiness Score (KDS); (2) we automatically extracted from images of the eye a set of ocular parameters including the PERCLOS, the mean blink duration, the percentage of microsleeps, and the pupil diameter, and we also computed a POG-based LoD.

Results: Results will investigate the relation between the ocular parameters automatically extracted from images of the eye with the features extracted from PSG signals. In particular, we will analyze the correlation between the variation of the pupil diameter and the presence of alpha rhythm and/or theta activity in PSG signals. We will also compare the POG-based LoD with the PSG-based LoD to determine if they are in concordance as a function of time.

Conclusions: Besides highlighting the relationship between ocular parameters indicative of drowsiness and the presence of alpha rhythm and/or theta activity in PSG signals, the aim of this study is also to validate the POG-based drowsiness monitoring system that we have developed and to show that it is able to reliably and objectively determine drowsiness and ultimately to help and facilitate the diagnostic of sleep pathologies.
MISSING RRI INTERPOLATION ALGORITHM USING JUST-IN-TIME MODELING FRAMEWORK AND ITS APPLICATION TO HRV-BASED DROWSY DRIVING DETECTION

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Introduction: The R-R interval (RRI) fluctuation in electrocardiogram (ECG) is called heart rate variability (HRV). Since HRV reflects autonomic nervous function, HRV-based health monitoring services, such as stress estimation, drowsy driving detection, sleep apnea syndrome screening have been proposed by integrating HRV analysis and machine learning techniques. Although ECG can be easily measured by a wearable sensor, precise R wave detection from ECG is required; however, R waves cannot be detected stably due to ECG artifacts. Thus, missing RRI data should be interpolated appropriately for HRV analysis in order to improve performances of these health monitoring services. In HRV-based drowsy driving detection, in particular, false positives occur by RRI missing because motion artifacts are frequently contaminated in ECG by driving operation, which are annoying for drivers. The present work proposes a new missing RRI interpolation algorithm and its application to drowsy driving detection for false positive suppression.

Materials and methods: The present work proposes a missing RRI interpolation method by utilizing just-in-time (JIT) modeling. The proposed method adopts locally weighted partial least squares (LW-PLS), which is a well-known JIT modeling method used in the field of process control. In LW-PLS algorithm, a local model is built from past data around a query by partial least squares (PLS) only when an estimate is requested. That is, a missing RRI is estimated by using a local PLS model constructed from RRI data stored in a database only when RRI missing is detected. After estimating the missing RRI, the constructed local model is discarded. The proposed RRI interpolation method was applied to drowsy driving detection. The RRI data and the electroencephalogram (EEG) data were collected simultaneously from 18 healthy persons while they drove on a course that simulated a highway loop line for total three hours using a driving simulator. In addition, their sleep onsets were determined based on the EEG data by a sleep specialist. This experiment was approved by the Research Ethics Committee of Kumamoto University.

To validate the RRI interpolation performance of the proposed method, 5% of RRI samples in the collected RRI data were intentionally lost in a random manner, and the missing RRI data were interpolated by a median value of the missing RRI samples or the proposed interpolation method. Finally, these two interpolated RRI data were applied to the drowsy driving detection algorithm. In order to evaluate their interpolation performances, a false positives rate [times / hour] in each interpolated RRI data were calculated. This procedure was repeated thirty times for precise evaluation.

Results: The means of thirty false positive rates in the missing RRI data interpolated by the median value and the proposed method were 2.96 and 2.54, respectively. That is, with the proposed RRI interpolation method, the false positive rate was improved by about 17% in comparison with the median-based method.

Conclusions: The present work proposed a new missing RRI interpolation method. The case study showed that the proposed LW-PLS-based interpolation method functioned well.
SLEEP STAGE CLASSIFICATION USING SPECTRAL ANALYSES AND SUPPORT VECTOR MACHINE ALGORITHM ON C3- AND C4-EEG SIGNALS

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Introduction: Sleep stage classification currently relies largely on visual classification methods. We tested a new scheme for automated offline classification based upon power spectrum at five different frequency bands. Both approaches allowed sleep stage classification and provided whole-night visualization of sleep stages.

Materials and methods: 102 subjects (69 male; 53.74 ± 12.4 years) underwent full-night polysomnography. The recording system included C3- and C4-EEG channels. All signals were measured at sampling rate of 200 Hz. Four epochs (30 seconds each) of each sleep stage (N1, N2, N3, REM, awake) were marked in the visually scored recordings of each one of the 102 patients. Scoring of sleep stages was performed according to AASM 2007-criteria. Therefore 408 epochs for each sleep stage were included in the sleep stage classification analyses. Recordings of all these epochs were fed into the pipeline to estimate the power spectrum at five different frequency bands, namely from very low frequency (VLF, 0.1-1Hz) to gamma frequency (30-50Hz). The estimated parameters were given as input to the support vector machines (SVM) algorithm to classify the five different sleep stages based on the mean power amplitude estimated from five different frequency bands.

Results: The estimated accuracy of prediction of the sleep stages was 84.1% for stage N1 using the mean power amplitude from the delta frequency band. Accuracy was 67.8% for stage N2 from the delta frequency band and 74.9% for stage N3 from the VLF. Accuracy was 79.7% for REM stage from the delta frequency band and 84.8% for the wake stage from the theta frequency band.

Conclusions: We were able to successfully classify the sleep stages using the mean power amplitude at five different frequency bands separately and achieved up to 85% accuracy using the electrophysiological signals. The delta and theta frequency bands gave the best accuracy of classification for all sleep stages.
TELEHEALTH-SUPPORTED HOME PAEDIATRIC POLYSOMNOGRAPHY

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Introduction: Our paediatric clinical sleep unit runs a limited home polysomnography (HPSG) service utilizing telehealth support. The gold standard for diagnosis of paediatric obstructive sleep apnoea (OSA) is in-laboratory polysomnography (PSG) (Marcus, 2012). In-laboratory PSG is time and labour intensive, expensive, poorly available and inconvenient to parents (Tan, Kheirandish-Gozal et al, 2015). Paediatric HPSG is feasible in school aged children (Goodwin JL, 2001), however is technically limited due to displacement of electrodes and sensors. We utilise telehealth support to improve technical accuracy. The aim of the present study was to audit all HPSG studies completed between the commencement of the service (December 2013) until the end of February 2017.

Materials and methods: The HPSG reports of children aged 5-18 yrs with suspected OSA were analyzed retrospectively. The service excludes children with autism, attention deficit hyperactivity disorder, psychiatric disorder or significant medical co-morbidity. All studies were Type 2 tests using the Compumedics Somte PSG V2, (unattended, ≥ 7 channels). The primary outcome was the % of technically accurate studies achieving an adequate diagnosis. Secondary outcomes included adequacy of sleep architecture, sleep efficiency, sleep duration and parental acceptance (by questionnaire). Statistics were performed and graphs created in Excel (Microsoft Office 2010).

Results: A total of 94 patients (39 females) aged 5.1 to 18.2 years (median age 10 yrs) underwent Telehealth-supported HPSG between December 2013 and February 2017. There was technical accuracy in 87% of HPSG studies leading to an acceptable diagnosis in this group. The diagnosis was potentially underestimated in 18 (19%) where minor signal loss occurred. Repeat studies (inpatient PSG) were indicated in 12 (12.7%) due to major signal loss. The median total sleep time (TST) was 8.52 hrs (range 4.45-11.5 hrs). 89 studies (94.7%) satisfied our hospital in-laboratory PSG minimum TST of 6 hrs. The median sleep efficiency was 83.4% (range 50.0-94.9%).Sleep architecture was normal in 74 (82%), mildly abnormal in 8 (5.3%) and not able to be assessed in 12 patients (12.7% - test failure). Questionnaire responses from the first 25 patients confirmed acceptance of the procedure with 96% reporting it more convenient than "in lab PSG", 84% reporting very good/excellent Telehealth support, and 96% reporting high level care.

Conclusions: In our service, paediatric HPSG with telehealth support is feasible and achieves 87% technical accuracy. In the majority of patients, sleep duration, sleep efficiency and sleep architecture fall within normal ranges. Families have responded favorably to questionnaires confirming acceptability of the service.
OBJECTIVE ASSESSMENT OF SLEEP USING A 2-CHANNEL PORTABLE, SELF-APPLICABLE DEVICE

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Introduction: Portable solutions for sleep measurement are gaining increasing acceptance based on published evidence. Currently, however, most such solutions still rely on the availability of a full montage including EEG, EMG, and EOG according to the published standards (AASM 2007), preventing the easy self-applicability and thus limiting the potential scope of these instruments. Recently, we presented a new method of sleep staging based on a reduced setting using two EOG channels only (Gruber et al. 2016). We could demonstrate, that the algorithm identified effectively the three main states wakefulness, NREM sleep and REM sleep from the two EOG channels as compared to the standard setting including additional EEG and EMG channels. The aim of this paper is to investigate if a reduced montage, restricted to 2 EOG channels could yield comparable sleep staging results.

Materials and methods: 20 healthy subjects (aged 20 - 29 years) participated in the experiment. Standard PSG was recorded using the EEG channels F4, C4, and O2 referenced versus the contralateral mastoid (A1), submental EMG, and 2 EOG electrodes placed one cm above the outer cantus of the right eye (ROC) and below the outer cantus of the left eye (LOC) referenced both versus A1. The reduced montage included 2 EOG electrodes placed one cm above LOC and below ROC respectively, referenced versus A2 and was recorded using an Actiwave miniature recorder (Camntech, Cambridge UK). All 40 recordings were analyzed either using a validated computer assisted scoring system (Anderer et al. 2010) for the standard PSGs and a modified version adapted for the reduced 2-channel montage. The calculated target variables included - among others - the sleep efficiency index (EFF), Wake after sleep onset (WASO), latency to persistent sleep (LCONT), and the percentages of sleep stages N1, N2, N3, and R.

Results: Data loss as a result of absent backup channels was minimal in the 2-channel recorder. The number of epochs not scoreable was 1.3 % in the portable device (0 % in the standard recording). In general, the differences between the target variables between reduced and standard montage were marginal in absolute terms: EFF: -0.47 % (SD=2.6), WASO: -3.2 minutes (SD= 9.05), LCONT: +3.2 minutes (SD=8.28), N1%: -0.24 % (SD=4.57), N2%: -0.61% (SD=7.36), N3%: -0.52% (SD=7.17), and R%: +1.44 (SD=4.5). As expected, no significant differences were found in a paired samples t-test in any variable. Bland-Altman plots showed no evidence of a systematic bias.

Conclusions: The results provide further evidence that, with appropriate computer-supported sleep scoring, data obtained by means of a 2-channel portable device lead to sleep measurements similar to a full PSG.

References:
Introduction: It is estimated that in the US alone, the number of patients on oral appliance therapy (OAT) will be over one million by 2023. To keep up with the rising demand, more efficient and precise workflow models are required to minimize inaccuracies and costs associated with delivery of care. The purpose of this study is to evaluate the feasibility of a novel, fully digital workflow model, utilizing intra-oral digital scanning and CAD/CAM device manufacturing, in combination with an AMP for patient selection and effective target protrusion (ETP) prediction to minimize inefficiencies and improve quality of care.

Methods: In the first study group (Group A: n=30), the workflow impact of placing participants prospectively determined to be successful with OAT directly at a pre-selected target was evaluated. A CAD/CAM MRD (MicrO2® Sleep Device) was inserted at the pre-determined ETP or if required, at a lower protrusion with instructions to adjust in 1-2 mm increments to ETP at home. During the first year, additional follow-up appointments requested by the participants were recorded. In the second study group (Group B: n=5), we evaluated the feasibility of utilizing existing technologies to create a fully digital clinical workflow for manufacturing MRDs at a pre-selected target. Two CAD/CAM MRDs (MicrO2®) per patient were manufactured using a conventional method (PVS impressions and bite registration) and a digital method using an intraoral digital scanner (iTero®) and a “digital open-bite registration”. Each patient received both appliances and the dental fit, occlusal fit and patient preference were recorded.

Results: Group A: The median ETP was 63% (range: 36-100%). 67% of participants had their OA inserted directly at ETP, including 2 who had an ETP >80%. All participants self-calibrated at home to achieve ETP, where 86% were a therapeutic success. 4 participants required in-office appointments for calibration of the OA to achieve success. Once therapeutic success had been achieved, 12 participants required 1-2 non-calibration follow-up appointments for reasons such as new dental restorations, polishing, repair, or discomfort. The remainder of participants did not require additional dental chair time. Group B: In the conventional workflow, 2 appliances required minor dental adjustments & 3 appliances required occlusal adjustments. In the digital workflow, no dental or occlusal adjustments were required. All patients preferred the digital MRDs in terms of comfort.

Conclusions: Utilizing the existing tools and technologies, it may be possible to create new workflow models for OAT that are more accurate, require less follow-up and chair time, and improve patient satisfaction. In combination with an AMP test to select suitable patients for OAT and identify an ETP, these models may improve the quality and delivery of care. Further well-controlled studies are required to test the complete workflow.
SAGITTAL MEASUREMENT OF GENIOGLOSSUS MOVEMENT DURING RESPIRATION: COMPARISON BETWEEN ULTRASONOGRAPHY AND MAGNETIC RESONANCE IMAGING

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Introduction: Genioglossus (GG) is the largest upper airway dilator and pulls the tongue antero-inferiorly during inspiration. Tagged MRI has been successfully used to quantify respiratory related dilation of GG. We have recently developed an ultrasound method to achieve this. The aim of this study is to determine the agreement between ultrasonography and MRI measurement of regional GG displacement in healthy and OSA subjects in quiet breathing awake.

Materials and methods: Twenty-one subjects (15 males, 6 females) rested supine with standardized head position and breathed through their nose. A curved array ultrasound transducer (5-8 MHz frequency) was positioned submentally, in the mid-sagittal plane, with frame rate of 40Hz. Tagged MRI images were acquired using a 3 tesla MRI scanner while respiration was recorded.

Genioglossus motion was imaged over three respiratory cycles for each subject in both modalities, excluding image sequences with >1mm mandibular movement. For analysis, two matched rectangular grids of 3 columns (~3 mm apart) of 5 points (~2 mm apart), were placed in the anterior GG and posterior GG, with a further line of 5 points (~5 mm apart) in the most posterior region to measure regional displacement. Mean resultant displacements were used to determine variability, agreement and consistency between MRI and US, using Bland-Altman analysis and a two-way mixed intraclass correlation coefficient (ICC).

Results: Mean participant age was 45.7 ± 13.7 years (mean ± SD). Three subjects with AHI < 5, seven had mild OSA (5 ≤ AHI < 15), seven had moderate OSA (15 ≤ AHI < 30), four had severe OSA (AHI ≥ 30).

During inspiration the posterior grid-points moved anteriorly by 0.96 ± 0.44 mm and 1.20 ± 0.66 mm measured using MRI and US respectively. The mean anterior grid-points displacement was 0.37 ± 0.17 mm and 0.32 ± 0.14 mm measured with MRI and US respectively. The posterior line of 5 points moved by 0.77 ± 0.41 mm measured with MRI and 0.79 ± 0.57 mm measured with US during inspiration.

The ICC was 0.63 (95%CI: 0.51 - 0.73), 0.64 (95%CI: 0.54 - 0.72) and 0.74 (95%CI: 0.61 - 0.82) for the posterior, anterior grids and posterior line respectively. The differences in GG displacement (MRI - US) was -0.24 ± 0.64 mm (-1.49 to 1.03) [ mean ± SD, 95% limits of agreement], -0.02 ± 0.58 mm (-1.15 to 1.11) and 0.05 ± 0.21 mm (-0.35 to 0.46) respectively.

Conclusions: This study directly compared ultrasonography and MRI for measurement of genioglossus motion during respiration. Our ultrasonography technique has good consistency and agreement with MRI in measuring maximal inspiratory GG displacement in awake supine-lying subjects. Ultrasound recorded greater anterior displacement in the posterior genioglossus possibly due to higher spatial and temporal resolution. This study further validates ultrasound in quantifying inspiratory movement of genioglossus in healthy and OSA subjects, and confirms maximal inspiratory displacement is within the infero-posterior genioglossus region.

Acknowledgements: We like to thank Ben Tong and Prof Rob Herbert for their assistance.
THE LNQ25 AND ELN PVT METRICS EXHIBIT A GOOD SENSITIVITY TO SLEEP DEPRIVATION AND ARE INDEPENDENT FROM THE SUBJECT

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Introduction: Performance of people undergoing critical tasks (like driving) may be completely impaired by the lowering of their vigilance level, due to sleep deprivation for instance. This reduction of performance is measured by metrics computed from the reaction times (RT) recorded during a 10min Psychomotor Vigilance Test (PVT). We analyze and compare the sensitivity to sleep deprivation and the subject dependent variability of the PVT metrics performance, with a special emphasis on the time interval sizes.

Materials and methods: Individuals (22 volunteers; 11 males, 11 females, mean 22.2y., range 19-34 years) attend an uninterrupted 28h sleep deprivation standard PVT protocol composed of two groups of three PVT sessions (in different conditions). In each group, the first PVT is in Non-SDP condition (9h30, 10h30 Day 1) while the second and third PVT are in SDP condition (2h30, 3h30, 10h30, 11h30 Day 2). The subjects fill a sleep journal during the week before the experiment. We checked that they had a normal sleep-wake cycle with no sleep deprivation, jet-lag or shift work and no medication. During the PVT of the first group, the subjects were wearing the glasses of the Phasya's Drowsimeter.

We compute the usual PVT metrics; meanRT, meanRS (Reaction Speed) and LN500 (500ms lapses number). We also compute the LNQ25 (adaptive lapses number computed with a subject dependent threshold) and the ELN (Expected Lapse Number, computed from a subject dependent estimation of the lapse probability).

Results: We use the "Effect Size" (ES, ratio of the mean by the standard deviation of the difference of metrics in the SDP and Non-SDP conditions) to assess the sleep deprivation sensitivity. For the 10min (resp. 1min, 3min) interval, the ES of LNQ25 and ELN are respectively 1.38 (resp. 0.95, 1.22) and 1.35 (resp. 0.85, 1.14), the ES of meanRS, meanRT and LN500 are 1.23 (resp. 0.91, 1.09), 0.81 (resp. 0.54, 0.68) and 0.85 (resp. 0.63, 0.77). We classify the intervals on which metrics are computed as SDP (positive class) or non-SDP (negative class). We use a fixed threshold for the metrics, common for all subjects. In the ROC space, the TPR (True Positive Rate), for a FPR (False Positive Rate) of 10%, expresses the quality of the classification, and indicates some form of subject independence. For the 10min (resp. 1min, 3min) interval, the TPR of LNQ25 and ELN are respectively 0.86 (resp. 0.56, 0.75) and 0.83 (resp. 0.58, 0.75), the TPR of meanRS, meanRT and LN500 are 0.42 (resp. 0.38, 0.41), 0.40 (resp. 0.39, 0.40) and 0.42 (resp. 0.24, 0.30).

Conclusions: We demonstrate that the LNQ25 and ELN metrics enable a good classification of the SDP condition for time intervals greater than or equal to 3min, independently of the subject. On the other hand, these metrics provide also a good sensitivity to sleep deprivation. They outperform the usual metrics for both criteria. For time intervals below 3min, the performances degrade first progressively and then more rapidly below 1min.

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USING MOBILE TECHNOLOGY INTERVENTIONS TO FACILITATE HEALTHY SLEEP HABITS FOR CHILDREN WITH ADHD

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Introduction:
We present a technology-based approach to support families of children with ADHD. Sleep problems including sleep onset delay, bedtime resistance, and consequent daytime sleepiness are commonly reported in children with ADHD. Establishing an effective bedtime routine is important, as sleep deprivation in this population manifests in increased hyperactivity and inattention, increased disruptive behaviors, and poorer concentration and overall school performance. However, morning and bedtime routines can be particularly stressful and frustrating for parents of children with ADHD. Our aim was to develop a mobile technology to assist families in establishing effective bedtime and morning routines.

Through a design process involving parents of children with ADHD and ADHD domain professionals comprising two child psychiatrists, three psychologists, and three medical researchers, we developed the Morning and Bedtime Routines smartphone system (MOBERO) [1]. We hypothesised that mobile technologies may: lower parental frustration level during their child’s morning and bedtime routines; assist the child in becoming more independent during morning and bedtime routines; and improve the child’s sleep habits.

Materials and methods:
MOBERO, a novel mobile phone intervention was developed through a participatory design process as part of this study to assist families in establishing healthy sleep habits for children with ADHD.

Thirteen children (four female) clinically diagnosed with ADHD aged between 6-12 years (average age: 9.3) and their families participated in a four-week within-subject study. The study was divided into a two weeks baseline period followed by two weeks intervention period. At baseline and again post-intervention, the families completed the ADHD Rating Scale IV (ADHD-RS IV) and the Child Sleep Habit Questionnaire (CSHQ). In both baseline and intervention periods parents were reminded daily via a smartphone application to assess: the child’s wake-up time; bedtime; sleep time; in addition to their rating of the child’s independence level during bedtime routines; and their own frustration level during the child’s bedtime routines.

Results:
Our experiment showed a significant 8.3% improvement in the CSHQ scores between baseline and intervention; a significant 16.5% reduction in the ADHD-RS IV score; significant improvements in parental assessment of their child’s independence level around bedtime; and significant reductions in parental assessment of their own frustration level around their child’s bedtime. Our study revealed a non-significant trend towards more consistent bedtimes between baseline and intervention phases. However there was no significant difference in actual sleep times between baseline and intervention phase.

Conclusions:
Our study suggests that technological interventions, such as MOBERO, are effective in assisting families of children with ADHD to improve their sleep and reduce ADHD symptoms. In addition, our intervention showed the potential for reducing parent frustration and increasing child independence around the child’s bedtime.

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References
A MACHINE LEARNING APPROACH TO DETECTING SLEEP AND SLEEP DISORDERS IN ACCELERATION SENSOR DATA

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Introduction: The major diagnostic sleep laboratory tool for assessing excessive daytime sleepiness (EDS), the mean sleep latency test (MSLT), is increasingly criticized for poor precision in the differentiation of idiopathic hypersomnia (IH) and narcolepsy (Trotti et al., 2013; Johns, 2000). Recent evidence suggests that actigraphy can supplement the diagnostic process by providing information about the sleep-wake rhythm (Kretzschmar et al. 2016; Filardi et al., 2015).

Materials and methods: An actigraphy analysis tool is introduced that processes actigraphy recordings with machine learning methods, which are capable of detecting complex patterns. It is preliminarily validated for recordings of hypersomnolent patients. Sleep is detected using a support vector machine (SVM) with 61 features describing the actigraphy signal. Each detected sleep phase is automatically verified in order to not be confused with episodes of unattached actigraphy device. Moreover, an SVM is trained to identify the main sleep episode of each day, based on features describing a sleep phase’s probability of being a nap. Finally, the classifiers’ annotations are used to calculate 217 sleep-wake rhythm and motor activity parameters.

Results: Testing the prediction of sleep against polysomnographically validated labels on nocturnal recordings of hypersomnolent patients showed an accuracy of 87%, a sensitivity of 93% and a specificity of 51%. Post-processing the prediction with morphological operations increases the specificity to 73%, with only minor declines in accuracy and sensitivity (85% and 88%, respectively). Individually training an SVM per patient revealed the most promising results with 95% accuracy, 73% specificity and 99% sensitivity. Furthermore, testing the differentiation of diurnal and nocturnal sleep on 14-day actigraphies of EDS patients with manually generated training data showed an accuracy of 90%, a specificity of 96% and a sensitivity of 86%. Applying the trained algorithm on 15 long-term actigraphies from IH patients and comparing the automatically derived sleep-wake parameters to previously published results (Filardi et al., 2015) showed good accordance.

Conclusions: Altogether, the developed tool and the methods used appear a promising pathway for future investigations in the search for disorder inherent sleep-wake rhythm and motor activity patterns in big patient cohorts.


COMPARISON OF ACTIGRAPHY SCORING PROTOCOLS TO DEFINE THE REST INTERVAL AND OPTIMALLY DERIVE PEDIATRIC SLEEP DIMENSIONS

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Introduction: While polysomnography is the established gold standard, technological advances have enabled more resource efficient (cost, time, user-ease) assessment of select sleep dimensions and patterns. Wrist actigraphy is an ambulatory wearable increasingly used in research and clinical settings as it permits unobtrusive measurement of sleep in one's home environment. Previous research analyzed accelerometry data to yield validated algorithms (e.g., Sadeh, Cole) to distinguish sleep/wake epochs. Within the pediatric literature, Meltzer and colleagues (2011, 2015) comprehensively compared timing rules for immobility minutes and sensitivity thresholds to define sleep onset. These technical specifications rely on accurate identification of the "lights-out" rest interval, within which algorithms are applied to derive sleep parameters. Few studies state how the rest interval was defined; fewer explicitly report using sleep diaries, event markers, light intensity, visual inspection with manual scoring, or default software settings. A related challenge is the contemporary meaning of "lights-out" given the ubiquitous use of electronic gadgets in the bedroom while falling asleep. The aim of the present study was to compare three scoring protocols to define the rest interval for actigraphy among children and adolescents.

Materials and methods: Children and adolescents (Mage=13.7 years; N=76; 41.2% girls) participated in the larger Healthy Heart Project at Concordia University, Quebec. Youth wore a wrist actigraphy (piezoelectric accelerometer; Actiwatch2, Philips Respironics) on their non-dominant arm continuously for two weeks. Three scoring protocols were used to define the start and end time of the rest interval in Actiware software: (1) Parent and youth report (rest interval defined as bedtime and waketime for school night or weekend from Children's Sleep Habits Questionnaire); (2) Sleep log (varied nightly to correspond with adapted Consensus Sleep Diary; "What time did you close your eyes and try to go to sleep"); and (3) Manual scoring (varied nightly according to standardized rules for combinations of activity, light, event marker; rater reliability=.96).

Results: Intraclass correlation coefficients were used to evaluate correspondence of the scoring protocols. Manual scoring yielded the highest correspondence with the sleep log for rest interval start (ICC=.79), end (ICC=.93), and duration (ICC=.80). Compared to parent reported times, children had better correspondence with manual scoring and sleep log (ICC=.49 vs .59). Both parents and children overestimated the time spent sleeping, reporting bedtimes nearly 1 hour earlier than manual scoring and sleep log. Waketime was also misestimated; children slept-in or snoozed almost 30 minutes longer than reported. Changing the timing of the rest interval consequently yielded longer onset latency, lower efficiency, more wake bouts, and greater fragmentation based on child and parent reported times, compared to manual scoring and sleep log.

Conclusions: Results underscore the importance of accurately defining the rest interval. Consistent with previous recommendations, the sleep log was an essential supplement for actigraphy scoring. Parent and child report of typical bedtime was non-optimal for defining the rest interval, and could yield inaccurate sleep dimension parameters, especially latency and efficiency. Future researchers should consider how to precisely capture the intention of "lights-out".

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Introduction: Sleep spindles are one of the hallmarks of NREM sleep in the human EEG. Despite their recognisability as single events even in continuous EEG traces, they have often been measured using spectral power analysis in the 11-16 Hz range. Here we introduce an automatic detection algorithm for individual spindle events, with emphasis on its utility in high-density EEG recordings. Furthermore we demonstrate how spindle parameters could be analysed using 3 exemplary analyses: early versus late night spindles; young versus elderly spindles; and spindle properties after thalamic stroke versus age matched controls.

Materials and methods: Individual spindles were automatically detected in 9 young and 9 elderly healthy controls, as well as 9 thalamic stroke patients. Analysis proceeded in 3 essential steps. First, the hd-EEG of 125 channels, were spatially sub-sampled into 9 non-overlapping regions. Next, each of these canonical regions were examined for spindle activity using a wavelet-based method which looked for supra-threshold wavelet activity in the 11 - 16 Hz. Further detection criteria were applied to potential spindle duration, amplitude, power ratio (in relation to neighboring frequencies), and frequency. In the final step, the original channels are then re-examined to determine the spindles topographic extent and parameters at the individual channel level. The process results in a large structure of 100s of spindles for each recording with several distinct and independent parameters. This structure is then directly analysed using linear mixed models. This improves specificity, sensitivity and validity of results compared to traditional methods which tend to only consider the mean values for each recording.

Results: In the early versus late spindle comparison while spindle incidence and peak-to-peak amplitude decreased over the course of the night, the spectral power of individual spindles actually increased due to an increase in both the duration and globality of spindles. For young versus elderly we found a significant reduction in individual spindle power between the groups where the classic group comparison failed to detect this difference. In the stroke comparison we found that only left-side damage lead to a reduction in individual spindle power. Furthermore this reduction was specific to posterior/fast spindles and did not impact frontal/slow spindles.

Conclusions: Altogether we demonstrate how state-of-the-art spindle detection techniques, applied to high-density recordings, and analysed using advanced statistical approaches can yield novel insights into how both normal and pathological circumstances affect sleep.

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APPLICATION OF A ELECTRONIC DIARY COMPATIBLE WITH SMARTH PHONES IN THE EVALUATION OF SLEEP AND OTHERS CLINICAL SYMPTOMS IN FIBROMIALGIA

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Introduction: Traditional assessment self-registers of paper and pencil present diverse problems for both the patient (e.g., to forget to complete it) as well as the therapist (e.g., too much time to do a data analysis). It has been developed some electronic records of symptoms but limited to investigation contexts and usually centred on one or two variables.

The aim of this work is to design an electronic diary versatile and compatible with smart phones for the evaluation of the main symptoms present in chronic pain syndromes as fibromyalgia (sleep alteration, fatigue, sleepiness, pain, stress, emotional distress, and deterioration in daily functioning), and to realize a pilot study in a sample with fibromyalgia.

Materials and methods: The clinical diary will consist of a web platform compatible con Smart phones and will be developed with HTML5, Javascript and CSS technologies and using Yii system, a high-performance PHP framework for developing Web 2.0 applications. The web platform will run on an apache server on Linux. It will be designed to include several questions to monitor the mentioned symptoms (rated from 1 to 10). The web application will include a management backend for therapists and a frontend for patients. Therapists register patients and assign one or more measures to them (sleep, pain, etc.) to answer several times a day (morning, afternoon and night).

Users will be registered anonymously, being associated with a numeric identifier. The answers will be stored in a MySQL relational database that allow to download all answers in an Excel-compatible data file.

Seven women with fibromyalgia, mean age 46.53 ± 6.07 complete the electronic diary one week. The patients, recruited from the Rheumatology Service of the Virgen de las Nieves Universitary Hospital, have to be stabilized in the consumption of medication during one month.

Results: The clinical diary can be seen in http://diarioclinico.everywaretech.es. In the pilot study, all symptoms show a non-significative trend to be worse at afternoon, with the exception of functioning that is worse at morning. Spearman Rho' correlations between symptoms are different depending the time slot. Thus, in the morning, stress was related with more emotinal distress (r=0.79, p< 0.05) and worse functioning (r=0.96, p< 0.01). In the afternoon, in adittion to significative correlations of stress with fatigue, sleepiness and emotional distress, we found several relations of stress with sleepiness and emotional distress (r=0.85, p< 0.05 and r=0.77, p< 0.05, respectively). At night fatigue correlate with pain (r=0.76, p< 0.05), pain is associated with emotional distress (r=0.75, p< 0.05), and emotional distress with worse funtioning (r=0.89, p< 0.01).

Conclusions: A electronic diary compatible with Smart Phone have potential improving our clinical assessment in conditions as fibromyalgia. The device improve the adherence of the patients to the register system, is efficient and allows a more precise analysis of the information. This electronic diary is, in addition, a useful complement for the development of on-line therapy facilitating the process of evaluation and helping to detect therapy effects.

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COMPACT OPTICAL FIBER-TYPE SLEEP APNEA SYNDROME SENSOR

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Introduction: We have developed an optical Fiber-type Sleep Apnea Syndrome sensor (F-SAS sensor) that can detect a change in lateral pressure as a signal light beam change and apply it to hotel and medical checkups. We have succeeded in downsizing the F-SAS sensor and have recognized that it highly correlates with PSG and PLSX.

Materials and methods: Under the agreement of the ethical committee of Tohoku Rosai Hospital and the following two conditions, coincident measurements of PLSX and F-SAS sensors were taken for an overnight medical checkup screening.

(1) Subjects were 33 men and 8 women (age: 55.7±7.49, BMI: 25.6±4.2), and an optical fiber sheet was set under the bed pad, respiratory motion of the chest and arterial blood oxygen saturation was measured by PLSX from Feb. 16, 2012 to Sep. 7, 2016.

(2) Next, conditions for 68 men and 8 women (age: 52.5±20.5, BMI: 24.8±6.8) were measured by using the downsized F-SAS sensor with a conventional PLSX from Mar. 12, 2013 to Jan. 11, 2016.

(3) Finally, the clinical examining body was the Department of Sleep Medicine, University of Tsukuba. Candidates were chosen from both healthy subjects and those suspected to be severe SAS patients who were definitive diagnosed by PSG and complied with F-SAS sensor clinical tests. Clinical test periods were from Sep. 25, 2013 to Feb. 12, 2014, and measurements were taken for 35 SAS patients including healthy subjects. Simultaneously parallel used measurements were taken with a PSG system, Alice-5, and a compact F-SAS sensor system.

Results: The analytical results of RDI by the conventional F-SAS sensor and ODI3% of PLSX. Thirty eight of the 42 examinees show Pro-AHI >5 and were suspected of SAS. The coincident measurement of ODI3% and Pro-AHI shows significant correlation (r=0.79, p< 0.01). Seventeen examinees with Pro-AHI were over 10. Four of them received a complete checkup by PSG and were given CPAP therapy.

Next, a comparison of the analytical data of RDI (Pro-AHI) by the compact F-SAS sensor system and the coincident measurement of ODI3% were done. Out of 76 examinees, 56 were Pro-AHI>5 and were suspected of SAS. The coincident measurement of PLSX, Pro-AHI, and ODI3% shows good correlation (r=0.796, p< 0.01). The 32 examinees were consulted during SAS outpatient screening.

Finally, we show the simultaneous measurement results of the portable F-SAS sensor and PSG (Alice-5) including measurements taken for healthy subjects and severe adult patients definitively diagnosed by PSG for hospital stay. The correlation value between the gold standard for the screening of sleep apnea syndrome, PSG (Alice-5), and a compact F-SAS system demonstrated a highly significant relationship, 0.83.

Conclusions: The F-SAS sensor is useful for being non-invasive and non-restrictive and does not disturb normal sleep during examination. In this study, we demonstrated through a detailed examination by PLSX and PSG (Alice-5) that PLSX data and PSG (Alice-5) data are well correlated with those of the F-SAS sensor.

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AT-HOME QUANTIFICATION OF SLEEP CHARACTERISTICS WITH SELF-APPLICABLE FACIAL ELECTRODE SET

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Introduction: Although full home polysomnography (H-PSG) offers many advantages over in-lab PSG such as increased accessibility, better patient convenience and reduced cost, its use has remained restricted. This is partly due to present electroencephalography (EEG) electrodes being too cumbersome for patient’s self-application. A trained sleep technician must apply the electrodes, and this fact limits the wider utilization of H-PSG. We have recently introduced a screen-printed ambulatory electrode set (AES), and shown its accuracy in sleep staging, and in detection of sleep bruxism events. In this study, we tested the hypothesis that a newly designed AES is simple enough for patient self-application and it enables reliable acquisition of in-home sleep data.

Materials and methods: Sixty-two self-administrated H-PSG recordings with a newly designed AES were performed in volunteer subjects (aged 39.6±11.6 years, 86% females) with self-reported sleep bruxism. The recording montage consisted of four EEG derivations (Fp1-T10, Fp2-T9, Af8-T9, Af7-T10), two electrooculography (EOG) derivations (F7-T10, F8-T9), two submental electromyography (EMG) derivations, two bipolar masseter EMG derivations and single electrocardiography channel (modified lead II). Skin-electrode contact impedances were continuously recorded by the ambulatory PSG device (Nox A1, Nox Medical). Technical quality of the recordings was graded based on the proportions of interpretable data. All subjects filled in a questionnaire including questions concerning subjective quality of sleep and ease of applying the AES.

Results: Out of the sixty-two sleep studies conducted, the quality of fifty-seven recordings (91.9%) was graded good or better, and three recordings (4.8%) were considered as failed. Electrical characteristics of hydrogel-coated silver ink electrodes were found adequate for clinical sleep recordings and skin-electrode impedances generally remained stable and low enough in overnight recordings. The most common artifact present in EEG and EOG channels was low frequency (< 1 Hz) activity (“sweat artifact”) but this was found to be partly manageable by using digital high-pass filtering. AES was considered as easy to apply by participants (easiness for EEG and EOG: 3.6±2.2 (mean±SD) and for chin EMG: 2.1±1.4; scale from 1 = easy to 10 = difficult). Only one recording (1.6%) failed due to mistakes in AES appliance. Good subjective sleep quality was in concordance with determined sleep parameters, such as high sleep efficiency (90.6±6.9%).

Conclusions: AES was found to be a simple and less disturbing tool for portable sleep monitoring. Reliability of AES recordings was comparable to that previously reported for conventional unattended H-PSG that includes EEG electrodes applied by a technician. Self-applicable AES has a great potential to become a reliable tool for H-PSG.

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A MULTISENSORIZED WEARABLE DEVICE FOR AMBULATORY CIRCADIAN MONITORING (ACM) AND SLEEP DETECTION: COMPARISON WITH PSG

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Introduction: Sleep-wake rhythm is under circadian system (CS) regulation. Sleep can be considered an output of the master clock, the suprachiasmatic nucleus (SCN) of the hypothalamus; in turn, as sleep can be voluntarily modified, it modulates the strength of the synchronizing input signals to the SCN: light, feeding and activity. Considering this bidirectional crosstalk between sleep and CS, the monitoring, diagnosis and treatment of circadian and sleep disorders should not be addressed separately.

Here, we propose an ACM method for circadian and sleep monitoring using a new multisensorized device (Kronowise - KW - Chronolab, UM) which, through the assessment of 15 different variables obtained from wrist temperature (T), motor activity (A), body position (P) and environmental light (L) exposure, allows non-invasive and accurate detection of sleep wake states.

Materials and Methods: This study included twenty five patients attending to Sleep Unit of Hospital de la Ribera (Valencia, Spain) with different sleep pathologies (SBD, PLM and insomnia). Patients wore the KW device during the nocturnal PSG. Variables from KW were sampled at 10 Hz for three-axial acceleration (PIM mode procedure), time in movement (time above threshold), and tilt; at 1 Hz for wrist skin temperature and infrared, blue and visible light; or at 0.33 Hz (event marker). All variables were stored in 30 min epoch. A modification of TAP algorithm was used to determine sleep-wake states (Ortiz-Tudela et al., 2010, 2014). In brief, temperature, acceleration, position and visible light values were normalized and integrated. This allows to indentify the main sleep periods during the night, then epochs scored as sleep were subjected to a second rescoring process using the time in movement (TIM) in each 30 s epoch to detect awakenings ≥30 s. Time in bed (TIB), total sleep time (TST), sleep efficiency (SE) and wake after sleep onset (WASO) were estimated from KW and PSG. Additionally, TIM from KW was used to infer WASO, SE and REM sleep. Agreements between both procedures were calculated using Pearson correlation.

Results: Statistical analyses of TIB revealed strong correlation between KW and PSG (r=0.98) as well as TST (r=0.93), SE (0.92). Moreover, a variable directly generated by the KW device, TIM, could be used to directly and accurately infer some PSG variables. TIM was inversely associated to SE (SE=-24.2*TIM+100, r=0.92) and directly correlated with WASO (WASO=102.2*TIM+27.68, r= 0.919). This variable could also predict the time of REM sleep (REM time= -56.9*TIM+97.08, r= 0.61).

Conclusions: Our results suggest that a multisensorized ACM device, designed for assessing the circadian system status, can be used reliably to measure sleep duration and quality without the need to develop specific algorithms for different pathologies. This wearable device, combined with big data analysis, opens the possibility to perform epidemiological studies and clinical screenings in large populations.

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POSSIBILITIES OF USING AUTOMATED VIDEO MONITORING FOR HIGH FREQUENCY JET VENTILATION

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Introduction: Video based vital sign detection is a promising direction in the evolution of non-contact patient monitoring techniques. This paper presents the possibilities of such methodology for use with patients in intensive care during substitutive high frequency jet ventilation (HFJV). All experiments were performed on the premise of the Regional Anti-Tuberculosis Dispensary, with the participation of Ural Federal University (UrFU) and Triton Electronics Systems Ltd. employees. (Yekaterinburg, Russia).

Materials and methods: 16 patients (male and female) aged between 24 and 76 years with surgical lung diseases were involved. All patients provided written informed voluntary consent prior to study procedures. Immediately before the study each patient was operated on in the thoracic cavity. In the immediate postoperative period, patients enter the intensive care unit, where they have regained consciousness and are for on HFJV from 30 minutes up to 2 hours or until full recovery of muscle tone, consciousness and adequate spontaneous breathing is made. The HFJV was performed by the ZisLine JV100A device (Triton Electronics Systems Ltd., Yekaterinburg, Russia, registration certificate from August 16, 2011 No. 2010/08739). During this process, the patients were recorded using two low-cost Logitech C920 webcams placed at a distance of 80 cm above the patient with 30 Hz sampling frequency and 640x480 pixel resolution. The original video processing software was developed to register vertical movements in the chest and epigastric regions of the patients. The period of the respiratory cycle frequency was determined by spectrum analysis of these processes. All these calculations were performed in real-time.

Results: The results of video processing show that in all cases, the mean error of lung ventilation rate detection when comparing 60, 100, 200 and 300 respiratory cycles per minute (1, 1.6(6), 3,3(3), 5 Hz respectively) specified on the ZisLine JV100A device, does not exceed 0.01 Hz. The state of the jet ventilation disconnection can be reliably diagnosed by video.

Conclusions: The proposed method of video images analysis provides a high accuracy of respiratory cycles frequency estimation through the measurement of movements in the chest and epigastric regions of patients during the HFJV procedure in the immediate postoperative period. It can be considered as a promising method for respiration monitoring in clinical practice. The proposed method can be used as an additional method of non-invasive breathing monitoring. The safety of a patient during ventilation procedure is increased through the implementation of the presented method.

Acknowledgements: The authors give thanks to the intensive care unit staff from the department of Resuscitation of the Regional Anti-Tuberculous Dispensary for their assistance in the research process.
introduction: Non-contact vital signs monitoring techniques constitute a growing branch of modern medicine. The present paper puts forward the case study results for automated video based monitoring of substitutive continuous mandatory ventilation for patients in intensive care. All experiments were performed at the Regional Anti-Tuberculosis Dispensary with the participation of employees from the Ural Federal University (UrFU) and from Triton Electronics Systems Ltd. (Yekaterinburg, Russia).

Materials and methods: In this paper we use the example of patient S., a man, aged 52, who underwent lobectomy of the right lung. The patient provided written informed voluntary consent prior to study procedures. Within one hour of using the mechanical lung ventilation device in the immediate postoperative period, the patient regained consciousness and used the device until the patient had stabalized adequate spontaneous breathing. The mechanical lung ventilation was performed by the "ZisLine MV200" device (Triton Electronics Systems Ltd., Yekaterinburg, Russia, EC registration No. D1237200008 issued by mdc medical device certificate GmbH and valid from December 11, 2015). The recovery process consisted of a sequence of modes: PCV, SIMV and PS CPAP. The experiment was recorded by using a low-cost Logitech C920 webcam, which was placed above the patient at a distance of 80 cm. The image resolution is equal to 640x480 pixels. The frequency of sampling frames is equal to 30 Hz. The video processing was carried out by using original software, which enables the vertical movements of chest and epigastric regions of the patient to be measured. The respiration cycles frequency was calculated, as the distance between local maxima of autocorrelation function. All these calculations were performed in real-time. All these calculations were performed in real-time.

Results: Using the "ZisLine MV200" device, values from 10 to 15 respiration cycles were established and compared, the video processing results showed that the mean error of respiration cycles frequency estimation is less than 0.01 Hz. The state of the mechanical lung ventilation disconnection can be reliably diagnosed by video.

Conclusions: The proposed method of video images analysis provides a high quality estimation of movements in the chest and epigastric regions of a patient. It allows to accurately measure movements during mechanical lung ventilation. Analysis of video can be used as an additional monitoring channel for patient during mechanical lung ventilation. It is likely to improve the safety of patients during an artificial ventilation procedure.

Acknowledgements: The authors express gratitude to intensive care unit staff from the department of Resuscitation of the Regional Anti-Tuberculous Dispensary for their assistance in the research process.
Introduction: Sleep inertia is a term associated with grogginess and poor performance after waking. The goal of the present study was to investigate whether retinal exposure to red light prior to or following awakening reduced sleep inertia as measured by performance tasks and self-reports.

Materials and methods: Every participant (n = 20) slept in the laboratory for 2.5 hours, followed upon awakening for a 35 minute test session where they performed two auditory performance tasks and provided self-reports of sleepiness. All participants were exposed to three experimental conditions on separate nights, one week apart: (1) a “dim light” condition where participants were awakened and not exposed to any light treatment while their eyes were open, (2) a “red light goggles” condition where participants’ corneas were exposed to 50 lx of red light from 631 nm LEDs while their eyes were open after awakening, and (3) a “red light mask” condition where participants’ corneas, after transmission through closed eyelids, were exposed to 56 lx from 628 nm LEDs while sleeping; upon awakening the red light was turned off and their eyes were open.

Results: Compared to the dim light condition, auditory performance was significantly better for the two red-light conditions and subjective sleepiness significantly less for the red light mask condition.

Conclusions: Retinal exposure to red light prior to or just after awakening can reduce sleep inertia.

Acknowledgements: Office of Naval Research
Introduction: Obstructive sleep apnea syndrome (OSAS) is becoming one of the main medical social topics, as there are several epidemiologic data of incidence, prevalence, morbidity and mortality that describe the essence of the problem. The role of the maxillomandibular advancement in the OSAS pathogenesis is linked to the inner relations in the cranium and to its bowels; this relation defines the volume of the superior airway space, whereby an analysis of the soft tissue and of the mouth bowels is essential to understand their relative hyperplasia. The aim of this study is to evaluate the ability of PROPLAN CMF (DePuy Synthes®) in implementing the surgical outcome for OSAS surgery.

Materials and methods: Between 2014 and 2016, 12 patients with severe sleep apnea and intolerant to CPAP treatment underwent maxillo-mandibular advancement surgery. All patients have been studied with presurgical CBCT scans and 3D stereophotogrammetry that were loaded onto ProPlan CMF (DePuy Synthes®) to perform virtual osteotomies and soft tissue prediction. For each patient a counterclockwise rotation of the maxillo-mandibular complex was performed to maximize the aesthetic outcome and ensuring an advancement in order to lead to the healing the patient. Accuracy evaluation of the surgical planning was made thanks to an industrial CAD/CAM software (Geomagic Study Platform) that allowed us to make a surface superimposition between the 3D planned model and the 3D postoperative model of maxillo-facial skeleton.

Results: We gained, for each patients, a medium discrepancies inferior to the one considered statistically significant by the literature (2 mm); for four patients medium discrepancies were between 1,5 mm to 2, while for 1 case it was between 1 to 1,4 mm. The use of PROPLAN (DePuy Synthes®) made possible to improve aesthetic outcome, considering the skeletal relationship and the soft tissue simulation during the planning. Postoperative polysomnography shows the complete recovery of all patients.

Conclusions: The software can be considered a useful method that provides a precise and reliable prediction of facial profile after orthognathic surgery.
DESIGN, DEVELOPMENT AND FEASIBILITY TESTING OF AN MHEALTH APPLICATION FOR SLEEP-RESTRICTED ADOLESCENTS


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Introduction: Interventions to increase nighttime sleep for adolescents are needed. Wearable sensing devices are a popular means of quantifying sleep and adoption of smart phones is ever-increasing. The aim of this study was to develop and evaluate feasibility and usability of a self-management sleep intervention delivered via a Bluetooth-enabled wearable activity tracker (MetaWear, mbientlab) and a mobile health application (SOmNI). Objectives of the SOmNI application were to: apply a custom sleep algorithm to progress the user to earlier bedtimes; allow current and historical views of sleep data; and motivate users to reach goals by awarding points for real-world rewards.

Materials and methods: High school students [13-18 years; sleep < 8 hours/school night; no mental health/sleep disorder] participated in a User Centred Design (UCD) process.

Phase 1: Usability Testing
Medium and high-fidelity prototypes of 10 scenarios covering SOmNI screens and functions were loaded into a clickable prototype. Feedback on design, content, and fit with adolescent behaviours was elicited via semi-structured interviews, think-aloud technique and questionnaires. Results of Phase 1 were used to refine the SOmNI app before Phase 2.

Phase 2: Feasibility Testing
Participants were provided with an iPhone 4S preloaded with the SOmNI app and paired to a MetaWear. For the first week of use, participants also wore an Octagonal Basic actigraph (AMI). After 4 weeks of using SOmNI, surveys and semi-structured interviews elicited data on: usability of the intervention in the participants’ natural environment; features that were accepted; and technical barriers. Google analytics were used to track SOmNI app usage.

Results:
Phase 1: Usability Testing
All 8 participants (6 female, 2 male) interacted easily with the SOmNI app and appreciated its visual designs and colours. Qualitative analysis identified that SOmNI aesthetics were appealing, gamification and rewards were engaging, and tracking personal data with minimal effort was desirable. Minor changes to font size, language and icons were suggested.

Phase 2: Feasibility Testing
The 9 participants (6 female, 3 male) spent 1.6 min/day using the app, most often on school days when first awake, after school and evenings. Only 25% of possible rewards were distributed. The tracker was not worn for 40 nights (16%) and 91 nights of data (36%) were lost due to connection issues, and users closing the SOMNI app before data were transferred. Participants indicated that they enjoyed earning points, viewed the leaderboard as friendly competition, and desired more sleep patterns and trends information. However, social activities prevented them from meeting goals.

Conclusions: The UCD process revealed good usability and feasibility of the SOmNI app. Technical issues identified have since been remedied to ensure greater data capture and increase user reward achievement. Further testing of the SOmNI app in a pilot RCT to determine compliance, feasibility and preliminary data on sleep and other health outcomes is planned for Fall 2017.

Acknowledgements: This project was funded by the Canadian Institutes of Health Research (Grant No. MOP 136818).
ASSESSING COMPETENCY OF Z3SCORE AUTOMATED SLEEP STAGE SCORING SYSTEM WITH MANUAL SLEEP STAGE SCORING BY MULTIPLE SCORERS

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Introduction: Type I Sleep study comprises of continuous recording of multiple physiological signals for many hours which results in analyzing massive amount of data. Manually analyzing these data requires considerable amount of time which might leads to delay in availability of results for diagnosis. Therefore, automated analysis should be considered. The purpose of this study is to compare the competency of automatic analysis to manual analysis of sleep stages obtained with ProFusion PSG3.

Materials and methods: Ten Type I Polysomnographic data retrospectively collected from patients suspected of obstructive sleep apnea syndrome were randomly selected. Sleep stages of the ten recordings were scored and compared between manual scoring, ProFusion PSG3 automatic scoring and Z3score automatic scoring. Manual scoring is scored by four referent scorers and one expert scorer, based on American Academy of Sleep Medicine (AASM) rules. All referent and automated scoring were compared with the expert scoring via epoch-by-epoch basis. Competency assessment is based on comparing the various variables obtained from the sleep stage scoring such as Kappa coefficient, percentage of matched epoch, total sleep time, sleep efficiency, percentage of Stage N1, N2, N3 and REM sleep, sleep latency and REM latency.

Results: The average Kappa coefficient of manual scoring compared to ProFusion PSG and Z3score is 0.80, 0.68 and 0.75 respectively which shows no significant difference. Similarly for the percentage of matched epoch compared between manual scoring to ProFusion PSG and Z3score is 87.3%, 79.1% and 83.3%, total sleep time is 408.3mins, 399.4mins and 406.1mins, sleep efficiency is 88.2%, 84.3% and 85.5%, percentage of Stage N2 sleep is 59.3%, 58.1% and 60.1% and percentage of Stage REM sleep is 18.5%, 16.2% and 17.0% respectively which was able to yield comparable values. Slight difference between sleep latency was seen when compared to manual scoring, ProFusion PSG and Z3score is 14.9mins, 23.3mins and 21.1mins, REM latency is 120.3mins, 107.8mins and 143.3mins and percentage of Stage N1 sleep is 7.5%, 4.3% and 4.7% and Stage N3 sleep is 15.4%, 21.5% and 18.2% respectively. The time taken between each method showed a significant decline in ProFusion PSG, Z3autoscore and manual scoring is 2.75 seconds, 33.3 seconds and 735.52 seconds).

Conclusions: This study verified that the automated sleep stage scoring by Z3score is adequately accurate when compared to manual sleep stage scoring. Further testing of Z3score with external proficiency testing program in-line with AASM guidelines should be carried out to validate its usability. Future development for autoscoring respiratory tracing should be considered to achieve a complete analysis of the polysomnographic data that brings diagnostics values.

Acknowledgment: The authors of this study thank Dr Amiya Patanaik for the help with the Z3score system and the team of sleep technologist from Singapore General Hospital, Sleep Disorders Unit, for the help with the manual scoring.
**Technology/Technical Board #157: P6 - Wednesday**

**TRANSDERMAL ELECTRICAL NEUROMODULATION OF THE TRIGEMINAL SENSORY NUCLEAR COMPLEX IMPROVES SLEEP QUALITY**

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**Introduction:** The aims of this study were to assess the effectiveness of pTESHF in improving sleep quality vs controls (sham), and pTESLF improving sleep quality over pTESHF. The central hypothesis was pTESLF would have a more profound effect on sleep quality.

**Materials and methods:** Healthy volunteers with a pre-screening PSQI ≥ 5 were recruited. Exclusion criteria were: diagnosed sleep disorder, actively medicated for sleep difficulties, neurological or psychiatric disorder, cranial or facial implants, recent head trauma/concussion, recent hospitalization, high blood pressure, pregnancy, diabetes. pTES treatment was administered using a novel transdermal electrical neuromodulation device with adhesive electrodes over the right temple (trigeminal nerve) and the base of the neck (cervical nerve).

Subjects self-treated with pTESHF (3-11 kHz, biphasic pulse, 5-7 mA), pTESLF (0.5 - 0.75 kHz, biphasic pulse, < 5 mA) or sham each night before retiring. Blinding of subjects was accomplished with a sham mode which provided a 30 sec ramp up period to the steady state current and then secured. The evaluators were also blinded.

Subjects wore actigraph watches with event markers to capture bedtime and morning waking. Nightly measures included: number of wakeups after bedtime, waking time after sleep onset (WASO), and % time awake.

A total of 27 subjects were enrolled (2 dismissed for failure to comply). The remaining 25 subjects were randomized into two groups according to week in a crossover design:

- Week 1: pTESHF (n = 15) or sham (n = 10)
- Week 2: pTESLF (n = 12) or pTESHF (n = 13)

**Results:** There were no significant differences noted in baseline group demographics. 93% of the subjects were male, average age 32 years, 79% Caucasian, 11% Black, 7% Asian and 4% Hispanic. Baseline PSQI 9.56 ± 2.55 (mean ± sd). There were no significant inter-week differences between subjects in the treatment group.

**Conclusions:** Based on the evidence presented here, non-invasive neuromodulation of the trigeminal and cervical neural pathways with Neuros can offer a chemical-free method of regulating autonomic arousal to improve sleep quality.

**Acknowledgements:** WJT produced this work while at Thync, Inc. (Boston, MA) The pTESLF parameters are used by Neuros™ which is pending CE mark approval for sale in EU by Ceramic Medical, Inc. Redmond, Wa., USA
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We introduce Sleep, a new Python open-source graphical user interface (GUI) dedicated to visualization, scoring and analyses of sleep data. Among its most prominent features are:
1) Dynamic display of polysomnographic data, spectrogram, hypnogram and topographic maps with several customizable parameters,
2) Implementation of several automatic detection of sleep features such as spindles, K-complexes, slow waves and rapid eye movements,
3) Implementation of practical signal processing tools such as re-referencing or filtering, and
4) Display of main descriptive statistics including publication-ready tables and figures.

The software package supports loading and reading raw EEG data from a standard file formats such as European Data Format, in addition to a range of commercial data formats. Most importantly, Sleep is built on top of the VisPy library, which provides GPU-based fast and high-level visualization. As a result, it is capable of efficiently handling and displaying large sleep datasets. Sleep is freely available (http://visbrain.org/sleep) and comes with sample datasets and an extensive documentation. Novel functionalities will continue to be added and open-science community efforts are expected to enhance the capacities of this module.
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\textbf{Introduction}: Wrist-worn accelerometers are increasingly used for the assessment of physical activity in large population studies, but little is known about their value for assessing sleep. This study aims to evaluate a method for sleep assessment based on raw accelerometry data, with and without use of a sleep diary.

\textbf{Materials and methods}: A wrist-mounted tri-axial accelerometer (GENEActiv) was worn for ten days (\textit{N}=4,095; age:65-84yrs). Sustained inactivity periods were detected as the absence of change in arm elevation angle larger than 5 degrees for more than 10 minutes and labelled as nocturnal sleep either guided by a sleep diary or by a 12 hour window centred at the least active five hours of a day.

\textbf{Results}: When guided by sleep diary and compared with sleep diary the estimated sleep duration (waking-onset time) was on average 19 (between individual Standard Deviation (SD)=37) minutes shorter, sleep onset was 7 (SD=32) minutes later, and waking time was 11 minutes earlier (SD=36); all \textit{P}< 0.002. When not guided by sleep diary and compared with sleep diary the estimated sleep duration was on average 46 (SD=96) minutes longer, sleep onset was 36 (SD=80) minutes earlier, and waking time was 10 (SD=68) minutes later. Compared to men, womens’ sleep duration difference was 4.3 minutes lower and difference in waking time 2.9 minutes lower. Older participants showed larger differences in sleep duration, sleep onset, and waking time (5.0, 2.6, and 2.4 minutes increase per 10 years of age respectively).

\textbf{Conclusions}: Using sleep diary to guide extraction of sleep parameters from the accelerometer is recommended in order to combine the strengths of both methods and is consistent with the sleep literature. For studies that do not use a sleep diary a crude estimate of sleep can be derived, but caution is urged as such estimates are not compatible with self-reported sleep.
INTERNET SLEEP MEDICINE: COMPARISON OF ASSISTED VS. NON-ASSISTED ONLINE HEALTH SCREENING FROM 67446 COMPLETED QUESTIONNAIRES

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Introduction: In an online campaign conducted in Swiss pharmacies 2003 to 2004, with form entry and result interpretation assisted by pharmacy staff, the prevalence and severity of daytime sleepiness in several sleep diagnostic categories was assessed and previously published. In a non-assisted followup campaign by the Swiss lung league, a condensed extract of these questions, aiming only at sleep apnea, was freely accessible on the internet from 2005 to 2008. Here we compare data from the supervised and non-supervised online screening, with focus on feasibility, reproducibility, and limitations.

Materials and methods: In the assisted campaign, pharmacy clients with sleep related problems could participate in a free anonymous screening, assisted by pharmacy staff, with a once-only access code per person. Symptoms from 4 categories of sleep disorders were classified using Stanford sleep disorders questions, complemented with the Epworth Sleepiness scale (ESS). In the followup internet campaign, only the sleep apnea category was rated using a reduced set of questions together with the ESS. The client-side browser was provided with an immediate evaluation calculated on the server. Pharmacy participation guaranteed exactly one assisted, good quality questionnaire entry per person. Online screening without assistance and without supervision could not verify plausibility (i.e. of gender, weight or age), and multiple different form entries were possible from the same anonymous participants.

Results: The supervised pharmacy campaign yielded n=5006 completed questionnaires from 804 pharmacies. The unsupervised internet campaign yielded n=62440 completed questionnaires. Gender distribution showed a higher percentage of women via pharmacies (66%) than via internet (28%). Differences in terms of sleepiness (16% with high ESS in the four-disease-category pharmacy data including insomnia, vs. 29% with high ESS in oSAS-only internet data) were as to be expected. BMI differences (25 in pharmacy and 27 internet) were also found. Time of day of the entries also differed between campaigns. Multiple questionnaire entries by the same individuals, as evidenced by change of only one or a few variables within a short time, could be detected. This presumably indicates try-and-see experimentation. The comparison demonstrates the presence of a bias dependent on mode of recruitment, and allows for quantitative estimation of the reliability of unsupervised internet data acquisition.

Conclusions: Online campaign monitoring using side channel information from pharmacies had already indicated that potential sleep apnea patients could be reached who would otherwise not have gone to the doctor, with computer recommendations often perceived as ‘objective’. Comparison suggests that results from the assisted and supervised campaign are more reliable than data from unsupervised completely anonymous internet access. Such an unsupervised internet campaign can reach a different, but larger population.
VALIDATION OF HRV-BASED DROWSY-DRIVING DETECTION METHOD WITH EEG SLEEP STAGE CLASSIFICATION

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Introduction: Driver monitoring for drowsy driving detection is a key solution to preventing fatal car accidents. The transition of the sleep condition affects autonomic nervous activity, which may modulate heart rate variability (HRV) calculated from the R-R intervals (RRI) of the electrocardiogram (ECG).

Materials and methods: We developed a driver-drowsiness detection algorithm using multivariate statistical process control (MSPC) for detecting anomalies from eight HRV indices. During the experiment, an originally developed wearable telemeter measures the ECG of the subjects using a driving simulator. Then, it transmits the RRRs to a smartphone. An Android app was developed to calculate the HRV indices from the received RRIs, and perform MSPC analysis in real time. The electroencephalogram and electrooculogram were simultaneously measured for sleep-stage classification in order to detect the onset of sleep stage N1. Healthy subjects with a driving career, without abnormal sleep habituation, were recruited to drive the virtual vehicle on a simulator. The subjects drove twice on a course simulating a highway loop line, without other cars, for 1.5 h, with a resting interval of 1 h between the two trials. The experimental procedure was approved by the Research Ethics Committee of the Graduate School of Science and Technology at Kumamoto University. Written informed consent was obtained from all participants.

Results: Twenty-two subjects participated in the experiment, and there were no rejected participants. The measured EEG and EOG were analyzed by a specialist certified by the Japanese Society of Sleep Research; 56 awake and 11 drowsy episodes were recorded. Twenty-two awake episodes were used for modeling the normal operation condition of MSPC; the other 34 awake episodes were used to evaluate false alerts. The calculated Q statistic, which is a statistical index of MSPC, detected 10 out of 11 sleep onsets (91% sensitivity), 596 ± 256 seconds (mean ± SD) prior to their onset, with a false positive rate of 1.8 times per hour. It is assumed that the detection of the drowsy episode failed due to the control limit (detection threshold) calculated from noisy data.

Conclusions: The sensitivity of the proposed method demonstrated the feasibility of drowsy driving detection using a wearable system. Although further improvement is required in order to reduce false positives, the false positive rate indicated the reliability of exceeding the random predictor in the prediction horizon of 15 minutes.

Acknowledgements: This study was partially supported by JSPS KAKENHI Grant Number 17H00872.
CONTINUOUS CUFF-LESS BLOOD PRESSURE PARAMETER MONITORING BY THE OPTICAL SENSOR IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME

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Introduction: We developed a blood pressure (BP) measuring system using a optical sensor. We reported that estimated BP value by the optical sensor highly correlated with measured the value with a mercury sphygmomanometer at rest (SBP r=0.93, DBP r=0.84) and our system enables us to record the BP continuously in seconds order sampling (Yamazaki and Eda, European society of Hypertension 2016, Council on Hypertension 2016). Purpose of this study is to validate whether the optical sensor can capture the BP changes during overnight sleep.

Materials and methods: We performed both polysomnography and continuous BP recording simultaneously in patients with obstructive sleep apnea syndrome. We placed our new optical sensor module (AG sensor Prot.2, ALPS ELECTRIC CO., LTD, Tokyo, Japan and Genial Light. co.,LTD, Hamamatsu, Japan) in the subject's right finger. The optical sensor measured the pulse and calculated the BP value continously in seconds.

Results: Our optical system provided continuous BP estimation value without disturbing the sleep. The BP value showed the obvious changes associated with severe respiratory event during the REM sleep compared to the non REM sleep. The amount of BP changes showed more high-value in diastolic BP compared to systolic BP.

Conclusions: Our cuff-less BP measuring device which uses a optical sensor and calculate the pulse wave enables us to validate the BP without disturbing the sleep. BP value estimated in seconds order gives us more precise information to understand the relation between respiratory event and BP. Our cuff-less BP measuring device which uses a photic sensor and calculate the pulse wave enables us to validate the BP without disturbing the sleep. BP value estimated in seconds order gives us more precise information to understand the relation between respiratory event and BP.

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