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ABSTRACTS

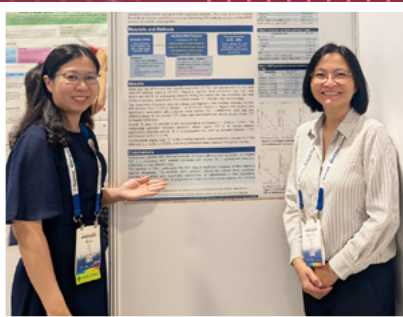


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Aging and Developmental Issues

Clinical Trial: Efficacy of Metered-dose Negative-Pressure Breathing Training in OSA Patients

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Introduction: Oliven et al (J Sleeping Res. 2018) found pharyngeal muscles response linearly to airway negative pressure change. We use that as a “dumbbell” load for exercise prescription. This study aims to assess the effectiveness of a resistance mask device (GST) for negative pressure breathing training in patients with obstructive sleep apnea (OSA).

The study plans to enroll 10 participants to assess the device's impact on respiratory muscle strength and sleep apnea symptoms. One of the main contributors to sleep apnea is the collapse of upper airway muscles during sleep, resulting in breathing difficulties. Strengthening these muscles through targeted exercises could potentially alleviate symptoms and improve quality of life for patients with sleep apnea.

Materials and methods: * Participants diagnosed with sleep apnea will be recruited for the trial and provided with the mask device for daily use. The device GST utilizes resistance inspiration negative pressure with 10-40 hpa depending on the patient's condition to enhance the strength of upper respiratory dilator muscles during breathing exercises. Assessments of 4% ODI, questionnaire and visual analogue score will be conducted before and after using the device. Data analysis will focus on comparing pre- and post-treatment measurements to determine the device's efficacy in improving respiratory muscle function and alleviating sleep apnea symptoms. This study aims to provide valuable insights into the role of targeted muscle strengthening in managing sleep apnea and enhancing respiratory health.

Recruitment Criteria:

>Inclusion Criteria:

OSA patients aged 18-65, willing to participate, with a confirmed OSA diagnosis, and able to comply with the study protocol.

>Exclusion Criteria:

Abnormal PFT, acute illnesses, cardiovascular diseases, and uncontrolled allergic rhinitis or nasal obstruction diseases, BMI>30, will be excluded

Results: 6 patients complete the trial

4% ODI: Decreased by an average of 29%

minSpO₂: Improved by 2%

Snoring Score: Totally reduced by 22%, very loud by 76%

Morning Symptoms: Headache and dizziness frequency dropped by 28%

Adherence: 100%

Training Load: 10–30 hPa, tailored per subject

Temporal Trends:

- ODI improvement occurred between Day 10–26
- Symptom relief noted after Day 32–40
- Snoring decreased after Day 7-25

Conclusions: Preliminary findings suggest GST is a promising adjunct to conventional OSA therapy, especially in enhancing patient tolerance and respiratory muscle endurance. GST's adaptability and high adherence rate support its feasibility. The initial clinical response appears temporally progressive and responsive to upper airway events, implying a muscle-based mechanism.

Metered-dose negative-pressure respiratory muscle training using the GST device shows early effectiveness in improving oxygenation, reducing snoring, and alleviating OSA-related symptoms. This pilot supports the rationale

for broader trials and potential integration into multimodal OSA management

Future Directions

- Expansion to full cohort with subgroup analysis
- Long-term follow-up on muscle strength and AHI
- Combination therapy with CPAP/APAP
- AI-guided personalization of pressure dosing

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Association Between Functional Dyspepsia and Sleep Architecture Disruption in Geriatric Patients: A Comprehensive Cohort Study

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Introduction: Sleep disorders and functional dyspepsia are prevalent comorbidities in patients with geriatric syndrome. The co-occurrence of functional dyspepsia and sleep disturbances demonstrates significant epidemiological overlap, with sleep disruptions frequently triggering emotional disturbances and exacerbating gastrointestinal symptoms. Further investigation into the bidirectional pathophysiological interplay between these conditions is warranted to advance clinical risk stratification and therapeutic decision-making.

Materials and methods: A cohort of 400 elderly patients (aged ≥ 65 years) treated in Shijiazhuang People's Hospital, Hebei Province, P. R. China, from January 2022 to December 2023 was prospectively analyzed. Participants were stratified into sleep disorder ($n=281$, $PSQI \geq 8$) and normal sleep groups ($n=119$, $PSQI \leq 7$) using Pittsburgh Sleep Quality Index (PSQI) criteria. Comparative analysis of clinical characteristics was performed, followed by multivariate logistic regression to identify sleep quality determinants. The sleep disorder cohort was further subclassified by functional dyspepsia (FD) status into FD group ($n=224$) and non-FD group ($n=57$), with FD severity stratified into mild and moderate-severe subgroups. Polysomnography (PSG)-derived sleep architecture parameters were compared across groups. Spearman's rank correlation analyzed FD severity-PSQI associations.

Results: Significant intergroup differences emerged in marital status, smoking history, chronic gastrointestinal disorders, SDS scores (≥ 53), SAS scores (≥ 50), and FD prevalence (all $P < 0.05$). Multivariate analysis identified $SDS \geq 53$ ($OR=2.41$, 95%CI 1.62-3.58), $SAS \geq 50$ ($OR=1.97$, 95%CI 1.28-3.04), chronic gastrointestinal comorbidity ($OR=3.12$, 95%CI 1.89-5.15), and FD diagnosis ($OR=4.05$, 95%CI 2.47-6.63) as independent risk factors for sleep disorders. The FD subgroup demonstrated elevated PSQI scores (14.3 ± 3.2 vs 8.1 ± 2.7 , $P < 0.01$) and increased $N1+N2$ sleep stage proportion ($68.4\% \pm 9.1$ vs $59.2\% \pm 8.3$, $P < 0.001$) compared to non-FD counterparts. PSG analysis revealed obstructive sleep apnea (OSA) severity stratification: no OSA (4.2%), mild OSA (13.9%), moderate OSA (22.1%), and severe OSA (59.8%), with significant PSQI elevation in moderate-severe OSA groups ($P < 0.05$). Strong positive correlation emerged between FD severity and PSQI scores ($r=0.625$, $P=0.021$).

Conclusions: Progressive sleep architecture disruption in elderly patients demonstrates significant associations with FD severity, modulated by psychological parameters (SDS/SAS thresholds) and gastrointestinal comorbidity. These findings advocate integrated sleep-gut axis evaluation in geriatric care protocols.

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Predictive factors of sleep-related accidents in a large population of retired regular highway drivers

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Introduction: Sleepiness at the wheel is a well-known risk factor for traffic accidents. The aim of this study is to explore the prevalence of sleepiness at the wheel and the risk factors associated with driving near misses and road accidents in regular French highway users who declared they were retired.

Materials and methods: Regular French highway users were invited to participate in an internet survey between April-May and October-November, 2024. A total of 14,046 retired drivers (mean age: 69.9 ± 6.2 years, 25.1% female) answered questions on socio-demographic characteristics, sleep behaviors, sleep disorders, lifestyle and health, substance use, driving habits, and near-accident and accident conditions.

Results: 14.9% reported at least one near-miss accident, and 4.5% reported at least one accident in the previous year. More than one out of three drivers (22.3%) experienced at least one episode of severe drowsiness at the wheel during the previous year (i.e., making driving difficult or forcing the driver to stop driving). Among these sleepy drivers, 26.6% reported at least one near-miss accident and 6.0% an accident in the past year. 67.2% of near-misses or accidents linked to sleepiness occurred on highways, and 68.7% on trips of over 2 hours. 67.2% of sleep-related near-misses and accidents occurred in a monotonous context (low traffic).

After adjustment for age, gender, mileage exposure and self-reported psychiatric disorders, the best predictive factors for accidents were: being widowed or divorced [adjusted OR 1.7, 95% CI, 1.3-2.2, $P < .001$], reporting at least one episode of severe sleepiness at the wheel in the past year [adjusted odds ratio (OR) 1.4, 95% confidence interval (CI) 1.1-1.8, $P < .01$], an Epworth score ≥ 11 [adjusted OR 1.5, 95% CI, 1.1-2.0, $P < .01$], being treated with hypnotics [adjusted OR 2.0, 95% CI, 1.1-3.7, $P < .001$] and having ever reported a near miss within the year [adjusted OR 6.6, 95% CI, 5.3-8.1, $P < .001$].

Conclusions: Occurrence of sleepiness at the wheel still constitute a major risk factor for near misses and accidents on highway in retired drivers. Having pathological excessive daytime sleepiness, being treated with hypnotics, reporting episodes of severe sleepiness at the wheel in the past year, and the reporting of a near miss in the past year, are major risk factors for near misses and road accidents in retired drivers.

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An integrated analysis of rhythmic ageing markers, targets of anti-ageing compounds, and metabolic pathways for unraveling the circadian impact on ageing

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Introduction: Circadian rhythms have pronounced impacts on human health, diurnally synchronising physiological and behavioural processes. Circadian dysfunction can cause a multitude of physiological and metabolic irregularities, neurodegeneration, oxidative damage, and reduced lifespan. Ageing enhances these disruptions, leading to diverse chronic diseases. Therefore, it is crucial to investigate the molecular underpinnings and markers of ageing and their effects on circadian dysregulations. Also, compounds with evidence of prolonging lifespan are now well-reported; however, the effects of gero-protectors on circadian behavior remain poorly understood from a clock-controlled perspective. Our study addresses these gaps by a) creating a comprehensive map of circadian ageing markers across the mammalian system, b) identifying chrono-geriatric targets for ageing attenuation, and c) elucidating the effects of geroprotectors on circadian behavior across different aged *Drosophila*.

Materials and methods: In this study, we performed an *in-silico* analysis from a circadian perspective to identify ageing markers and chrono-geriatric targets for ageing attenuation. We curated a comprehensive map of human ageing markers (besides homologs in mice and *Drosophila*) from the Human Aging Genomic Resources, Aging Atlas, and Digital Aging Atlas databases. Another aspect of our study was curating anti-ageing drugs utilising the DrugAge and Ageing Atlas databases and their targets from Drugbank. We identified 24-hour rhythmic transcripts using CircaDB at the transcriptome level across the mammalian system for both the ageing markers and targets of anti-ageing pharmacological compounds (<http://circadb.hogeneschlab.org/>). Using the DAVID (<https://david.ncicrf.gov/>) resource system, we conducted a functional analysis of the ageing-related rhythmic transcripts and robustly rhythmic compound targets (Period 24 ± 3 hr, JTKQ < 0.1) to map the enriched pathways (FDR < 0.01). On examining compounds with secondary clock targets and evidence of lifespan extension, we selected resveratrol as a candidate compound. The effects of resveratrol were investigated in different age groups of *Drosophila*.

Results: 50% of ageing genes investigated across the mammalian systems exhibit 24-hour rhythmic oscillation at the transcriptome level. The key physiological pathways associated with prevalent rhythmic genes were the

longevity-regulating pathway, the AGE-RAGE signaling pathway, and pancreatic cancer in humans. The convergent biological process corresponding to oscillating targets of anti-ageing compounds was lipid metabolism. Resveratrol treatment was found to enhance locomotor activity with ageing, besides its sleep-altering effects when administered early in life.

Conclusions: The robustly rhythmic molecular components associated with the Absorption, distribution, metabolism, and excretion (ADME) process of geroprotectors converged to the biological process of lipid metabolism, a potential target for future chrono-geriatric treatments. Additionally, our investigations portray anti-ageing compounds' role in altering clock-controlled behavioural rhythms.

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Enlarged perivascular spaces is associated with cognitive impairment in older adults with obstructive sleep apnoea

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Introduction: Obstructive sleep apnoea (OSA) is prevalent among older adults and is often link to cognitive impairment when untreated. It is posited that the underlying pathology of OSA is connected to glymphatic dysfunction - a perivascular network in the brain responsible for metabolic waste removal. Although various methods have been proposed to index the perivascular spaces (PVS) as a promising imaging marker for the glymphatic system, these methods are often developed and tested on homogeneous datasets with high resolution scans, limiting its generalizability. Therefore, using a newly developed automated PVS segmentation method, this study aimed to determine (1) if PVS differs across OSA groups, and (2) if PVS is associated with cognitive impairment.

Materials and methods: Participants aged 50-80 with new onset cognitive or mood concerns underwent clinical and neuropsychological profiling at a memory clinic. Domain specific cognitive composites (i.e., verbal learning, verbal memory, executive function, processing speed and language) were created from neuropsychological tests, with age and education (where possible) adjusted. From polysomnography, apnea hypopnea index (AHI) was derived. Participants were categorized into normal (AHI<5; n=83), mild (AHI=5-14; n=92), moderate and severe (AHI≥15, n=111) OSA groups. PVS clusters and volumes were derived from a deep learning algorithm - Perivascular space Identification Nnnet for Generalised Usage (PINGU). Regions of interests (ROIs) included the Basal Ganglia, frontal lobe and Thalamus due to their functional relevance for sleep and cognition. One-way analysis of variance (ANOVA) and spearman's rho were used to estimate group differences and correlations, adjusted for age, sex and body mass index.

Results: After adjusting for covariates, PVS clusters and volumes in all ROIs showed no differences among the three OSA groups. Across the whole sample, PVS was not associated with cognitive outcomes. However, in the mild OSA group, enlarged PVS in the Basal Ganglia was associated with impaired language ability (Clusters, $r=-.227$, $p=.042$; Volumes, $r=-.25$, $p=.023$). Enlarged PVS in the Thalamus was associated with lower performance in verbal learning (Clusters, $r=-.285$, $p=.010$; Volumes, $r=-.289$, $p=.009$), verbal memory (Clusters, $r=-.221$, $p=.049$; Volumes, $r=-.225$, $p=.043$), executive function (Volumes, $r=-.283$, $p=.012$) and processing speed (Volumes, $r=-.231$, $p=.039$).

Conclusions: This study, utilizing a new model of PVS processing pipeline, indicates that while OSA severity alone does not globally correlate with PVS enlargement or broad cognitive deficits in older adults, localized PVS changes in specific brain regions may influence domain-specific cognitive impairments, particularly in mild OSA. Early-stage OSA might trigger glymphatic dysfunction in cognition-critical regions, potentially masked or compounded by other pathological mechanisms in moderate/severe OSA. The Thalamus and Basal Ganglia, crucial for sleep regulation, memory, and executive function, appear susceptible to PVS-related changes, highlighting their role as neural hubs where glymphatic disruption may disproportionately impact cognition. The PINGU tool allowed detection of subtle, region-specific PVS-cognition relationships, emphasizing the value of advanced segmentation techniques in heterogeneous clinical populations.

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Associations between obstructive sleep apnoea risk and fall-related physical performance

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Introduction: Falls are a leading cause of injury, loss of independence and mortality in older people. Measures of physical performance, including balance, gait speed, and handgrip strength are significant predictors of falls. Emerging evidence suggests that obstructive sleep apnoea (OSA), a common sleep-related breathing disorder, may impair physical and cognitive performance in older adults, potentially through mechanisms including nocturnal hypoxemia, excessive daytime sleepiness, and impaired vasoreactivity. However, associations between the risk of OSA and fall-related physical performance remain unclear.

Materials and methods: Cross-sectional data from the 2016 Health and Retirement Study was analysed. OSA risk was derived using survey items aligned with the STOP-Bang questionnaire. Poor balance was defined as the inability to hold a semi-tandem stance for 10 seconds. Slow gait speed was defined as walking <0.8 m/s over 2.5 meters. Weak handgrip strength (HGS) was defined as HGS divided by body mass index (BMI) of <1.00 kg/BMI for males and <0.56 kg/BMI for females. Binomial logistic regression models were used to examine associations between high-risk OSA and physical performance measures. Potential confounders adjusted in the models include age, sex, BMI, physical activity, alcohol consumption, comorbidity burden, ethnicity, and treatment for sleep/snoring problems.

Results: Data from 6,911 participants (mean age 66±11 years; 57% female) were analysed. The prevalence of high-risk OSA, poor balance, slow gait speed and weak HGS was 36%, 32%, 63% and 15%, respectively. High-risk OSA was significantly associated with higher odds of poor balance (OR: 1.23, 95% bootstrapped confidence interval (BCI): 1.07-1.39, p=0.002), slow gait speed (OR: 1.29, BCI: 1.06-1.56, p=0.009), and weak HGS (OR: 2.20, BCI: 1.86-2.60, p=0.001).

Conclusions: High-risk OSA is associated with higher odds of poor balance, slow gait speed and weak relative HGS, which are key predictors of falls. Co-screening of OSA and poor fall-related physical performance may support early detection and preventative strategies to improve safety and maintain functional independence in older adults.

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Sleep EEG-Based Brain Age Index as a Biomarker of Cognitive Function

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Introduction: Sleep quality and architecture are known to influence cognitive processing, and growing evidence links sleep disruption to neurodegenerative diseases and cognitive decline. Our group recently introduced the brain age index (BAI), a novel biomarker derived from sleep EEG, which has shown associations with cortical thinning. This study examines whether the sleep EEG-based BAI can serve as an indicator of brain health, specifically by evaluating its association with cognitive function

Materials and methods: We retrospectively analyzed polysomnography (PSG) data from 128 individuals (89 with obstructive sleep apnea [OSA], 39 healthy sleepers) who also completed neuropsychological assessments. Sleep EEG data were transformed into scalograms and input into a 3D deep learning model to predict brain age.

BAI was calculated as the difference between predicted and chronological age. We performed correlation and mediation analyses to evaluate the role of BAI in linking sleep features and cognitive outcomes.

Results: BAI showed negative correlation with attention and executive function in both overall subjects and the OSA subgroup. Mediation analysis revealed that BAI significantly mediated the relationship between sleep EEG microstructure and attention/executive function, as well as between sleep macrostructure (N3%, sleep efficiency) and attention/executive function.

Conclusions: This study demonstrated that sleep EEG based-BAI could be a promising biomarker for assessing cognitive impairment in patients with sleep disorders. Furthermore, BAI may serve as a mediator in the relationship between sleep and cognitive function, offering novel insights into the pathophysiology of neurodegenerative diseases.

Age-related Changes in Sleep Characteristics and Chronotype, and Their Associations with Physical Frailty: A Longitudinal Study

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Introduction: Sleep phenotypes and circadian manifestations are closely linked with physical frailty. However, the associations between sleep traits, chronotype, and the impact of chronological changes in these factors on frailty remain underexplored.

Materials and methods: A total of 292,940 UK Biobank participants were included for association analysis. Among, 34,157 participants were used for transition analysis. Self-reported continuous sleep duration (short (≤ 6 h) and long (≥ 9 h) sleep durations), insomnia, and chronotype were treated as exposures. Physical frailty was assessed by Fried five criteria, including weight loss, exhaustion, low physical activity, slow walking speed, and low grip strength. Multinomial logistic regression (MLM) and Two-stage regression (2SLS) were applied to analyze the associations. Transition analysis examined the effect of changes in sleep traits and chronotype on frailty risk.

Results: In both MLM and 2SLS models, each additional hour of sleep was associated with a lower risk of frailty (MLM: OR 0.92, 95% CI 0.91-0.94; 2SLS: OR 0.58, 95% CI 0.45-0.73). Short sleep duration (MLM: OR 1.96, 95% CI 1.88-2.05; 2SLS: OR 5.89, 95% CI 2.84-12.18) and insomnia (MLM: OR 2.72, 95% CI 2.61-2.83; 2SLS: OR 2.44, 95% CI 1.37-4.36) were associated with increased frailty risk. Morning chronotype was linked to a lower risk of pre-frailty (MLM: OR 0.94, 95% CI 0.93-0.94; 2SLS: OR 0.93, 95% CI 0.90-0.97). Transition analysis revealed that maintaining healthy sleep patterns (7-8 hours of sleep, no insomnia, and morning chronotype), along with improvements in insomnia and chronotype shifts, were associated with reduced frailty risk.

Conclusions: Multiple sleep and circadian phenotypes including short sleep duration, insomnia, and late chronotype may predispose physical frailty, and improvements in these factors overtime can reduce frailty risk. This underscores the need for widespread attention to sleep and circadian health.

Clinical Characteristics of pediatric Obstructive Sleep Apnea Hypopnea Syndrome After SARS-CoV-2 Exposure

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Introduction: Pediatric obstructive sleep apnea (OSA) is a prevalent sleep disorder characterized by recurrent episodes of partial upper airway obstruction, leading to oxygen desaturation and sleep disruption. Recent studies published between 2016 and 2023 have reported higher prevalence rates, ranging from 12.8% to 20.4%. Studies have demonstrated that persistent viral RNA can be detected in the tonsillar and adenoid tissues of children for weeks to months following acute SARS-CoV-2 infection. To investigate the incidence trends and clinical characteristics of pediatric obstructive sleep apnea (OSA) following exposure to SARS-CoV-2.

Materials and methods: This study enrolled a consecutive cohort of pediatric patients with polysomnography (PSG) recordings from the Sleep Medical Center of Beijing Tsinghua Changgung Hospital between January 2021 and November 2024. Patients who had severe concomitant pulmonary, neurologic, cardiovascular, or psychiatric disorders were excluded. The demographic and PSG characteristics were compared.

Results: 1. A total of 1,377 children were included in the study; a notable upward trend in the incidence of pediatric OSA was observed following exposure to SARS-CoV-2, with the pre-SARS-CoV-2 Exposure Group (pre-SCE) (n=496) and the post-SARS-CoV-2 Exposure Group (post-SCE) (n=881). After stratification by age, the incidence rose 1.06-fold in children <6 years and 2.09-fold in those aged 6-8 years. Strikingly, children > 8 years exhibited the most pronounced increase, with a 3.94-fold surge in the prevalence of OSA.

2. Pediatric OSA showed significant disease progression after SARS-CoV-2 exposure. The post-SCE group exhibited higher median values for the apnea-hypopnea index (AHI: 5.500 [2.750, 13.000] vs. 3.800 [1.900, 7.700]), hypopnea index (HI: 3.500 [1.400, 8.400] vs. 1.800 [0.600, 4.850]), and obstructive apnea-hypopnea index (OAHl: 4.150 [1.400, 10.675] vs. 2.000 [0.697-6.400]), $P < 0.001$.

3. PSG analysis indicated significant sleep architecture modifications post-SCE, with the arousal index increasing from 7.500 [5.100, 10.700] to 11.900 [8.700, 16.700], $P < 0.001$.

4. A comparative analysis of tonsillar and adenoid dimensions before and after viral exposure revealed a statistically significant rise in the proportion of grade 3 (36.49% vs 43.47%) and grade 4 (12.10% vs 14.42%) ($p < 0.05$) tonsillar enlargement following SARS-CoV-2 exposure. Within the age > 8 years group, the prevalence of adenoid tissue obstruction > 75% following SARS-CoV-2 exposure increased significantly from 11.90% to 22.05%, despite this age group typically exhibiting physiological adenoid involution.

5. Multivariate regression analysis revealed that children with grade 4 tonsillar hypertrophy demonstrated a significantly greater increase in the OAHl scores following exposure to SARS-CoV-2 compared to the pre-pandemic period ($\beta=3.40$, $p<0.001$).

Conclusions: Following exposure to SARS-CoV-2, there has been a notable increase in the incidence of pediatric OSA and the severity of the disease, which is associated with significant tonsillar hypertrophy and delayed adenoid regression.

Cerebral and Peripheral Hemodynamics across wakefulness and NREM Sleep

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Introduction: Wake/sleep state-related changes in cerebral hemodynamic oscillations are well established. However, similar changes in peripheral hemodynamics are vastly understudied. Importantly, the inter-relationships between cerebral and peripheral hemodynamics may change with wake/sleep states, given the fact that these oscillations in the low-frequency range are strongly coupled during wakefulness. The current study therefore investigates the temporal and spectral variations in cerebral and peripheral hemodynamics as well as the coupling between them in the low-frequency range across sleep-wake states.

Materials and methods: To study these, we concurrently measured cerebral hemodynamics and peripheral hemodynamics respectively using functional Magnetic Resonance Imaging of the brain and Near-infrared spectroscopy of the fingertips during wakefulness and non-rapid eye-movement sleep. This study included 10 healthy participants (6 females) aged 19 – 24 (20.90 ± 1.59) years. Actigraphy was used to track each participant's sleep-wake cycles for at least four days before the experiment to ensure they adhered to their usual sleep schedules. Additionally, to allow for sound acclimation, they were instructed to listen to sound recordings from the MR scanner at bedtime for two to three nights before their scheduled bedtime scan. To capitalize on elevated homeostatic and circadian sleep pressures, participants were asked to wake up three hours earlier than usual the morning of their scan, and the scan sessions began roughly one hour after their usual sleep onset time. All MRI data were acquired using a 3T SIEMENS MRI scanner with a 64-channel head coil. Peripheral hemodynamics were recorded from two fingertips (fourth finger of both arms) using a Continuous Wave (CW) NIRS system with two laser sources, each combining two wavelengths (785 and 830 nm) and MRI-compatible NIRS probes with 10 m long optical fibers. For sleep scoring, a 32-channel Electroencephalography (EEG) was also simultaneously acquired using an MRI-compatible EEG system.

Results: Overall findings from the present study are twofold. First, hemodynamics in the brain remarkably differ in both oscillation amplitude and spectral power from peripheral hemodynamics during NREM sleep stages. Second, the LF coupling between cerebral and peripheral hemodynamics become desynchronized during NREM3 sleep.

Conclusions: Our data demonstrate the amplitude fluctuations of cerebral hemodynamics significantly increase during light NREM sleep (NREM1 and NREM2) and then decrease significantly during deep sleep (NREM3). Fluctuation levels of peripheral hemodynamics however stays the same from wake to NREM3. To our knowledge, this is the first study to report this discrepancy in hemodynamic fluctuation levels between brain and periphery during NREM sleep.

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Sleep, breathing, hemodynamic oscillations, and cerebrospinal fluid movements - Building toward a novel treatment approach for Alzheimer's disease.

Basic Research

The Impact of Obstructive Sleep Apnea on the Temporal Coupling of NREM Sleep Oscillations in Schizophrenia

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Introduction: Dysfunctional connectivity between and within brain regions is a proposed mechanism underlying schizophrenia. Electroencephalographic (EEG) abnormalities during Non-Rapid Eye Movement (NREM) sleep such as reduced and dysmorphic sleep spindles and slow oscillations (SO) have been described in schizophrenia. The temporal coupling between these oscillations is thought to reflect the coordination and integrity of the thalamocortical circuitry and has been associated with functions of memory with uncoupling being associated with aspects of ageing and cognitive decline. We investigated 1) whether a reduction in the temporal relationship between SO and spindles are observed in the schizophrenia group reflecting thalamocortical dysfunction. Individuals with schizophrenia are often given obesogenic medication, increasing the likelihood of developing obstructive sleep apnea (OSA). We further explored 2) whether this oscillatory coupling would be further impaired in those with OSA and 3) the association of coupling with cognitive performance.

Materials and methods: We measured high-density EEG overnight polysomnography in two groups 1) people with schizophrenia (n=31) and 2) without schizophrenia (n=31) across a range of OSA severity, defined by the Apnea Hypopnea Index (AHI), matched for age and sex. Participants completed a cognitive test battery before and after sleep. Sleep spindles and SO events were automatically detected using previously reported algorithms across 256 High-density EEG. The mean phase angles (phase preference), the resultant vector length (coupling strength) and coupling density of each co-occurring event between SO and sleep spindles were measured. To reduce bias of phase angle concentration, participants with >10 events were included in the analyses. General linear models were used to test the association between coupling metrics and the effects of group and AHI and the interaction between the two and the association of cognition in the form of a procedural memory task (finger tapping) with the main effect of the coupling strength, group and AHI.

Results: We observed group differences in the schizophrenia group showing reduced coupling density compared to controls (b -0.06, p<0.01) this was not further impaired if they had comorbid OSA (b 0.00 p=0.65). Across both groups, we did not see a difference in coupling strength (resultant vector length) (Group x AHI b = 0.00 p=0.82). No significant differences were observed in overnight improvement on the procedural memory motor task and AHI (b -0.11 p=0.31). Worse task performance was observed in the schizophrenia group (b=-22.37, p=0.01) but not significant if these patients had OSA (p=0.05)

Conclusions: Our results show that the coupling of SO and sleep spindles in schizophrenia may be preserved and is not impacted by the presence of OSA. The schizophrenia group show additional activation in the centroparietal regions which may possibly reflect a compensatory mechanism. This interpretation might suggest that recruitment of function with adjacent areas could be due to local network dysfunction in the frontal brain regions in schizophrenia. Future work will aim to understand the effects on these dynamics following CPAP treatment in

schizophrenia and explore the potential of SO-spindle coupling reflecting functional connectivity and its interaction with other brain regions

KLF9 Regulates Sleep Architecture via B-Mediated Excitability of VTA Dopaminergic Neurons

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Introduction: Sleep is a fundamental physiological process essential for physical and mental recovery, representing a state of comprehensive brain rest. In mammals, sleep is tightly regulated by a complex network of deep brain nuclei. However, the genetic and molecular mechanisms underlying this intricate regulatory network remain largely unknown. Genome-wide association studies have identified a significant association between genetic polymorphisms in Krüppel-like factor 9 (KLF9) and alterations in sleep architecture in patients with obstructive sleep apnea. Nevertheless, whether KLF9 plays a functional role in sleep regulation and the nature of its downstream mechanisms remain unclear and warrant further investigation.

Materials and methods: To investigate the role of *Klf9* in sleep regulation, we employed a combination of genetic, neurophysiological, and multi-omics approaches. A *Klf9* knockout mouse model was generated using CRISPR/Cas9 technology, while whole-brain neuronal overexpression of *Klf9* was achieved through retro-orbital injection of AAV-hsyn-*Klf9*. Sleep parameters were assessed using EEG/EMG recordings to evaluate the impact of *Klf9* manipulation on sleep architecture. To trace the spatial expression of KLF9 protein in the brain, we constructed an in-frame *Klf9*-HA knock-in mouse model for in situ labeling. Region- and cell-type-specific overexpression or deletion of *Klf9* was further accomplished via stereotactic injection of AAV vectors combined with the Cre-loxP system, enabling precise dissection of its function in specific brain regions and neuronal populations. To uncover the transcriptional network downstream of *Klf9*, we integrated single-nucleus RNA sequencing (snRNA-seq) with CUT&Tag profiling. The regulatory relationships between *Klf9* and its target genes were subsequently validated through molecular biology, epigenetic, and electrophysiological analyses. Finally, rescue experiments were conducted in *Klf9*-deficient mice by restoring the expression of downstream gene, confirming the mechanistic role of the *Klf9* signaling in modulating sleep.

Results: *Klf9* knockout mice exhibited a significantly reduced total wake duration, increased frequency of microarousals, and shortened average wake episode length, indicative of a fragmented sleep phenotype. In contrast, overexpression of *Klf9* in whole-brain neurons led to opposing effects on sleep architecture, suggesting a regulatory role for *Klf9* in maintaining stable sleep-wake states. In situ protein tracing revealed that KLF9 is highly expressed in the subthalamic nucleus (STN), substantia nigra (SN), and ventral tegmental area (VTA). Region- and cell-type-specific genetic manipulation further demonstrated that KLF9 is essential for wake maintenance and sleep structure stability specifically in dopaminergic neurons of the VTA. Integrated multi-omics analysis identified B as a direct downstream transcriptional target of KLF9. Loss of *Klf9* resulted in markedly altered B expression and decreased excitability of dopaminergic neurons. Notably, in situ restoration of B expression in *Klf9*-deficient mice effectively rescued the observed sleep abnormalities, confirming the functional relevance of the KLF9-B regulatory axis in sleep regulation.

Conclusions:

This study is the first to demonstrate the critical role of KLF9 in maintaining wakefulness and stabilizing sleep architecture.

A Machine Learning-Derived Transcriptomic Risk Model Linking DEHP and Sleep-Disordered Breathing to Cancer Prognosis and Immune Dysregulation

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Introduction: Both sleep-disordered breathing (SDB) and exposure to environmental toxicants such as di(2-ethylhexyl) phthalate (DEHP) are associated with chronic inflammation, immune dysfunction, and tumor progression. However, their combined molecular impact remains poorly understood. Clarifying this relationship may uncover novel mechanisms linking environmental and physiological stress to cancer outcomes.

Materials and methods: Thirteen overlapping genes related to both DEHP and SDB were identified via transcriptomic analysis and literature mining. A DEHP-SDB score was developed using LASSO Cox regression in The Cancer Genome Atlas (TCGA) pan-cancer cohort. Risk groups were compared across survival endpoints (OS, PFI, DSS). Functional enrichment and immune microenvironment analyses were conducted to interpret the biological relevance of the score.

Results: The DEHP-SDB score was significantly associated with poor survival in multiple cancers (-LUAD, KIRC, COAD, and ACC). High-risk tumors showed activation of epithelial-mesenchymal transition, IL-17 signaling, and the p53 pathway. These tumors also had increased immune checkpoint expression and stromal activation. A prognostic nomogram incorporating the score achieved an AUC of 0.81 for 5-year survival prediction.

Conclusions: We propose a novel DEHP-SDB transcriptomic signature that integrates environmental and sleep-related stressors into a unified prognostic model. This risk score not only predicts survival outcomes but also reflects immune and inflammatory remodeling, offering new insights for cancer risk stratification in vulnerable populations.

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Comparison of epilepsy mouse models induced by kainic acid through different administration routes

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Introduction: Epilepsy is a debilitating neurological disorder driven by abnormal excessive or synchronous neuronal activity in the brain, affecting about 50 million people worldwide according to the World Health Organization Report 2024. Over the last decades, different epilepsy models have been developed including injection of chemoconvulsants, traumatic brain injury, electrical kindling, and optogenetic kindling established more recently. The most widely used epilepsy model is created with kainic acid (KA) due to its convenience and robust phenotype mimicking the clinical symptoms observed in patients bearing epilepsy. However, a side-by-side comparison of sleep/wake pattern, and the implicated brain regions in epilepsy mouse models with KA administration through different routes remains underexplored. In this study, we administered KA/saline intraperitoneally or intrahippocampally, and compared their seizures, isolated spikes, and c-Fos expression pattern spanning the entire mouse brain at different time points in a systematical manner.

Materials and methods: Epilepsy mouse models were created through intraperitoneal injection of KA (IPKA, 20mg/kg, saline (0.9% NaCl) as solvent, IPS), or locally to dorsal hippocampal CA1 region (IHKA, 150ng, saline as solvent, IHS). EEG and simultaneous EMG were sampled at various times to monitor the dynamic changes of sleep/wake architecture, and the development of epilepsy. A subgroup of mice was perfused at different times following drug administration, and their brains were collected for immunohistochemical analyses to determine the contribution of dynamic neuronal activity during the development of epileptogenesis.

Results: We observed a more severe disruption of sleep architecture perpetuating for a longer time associated with seizures in the IHKA group. IHKA induced a more robust epilepsy pattern during the acute phase. Both IPKA

and IHKA increased the amount of wakefulness and decreased non-rapid eye movement (NREM) sleep within a few hours after injection. REM sleep was completely abolished during the initial 5 hours in the IHKA group, whereas the absence of REM in the IPKA group lasted for a shorter time. A chronic epilepsy model was developed as seizures were observed up to 4 weeks in the IHKA group, but not in the IPKA group. Reduction of REM sleep remained 4 weeks after treatment of IHKA. IHKA induced more isolated spikes overall, and stabilized at 3 weeks after drug administration. Both IPKA and IHKA induced increased c-Fos expression within 3 hours after the drug administration as compared to their controls. Pearson correlation analyses among different brain regions expressing c-Fos revealed that IHKA primarily affected forebrain and midbrain, but IPKA implicated subnuclei across the entire brain despite c-Fos⁺ cell counts were less than the IHKA group.

Conclusions: Our results demonstrate that the IHKA induced a more robust epilepsy mouse model, which exhibited acute and chronic disruption of sleep/wake architecture, perpetuating seizures, and more isolated spikes. c-Fos expression analysis revealed that the correlation pattern of brain regions expressing c-Fos in the IHKA group is distinct from the correlation pattern in the IPKA group at the acute phase.

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Multi-Person Sleep Monitoring Based on mmWave Radar

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Introduction:

The 60GHz mmWave radar enables non-contact detection of subtle thoracic respiratory movements, facilitating the estimation of sleep stages. In this study, we extend the application of this technology from single-subject monitoring to multi-person environments by developing a real-time sleep monitoring system capable of simultaneously assessing multiple individuals. The proposed multi-person sleep staging algorithm achieved a classification accuracy of 76% (Cohen's kappa: 0.61), comparable to the 78% accuracy (Cohen's kappa: 0.64) of our previously validated single-subject model. These results demonstrate the system's ability to overcome the limitations of single-user monitoring, highlighting its feasibility for real-world deployment in shared living environments.

Materials and methods:

In this study, we implemented a real-time multi-person sleep monitoring system using a 60GHz mmWave radar. The radar captures reflected signals from transmitted waves to extract distance, velocity, and angle information, which is then mapped into a three-dimensional coordinate system to generate a point cloud.

The sequentially acquired point cloud data were processed using the DBSCAN (Density-Based Spatial Clustering of Applications with Noise) algorithm, a density-based clustering method. This approach enabled the formation of distinct clusters based on spatial density, allowing for independent identification and tracking of multiple individuals within the radar's sensing range by assigning unique IDs to each cluster.

Once individuals were detected to have entered a stable posture with minimal movement, spatial zones were defined based on their positions. Sleep stages were then independently estimated for each person, enabling simultaneous multi-subject sleep analysis.

Results:

In our previous study (presented at *Sleep 2024*), we achieved a sleep stage classification accuracy of 78% (Cohen's kappa: 0.64) using a CNN and Transformer-based model in a single-subject setting, validated through a clinical trial involving 340 participants (200 for training and 140 for validation).

To evaluate the performance of the newly developed multi-person algorithm, we conducted a clinical trial in an environment where two individuals slept simultaneously. The system performed real-time tracking and spatial separation, allowing for individual sleep stage estimation. Due to limitations of the PSG device, sleep stage accuracy could only be validated for one participant at a time. A total of 20 subjects participated in the trial.

The results showed that the multi-person system achieved a classification accuracy of 76% with a Cohen's kappa of 0.61, indicating a slight decrease in accuracy compared to the single-subject model, yet maintaining comparable performance under multi-occupant conditions.

Conclusions:

This study extends conventional single-person sleep analysis to a multi-person setting using point cloud-based techniques. The results demonstrate that mmWave radar-based sleep monitoring can maintain a comparable level of accuracy in estimating sleep stages for multiple individuals, similar to that observed in single-subject scenarios. These findings validate the feasibility of applying mmWave radar for real-world, non-contact sleep monitoring in environments with multiple occupants.

The significance of this work lies in its demonstration of the practical potential of non-contact sensor technologies for multi-person sleep monitoring, marking a step forward in scalable, unobtrusive sleep assessment systems.

Effects of Combined Chronic Intermittent Hypoxia and Hypercapnia Exposure on Blood Pressure, Systemic Inflammation, and Oxidative Stress Levels in Rats

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Introduction: Chronic Intermittent Hypoxia (CIH), the most characteristic pathophysiological feature of obstructive sleep apnea (OSA), has been extensively documented in animal studies to induce multiple OSA-associated adverse outcomes. Intermittent hypercapnia, another hallmark pathophysiological trait of OSA, however, has rarely been incorporated into OSA animal modeling paradigms. The purpose of this study is to investigate the effects of combined chronic intermittent hypoxia with hypercapnia (CIHHC) exposure on blood pressure, systemic inflammation, and oxidative stress (OS) levels in Sprague-Dawley (SD) rats, compared to chronic intermittent hypoxia (CIH) alone and chronic intermittent hypercapnia (CIHC) alone.

Materials and methods: Forty 6-week-old male SD rats were randomly divided into four groups (n=10 per group) and exposed for 8 hours daily to specific oxygen (O₂) or carbon dioxide (CO₂) partial pressure conditions: (1) Control group (O₂: 21%, CO₂: 0.3%); (2) CIH group (O₂ cycled every 60 seconds between 5% and 21%, CO₂: 0.3%); (3) CIHC group (O₂: 21%, CO₂ cycled every 60 seconds between 0.3% and 5%); and (4) CIHHC group (O₂ cycled between 5% and 21%, CO₂ cycled between 0.3% and 5% every 60 seconds). Tail artery systolic blood pressure (SBP) was measured pre- and post-30-day exposure. Post-exposure peripheral serum samples were collected to quantify levels of inflammatory biomarkers [tumor necrosis factor- α (TNF- α), interleukin-6 (IL-6)] and OS markers [superoxide dismutase (SOD), malondialdehyde (MDA)].

Results: No significant differences in pre-exposure SBP (pre-SBP) were observed among the four groups. While post-exposure SBP (post-SBP) differed significantly ($P=0.002$), with the order CIH > CIHC > CIHHC > Control. Post-SBP increased significantly in all experimental groups but not the control group compared to their respective pre-SBP (all $p<0.05$). Post-exposure serum levels of TNF- α , IL-6, SOD, and MDA also differed significantly among groups (all $P<0.05$). TNF- α , IL-6, and MDA levels followed the order CIH > CIHC > CIHHC > Control, while SOD levels ranked Control > CIHHC > CIHC > CIH.

Conclusions: Both CIH and CIHC exposure significantly elevated blood pressure, systemic inflammation, and OS levels in rats. However, combined CIHC exposure induced significantly milder effects compared to CIH or CIHC alone, suggesting that intermittent hypercapnia concurrent with CIH may exert a protective or ameliorative influence on these pathological processes.

BTBD9 Controls Sleep via Ubiquitination of IMPDH2 and Adenosine Modulation in the Basal Forebrain

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Introduction: BTBD9 has been established as a critical sleep-regulating gene, whose genetic variants are associated with human insomnia and restless legs syndrome (RLS), while its loss-of-function leads to disrupted sleep architecture in both mice and *Drosophila*. However, its precise molecular mechanisms remain elusive.

Materials and methods: We employed an integrated multidisciplinary approach: 1) AAV-mediated Cre/loxP system with stereotaxic injection for basal forebrain (BF)-specific genetic manipulation; 2) Long-term sleep monitoring and deprivation experiments using synchronized electroencephalography/electromyography (EEG/EMG) recordings; 3) Quantitative proteomics, ubiquitinomics, and bioinformatic prediction to identify key substrates; 4) Structural analysis, in vitro ubiquitination assays, and site-directed mutagenesis to validate molecular interactions; 5) Fiber photometry and tissue metabolome for neurotransmitter dynamics assessment; 6) AAV-delivered competitive interfering peptides for in vivo functional rescue experiments.

Results: We discovered that BF-specific *Btbd9* knockout induces a previously-unexpected pro-sleep phenotype mediated by elevated adenosine levels. IMPDH2, the rate-limiting enzyme in *de novo* GTP biosynthesis, was identified as an evolutionarily conserved ubiquitination substrate of BTBD9, with lysine 195 (K195) being the critical modification site. BTBD9-mediated ubiquitination disrupts GTP-dependent feedback inhibition of IMPDH2, altering its enzymatic activity. Both pharmacological inhibition of IMPDH2 with MPA and conditional knockout in BF neurons recapitulated the sleep-promoting effects, increasing NREM sleep duration and slow-wave activity (SWA)—key markers of sleep pressure. Crucially, targeted disruption of the BTBD9-IMPDH2 interaction via AAV-delivered interfering peptides not only prolonged NREM sleep but also confirmed the druggability of this pathway.

Conclusions: Our study unveils the novel BTBD9-IMPDH2-adenosine axis in sleep regulation and proposes targeting this interaction as a promising therapeutic strategy for sleep disorders. These findings provide groundbreaking insights into the molecular pathogenesis of sleep disturbances.

Effect of sleep irregularity on driving simulator performance during extended wakefulness

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Introduction: Insufficient and irregular sleep are now well-established risk factors for adverse health outcomes. While the impact of insufficient sleep on driving performance is known to be substantial, the degree to which irregular sleep, independent of sleep duration, affects driving performance is far less understood. We examined whether habitual sleep irregularity in the lead up to acute sleep loss influences subsequent driving simulator performance during extended wakefulness.

Materials and methods: Thirty-eight healthy sleepers (23 females and 15 males, aged 31.0±11.6y) completed two weeks of sleep/wake monitoring (GENEActiv activity monitors) prior to undergoing 29 h laboratory extended wakefulness study. Five 60-minute driving simulator (AusEd) tests were completed: 1, 7, 13 h of wakefulness determined baseline rested performance, while 19 and 25 h determined performance while sleep deprived. Sleep irregularity prior to the laboratory was calculated using the standard deviation (SD) of sleep midpoint time and

total sleep time, used to split participants into irregular ($n=11$) or regular ($n=27$) sleeper groups using two-step cluster analysis. Linear mixed model analysis was used to test the effects of time awake (rested vs sleep deprived) and sleep irregularity (regular vs irregular) on driving simulator steering deviation. Binary logistic regression was used to examine the association between continuous sleep irregularity measures and incidence of driving crashes.

Results: Steering deviation significantly deteriorated throughout extended wakefulness (Mean $\pm$ SD, rested vs sleep deprived, 45.1 ± 27.9 vs 69.1 ± 37.5 cm, $F(1, 30.45) = 17.03$, $p < .001$), but there was no interaction ($F(1, 30.5) = 0.19$, $p = .665$) or main effect of sleep irregularity group ($F(1, 35.5) = 0.02$, $p = .901$). Binary logistic regressions revealed that when rested (i.e., 1, 7, and 13 hours after waking), neither irregularity in total sleep time (OR=1.85 [95% CI:0.67, 9.34], $p = .458$) nor irregularity in sleep midpoint timing (OR=0.59 [95% CI:0.14, 2.47], $p = .467$) were associated with crash incidence. However, when sleep deprived (i.e., 19 and 25 hours after waking), irregularity in total sleep time (OR=9.97 [95% CI:1.20, 85.67], $p = .033$) but not irregularity in sleep midpoint timing (OR=0.42 [95% CI:0.07, 2.40], $p = .325$) was associated with crashing events on the driving simulator.

Conclusions: These findings suggest that although sleep irregularity does not impact steering stability. Driving simulator crash events are indicative of alertness and performance failure, and hence our findings suggest that irregular sleep duration may predispose drivers to adverse effects of sleep loss by increasing the risk of a crash. Further studies are warranted to determine the relative impacts of habitual sleep irregularity, independent of sleep duration, to better understand impacts on road safety.

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Shared genetic architecture between sleep apnea related sleep traits and cardiometabolic diseases

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Introduction: Sleep apnea related sleep traits show high comorbidities with cardiometabolic diseases (CMDs). Although genetic relationships between them have been widely reported, it is still unknown whether a small number of loci or the whole genome would be responsible for the overall genetic association. Genome-wide association studies (GWAS) have identified single nucleotide polymorphisms (SNPs) associated with either sleep apnea or cardiometabolic diseases. These findings provide a foundation for subsequent analysis of pleiotropic SNPs exhibiting cross-traits associations, which might aid in the understanding of potential shared genetic architectures underlying these comorbid conditions. The purpose of this study was to find shared genomic regions, genes, and pathways between sleep apnea and associated sleep traits (insomnia, sleepiness and snoring) and seven cardiometabolic diseases (atrial fibrillation, coronary artery disease, heart failure, hypertension, stroke, type 2 diabetes and venous thromboembolism).

Materials and methods: Using GWAS summary statistics from publicly available data sources, we calculated genetic correlation between two traits using linkage disequilibrium (LD) score regression (LDSC) and high-definition likelihood (HDL) analysis. Furthermore, PLACO, a pleiotropic analysis under a composite null hypothesis, was used to identify genetic variants that influence risk of two traits. And causal variants were identified by FM-summary, a Bayesian fine-mapping method. Colocalized association signals between trait pairs or among multiple traits were determined by the R packages coloc or HyprColoc. ANNOVAR program were used to identify nearest genes of causal variants and MAGMA was used to detect potential pleiotropic genes. Phenotype enrichment analysis and over-representation enrichment analysis were performed to characterize the phenotype and pathway specificity of these pleiotropic genes. Two-sample and multivariable mendelian randomization (MR) were used to identify causal associations between these traits and potential factors mediating causal relationships.

Results: Among 28 trait pairs between four sleep traits and seven cardiometabolic traits, 23 showed significant genetic connections. Pleiotropic analysis identified 720 (678 unique) pleiotropic causal SNPs in 23 trait pairs, with 92 (85 unique) colocalized loci. 73 nearest genes of colocalized loci were annotated with ANNOVAR program and gene-based analysis verified 48 of them. Shared genes were highly enriched in aging, live/biliary system, muscle and

endocrine/exocrine gland phenotypes. Furthermore, pathway enrichment analysis highlighted biological pathways including Cushing syndrome, an endocrine and metabolic disease characterized by too much cortisol in the body, and signal transduction like cAMP, Rap1 and cGMP-PKG signaling pathway. Vertical pleiotropy was further demonstrated across 14 trait pairs using MR analysis. Adjusting triglyceride, total cholesterol and glycemic traits, genetically predicted snoring was associated with higher risk of atrial fibrillation and heart failure. And genetically predicted sleep apnea was independently related with heart failure and type 2 diabetes, after adjusting blood pressure. Particularly, some pleiotropic loci were identified to be shared among multiple traits, such as 3q27.1 (ECE2), 4p12 (GNPDA2) and 17q21.31 (ACBD4).

Conclusions: This study not only supported the observed comorbidity of sleep apnea related sleep traits and CMDs, but also indicated shared genetic determinants underlying these trait pairs, might facilitating treatment and management of comorbid sleep apnea and CMDs.

AI-Driven Contactless Sleep Monitoring Using Smart Mattress and Machine Learning to Predict Obstructive Sleep Apnea and Sleep Quality in Military Personnel

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Introduction: Obstructive Sleep Apnea (OSA) significantly impairs sleep quality and daytime alertness, especially in military personnel who face high operational and cognitive demands. Polysomnography (PSG), while being the diagnostic gold standard, is impractical for large-scale or continuous monitoring. This study aims to develop and validate a contactless sleep monitoring system using AI-enhanced smart mattress data integrated with machine learning (ML) algorithms to classify OSA severity and estimate sleep quality among hospitalized military personnel.

Materials and methods: Sleep data from military inpatients will be collected using a smart mattress system (Huijia Health Life Corporation) that records physiological signals (heart rate, respiratory rate, body movement) simultaneously with PSG. Supervised ML models-random forest, support vector machines, and deep neural networks-will be trained to classify OSA severity and predict sleep quality. SHAP values will be applied to interpret model outputs and identify key contributing features.

Results: We expect to establish a high-performing and interpretable model capable of classifying OSA severity with high accuracy and estimating sleep quality non-invasively. The model may also uncover latent relationships between OSA and degraded sleep, enabling early intervention and clinical decision-making.

Conclusions: Integrating smart mattress technology with ML provides a novel, non-contact, and scalable solution for OSA risk detection and sleep quality assessment. This approach could transform sleep monitoring and enhance military healthcare strategies.

Acknowledgments: Keywords : Obstructive Sleep Apnea; Smart Mattress; Machine Learning; Sleep Quality; Military Personnel

Investigation of the Role and Mechanism of the Der p1-IL-21 Axis in Adenoid Germinal Center Responses

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Introduction: Adenoid hypertrophy is a key etiological factor in obstructive sleep apnea-hypopnea syndrome (OSAHS), often associated with excessive germinal center (GC) proliferation. House dust mite (HDM) colonization, particularly by the allergen Der p1, has been implicated in this pathology, but its mechanistic role remains poorly understood.

Materials and methods: To investigate this, we established an innovative adenoid organoid model and utilized IL-21^{-/-} mice to evaluate the effects of Der pI on GC responses.

Results: Our findings demonstrate that Der pI stimulation significantly increased IL-21⁺ T follicular helper (Tfh) cells, which in turn enhanced GC responses. Notably, IL-21^{-/-} mice showed markedly reduced GC formation in the spleen.

Conclusions: These results suggest that the Der pI–IL-21 axis plays a critical role in promoting GC proliferation in adenoid hypertrophy, offering new insights into the pathogenesis of OSAHS and potential therapeutic targets.

Effects of chronic intermittent hypoxia during sleep on intraoral pain via hypoxia inducible factor-1 α in ovariectomized rats

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Introduction: Burning mouth syndrome (BMS) is a chronic pain condition characterized by a burning sensation or discomfort in oral mucosa without any visible lesions. In BMS, capsaicin, an agonist of transient receptor potential cation channel subfamily V member 1 (TRPV1), can exacerbate pain in the tongue and the oral mucosa. The etiology of BMS is thought to involve a complex interplay of multiple factors. The risk of developing BMS increases after menopause, a trend also observed in obstructive sleep apnea (OSA). Moreover, OSA has been reported as a potential risk factor for BMS. Therefore, we propose that there is a link between OSA and the development of BMS, with OSA-induced hypoxia serving as a contributing factor. Hypoxia-inducible factors (HIFs) serve as a sensor of hypoxia; under hypoxic conditions, HIF-1 α accumulates and is translocated to the nucleus, where it functions as a transcription factor that regulates genes related to the cellular responses to hypoxia. The HIF pathway has been implicated in various physiological and pathophysiological processes. Based on these, we hypothesized that hypoxia by OSA contributes to the accumulation of HIF, which then promotes TRPV1 expression in the trigeminal ganglion (TG), then enhancing the sensitivity to capsaicin and contributing to the development of BMS.

Materials and methods: Ovariectomized (OVX) rats were exposed to chronic intermittent hypoxia (CIH) (nadir O₂ 5%, 6-min cycles, 6 h/day, 14 days). Intraoral pain was assessed using a two-bottle preference drinking test with a capsaicin solution. Immunohistochemical staining was used to assess changes in the proportion of TRPV1-positive and HIF-1 α -positive cells in the ophthalmic, maxillary, and mandibular nerve branches of the TG. Additionally, a HIF-1 α inhibitor was administered to the TG to determine the effects on capsaicin sensitivity and the proportion of TRPV1-positive and HIF-1 α -positive cells.

Results: Capsaicin consumption was significantly lower in the OVX-CIH group than that in the control group. OVX-CIH rats showed a significantly higher number of TRPV1-positive, HIF-1 α -positive, and TRPV1+HIF-1 α co-positive cells in all branches of the TG. Furthermore, the administration of an HIF-1 α inhibitor to the TG of OVX-CIH rats alleviated intraoral sensitivity to capsaicin. The increase in the number of TRPV1-positive cells in the OVX-CIH group was suppressed by the HIF-1 α inhibitor administration.

Conclusions: These findings suggest that the CIH-induced stabilization of HIF-1 α in the trigeminal ganglion contributes to BMS-like intraoral pain by upregulating TRPV1.

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I-SLEEPS: A Simplified and Accurate Approach to Sleep Disorder Prediction with Body Composition Metrics

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Introduction: Accurately predicting the risk of sleep disorders such as insomnia, obstructive sleep apnea (OSA), and comorbid insomnia and sleep apnea (COMISA) typically requires a costly and time-consuming process involving multiple questionnaires and polysomnography tests. As a simpler alternative for sleep disorder prediction, the SLEEPS algorithm uses only nine questions, which includes the body mass index (BMI) as a key feature. However, BMI alone fails to capture differences in body composition, as individuals with identical BMI values can exhibit significant variations in muscle and fat distribution. We aim to develop a machine learning algorithm that can accurately predict the risk of insomnia, OSA, and COMISA using body composition metrics.

Materials and methods: We applied a tree-based machine learning algorithm to a dataset of 3291 patients. Demographic data, sleep-related questions, and body composition metrics were evaluated as potential features for the model. The final feature selection was based on feature importance calculated by Shapley additive explanations (SHAP) method. Using the selected features, we developed a new machine learning algorithm for predicting insomnia, OSA, and COMISA, named I-SLEEPS (InBody-based Simple questionnaire Predicting Sleep disorders). The accuracy of the algorithm was evaluated using the area under the receiver operating characteristics curve (AUROC).

Results: A total of 10 features were selected to construct I-SLEEPS, including skeletal muscle index (SMI) and fat-free mass index (FFMI) instead of BMI, along with the original SLEEPS questionnaire items. I-SLEEPS achieved superior predictive accuracy (AUROC > 0.93 for OSA, COMISA and insomnia) compared to SLEEPS (AUROC > 0.90). Additionally, our approach significantly enhanced AUPRC values, which is critical for addressing the imbalanced datasets of COMISA and insomnia. Furthermore, our analysis revealed distinct relationships between muscle mass indices (SMI and FFMI) and the risks of OSA, insomnia, and COMISA, providing new insights into the role of body composition in sleep disorders.

Conclusions: By leveraging the accessibility of InBody analysis, I-SLEEPS offers a practical, non-invasive alternative for diagnosing and managing sleep disorders, improving upon traditional screening methods such as polysomnography.

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A Case Study---Improving Sleep Quality and Glycemic Biomarkers in Patients with Obstructive Sleep Apnea and Type 2 Diabetes through Long-Term Use of Continuous Positive Airway Pressure Therapy

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Introduction: Obstructive Sleep Apnea (OSA) and Type 2 Diabetes Mellitus (T2DM) frequently coexist and exacerbate each other. OSA leads to intermittent nocturnal hypoxia and sleep fragmentation, which can worsen insulin resistance and glycemic control. Studies have shown that long-term use of Continuous Positive Airway Pressure (CPAP) therapy significantly improves sleep quality, reduces hypoxic episodes, and helps stabilize key biochemical markers in T2DM patients, such as fasting glucose, HbA1c, and insulin sensitivity. As a non-invasive intervention, CPAP presents a promising adjunctive treatment for patients suffering from both OSA and T2DM.

Materials and methods: This single-case study involved a patient with type 2 diabetes and insomnia, diagnosed with severe obstructive sleep apnea (AHI > 100), a body mass index (BMI) over 40, and an HbA1c level above 10. The patient underwent a two-month intervention using a Continuous Positive Airway Pressure (CPAP) device, worn nightly. Sleep quality and type 2 diabetes-related biochemical markers—including fasting glucose, HbA1c, and insulin sensitivity—were regularly monitored to evaluate the clinical impact of sustained PAP therapy.

Results: Before intervention, the patient's AHI exceeded 100 and HbA1c was over 10. After two months of continuous positive airway pressure therapy, AHI dramatically decreased to below 20. HbA1c levels significantly

dropped, BMI showed a downward trend, and sleep quality improved markedly. Additionally, glycemic control became more stable.

Conclusions: these findings suggest that continuous positive airway pressure therapy has beneficial clinical and metabolic effects in patients with severe obstructive sleep apnea combined with type 2 diabetes, offering a promising adjunctive treatment approach.

Acknowledgments: Key Word: Obstructive Sleep Apnea (OSA), Type 2 Diabetes Mellitus (T2DM), Continuous positive airway pressure (CPAP), Apnea-Hypopnea Index (AHI), Sleep Quality, Hemoglobin A1c (HbA1c)

Preliminary analysis of intestinal flora characteristics in children with obstructive sleep apnea hypopnea syndrome

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Introduction: Obstructive sleep apnea-hypopnea syndrome (OSAHS) has attracted increasing attention due to its high prevalence and serious long-term complications. A growing number of studies demonstrate a link between OSAHS and gut microbiota. We speculate that OSAHS can probably lead to changes in the abundance and composition of gut microbiota.

Materials and methods: Children diagnosed with primary snoring and OSAHS by PSG were enrolled in the study group. Nonsnoring children undergoing elective surgery were selected as the control group. Stool, sleep monitoring data and medical history data were collected. 16S rRNA high-throughput sequencing technology was used to analyze the composition of the intestinal flora.

Results: A total of 62 OSAHS patients (42 mild OSAHS and 20 moderate to severe OSAHS), 16 primary snoring patients and 46 controls were enrolled in this study. There were differences in some intestinal flora at the phylum, class, order, family, genus and species levels between the control group and OSAHS group. The predictive model for OSAHS diagnosis established by the receiver operating characteristic (ROC) curve showed that the area under the curve (AUC) of Firmicutes and the abundance ratio between Firmicutes and Bacteroidetes (F/B) were more than 50%. At the genus level, Akkermansia, Dialister, Escherichia-Shigella and Faecalibacterium was correlated with some PSG indicators.

Conclusions: The intestinal flora of children with OSAHS is slightly different at the phylum, class, order, family, genus and species levels. The F/B and Firmicutes abundance detection have auxiliary value for the diagnosis of OSAHS. At the genus level, some gut microbiota were correlated with PSG indicators.

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Investigating the Effects of Sedative-Hypnotic Drugs on Sleep and Autonomic Nervous System Function in Wild-type and Alzheimer's Disease Transgenic Mice

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Introduction: Patients with Alzheimer's disease (AD) often experience insomnia, and clinical management frequently involves the use of sedative-hypnotic drugs to alleviate sleep disturbances. However, previous studies have indicated potential negative consequences of long-term sedative use in patients. This study aims to explore the effects of single dose and long-term administration of sedative-hypnotic drugs on sleep patterns and autonomic nervous system function in APP/PS1 transgenic mice, a model of AD, during the pre-symptomatic stage.

Materials and methods: In this experiment, both pre-symptomatic APP/PS1 mice (17-18 weeks old) and wild-type (WT) control mice were orally administered different doses of Lorazepam (1, 2, and 4 mg/kg) and Zolpidem (5, 7.5, and 10 mg/kg) for a single dose. After one week, the mice were further administered Lorazepam (2 mg/kg)

and Zolpidem (7.5 mg/kg) daily, along with a vehicle control, for two weeks. Each group consisted of 9 mice, and physiological signals such as EEG, EMG, and ECG were recorded continuously for 24 hours each week.

Results: Prior to drug administration, assessment revealed that APP/PSI mice, compared to WT mice, exhibited poorer performance in quiet sleep (QS) duration (similar to human Non-REM sleep), sleep disturbances, and heart rate variability (HRV) parameters, including RR interval (RR), total power (TP), high frequency (HF), and normalized low frequency (LF%). Single-dose administration of Lorazepam and Zolpidem increased QS duration while reducing paradoxical sleep (PS) duration in both APP/PSI and WT mice. Long-term drug use for two weeks showed that neither Lorazepam nor Zolpidem had a sustained effect on QS duration, and Lorazepam reduced PS duration in WT mice, while Zolpidem reduced both QS and PS durations in APP/PSI mice, along with an increase in awake time. Lorazepam significantly decreased HRV parameters (TP, HF, and LF%) during PS in APP/PSI mice after a single dose, whereas Zolpidem had a smaller impact on HRV. However, after two weeks of continuous use, Zolpidem exhibited significant effects, particularly on PS sleep in APP/PSI mice, approaching the impact observed with Lorazepam. Regardless of single or long-term administration, HRV in WT mice was less affected.

Conclusions: A single dose of Lorazepam and Zolpidem increased QS sleep in both WT and APP/PSI mice, but this effect disappeared after two weeks of continuous administration, showing a trend of worsening sleep quality. Lorazepam, whether administered acutely or chronically, affected HRV during sleep in APP/PSI mice, while Zolpidem had a minor impact with acute use, becoming more pronounced after two weeks of continuous administration, especially during PS sleep in APP/PSI mice.

Temporal effects of chronic intermittent hypoxia on genioglossus electromyography and ultrastructure in a rat OSA model

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Introduction: This study established a chronic intermittent hypoxia (CIH) rat model simulating obstructive sleep apnea (OSA) to evaluate the temporal impact of CIH on genioglossus (GG) electromyography (EMG), mitochondrial morphology, and neuromuscular junction (NMJ) integrity.

Materials and methods: Forty healthy male Sprague-Dawley rats (7-week-old) were randomized into three groups: normal control (NC, n=10), CIH (4-week hypoxia, n=15), and prolonged CIH (8-week hypoxia, n=15). CIH groups underwent daily 8-hour cycles of alternating hypoxia (90s at 7% O₂) and normoxia (90s at 21% O₂). Serial measurements of GG-EMG activity were performed at baseline and weekly intervals, complemented by repetitive nerve stimulation (RNS) assessments during weeks 4-8. Histopathological evaluation through H&E staining and transmission electron microscopy (TEM) quantified myofibrillar architecture and subcellular organelle integrity.

Results: In the CIH group, the GG-EMG showed a gradually increasing trend from the first week of CIH to the end of the fourth week ($P < 0.05$). And the multiple comparisons of GG-EMG between the groups during 1-4 weeks of CIH were statistically significant ($P < 0.05$). Meanwhile, the GG-EMG in most CIH prolonged groups showed a decreasing trend around 6 weeks of CIH. At 4 weeks of CIH, 15% of the rats showed decreased RNS high-frequency (20Hz) stimulation, and with the extension of hypoxia time, up to 8 weeks of CIH, 60% of the rats showed decreased RNS high-frequency stimulation ($P < 0.05$). Compared with the NC group, the CIH group had disordered arrangement of GG fibers, irregular and swollen fibers. TEM showed that the damage of GG muscle fibers and mitochondria was not obvious two weeks before CIH, and the damage of GG mitochondria was earlier than that of GG muscle fibers. With the prolongation of CIH exposure, the damage of GG muscle fibers and mitochondria was further aggravated.

Conclusions: CIH induces time-dependent GG neuromuscular dysfunction: Early compensatory EMG enhancement (≤ 4 weeks) transitions to decompensation (≥ 6 weeks). Mitochondrial vulnerability manifests earlier than myofibril damage. Progressive NMJ impairment correlates with RNS-detected abnormalities. These findings highlight critical phases of hypoxic adaptation in OSA-related upper airway dysfunction.

Beyond Sleep Duration: The Critical Role of Sleep Stages in Cardiovascular Disease Risk: Insights from two community-based cohort study

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Introduction:

While most studies have focused on conventional self-reported measures such as sleep duration and quality, emerging evidence highlights the physiological and clinical heterogeneity of sleep architecture. This study comprehensively investigated the linear and nonlinear associations between four polysomnography-derived sleep stages (N1, N2, N3/N4, REM) and long-term CVD incidence in two large independent cohort studies, focusing on effect modification by habitual sleep duration and obstructive sleep apnea (OSA) status, as well as the mediating pathways exploration.

Materials and methods: We recruited 5,804 middle-aged and elderly individuals from the Sleep Heart Health Study (SHHS) and 1,416 individuals from the Wisconsin Sleep Cohort (WSC). Sleep stages were assessed objectively using in-home polysomnography. Multivariable Cox regression models were employed to calculate hazard ratio (HR) for CVD, coronary heart disease (CHD), and stroke, adjusting for demographics and other sleep metrics. Subgroup analyses stratified by habitual sleep duration and OSA status were conducted. Mediation analysis was used to quantify the mediating effect of six modifiable cardiometabolic biomarkers.

Results: A total of 4,042 participants from SHHS and 600 participants from WSC were included in the analysis, with a mean follow-up of 11.0 (SD=2.7) and 8.8 (SD=2.6) years, respectively. During the follow-up time, 695 and 60 CVD cases occurred in SHHS and WSC. After adjustment for potential confounders, each standard deviation (SD) increase in N2% was associated with a 17% increase in CVD risk (adjusted hazard ratio (AHR)=1.17, 95% CI: 1.08–1.27), while each SD increase in REM% was associated with an 11% reduction in CVD risk (AHR=0.89, 95% CI: 0.83–0.96). Sleep duration shows a significant modification effect for REM% (P for interaction=0.008), while OSA status shows a significant modification effect for N2%, N3/4%, and REM% (All for interaction<0.05). Restricted cubic spline curves indicate U-shaped associations of N3/4% with CVDs (P for non-linearity<0.001). Mediation analysis shows BMI and SBP are the main mediators, accounting for 13.1% and 5.5% for N2% and 13.9% and 7.4% for REM% sleep.

Conclusions: Our study demonstrates that a higher proportion of N2 sleep and a lower proportion of REM sleep are associated with increased CVD risk, especially in individuals with short habitual sleep duration and non-OSA populations. The BMI reduction and SBP control for CVD prevention may warrant prioritization, targeting the adverse effects of unfavorable sleep stage proportion.

The Impact of Early Morning Training on Subjective and Objective Sleep Indices Among Male Collegiate Rowers in Japan

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Introduction: Sleep deprivation is a well-known factor that can impair cognitive, physical, and technical aspects of athletic performance. Despite increasing awareness, many athletes-especially those with early morning training schedules-are unable to secure sufficient and high-quality sleep. Although sleep patterns in athletes have been studied, little research exists on Japanese collegiate rowing athletes. Moreover, few studies have combined both subjective and objective methods to assess sleep. This study aimed to clarify the sleep characteristics and lifestyle habits of male collegiate rowing athletes in Japan, focusing on the impact of early morning training on sleep.

Materials and methods: This study included 11 male collegiate rowers from University A, observed over 7 consecutive days in June 2025. Participant characteristics were as follows: height 172.8 ± 5.1 cm, age 20.3 ± 0.9 years, weight 71.0 ± 4.3 kg, and BMI 23.8 ± 0.9 . Collected data included demographic factors (e.g., caffeine and alcohol consumption, nap habits), subjective sleep quality using the Japanese version Pittsburgh Sleep Quality Index (PSQI-J) and sleep diaries, objective sleep data from wrist-worn actigraphy, dietary records, and training schedules.

Results: During the 7-day observation period, participants had morning training starting at 5:00 a.m. on three weekdays, 6:30 a.m. on two weekend days, and two weekdays without morning training. 63.6% of athletes were classified as having poor subjective sleep quality ($5.5 < \text{PSQI-J}$ score; mean $\text{PSQI-J} = 6.9 \pm 2.6$).

Actigraphy data showed that Total Sleep Time (TST) was significantly shorter on nights before weekday morning training compared to nights before weekdays without morning training and nights before weekend ($p < 0.01$).

Furthermore, bedtime on nights before weekday morning training was more than two hours earlier than that on nights before weekday without morning training.

One-way ANOVA revealed significant differences across training categories in some objective sleep indices. TST and total minutes in bed on nights before weekday morning training were significantly shorter than those on nights before weekdays without morning training ($p < 0.01$) and on weekend nights ($p < 0.01$). The number of awakenings was also significantly smaller on nights before weekday morning training than that on nights before weekend training ($p = 0.014$). Subjective TST from sleep diaries showed similar results: significantly shorter on nights before weekday morning training than on the other nights ($p < 0.01$). TST was significantly shorter in objective data than in subjective sleep diary data ($p < 0.001$, 0.013 , and < 0.001 for weekday with morning practice, weekday without morning practice, and weekend, respectively). On the other hand, subjective sleep latency was significantly longer ($p = 0.003$), and sleep efficiency was significantly higher ($p = 0.017$) than those in objective measures respectively.

Conclusions: This study found that early morning training reduced TST and caused earlier bedtime among Japanese male collegiate rowers. Many athletes reported poor subjective sleep quality and discrepancies were observed between subjective and objective sleep assessments. These findings highlight the importance of using both types of measures when evaluating sleep and suggest that training schedules should be reviewed to support adequate sleep and recovery.

The Role of Endothelin Receptor Antagonist on Pulmonary and Systemic Hemodynamic Alteration in Chronic Intermittent Hypoxic Animal Model

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Introduction: Obstructive sleep apnea (OSA) has contributed critical risk factor for unfavorable cardiovascular outcome. On the basis of published evidence made the patients with OSA have potential to develop systemic and pulmonary vascular consequences, on the pathological basis of chronic intermittent hypoxia (CIH) is found to be major responsible. CIH is associated with the alteration of sympathetic nervous system activation and cardiovascular variability. Furthermore, the involvement of endothelin in CIH animal model was previously demonstrated and provide the rationale to examine the crucial effect of bosentan (endothelin receptor antagonist) on hemodynamic alteration in CIH animal model (OSA model).

Materials and methods: Eighteen Wistar rats were randomly divided into three groups (six rats in each group), including one control group and two CIH-groups. Rats in both CIH-groups were exposed to alternating cycles of normoxia (30 seconds at 21% O₂) and hypoxia (30 seconds at 10% O₂), repeated continuously for 8 h/day during the light phase for 14 days. Bosentan 100 mg/kg/day was given to one CIH-group throughout the study. At the end of study, hemodynamic and histopathological studies were completely performed.

Results: Hemodynamic assessment revealed a significant reduction in mean right ventricular systolic pressure (RVSP) in the bosentan-treated CIH group compared with both the control and untreated CIH groups ($p < 0.001$). In the untreated CIH group, mean heart rate (HR) was significantly higher than in the control and bosentan-treated CIH groups ($p = 0.011$). Bosentan treatment significantly reduced mean HR and increased heart rate variability compared with the other groups. Histopathology showed no significant difference in percent wall thickness of pulmonary arterioles among groups. However, neomuscularization of small pulmonary arterioles was significantly greater in the CIH group (muscularized arterioles per 50 total vessels; $p = 0.042$). Right ventricular hypertrophy

(RVH), expressed as the RV-to-(LV + septum) weight ratio, was also significantly higher in the CIH group compared with the other groups ($p = 0.015$).

Conclusions: Chronic intermittent hypoxia has been demonstrated to induce pulmonary and systemic hemodynamic alteration, recognized complication of OSA. The beneficial effect of endothelin receptor antagonist on systemic vascular parameters (heart rate and heart rate variability) and pulmonary vascular parameters (pulmonary arterial pressure, right ventricular hypertrophy and pulmonary vascular remodeling) suggest their potential as a therapeutic option for the cardiopulmonary consequences associated with OSA.

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Adiponectin ameliorates chronic intermittent hypoxia induced insulin resistance by modulating macrophage polarization in visceral white adipose tissue

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Introduction: Chronic intermittent hypoxia (CIH) caused by obstructive sleep apnea (OSA) is an independent risk factor for insulin resistance (IR) in non-obese individuals, yet its underlying mechanisms remain unclear. Visceral adipose tissue (vWAT) is a central driver of insulin resistance, and its dysfunction is closely associated with IR. Adiponectin (Ad), one of the key adipokines secreted by adipose tissue, playing a key role in metabolic regulation. This study investigated how IR was induced by CIH and ameliorated by Ad through modulating macrophage polarization in vWAT.

Materials and methods: This study successfully set up a lean murine CIH-IR model, C57BL/6J mice were divided into normoxic control (NC) group, CIH-exposed (CIH) group, and Ad-intervened CIH-exposed (CIH+Ad) group (10 mice / group) .

Glucose metabolic parameters were measured to evaluate systemic glucose homeostasis. Subsequently, epididymal white adipose tissue (eWAT) was collected for comprehensive analysis. Macrophage infiltration and polarization status were assessed using a combination of immunofluorescence (IF) staining, flow cytometry, and ELISA. In parallel, RNA sequencing (RNA-seq) was conducted to identify differentially expressed genes in the adipose tissue, followed by Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway enrichment analysis to elucidate significantly altered biological pathways. To further investigate the pathway, Western blot (WB) analysis was performed to examine key proteins in the insulin signaling pathway.

Results: It was found that the serum Ad level was significantly reduced in CIH group compared with the NC group, while accompanied by clearly increased Homeostatic Model Assessment of Insulin Resistance (HOMA-IR). When Ad was administered to CIH mice twice a week for 10 weeks, we observed reductions in HOMA-IR.

Transcriptomic sequencing identified the top 100 differentially expressed genes (DEGs) in eWAT among three groups. KEGG pathway enrichment analysis revealed significant alterations in the PI3K-AKT signaling pathway.

Western Blot (WB) analysis demonstrated that p-PI3K and p-AKT protein expression was downregulated in the eWAT of CIH group, and improved by Ad complementation.

The IF tests of F4/80 in mouse eWAT indicated that the proportion of F4/80-positive cells in the CIH group was significantly higher than that in the NC group and CIH+Ad group. Flow cytometry analysis revealed that the number of F4/80 and CD11b double-positive cells in the single-cell suspension of the stromal vascular fraction (SVF) from eWAT was remarkably increased in the CIH group compared to the NC group, while it was decreased after Ad intervention. Meanwhile, it showed a higher M1/M2 ratio in the CIH group compared to the NC group, while a reduced M1/M2 ratio was identified in the CIH+Ad group.

The levels of TNF- α , IL-6, and IL-1 β in the eWAT suspension of the CIH group were significantly higher compared to the NC group, whereas these inflammatory cytokines were lower in the CIH+Ad group.

Conclusions: CIH might impair insulin signaling pathways in mouse eWAT by promoting M1 polarization of eWAT macrophages, which is probably an important mechanism of CIH-induced insulin resistance. Furthermore, it is hypothesized that Ad alleviates CIH-induced insulin resistance in mice by regulating eWAT macrophage polarization and restoring insulin signaling pathways.

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CD169⁺ Macrophages Mediated Downregulation of Endothelial CX43 Expression Underlies Obstructive Sleep Apnea Related Cognitive Impairment

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Introduction: Objective: Obstructive sleep apnea (OSA) is an independent risk factor for cognitive impairment, with chronic intermittent hypoxia (CIH)-induced blood-brain barrier (BBB) injury being a critical mechanism. However, the specific pathways remain unclear. Macrophages may regulate BBB damage by influencing endothelial cell function. Macrophages exhibit heterogeneity, and tissue-resident macrophages in the brain (CD169⁺ macrophages) play a pivotal role in the early stages of disease. This study investigates the molecular mechanism by which CD169⁺ macrophages mediate OSA-related cognitive dysfunction through interactions with endothelial cells.

Materials and methods: Methods: A CD169⁺ macrophage-depleted mouse model was generated by intraperitoneal injection of diphtheria toxin (DT) into CD169-DTR mice. These mice were then subjected to chronic intermittent hypoxia stimulation to mimic OSA-related pathological conditions. Changes in blood-brain barrier permeability were quantitatively analyzed using two-photon fluorescence imaging. Cognitive dysfunction was assessed through behavioral tests, including the Morris Water Maze and Novel Object Recognition assays. Immunofluorescence staining was employed to determine the spatial localization of CD169⁺ macrophages in specific brain regions of CIH-exposed mice. Additionally, an *in vitro* co-culture system of CD169⁺ macrophages and endothelial cells was established to investigate the downstream molecular mechanisms mediated by the CX43-Claudin 5 pathway. Sequencing and pathway analyses were conducted to identify key gene expression changes and signaling cascades underlying macrophage-endothelial interactions.

Results: Results: CIH impaired learning and memory in mice and increased BBB permeability to 10-kDa small molecules. These effects were alleviated after CD169⁺ macrophage depletion. Under CIH, CD169⁺ macrophages proliferated in the hippocampal region and exacerbated neuroinflammation. The expression of chemokines CXCL3 and CXCL5, as well as inflammatory factors IFN β and IL-6, was significantly elevated in CD169⁺ macrophages. Sequencing results from the *in vitro* co-culture system revealed that CD169⁺ macrophages downregulated endothelial *Gja1* (encoding connexin CX43) expression. Pathway analysis showed that CX43 inhibited the expression of p38 α in the MAPK signaling pathway, thereby suppressing *Cldn5* gene transcription. This led to reduced levels of the tight junction protein Claudin 5, resulting in disrupted BBB integrity and increased permeability.

Conclusions: Conclusion: In summary, CIH promotes BBB injury and neuroinflammation, contributing to cognitive dysfunction via interactions between CD169⁺ macrophages and endothelial cells. CD169⁺ macrophages downregulate connexin CX43 expression in endothelial cells, suppress the MAPK pathway, and reduce Claudin 5 levels, ultimately increasing BBB permeability. Targeting CD169⁺ macrophages may provide a theoretical foundation for understanding the immunological mechanisms and therapeutic strategies for OSA-related cognitive impairment.

A cross-sectional observational study on sleep parameters in Indian males and females

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Introduction: Nearly all living organisms spend a fraction of their lives in a reversible, unconscious, coma-like state. It is still unclear why exactly organisms sleep but it is related to health and well-being. Disturbed sleep has negative effects on mental and physical health. Sleep has gender difference as well. The aim of the present study was to understand and compare sleep pattern of adult Indian males and females.

Materials and methods: A cross-sectional observational study was conducted on 301 participants presenting to a tertiary care centre in India. Participants were bystanders of patients representing the community and were not suffering from any known medical or psychiatric disorder. The participants were assessed on their socio-demographics, sleep profile and substance use profile with the help of Pittsburgh Sleep Quality Index (PSQI), Sleep

-50, Epworth Sleepiness Scale (ESS), sleep Hygeine and The Alcohol Smoking and Substance involvement screening test (ASSIST).

Results: 187 males and 114 females participated in the study. Nearly half of the sample was married and nearly 60% of the sample were employed. Most of the sample belong to urban locality and middle socio-economic status. Only five percent of the sample reported lifetime use of tobacco and three percent reported current tobacco use. No participant reported use of any other substance. There was no difference in socio-demographics in males and females except for employment status as most of the females in our study were housewives. The mean age of the total sample was 31.2 (10.2) years. The mean subjective sleep latency and total sleep time of the sample were 30 (15,60) minutes and 417.3 (70.7) minutes. Near about 30 percent of the sample has PSQI>5. Females reported more sleep disturbance (n=37,33%) than males (n=53,28.8%) in terms of total PSQI score>5, however it was not statistically significant. The median PSQI score of the sample was 4(2,6). The median sleep latency was found to be same for males and females (30(15,60) minutes vs30 (15,30) minutes). The median ESS scores for males was 3.5 (0,7) and for females was 4 (1,9). The mean total sleep latency for males and females was 417.2 (73.7) minutes and 418.4 (67.1) minutes respectively. Most of the patients had normal day time sleepiness (n=268,89%). Only three percent of the participants (n=8) reported moderate to severe day time sleepiness. No significant difference was observed between subjective sleep latency, subjective total sleep time, total PSQI scores and total ESS scores between male and female participants. A significant negative correlation was observed between marital status and sleep latency in males but not in females. A significant positive correlation was observed between total ESS scores and type of employment in males but not in females.

Conclusions: The general adult population in India has a sleep of around seven hours. Females had more sleep disturbance than males although difference was not statistically significant. Married males had earlier onset of sleep.

LncRNA NONMMUT009018 drives tumorigenesis and progression by modulating the miR-8100/Coll α 2/Thbs1 axis under intermittent hypoxia

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Introduction: This study aims to investigate the mechanism by which LncRNA NONMMUT009018 /miR-8100/Coll α 2/Thbs1 in promoting tumor proliferation, invasion, metastasis mediated by obstructive sleep apnea hypopnea syndrome (OSAHS)-related intermittent hypoxia (IH). To provide a theoretical foundation and potential therapeutic targets for the clinical prevention and treatment of OSAHS-associated tumors.

Materials and methods: Affymetrix Clariom D microarray and bioinformatics analysis, RIP, and dual-luciferase reporter assays were used to confirm binding interactions within the ceRNA network. DMOG was used to stabilize HIF-1 α expression in tumor cells, and C57BL/6J mouse tumor-bearing models were subjected to IH mimicking OSAHS for 28 days in vivo. Lentiviral and mimic transfection techniques were applied to modulate LncRNA NONMMUT009018 and miR-8100 expression in LLC and B16F10 melanoma cells, influencing downstream target genes *Coll α 2* and *Thbs1*. CCK-8, transwell chamber, scratch wound healing assays, in vivo imaging, tumor weight/volume measurements, HE staining, RT-qPCR, and western blot were conducted to explore the role of the LncRNA NONMMUT009018/miR-8100/*Coll α 2/Thbs1* regulatory axis in tumor growth, invasion and metastasis.

Results: Compared to the normoxic group, IH significantly upregulated the expression of LncRNA NONMMUT009018, *Coll α 2*, and *Thbs1* in tumor tissues ($P < 0.05$), while miR-8100 expression was markedly downregulated ($P < 0.01$). RIP, MS2/AGO2-RIP and dual-luciferase reporter assays demonstrated direct binding of HIF-1 α to LncRNA NONMMUT009018, LncRNA NONMMUT009018 to miR-8100, and miR-8100 to *Coll α 2* and *Thbs1*. Knockdown of LncRNA NONMMUT009018 and overexpression of miR-8100 significantly reduced *Coll α 2* and *Thbs1* mRNA expression by RT-qPCR ($P < 0.01$). CCK-8 assays, transwell invasion and migration assays, scratch wound healing experiment, and EMT-related marker proteins E-cadherin, N-cadherin and MMP9 revealed that knockdown of LncRNA NONMMUT009018 or overexpression of miR-8100 can significantly inhibit HIF-1 α -mediated proliferation, invasion and metastasis of LLC and B16F10 tumor cells. However, overexpressing LncRNA NONMMUT009018 or inhibiting miR-8100 restored proliferation, invasion, migration of tumor cells. Similar phenotypic characteristics were found in IH-mediated tumor tissues.

Conclusions: This study established the LncRNA NONMMUT009018/miR-8100/*Coll α 2/Thbs1* ceRNA network driving IH-associated tumor progression. HIF-1 α activation upregulated LncRNA NONMMUT009018, which

sponged miR-8100 to derepress *Colla2/Thbs1*, promoting tumor proliferation, invasion, migration, and EMT. Targeting this axis may offer novel strategies for OSAHS-related cancer prevention and therapy.

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Investigating the impact of night-duty on sleep architecture and mental well-being in the security personnel: A quasi-experimental study

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Introduction:

In a world that never sleeps, the role of security personnel is vital in maintaining order, safety, and peace. While the responsibilities of security professionals are diverse and multifaceted, one aspect of their job that often remains hidden in the darkness is the relentless demand for night-duty shifts. This research delves into the often-overlooked consequences of night-duty shifts on security personnel. The study aims to investigate impact of night shifts on the physical health, psychological well-being of security professionals. By exploring the disruptions to sleep architecture, such as stages of sleep (N2), sleep efficiency, and the potential mental health implications like mental well-being, the research seeks to enhance understanding of the physiological changes in these dedicated professionals.

Materials and methods:

Using a novel quasi-experimental design approach, the study was conducted in AIIMS Bibinagar. Polysomnography (PSG) was used to monitor and analyze the sleep patterns of security personnel on night-duty shifts compared to off-duty periods. Additionally, mental well-being was assessed through validated mini state mental examination scores as psychological questionnaire.

Results:

PSG parameters like sleep time have significantly decreased, sleep efficiency along with duration of sleep stages of N2 has significantly decreased. There is a notable rise in systolic blood pressure which can be correlated to a decrease in the sleep's efficiency and total sleep time. These changes attributed to physiological changes due to sleep deprivation for the security personnel post night-duty shifts.

Conclusions:

In conclusion, the reviewed literature and our current study clearly demonstrates the detrimental impact of night-duty on sleep architecture and mental well-being among security personnel. This study aims to provide the necessary evidence to develop and implement interventions that ultimately enhancing both personal and public safety.

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Behavior, Cognition and Dreaming

Effects of Binaural Beats on Sleep Initiation and Cognitive Control: A Neurobehavioral Study

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Introduction:

Binaural beat (BB) stimulation is known to modulate electroencephalographic activity by brain entrainment, but only a few studies have established whether BB can affect the sleep onset process and daytime executive

functioning. Sleep has a particularly detrimental effect on executive functioning involving response inhibition (RI), which plays a central role in regulating and modulating behavioral responses (Schiller et al., 2014). By prioritizing the enhancement of sleep quality, we can effectively enhance RI. In this study, BB stimulation as a sleep intervention was administered for two weeks in which the participant was exposed to 20 minutes of 4-Hz binaural beats before sleep. The primary aim of this study was to investigate the effects of BB stimulation on both sleep parameters and RI, assessed at electrophysiological and behavioral levels.

Materials and methods:

The study used a cross-over experimental design, with a sample of 20 participants (age 28.37 ± 2.06 years). Each participant underwent three nights consisting of an adaptation night (T0), a baseline night (pre-intervention without BB) (T1), and a post-intervention night (after two weeks of BB intervention) (T2). Sleep was analyzed using polysomnography on T1 and T2. To evaluate cortical arousal during wakefulness, 5-minute resting-state EEG recordings were conducted on T1 and on T2, before sleep. RI was measured using the Go/NoGo task, programmed in PsychoPy (version 3.0.2). The task was designed in a way that allowed us to study the dynamic RI using mouse tracking to differentiate between the aware and unaware errors.

Results:

BB intervention significantly reduced sleep latency and cortical arousal, as reflected by decreased beta and gamma power in resting-state EEG in post-intervention as compared to the baseline condition. The participants demonstrated improved RI following BB intervention in terms of increased response times and correct Go responses and a reduction in unaware commission errors and omission errors.

Conclusions:

These findings suggest that BB intervention effectively attenuates high-frequency brain activity associated with alertness and cognitive processing. The observed reduction in beta power implies a shift toward a more relaxed, internally directed neural state. Similarly, the decrease in gamma power may indicate reduced cognitive load or internal information processing demands. At the behavioral level, improvements on the Go/NoGo task suggest enhanced RI following BB intervention. Participants exhibited a reduction in unaware commission errors following the BB intervention compared to the baseline condition, indicating increased attention and improved monitoring of inhibitory control processes. Taken together, the results support the notion that BB may promote better sleep quality, which in turn facilitates improved response inhibition. Thus, BB stimulation appears to offer dual benefits—enhancing both sleep onset time and daytime executive functioning, particularly in the domain of cognitive control.

Cognitive Impairment and Its Impact on Gait Parameters and Physical Function in the Elderly

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Introduction: Cognitive impairment is a major issue in aging societies, as it significantly reduces quality of life and independence. It is closely associated with gait disturbances and an increased risk of falls. Subtle changes in gait patterns can serve as early indicators of cognitive decline, highlighting the importance of preventive approaches through physical function assessment. Therefore, this study aimed to analyze differences in gait characteristics and physical function according to cognitive status based on gait data.

Materials and methods: A total of 65 participants from the KLOSDOM Gangwon Living Lab at Yonsei University Wonju Severance Christian Hospital were included. Cognitive function was assessed using the Short Blessed Test (SBT), which evaluates memory, concentration, orientation, and ability to perform activities of daily living. Gait and physical performance were evaluated using the N Steps Walking Test (NSWT), Timed Up and Go Test (TUGT), Five Times Sit to Stand Test (FTSST), and Single Leg Stance Test (SLST). Participants were divided into two groups based on SBT scores: cognitively normal ($SBT \leq 8$; $n = 36$; mean age = 70.7 ± 5.7 years; male: 41.7%) and cognitively impaired ($SBT \geq 9$; $n = 19$; mean age = 74.4 ± 6.2 years; male: 47.4%).

Results: The analysis revealed that the cognitively normal group showed significantly higher values in L_Toe (%) from NSWT_L (left side), R_Final Score from NSWT_R (right side), and Total Score of the SPPB ($p < 0.05$). Conversely, they demonstrated significantly lower values in L_Mid (%) from NSWT_L, R_Heel (%) from NSWT_R, and time (seconds) required to complete the TUGT and FTSST ($p < 0.05$), indicating overall superior gait and physical performance.

Conclusions: These findings suggest that cognitive impairment is closely related to changes in gait characteristics. This study provides foundational evidence for the use of physical function and gait analysis as a potential tool for early detection and prevention of cognitive decline in older adults.

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Napping and cognition in older adults-context matters: reasons for napping, nap timing, and overall sleep health

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Introduction: While midday napping in younger persons benefits cognition, napping in older persons tends to be associated with poorer cognitive outcomes, leading to the view that napping may be 'symptom' of age-related degradation in sleep neurobiology. However, whether naps are maladaptive or productive for older adults may depend on the reason behind the nap and must be understood in the context of overall sleep health as these may underlie negative associations. To rule this out, we examined associations between napping and cognition in a group of older adults with relatively good sleep health (7-10h average TIB, having no trouble falling asleep and/or staying asleep for ³ 5 nights/week, no sleep disorders).

Materials and methods: Older adult healthy sleepers ($n = 393$) aged between 67-80 years (mean age: 73.8 years, SD: 2.7 years) completed neurocognitive testing and questionnaires probing nap behaviour. Nap frequency (no naps, 1-2 naps/week, 3-6 naps/week, daily naps), nap duration (≤ 30 mins, 31-60 mins, > 60 mins), nap timing (morning, afternoon, evening), nap intention (unintentional, intentional) and reasons for napping (slept poorly the night before, felt tired, boredom, habit) were assessed. Linear regression models were used to determine the effects of nap characteristics on cognitive domains (global cognition, speed of processing, executive function, attention, language, verbal, visual, and visual-spatial memory). Models adjusted for age, gender, years of education, smoking, high blood pressure, diabetes, and history of cardiovascular events and organ disease.

Results: Napping to counter tiredness was associated with better verbal memory ($B = 2.47$, $CI_{95} = 0.29-4.66$) and language ($B = 2.08$, $CI_{95} = 0.07-4.09$) compared to napping because one slept poorly the night before. Napping in the afternoon was associated with better visuospatial memory compared to napping in the morning ($B = -5.77$, $CI_{95} = -10.55--0.99$). Napping daily was also associated with better verbal memory ($B = 0.58$, $CI_{95} = 0.00-1.17$) and language ($B = 0.64$, $CI_{95} = 0.10-1.17$) compared to not napping at all, but with relatively small effects.

Conclusions: In older adults with 'intact' sleep health, napping in the afternoon in response to tiredness cues is associated with better memory performance. Our findings suggest that whether or not napping is a 'symptom' or a 'strategy' for better daytime function may depend on its use patterns and the overall sleep health of an older person.

Investigating Task Switching Performance in a 31h Total Sleep Deprivation Protocol

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Introduction: In 24/7 operational environments, managing multiple complex tasks in rapid succession can be cognitively demanding. Managing multiple tasks requires ongoing attention, often requiring the operator to shift their attention between tasks, a phenomenon called task switching. Under conditions of extended wakefulness, the added workload caused by task switching, can slow cognitive processing, impair attention, and increase error rates. This study examined the effects of 31 hours of sustained wakefulness on task-switching performance between a visual and working memory task and the cost of switching on overall performance.

Materials and methods: Twenty-six healthy participants completed a 31-hour sustained wakefulness protocol in a controlled laboratory environment, with testing sessions across the wake period at 11:00h, 17:00h, 23:00h, 05:00h, and 11:00h. Participants were presented with a switching task, where a spatial-rotation (manikin) task was presented on the left and a math task on the right. An arrow indicated which task participants had to respond. Performance measures included mean reaction time (RT), accuracy (proportion correct), and throughput (a measure of speed-accuracy trade-off), analysed across four transition types: math-to-math, manikin-to-manikin, manikin-to-math, and math-to-manikin. Mixed-effects models were used to analyse changes in mean RT, accuracy, and throughput separately as a function of transition type and hours of wakefulness, with random intercepts for participants.

Results: Hours of wake had a significant main effect on mean RT ($p < .001$), throughput ($p < .001$) and accuracy ($p < .001$) with poorest performance at 05:00h respectively. Significant main effects of transition type on RT ($p < .001$) and throughput ($p < .001$) were observed but not for accuracy ($p = .972$). Transitioning from 'different', i.e., manikin-to-math, to 'same', i.e., manikin-to-manikin, there was a reduction in mean RT compared to 'same', i.e., manikin-to-manikin transition types ($p < .001$), no interaction effects were found.

Conclusions: Impairments due to switching were dependent on the preceding and proceeding task. When transitioning between two different tasks, there was a speed/accuracy trade-off observed with participants slowing down to maintain accuracy. To improve/maintain switching performance during around-the-clock operations, it is vital to be aware of the cost of switching multiple different tasks where possible, identify strategies within teams to reduce the number of switches completed by individuals. Future studies should look at human-centred interfaces which are designed to strategically implement cuing in a task that can help mitigate cognitive demands and maintain attentional focus during fatigue.

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Association of sleep trajectories and depressive symptoms among rural-dwelling older adults

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Introduction: The relationship between sleep duration trajectories and depressive symptoms in China remains inconclusive. We aimed to explore this relationship over 9 years among rural-dwelling older adults in China.

Materials and methods: We used prospective data from participants of the MIND-China study. Sleep durations were measured at 3 study visits between 2014 and 2021 using the Pittsburgh Sleep Quality Index. We used group-based trajectory modeling to identify four sleep trajectories: "Normal stable," "Short stable," "Decreasing," and "Extremely short stable." Depressive symptoms were measured using 15-item Geriatric Depression Scale in 2023.

Linear regression was used to relate sleep trajectories with depressive symptoms, and stratified analysis was conducted by physical activity, and hypertension.

Results: The mean [SD] baseline age was 68.60 [3.49], and 59.8% were female. Compared with having “Normal stable,” having “Decreasing” (95% CI=0.06, 1.14) or “Extremely short stable” (95% CI=0.03, 1.46) sleep trajectories were associated with an increased likelihood of depressive symptoms. Compared to those who do not participate in physical activity, having “Decreasing” (95% CI=0.45, 1.91) sleep trajectories among participants who engage in physical activity were associated with an increased likelihood of depressive symptoms. Compared to those without hypertension, having “Decreasing” (95% CI=0.17, 1.47) or “Extremely short stable” (95% CI=0.44, 2.20) sleep trajectories in participants with hypertension were associated with an increased likelihood of depressive symptoms.

Conclusions: Prolonged exposure to decreasing and extremely short sleep duration may result in worse depressive symptoms. This association differed by physical activity, and hypertension.

The role of sleep-related dysfunctional beliefs in the effect of cognitive behavioral therapy on the severity of insomnia

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Introduction: Dysfunctional beliefs are an important characteristic of patients with chronic insomnia.

Unreasonable sleep beliefs will aggravate the severity of insomnia and affect the normal life of patients. Cognitive behavioral therapy for Insomnia (CBT-I) is currently the first-line treatment for insomnia in the world. However, there is a lack of specific research on the role of changes in sleep-related dysfunctional beliefs in the treatment process. Therefore, the purpose of this study was to explore the changes of dysfunctional beliefs in different dimensions and their effects on the severity of insomnia during CBT-I.

Materials and methods: 120 patients with insomnia were included. They were randomly assigned to CBT-I group (n=30), cognitive therapy for insomnia group (CT-I, n=30), behavioral therapy for insomnia group (BT-I, n=30), and conventional treatment group (TAU, n=30). Patients in all three treatment groups received treatment once a week for eight weeks. The Insomnia Severity Index (ISI) and the Brief Version of Dysfunctional Beliefs and Attitudes about Sleep (DBAS-16) were used to assess changes in insomnia severity and sleep-related dysfunctional beliefs at baseline, 4th week, and 8th week, respectively. The parallel process latent growth curve model (PP-LGCM) was used to analyze the mediating role of dysfunctional beliefs in the process of cognitive and behavioral techniques to improve sleep quality. The Cross-Lagged Panel Model (CLPM) was used to explore the interaction between dysfunctional beliefs and insomnia severity over time.

Results: CBT-I, CT-I, BT-I can effectively improve the severity of insomnia and reduce sleep-related dysfunction beliefs ($p<0.001$). Sleep-related dysfunctional beliefs fully mediated the effect of CT-I on insomnia severity and partially mediated the effect of CBT-I. However, the mediating effect of sleep-related dysfunctional beliefs was not found in the BT-I group. In CBT-I group, insomnia severity at week 4 significantly predicted the scores of perceived consequences of insomnia ($p=0.011$) and scores in the medication dimension ($p=0.020$) at week 8. In CT-I group, the baseline medication dimension scores significantly predicted the severity of insomnia in 4th week ($p=0.015$), which can significantly predict the total score of dysfunctional beliefs ($p=0.002$) and the scores of perceived consequences of insomnia ($p<0.001$) at 8th week. While in BT-I group, the severity of insomnia in 4th week can predict the total score of dysfunctional beliefs ($p=0.003$) and the scores of medication dimension ($p<0.001$) in 8th week.

Conclusions: This study investigated the relationship between sleep-related dysfunctional beliefs and the severity of insomnia in different treatment methods. The results showed that sleep-related dysfunctional beliefs mediated the effects of CBT-I and CT-I on the severity of insomnia. It was also found that the severity of insomnia can predict changes in sleep-related dysfunctional beliefs.

The Interplay of Sleep and Cognition: Amnestic MCI and Severe OSA in the Elderly

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Introduction: 79-year-old gentleman who sought medical attention due to concerns about failing memory. Although retired, he remains active in business. His family has observed that his immediate memory is poor, leading to frequent repetitions of events and conversations. Additionally, he sometimes shows confusion with dates and the context of events. Despite being aware of these issues, he attributes them to aging, saying, “what can you expect after 75?” He weighs 90 kgs, has a history of a sedentary lifestyle in recent years but was active during middle age. He describes himself as a “light sleeper” with frequent nocturnal awakenings and has a long-standing history of snoring. Despite not feeling refreshed upon waking, he believes his sleep is acceptable, although he is more concerned about his forgetfulness.

Materials and methods: Plan of Assessment:

1. Biochemistry, MRI Brain & Neuropsychological assessment
2. Indication for Sleep study: His history of long-standing snoring, frequent nocturnal awakenings, and non-restorative sleep, along with his ability to nod off easily when not engaged in goal-directed tasks, strongly suggest a possible sleep disorder.

Results: Sleep Study results indicate several important findings:

1. Sleep efficiency was 95%
2. Sleep Stage Percentages -
 - N1 - 23.7%
 - N2 - 57.1%
 - N3 - 11.4% (Normal N3 sleep 15-20%)
 - R - 7.8% (Normal R sleep 20-25%)
3. Obstructive apnea - 331, Hypopnea - 141
4. Apnea Hypopnea index (AHI) - 59events/hr. An AHI of 59/hour is classified as severe obstructive sleep apnea.
5. The average oxygen saturation was 96% & lowest 78%
6. He spent 5minutes of his sleep time below 90% of SpO2
7. Total Arousals - 257
 - Respiratory arousals - 129
 - PLMS - 76
 - Spontaneous arousals - 52

Interpretation: Severe obstructive sleep apnea with secondary poor fractionation of deep sleep

Conclusions: Cognition and Sleep:

1. Deep Sleep (N3) - Slow-wave sleep (SWS), is essential for consolidating declarative memories (e.g., facts and events). During this phase, the brain replays and strengthens memories from the day, integrating them into long-term storage.
2. REM Sleep is crucial for procedural memory consolidation (e.g., motor skills) and emotional regulation.
3. Glymphatic System - It is a waste clearance system in the brain that removes metabolic waste products, including amyloid-beta and tau proteins, which are associated with neurodegenerative diseases. This system is most active during sleep, especially during deep sleep (N3)
4. Autophagy activation - REM sleep has been shown to be important for neuronal autophagy, aiding in the removal of cellular debris and damaged proteins, thereby supporting overall brain health
5. OSA leads to repeated interruptions in sleep which can impair the glymphatic system's ability to clear waste products effectively, potentially exacerbating cognitive decline and increasing the risk of neurodegenerative diseases.
6. Ensuring good sleep health and addressing sleep disorders like OSA are vital steps in supporting cognitive function and reducing dementia risk

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Exacerbated Negative Impact on Sleep, Mood, Cognition and Daytime Functions in Comorbid Frequent Nightmares and Insomnia

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Introduction: Insomnia often co-occurs with frequent nightmares. While previous studies have examined the independent effects of insomnia and nightmares, few studies have investigated the impact of the comorbidity of these conditions. This study aims to determine whether frequent nightmares exacerbate impairments in sleep, mood, cognition, and daytime functioning in individuals experiencing insomnia, compared to those with insomnia alone.

Materials and methods: This is a cross-sectional study recruited adults aged 18 to 70 with insomnia symptoms (Insomnia severity index, ISI $\geq$ 10) in Hong Kong. Participants completed online questionnaires on sleep and mood, clinical interviews (The Structural Clinical Interview for DSM-5 Disorders, SCID-V) for psychiatric diagnoses, and mobile cognitive tests assessing attention (The Psychomotor Vigilance Test, PVT), risk-taking propensity (Balloon Analogue Risk Task, BART), inhibition control (Go/No-go Task) and working memory (N-back Task). Frequent nightmares were defined as occurring more than once a week over the past three months (Nightmare Frequency Questionnaire). Individuals with post-traumatic disorder (PTSD, identified by SCID-V) were excluded. Group comparisons (insomnia with vs without nightmares) were analysed using Pearson's chi-square test and Wilcoxon rank-sum test. Associations between frequent nightmares and outcomes were further examined using linear and logistic regression.

Results: A total of 230 participants (median age 43 years; 75.7% female) with complete clinical interview, questionnaire, and cognitive task data were included. Individuals with comorbid frequent nightmares (N=53, median age 37 years; 77% female) exhibited greater insomnia severity, pre-sleep arousal, mood disturbances, suicidal ideation, somatic symptoms, and less satisfaction with surrounding environment compared to those with insomnia alone. After adjusting for covariates (age, gender, income, psychiatric diagnoses and insomnia severity), frequent nightmares remained significantly associated with higher depressive severity ($\beta = 1.55, p < .05$), rumination ($\beta = 4.16, p < .05$), suicidal ideation (OR = 2.34, $p < .05$), attention deficits (longer PVT reaction time: $\beta = 55.63, p < .01$; higher Go/No-go omission rate: $\beta = 4.86, p < .05$), and somatic symptoms ($\beta = 1.72, p < .01$). Adjusting further for depressive and anxiety symptoms, frequent nightmares still demonstrated significant associations with greater pre-sleep cognitive arousal ($\beta = 1.84, p < .05$), reflective rumination ($\beta = 0.86, p < .05$), attention deficits (longer reaction time in PVT: $\beta = 55.05, p < .01$; higher omission rate in Go/No-go Task: $\beta = 5.50, p < .01$), and somatic symptoms ($\beta = 1.44, p < .05$).

Conclusions: Frequent nightmares comorbid with insomnia exacerbated pre-sleep arousal, reflective rumination, attention impairment, and somatic symptoms beyond the impact of insomnia alone, independent of insomnia severity and mood disturbances. These findings suggest that intervention targeting both nightmares and insomnia should be incorporated into management of comorbid insomnia and nightmares.

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Factors and Issues Affecting Sleep Quality in Elderly Hong Kong Residents: A Cross-Sectional Survey, 2024-2025

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Introduction: Sleep is a vital component of health and well-being. Older adults in high living density living environments may experience disproportionately higher levels of sleep disturbances, reducing the quality of sleep. This study investigates the factors associated with poor sleep quality among Hong Kong adults aged 65 and older, with the aim of identifying modifiable targets for evidence-based interventions.

Materials and methods: Between December 2024 to April 2025, a cross-sectional random telephone survey was conducted on community-dwelling older adults ($n=723$). The Pittsburgh Sleep Quality Index (PSQI) was used to assess overall sleep quality, alongside questions regarding the sleep environment, substance use, and pre-sleep cognitive activity. Multiple linear regression models, adjusted for age, gender, education, and income, were applied to identify predictors of PSQI scores.

Results: Among the older age participants (59.9% female), respondents reported an average of 29 minutes to fall asleep, resulting in a mean total sleep duration of 6.45 hours/night ($SD=1.34$). Of the sample, 24.9% reported less than 6 hours of sleep/night. Significant sleep impairments were observed, with 71.1% reporting difficulty initiating sleep and 93.1% struggling with sleep maintenance. Regression analysis identified three key predictors of PSQI scores: nocturia ($\beta=0.988$, $p<0.001$), pre-sleep cognitive arousal ($\beta=3.223$, $p=0.001$), and trends indicating that substance use, specifically smoking ($\beta=0.258$, $p=0.26$), was associated with reduced sleep efficiency. Breathing difficulties, loud cough/snoring, feeling cold/hot, bad dreams and pain were not significantly associated with PSQI scores.

Conclusions: This study highlights the complex interplay of physiological, psychological, and behavioral factors contributing to sleep deficits among older adults in Hong Kong. Addressing these determinants could alleviate the healthcare burden associated with geriatric sleep disorders and enhance the quality of life for this vulnerable population.

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Linking Childhood Trauma to Suicidal Ideation through Nightmares in Youth

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Introduction: Childhood trauma, encompassing experiences such as emotional abuse and neglect, often leaves profound and lasting effects. One of the lesser-recognized consequences of such trauma is its association with frequent nightmares, which may, in turn, contribute to the development of suicidal ideation. This study seeks to examine the relationship between childhood trauma, nightmares, and suicidal ideation, focusing on the impact of both single and multiple types of trauma on frequent nightmares. Additionally, the study aims to explore the mediating role of nightmares in the association between trauma and suicidal ideation and to assess the possible moderating effect of sex on these relationships.

Materials and methods: Youth aged 12–25 years ($n=6145$) participated in an online survey assessing childhood trauma, nightmares, and suicidal ideation. Logistic regression analyses were employed to investigate the relationship between distinct types of childhood trauma and frequent nightmares. Cumulative scores and latent class analyses were applied to identify multiple childhood traumas. Furthermore, moderated mediation analyses were conducted, considering childhood trauma as the independent variable, suicidal ideation as the dependent variable, nightmare frequency as the mediator, and sex as the moderator.

Results: After controlling for a range of covariates, emotional abuse ($OR: 1.45$, $95\%CI: 1.23–1.87$) and emotional neglect ($OR: 1.19$, $95\%CI: 1.03–1.37$) were found to be significantly associated with an increased likelihood of experiencing frequent nightmares. A dose-response relationship was observed, where a higher number of trauma types was linked to a greater likelihood of experiencing nightmares. Latent class analysis identified three trauma patterns: “low abuse, low neglect (62.4%, $n = 3837$)”, “low abuse, high neglect (34.0%, $n = 2089$)”, and “high abuse, high neglect (3.6%, $n = 219$).” The latter two patterns were associated with an increased likelihood of nightmares by 26% and 47%, respectively, compared to the first pattern. Furthermore, nightmare frequency was found to significantly mediate the relationship between childhood trauma and suicidal ideation, accounting for approximately 4.11% of the total effect, even after adjusting for relevant covariates. However, no significant moderating effect of

sex was observed, suggesting that both male and female individuals may be equally influenced by trauma-related pathways.

Conclusions: The findings of this study contribute to a deeper understanding of the heterogeneity in childhood trauma and its potential implications for the occurrence of nightmares. They suggest that nightmares may not only reflect the psychological impact of trauma but also serve as a key factor in the development of suicidal ideation. It is possible that interventions targeting nightmares could be effective in mitigating suicide risk in traumatized youth. However, further research is warranted to explore the generalizability of these findings and to evaluate the efficacy of interventions designed to address nightmares in this population.

Chronotype and time-of-day in inhibitory control performance among healthy adults – a randomised cross-over trial

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Introduction: Chronotype reflects stable individual differences in the preferred timing of behavioural activity, productivity, and sleep. Morning-types tend to function best earlier in the day, whereas evening-types perform better later. Prior research shows that cognitive performance – particularly executive functions such as working memory and attention – varies by chronotype and time-of-day; however, their effects on distinct components of inhibitory control remain unclear. Inhibitory control is widely studied using the Go/No-Go Task (GNG) and Stop-Signal Task (SST), which assess action restraint (withholding a prepotent response) and action cancellation (halting an ongoing response), respectively. This study investigated whether chronotype and time-of-day modulate GNG and SST performance in healthy adults.

Materials and methods: This randomised crossover study recruited adults aged 18-30 years from Melbourne, Australia, who self-identified as either morning- or evening-types. Participants completed demographic questionnaires including the Pittsburgh Sleep Quality Index and the Munich Chronotype Questionnaire. Sleep was monitored via actigraphy and sleep diaries prior to testing. Each participant completed two laboratory sessions in randomised counterbalanced order (stratified by chronotype and gender): one in the morning (08:00-10:00h) and one in the afternoon/evening (16:00-18:00h). At each session, participants completed subjective sleepiness ratings, the Psychomotor Vigilance Task (PVT), GNG and SST. Commission error rates and stop-signal reaction times were the primary outcomes. Linear mixed models assessed effects of chronotype, time-of-day and covariates (subjective sleepiness and objective vigilance), with Bayesian equivalents used to calculate likelihood ratios. This study was approved by the Human Research Ethics Committee (2022-333).

Results: The final sample included 59 healthy adults (55.9% female; mean age: 22.1 ± 3.77 years), with 29 identified as morning-types and 30 as evening-types. At baseline, groups differed significantly in sleep-corrected mid-sleep timing (mean $\pm$ SD: morning-types = 2.98 (0.96); evening-types = 5.76 (1.14); $p < .001$), but not in age, gender, or sleep quality. No significant effects of chronotype ($BF_{01} = 2.717$), time-of-day ($BF_{01} = 3.742$) or their interaction ($BF_{01} = 34.623$) were observed for GNG performance. In contrast, SST performance showed a significant main effect of chronotype ($BF_{10} = 1.645$), with evening-types exhibiting longer SSRTs than morning-types, independent of time-of-day. No significant effects of time-of-day ($BF_{01} = 2.999$) or interaction ($BF_{01} = 6.078$) were found for SST performance. Subjective sleepiness and objective vigilance were not significant covariates for either task.

Conclusions: These findings highlight the importance of considering the multifaceted nature of inhibitory control, suggesting its subcomponents are differentially sensitive to chronotype. Evening-types may experience greater difficulty cancelling initiated responses, regardless of time-of-day. This work underscores the significance of accounting for subjective and objective alertness in contexts where inhibitory control is critical. Future work should integrate biological circadian markers and neurophysiological measures to provide a more comprehensive understanding of individual variability in inhibitory control across the day.

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Associations between multidimensional sleep health and cognitive continuum among Chinese older adults: a population-based study

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Introduction: To explore the relationship between multidimensional sleep health (MDSH) and cognitive continuum.

Materials and methods: This population-based study included 5272 participants living in rural China. Sleep parameters were measured using the Pittsburgh Sleep Quality Index (PSQI). The multidimensional sleep health (MDSH) score (ranges 0-5) was generated based on satisfaction, alertness, timing, efficiency, and duration, with a higher score indicating healthier sleep. Subjective cognitive decline (SCD) was assessed using three questions regarding memory problems. Mild cognitive impairment (MCI) and dementia were diagnosed according to the internationally recognized criteria. Linear regression analysis examined the correlation between MDSH and cognitive domains. Logistic regression models examined the relationship between MDSH and SCD, MCI and its subtypes, all-cause dementia, and AD. We also conducted stratified analyses based on APOE genotype.

Results: Of all participants, 2913 (55.3%) were diagnosed with SCD, 1310 (24.8%) with MCI, and 181 (3.4%) with all-cause dementia, including 117 (2.2%) with Alzheimer's disease (AD). As a continuous variable, MDSH was positively associated with memory (multivariate-adjusted β coefficient = 0.05, 95% confidence interval [CI] = 0.03 to 0.07), language (0.03; 0.01 to 0.05), attention (0.04; 0.02 to 0.06), executive function (0.02; 0.004 to 0.04), and the global cognitive function (0.04; 0.02 to 0.05). Each unit increase in MDSH was associated with an decrease in SCD (multivariate-adjusted odds ratio = 0.75, 95% CI = 0.69 to 0.82), MCI ((0.90; 0.85 to 0.96), amnesic mild cognitive impairment (aMCI) (0.88; 0.83 to 0.94), all-cause dementia (0.81; 0.71-0.93), and AD (0.76; 0.64 to 0.89), and similar associations were observed when MDSH was used as a categorical variable (0-1/2-3/4-5). In addition, we found that MDSH (as a continuous variable) interacted with SCD, all-cause dementia, and AD in the APOE genotype (p for interactions = 0.018, <0.001, and 0.018, respectively).

Conclusions: MDSH was significantly associated with the cognitive continuum. And the effects vary by APOE genotype.

Personality, cognitive performance and perceived workload in young adults with unmanaged sleep disorders after 20 hours of extended wake

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Introduction: There are inter-individual differences in the effects of extended wake on cognitive performance, including a potentially modifying influence of personality trait dimensions. Greater extraversion has previously been associated with poorer psychomotor vigilance performance during extended wake in young adults with healthy sleep.

Performance may also be worsened in individuals with sleep disorders. Up to 20% of young adults have sleep disorders that require clinical investigation and up to 80% of these disorders are undiagnosed. Yet, young adults with sleep disorders are poorly represented in existing studies of extended wake. The aim of this study was to determine associations between sleep disorders, cognitive performance and perceived mental workload after extended wake in young adults, and explore whether personality dimensions modify any observed associations.

Materials and methods: Data from 24 young adults aged 18 – 32 years (Mean(SD) = 25.0(3.9), 42% female) were included. Participants first completed a Structured Clinical Interview (SCISD) and NEO Personality Inventory (NEO-PI-R) with a trained psychologist. All participants included in analyses met diagnostic criteria for insomnia ($n=14$) or delayed sleep wake phase disorder (DSWPD; $n=10$) according to DSM-5-TR criteria but had no prior diagnosis or treatment for a sleep disorder at baseline.

Participants underwent a diagnostic polysomnography with sleep onset and offset times aligned with their habitual

bedtime before commencing extended wake. The psychomotor vigilance task (PVT) was performed at 2 hours and 20 hours after wake. Reciprocal reaction time (RTT; 1/ mean reaction time) and number of lapses in attention were used to determine changes in performance and were the primary performance outcomes. The NASA Task Load Index (NASA-TLX) assessed subjective workload immediately after each PVT (performance, effort, frustration, and mental, physical, and temporal demand) on a 0-100 scale. Data were analysed in R Studio, using a combination of linear regression and mixed effects regression in the *lmer* package.

Results: We observed the anticipated effect of extended wake on PVT metrics, with reduced RRT (reflecting poorer performance, $3.02(0.56)$ v $2.22(0.77)$, $p<0.001$), and increased PVT lapses ($3(7)$ v $15(13)$, $p<0.001$). All indicators of subjective mental workload on the NASA-TLX were elevated at 20hours wake compared to 2hours (all $p<0.05$), with the exception of temporal demand ($p=0.42$).

Time by personality dimension interactions on PVT performance were not significant (all $p>.05$), suggesting cognitive performance was not modified by personality dimensions. However, extraversion modified the association between extended wake and mental workload, where higher extraversion was associated with higher perceived temporal demand ($B=1.04$, $95\%CI = 0.41, 1.68$, $p=.002$), poorer perceived performance ($B=0.79$, $95\%CI=0.08, 1.49$, $p=.031$), and greater frustration ($B=0.96$, $95\%CI=0.09, 1.83$, $p=.033$).

Conclusions: Extraversion may modify the perceptions of performance and mental workload more broadly in young adults with sleep disorders. Unlike healthy sleepers, extraversion in young adults with sleep disorders modified the association between 20h of extended wake and subjective performance, but not objective performance. Personality-task mismatch on monotonous tasks may be an issue for extroverts who are entering healthcare professions, who may feel greater frustration and perceive poorer performance when sleep deprived.

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Sleep Surprises Questionnaire: Using Expectancy Violations from Naturalistic Behavioural Experiments to Enhance Sleep-Wake State Curiosity

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Introduction: Surprises, triggered by expectancy violations, drive new learning, reshape expectations, prompt adaptive behaviours, and generate evolving perceptions, creating further curiosity in a cycle of resilience. Surprises abound in sleep and waking, arising from naturally-occurring behavioural experiments and challenging our assumptions about sleep-wake states, next-day alertness and energy. The Sleep Surprises Questionnaire (SSQ) captures these expectancy violations in non-insomnia and (potentially) insomnia populations, promoting trust in sleep self-regulation, and gathering evidence that promotes curiosity about sleep-wake states. This oral presentation will explore how the SSQ's design and scoring illuminate surprise-driven learning, encouraging behaviours that enhance perception of sleep robustness with implications for preventive sleep health strategies.

Materials and methods: The SSQ, comprising 22 items across naturalistic behavioural experiments (eg, sleeping after an evening coffee or cinema screening), sleep-wake discrepancies (eg nearby sounds incorporated into dreams, time distortions), and next-day functioning (eg surprising alertness after broken sleep), uses a unified response scale:

N/A (never experienced), not surprised (0), mildly surprised (1), quite surprised (2), or very surprised (3). Scores sum across items (max 66, N/A excluded) with categories: little surprise (0–22), some surprise noted (23–44), very attentive to sleep surprises (45–66).

Objective is to establish SSQ norms (eg score distributions for 22 items (max 66), categories: 0–22, 23–44, 45–66), validate against ISI (insomnia severity) and DBAS-16 (dysfunctional beliefs), and assess content validity. Sourcing a population of non-insomnia adults (eg general population or students, $N\approx 300$ for normative study, $N\geq 100$ for EFA, and $N\geq 50$ for test-retest, stratified by age, gender). Will include a subset with mild insomnia (eg ISI 8–14) for comparison. Rationale is to gauge if SSQ scores reflect openness to surprise and correlate inversely with ISI and DBAS-16 scores. Will recruit participants using convenience sampling (eg universities, online platforms) or random sampling for representativeness, and obtain informed consent & ethics approval. Initially exclude clinical population (ISI ≥ 15) until second stage of research.

Results: Preliminary findings for 3 participants with mild insomnia (eg Sunday night sleep concerns) score low on both ISI (<15 , or Subthreshold insomnia) and SSQ (eg SSQ: 6-10/66, "little surprise"), but individual high-surprise

items (eg surprise at alertness after poor sleep) suggest intervention pathways. The preliminary data indicate higher openness & attentiveness to surprises inversely correlates with insomnia severity, offering a streamlined tool to foster adaptive sleep perceptions.

Conclusions: Even in a non-insomnia demographic, negative sleep predictions fuel sleep "safety-seeking" behaviours which reinforce beliefs about sleep fragility, while increased tolerance of the inherent uncertainty of sleep-wake state discrepancies drives optimistic predictions and nonfearful behaviours. Preliminary findings suggest naturalistic behavioural experiments have the potential to raise expectancy violations, reflected in SSQ scores which inversely correlate with insomnia severity & rigidly dysfunctional beliefs about sleep. Surprises disconfirm perceptions of fragile sleep and build confidence in sleep self-regulation. By quantifying surprise, the SSQ supports CBT-I behavioural experiments, creating learning opportunities to explore sleep-wake perceptions with growing curiosity.

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The Impact of Sleep Deprivation on Superiority Illusion

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Introduction: Superiority Illusion (SI) is common cognitive bias which healthy individuals usually have the tendency to overestimate their abilities than others. Lower SI ability has been proved linked to various mental health problems, including generalised anxiety disorder, depression and bipolar disorder. Previous studies found that cognitive function would be impaired by sleep deprivation. However, the change on SI remains unexplored. This study aims to elucidate the effects of sleep deprivation on SI and the related psychological mechanisms.

Materials and methods: Healthy adults from universities aged 18–28 years completed a repeated-measures cross-over design, including 2 sessions conducted in a counterbalanced order—one after a normal night of sleep (SR) and one after 24 h sleep deprivation (SD). Sleep status control prior to the experiment includes actigraphy devices and sleep diaries for more than seven consecutive days. On the night preceding SR session, polysomnography (PSG) was conducted. On the morning of the behavioral task, affective states were assessed through the Positive and Negative Affect Schedule (PANAS) and the Brief Fear of Negative Evaluation Scale (BFNES). The core SI task consists of 60 trials, incorporating two dimensions (positive and negative words).

Results: Data from 47 participants (mean age 23.0 ± 1.0 years, 27 women) were included in the final analysis. A significant reduction on SI scores in SD (mean difference = -0.184 , 95%CI = $[0.050, 0.317]$, $t = 2.775$, $p = 0.008$), a significant main effect of sleep condition ($F_{(1, 46)} = 7.701$, $p = 0.008$, partial $\eta^2 = 0.143$) and a significant main effect of valence ($F_{(1, 46)} = 19.151$, $p < 0.001$, partial $\eta^2 = 0.294$) were found, whereas the interaction between these factors was nonsignificant ($F_{(1, 46)} = 0.004$, $p = 0.948$). In positive-word trials, SD led to a marginal reduction in SI scores (mean difference = -0.181 , 95%CI = $[-0.371, 0.009]$, $t = 1.918$, $p = 0.061$), whereas in negative-word trials, the reduction was statistically significant (mean difference = -0.187 , 95%CI = $[-0.308, -0.065]$, $t = 3.095$, $p = 0.003$). Correlational analyses under SD revealed total task scores had positive correlations with PANAS positive affect scores ($r = 0.353$, $p = 0.015$) and negative correlations with PANAS negative affect scores ($r = -0.343$, $p = 0.018$) and BFNES scores ($r = -0.421$, $p = 0.003$).

Conclusions: The present findings indicate that SD results in a significant decline in SI scores. Meanwhile, the SD scores correlate to post-deprivation emotional states. These results provide novel insights into the role of sleep in self-referential cognitive processes and offer a theoretical foundation for understanding sleep deprivation.

The neural pathway from glutamatergic neurons in the lateral hypothalamus to the rostromedial tegmental nucleus mediates defensive behaviors in mice

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Introduction: Defensive behaviors responding to actual or perceived threats are essential for survival, encompassing flight, avoidance, and hiding. Although these behaviors are adaptive, excessive or maladaptive defensive responses are implicated in the pathogenesis and progression of various psychiatric disorders in humans. The underlying neural circuit mechanisms governing defensive behaviors remain poorly understood. In this study, we investigated the role of the neural circuit from lateral hypothalamic (LH) glutamatergic neurons to the rostromedial tegmental nucleus (RMTg) in defensive behaviors in mice.

Materials and methods: Adult male vesicular glutamate transporters (Vglut2)-Cre mice (8–10 weeks old) were randomly assigned to either a control group (mCherry) or an experimental group (ChR2). The control group received bilateral injections of AAV2/9-EF1 α -DIO-mCherry-WPRE-pA into the LH, while the experimental group received AAV2/9-EF1 α -DIO-ChR2-WPRE-pA. Optical fibers were implanted in the RMTg of all mice. After three weeks for recovery from surgery and sufficient viral expression, behavioral tests—including the open field test, real-time place preference (RTPP) test, and hiding box test—were conducted. Following the experiments, viral infection was confirmed by mCherry expression in the LH, and c-Fos expression in the RMTg was assessed to validate the activation of the pathway from LH glutamatergic neurons to the RMTg upon 473 nm laser stimulation.

Results: During a 473 nm laser stimulation of RMTg GABAergic terminals in the LH, mice in the ChR2 group exhibited significantly increased velocity in the open field test, indicative of escape behavior. In the RTPP test, these mice spent less time on the preferred side, suggesting avoidance behavior. Additionally, the latency to enter the hiding box was significantly reduced, reflecting enhanced hiding behavior. The expression of c-Fos in the RMTg was elevated in ChR2-expressing mice following laser stimulation, confirming successful pathway activation.

Conclusions: Activation of the LH glutamatergic neuron projections to the RMTg promotes defensive behaviors in mice. These findings provide insights into the neural basis of defensive behaviors and may inform future research on mental diseases.

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Correlation between iron deposition and cognitive function in OSA patients of different severity levels based on quantitative susceptibility mapping

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Introduction: Excessive cerebral iron deposition has been implicated in cognitive dysfunction across various neurological disorders. This study investigates severity-dependent patterns of cerebral iron accumulation in OSA using quantitative susceptibility mapping (QSM) and examines their potential role in mediating cognitive impairment.

Materials and methods: The study cohort comprised 139 OSA patients stratified by severity (68 mild-moderate [OSA-M: apnea-hypopnea index (AHI) 5-30 events/hour]; 71 severe [OSA-S: AHI>30]) and 48 healthy controls (HC). All participants underwent polysomnography, neurocognitive assessment using the Montreal Cognitive Assessment (MoCA), and 3T MRI with multi-echo gradient echo sequences for QSM analysis. Whole-brain voxel-wise comparisons were conducted to characterize iron deposition patterns. Correlation analysis and mediation models evaluated associations between OSA severity, regional iron content, and cognitive performance.

Results: As the severity of OSA increases, iron content increased in the left central anterior gyrus, left medial superior frontal gyrus, right central anterior gyrus, right medial superior frontal gyrus, right putamen, and middle cingulate gyrus increases; while it decreased in the left superior temporal gyrus, left superior frontal gyrus, right parietal sulcus, and middle right frontal lobe. Critically, higher iron levels in the left precentral gyrus and right putamen negatively correlated with cognitive deficits (MoCA), particularly in visuospatial function ($P < 0.05$), whereas lower iron in the left superior temporal gyrus and right parietal sulcus correlated with poorer cognition ($P < 0.05$). Mediation effect analysis demonstrated that iron deposition in the right putamen partially mediated the relationship between AHI, BMI, N3 stage proportion, Pulse oxygen<90% and cognitive function, especially the visuospatial abilities.

Conclusions: Our findings suggest that cerebral iron overload may contribute to cognitive dysfunction in OSA patients across severity levels, with chronic intermittent hypoxia-induced iron metabolism dysregulation serving as a potential neuropathological mechanism.

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Chronobiology/Circadian Disorders

Light at Night Exacerbates Depression Risk via Circadian Disruption and Hippocampal Per1 Dysregulation: Translational Evidence from a Large-scale Prospective Cohort and Animal Study

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Introduction: In the modern era of pervasive artificial lighting, approximately 80% of the global population is exposed to light at night (LAN), posing significant public health challenges. While cross-sectional evidence suggests a link between LAN and mood disorders, the causal effects and mechanisms remain poorly understood. This study integrates human cohort data with controlled animal experiments to elucidate the behavioral and neurobiological pathways linking LAN exposure to depression pathogenesis.

Materials and methods: We analyzed 75,636 UK Biobank participants with objectively measured LAN exposure via wearable devices. Incident depression cases were ascertained through linked electronic health records (hospitalizations, primary care visits) and mortality registries. Cox proportional hazard models, adjusted for potential confounders, were used to assess associations. To further confirm the causal effects of LAN on depression onset, ICR mice (n=50/group, 10-week-old) were randomized to: control group (12h 200 lux light/12h dark) or LAN group (12h 200 lux light/12h 5 lux dim light). Spontaneous locomotor activity was monitored using Clocklab. Depression-like behaviors were evaluated via sucrose preference test (SPT) and forced swim test (FST). Brain serotonin (5-hydroxytryptamine, 5-HT) and brain-derived neurotrophic factor (BDNF) levels were measured by ELISA. Hippocampal circadian genes were analyzed through multi-timepoint transcriptome sequencing, with rhythmicity evaluated using CircadiOmics. Key genes were further validated by Real-Time Quantitative Polymerase Chain Reaction (RT-qPCR).

Results: Compared to participants with low LAN exposure (median: ~ 1 lux), those with higher exposure exhibited significantly higher adjusted hazards for depression (HR=1.24, 95% CI: 1.12-1.35), demonstrating a dose-response relationship (P for trend < 0.01). Animal experiments demonstrated that, compared to the control group, LAN group exhibited significantly increased depression-like behaviors, such as decreased sugar preference and increased immobility time (all P < 0.05). In addition, locomotor rhythms monitoring revealed that LAN exposure reduced wheel-running activity, nocturnal activity levels, and rhythm amplitude (all P < 0.05). Correlation analysis revealed that disruptions in rest-activity rhythms were significantly associated with these depressive-like behaviors (all P < 0.05). ELISA analysis demonstrated decreased levels of both 5-HT and BDNF in the LAN group (all P < 0.05), with 5-HT levels showing positive correlations with activity amplitude (P = 0.04) and nighttime activity (P = 0.01). Moreover, transcriptome and RT-qPCR analysis further identified LAN exposure disrupted the expressions of hippocampal circadian genes particularly *Period 1 (Per1)* in mice.

Conclusions: Integrating epidemiological and experimental evidence, we propose that LAN exposure may contribute to depression risk through circadian disruption, with hippocampal Per1 alterations and monoaminergic dysfunction emerging as plausible mechanistic links. This translational framework warrants further validation in targeted human interventions.

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Sleep regularity is related to variance in sleep stage composition

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Introduction: Irregular sleep-wake patterns are linked to numerous adverse health and well-being outcomes, but the underlying mechanisms remain largely unknown. One potential mechanism is changes in sleep stage composition, since irregular sleep patterns entail sleeping for variable durations, and at variable circadian phases and levels of sleep homeostatic pressure. However, this association has yet to be studied.

Materials and methods: We investigated the relationship between sleep regularity and sleep stage composition (light, deep, REM sleep) measured using Z-Machine Insight+ home EEG devices in 97 healthy young adult university students in Victoria, Australia (80.41% Female, mean±SD age 20.55±1.65 years) across a total of 1101 nights (11.35±3.46 nights per participant). Sleep regularity was measured using the Sleep Regularity Index (SRI). At the daily level, we measured sleep duration, variations in sleep onset and offset times, time awake before each sleep episode, and the hourly stage transition rates. Partial correlations were used to assess the association between sleep regularity and sleep stage composition, while controlling for mean sleep duration. Piecewise linear mixed-effects models were used to examine sleep stage composition using daily-level predictors.

Results: Lower SRI was associated with greater standard deviation in both absolute amounts (all $p < .001$, $r_{\text{partial}} = -.53$ to $-.45$) and percentages (all $p < .05$, $r_{\text{partial}} = -.53$ to $-.28$) of light, deep, and REM sleep, lower mean percentage REM sleep ($p = .042$, $r_{\text{partial}} = .24$), and more frequent wake-sleep transitions ($p = .008$, $r_{\text{partial}} = .30$). At the daily level, longer sleep duration was associated with greater absolute amounts of light, deep, and REM sleep, greater percentages of light and REM sleep, but a lower percentage of deep sleep (all $p < .05$). Shorter time awake and later sleep onset were associated with lower amount and percentage of deep sleep (all $p < .001$). Earlier sleep offset was associated with lower percentage of light sleep, lower amount and percentage of REM sleep (all $p < .05$), and more frequent wake-sleep transitions and less frequent transitions to and from REM sleep (all $p < .001$).

Conclusions: Less regular sleep-wake patterns were associated with greater variance in sleep stage composition, which may partially explain the link between irregular sleep-wake patterns and negative health outcomes. Analysis at the daily level revealed that changes in sleep stage composition are primarily explained by changes in sleep duration, rather than changes in sleep timing. Maintaining consistent sleep duration is likely a key target for stabilizing sleep stage composition in irregular sleepers.

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Impact of circadian rhythm sleep disruption on cortisol and melatonin biomarkers and cellular metabolism (telomeres) in oral health: systematic review

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Introduction: This systematic review focused on the impact of sleep disorders related to circadian rhythm on cortisol and melatonin biomarkers and also on cell metabolism, especially at the telomere level.

Materials and methods: The following quantitative records were found: Scielo (35); Pubmed (1,114) and Cochrane (1,478). The Covidence system automatically marked 221 records as duplicates and 744 records as automatically ineligible. Database selection and identification were carried out according to the Prisma system for systematic reviews. After evaluating the full text, 12 publications remained for data extraction. In the 12 studies evaluated, 12,866 people between the ages of 18 and 88 took part. The samples ranged from 13 young men to 5,268 elderly people. All the studies identified the participants' gender, with 9,022 women (70.13%) and 3,844 men (29.87%). Eligibility criteria were selected based on the structuring factors that make up the PICOS approach (P= Population; I= Intervention; C= Comparison; O= Outcome; S= Study design). The population (P) being analysed included participants with circadian rhythm sleep disorders. The intervention (I) included biomarkers of cortisol, melatonin and telomeres. The comparison group (C) included individuals with regular sleep patterns aligned with the natural circadian rhythm. Outcomes (O) included telomere length and a measure of sleep quality, assessed using objective sleep indices or by self-report and cortisol and melatonin levels in the blood. The study design (S) included randomised control trials and other formats. regarding the exclusion criteria, unpublished studies, conference abstracts and studies whose full article was not available and could not be obtained directly from the authors were removed.

Results: The variability in study designs, as well as the heterogeneity of samples and measurement methods, emphasizes the need for future, more rigorous research to clarify these associations. These results reinforce the importance of synchronizing internal biological rhythms with natural environmental cycles in order to maintain general health, which includes oral health

Conclusions: The evidence from the selected studies indicates an association between circadian dysregulation and variations in these biomarkers, with possible implications for telomere length, suggesting a role in the processes of premature cellular ageing, cell renewal and recovery, and metabolic and hormonal imbalances. In dentistry, the cellular ageing process and hormonal imbalances influence processes such as healing and post-surgical recovery, the immune response and the development of periodontal disease, changes in the salivary pH of the microbiome and, consequently, dental caries. Proper regulation of the circadian rhythm can therefore play a crucial role in optimizing dental care and maintaining chronic oral conditions. Recognizing the interconnection between sleep, metabolic health and oral health can lead to more holistic approaches in dental treatment, underlining the importance of considering circadian rhythms in clinical dental practice to promote more comprehensive and lasting oral health.

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Safety and Efficacy of Acupuncture in Patients With Circadian Rhythm Sleep Disorder: A Randomized Clinical Trial

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Introduction: Circadian Rhythm Sleep-Wake Disorders (CRSWDs) arise from misalignment between endogenous circadian rhythms and external environmental cycles, causing chronic insomnia and excessive sleepiness. Affecting 0.2-10% of the population, growing evidence indicates that circadian misalignment not only disrupts sleep but also adversely affects multiple physiological systems, increasing susceptibility to cardiovascular diseases, metabolic disorders, cognitive impairments, and immune dysfunction. While planned sleep schedules, timed light exposure, and melatonin therapy show efficacy, alternative treatments remain underexplored.

Preliminary studies suggest that acupuncture may improve sleep quality and reduce anxiety in insomnia and perimenopausal insomnia. Acupuncture has demonstrated potential in improving sleep and modulating circadian pathways, possibly through melatonin-related mechanisms. However, robust clinical evidence is lacking. Considering the efficacy of acupuncture in many areas and the lack of studies in CRSWD, we conducted a randomized, placebo-controlled trial to assess acupuncture's short-term efficacy in CRSWD using objective and subjective measures, addressing a critical gap in non-pharmacological interventions for circadian disruption.

Materials and methods: Design: A randomized, participant-blind, placebo-controlled trial consisted of the acupuncture group ($n = 36$) and placebo-acupuncture group ($n = 36$). Setting: a tertiary hospital of integrated

Chinese and Western medicine. Participants: 72 participants with CRSWD based on the International Classification of Sleep Disorders, Third Edition. Interventions: A 10-session intervention of acupuncture at Shenshu (BL 23) and Xinshu (BL 15) or Streitberger needles at the same acupoints was performed for over 3 weeks. Measurements: The Pittsburgh Sleep Quality Index (PSQI) and insomnia severity index (ISI) were evaluated at baseline and post-treatment as the primary outcome measures. Actigraphy recordings were evaluated at baseline and post-treatment as the secondary outcome measures.

Results: After the treatments, the decrease from baseline in PSQI score was 8.97 points in the acupuncture group and 1.28 points in the placebo-acupuncture group. The change from baseline in ISI score was 7.91 points in the acupuncture group and 2.02 points in the placebo-acupuncture group. Actigraphy results showed that the actual sleep time (AST), sleep efficiency (SE) and Inter daily stability (IS) increased significantly ($P < 0.05$); the sleep onset latency (SOL), fragmentation index (FI) and Intraday variability (IV) was significantly decreased ($P < 0.05$); peak time (Cosinor Peak, time activity, CPT) significantly moved forward ($P < 0.01$).

Conclusions: Acupuncture can contribute to a clinically relevant improvement in the short-term treatment of CRSWD. We suggest that acupuncture represents a safe and useful non-pharmacologic intervention option for CRSWD.

Association between wearable device-measured weekend catch-up sleep and brain health in UK Biobank participants

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Introduction: Sleep deprivation was correlated with risks of brain diseases. However, as a compensation for weekday sleep deficits, the effects of weekend catch-up sleep (WCS) on brain health remain inconclusive. This study investigated the association between WCS and major brain disorders, including depression, anxiety, dementia, stroke, and Parkinson's disease (PD) during a 13.65-year follow-up period, using wearable device data of 93,506 UK Biobank participants.

Materials and methods: A total of 93,506 participants from the UK Biobank were followed for an average of 13.65 years. Accelerometer-measured sleep data were used to classify WCS into four categories: no WCS (≤ 0 hours), short (>0 to <1 hour), medium (≥ 1 to <2 hours), and long (≥ 2 hours). Cox proportional hazards models, adjusting for multiple confounding factors, were used to estimate the association between WCS duration and disease incidence. Restricted cubic spline analyses assessed potential nonlinear relationships.

Results: The fully-adjusted Cox proportional hazards model revealed that medium WCS significantly reduced the risk of depression (HR 0.89, 95% CI 0.81–0.99) and anxiety (HR 0.88, 95% CI 0.79–0.98). Nonlinear dose-response relationships were observed between WCS and depression/anxiety (P for nonlinearity < 0.001). No significant associations were found between WCS and dementia, stroke, or PD. Subgroup analyses indicated a significant interaction between WCS and age for anxiety (P for interaction = 0.003).

Conclusions: Medium WCS may be a promising, cost-effective strategy for promoting mental health, specifically reducing the risk of depression and anxiety. However, no significant associations were found with dementia, stroke, or PD. Future research should explore the underlying mechanisms and replicate these findings in diverse populations.

Automatic sleep-wake classification and Parkinson's disease recognition using multi-feature fusion with support vector machine

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Introduction: Sleep disturbance is a prevalent non-motor symptom of Parkinson's disease (PD), however, assessing sleep conditions is always time-consuming and labor-intensive. In this study, we performed an automatic

sleep-wake state classification and early diagnosis of PD by analyzing the electrocorticography (ECoG) and electromyogram (EMG) signals of both normal and PD rats.

Materials and methods: The study utilized ECoG power, EMG amplitude, and corticomuscular coherence values extracted from normal and PD rats to construct sleep-wake scoring models based on the support vector machine algorithm. To evaluate the applicability of the sleep-wake classification models across different rat groups, we randomly selected the features from 8 rats in the sham group (Sham train) and 8 rats in the lesion group (Lesion train) to train the SVM models, respectively. Subsequently, the remaining sham record (Sham test) and lesion record (Lesion test) were considered as two test data points for cross-validation of the models. The Sham dataset contained 6480 10-second segments labeled by the sleep experts with data encompassing WAKE: 1548, NREM: 4164, REM: 768. Similarly, the Lesion dataset contained 6521 10-second segments labeled by the sleep experts with data encompassing WAKE: 2047, NREM: 3866, REM: 608. The Sham test and Lesion test contained approximately 720 10-second segments, respectively. For comparison, we used ECoG from occipital or frontal cortex regions in the Sham train and Lesion train for feature extraction and model training to construct four different sleep-wake classification models. Finally, by incorporating PD-specific features from frontal ECoG, we developed two models capable of simultaneous sleep-wake state classification and PD detection. By incorporating the previously selected features and expanding the functionality of the model, we achieved simultaneous detection of sleep-wake states and the likelihood of PD in rats.

Results: The highest accuracy was achieved when the model was trained by the Sham train of the occipital ECoG and tested by the Sham test data, at which time the Cohen's kappa value was 0.77 ± 0.05 . Features extracted from occipital ECoG signals were more suitable for constructing sleep-wake scoring models than those from frontal ECoG (average Cohen's kappa: 0.73 vs. 0.71). Additionally, after retraining, the new models demonstrated increased sensitivity to PD and accurately determined the sleep-wake states of rats (average Cohen's kappa: 0.79). A slightly greater level of overall accuracy was noted when conducting classification through a combination of occipital and frontal ECoG, as opposed to relying solely on frontal ECoG ($84.87\% \pm 2.22\%$ vs. $83.90\% \pm 2.50\%$).

Conclusions: This study accomplished the precise detection of substantia nigra lesions and the monitoring of sleep-wake states. The integration of circadian rhythm monitoring and disease state assessment has the potential to improve the efficacy of therapeutic strategies considerably. Furthermore, the algorithms developed in this research exhibit promising potential for future integration into adaptable, wireless, and portable DBS monitoring systems.

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Association of circadian rest-activity rhythm and genetic risk with incident irritable bowel syndrome

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Introduction: Irritable bowel syndrome (IBS) is a common functional bowel disorder characterized by recurrent abdominal pain, altered defecation, or changes in bowel habits. Although the exact mechanisms remain unclear, disrupted communication between the gut and brain has been implicated. The circadian system regulates various gastrointestinal functions, and circadian rhythm disruptions are associated with gastrointestinal diseases. However, prospective studies linking circadian rhythms and IBS risk are limited.

Materials and methods: This study included 86,106 UK Biobank participants who were free of IBS at baseline. Circadian rest-activity rhythm (CRAR) was assessed using non-parametric parameters, including interdaily stability (IS), intradaily variability (IV), activity level during the most active 10 hours (M10), activity level during the least active 5 hours (L5), relative amplitude (RA), M10 onset, and L5R onset. The incidence of IBS was identified using hospital records and a self-assessment questionnaire, and genetic risk was determined using a polygenic risk score (PRS). Cox proportional hazards models were used to examine the association between CRAR and incident IBS.

Results: During 620,851 person-years of follow-up (median follow-up period of 7.8 years), a total of 8,790 new cases of IBS were identified. We found that the risk of incident IBS decreased with increasing RA and M10, with multivariate adjusted hazard ratios (HRs) (95% CI) were 0.86 (0.81, 0.91) for decreasing RA and 0.88 (0.83, 0.92) for high M10. Conversely, high L5, a delayed onset of M10 and an advanced onset of L5 were associated with a

higher risk of IBS, with the HRs (95% CI) of 1.06 (1.04, 1.12) for high L5, 1.10 (1.04, 1.16) for delayed M10 onset time, and 1.06 (1.01, 1.12) for advanced L5 onset time. However, the relationships of IS and IV with IBS risk did not reach statistical significance. No significant interactions between CRAR parameters and genetic risk are observed. Additionally, individuals with high genetic risk and poor CRAR parameters showed a significantly higher risk of IBS.

Conclusions: CRAR disturbances, characterized by lower amplitude and abnormal phase, are linked to an elevated risk of developing IBS. These findings underscore the potential of circadian rhythm management as a modifiable risk factor for IBS prevention. Further research is needed to explore the underlying mechanisms linking CRAR disruptions to IBS.

Timed Blue-Light Intervention Enhances Alertness and Reduces Clinical Errors in ICU Night-Shift Nurses

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Introduction: Night-shift intensive care unit (ICU) nurses frequently suffer from circadian misalignment, resulting in elevated melatonin secretion, increased sleepiness, psychological stress, and reduced cognitive performance-factors associated with heightened risk of medical errors. To evaluate the efficacy of a timed blue-light intervention in mitigating circadian disruption and enhancing alertness, mood, and vigilance in ICU night-shift nurses.

Materials and methods: A quasi-experimental crossover design was implemented involving 22 ICU nurses. Participants were randomized to either wear blue-light emitting eyewear (460 nm, 1500 lux) for 20 minutes at 00:00, 02:00, and 04:00 during two consecutive night shifts, or remain under standard ambient lighting. After a one-month washout, subjects crossed over to the alternate condition. Key outcome measures included salivary melatonin levels, Karolinska Sleepiness Scale (KSS), Depression Anxiety Stress Scale (DASS-21), and 10-minute Psychomotor Vigilance Task (PVT), assessed before, during, and after each shift.

Results: Compared with the control condition, blue-light exposure suppressed melatonin levels by over 30%, decreased subjective sleepiness and stress scores by at least 20%, and improved PVT reaction time and accuracy by 15% and 10%, respectively. These effects were consistent across the crossover phases.

Conclusions: Timed blue-light exposure via eyewear is an effective, low-cost, non-pharmacological intervention to improve cognitive alertness, mood, and vigilance among ICU night-shift nurses, with potential to reduce clinical errors and enhance patient safety.

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Sleep variability, eveningness and depression in adolescents: a case-control study

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Introduction: Adolescence is characterized by a circadian shift towards eveningness and changes in sleep pattern. This period is also often associated with an increased incidence of psychopathology, such as depression. Greater intraindividual sleep variability has been linked to both eveningness and depression. However, limited research has explored the interplay between eveningness and depression in relation to sleep variability in youth. The present

case-control study aimed to investigate sleep variability in adolescents with eveningness and/or depression, as well as to explore the correlates of sleep variability.

Materials and methods: Four groups of adolescents aged 12-20 years were recruited: eveningness and depression group (ED), eveningness only group (E), depression only group (D), and healthy controls. Eveningness was defined as a score of ≤ 41 on the Morningness-Eveningness Questionnaire. Depression groups met DSM-5 criteria for major depressive disorder or dysthymia. Participants completed a 7-day sleep diary with actigraphy monitoring and self-reported questionnaires to assess circadian preference, insomnia symptoms, depressive symptoms, and bedtime procrastination. Subjective and objective sleep variabilities were calculated using root mean squared successive differences from sleep diary and actigraphy data, respectively.

Results: A total of 95 participants (mean age: 17.82 s.d. 1.59 years, 76% female) were included in the analysis (ED: $n = 23$, E: $n = 26$, D: $n = 25$, C: $n = 21$). Both ED and D groups showed significantly more severe depressive symptoms compared to E and C groups (all p s $< .001$). ED group showed greater variability in time in bed (vTIB) compared to D group (sleep diary: $p = .033$; actigraphy: $p = .040$) and controls (sleep diary: $p = .025$; actigraphy: $p = .013$). ED group also showed greater variability in sleep offset (vSOFF) and rise time (vRT) as measured by sleep diary compared to D group (SOFF: $p = .009$; RT: $p = .004$) and controls (SOFF: $p = .037$; RT: $p = .012$). ED group showed greater variability in sleep offset as measured by actigraphy compared to E group ($p = .034$), D group ($p = .005$), and controls ($p < .001$). E group showed greater variability in time in bed as measured by actigraphy ($p = .026$) compared to controls. Regression analyses showed that stronger eveningness preference was independently associated with greater sleep variability in TIB, TST, and RT as measured by sleep diary, and TIB as measured by actigraphy (all p s $< .05$). No other associations were found between sleep variability parameters and insomnia symptoms, depressive symptoms, or bedtime procrastination.

Conclusions: The present study suggested a synergetic effect of eveningness and depression on increasing sleep variability in adolescents. Evening preference was independently associated with greater sleep variability. Future research may consider adopting a longitudinal design to further elucidate the relationships between sleep variability, chronotype preference and depression and to explore the effects of circadian-focused interventions on reducing sleep variability and depressive symptoms in youth.

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Dim light melatonin onset is later in post-menopausal women following Breast Cancer compared with controls

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Introduction: One year after treatment for breast cancer, >80% post-menopausal women in remission from breast cancer complain of poor sleep-quality, which may be a consequence of circadian misalignment. The aim of this study was to compare central circadian timing via nocturnal melatonin-secretion, in post-menopausal women in remission from breast cancer (≥ 12 -months) (BCG), with age-matched post-menopausal women with no cancer history (CG).

Materials and methods: Participants were recruited from outpatient breast cancer clinics (BCG: $n=6$) or the community (CG: $n=10$). Sleep and psychological symptoms were assessed using the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Epworth Sleepiness Scale (ESS) and the Depression, Anxiety, Stress Scale (short form; DASS-21). Habitual bedtime (HBT) was quantified using actigraphy (7 days). Overnight in-laboratory polysomnography was performed, and saliva samples collected under strict lighting conditions (< 1 Lux; 13 samples in total) 5 hours prior to HBT until 2 hours after habitual wake time. Salivary melatonin was quantified by radioimmunoassay. Individual melatonin profiles were analysed for the; (1) Clock-time when melatonin concentrations reached 4pg/mL (DLMO), (2) Area under the melatonin curve (AUC), and the Time-interval

between HBT and DLMO (PA). Group data were summarised as median (interquartile range) and compared through 2-sided Mann-Whitney U-tests. $p < 0.05$ indicated statistical significance.

Results: There were no significant differences ($p > 0.20$) in age (BCG: 62.5 (59.5-67.3) vs. CG: 58.5 (54.0-66.3) years), body-mass indices (BCG: 28.0 (24.0-30.5) vs. CG: 25.1 (22.1-29.9) kg/m²) or HBT (BCG: 22:49 (21:46-23:38) vs. CG: 22:16 (21:59-22:21)). Neither group had evidence of negative emotional state (DASS-21; BCG: 8.5 (2.8-9.5) vs CG: 5.0 (2.8-9.0) au), sleepiness (ESS; BCG: 8.0 (5.0-9.0) vs. CG: 3.5 (1.8-6.3) au) or severe obstructive sleep apnoea (OSA) (Apnoea-hypopnoea index; BCG: 9.0 (6.6-10.3) vs. CG: 6.9 (2.4-21.3) events/hr), all having $p > 0.10$. Compared to CG, BCG tended to have higher PSQI (BCG: 8.5 (5.3-10.8) vs. CG: 4.0 (3.8-5.5) au; $p = 0.07$) and ISI scores (BCG: 10.5 (5.5-17.3) vs. CG: 5.5 (3.8-8.0) au; $p = 0.07$), lower AUC (BCG: 97.3 (83.7-125.0) vs. CG: 170.8 (96.6-250.3) pg/mL; $p = 0.09$), and shorter PA (BCG: 1.4 (1.0-2.4) vs CG: 3.6 (2.2-3.9) hrs; $p = 0.09$). BCG had significantly delayed DLMO compared to CG (20:46 (20:01-22:03) vs 18:40 (17:55-20:07); $p = 0.03$).

Conclusions: In this small cohort, in the absence of severe OSA, negative emotional state or sleepiness, post-menopausal women in remission from breast cancer tended to report poorer sleep-quality, increased insomnia symptoms, with lower overnight melatonin secretion, altered circadian-sleep alignment, and a significantly delayed melatonin onset. We speculate poor sleep-quality and insomnia symptoms following breast cancer treatment attribute to circadian-sleep misalignment from delayed central circadian timing.

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Abnormal Global Brain Function in Shift Work Disorder Patients: A Resting-State Functional MRI Study

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Introduction: Since the negative influence caused by shift work disorder (SWD), its underlying mechanisms still reminds unclear. Thereby, we conducted this study to explore the neuromechanism of SWD due to the disrupted circadian rhythm using Resting-state functional magnetic resonance imaging (rs-fMRI)

Materials and methods: 65 SWD patients 65 healthy controls (HC) had received assessments of relevant questionnaires, including PSQI, ISI, ESS, FS-I4, PHQ-9, GAD-7, and rs-fMRI scans.

Amplitude of Low Frequency Fluctuations (ALFF), Regional Homogeneity (ReHo)

analyses were performed on rs-fMRI data to compare the differences between the two groups. The peak points, which significantly altered in ALFF and ReHo were chosen as the seed regions to further calculate and Functional Connectivity (FC) of the whole brain. Finally, we performed correlation analyses to assess the association between alterations in brain function and clinical characteristics.

Results: The study included 121 participants (61 SWD, 60 HC). The SWD group showed higher PSQI, ISI, ESS, FS-I4, PHQ-9, and GAD-7 scores (all $P < 0.05$) but no demographic differences versus HCs. ALFF analysis revealed increased activity in frontal regions (left medial superior frontal gyrus, orbital middle frontal gyrus, right dorsolateral superior frontal gyrus) and decreased activity in occipital areas (left middle occipital gyrus, right superior occipital gyrus/lingual gyrus) in SWD. ReHo was reduced in the right middle occipital gyrus. FC analysis showed decreased connectivity between the right superior occipital gyrus and left superior occipital gyrus/cuneus.

Conclusions: The the changes of functional brain activities in SWD patients are mainly in the prefrontal and occipital lobes, and related brain network is the default mode network (DMN), which might be potential neuroimaging indicators and therapeutic target brain region for SWD patients.

Integrating Traditional Chinese Medicine (TCM) and Western Medicine Perspectives on Biological Rhythms - From Ancient Theories to AI-Driven Multidisciplinary Modeling

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Introduction: The concept of biological rhythms-daily, lunar, seasonal, and annual-has been foundational in both Traditional Chinese Medicine (TCM) and modern Western medicine, yet their theoretical frameworks and clinical applications diverge significantly. TCM conceptualizes daily rhythms through a twelve-phase system (*Ziwu Liuzhu*), correlating temporal energy fluctuations (*qi*-blood *yin-yang* dynamics) with organ-specific functional changes. Modern chronobiology, conversely, decodes 24-hour biological oscillations via molecular mechanisms - particularly circadian clock genes that synchronize cellular and systemic processes through transcriptional-translational feedback loops. Nowadays, the irregular lifestyles of modern humans have led to a high incidence of chronic diseases, highlighting an inseparable relationship between disrupted circadian rhythm and disease development. This study establishes a comparative framework analyzing TCM and Western chronobiology's mechanistic interpretations of daily, lunar, seasonal, and lifespan rhythms, followed by proposing an AI-augmented synthesis for precision health applications. By highlighting the interdisciplinary nature of the two fields, we offer a new direction for exploring the field of chronomedicine.

Materials and methods: This comparative study employed a three-phase framework:

Theoretical Synthesis: Textual analysis of TCM classics (e.g., *Huangdi Neijing*) and modern chronobiology literature identified core concepts of biological rhythms (daily *Ziwu Liuzhu*, lunar *Yueqi*, seasonal *Wuyun*, and annual *Shierqi*) .

Data Integration: Structured databases were created for TCM rhythms (organ-phase correlations) and Western molecular mechanisms (circadian genes like *CLOCK/BMAL1*) .

AI Modeling: Machine learning (random forest, LSTM networks) cross-validated patterns across datasets, incorporating meteorological variables (temperature, humidity) and TCM "Five Phases" theory to predict rhythm disruptions.

Results: Daily Rhythms: TCM's *Ziwu Liuzhu* (meridian energy cycles) aligned with circadian gene expression peaks (e.g., *PER2* at 11:00 AM) but emphasized organ-specific dominance (e.g., liver activity at 1:00-3:00 AM) .

Lunar Cycles: TCM's *Yueqi* theory linked lunar phases to immune function (e.g., higher inflammation during waxing phases), validated by modern cytokine data.

Seasonal Adaptation: Both systems recognized seasonal immune shifts, with TCM's *Wuyun* correlating to vitamin D fluctuations and *CYP24A1* gene expression.

AI Model Performance: The integrated model achieved high accuracy in predicting insomnia and seasonal affective disorder, outperforming single-system predictions.

Conclusions: This study demonstrates that TCM and Western medicine offer complementary perspectives on biological rhythms, with TCM emphasizing holistic environmental interactions and Western medicine detailing molecular mechanisms.

Future research should prioritize AI-driven platforms that fuse:

Temporal Precision: High-resolution circadian tracking (wearables, omics) with TCM "meridian clocks."

Environmental Integration: Meteorological data and *Wuyun* theory to model climate-related health risks.

Personalized Interventions: Adaptive AI therapies combining acupuncture (TCM) and melatonin modulation (modern Western medicine) .

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The Impact of Shift Work on Eating Patterns and Glucose Levels in Medical Interns: An Observational Study

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Introduction: Shift work, particularly night shifts, is an established disruptor of circadian rhythms and is linked to adverse metabolic outcomes, including impaired glucose regulation. Medical interns represent a population at heightened risk due to long and irregular working hours. Understanding the interplay between shift schedules, eating behaviours, and glycemic control is critical for informing preventive strategies in this vulnerable group.

Materials and methods: We conducted a prospective observational study among medical interns from various departments at a large training hospital in Singapore. Participants were monitored over two weeks during regular day shifts and night shifts. Eating patterns were assessed by real-time photographic dietary logging via a mobile application. Each participant wore a continuous glucose monitoring (CGM) device for two weeks, enabling detailed analysis of interstitial glucose fluctuations. Primary endpoints included changes in meal timing, meal frequency, macronutrient distribution, and mean glucose. Statistical analysis was conducted using four time windows (evening: 17h-23h, night 23h-5h, morning: 5h-11h, afternoon: 11h-17h) and shift type (day shift, night shift) as factors in repeated measures ANOVA.

Results: A total of 61 interns (mean age 24.6 ± 1.0 years; 61% female) contributed data from 416 day shifts and 190 night shifts. Night shifts were associated with a significant shift in meal timing. While overall meal frequency was not different (2.4 ± 0.8 meals/day shift vs 2.6 ± 1.1 meals/night shift), fewer meals were taken in the evening preceding a night shift (0.74 ± 0.5) compared to a dayshift (0.96 ± 0.4 meals, $p = 0.02$), and more meals were taken during the night (0.47 ± 0.5 meals/night shift vs. 0.05 ± 0.1 meals/day shift, $p < 0.001$) and morning period (0.69 ± 0.4 meals/night shift vs. 0.55 ± 0.4 meals/day shift, $p = 0.043$). Increased meals at night more often contained proteins, carbohydrates, and processed snacks, while meals less often contained fruit/vegetables during the evening. CGM data revealed a similar shift towards higher mean glucose levels during the nights (night shift: 88.3 ± 1.4 mg/dL vs. day shift: 82.8 ± 1.2 mg/dL, $p < 0.001$) and lower mean glucose levels in the afternoon following a night shift (night shift: 88.5 ± 1.6 mg/dL vs. day shift: 97.5 ± 1.2 mg/dL, $p < 0.001$).

Conclusions: Among medical interns, night shifts substantially alter eating behaviours, showing a redistribution of meal timing and a shift in macronutrient content toward more energy dense and processed food with lower fruit and vegetable intake. These behavioral changes were accompanied by shift in glycemic control, with higher night-time glucose levels and lower glucose during the afternoon post-night shift compared to day shifts. These findings underscore the need for targeted nutritional and organizational interventions to mitigate the adverse metabolic impact of shift work in healthcare professionals.

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Within-subject variation in circadian timing in shift workers repeating the same shift pattern

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Introduction: While inter-individual variation in circadian response to shift work has been demonstrated, the within-individual variation in circadian timing when shift workers repeat the same shift pattern is unknown. Light is a key factor influencing individual circadian timing. This study aims to examine the consistency in circadian timing between two repeated occasions of the same shift pattern and the role of light exposure in explaining within-individual variability in circadian timing among shift workers.

Materials and methods: In an ongoing study, shift workers ($n=25$, age 39.12 ± 11.50 years, 10 females) from multiple industries were monitored during two replications of their usual shift patterns (8-10 days), separated by at least 6 weeks. Shift patterns included consecutive night shifts, consecutive early morning shifts, and early-morning-to-night rotations. Participants completed daily sleep diaries and wore a wrist activity monitor to measure sleep-wake timing, and a lapel-worn light sensor for continuous measurement of light exposure. Circadian phase was assessed at the end of each shift pattern via 6-sulphatoxymelatonin (aMT6s) acrophase (peak) in urine. A light consistency index (LCI) was calculated as the percentage of time for which light was above or below a threshold of 70[TSI] melanopic lux at corresponding parts of the work roster, to examine the consistency of light exposure patterns between the two occasions of the same shift pattern. The difference in average light exposure between

the two occasions in the phase-advance (90-degree bin after acrophase) and phase-delay zones (90-degree bin before acrophase) of the circadian phase response curve to light was calculated.

Results: Analyses revealed moderate consistency in aMT6s acrophase between the two occasions of the same shift pattern (within-subject correlation: $r = 0.59$, $p < .001$), although substantial within-individual differences remained (mean difference = 2.38 ± 1.56 h; range = 0.14–5.46 h). Consistency in circadian timing was significantly associated with a higher light consistency index prior to circadian assessment ($\beta = -0.09$, $p = .02$, $R^2 = .22$). Aligning LCI to individual acrophase improved its ability to predict differences in acrophase ($\beta = -0.08$, $p = .0003$, $R^2 = .45$). Individuals with greater variation in acrophase had greater difference in light within the phase advance and delay zones. Linear regression revealed within-individual variation in acrophase was associated with differences in average light level in the advance ($\beta = 1.99$, $p = .02$) and delay ($\beta = 3.75$, $p = .00002$) zones between the two occasions ($R^2 = .56$).

Conclusions: Findings highlight within-individual variability in circadian phase in shift workers, despite following identical shift patterns. This indicates that circadian timing in workers cannot be assumed from a single measurement. This variability was explained by differences in light exposure, highlighting the value of light exposure for predicting circadian timing amongst shift workers. The ability to use light to improve circadian prediction has implications for informing personalised interventions in this population.

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Wearable-device-measured light at light exposure and Irritable bowel syndrome risk

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Introduction: Irritable bowel syndrome (IBS) affects approximately 7–21% of the global population. Circadian rhythm disruption (CRD) is increasingly recognized as a contributing factor in gastrointestinal disorders. Light at night (LAN), a common feature of modern environments, is a primary external cue for circadian misalignment. However, the relationship between LAN exposure and IBS risk remains unclear. This study aimed to investigate whether objectively measured LAN exposure is associated with incident IBS.

Materials and methods: We analyzed data from 67,590 UK Biobank participants (mean age: 62.7 years; 59.2% female), excluding baseline shift workers. LAN exposure was measured via wrist-worn accelerometers. IBS cases were identified through linked health records. Cox proportional hazards models were used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for IBS risk across LAN levels, adjusting for demographic, lifestyle, metabolic, psychiatric, and sleep-related covariates. Additionally, a series of sensitivity analyses were conducted to validate the main results.

Results: Over a median follow-up of 7.0 years (466,674 person-years), 820 incident IBS cases were recorded. A non-linear association was observed: IBS risk began to rise above an average nighttime LAN level of 175 lux. Participants exposed to >175 lux had a higher risk of IBS (HR = 1.35; 95% CI: 1.05–1.73) compared to those with lower exposure. Findings remained robust in multiple sensitivity analyses: excluding early IBS cases (within 1 or 2 years), using non-imputed data, restricting the sample to participants with ≥ 6 days of valid accelerometer wear, adjusting for the month of accelerometer measurement, and excluding individuals with high nighttime activity levels. All results remained significant ($P < 0.05$), confirming the robustness of the association.

Conclusions: Among older adults, higher LAN exposure was associated with an elevated risk of incident IBS. LAN exposure may serve as a novel and robust predictor of IBS risk, warranting further investigation.

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Disease-Based Chronoseasonal Patterns in Emergency Department Visits Reflecting Traditional and Emerging Trends

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Introduction: Seasonal variation in emergency department (ED) visits reflects underlying chronobiological rhythms shaped by environmental exposures, temporal patterns in disease incidence, and healthcare utilization behaviors.

In recent years, global shifts in climate and human behavior have raised questions about the consistency of these seasonal trends. This study investigated whether traditional seasonal patterns in ED utilization have continued across different disease categories and age groups.

Materials and methods:

We retrospectively analyzed 420,000 ED visits from two regional hospitals in Korea (2020–2024). Patients were stratified into three age groups (pediatric, adult, older adults), and symptoms/diagnoses were mapped to clinically relevant categories based on ICD codes, with expert-reviewed reclassification by organ system. To model seasonal trends, we used generalized additive models with quasi-Poisson distribution and cyclic cubic splines for month, adjusting for year, hospital, age, and sex. We fitted a quasi-Poisson model with cyclic splines for months that varied by age group, and used a Wald test to assess differences in seasonality across age groups. Relative risks were calculated relative to the trough month, and the peak-to-trough ratio (PTR) was defined as the ratio of the peak to the trough predicted count.

Results: From 2020 to 2024, the mean age and proportion of elderly ED visitors steadily increased (46.66 to 50.55 years; 26.1% to 35.8%). Seasonal variation was most pronounced in pulmonary and infectious diseases, with peaks in January and July, respectively (PTR = 1.58 and 1.46). Notably, this seasonal pattern was attenuated during the early COVID-19 period and gradually recovered in subsequent years, likely reflecting the impact of public health measures such as mask-wearing and social distancing. Orthopedic and trauma surgery showed summer peaks in June and August, respectively (PTR = 1.27 and 1.40). Acute cardiovascular events, including myocardial infarction and stroke, did not show apparent seasonal variation in our data. In general, seasonal variation was attenuated in older adults compared to younger ones, possibly due to a smaller sample size. However, nephrology-related visits were significantly more common among older adults. No nocturnal or diurnal differences were observed in the ED presentation of any symptoms or diseases.

Conclusions:

This study demonstrates that seasonal variation in emergency care differs by disease and age group. Pulmonary and infectious diseases maintain consistent seasonal patterns, while trauma and cardiovascular conditions display altered or absent seasonality compared to traditional reports. The attenuation and partial recovery of seasonality during the COVID-19 period highlight the influence of behavioral and environmental factors on temporal disease dynamics. Reduced seasonal variation in older adults, with a disease-specific exception, warrants further investigation with a larger sample. These findings underscore the complexity of seasonal rhythms in emergency care and the importance of considering demographic and environmental contexts in temporal analyses.

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The Association between Sleep Quality and Irregular Meal Timing among Malaysian Healthcare Workers in Rotating Shifts

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Introduction: Shift work often disrupts the natural circadian rhythm, significantly impacting both nutritional habits and sleep patterns. Among healthcare professionals, poor sleep quality may be exacerbated by irregular eating schedules, particularly in relation to chrononutrition behaviors. Despite growing global interest, studies investigating the interplay between sleep quality and chrononutrition among Malaysian shift workers remain limited. This study aimed to assess the association between chrononutrition behaviors and sleep quality among Malaysian healthcare shift workers.

Materials and methods:

A cross-sectional study was conducted involving 368 healthcare shift workers from three hospitals in Klang Valley. Participants aged 19 to 60 years working on a 3-shift rotation were selected via simple random sampling. Those with diagnosed sleep disorders, mental illness, or chronic diseases were excluded. Chrononutrition behaviors and sleep quality were assessed using the validated Chrononutrition Profile Questionnaire (CPQ) and the Pittsburgh Sleep Quality Index (PSQI).

Results: Most participants exhibited favorable behaviors in breakfast skipping, night eating, and eating window timing, while moderate behaviors were seen in evening eating, largest meal timing, and evening latency. However, 51.9% of participants demonstrated poor sleep quality. Significant predictors of sleep quality included age, marital status, and breakfast skipping behavior ($p < 0.05$). Logistic regression revealed that younger participants (AOR = 3.51; 95% CI: 1.5–8.3), those not married (OR = 1.82; 95% CI: 1.1–3.0), and those with poor breakfast skipping habits (AOR = 2.12; 95% CI: 1.3–3.5) had higher odds of poor sleep quality.

Conclusions: Findings underscore the need to prioritize sleep health in relation to eating patterns among healthcare shift workers. Targeted interventions that improve chrononutrition behaviors could be instrumental in enhancing sleep quality and overall well-being in this vulnerable population.

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Dental

Effects of Home-Based Tongue Exercises on Tongue Strength in Older Adults: Implications for Sleep-Disordered Breathing

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Introduction: Age-related declines in orofacial muscle tone, particularly reductions in tongue strength, contribute to dysphagia and increased upper airway collapsibility during sleep—an important pathophysiological mechanism in obstructive sleep apnea (OSA). Tongue exercises (TEs) utilizing specialized devices have been proposed as effective interventions for improving tongue strength and mitigating OSA severity. However, such devices are often costly, cumbersome, and impractical for routine home use, limiting their accessibility for older adults. Home-based TEs offer a feasible, low-cost alternative to improve tongue function without specialized equipment.

Despite emerging interest in their use, the most effective home-based TE protocols for enhancing tongue strength in older adults remain insufficiently studied. This study aimed to evaluate the effects of three simple home-based TE protocols on anterior and posterior tongue strength in older adults, with potential implications for the management of sleep-disordered breathing.

Materials and methods: Thirty-six healthy older adults (aged ≥ 65 years) were randomly assigned to one of three home-based tongue exercise (TE) protocols: **tongue wrap**, **tongue corner**, or **tongue paint**. Participants were instructed to perform each exercise five times per session, three sessions per day, over a four-week period at home. Anterior tongue strength (ATS) and posterior tongue strength (PTS) were assessed using the Iowa Oral Performance Instrument (IOPI) at baseline and after the intervention period. Improvements in both ATS and PTS were recorded and analyzed to evaluate the efficacy of each TE protocol.

Results: All TE groups showed post-training gains in tongue strength. The **tongue paint** group showed statistically significant improvements in both ATS and PTS ($p < 0.05$), with mean gains of 28.70 ± 27.93 and 53.13 ± 89.96 kPa, respectively, corresponding to the greatest relative increase (30.72%). The tongue wrap and tongue corner groups also exhibited improvements (ATS: 12.75 ± 25.05 and 20.74 ± 36.14 kPa; PTS: 18.56 ± 35.53 and 9.04 ± 21.57 kPa, respectively), although changes were not statistically significant.

Conclusions: Home-based TEs, particularly the **tongue paint** protocol, significantly improved both ATS and PTS in older adults. These findings support the effectiveness of targeted, cost-free TEs as a non-invasive strategy to enhance tongue function. Strengthening tongue musculature through such exercises may contribute to improved oropharyngeal stability and potentially reduce the risk of sleep-disordered breathing in the elderly population.

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Upper Airway Dimensional Changes Following Treatment in Patients with Temporomandibular Disorders: A Longitudinal CBCT-Based Study

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Introduction: This study aimed to evaluate changes in upper airway volume and length in patients with temporomandibular disorders (TMD) before and after treatment, and to investigate how alterations in mandibular position affect upper airway dimensions.

Materials and methods: A total of 102 patients diagnosed with TMD based on the Research Diagnostic Criteria for TMD (RDC/TMD) were enrolled. Each patient underwent clinical and radiographic evaluation, including cone-beam computed tomography (CBCT), before and after a one-year treatment. Condylar bony changes were assessed on sagittal and coronal CBCT views by dividing each mandibular condyle into nine sections and scoring the degenerative change according to presence of erosion, osteophytes, and subchondral cysts. Airway measurements were performed using AVIEW Modeler software and included volumetric and cross-sectional analyses of the velopharyngeal, oropharyngeal, and hypopharyngeal airways. Additional parameters including the anteroposterior and transverse diameters at the narrowest cross-section, total upper airway volume, upper airway length, and condylar volume were also evaluated.

Results: Of the 102 patients, 33 were classified into the improved group and 69 into the worsened group based on CBCT findings. The improved group demonstrated statistically significant increases in velopharyngeal airway volume and total upper airway volume ($p < 0.05$). In this group, the minimum anteroposterior diameters of all airway regions significantly increased following treatment, whereas the worsened group showed significant decreases in these dimensions ($p < 0.05$). Moreover, both upper airway length and condylar volume increased in the improved group but decreased in the worsened group ($p < 0.05$).

Conclusions: Improvements in condylar morphology following TMD treatment are associated with favorable changes in upper airway dimensions, particularly in the velopharyngeal region, total airway volume, and the minimum anteroposterior diameter across all regions. These findings suggest that appropriate TMD management may contribute to improved upper airway patency and potentially reduce the risk of OSA by optimizing mandibular and airway structures.

Breath, Bite, and Bedtime: Sleep's Impact on Kids' Oral Health

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Introduction: Background: Sleep-Disordered Breathing (SDB) in children affects both airway function and oral health, with often-overlooked links to dental caries.

Objectives: This poster outlines the mechanisms connecting SDB to increased caries risk in children by examining key contributing factors and how myoline treatment can be helpful in treatment.

Materials and methods: Methods: We synthesize current understanding of SDB's physiological and behavioral impacts, like mouth breathing and poor sleep, and their direct/indirect effects on oral health.

Results: Results: SDB frequently causes xerostomia (dry mouth) due to mouth breathing, reducing salivary protection. Associated gastroesophageal reflux (GERD) often lowers salivary pH, fostering an acidic oral environment that promotes enamel erosion and sensitivity. Poor sleep quality leads to inconsistent oral hygiene and disrupted eating, escalating caries risk. Nighttime snacking or sugary drinks for comfort further exacerbates problems. SDB is also linked to bruxism.

Conclusions: Conclusions: Early dental recognition of these SDB-related oral signs is crucial for timely diagnosis and multidisciplinary interventions including myoline therapy to mitigate oral health complications.

Variations of craniofacial structure and the pediatric upper airway

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Introduction: Constricted upper airway and cranio-facial structures are risk factors for sleep-disordered breathing in the paediatric population. Identification of adeno-tonsillar hypertrophy and associated cranio-facial factors require a large cross-sectional sample. Lateral cephalometric radiographs are routinely used in paediatric orthodontic screening, and have reproducible landmarks of the upper airway structure that can be assessed. The current study aims to 1) investigate for differences in airway measurements between groups of different age & gender, anteroposterior and vertical skeletal patterns, and ancestry, 2) report prevalence rates of adenoid and/or tonsillar hypertrophy, and 3) report upper airway, skeletal, dental and soft tissue cephalometric measurements in a large Singaporean paediatric orthodontic population.

Materials and methods: Consecutive lateral cephalograms of 203 boys and 201 girls (n=404) between 7.04 to 10.99 years of age were retrieved retrospectively, from a national dental centre. Upper airway, skeletal, dental and soft tissue variables were measured and

investigated for differences between groups based on age, gender, antero-posterior and vertical skeletal patterns, and ancestry. Prevalence of adeno-tonsillar hypertrophy was identified in this population.

Results: Mean values of various upper airway and cephalometric measurements were reported according to age and gender. Significant differences ($p < 0.05$) were noted for thirteen airway variables (Ad, Np (adenoids), Ad/Np, Op (tonsils), PM-U, SPT, NL/PM-U, PM-UPW, UMPW, PASmin, V-LPW, AH-FH, AH-CV) between groups differentiated by gender and age, six (Np (adenoids), Ad/Np, Tn, Op (tonsils), PM-U, NL/PM-U) and four (Ad, Ad/Np, NP/PM-U, AH-CV) variables between groups of different antero-posterior and vertical skeletal patterns respectively, and one variable (AH-CV) between Chinese and non-Chinese children. The overall prevalence of lymphoid tissue hypertrophy based on the lateral cephalograms was 92.3% (based on $Ad/Np \geq 0.5$ and/or $Tn/Op \geq 0.5$).

Conclusions: Mean values of various upper airway and cephalometric measurements were reported for a large paediatric orthodontic population in Singapore. Young, male, Chinese boys aged 7 to 8.99 years with Class I, Class II and high maxillomandibular plane angle had upper airway measurements that increased their risk for SDB. Greater mandibular retrusion and downward positioning were associated with adeno-tonsillar hypertrophy that restricted the paediatric upper airway.

Effects of Sleep Position Therapy on Sleep Bruxism: A pilot study

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Introduction: It has been reported that patients with sleep bruxism (SB) have significantly more rhythmic masticatory muscle activity (RMMA) episodes when they sleep in supine position. The objectives of this study were to investigate if supine sleep position can be a phenotype associated to SB-RMMA genesis and to test if it could correct by sleep positioning device.

Materials and methods: Twelve participants with SB were recruited (4 males and 8 females, mean age 28 ± 8 years). SB was identified using criteria of the International Classification of Sleep Disorders third edition (2014). Correction of supine sleep position was done using a sleep position biofeedback (BF) device, Night Shift (Advanced Brain Monitoring). The BF device produces a vibration behind the neck 5 seconds after supine positioning. Supine sleep time and snoring time above 50 dB were also measured with this device. Grindcare (SUNSTAR), which can measure surface electromyography on a unilateral temporal muscle, was used to measure RMMA episodes per hr (RMMA frequency). Pulse Watch PMP-200 G plus (Pacífico Medico) was used to measure blood oxygen saturation, pulse rate, body movement, and then sleep state, pulse rate elevation index, and 3% oxygen depletion index. Measurements were performed at participant's home over 5 nights. The first night was for baseline/control without BF. During nights 2 to 4, measurements were taken with active BF, and on day 5 without BF. A series of questionnaires were administered each time we collected data: PSQI, Epworth sleepiness scale, STOP-BANG. The study was approved by the Ethic Review Board for Life Science and Medical Research of the University of Tokushima Hospital (No. 3534). Statistical analyses were performed for the comparison of each measurement data.

Results: Among the 12 participants, one was excluded from the analysis because the vibration did not change the sleep position. Overall, BF significantly reduced supine sleep time per sleep period time (Night 1 = 33.7 to 85.6 % to Night 4 = 0.2 to 8.8 %), but overall RMMA frequency did not differ. We then classified participants as responders or non-responders when a change occurred from Night 1. Six participants were classified as responders since they had a 24.1% to 85.6% decrease in RMMA frequency on the last night with BF (Night 4) versus the control one (Night 1). At the opposite end, 5 non-responders were identified; they had an increase of 3.9% to 193.9% in the RMMA frequency. None of sleep variables were statistically different between responders and non-responders.

Conclusions: Owing our small sample size, these preliminary results suggest that supine sleep position role in the genesis of RMMA-SB is not a strong phenotype since a RMMA reduction was observed in only half of participants, and that RMMA frequency was worsen in the other half. It remains to be investigated if rise in RMMA in non-responders could be associated to arousal threshold reactivity.

Acknowledgments: Night Shift and Sunstar devices were provided from respective firms. This study was supported by a donation from the Organization for People with Universities (OTSUCLE) Crowdfunding Project to Elucidate Mechanisms for the Treatment of Sleep Bruxism”.

Effects of Oral Appliance Therapy on Sleep Bruxism and Sleep-Respiratory Parameters in Patients with Obstructive Sleep Apnea

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Introduction: This study aimed to investigate the relationship between sleep-related respiratory events and sleep bruxism (SB) in patients with obstructive sleep apnea (OSA) treated with oral appliance (OA) and to clarify the efficacy of OA treatment on SB.

Materials and methods: Twenty-one OSA patients (10 males and 11 females; mean age, $57.8 \text{ years} \pm 16.0 \text{ SD}$) were sequentially enrolled in this study at Fukuoka University Hospital from October 2020 to May 2025. They

underwent overnight polysomnography (PSG), and their masseter muscle activity was simultaneously assessed using a wearable electromyographic device before and after OA treatment. The apnea-hypopnea index (AHI), arousal index (Arl), percutaneous oxygen saturation (SpO₂), and episodes of SB were compared before and after OA treatment. The responding group that improved AHI by more than 50% or reduced it by less than 5 after treatment (n = 10) was compared to the non-responding group with other conditions (n = 11). OSA and SB diagnoses were based on the guidelines and criteria of the AASM.

Results: OA treatment significantly reduced mean AHI from 17.3 ± 7.8 SD to 12.3 ± 10.7 SD ($p = 0.008$), and respiratory events during both REM and NREM sleep. The total episodes of SB, tonic, and mixed episodes also significantly decreased ($p = 0.002$, $p = 0.034$, and $p = 0.002$, respectively). Meanwhile, the ArI and spontaneous arousal index (SAI) during REM sleep significantly increased ($p = 0.008$ and $p = 0.007$, respectively). Additionally, the non-responding group in OA treatment showed a significant reduction in total SB episodes ($p = 0.013$).

Conclusions: This study suggests that SB is a pathological condition associated with multiple factors besides OSA. OA may be effective for both respiratory events and SB. Meanwhile, to understand the mechanism that causes SB and to determine the applicability of OA and maximize its therapeutic effect, further research is needed.

Multidisciplinary approaches to managing complex phenotypes of patients with Obstructive Sleep Apnea

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Introduction: The management of obstructive sleep apnea (OSA) is shifting toward a precision model grounded in phenotype-based strategies. Accurate phenotyping is essential for targeted treatment of adult OSA. Eckert's classification identifies anatomically collapsible airway as the primary cause, often accompanied by non-anatomical traits like poor muscle response and low arousal threshold. Within this framework, orthodontists serve a key role in identifying and addressing craniofacial skeletal phenotypes (CSPs) that contribute to airway obstruction, thereby enhancing patients' breathing and sleep quality. Additionally, orthodontists are increasingly involved in the interdisciplinary care of OSA patients who exhibit non-craniofacial skeletal phenotypes (N_CSP), necessitating a broader, more integrative treatment approach.

Materials and methods:

This study included 120 Korean adult patients (mean age: 41.5 years; range: 18–70 years) diagnosed with obstructive sleep apnea (OSA) with an apnea-hypopnea index (AHI) of ≥ 5 . Cone-beam computed tomography (CBCT) was utilized to evaluate three-dimensional craniofacial skeletal morphology, condylar deformities, and temporomandibular joint (TMJ) space. Cross-sectional TMJ images were analyzed to assess degenerative changes and the specific locations of bony alterations. Polysomnography (PSG) was performed to determine the severity of OSA.

Results: A total of 120 subjects were classified into four types based on condylar resorption & condylar surface remodeling. Significant differences in AHI and RDI were observed among the four OSA phenotypes, with Types I and II showing lower values compared to Types III and IV ($p < .05$). However, no significant differences were found in ODI or lowest oxygen saturation.

CBCT analysis revealed significant differences in joint space dimensions among the groups. For the right condyle, the superior joint space was significantly smaller in Type I compared to Types II, III, and IV (Type I: 2.87 ± 0.45 mm vs. Type II: 3.41 ± 0.80 mm, Type III: 3.67 ± 0.83 mm, Type IV: 3.13 ± 0.19 mm; $p < .05$), while anterior and posterior joint spaces showed no significant differences. For the left condyle, all three joint spaces—anterior, superior, and posterior—were significantly smaller in Type I than in the other types ($p < .05$).

Condylar angle measurements also differed significantly across groups. Axial angles were smaller in Types I and II on both sides, while lateral angles showed a side-dependent pattern, with higher values on the right in Types I and II and on the left in Types III and IV ($p < .05$).

Conclusions: This study demonstrated that morphological changes in the mandibular condyle, as classified by CBCT-based resorption and remodeling grades, are associated with variations in temporomandibular joint space, condylar angulation, and sleep-related breathing indices. Specifically, advanced resorption types (Types III and IV) showed reduced joint space, altered condylar angles, and higher AHI and RDI values, suggesting a potential link between TMJ structural degeneration and obstructive sleep apnea severity. These findings highlight the clinical relevance of condylar morphology in the assessment and management of patients with OSA.

Acknowledgments: Within the emerging phenotype-based precision approach, orthodontists are crucial in identifying craniofacial skeletal phenotypes (CSPs) and providing both surgical and non-surgical 3D skeletal interventions to improve airway function and sleep quality.

Surgical Orthodontic Treatment of Patient with Moderate Obstructive Sleep Apnea

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Introduction: This case report presents a 38-year-old female who visited the hospital's orthodontic department with chief complaint of an unesthetic smile with excessive gingival display, and issues of anterior open contact and tilted mandibular molars. During routine orthodontic examination, a narrow nasopharyngeal was noted on the lateral cephalometric radiograph. The STOP-Bang questionnaire demonstrated to be a simple, practical, and reliable method identifying patients with risk of obstructive sleep apnea (OSA) in dental clinical settings. Subsequent PSG confirmed diagnosis of moderate OSA (AHI=27.3/hr) and significantly influenced the decision making regarding non-surgical or surgical orthodontic treatment. Collaboration among healthcare providers from different specialties was essential in optimizing treatment outcomes.

Materials and methods: Complex skeletal malocclusions often necessitate an interdisciplinary approach. In addition to addressing skeletal discrepancies, the concomitant issue of compromised upper airway functions, most often in retrognathia cases, require thorough evaluation.

During initial radiographic examination, a narrow nasopharyngeal airway was noted on the lateral cephalometric radiograph. To further confirm whether issues with upper airway patency were present, the STOP-Bang questionnaire was used for OSA risk screening. With a STOP-Bang score of 3/8, an otolaryngology consultation was arranged. The otolaryngologist scheduled an overnight PSG examination, and results revealed an AHI score of 27.3/hr, indicating moderate OSA. Nasopharyngolaryngoscopy was also used for examination, and tumors, cysts, lingual tonsils, or laryngeal pathology were ruled out, while tongue hypertrophy was noted. The diagnosis of moderate OSA significantly influenced the decision making regarding non-surgical or surgical orthodontic treatment.

Maxillomandibular advancement is considered one of the most effective surgical procedures in treating patients with moderate to severe OSA. Upon skeletal evaluation of the patient, maxilla retrusion was not present, and excessive advancement of the maxilla will have adverse effects on the patient's profile. Moreover, the most narrow dimension of the upper airway was identified at the retroglossal area, which is most influenced by mandibular retrusion. Hence, the surgical treatment plan prioritized advancement of the mandible and limited maxillary advancement.

Results: Based on superimposition of lateral cephalometric tracings before and after treatment, the maxilla was impacted by 2.5 mm, and point B of the mandible moved upward by 2.5 mm and forward by 7 mm. Combined with genioplasty, the pogonion moved upward by 10 mm and forward by 15 mm. The soft tissue facial contour angle improved from 24 degrees to 14 degrees.

Post-treatment PSG assessment revealed a reduction in AHI from 27.3/hr to 17.0/hr. Less daytime fatigue was reported by the patient.

Conclusions: Improvement in OSA severity following orthognathic surgery is demonstrated. AHI decreased by 37.7%, and the patient's subjective improvement (reduced daytime sleepiness) is notable, indicating a benefit in sleep quality. In surgical planning, amount of maxillomandibular advancement was limited due to esthetic considerations. Persistent symptoms suggest the need for ongoing evaluation and possibly adjunctive therapy. The case highlights the critical role of dental professionals in screening, referral, and co-managing sleep disorders.

Recognition and intervention in dental settings can lead to earlier diagnosis, improved outcomes, and a multidisciplinary approach to this prevalent but often overlooked condition.

Excessive Daytime Sleepiness

Consensus recommendations for special challenges faced by technical personnel with elderly and very old patients in the sleep laboratory

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Introduction: Sleep disorders increase with increasing age. In the US American population 50% of all persons 65 yrs and older complain about sleep problems. Therefore, elderly patients make up a large portion of clients in the sleep laboratory with polysomnography for diagnosis and therapy.

The technical staff confronted with elderly clients in the sleep laboratory faces several special challenges with this cohort, which are discussed and given recommendations to deal with them in this consensus statement.

Materials and methods: Based on the experience of challenges faced by elderly patients in the sleep laboratory, which have been revealed by consensus in an open in presence discussion of members of our assemblies (Geriatric Sleep Medicine of the German Sleep Society, Certified Sleep Technicians of the German Sleep Society and Geriatric Pulmonary Medicine of the German Society of Pneumology) at the 2024 annual conference of the German Sleep Society in Essen, Germany and written reports of members of the Certified Sleep Technicians of the German Sleep Society via email to assembly chairs, the assembly chairs voted on recommendations.

Results: The changes in electrophysiologic signals with lower amplitudes in the electroencephalogram of elderly people increase the difficulties to distinguish between sleep stages. Technicians must be aware of different normal values of sleep stage distribution, arousals, sleep efficiency and mean oxygen saturation. The automatic analysis of polysomnography devices can most often not be applied and electrophysiologic channels must be analyzed manually. The older, most often dryer skin of elderly persons leads to higher electric resistance weakening electrophysiologic signal quality.

Older sleep laboratory clients often need more care during the night and home polysomnographies are difficult to perform. Nycturia, the risk of falls and reduced cognitive function with disorientation during the night in elderly increase these difficulties.

Special challenges can come from dentures worn or taken out at night, a more often tendency to keep the mouth open during breathing, being frightened to wear a nasal or full-face mask, not understanding the procedure and the need for therapy overall and the forced influence and interventions of relatives before, during and after polysomnography. The collaboration with relatives on the other hand is often needed to perform the diagnostic and therapeutic procedures.

Conclusions: The developed recommendations by several assemblies of the German Sleep Society could be used as a hands on track for technical personnel in sleep laboratories world wide.

Investigation of Sleep Architecture and Individual Traits Associated with the Discrepancy Between Subjective and Objective Sleepiness: A Retrospective Observational Study

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Introduction: Excessive daytime sleepiness (EDS) is a common complaint in sleep clinics. However, some patients who report pronounced subjective sleepiness show no objective signs of sleepiness when evaluated using tools such as the Multiple Sleep Latency Test (MSLT). This discrepancy remains poorly understood and poses diagnostic

challenges. While physiological assessments play an important role, they do not always reflect patients' real-world experiences. This study aimed to investigate how the discrepancy between subjective and objective sleepiness relates to sleep architecture, as measured by polysomnography (PSG), and individual characteristics. The study was approved by the Kurume University Ethics Committee (No. 22237).

Materials and methods: We retrospectively analyzed medical records of patients who visited Kurume University Hospital between 2020 and 2023 with complaints of EDS and underwent overnight PSG and daytime MSLT. From these, 153 patients (mean age: 24.8 ± 13.3 years) who had an Epworth Sleepiness Scale (ESS) score ≥ 11 and a mean sleep latency >8 minutes on MSLT were selected. Statistical comparisons were conducted for age, sex, PSG parameters (sleep latency, sleep efficiency, REM latency, WASO, total sleep time, and slow wave sleep [SWS] time and percentage), as well as neurodevelopmental traits and other characteristics. Correlation, regression, and mediation analyses were performed, including stratified logistic regression by age group.

Results: The discrepancy group showed significantly higher SWS time and SWS percentage, and longer REM latency (all $p < 0.005$), with no significant differences in other PSG parameters, including WASO. No significant associations were found with questionnaire measures (BDI-II, ISI-J, ASRS, AQ-J-10, MEQ-SA). SWS% was positively correlated with MSLT latency ($r = 0.185$, $p = 0.0002$), whereas ESS showed only a minimal association ($r \approx -0.12$, $p = 0.02$, $<2\%$ variance). In multivariable models, SWS% and REM latency remained independent predictors of longer MSLT latency. However, when discrepancy was used as the dependent variable, age and AHI—but not SWS%—were significant predictors. Stratified regression revealed that discrepancy was mainly associated with SWS% in patients ≤ 18 years, whereas AHI emerged as the predictor in those ≥ 19 years. Discrepancy tended to widen with greater SWS and shrink with higher AHI. Mediation analysis further indicated that the effects of AHI and age on discrepancy were largely mediated through changes in SWS.

Conclusions:

Patients who reported subjective but not objective sleepiness exhibited a favorable sleep profile with more deep sleep and longer REM latency. Although SWS was associated with longer MSLT latency, age and AHI—not SWS—were the main predictors of discrepancy. The contribution of ESS and other questionnaire-based measures was negligible. Discrepancy widened with abundant SWS and diminished with higher AHI, suggesting age-dependent mechanisms: preserved deep sleep in younger patients and respiratory disturbances in older patients. This single-center cross-sectional study relied on self-report questionnaires for patient traits and may have unmeasured confounders; multicenter studies are needed to validate these findings.

Acknowledgments: This study was supported by the "Sleep Polysomnography Databank Project" of the National Center of Neurology and Psychiatry (NCNP), Japan.

Residual Excessive Daytime Sleepiness in CPAP-Treated OSA Patients: A Retrospective Study from a Tertiary Australian Hospital

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Introduction: Obstructive sleep apnoea (OSA) is a frequent cause of excessive daytime sleepiness (EDS). EDS impairs quality-of-life and can lead to motor vehicle accidents and/or workplace injuries. CPAP (continuous positive airway pressure) is the gold standard treatment for OSA but up to 22% of CPAP-treated OSA patients report residual EDS on follow-up. The causes of residual EDS are multifactorial and can be broadly categorised into: 1) ineffective CPAP treatment, 2) another sleep disorder contributing to EDS, 3) medical disorders causing EDS, and 4) persistent EDS with no clear aetiology. Identifying the underlying cause(s) of residual EDS is essential for improving treatment adherence and patient quality of life. Despite increasing awareness, there is limited real-world data on the prevalence and causes of residual EDS in CPAP-treated OSA patients in Australian clinical settings, highlighting the need for this study.

Materials and methods: This retrospective study was conducted at Gold Coast Hospital University Hospital (GCUH), a tertiary referral centre with a catchment population of over 600,000 people across South-East

Queensland and Northern New South Wales regions of Australia. Medical records were reviewed for patients aged ≥ 18 years who presented to the GCUH Sleep Medicine Outpatient Clinic with an OSA diagnosis between 2019-2024 (inclusive). Residual EDS was defined as Epworth Sleepiness Scale (ESS) of >10 or patients' subjective complaint of significant residual daytime somnolence during their post-CPAP commencement clinic review. Data collected included demographics, diagnostic modality, CPAP therapy details, co-morbidities and investigations/treatments for persistent EDS.

Results: Out of 354 patients treated for OSA at our sleep clinics, 35 (10%) reported residual EDS following CPAP commencement. The median age of these patients was 58 years (IQR 53-75 years), with 60% (n=21) being male. Nearly half (46%) had chronic pain or a mental health disorder as a co-morbidity. Median ESS and Apnoea-Hypopnoea Index (AHI) at OSA diagnosis were 14 (IQR 10.5-17) and 31.7 (IQR 20.5-51), respectively. Most patients (n=20) had a home-based diagnostic study while the majority (n=24) also had a lab-based CPAP titration. Six patients required in-lab CPAP titration, and three underwent vigilance testing to assess for central hypersomnolence disorders. Multiple contributing factors were identified in eight patients, with insomnia (n=7) being the most common. Other frequent causes included mask fit issues, inadequate pressure, and CPAP discomfort. Two patients were prescribed modafinil: one had a mean sleep latency (MSL) <8 mins on vigilance testing (with no sleep-onset Rapid Eye Movement periods) but also had post-traumatic stress disorder and insomnia, while the other had a normal MSL.

Conclusions: Insomnia, a common co-occurrence with OSA, was the leading contributor to post-CPAP residual EDS in our cohort. Early screening and management with cognitive behavioural therapy and sleep hygiene strategies may improve patient quality-of-life. Chronic pain and mental health co-morbidities, which were prevalent in this group, can fragment sleep and should be identified at initial screening. CPAP intolerance and mask related issues remain global challenges, and limited access to lab-based titration and sleep scientist clinics may hinder timely resolution. Overall, post-CPAP residual EDS is often multifactorial and requires a systematic assessment and individualised approach.

Assessment of wakefulness in Vietnamese patients with obstructive sleep apnea using a modified Maintenance of Wakefulness Test protocol

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Introduction: Obstructive sleep apnea (OSA) is marked by the recurrent collapse of the upper airway during sleep, causing fragmentation of normal sleep patterns and notable sleepiness during the daytime. The Maintenance of Wakefulness Test (MWT) assesses a patient's ability to stay awake in a dark environment without any external support. With this study, we aimed to evaluate the ability to maintain wakefulness among OSA patients in the Vietnamese population using a modified MWT protocol.

Materials and methods: A cross-sectional study, collecting patients from University Medical Center, Ho Chi Minh City, from November 2022 to August 2024. Adult patients with newly diagnosed, untreated OSA were recruited, excluding those on sleep-affecting medications or those with other conditions affecting alertness. Pilot testing revealed challenges with the standard MWT due to cultural napping habits, leading to protocol adaptation. The modified MWT allowed participants to nap between sessions at their usual times, required waking at least 30 minutes before each session, and subjects were not awakened if sleep occurred during the 40-minute sessions. Signals from the MWT electrodes were recorded continuously between sessions to measure the sleep latency (SL) of each session and the total sleep time (TST) during the test day.

Results: The study included 63 subjects, median age 48 (IQR 36-58), 79% male, median BMI 27.4 (IQR 25.1-29.8), 84% reported napping habits. Most of participants (71%) had severe OSA (median AHI 44, IQR 26-70). Objective MWT measurements showed average SL of 22 minutes (IQR: 11-30). A clear correlation was observed, with baseline AHI positively correlated with TST and negatively correlated with SL measured by MWT. In MWT,

sleeping in session 1 increased the odds of sleeping in session 2 by 3.64 times (95% CI: 1.16, 11.9); greater TST in a preceding session was significantly associated with shorter SL in the subsequent session(s).

Conclusions: Higher TST in a preceding MWT session correlated with higher TST and shorter SL in subsequent session(s), indicating persistent difficulty staying awake, regardless of nap. The modified MWT protocol, tailored for cultural sleep practices, provides feasible and meaningful assessment of wakefulness in Vietnamese patients with OSA, thereby suggesting adaptation the MWT for countries with nap habits.

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Effects of Sleep Patterns and Daytime Sleepiness on School Attendance Among Students in Elementary and Junior High Schools

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Introduction: According to a Japanese national survey, the number of students who are chronically absent from elementary and junior high schools has reached approximately 350,000. Common reasons for absenteeism include “lack of motivation toward school life” and “irregular lifestyle habits.” Since an “irregular lifestyle” may be associated with irregular sleep behavior, understanding the amount and pattern of sleep and the degree of daytime sleepiness, and how it affects school attendance behavior, may provide valuable insights into the prevention and early intervention of school absenteeism. Thus, we aimed to clarify the relationship among (1) average sleep duration on weekdays and weekends, (2) the intensity of daytime sleepiness, and (3) frequency of attendance and absence in elementary and junior high school students.

Materials and methods: The survey was conducted among 929 elementary school (4th grade to 6th grade) and 332 junior high school students (1st grade to 3rd grade) between October 7 and November 1, 2024. Students were asked to digitally record their bedtimes and wake-up times for one week including weekends using an originally developed application. We analyzed the average sleep duration, as well as bedtime and wake-up time of their daily routines. Additionally, daytime sleepiness was assessed using the Japanese version of the Epworth Sleepiness Scale (JESS) and we analyzed the relation between sleepiness and absence and tardiness in junior high school students.

Results: The average sleep times in elementary school and junior high school students were 8.7 ± 1.1 hours and 7.3 ± 1.2 . The average JESS score across the sample was 4.4 for elementary school students and 7.7 for junior high school students and 8.3% of the elementary school students and 25.9% of junior high school students scored ≥ 11 , indicating excessive daytime sleepiness.

Junior high school students were divided into two groups based on their JESS scores. Group 1: JESS ≥ 11 , and Group 2: JESS ≤ 10 . A comparison was made between the average monthly number of absences and tardiness based on annual data, revealed that students in Group 1 had significantly more absences and instances of tardiness than in Group 2 (absence: 10.7 days vs 7.1 days: $p < 0.01$, tardiness: 7.4 days vs 4.2 days: $p < 0.01$).

The average sleep duration over one week and the JESS score showed a negative correlation ($p < 0.01$). In particular, students who averaged less than 6 hours of sleep had a significantly higher proportion of JESS scores of 11 or above.

Conclusions: In this study, it was found that sleep time was progressively shortened with age and approximately one in four junior high school students felt sleepy during the day. A higher rate of absenteeism and tardiness was observed, especially among the students who slept less than 6 hours or who felt sleepy. As the sleep habits of junior high school students were closely related to their school attendance status, screening for irregular or insufficient sleep using user-friendly application might be highly effective method to detect the abnormal sleep patterns and perform the preventive supports in order to minimize the absenteeism and tardiness.

Long-Term Clinical and Functional Evolution in Patients with Obstructive Sleep Apnea and Daytime Sleepiness Treated with CPAP: Results from the HYPNOSA Cohort Study

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Introduction: Obstructive Sleep Apnea (OSA) associated with Excessive Daytime Sleepiness (EDS) is a highly prevalent clinical phenotype with significant impact on physical and psychological wellbeing. The HYPNOSA study aims to characterize this phenotype and evaluate the evolution of symptoms, quality of life, and physiological parameters under CPAP therapy. This abstract presents descriptive interim findings at 6, 12, and 24 months of follow-up.

Materials and methods: HYPNOSA is a prospective, multicenter observational study including 616 patients diagnosed with OSA and EDS. Patients were evaluated at baseline and followed at 6, 12, and 24 months. Collected data included demographics, respiratory sleep parameters (AHI, CT90, mean SatO₂), ESS, EuroQol-5D, FOSQ, HADS, and CPAP adherence. Analyses were conducted using R v4.4.2.

Results: The population had a mean age of 55.6±11.5 years; 65.6% were male. Baseline sleep study showed severe OSA (mean AHI: 39.5/h), oxygen desaturation (SatO₂: 91.4%) and prolonged hypoxic burden (CT90: 21.7%). Baseline clinical scales revealed a high burden of symptoms:

- **Epworth Sleepiness Scale (ESS):** mean 10.9 (P50: 11), with most reported sleepiness while watching TV (2.06±0.95) and lying down in the morning (2.22±0.98).
- **EuroQol-5D:** moderate limitation in mobility, pain, and daily activities (mean ~1.5), with **anxiety/depression as the most impaired domain**.
- **FOSQ:** mean score of 92.1±24.4, with marked functional impairment; 20 of 30 items scored >3.2 (quite a bit/much), especially in concentration, household chores, and keeping pace with peers. Lowest was general activity (2.69±1.1).
- **HADS:** total score 12.07±7.24, indicating frequent symptoms of anxiety and low mood.

At 6 months, improvements were substantial:

- **ESS:** 7.95±4.61, with reduction in most somnolence items.
- **EuroQol-5D:** improved to 73.5±16.5, pain remained most reported limitation.
- **FOSQ:** increased to 100.07±21.3, 29/30 items >3.4; lowest again was general activity (2.8±1.04).
- **HADS:** reduced to 4.17, indicating low-mild psychological symptoms.
- **IAH:** decreased to 3.2/h; **CT90 fell to 0.5%; SatO₂ improved to 95%;** average CPAP use: 6.2 h/night.

At 12 months, this trend continued: ESS 7.19; HADS 2.04; FOSQ 101.5; EQ-5D 72.5. At 24 months (in limited data), results remained stable: ESS 6.67, HADS 0.05, FOSQ 109.7, EQ-5D 76.7. CPAP adherence was consistently above 5.3 h/night.

Conclusions: Despite being relatively young and without major comorbidities, patients with OSA and EDS present with significant functional, emotional, and quality-of-life impairment. CPAP treatment leads to rapid and sustained improvement in sleep physiology, daily functioning, and psychological wellbeing. However, some limitations—especially general activity—persist. These findings support the value of long-term follow-up and structured management in this clinical phenotype.

Preliminary Findings on Sleep Patterns in Working Women of Menopausal Generation in Japan

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Introduction: Currently, approximately 40% of working women in Japan are in their mid-40s to 50s, which corresponds to the menopausal age group. This demographic also shows a high rate of labor force participation. Therefore, supporting the health and well-being of this population is considered crucial to maintaining overall workforce productivity. However, many women experience difficulties balancing menopausal symptoms with work, and sleep-related issues in particular have been reported to affect job performance. In this study, we present our interim findings from a project funded by the Japan Agency for Medical Research and Development, which investigates the impact of menopausal symptoms on work productivity. Specifically, we report on the measurement of sleep status among working women in the menopausal age group. The objectives of this investigation are to assess sleep disturbances as menopausal symptoms and to clarify their impact on work productivity.

Materials and methods: The study aims to include 50 working women in their 20s to 30s as a comparison group, and 50 working women in the menopausal age group (40s to 60s) as the primary study population. Participants put on a wearable, simplified electroencephalogram device. The SmartSleep™ device (Philips, Koninklijke Philips N.V., the Netherlands) used in this study was placed on the women's heads during sleep for approximately three weeks, from bedtime to wake-up time. The device is connected to a smartphone, which collects sleep data such as sleep depth and sleep duration. One week after the start of the measurement and again at the end of the two-week measurement period, participants completed web-based questionnaires regarding their subjective sleep quality, sleep duration, and work productivity. The study commenced in December 2024 and is scheduled to be conducted over five terms. To date, two waves have been completed.

Results: A total of 16 participants were included in the first wave and 19 participants in the second wave. In the first wave, 44% were in their 40s and 56% in their 50s. In the second wave, 46% were in their 40s, 34% in their 50s. The self-reported average sleep duration was 359 minutes in the first wave and 383 minutes in the second wave. However, the actual measured sleep duration was 281 minutes in the first wave and 283 minutes in the second wave, indicating a discrepancy between perceived and actual sleep duration. The proportion of deep sleep was 37.5% in the first wave and 31.3% in the second wave. The presenteeism score, assessed using the WHO-HPQ (World Health Organization Health and Work Performance Questionnaire), was 59.4 in the first wave and 61.6 in the second wave.

Conclusions: These results provided an overview of the sleep conditions, including deep sleep, among women in the menopausal age group. We plan to complete the remaining study waves and accumulate further data to compare menopausal and younger women. We also aim to clarify the relationship between menopausal symptoms, sleep conditions, and work productivity.

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Das-Naglieri cognitive assessment system and serum A β levels contribute to the cognitive evaluation of OSAHS children

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Introduction: Obstructive sleep apnea hypopnea syndrome (OSAHS), a prevalent pediatric sleep disorder, is marked by recurrent episodes of apnea and hypoventilation throughout sleep. These events result in hypoxemia and disrupted sleep architecture, which are in turn linked to cognitive deficits.

Presently, reliable tools for evaluating such cognitive impairment are scarce. This study aims to evaluate cognitive function in children diagnosed with OSAHS and primary snoring (PS) by employing the Das-Naglieri cognitive assessment system (DN: CAS), measure serum Amyloid- β (A β) protein and investigate the potential relationship between cognitive performance and A β levels in the pediatric OSAHS population.

Materials and methods: Based on the results of all-night polysomnographic monitoring, the 118 participants were categorized into OSAHS and PS groups. The cognitive function of all children from these two groups, along with an age-matched control cohort (n=82), was evaluated with the DN:CAS assessment and serum A β levels were quantified via Enzyme-Linked Immunosorbent Assay (ELISA).

Results: Children with PS showed poorer performance in Planning relative to their healthy counterparts. In the OSAHS group, significant reductions were observed in Full Scale, Planning, and Attention scores. These scores were also inversely associated with the lowest blood oxygen saturation (LSaO₂). Furthermore, serum A β levels were elevated in children with OSAHS and demonstrated a negative correlation with Full Scale and Attention scores, but a positive correlation with the obstructive apnea-hypopnea index (OAHl).

Conclusions: The DN:CAS assessment system is instrumental in evaluating cognitive function, and serum A β levels hold promise as a biomarker for the early diagnosis of cognitive impairment in children with OSAHS.

Unpacking the Discrepancy Between Subjective and Wearable-Measured Sleep: A Neurophysiological Perspective Using fNIRS

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Introduction: Discrepancies between subjective sleep experience and objective sleep metrics are well-documented in both clinical and consumer settings. While consumer sleep trackers like Fitbit provide convenient longitudinal monitoring of sleep structure using accelerometry and PPG, many users report that these data do not align with how they feel upon waking. These mismatches are often attributed to device inaccuracy, yet even gold-standard polysomnography (PSG) explains only a small fraction of the variance in subjective sleep quality. Despite this, little is known about the underlying neural basis of this divergence, particularly in the context of sleep-tracking technologies. This study aims to explore the neurophysiological correlates of subjective versus wearable-derived sleep assessments during the first sleep cycle, and to evaluate whether these reflect distinct patterns of prefrontal cortical activity.

Materials and methods: We conducted an N-of-1 pilot study with a healthy male in his 30s, free from diagnosed sleep or mental health conditions. Prefrontal cortical hemodynamics were recorded during the first 90 minutes of sleep using a 27-channel wearable fNIRS system (Brite 24, Artinis). Concurrently, sleep metrics were obtained from a Fitbit Sense (e.g., TST, WASO, sleep efficiency, light/deep/REM sleep ratios, and Fitbit's sleep score). Subjective sleep quality was self-rated on a 5-point Likert scale each morning. Eight hemodynamic features

were derived from fNIRS data (i.e., mean, median, SD, skewness, kurtosis, total power, peak amplitude, peak ratio), and correlations were computed with both subjective ratings and Fitbit metrics.

Results: Subjective sleep ratings were moderately and positively correlated with median ΔO_2Hb and ΔHHb in specific prefrontal cortex (PFC) channels, suggesting that more stable or elevated hemodynamic activity during the first sleep cycle may support better perceived sleep. Negative correlations were observed between subjective ratings and the skewness and kurtosis of ΔO_2Hb , indicating that flatter or more symmetrical signal shapes may align with positive sleep perception. In contrast, Fitbit's sleep score showed strong negative correlations with the mean and standard deviation of ΔO_2Hb and ΔHHb in a different set of PFC channels ($r < -0.70$), implying that higher signal amplitude or variability is linked to poorer device-rated sleep quality. Additional Fitbit metrics demonstrated distinct physiological signatures. Sleep continuity metrics—including sleep efficiency, WASO, wake ratio, and light sleep ratio—were positively associated with hemodynamic activity. Conversely, sleep quantity metrics like total sleep time and deep sleep ratio showed negative associations. REM sleep ratio exhibited weak or inconsistent correlations. Topographical analyses revealed little spatial overlap between channels linked to subjective ratings and those linked to Fitbit metrics.

Conclusions: Subjective and wearable-based sleep assessments appear to reflect different neurophysiological dimensions of early sleep cycle. The commonly observed mismatch is not merely a matter of device error but rather of measurement misalignment. These findings suggest a need to move beyond improving algorithmic accuracy and toward personalized, neuroscience-informed feedback in future sleep tracking technologies.

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Relaxation of social time pressure affects subjective sleep quality and its associations vary depending on chronotype

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Introduction: Modern societal factors frequently impede the attainment of good sleep quality by many healthy adults. We investigated the chronotype-specific predictors of changes in subjective sleep quality following the relaxation of social time pressure during COVID-19 pandemic social restrictions in Japan.

Materials and methods: The internet-based Global Chrono-Corona Survey (GCCS) study received approval from the Ariel University Human Research Ethics Committee, Faculty of Health Sciences (AU-HEA-MK-20200629). A total of 1,649 participants completed the Japanese version of this study during the initial COVID-19 social restrictions. The final sample for analysis were 1,252 (34.6 ± 13.8 years, 67% female). Logistic regression analyses were used to assess changes under modified social time pressure in sleep quality by chronotype group (early, intermediate or late) from changes in patterns of daily behaviors.

Results: During social restrictions, subjective sleep quality deteriorated with decreased sleep duration and delays in sleep timing in the intermediate chronotype, while late chronotypes' reduction in sleep quality was associated with delayed sleep timing. Improved subjective sleep quality was associated with increased sleep duration and minimal sleep timing delay in the early and intermediate chronotypes. In late chronotypes, improved sleep quality was also associated with longer outdoor light exposure. These findings indicate that the determinants of changes in subjective sleep quality under modified social time pressure are at least partially chronotype-specific. Maintaining sleep timing may universally enhance subjective sleep quality during perturbations of social schedules. Moreover, in late chronotypes, the exposure to daylight may improve sleep quality, regardless of changes in sleep behaviors.

Conclusions: These insights may contribute to the development of effective strategies for promoting better sleep quality in modern societies where insufficient sleep is becoming increasingly widespread.

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Sleep Health of Preschool Children in Bangladesh

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Introduction: Sleep affects a range of physical and neurodevelopmental outcomes, including executive function, growth, and obesity risk, which are public health priorities in low- and middle-income countries (LMICs). However, most data on children's sleep health come from high-income countries, and their recommendations may not apply to LMICs. Despite the importance of childhood sleep and emerging evidence of cross-cultural variation in early childhood sleep, little is known about children's sleep health in Bangladesh, a lower middle-income country in South Asia experiencing rapid urbanization and growing socioeconomic inequality.

Materials and methods: We collected sleep health data from 433 preschoolers in Dhaka, Bangladesh, using the Brief Infant Sleep Questionnaire Short Form (BISQ-R-SF) to assess children's sleep patterns and parental perceptions and behaviors. Additionally, we conducted qualitative research through two focus group discussions (6 participants each) and seven in-depth interviews to explore maternal knowledge and attitudes toward children's sleep needs, co-sleeping, and potential sleep health interventions.

Results: Children aged 3–4 years slept an average of 10.3 hours per day (SD 1.5 h), with 40% sleeping less than the recommended duration (10–13 hours). Only 17.5% of children meet WHO's recommendation for maximum screen use (1h/day); mothers reported an average of 3.2 h (SD 1.9) of daily screen use for their preschoolers. Night-waking was common, only 30% of children slept through the night, while 66% woke 1–2 times at night, and 10% woke 3 or more times. Children went to bed on average at 10:30 p.m. (SD 1.2 h), about two hours later than the Western norm of 8:30 p.m. Screen time was positively associated with later bedtimes (p for trend < 0.001). Children of more educated mothers also had later bedtime and longer daytime naps. Co-sleeping was nearly universal. During in-depth interviews and FGDs, mothers expressed strong reluctance to allow children to sleep alone before age seven. Some linked their child's night-waking to their own sleep disturbances and daytime fatigue. Most mothers were unaware of recommended sleep durations, and the concept of a bedtime routine was unfamiliar. Although sleep interventions were described as “foreign”, mothers actively sought advice on best practices.

Conclusions: Preschool children in Bangladesh sleep less than recommended and frequently wake at night. Higher screen time is linked to poorer sleep outcomes. These findings, along with limited parental knowledge about healthy sleep practices, highlight the need for culturally adapted sleep promotion interventions in Bangladesh.

Postpartum Sleep Health as a Network: Mapping Multidimensional and Contextual Dynamics

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Introduction: In the postpartum period, women experience significant sleep disruptions, affecting not just sleep quality but also how rested, alert, and satisfied they feel. Sleep health is a multidimensional construct encompassing sleep satisfaction, alertness, sleep timing, efficiency, and duration. Despite its multidimensional nature, prior research has largely focused on individual domains, with little attention to the interactions between domains. Moreover, sleep, particularly during the postpartum period, is embedded within a complex interplay of psychosocial contexts. This study aims to model interrelations among sleep health domains and their maternal, infant, and psychosocial correlates.

Materials and methods: Participants were a community sample of nulliparas 4–12 months postpartum. Sleep health was assessed using five domains: (1) Sleep Satisfaction was assessed using two items from the Insomnia Severity Index: sleep dissatisfaction and distress related to sleep. (2) Alertness was assessed using Fatigue Severity Scale, Epworth Sleepiness Scale, and Karolinska Sleepiness Scale. (3) Sleep Timing was calculated via bedtime deviation and rise deviation, which quantified the misalignment between participants' preferred and actual sleep/wake timing. (4) Sleep Efficiency was assessed using sleep onset latency and wake after sleep onset. (5) Sleep Duration was assessed by total sleep time. Maternal cognitive sleep factors included Glasgow Sleep Effort Scale and Dysfunctional Beliefs and Attitudes about Sleep; Infant sleep factors included infant daytime/nighttime total sleep

time, sleep onset latency, and wake after sleep onset; Social-support factors included emotional and instrumental support, and proportion of nighttime support.

Network structures were estimated using Gaussian Graphical Model, where nodes represent variables and edges represent conditional associations after controlling for all other variables in the network. To identify influential variables, strength centrality, bridge centrality, and expected influence were computed.

Results: The study included 329 participants (Mean_{age} = 31.76, SD_{age} = 4.67), with infants averaging 7.04 months old (SD = 2.60). For the sleep health network, the strongest connection was observed between sleep dissatisfaction and sleep-related distress (Satisfaction domain), followed by the association between distress and fatigue (Satisfaction and Alertness), and sleep onset latency and total sleep time (Efficiency and Duration). Nodes ranked highest in both strength centrality and expected influence were distress, fatigue, and dissatisfaction. For the integrated network with sleep health and contextual factors, maternal cognitive sleep factors showed the most extensive associations, particularly with satisfaction, alertness, and efficiency. Infant-related variables were linked primarily to efficiency and alertness, while social support factors had fewer direct connections. Maternal sleep effort demonstrated the highest bridge strength.

Conclusions: Postpartum sleep health is not only multidimensional, but the domains are interconnected. During the first postpartum year, distress with sleep and fatigue played central roles in overall sleep health. Further, amongst maternal, infant, and psychosocial correlates of sleep health examined, sleep effort emerged as a modifiable factor that exerted a strong influence on maternal sleep health. These findings contribute to a growing shift toward an integrated, multidimensional approach to postpartum sleep health. Distress with sleep, fatigue, and sleep effort may be prioritised in as therapeutic targets in sleep health interventions.

Influence of Climate Changes on Sleep. Systematic Review

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Introduction: Climate changes could lead in changes of sleep and sleep pattern as well as in sleep disorders and chronobiological changes, beginning with a poor quality of sleep, reinforced by a shift of the sleep-wake rhythm and lead in severe sleep disorders. Their prevalence and incidence are unknown until now. Both sleep disorders and chronobiological changes have a wide variety of causes and usually appear as a comorbid disorder in various somatic and psychiatric diagnoses, mental disorders and treatments. There can be many different predictors of sleep disorders and chronobiological changes, such as predisposition or pre-existing diseases, caused and / or reinforced by climate changes.

Materials and methods: A systematic literature review related to Climate changes and Sleep was carried out and 1,649 studies were evaluated. The articles were identified through PubMed, PsycInfo, and Web of Knowledge; a total of 30 publications were included in the analysis.

Results: A total number of ninety-five studies of the topic climate changes and sleep were identified; thirty of them were analysed, based on different criteria (climatic and civilization-related changes, natural disasters and special weather phenomena).

Conclusions: The review found that changes of sleep, of sleep pattern and of sleep quality as well as different sleep disorders (such as insomnias, hypersomnias, parasomnias) and chronobiological changes can be predicted for very different reasons. Personalized treatment of climatic-related changes would be needed to improve the mental and / or physical condition of these patients.

Sleep characteristics and predictors of their disturbances in the Russian population: preliminary data from the large-scale SLEEPSTUDYRU project

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Introduction: Sleep disturbances are a significant public health concern, linked to diminished quality of life and various somatic and mental disorders. Despite high prevalence, systematic data on sleep in Russia's vast, geographically diverse population remain limited. The SleepStudyRU project, encompassing 11 time zones and diverse climatic regions, offers unique scale and fundamental significance for sleep epidemiology in such a heterogeneous environment. Our objective was to examine sleep characteristics, ascertain disturbance prevalence, and identify associated factors among the Russian population.

Materials and methods: This multicenter SleepStudyRU project surveyed 3,529 adults across all Russian Federal districts, ensuring robust sample representativeness. Data were collected via a custom questionnaire covering demographic, somatic, somnological, and chronobiological profiles. Analysis used frequency characteristics (proportion, %), median, and interquartile range (IQR). Multivariate logistic regression identified associated factors, calculating adjusted odds ratios (aORs) with 95% confidence intervals (95% CIs)

Results: Our sample comprised 3,529 respondents (66.2% women; 33.8% men) from diverse age groups (14-60+ years) and socioeconomic strata across all Federal districts. A striking 67.0% reported sleep quality disturbances. Primary issues included difficulties with sleep onset (38.6%), early morning awakenings (19.8%), and sleep maintenance challenges (13.9%). Daytime sleepiness was reported by 68.1%. Median self-assessed sleep quality was 7 (IQR 5–8) out of 10. For duration, 31.5% slept 7 hours, 25.9% slept 6 hours, and 15.2% slept under 5 hours. Multivariate regression identified these independent factors significantly associated with increased likelihood of sleep quality disturbances: female sex (aOR 1.26; 95% CI 1.08–1.47); age over 60 years (aOR 1.49; 95% CI 1.07–2.08), presence of comorbidities (aOR 2.15; 95% CI 1.82–2.54), mobile phone use before sleep (aOR 1.56; 95% CI 1.32–1.85), watching TV before sleep (aOR 1.27; 95% CI 1.06–1.51), divorced or widowed marital status (aOR 1.90–1.91; 95% CI 1.38–2.63 and 1.19–3.07), residence in Volga (PFD), Siberian (SFD), or Southern (YFD) Federal Districts (aOR 1.62–2.52 vs. Central (CFD)), suggesting regional specificities. Conversely, moderate regular physical activity (1-2 times/week) was associated with reduced disturbance likelihood (aOR 0.74; 95% CI 0.62–0.89).

Conclusions: These preliminary SleepStudyRU data confirm an exceptionally high prevalence of sleep quality disturbances (67.0%) in Russia. Identified modifiable factors like pre-sleep gadget/TV use and comorbidities indicate promising targets for preventive/therapeutic interventions. Results spanning 11 time zones and diverse climatic zones critically underscore their importance for future investigations into geographical/chronobiological influences on national-scale sleep. Developing large-scale educational programs on sleep hygiene and behavioral impact is unequivocally necessary for improving Russian public health. Further research will clarify regional specificities.

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Objectively-defined sleep regularity is associated with macrovascular and microvascular complications among individuals with type 2 diabetes – a cohort study

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Introduction: To assess the association of accelerometer-measured sleep regularity with macrovascular and microvascular complications among individuals with type 2 diabetes (T2D).

Materials and methods: A total of 3,862 participants with type 2 diabetes at baseline from UK Biobank (UKB) were included. The sleep regularity metrics measured by wrist-worn accelerometers include sleep regularity index (SRI) and sleep duration SD. Macrovascular complications included coronary heart disease (CHD) and stroke. Microvascular complications included diabetic neuropathy, diabetic kidney disease, and diabetic retinopathy. Cox proportional hazard models were used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for macrovascular and microvascular complications.

Results: During a median follow-up of 8.0 years, 410 composite macrovascular and 615 composite microvascular events occurred. Compared to participants in the highest tertile of SRI (regular sleepers), those in the lowest tertile were at higher risk of composite macrovascular complications (HR 1.29, 95% CI: 1.01-1.66) and stroke (1.97, 1.08-3.58). Compared to participants in the lowest tertile of sleep duration SD (regular sleepers), those in the highest tertile were at higher risk of composite macrovascular complications (1.44, 1.12-1.84), CHD (1.40, 1.07-1.82), and stroke (2.07, 1.13-3.81). For microvascular complications, no significant association of sleep regularity metrics was found (all $P > 0.05$). However, the dose-response analysis suggested a potential nonlinear association between SRI and diabetic neuropathy, with lower SRI consistently associated with higher risk of diabetic neuropathy compared with the median of SRI (HR 1.92, 95%CI: 1.28-2.88, 5th percentile vs. 50th percentile).

Conclusions: An irregular sleep pattern across days is clinically relevant for increasing the risk of macrovascular complications and diabetic neuropathy among individuals with type 2 diabetes.

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Associations between thyroid hormone regulation and sleep phenotypes

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Introduction: Our study aims to assess the causal relationships between thyroid hormone regulation (including thyroid stimulating hormone (TSH), free thyroxine (FT4) levels, hypothyroidism, and hyperthyroidism) and sleep traits such as Apnea-Hypopnea Index (AHI)/Respiratory event index (REI), obstructive sleep apnea (OSA), snoring, excessive daytime sleepiness (EDS), insomnia as well as sleep duration.

Materials and methods: We obtained summary statistics from published genome-wide association studies (GWAS) on thyroid hormone regulation and sleep traits. Subsequently, we performed bidirectional Mendelian Randomization (MR) analyses to estimate the causal directions and effects between them. The inverse variance weighting (IVW) approach was used as the primary method, with multiple methods serving as alternative sensitivity analyses.

Results: We revealed that insomnia has a negative causal influence on TSH levels ($\beta = -0.192$, 95%CI = $[-0.383, -0.002]$, $p = 0.048$). We also observed that OSA has a positive causal influence on FT4 levels ($\beta = 0.098$, 95%CI = $[0.022, 0.175]$, $p = 0.012$). Sleep duration was found to have a negative causal effect on FT4 levels ($\beta = -0.187$, 95%CI = $[-0.314, -0.060]$, $p = 0.004$). Conversely, TSH levels showed a positive causal impact on OSA ($\beta = 0.079$, 95%CI = $[0.025, 0.132]$, $p = 0.004$). Further validation analyses based on heterogeneity and pleiotropy status were consistent with the causal direction of the above initial results.

Conclusions: Our results indicated suggestive causations from insomnia to TSH levels, from OSA and sleep duration to FT4 levels as well as from TSH levels to OSA, providing valuable insights into clinical strategies for regulating thyroid function and preventing sleep problems.

Exploring the Influence of Emotion Regulation on Emotional Naps: A Preliminary Study

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Introduction:

Previous studies identified five types of naps: dysregulative, replacement, emotional, appetitive, and mindful naps. Among these, emotional naps are taken explicitly to enhance mood, alleviate stress, or avoid particular behaviors. While the mutual relationship between sleep and emotions is well-established, existing research predominantly emphasizes naps' capacity to enhance mood rather than explicitly examining their emotion-regulation properties. Addressing this gap, the current research aimed to investigate the phenomenon and emotional regulatory effects of emotional naps within a Taiwanese context.

Materials and methods:

Participants were initially recruited through an online survey. This initial screening phase collected comprehensive data including demographic information, sleep and nap habits, napping motivations, chronotype, depression (CES-D), perceived stress (PSS), coping strategies (Brief COPE), and emotional states (assessed via the Self-Assessment Manikin, SAM scale). From this initial pool, 22 individuals were selected to participate in a subsequent, more intensive one-week experimental phase designed to examine the direct effects of emotional regulation. Inclusion criteria for this experimental phase were stringent, ensuring a focused and relevant sample. Participants were required to: (1) self-report taking emotional naps, (2) be non-shift workers who did not nap after dinner, (3) have no history of major physiological diseases or significant surgical history, (4) be free from severe psychiatric conditions (e.g., schizophrenia, bipolar disorder) or psychotic symptoms (e.g., hallucinations, delusions), (5) report no sleep disorders, and (6) not be continuously using illicit substances or non-prescription medication. During the one-week experimental period, participants maintained daily sleep diaries and wore actigraphy devices continuously. Emotional states were recorded twice daily using the SAM scale at 1 PM and 5 PM, with participants additionally noting any occurrences of emotional naps. SAM scale indicators included pleasure, arousal, dominance, stress, and fatigue, each ranging from 1 to 5.

Results:

Nonparametric analyses (Wilcoxon signed-rank test) indicated that emotional naps significantly reduced fatigue ($Z = -2.174$, $p = .03$; pre-nap: $M = 3.14$, $SD = 0.52$; post-nap: $M = 2.70$, $SD = 0.57$), but showed no significant differences in pleasure, arousal, dominance, or stress. In contrast, in non-emotional nap conditions, a significant increase in dominance was observed post-nap ($Z = -2.04$, $p = .04$; pre-nap: $M = 2.48$, $SD = 1.02$; post-nap: $M = 2.93$, $SD = 0.86$), while no significant changes were found in pleasure (pre: $M = 2.29$, $SD = 0.64$; post: $M = 2.43$, $SD = 0.77$), arousal (pre: $M = 3.19$, $SD = 0.87$; post: $M = 2.92$, $SD = 1.16$), stress (pre: $M = 2.04$, $SD = 0.82$; post: $M = 2.28$, $SD = 0.76$), or fatigue (pre: $M = 2.49$, $SD = 0.71$; post: $M = 2.32$, $SD = 0.45$).

Conclusions: Emotional naps effectively alleviated fatigue but did not significantly influence emotional or stress regulation. Due to the reliance on self-reported home-based experiments in this study, confounding factors cannot be entirely excluded. Future research is encouraged to further elucidate the nuanced impacts and underlying mechanisms of emotional naps.

Association between Work Engagement and Psychomotor Vigilance among Physicians in a Japanese University Hospital: Stratified Analysis by Age Group and Medical Specialty

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Introduction: Work engagement is a positive and fulfilling psychological state related to one's work, often considered the opposite of burnout. In clinical settings, higher work engagement among physicians has been associated with better patient care and lower turnover rates. Since the COVID-19 pandemic, there has been growing concern about the work environment and mental health of healthcare professionals. This study aimed to examine age- and specialty-related differences in work engagement and its association with psychomotor vigilance, an objective indicator of sleep debt, among physicians at a Japanese university hospital.

Materials and methods: Among 836 physicians, 391 (response rate: 46.8%) completed a questionnaire and underwent a 3-minute brief Psychomotor Vigilance Test (PVT-B) after work. The total score of the Utrecht Work Engagement Scale (UWES-17) was used as the dependent variable. Independent variables included depressive symptoms (Center for Epidemiologic Studies Depression Scale: CES-D) and PVT performance (lapse355), with sex, BMI, age group (20s, 30s, 40s, ≥50s), and sleep duration (<5 h or ≥5 h) as covariates. Stratified analyses were performed by age group and by specialty (medical vs. surgical). Statistical significance was defined as $p < 0.05$. Statistical analyses were conducted by SAS version 9.4 software (SAS Institute Inc., Cary, NC).

Results: Stratified analyses were performed by age group and by specialty (medical vs. surgical). Statistical significance was defined as $p < 0.05$. UWES scores were significantly lower in the 20s ($\beta = -13.8$, $p < 0.01$) and 30s ($\beta = -10.1$, $p < 0.01$) compared to ≥50s. Lapse355 was negatively associated with UWES ($\beta = -0.3$, $p < 0.01$), and CES-D showed a marginal association ($\beta = -3.9$, $p = 0.08$). In adjusted models that substituted objective PVT measures for subjective sleepiness, model fit improved ($\Delta R^2 = 0.018$, $\Delta F = 7.58$, $p < 0.01$). In age- and specialty stratified analyses, the association was more evident among physicians with a surgical specialty in their 20s.

Conclusions: The results from present study suggest that work engagement is associated with PVT performance, an objective indicator of sleep debt, especially among young physicians at a Japanese university hospital. These findings highlight the need for early intervention in cognitive and mental fatigue among early-career physicians.

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Healthcare measures adopted by medical students to mitigate brain function impairment caused by sleep deprivation: a qualitative interview study using health belief model

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Introduction: Research indicates that sleep deprivation impairs brain function in healthy adults. As future healthcare providers, medical students' strategies to address these effects may offer insights into managing sleep-related health issues. This study explored sleep-deprived medical students' willingness to adopt compensatory measures and decision-making processes when experiencing symptoms of impaired brain function.

Materials and methods: Approved by the Ethics Committee of Guangdong Provincial Hospital of Chinese Medicine (No. YE2022-266), semi-structured qualitative interviews were conducted with participants who reported notable symptoms of brain function impairment following sleep deprivation, focusing specifically on whether they had adopted any measures to alleviate symptoms, the reasons for their choice, and their subjective evaluations of these measures. The participants were all full-time Chinese medicine students interning in Guangzhou, reporting an average sleep duration <7 hours in the past week. Thematic analysis and the health belief

model (HBM), including perceived susceptibility (PSU), perceived seriousness (PSE), perceived benefits (PBE), perceived barriers (PBA), self-efficacy (SE), and cues to action (CA), guided data analysis. Each participant signed a written informed consent form before enrolment.

Results: Informed by HBM, qualitative data shows that all respondents reported using one or more measures to mitigate symptoms of sleep-deprivation-related brain impairment, demonstrating high PSU. These strategies were categorized as: lifestyle adjustments (sleep extension, dietary modifications including caffeine and sugar intake, and physical exercise) which were most preferred for accessibility and minimal side effects, indicating high PBE, and medical treatments including Chinese herbal medicine (CHM) like proprietary Chinese medicines and CHM decoctions, external traditional Chinese medicine (TCM) therapies including acupuncture, tuina massage, and foot bathing, and over-the-counter (OTC) non-TCM supplements such as melatonin. CHM and external TCM therapies were preferred over non-TCM supplements because of fewer side effects. PBA included significant side effects, high cost, and poor accessibility. Participants with higher PSE chose more strategies, while those with lower PSE believed adjusting lifestyle habits was sufficient to alleviate their current symptoms, without considering medical treatments. These choices are mainly driven by life experience, medical knowledge reserves, and independent research (SE). In addition, peer recommendations (CA) also influenced choices. Notably, the academic background did not uniformly predict preferences as some participants avoided or even resisted medical treatments, even the TCM treatments they were familiar with.

Conclusions: HBM analysis reveals that medical students' compensatory measure selection is primarily driven by subjective factors (high PSU/PSE/PBE/SE promoting engagement) and hindered by objective barriers (PBA). Interventions for sleep deprivation-related impairment should employ dual strategies: cognitive restructuring to enhance risk awareness and improved resource allocation to increase accessibility. The personalised preferences of different participants highlight the necessity of customised health promotion methods. However, these findings should be interpreted with caution. All participants received TCM training as part of their education, and the city of Guangzhou, where they lived and studied, has a well-established TCM culture.

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Effects of B vitamin intake on sleep duration and pulse wave velocity: a cross-sectional study based on NHANES

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Introduction: Sleep duration exhibits a U-shaped relationship with cardiovascular disease (CVD) risk and arterial stiffness, where both short (<7 h) and long (>9 h) sleep are independent risk factors. Although B vitamins, particularly riboflavin (B2), improve vascular endothelial function, their association with sleep duration remains mechanistically unclear. Our prior genetic study identified a missense variant in the riboflavin transporter *SLC52A3* (OR=0.83; 95%CI: 0.79-0.88; $P<0.01$) associated with obstructive sleep apnea severity, suggesting a nutrient-sleep-vascular link. Leveraging NHANES 2021-2023 data, this cross-sectional study aimed to examine associations between dietary B vitamin intake and sleep duration categories and to assess their joint effects on arterial stiffness.

Materials and methods: We analyzed adults from NHANES 2021-2023 with complete data on dietary B vitamins (B1/B2/B3/B6/B9/B12, choline), sleep duration, and pulse wave velocity. Sleep duration was categorized as short (<7 h), optimal (7-9 h), or long (>9 h) according to National Sleep Foundation guidelines. Total vitamin B intake was calculated from both dietary sources and supplements. ePWV was calculated using a validated equation from the Reference Values for Arterial Stiffness Collaboration. Survey-weighted multinomial logistic regression assessed associations between B vitamin intake and sleep duration categories, with restricted cubic splines (RCS) used to model non-linear relationships. Models were adjusted for age, sex, BMI, race and blood pressure as key covariates.

Results: Among 4,599 adults (median age 46.8 years; 48.5% male), participants meeting recommended B vitamin intake had higher odds of optimal sleep (OR=1.62, 95%CI: 1.38-1.91). This association followed U-shaped curves, strongest for vitamin B2. ePWV was higher in short sleepers (843 cm/s) than in optimal sleepers (827 cm/s; $P<0.001$). Moreover, vitamin B intake significantly modified the sleep-ePWV association: among short sleepers,

each 1-SD increase in B2 intake reduced ePWV by 3.36 cm/s (95%CI: 2.36-4.36; $P<0.05$). Significant interactions were also observed for vitamins B1, B3, B6, and choline ($P<0.05$).

Conclusions: Adequate B vitamin intake, especially riboflavin, is associated with optimal sleep duration and reduced arterial stiffness in short sleepers. While the cross-sectional design limits causal inference, nutritional interventions targeting B vitamins may nonetheless benefit cardiovascular health in individuals with sleep disturbances.

Effects of a 12-Week Machine-assisted Strengthening Program on sleep health in Frail Older Adults

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Introduction: Insomnia is a common sleep-related complaint in the elderly. Rehabilitation has been shown to have multiple benefits for the elderly, and a new trend of machine-assisted strengthening programs has been developed. Therefore, we compared the effects of a 3-month machine-assisted strengthening program to traditional physical therapy according to composite insomnia symptoms related to falling and the SATED questionnaire among community-dwelling frail older adults.

Materials and methods: A randomized controlled trial included 59 frail older adults (mean age: 78.0 ± 8.2 years) in north-eastern Taiwan. The intervention group ($N=31$) underwent a 12-week machine-assisted strengthening program using SMARC system, performing twice-weekly sessions that targeting 8 muscle groups, while the control group ($N=28$) received traditional physical therapy. We reviewed the sleep health of the participants with a self-reporting questionnaire, including composite insomnia symptoms related to falling and the SATED scale.

Results: The control group showed no statistical significant change in SATED questionnaire and composite insomnia symptoms related to falling before and after traditional rehabilitation. The intervention group showed improvement in composite insomnia symptoms related to falling (-0.65 ± 0.91 , $p<0.01$). When focusing on individual insomnia symptoms, the intervention group showed statistical improvement on 'trouble falling asleep' (-0.13 ± 0.34 , $p=0.04$), 'trouble with waking up during the night' (-0.29 ± 0.46 , $p<0.01$), and 'trouble with waking up too early and not being able to fall asleep again' (0.20 ± 0.40 , $p=0.01$).

Conclusions: Machine-assisted strengthening can improve the participants' composite insomnia symptoms related to falling and individual aspects of insomnia. Larger-scale research is still needed for further understanding.

The association between weekend catch-up sleep and the reduction of obesity and overweight risk in adolescents with insufficient weekday sleep

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Introduction: Some researches have emphasized the need to explore the relationship between sleep habits, particularly weekend catch-up sleep (CUS), and overweight/obesity outcomes in adolescents. However, the protective effect of compensatory sleep on weight remains controversial. This study investigates the association between weekend CUS and overweight/obesity in Korean adolescents, focusing on weekday sleep sufficiency.

Materials and methods: A nationwide cross-sectional study was conducted among 12,434 high school students in South Korea. Sleep patterns including total sleep duration and weekend CUS were assessed using self-reported questionnaires. Body mass index (BMI) was calculated and categorized into overweight/obese and normal weight groups based on age- and sex-adjusted Z-scores. Logistic and linear regression models were used to assess the associations between sleep variables and overweight/obesity.

Results: Students with 3 or more h of CUS had lower odds of being overweight/obesity (odds ratio = 0.67, 95% confidence interval: 0.57–0.80) compared to those with non-CUS. This protective effect remained significant in the subgroup with perceived insufficient weekday sleep. Furthermore, students with 3 or more h of CUS had significantly lower BMI z-scores ($\beta = -0.18$, $p < 0.001$), an association that was also observed in those with perceived insufficient sleep ($\beta = -0.16$, $p = 0.003$). The analysis showed a dose-dependent pattern, with greater weekend CUS being associated with a stepwise reduction in BMI z-scores.

Conclusions: Weekend CUS may serve as an important compensatory mechanism for adolescents to reduce the risk of being overweight or obese. However, no additional benefits of CUS were observed in adolescents with sufficient sleep quality.

Title: Relationship between initial pressure setting and continuous positive pressure therapy compliance

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Introduction: Various factors are known to affect continuous positive airway pressure(CPAP) therapy compliance. However, there is no consensus on its risk factors regarding compliance, since every study show different results. Furthermore, there are no prior studies regarding initial CPAP pressure setting and CPAP compliance. This study focuses on initial pressure setting and clinical characteristics of patients using CPAP to investigate factors affecting CPAP adherence.

Materials and methods: We retrospectively reviewed the medical records of patients diagnosed with OSA and treated with CPAP at the Haeundae-Paik Hospital, between November 2019 and July 2023. Patients' demographics, BMI(body mass index), past medical history, CT 90 (percentage of time spent with SaO₂ below 90% of the total recording), AHI(apnea-hypopnea index), percentage of days used for at least 4 hours were gathered. The patients were divided into 2 subgroups. One group started CPAP with wide pressure range(4~15cmH₂O) and changed to narrow range afterward. The other group was treated with narrow pressure range (commonly 8~11 cmH₂O) from start to end. Patients' clinical factors were compared. Using logistic regression analysis, factors associated with CPAP compliance were investigated.

Results: During the study period, 157 patients were treated with CPAP after diagnosed as OSA. After exclusion, 142 patients were included for data analysis(mean age 52.126, male : female 116 : 26) . There were 45(31.7%) patients in the wide to narrow range group, 97(68.3%) patients in the narrow group. CPAP Adherence rates were 48.8% in the wide to narrow group, 77.3% in the narrow group respectively. Chi square test result showed $p=0.001$. Logistic regression showed that BMI, age, CT 90 had strong correlation with adherence rate.

Conclusions: Patients undergone treatment with narrow range initial pressure significantly showed higher rate of passing adherence test, compared with patients started with wide range. Also, BMI, age, CT 90 were associated with poor adherence rate of CPAP.

Nocebo Effects on the Duration of First-Night Effect in Insomnia Patients: A Polysomnographic Study

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Introduction: The first night effect (FNE) is a phenomenon where individuals experience sleep disturbances during the first night in unfamiliar environment. This phenomenon may compromise the first night's polysomnography (PSG) results and impede daytime function. Previous studies have demonstrated that placebo administration can mitigate the FNE in healthy individuals but exacerbate sleep in insomnia patients. However,

duration of FNE under continuous placebo intervention in insomniacs remains undetermined. This study aims to investigate the variation of the FNE in insomnia patients with continuous placebo administration.

Materials and methods: This study enrolled 68 patients with insomnia disorder (DSM-5 criteria). Participants underwent four consecutive nights of PSG in a sleep laboratory following a 4-day placebo intervention. PSG data were analyzed using the Friedman test for differences across nights, with post hoc comparisons conducted via the Nemenyi method and Bonferroni correction.

Results: Following placebo intervention, significant differences were observed across key sleep parameters between the first and second nights : wake after sleep onset (WASO) decreased from (114.81 ± 78.10) minutes to (81.80 ± 54.34) minutes ($p = 0.001$), sleep efficiency (SE) improved from (69.84 ± 17.95)% to (76.02 ± 15.24)% ($p = 0.005$), N3 sleep duration increased from (42.95 ± 34.13) minutes to (53.63 ± 32.56) minutes ($p < 0.001$), REM sleep duration rose from (64.91 ± 54.79) minutes to (75.43 ± 48.35) minutes ($p = 0.002$), and REM sleep percentage increased from (17.71 ± 13.57)% vs (19.39 ± 11.75)% ($p = 0.018$). Following post-hoc comparison analysis, these parameters stabilized without further significant changes from the second night onward ($p > 0.05$).

Conclusions: The study indicates that placebo intervention may elicit the FNE in insomnia patients but may not impact its duration. Sleep parameters demonstrate stabilization starting from the second night. Future research should examine individual response differences.

Non-Rapid Eye Movement Parasomnias & their Impact on the Academic Performance in Medical University Students: A Cross Sectional Study

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Introduction: Parasomnias are disruptive motor episodes during sleep transitions, classified into rapid eye movement (REM) and non-rapid eye movement (NREM) types. NREM parasomnias (arousal disorders) include confusional arousals, sleepwalking, and sleep terrors. Despite knowing that parasomnias can negatively impact mental health, there is a noticeable dearth of studies on parasomnias among university students. This study aims to ascertain the prevalence of arousal disorders, their association with sleep quality, and their impact on the academic performance of university students.

Materials and methods: A quantitative cross-sectional study was carried out with validated questionnaires to collect online data using stratified random sampling after obtaining ethical approval from the ethical review board of Foundation Medical College. Rao soft was used to determine sample size with a 95% confidence interval and a 5% margin of error. The study included both male and female MBBS students at Foundation University School of Health Sciences. All descriptive and inferential statistical tests including Pearson chi-square test, t-test, and ANOVA test were applied using SPSS 26, and a p-value of < 0.05 was considered statistically significant.

Results: The sample consisted of $n=175$ participants of ages ranging from 18-25 years [19.82 ± 3.99]. There were $n = 96$ (54.9%) female participants and $n = 79$ (45.1%) male participants in terms of gender distribution. The PSQI (Pittsburgh Sleep Quality Index) score of participants ranged from 0-15 with a mean PSQI score of 6.74 ± 3.15 (PSQI score of ≥ 5 is indicative of poor sleep quality). On assessing the prevalence of NREM parasomnias a total of $n=84$ (48%) had confusional arousals, $n=29$ (16.6%) had sleepwalking, and $n=74$ (42.3%) had sleep terror. The results of the ANOVA test indicate no significant association ($p=0.387$) between academic performance (last exam score) and sleep quality (PSQI score). The t-test suggests a significant association between sleep quality (PSQI score) and the occurrence of confusional arousals ($p=0.006$), sleepwalking ($p=0.03$), and sleep terror ($p=0.04$). The Pearson chi-square test yields a significant association between academic performance (last exam score), and sleepwalking ($p=0.037$).

Conclusions: The study reveals a notable prevalence of NREM parasomnias among medical students. The study concludes that individuals with poor sleep quality (high PSQI scores) are more likely to experience NREM parasomnias. However, the results of the study are not generalizable, and this warrants the need for further large-scale multicenter study, and future work could be done on evaluating awareness, knowledge, and various perceptions related to it.

Causal Relationship Between Metabolites and Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS) Based on Two-Sample Mendelian Randomization Analysis

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Introduction:

Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS), a sleep-related breathing disorder, affects nearly one-fifth of adults worldwide. Identifying the pathogenesis associated with OSAHS is crucial. OSAHS patients exhibit metabolic alterations, which reflect the underlying biochemical activities and states of cells and tissues, directly linking to pathophysiology. Fatty acids, carbohydrates, and amino acids are common metabolites involved in cellular physiological processes, maintenance of cell structure, signal transduction, and cellular activity. Changes in these metabolites may serve as novel biomarkers, providing substantial insights into disease development.

Mendelian randomization (MR) analysis, a key epidemiological method, uses genetic variants as instrumental variables (IVs) to infer causal relationships between exposure factors and outcomes. Compared with traditional observational studies and randomized controlled trials, this approach avoids confounding factors and overcomes challenges such as high research costs and lengthy cycles. This study employed bidirectional two-sample MR analysis to further explore the causal relationship between metabolites and OSAHS.

Materials and methods: Metabolic disorder data and OSAHS data were obtained from OpenGWAS (<https://gwas.mrcieu.ac.uk>). MR analysis utilizes single-nucleotide polymorphisms (SNPs) strongly associated with exposure factors as instrumental variables (IVs). MR analyses were conducted in R (version 4.3.3) using the TwoSampleMR package. The inverse variance weighting (IVW) method served as the primary analysis, supplemented by alternative methods: MR-Egger regression, simple mode, weighted mode, and weighted median. Cochran's Q test assessed statistical heterogeneity among SNPs; MR-Egger regression intercepts analyzed horizontal pleiotropy. Sensitivity analysis was performed using leave-one-out methods. Funnel plots were generated to investigate potential influencing factors. A causal association was inferred if the IVW result had $P < 0.05$ and the causal effect directions of multiple methods were consistent with IVW.

Results: A total of 34,843 SNPs highly correlated with metabolism (all $F > 10$) were included from 1,400 metabolites. From the outcome data, 9,752 SNPs highly associated with exposure were extracted as instrumental variables. In IVW analysis, results with $P < 0.05$ were considered statistically significant. After excluding instrumental variables (IVs) with trends inconsistent with the inverse variance weighting (IVW) method across the remaining four MR analysis approaches, removing IVs with pleiotropy, and performing false discovery rate (FDR) correction, 45 metabolism-related SNPs were finally included, representing two metabolites or metabolite ratios: 2-palmitoyl-GPC (16:0) levels ($OR > 1$) and phosphate to threonine ratio ($OR < 1$).

Conclusions: This study used MR to investigate the causal relationships between 1,440 metabolites and OSAHS. As MR relies on the random allocation of genes during meiosis, it effectively avoids confounding factors and reverse causality compared with traditional observational studies. We found a positive association between 2-palmitoyl-GPC (16:0) levels and OSAHS, and a negative association with the phosphate to threonine ratio. Further validation using clinical samples is needed to confirm these intriguing findings.

Associations Between Sleep Health and Gut Microbiota: A Metagenomic Analysis in a Community-Based Sample in Hong Kong

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Introduction: The gut-brain axis plays a pivotal role in health and disease. Previous studies have shown that sleep problems disrupt gut microbiota composition, which have been linked to inflammation, metabolic dysregulation,

and cognitive impairments. However, evidence of sleep-gut microbiota relationships in community-dwelling populations is limited, with most studies relying on subjective sleep assessments and 16S sequencing microbiome analyses. This study addresses these gaps by employing both validated subjective and objective actigraphy-based sleep assessments, combined with high-resolution shotgun metagenomic profiling with the aim to investigate the associations between gut microbiota diversity and composition with sleep health.

Materials and methods: This cross-sectional study recruited participants from community in Hong Kong. A total of 645 participants (mean age: 53 ± 14 years; 64% female) provided stool samples for shotgun metagenomic profiling and completed sleep questionnaires assessing sleep related parameters including sleep-wake pattern, insomnia severity index and excessive daytime sleepiness. Actigraphy data (Actiwatch Spectrum PRO, Philips Respironics) was available for 567 participants meeting wear-time criteria (≥ 3 valid days with $< 33.3\%$ missing data/day). Sleep parameters included total sleep time (TST), sleep onset latency (SOL), wake after sleep onset (WASO), sleep efficiency (SE) and sleep fragmentation index (SFI) were generated from actigraphy. Multivariable linear models adjusted for age, sex, BMI, education, smoking and alcohol drinking habits, chronic disease history, depression and COVID-19 infection history were used to assess associations between gut microbiota diversity and sleep parameters. Species-level associations were identified using MaAsLin2, with false discovery rate correction.

Results: Gut microbiota alpha diversity indices were significantly reduced in individual with $SE < 80\%$ (adjusted beta [95% CI]: richness: $-24.76 [-39.24, -10.28]$, $P < 0.001$; Shannon index: $-0.13 [-0.23, -0.04]$, $P = 0.008$). PERMANOVA tests revealed that SE and SFI significantly influenced gut microbiota composition ($SE < 80\%$: $R^2 = 0.003$, $P = 0.018$; SFI: $R^2 = 0.003$, $P = 0.031$). In contrast, subjective sleep assessments were not associated with either alpha or beta diversity of the gut microbiota. MaAsLin2 identified 13 species significantly associated with $SE < 80\%$ and SFI. For example, *Coprobacillus cateniformis* and *Clostridium scindens* were positively associated with SFI (Coef = 0.0006, $P < 0.001$, $Q = 0.192$; Coef = 0.0002, $P = 0.007$, $Q = 0.322$). *Odoribacter splanchnicus* and *Phocaeicola plebeius* were reduced in individual with $SE < 80\%$ (Coef = -0.0002 , $P = 0.008$, $Q = 0.348$; Coef = -0.004 , $P = 0.024$, $Q = 0.469$). Elevated *P. plebeius* abundance was associated with increased TST (Coef = 0.004, $P = 0.028$, $Q = 0.517$). Increased *C. scindens* abundance was also associated with higher WASO (Coef = 0.0001, $P = 0.004$, $Q = 0.283$).

Conclusions: Our findings demonstrate that gut microbiota diversity and specific bacterial taxa are strongly associated with actigraphy-measured sleep parameters, particularly with sleep efficiency and fragmentation, in a community-based adult population. Notably, no significant associations were observed between gut microbiota and subjectively measured sleep parameters. These results highlight the potential for microbiota-targeted interventions to improve sleep health. Future studies are needed to confirm these findings, explore underlying mechanisms, and evaluate the causality in longitudinal and interventional studies.

Polysomnographic comparison of sleep architecture between patients with disorders of consciousness and healthy controls

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Introduction: Disorders of consciousness (DoC) involve prolonged impairments in awareness and wakefulness. Sleep architecture, particularly the presence of deep and REM sleep, has been suggested as a potential indicator of residual brain function and recovery potential. However, systematic comparisons between DoC patients and healthy individuals using polysomnography (PSG) are limited.

Materials and methods: In the current prospective study, patients diagnosed with DoC (more than one month post-injury) and their age- as well as sex-matched healthy controls were recruited. All DoC patients underwent 24-hour PSG monitoring in a hospital setting, while healthy controls underwent 12-hour standardized PSG in our sleep lab. Key parameters included total sleep time (TST), sleep efficiency, proportions of N1, N2, N3, REM sleep, and the presence of sleep-disordered breathing (SDB), evaluated by the apnea-hypopnea index (AHI).

Results: Five DoC patients (mean age 60.6 ± 13.4 years) and three healthy controls (mean age 54.2 ± 11.2 years) were included in this preliminary analysis. Average sleep efficiency in the DoC group was 67.1%, which was comparable to 68.3% in controls. In the patient group, the average proportions of sleep stages were: N1 at 5.9%, N2 at 13.9%, N3 at 69.5%, and REM at 10.7%, with an AHI of 2.9. In the control group, N1 accounted for an average of 7.8%, N2 for 44.7%, N3 for 31.5%, and REM for 16.0%, with an AHI of 0.9. These preliminary results suggest that DoC patients showed significantly reduced N2 and REM sleep, while a markedly increased proportion of N3 sleep, and more frequent SDB compared to healthy individuals.

Conclusions: Sleep architecture differs substantially between DoC patients and healthy individuals. PSG-based assessment may provide objective markers of residual brain function and support the development of sleep-informed approaches for consciousness evaluation and neurorehabilitation.

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Sleep Disorders in Chronic Kidney Disease Patients

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Introduction: Chronic kidney disease (CKD) is associated with a variety of comorbidities, including sleep disorders, which significantly impact patients' quality of life. Sleep disturbances in CKD patients are underreported and poorly managed, despite their potential to exacerbate CKD-related complications.

Aim of the study: This study aims to assess the prevalence and types of sleep disorders among CKD patients and explore their clinical characteristics

Materials and methods: A cross-sectional study was conducted on 50 CKD patients at conducted at the Department of Nephrology, Medical College for Women& Hospital, Dhaka Bangladesh. During 1 year from January 2024 to December 2024. Sleep disorders were evaluated using the Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS).

Clinical and demographic data were also collected.

Results: The study revealed that 40% of participants experienced insomnia, 30% had obstructive sleep apnea (OSA), 20% suffered from restless legs syndrome (RLS), and 10% reported excessive daytime sleepiness. A total of 80% of the participants exhibited poor sleep quality based on the PSQI score, and 30% showed excessive daytime sleepiness according to the ESS. The majority of patients were in advanced stages of CKD (stage 5D), with a high prevalence of

comorbidities such as hypertension and diabetes mellitus

Conclusions: In our study, sleep disorders were highly prevalent in CKD patients, significantly affecting their quality of life. The findings underscore the need for routine screening and management of sleep disturbances in this population. Further research is needed to explore the mechanisms linking CKD and sleep disorders, as well as the efficacy of targeted interventions to improve sleep quality in these patients.

Rotating shifts change gut microbiota and sleep in shift workers: an observational study

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Introduction: Shift work can adversely impact workers' sleep conditions and change gut microbiota composition. Meanwhile, a bidirectional relationship exists between gut microbiota and sleep regulation via the brain-gut axis. This study aimed to determine the associations between gut microbiota and sleep alterations in shift workers.

Materials and methods: A total of 31 shift workers and 44 controls were recruited from June 2018 to July 2021 (mean age=27.71±4.38 years, female%=77%). Shift work was defined as workers involved in 8-hour rotations for more than 3 years. Subjective and objective sleep were assessed via questionnaires and polysomnography (PSG), respectively. Poor sleep efficiency (SE) was defined as SE<85% assessed by PSG. The fecal samples were collected during the PSG recording day and immediately stored at -80°C until 16S rRNA sequencing. Linear and logistic regressions were used to examine the relationship between shift work, microbiota and sleep. All statistical analyses were performed using IBM SPSS 27.0. A p-value < 0.05 was used to determine statistical significance.

Results: Compared to controls, shift workers exhibited lower subjective (87.27±11.31% vs. 93.72±6.00%, p=0.004) and objective (86.07±11.01% vs. 91.66±4.33%, p=0.013) SE. Furthermore, we found that the reciprocal-transformed abundance of *Collinsella* was significantly lower in shift workers compared with controls (0.82 vs. 0.93, p=0.029). After adjusting for age and sex, shift work was associated with both the reciprocal-transformed abundance of *Collinsella* (β = -0.11, p=0.033) and poor objective SE (OR=9.30, p=0.005), while the reciprocal-transformed abundance of *Collinsella* was significantly correlated with poor objective SE (OR=0.05, p=0.018). The association between shift work and poor objective SE was diminished by the reciprocal-transformed abundance of *Collinsella* (OR=7.70, p=0.012), though the mediating effect was insignificant.

Conclusions: Shift workers showed changes in gut microbiota composition and lower sleep efficiency. *Collinsella* may be the potential key microbiota linking the relationship between sleep and shift work. Microbiota might be a beneficial therapeutic targeting of sleep disturbances in shift workers.

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Head Rocking Enhances Deep Sleep During Daytime Naps: Evidence from a Motorized Pillow Study

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Introduction: Recent attention to sleep quality has highlighted its impact on physical and mental health. Short naps, in particular, have been shown to improve attention and memory (Dutheil et al., 2021). As interest in daytime productivity and health maintenance grows, so does the demand for better nap quality. Vestibular stimulation has been reported to enhance sleep, with whole-body rocking shown to promote sleep onset and increase NREM sleep (Perrault et al., 2019). However, most studies focus on whole-body movement, and the effects of head-only rocking remain unclear. This study investigates how head rocking during napping, using a specially designed motion pillow, affects sleep architecture as measured by polysomnography (PSG).

Materials and methods: The pillow used in this study was designed with a structure that allows control of its height using a stepping motor and a ball screw mechanism. By utilizing this mechanism, the pillow can periodically change its vertical position, providing sinusoidal rocking stimulation to the head at a frequency of 0.125 Hz (one cycle every 8 seconds). Eleven participants completed two nap sessions on separate days: one with head rocking, the other without. Polysomnography (PSG) was used to record electroencephalography (EEG), electrooculography (EOG), and electromyography (EMG). Sleep stages were scored, and the time course of the proportion of delta waves in the EEG was analyzed.

Results: After excluding two participants due to incomplete recording data, the analysis was conducted on the remaining nine participants. In the rocking condition (S), the number of wake epochs was higher, and the number of N2 stage epochs was lower compared to the no-rocking condition (NS). Additionally, the number of N3 stage epochs was higher in the S condition. Furthermore, the proportion of delta waves during non-wake EEG periods was significantly higher in the S condition. A Mann-Whitney U test revealed a statistically significant difference (p < 0.05).

Conclusions: In this study, we investigated the effects of head-only rocking during napping using a motorized pillow on sleep architecture. The observed increase in N3 sleep and the elevated proportion of delta waves suggest that head-only rocking can induce effects similar to those reported with whole-body rocking. This may be attributed to the activation of the vestibular system in the head, which is thought to mediate these effects (K. Kompotis et al., 2019). The increase in wake epochs can be explained by the inclusion of two participants who were unable to fall asleep under the rocking condition, likely due to a mismatch between the stimulation frequency and their physiological preferences. It is assumed that the 0.125 Hz stimulation may have overly activated their vestibular system, causing symptoms akin to motion sickness (O'Hanlon & McCauley, 1974). Future studies should focus on designing individually optimized stimulation parameters to prevent such adverse responses.

Associations of Pre-Sleep Arousal and Dysfunctional Sleep Belief with Depression in Youths with Eveningness

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Introduction: Youths with eveningness are vulnerable to developing sleep disturbances and mood related psychopathology. Psychological and arousal related factors may contribute to both insomnia and depression. Although previous research has investigated the association between insomnia, chronotype and depression, there has been limited research to explore insomnia-related cognitive and physiological factors specifically in youths with eveningness, especially in the context of depression.

Materials and methods: A total of 112 youths with eveningness (mean age = 18.3 ± 1.7 ; 69.6% female), as defined by a Morningness-Eveningness Questionnaire (MEQ) score of ≤ 41 , were recruited. Participants were classified into depressed (DA group; $n = 59$, mean age = 18.2 ± 1.8 , 76.3% female) and non-depressed groups (Control group; $n = 53$, mean age = 18.5 ± 1.7 , 62.3% female), based on the presence of depressive disorders by DSM-IV criteria as confirmed by the Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID) psychiatric interview. Insomnia severity (Insomnia Severity Index, ISI), dysfunctional sleep beliefs (Dysfunctional Beliefs and Attitudes about Sleep Scale, DBAS-16), and pre-sleep arousal (Pre-Sleep Arousal Scale, PSAS) were assessed.

Results: Depressed participants, as compared to non-depressed participants reported significantly higher levels of insomnia severity (ISI: DA: 15.0 vs. Control: 1.76, $t = 22.90$, $p < .001$), more dysfunctional sleep beliefs (DBAS: DA 97.2 vs. Control 71.5, $t = 4.36$, $p < .001$), and heightened pre-sleep arousal (PSAS: DA 40.0 vs. Control 30.2, $t = -4.14$, $p < .001$). Linear regression analysis demonstrated that depression was significantly associated with more severe insomnia (ISI: $\beta = 0.77$, $p < .001$), and elevated pre-sleep arousal (PSAS-C: $\beta = 0.24$, $p = 0.02$), after controlling for education level.

Conclusions: These findings highlight a significant association between depression and insomnia among youths with eveningness. In addition, pre-sleep cognitive arousal was elevated in depressed adolescents with eveningness. The findings underscore the importance in attending to insomnia-related factors in assessing depression in adolescents with eveningness. Interventions that address cognitive hyperarousal, alongside mood symptoms may be needed for this vulnerable group.

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The life style, sleep time and sleep duration of the people in different social strata during previous four decades in Taiwan

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Introduction:

Nearly half of adults report poor sleep quality, though most do not meet diagnostic criteria for insomnia. The concept of “poor sleep” has been introduced to describe insufficiently restorative sleep or reduced satisfaction in the absence of a clinical disorder ([Leger et al.](#)). Risk factors include unmodifiable characteristics such as age and sex, as well as modifiable contributors like lifestyle and sleep habits.

We hypothesize that demographic and lifestyle factors influence self-reported sleep quality. This study aims (1) to summarize sleep epidemiology with respect to quality, duration, and time, and (2) to examine associations between sleep quality and demographic and lifestyle factors, including age, sex, social stratum, sleep time and duration, and habitual inactivity.

Materials and methods:

The Taiwan Social Change Survey (TSCS) can be accessed on the Survey Research Database organized by the Institute of Sociology and the Center for Survey Research of the Academia Sinica in Taiwan ([Taiwan Social Change Survey](#)). It provides cross-sectional and panel study data that reveals Taiwan's economic, social, and cultural changes from 1984 till today.

Eight features were included in the analysis: year of survey, gender, age, social stratum, habitual inactivity, sleep time, sleep duration and sleep quality. The surveys spanned 1984–2022 and involved participants aged 19–97 (mean 44.3) years. Social stratum was classified into six levels, from core cities to less-developed towns. Habitual inactivity was categorized into four levels: often, sometimes, rarely, and never. Sleep time was grouped into four categories: (1) 18:00–22:00 (earlier–early), (2) 22:00–24:00 (later–early), (3) 00:00–02:00 (earlier–late), and (4) 02:00–05:00 (later–late). Sleep quality was defined by frequency of sleep loss (never, rarely, sometimes, often). After data cleaning, 30,902 records remained for analysis. Chi-square tests and ordinal logistic regression were applied to identify risk factors.

Results:

Overall, $9.2 \pm 3\%$ of participants reported often experiencing poor sleep quality. Social stratum was excluded after chi-square test ($p > 0.10$). Female gender emerged as the strongest predictor (odds ratio [OR] = 1.39, $p = 0.031$), followed by habitual inactivity (OR = 0.91, $p = 0.045$). Later sleep time (OR = 1.19, $p = 0.36$) and shorter sleep duration (OR = 0.90, $p = 0.60$) showed nonsignificant associations, with fluctuating p-values among different years. Epidemiology demonstrates that earlier sleep time exhibits longer sleep duration. Age was not a significant factor; although prevalence of poor sleep was higher in individuals aged ≥ 70 years (7.8%), prior literature suggests this is more attributable to inactivity, limited social engagement, and comorbid conditions rather than aging itself ([Ohayon et al.](#)).

Conclusions:

1. Females are more likely to experience poor sleep.
2. Habitual inactivity is associated with poor sleep.
3. Good sleep quality may still be achievable with late sleep time or short sleep duration, awaiting further validation.

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Effect of Sleep Quality on Heart Rate Variability in Medical Students: A Cross-sectional Study

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Introduction: In addition to being a biological necessity, sleep is a key regulator of cardiovascular health, emotional stability, and cognitive functioning. Medical students have particularly poor sleep quality due to their busy schedules, lifestyles choices, and high levels of academic stress. This vulnerable group frequently exhibits early symptoms of autonomic imbalance, a marker of long-term health risks. Heart rate variability (HRV) is a sensitive biomarker of autonomic nervous system (ANS) activity that offers non-invasive window to this physiological interaction. Studies demonstrating the connection between autonomic dysregulation and insufficient sleep continue to underrepresent medical students. This study aimed to examine the connection between HRV and sleep quality in order to offer a distinct physiological understanding of how sleep disruptions may subtly harm cardiovascular health.

Materials and methods: After receiving the Institutional Review Board Ethical approval, 84 MBBS students, aged 18 to 25, with normal BMIs ($18.5\text{--}24.9\text{ kg/m}^2$), participated in a descriptive, cross-sectional correlational study. The validated Pittsburgh Sleep Quality Index (PSQI), which measures subjective sleep quality over the previous month, was filled out by the participants. With an ECG recorded in lead II configuration, HRV recordings were made using the Power Lab AD instruments (Australia) under controlled conditions. To determine HRV parameters, a stable 5-minute ECG segment was examined offline using Lab Chart Pro 8. Frequency-domain measurements (Low Frequency [LF], High Frequency [HF], LF/HF) and time-domain indices (SDNN, RMSSD, pRR50) were calculated. Pearson or Spearman tests with a significance threshold of $p < 0.05$ were used to analyze statistical correlations between PSQI components and HRV indices using SPSS v26.0.

Results: Around 71% of students slept fewer than the recommended 7 hours, and a startling 76.2% of students had poor sleep quality ($\text{PSQI} \geq 5$). 6.44 ± 2.62 was the average global PSQI score. Parasympathetic HRV indices, including HF ($r = -0.358$, $p < 0.01$), pRR50 ($r = -0.288$, $p < 0.01$), and RMSSD ($r = -0.227$, $p < 0.05$), were strongly inversely correlated with poor sleep quality. On the other hand, positive correlations with LF ($r = 0.375$, $p < 0.01$) and LF/HF ratio ($r = 0.390$, $p < 0.01$) indicated sympathetic dominance. Autonomic imbalance was substantially associated with subjective sleep quality, sleep efficiency, and dysfunction during the day.

Conclusions: The study provides a compelling physiological narrative: autonomic dysregulation, which is characterized by decreased parasympathetic and increased sympathetic activity, is significantly linked to poor sleep quality in the medical students. These changes could predict cardiovascular risks in the future. In order to protect the health of tomorrow's healers, there is an increasing need for focused interventions that give sleep hygiene top priority in medical curricula.

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Home-Based Oropharyngeal Myofunctional Therapy for Habitual Snoring: A Randomized Controlled Trial of Snoring Severity and Sleep Quality

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Introduction: Habitual snoring affects up to 45 % of adults, leading to sleep fragmentation, daytime fatigue, and partner disturbance. Upper-airway collapse during sleep often stems from weakened oropharyngeal muscles. Myofunctional exercises targeting the tongue, soft palate, and related structures have shown promise in small case

series, but most studies focus solely on acoustic snore metrics, overlooking overall sleep quality. We therefore designed a randomized, assessor-blinded trial to determine whether a 6-week home-based oropharyngeal exercise program could concurrently reduce snoring severity—measured by our novel Snoring Severity Scale (SSS; frequency, loudness, duration, partner disturbance, daytime symptoms; range 0–20 and improve subjective sleep quality (PSQI; range 0–21)

Materials and methods: In this Parallel-group RCT forty adults aged between 18-60 with habitual snoring (≥ 3 nights/wk; SSS ≥ 8 ; PSQI > 5) were randomized (1:1) to Exercise (daily 20 min oropharyngeal routine 6 days/week for 6 weeks, $n=20$) or Control (single sleep-hygiene session, $n=20$) for 6 weeks, with a 2-week follow-up. Co-primary outcomes were Snoring Severity Scale (SSS) and Pittsburgh Sleep Quality Index (PSQI) at Week 6; secondary outcome was daytime sleepiness (Epworth Sleepiness Scale, ESS; 0–24). Outcome assessors and analysts were blinded. Data was analyzed by ANCOVA for SSS and PSQI and ESS and maintenance tested via paired t-test

Results: Thirty-eight participants completed Week 6 (Exercise $n=19$; Control $n=19$). Adherence in Exercise arm was 92% (SD 5%); no serious adverse events. At Week 6, the Exercise group showed a mean SSS reduction of 5.6 ± 1.8 points versus 0.7 ± 1.0 in Control (between-group Change -4.7 ; 95% CI -5.8 to -3.6 ; $p<0.001$; $d=2.2$). PSQI improved by 4.3 ± 1.2 points in Exercise versus 1.1 ± 1.0 in Control (Change -3.0 ; 95% CI -3.8 to -2.2 ; $p<0.001$; $d=2.5$). ESS decreased by 3.2 ± 1.0 versus 1.0 ± 0.9 (Change -2.1 ; 95% CI -3.1 to -1.1 ; $p=0.002$; $d=1.7$). Gains persisted at Week 8.

Conclusions: A structured, home-based oropharyngeal myofunctional therapy program significantly reduces snoring severity and improves sleep quality with sustained effects. The Snoring Severity Scale proves a responsive, practical tool for clinical and research monitoring. This low-cost, scalable intervention merits broader implementation and further investigation in diverse populations

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Latent physical activity profiles of people with chronic pain: Associations with pain severity, sleep and accelerometer-measured rest-activity rhythm

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Introduction: Approximately one-third of the global population experiences chronic pain (CP), significantly impacting daily activities and altering patients' engagement patterns. Recent research highlights that individuals with CP exhibit diverse pain-related activity patterns, underscoring the need for profiling-based approaches. Although previous studies have explored differences among activity profiles in terms of pain experiences and physical activity, limited attention has been given to differences in sleep and 24-hour rest-activity rhythms (RAR). This study aimed to apply latent profile analysis (LPA) to categorize individuals with CP by self-reported activity patterns, and subsequently examine differences across these profiles regarding pain experiences, sleep quality, and accelerometer-derived RAR.

Materials and methods: 195 participants with chronic non-cancer pain (CNCP), aged 18–65, were recruited in the UK. Eligibility required experiencing CNCP for ≥ 3 months. Participants completed baseline questionnaires assessing pain-related activity patterns (Patterns of Activity Measure–Pain, POAM-P: subscales of avoidance, overdoing, pacing), insomnia severity (Insomnia Severity Index, ISI), and pain severity and interference (Brief Pain Inventory–Short Form, BPI-SF). Actigraphic sleep quality (Actigraphic Total Sleep Time, A-TST; Sleep Efficiency, A-SE) and 24-hour RAR (MESOR – overall physical activity level; Amplitude – robustness of RAR; Intradaily Variability, IV – fragmentation of RAR) were objectively measured using wrist-worn accelerometers (MotionWatch 8) over a 7-day ecological momentary assessment (EMA). LPA identified distinct subgroups based on the three POAM-P subscales. Between-profile differences in pain, sleep, and RAR were analysed using Analyses of Covariance (ANCOVAs), adjusting for demographic covariates (age, gender, BMI).

Results: LPA identified four distinct profiles based on the three POAM-P subscales: “assorted activity regulation – moderate use” ($n = 101$, 51.8%), characterized by moderate use of all three strategies; “overdoing” ($n = 39$, 20%), defined by high overdoing but low avoidance and pacing; “avoidant pacing” ($n = 39$, 20%), marked by high

avoidance and pacing but low overdoing; and “assorted activity regulation – minimal use” ($n = 16$, 8.2%), showing minimal use of all strategies. ANCOVAs revealed significant differences in pain outcomes: the “assorted activity regulation – minimal use” profile reported the lowest pain severity and interference, while the “avoidant pacing” profile reported the highest. No significant differences emerged in sleep quality (ISI, A-TST, A-SE). However, RAR variables differed significantly: the “avoidant pacing” group showed the lowest MESOR and amplitude but the highest IV, reflecting lower activity and more disrupted rhythms. In contrast, the “assorted activity regulation – minimal use” group exhibited the highest MESOR and amplitude and the lowest IV, indicating more robust, stable daily activity rhythms.

Conclusions: This study highlights that distinct POAM-P profiles are associated with differing pain experiences and 24-hour activity rhythms. Understanding these profiles may enable clinicians to tailor more individualized interventions. Notably, minimal use of activity regulation strategies was linked to better outcomes, suggesting that a less pain-reactive, “non-action” approach may benefit CP management, challenging the contemporary assumption that activity pacing is the core intervention among CP patients.

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Transdiagnostic Effects of a Chinese Herbal Formula DEP-2306 on Improving Sleep in Adults with Depressive Episode with Insufficient Symptoms: A Real-World Study

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Introduction: Sleep disturbances and depression frequently coexist, with most individuals experiencing depressive episodes reporting poor sleep quality, which can exacerbate mood dysregulation. Depressive Episode with Insufficient Symptoms (DEIS), characterized by symptoms that are subthreshold in severity or duration for a diagnosis of Major Depressive Disorder (MDD), represents a critical intervention window due to its heightened risk of progression to MDD and significant functional impairment. Pharmacological treatments, such as antidepressants, are often premature at this stage. Psychotherapy, although effective, faces barriers such as stigma and resource limitations. This highlights the need for effective, safe, and culturally acceptable alternatives. Leveraging thousands of years of holistic practice, Chinese herbal medicine has shown efficacy in alleviating depression in many clinical and preclinical studies. However, specific evidence for its transdiagnostic effects on sleep quality in DEIS is sparse. DEP-2306, a Chinese herbal formula designed to target DEIS treatment in mood, has demonstrated therapeutic potential in preliminary trials. This report extends prior work by analyzing its transdiagnostic effects on improving sleep in DEIS.

Materials and methods: A total of 67 DEIS patients received daily DEP-2306 for four weeks. The core ingredients include Curcuma Radix (Yujin), Paeoniae Radix Alba (Baishao), Triticum Aestivum (Fuxiaomai), and Acanthopanax Senticos Radix et Rhizoma Sue Caulis (Ciwujia). Main outcomes included sleep quality, measured by the Pittsburgh Sleep Quality Index (PSQI), and the 7 domains of PSQI, which include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. A linear mixed model was used to analyze treatment effects, with statistical significance defined as $p < 0.05$.

Results: Among the 67 participants (mean age 37.3 ± 13.4 ; 70.1% female), significant improvements were observed in PSQI total scores, which decreased from 10.3 to 7.9 ($p < 0.01$, Cohen's d (d)=0.76). Significant improvements were also seen in subjective sleep quality, with a large effect size (d =0.83), moderate-to-large effects on sleep latency (d =0.73), and moderate effects on daytime dysfunction (d =0.51). Small to moderate effects were noted on sleep duration (d =0.37) and sleep disturbances (d =0.47). The tolerability rate, defined as the dropout rate due to adverse events, was very low, reported as 1.49%.

Conclusions: This study demonstrated that a 4-week DEP-2306 intervention is effective and safe for improving sleep quality in participants with DEIS. While the mean PSQI score reduction of 2.45 after 4 weeks of treatment fell slightly below the recommended minimal clinically important difference of 2.5, the short treatment duration may have limited its full therapeutic potential. Future research should employ longer intervention periods, placebo-controlled designs, and objective sleep measures to further validate these findings.

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Comparing sleep markers in a comparative micro-cohort study for mothers with depressive symptoms and a community cohort

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Introduction: Infant sleep is crucial for early development, with maternal mental health being linked to the infant's sleep patterns. While maternal depression can negatively affect various aspects of parenting, its direct impact on infant sleep remains underexplored.

This study aims to compare reported sleep markers of both infants and mothers from the Women's Emotional Health Service (WEHS) to those from the Sleep Easy Programme (SleEP). The WEHS supports mothers identified to have pre-and-postnatal depression or other types of emotional distress through the child's first year of life. The SleEP is the first community-based infant sleep screening and early intervention program in Singapore. We report findings from the first nine months of our collaboration (July 2024 to March 2025).

Hypothesis

It is hypothesized that infants of mothers with depressive symptoms will exhibit more frequent night wakings, shorter sleep durations, and disrupted sleep patterns compared to the community group. It is expected that in the former group, there will be a higher referral need to be referred for sleep interventions.

It is also hypothesized that mothers with depressive symptoms will report a shorter sleep duration compared to the community group.

Materials and methods: A 22-item questionnaire adapted from the Brief Infant Sleep Questionnaire, was administered on parents of infants for both groups during the enrollment. For the SleEP cohort, the parents completed the form during the infant's well-baby visits at the primary care.

A total of 30 mother-infant dyad from the WEHS group and a community sample comprising of 2185 mother-infant dyad are included in this study for the measured time range. Descriptive analysis is used to describe the study sample. Categorical data are presented as frequencies and percentage.

Results: The key findings support our hypotheses that (1) the percentage of infants referred for interventions is significantly higher at 70.0% for the WEHS cohort compared to the community SleEP cohort (26.5%). Of these, (2) they have more frequent night waking (3.5 times) than the SleEP cohort (2.3 times). Interestingly, the infants from the WEHS cohort sleep an average of nearly 30% more (12 hours) than their SleEP infants (8.4 hours).

The mothers from the WEHS cohort have reduced sleep quantity (5.4 hours) than the SleEP cohort (6.4 hours). There are double the number of mothers from the WEHS cohort (57.1%) who reported a significant lack of confidence than the SleEP cohort (29.7%). 66.7% of the WEHS mothers whose infants needed interventions perceived their sleep to be a moderate or serious problem than 49.1% of the mothers from the SleEP cohort.

Conclusions: Potential mediating factors identified during our related to the WEHS cohort's elevated results are: (1) infants from the WEHS cohort sleep on the same bed and room as their parent(s), (2) there is lack of consistency in bedtime routines (42.9% in WEHS cohort versus 61.2% of the SleEP cohort) for the infants needing interventions.

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Exploring Barriers to Sleep Hygiene Among Chronic Short Sleepers Using Reflexive Thematic Analysis: A Pilot Study

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Introduction: Sleep hygiene (SH), a set of behavioural and environmental practices conducive to good sleep is essential for achieving sufficient and restorative sleep (Irish et al., 2015). For individuals experiencing chronic short sleep, maintaining good SH is particularly important because limited sleep duration already hinders restorative processes. Drawing on the Health Belief Model (HBM; Becker et al., 1974) and Social Cognitive Theory (SCT; Bandura, 1977), various barriers may hamper the implementation and execution of SH practices effectively. Therefore, the current pilot study aimed to uncover a) the most common barriers to SH in chronic sleepers, and b) whether some barriers are more easily addressed than others.

Materials and methods: 11 chronically short sleepers ($M_{age} = 25$, $SD = 1.5$) completed sleep hygiene (SH) and extension (SE) interventions carried out in two sessions conducted by one of two trained researchers in motivational interviewing. In the first (T1) session, a) the SH intervention aimed to identify and address any potential barriers (e.g., late-night media use) to good sleep and to provide SH psychoeducation. Conducted four (± 1) days after the SH intervention (T2), b) the sleep extension (SE) intervention aimed to review the contents and goals of the SH intervention, to provide further guidance on SH issues, and to set a 90-minute sleep extension schedule for the following week. To evaluate the most common barriers, SH goals, and whether one is able to address poor SH, we adopted the six-phase qualitative reflexive thematic analysis (Braun & Clarke, 2020) due to the narrative nature (i.e., notes made by experimenters) of the interview data with our small sample size. The intervention notes were first translated into English and formatted. The cleaned data was then assigned labels based on the identified theme of the content, with this step repeated two more times to reduce redundancies (i.e., conceptual overlap) by combination or removal of theme categories.

Results: The most commonly reported barrier to SH and sufficient sleep was media use (i.e., late-night use; in-bed use right before sleep). While most behavioural barriers were addressed at T2 (e.g., caffeine intake; late-night media use), factors associated with one's sleep setting (e.g., noisy surroundings; small and messy bedroom; late-night interaction with roommates) appear more persistent and difficult to modify (see [Table 1](#)).

Conclusions: Using thematic analysis, we identified late-night media use as the most common and modifiable barrier, while environmental factors related to sleep setting might be more resistant to change. Our findings, aligned with the HBM and SCT models, underscore the importance of setting personalised and specific goals to effectively address barriers, as evidenced by the reported reduction or elimination of behavioral barriers following the SH intervention. These results highlight the need for future SH interventions to personalize goal-setting strategies and to target key barriers to action.

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Factors and associations related to sleep quality in patients with tinnitus

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Introduction: Tinnitus is a phantom symptom of hearing sounds with an unexplained source. The sound could become more perturbing when sleeping in quiet surroundings at night. Many people with tinnitus suffer from sleep difficulties, and some have psychological distress, such as depression and anxiety. Here, we aim to explore the relationship among the severity of tinnitus, sleep quality, and anxiety/depression.

Materials and methods: This prospective cross-sectional study was conducted at Chakri Naruebodindra Medical Institute (CNMI), a medical school hospital, from May 2023 to March 2025. Patients diagnosed with tinnitus aged over 18 years and lasting more than 3 months were enrolled. Data were collected using three standardized questionnaires: Tinnitus Handicap Inventory (THI) for tinnitus severity, Pittsburgh Sleep Quality Index (PSQI) for sleep quality, and Hospital Anxiety and Depression Scale (HADS) for symptoms of anxiety and depression. PSQI is divided further into 3 subscores of sleep efficiency, perceived sleep quality, and daily disturbance. Pure tone audiometry was also administered to objectively evaluate hearing in participants.

Correlation analyses among the three questionnaire scores were performed by IBM SPSS statistical software.

Results: A total of 115 participants met the inclusion criteria after careful evaluation and completed the questionnaires. Sixty-one (61) of 115 participants were female (53%) with an average age of 59.44 ± 12.60 years. The tinnitus severity across all participants was predominantly classified as mild handicap severity (18-36 points), with a mean total THI score 31.51 ± 21.64 points. The sleep quality assessment using the PSQI in tinnitus patients shows a mean total PSQI score of 7.84 ± 3.77 , indicating poor sleepers. Additionally, total THI scores showed a positive correlation with the total score of PSQI ($r = 0.19$ p value 0.042). The daily disturbance subscale of PSQI exhibited a strong correlation with total THI scores, with correlation coefficients of $r = 0.280$ (p value 0.002). In the corner of psychological distress, assessment using the HADS revealed that most participants were within the normal range (76.5% for the anxiety subscale and 82.6% for the depression subscale). However, both the anxiety and depression subscales of HADS showed a positive correlation with tinnitus severity ($r = 0.284$, p value 0.002).

Conclusions: Patients with tinnitus may have an associated impact on sleep quality. This might lead to daily disturbance, which may worsen tinnitus perception and contribute to emotional distress.

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Proposal of a Novel Sleep Evaluation Index Utilizing Metabolic Dynamics During Sleep

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Introduction: Recent studies have highlighted the impact of sleep quality on physical performance and quality of daily life (QOL). High-quality sleep, in particular, is essential for muscle repair, fatigue recovery, health maintenance, and enhancement of athletic performance (Charest J et al., 2020). However, conventional sleep research has mainly assessed sleep quality through sleep depth measured by polysomnography, leaving actual metabolic processes and concrete degrees of physical recovery largely unexplored. This study focuses on metabolic change as a core indicator of bodily recovery, aiming to quantitatively analyze metabolic dynamics during sleep and to propose metabolic indices that complement conventional sleep evaluation.

Materials and methods: Nine healthy adult men participated. Two mattress types—selected for their potential influence on sleep quality and physical recovery—were tested: (i) the FACET mattress, manufactured by INOAC Corporation and featuring a hexagonal-slit structure reported to promote efficient rolling, improve pressure distribution, and maintain posture during sleep (FACET condition); and (ii) a control mattress of identical material but without slits (standard condition). Each participant underwent two nights of sleep experiments under each condition. The measured parameters were heart rate, autonomic nervous system indices, metabolic rate, and body movement; we compared the effects of mattress type on each parameter and on the interrelationships among these parameters.

Results: Under the FACET condition, heart rate and metabolic rate decreased and body movement was suppressed during N3 sleep. The reduction in metabolic rate was especially pronounced, and both decreases were statistically significant according to the Mann-Whitney U test ($p < 0.01$). During N2 sleep, heart rate was

comparable to the standard condition, whereas metabolic rate fell significantly ($p < 0.01$) and body movement increased significantly ($p < 0.01$). In REM sleep, where bodily activity is commonly suppressed, heart rate rose significantly ($p < 0.01$), while metabolic rate and body movement both decreased significantly ($p < 0.01$). Autonomic nervous system indices—often used as conventional sleep indicators—showed no substantial differences between mattress conditions.

Conclusions:

Under the experimental condition of using different mattresses, metabolic indices captured changes in sleep state during the N2 and N3 stages more sensitively than heart-rate or autonomic nervous-system indices. The simultaneous reduction in metabolic rate and body movement during REM sleep under the FACET condition likely reflects better posture maintenance and reduced antigravity muscle activity afforded by the hexagonal-slit structure. The accompanying rise in heart rate and the absence of change in autonomic indices suggest that conventional bio-signal-based metrics may overlook certain metabolic responses. These findings indicate that integrating metabolic indices with traditional methods could enable more direct evaluation of recovery processes, offering a new perspective for assessing factors—such as mattress mechanical properties—that physically interact with the body.

Poor sleep behaviour from childhood to adolescence is associated with polycystic ovary syndrome in adolescence: Findings from the Raine Study

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Introduction: Poor sleep behaviour is highly prevalent in females with polycystic ovary syndrome (PCOS), but its relationship with PCOS during childhood and adolescence is unclear. This study compares the longitudinal sleep behaviour trajectories and specific sleep behaviours from childhood to adolescence in those with and without PCOS.

Materials and methods: Caregivers of index participants (Gen2) of the Raine Study completed the Child Behavior Checklist (CBCL) questionnaire at ages 5-, 8-, 10- and 14-years. The CBCL includes six sleep behaviour items, each rated as '0' (not true), '1' (somewhat/sometimes true) or '2' (very/often true), which were summed to generate a composite score. A higher score indicates poorer sleep behaviour. PCOS status was assessed at 14-year using the 2018 adolescent Rotterdam criteria. Sleep behaviour composite scores were analysed longitudinally using generalized estimating equations at each time point and across time from 5-, 8-, 10- to 14-years. Prevalence of each sleep behaviour item from ages 5- to 14-years were also determined.

Results: N=187 participants with fully completed sleep behaviour and PCOS data were included, consisting of 29 (15.5%) diagnosed with PCOS. After adjusting for age of menarche, body mass index percentiles, family income, and symptoms of anxiety/depression, participants with PCOS exhibited poorer sleep behaviour trajectory compared to participants without PCOS that worsened over time from ages 5- to 14-years (mean difference (MD)=0.65, 95% confidence interval (CI)=0.23 to 1.07, $p=0.003$). Poor sleep behaviour trajectories did not differ significantly between participants with and without PCOS at age 5 (MD=0.09, 95% CI= -0.39 to 0.58, $p=0.71$), but diverged significantly from age 8 (MD= 0.76, 95% CI=0.14 to 1.37, $p=0.016$) until age 14 (MD=1.04, 95% CI=0.36 to 1.72, $p=0.003$). Specifically, compared with participants without PCOS, those with PCOS had a higher prevalence of several poor sleep behaviours during childhood, including trouble sleeping (24.1–69.0% vs. 7.0–43.7% at ages 5, 10, and 14), being overtired without good reason (34.5–79.3% vs. 20.3–53.8% at ages 5, 8, and 14), and sleeping less than most kids (24.1–48.3% vs. 11.4–31.0% at ages 10 and 14). Other sleep problems such as nightmares, talking or walking in sleep, and sleeping more than most kids showed smaller or inconsistent differences between groups.

Conclusions: Our findings suggest that participants with PCOS diagnosed at adolescence have poorer sleep behaviour patterns during childhood compared to participants without PCOS. In children with diagnosed PCOS at adolescence, poor sleep may worsen hormonal imbalances and metabolic issues, potentially increasing insulin resistance and obesity, and further sleep problems in a vicious cycle. Future research should identify and address childhood sleep problems, leading to better interventions and support.

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Sleep Apnea Monitoring with a Consumer-Grade Wearable: Performance of the Samsung Galaxy Watch

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Introduction: Obstructive sleep apnea (OSA) is a common but significantly underdiagnosed sleep disorder associated with various adverse health outcomes, including cardiovascular disease, cognitive impairment, and reduced quality of life. The gold standard for diagnosing OSA is in-laboratory polysomnography (PSG), which, despite its diagnostic accuracy, presents challenges in terms of accessibility, cost, and user burden. Wearable devices have emerged as promising alternatives for sleep apnea screening due to their convenience and potential for continuous, at-home monitoring. The Samsung Galaxy Watch (GW), a wrist-worn wearable device equipped with optical sensors for SpO₂ measurement, recently received FDA approval as a Software as a Medical Device (SaMD) for sleep apnea screening. This study aims to validate the AHI estimation performance of the Galaxy Watch6 and Watch7 models in comparison to PSG.

Materials and methods: A total of 326 valid sleep datasets were collected from participants undergoing overnight PSG at Samsung Medical Center. Each participant wore two identical Galaxy Watch devices—either GW6 or GW7—on both wrists during sleep to assess device and wrist-based variability. The devices collected multi-wavelength photoplethysmography (PPG) signals at 25 Hz and calculated SpO₂ values every second. AHI was estimated using a machine learning algorithm applied to one-minute epochs of SpO₂-derived features. Only sleep sessions with ≥70% SpO₂ coverage and ≥4 hours of duration were included. PSG AHI values served as the reference standard for evaluation. Agreement metrics included Pearson correlation, intraclass correlation coefficient (ICC), Bland-Altman analysis, and diagnostic accuracy using AHI ≥15 as the clinical threshold.

Results: The estimated AHI from the Galaxy Watch showed strong correlation with PSG AHI (Pearson $r = 0.9$; ICC = 0.87; 95% CI: 0.84–0.90). Bland-Altman analysis revealed a mean bias of -1.9 events/h, indicating slight underestimation. For detecting moderate-to-severe OSA (AHI ≥ 15), the Galaxy Watch achieved 80% sensitivity, 87% specificity, 92% positive predictive value (PPV), and 70% negative predictive value (NPV). AHI estimation error varied by OSA severity: slight overestimation in normal cases and increasing underestimation in mild, moderate, and especially severe OSA groups (-4.77 events/h in severe cases). A significant negative correlation was found between AHI error and the PSG hypopnea index ($r = -0.47$), suggesting that errors were primarily driven by hypopnea detection, whereas no correlation was observed with the apnea index. SpO₂ coverage and estimation performance were similar between GW6 and GW7 (92.82% vs. 94.21%). Wrist-to-wrist AHI variability was minimal overall, but greater in severe OSA cases and under low SpO₂ coverage conditions, emphasizing the need for high-quality signal acquisition.

Conclusions: The Galaxy Watch demonstrates high accuracy in estimating AHI and effectively identifies moderate-to-severe OSA, aligning with previously reported FDA performance claims. Despite some limitations in hypopnea detection, the device offers a reliable and accessible screening solution for sleep apnea, supporting its broader use in home-based sleep health monitoring. High SpO₂ signal coverage is essential for optimal performance, especially in severe OSA cases. These findings highlight the potential of wrist-worn wearables as scalable tools for public health screening of sleep-disordered breathing.

The Effects of Sleep Extension on Emotion Regulation Among Chronically Sleep-Restricted Young Adults: The Moderating Role of Intervention Adherence

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Introduction:

Chronic sleep restriction in emerging adults is associated with altered emotion regulation (ER) including reactivity and regulatory capacity (Tomaso et al., 2021). One-week sleep extension (SE) interventions could improve affective states (e.g., increased positive emotions), but fail to alter conscious ER strategies (Parsons & Young, 2022). However, neuroimaging evidence suggests extended interventions may induce neuroplasticity: a 9-day SE protocol reduced amygdala activity and enhanced prefrontal-amygdala connectivity during rest, implicating implicit ER mechanisms (Motomura et al., 2017). Thus, the impact of over-one-week SE intervention on ER is worth further investigation, particularly for young adults, whose cognitive development is still ongoing (Benitez & Gunstad, 2012). Besides, a study found that higher adherence to a 5-week SE protocol correlates with greater sleep gains and emotional benefits (Dyk et al., 2017). This suggests that level of adherence may have a moderating effect on the impact of SE on emotions. However, there is still a gap in how adherence moderates the SE-ER relationship.

Therefore, this study aims to examine (a) how a two-week at-home SE protocol affects the ER capability of chronically sleep-restricted young adults, and (b) the extent to which adherence moderates the SE-ER relationship. It is hypothesised that: (1) the SE intervention will improve ER, and (2) greater adherence will amplify the efficacy of SE on ER.

Materials and methods:

110 participants (aged 18–29) with habitual sleep ≤ 7 hours/night) will be randomized into the SE group (n=55) and the sleep hygiene (SH) control group (n=55), after a 1-week baseline and 1-week SH education. By participating in an intervention interview, the SE group will receive a 2-week SE intervention (target: +60 mins/night). While the SH group will receive SH education only.

ER will be assessed through the Ecological Momentary Assessment (EMA): At least 3×/day prompts via PRO-Diary. The assessments involve:

1. Affective states: affective states on The Positive and Negative Affect Schedule, PANAS;
2. ER strategy use: 6 strategies (distraction, reappraisal, suppression, acceptance, avoidance, rumination) rated on 5-point Likert scales.

Adherence will be comprehensively measured based on the EMA/sleep diary completion rates, and the proportion of extended sleep, which is operationalized as $[(\text{intervention sleep duration} - \text{baseline duration})/60] \times 100\%$. Multilevel models will test whether adherence moderates the SE-ER relationship by examining the significance and directionality of the Group $\times$ Adherence interaction term.

Results: It is anticipated that the SE group will show greater improvement in adaptive strategy use (reappraisal and distraction). For the moderating role of adherence, high-adherence SE participants will exhibit more sustained emotional stability and larger ER gains than low-adherence peers.

Conclusions:

This study could demonstrate the SE-ER relationship among sleep-restricted young adults. The benefits of intervention may be facilitated by personalized adherence support. The findings could inform future sleep education programs to target/find ways to increase protocol and goal adherence to facilitate behaviour change.

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Healthy shiftwork: Co-designed, clickable, credible

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Introduction: Young adults (18–25 years) working shifts face increased risks of sleep and circadian disruption, contributing to long-term health consequences. Despite this, age-appropriate and accessible sleep health resources are lacking. This project aimed to develop and translate tailored, evidence-based content into engaging formats for young shiftworkers.

Materials and methods: A participatory co-design approach was used, involving 48 co-designers including young, current, and former shiftworkers, workplace health and safety professionals, science communicators, and academic researchers. Co-designers participated in online workshops to identify relevant content areas and shape the tone and delivery of the resources. Reflexive thematic analysis of workshop transcripts identified core themes, which were aligned with scientific evidence to guide resource development.

Results: Five key themes were identified: (1) sleep science, (2) impacts of poor sleep, (3) habits influencing sleep, (4) strategies to improve sleep, and (5) workplace recommendations. These themes were translated into three primary delivery modes:

a) An interactive website featuring in-depth, accessible content; b) A pictorial infographic summarising key takeaways; c) an animated video for digital and social media use.

A consistent visual identity and tone were applied to ensure appeal and usability for young audiences.

Conclusions: This project demonstrates how participatory methods can inform not only what content is developed, but how it is delivered. Translating sleep health science into youth-friendly formats may enhance engagement and impact. Evaluation of reach, usability, and behaviour change outcomes is now warranted.

Bedtime Stress and Prefrontal Cortex Hemodynamics During Sleep: A Pilot Study Using Wearable fNIRS and Salivary Biomarkers

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Introduction: Psychological stress is a well-known disruptor of sleep quality, yet little is known about how stress modulates brain activity during sleep. While neuroimaging studies have advanced our understanding of stress responses during wakefulness, technical and methodological barriers have hindered investigation of stress-related neural dynamics during sleep. This pilot study aimed to explore whether bedtime stress is reflected in cortical hemodynamics during the first sleep cycle. We further examined which signal features and prefrontal subregions are most sensitive to stress indicators.

Materials and methods: A longitudinal N-of-1 design was conducted with a healthy adult male over 15 consecutive nights. Stress was assessed using three complementary indicators: salivary cortisol (mean = 3.4 nmol/L), secretory immunoglobulin A (sIgA; mean = 295.3 µg/mL), and subjective perceived stress scores (range 2–8; mean = 4). Sleep-related hemodynamics were recorded using a wireless, wearable 27-channel functional near-infrared spectroscopy (fNIRS) system (Brite 24) targeting the prefrontal cortex. Supplementary physiological data (heart rate, respiratory rate, and sleep timing) were collected using Fitbit Sense. fNIRS signals were preprocessed

to remove physiological artifacts, and time-, frequency-, and nonlinear-domain features were extracted from both oxyhemoglobin ($\Delta\text{O}_2\text{Hb}$) and deoxyhemoglobin (ΔHHb) signals. An ensemble feature-ranking algorithm, integrating six machine learning and statistical methods, was used to identify stress-related signal features and channels.

Results: Cortisol was most strongly associated with time-domain features—particularly signal mean at channel 16 (left rostral lateral prefrontal cortex, RLPFC)—with correlation coefficients reaching $|r| = 0.74$. Sample entropy of ΔHHb at channel 26 also showed strong negative associations ($r = -0.70$). sIgA was moderately associated with Hurst exponent and Poincaré plot asymmetry at channels 21 and 26 ($r = 0.53\text{--}0.61$). Perceived stress showed robust correlations with nonlinear features such as crest factor (ΔHHb , channel 16; $r = 0.68$) and skewness ($\Delta\text{O}_2\text{Hb}$, channel 16; $r = -0.65$). While each indicator related to distinct feature sets, channel 16 emerged as a common site associated with all three stress measures. Additional associations were observed in the mid- and caudal dorsolateral prefrontal cortex (channels 3 and 20). The ventrolateral PFC showed no significant relationships with any stress markers.

Conclusions: This study introduces a novel, ecologically valid framework for assessing how stress manifests in the sleeping brain. Our findings highlight the relevance of the RLPFC and DLPFC in processing stress during early sleep, extending known wake-state functions of these regions into the nocturnal domain. The integration of wearable fNIRS, real-world biomarker tracking, and personalized analysis (via an N-of-1 design) provides a powerful methodology for sleep neuroscience. These results lay the groundwork for future multi-night, multi-participant studies and demonstrate the potential for next-generation stress monitoring and personalized sleep medicine. As stress increasingly contributes to sleep disorders, tools that noninvasively reveal how the brain processes stress during sleep could support earlier interventions, self-tracking, and more precise behavioral and clinical guidance.

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Liproxstatin-I Attenuates Chronic Intermittent Hypoxia-Induced Aorta Injury via Metabolic Reprogramming of the Pentose Phosphate Pathway

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Introduction: (1) Obstructive sleep apnea (OSA), a common sleep disorder, is pathophysiologically characterized by chronic intermittent hypoxia (CIH) resulting from recurrent upper airway collapse.

(2) OSA-induced endothelial dysfunction serves as the pivotal mechanistic link bridging hypoxia and cardiovascular pathology.

Ferroptosis pathway is particularly relevant to vascular pathophysiology, as evidenced by recent investigations into endothelial dysfunction mechanisms.

(3) Liproxstatin-I (Lip-I) is a potent ferroptosis inhibitor.

(4) The purpose of this study is to elucidate whether Lip-I exerts its protective effects against CIH-induced vascular injury through metabolic reprogramming.

Materials and methods: Twenty-four male Sprague-Dawley rats (7-8 weeks old) and rat aortic endothelial cells (RAOECs) were stratified into four experimental cohorts: 1) Normoxic control, 2) CIH exposure (8 hour/day, 6%–21% O_2 cycling, 12 weeks), 3) CIH+vehicle, and 4) CIH+Lip-I. Western blotting quantified protein expression of key ferroptosis regulators—glutathione peroxidase 4 (GPX4), cystine/glutamate antiporter solute carrier family 7 member 11 (SLC7A11), and acyl-CoA synthetase long-chain family member 4 (ACSL4)—using β -actin for normalization. Cellular viability was assessed via CCK-8 assay after 24h hypoxia exposure. Flow cytometry with specific fluorescent probes (DCFH-DA for ROS, FerroOrange for Fe^{2+} , C11-BODIPY for lipid ROS) quantified oxidative stress parameters. Commercial ELISA kits measured malondialdehyde (MDA), reduced glutathione (GSH), and NADPH/NADP⁺ ratios following manufacturer protocols. Mitochondrial ultrastructure was evaluated through transmission electron microscopy (TEM). Targeted metabolomic profiling (LC-MS/MS) mapped central carbon metabolism alterations, focusing on PPP intermediates.

Results: Oil Red O staining revealed that CIH treatment dysregulated lipid metabolism in aortic tissues. Western blotting analysis demonstrated that the protein abundance of GPX4 and SLC7A11 were significantly reduced in

aortic tissues of CIH-induced rats and RAOECs ($p < 0.05$), whereas ACSL4 expression was markedly upregulated ($p < 0.05$). Consistently, in CIH-exposed RAOECs, cell viability was notably decreased, accompanied by elevated levels of ROS, Fe^{2+} , lipid ROS, and MDA ($p < 0.05$). Conversely, GSH content and the NADPH/NADP⁺ ratio was significantly diminished ($p < 0.05$). Notably, transmission electron microscopy (TEM) revealed mitochondrial damage in the CIH group, characterized by ruptured mitochondrial membranes and disorganized matrix components. Furthermore, hierarchical clustering analysis profiling indicated that CIH disrupted metabolites of the pentose phosphate pathway (PPP). Strikingly, co-treatment with Lip-I reversed the aforementioned pathological alterations.

Conclusions: CIH induces ferroptosis-driven arterial endothelial injury through a PPP-dependent mechanism, characterized by NADPH depletion, redox imbalance, and impaired GPX4-mediated antioxidant defense. The PPP remodeling—manifested as suppressed glucose-6-phosphate dehydrogenase activity and diminished NADPH synthesis—creates a permissive environment for iron-catalyzed lipid peroxidation. Lip-I exerts multi-modal protection by 1) restoring SLC7A11-mediated cystine uptake, 2) enhancing GPX4 activity to neutralize lipid hydroperoxides, and 3) preserving PPP flux to maintain NADPH pools for glutathione regeneration. These findings position Lip-I as a promising therapeutic candidate for OSA-related vascular complications and highlight metabolic reprogramming of the PPP as a novel target for endothelial protection in hypoxic conditions. Further clinical translation requires investigation of optimal dosing regimens and long-term safety profiles in OSA models.

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Sleep Timing and Cardiovascular Events: A Systematic Review & Meta-Analysis

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Introduction: Cardiovascular disease risk is associated with multiple aspects of sleep health. There is a large body of evidence linking short and long sleep durations as well as sleep disorders like obstructive sleep apnea and insomnia with the occurrence of cardiovascular events. However, the risk of cardiovascular events with circadian factors such as sleep timing is less well studied. We performed a systematic review to determine the effect of bedtime or sleep onset timing on the risk of cardiovascular events (acute coronary events and stroke) and mortality.

Materials and methods: We performed a systematic search of the MEDLINE, Embase, Scopus, and Cochrane Central Register of Controlled Trials (CENTRAL) databases. Two authors independently screened the titles/abstracts and the full texts to identify studies that observed the risk of cardiovascular events and mortality based on bedtime or sleep onset timing. The risk of bias among the included studies was adjudged using the ROBINS-E tool. Meta-analysis was performed using a random effects model to estimate the pooled hazard ratios of cardiovascular mortality with early and late sleep timings. The review protocol was prospectively registered in PROSPERO.

Results: A total of seven studies were included. The exposure was measured either as bedtime using a questionnaire (five studies) or as sleep onset timing using actigraphy over one week (two studies). The outcomes included cardiovascular mortality (three studies), cardiovascular events (three studies), coronary events (two studies), and stroke (one study). All studies had some concerns of risk of bias. All studies adjusted for confounders, including age, sex, smoking status, socioeconomic status, and various clinical risk factors. Among three studies comprising of 95,764 subjects, meta-analyses revealed increased risk of cardiovascular mortality among both early sleepers (bedtime/sleep onset before 10 or 11 PM; HR = 1.23, 95% confidence intervals: 1.07 – 1.42, $I^2 = 0\%$) and late sleepers (bedtime/sleep onset after 12 AM; HR = 1.37, 95% CI: 1.12 – 1.68, $I^2 = 25.3\%$) compared to those with intermediate sleep timings. Meta-analyses could not be performed to assess the risk of cardiovascular events due to the variable definitions of the outcome. All three studies found an increased risk of cardiovascular events with early sleep timing (before 9 or 10 PM), whereas two out of three studies found an increased risk of cardiovascular events with late sleep timing (after 12 AM) compared to intermediate sleep timings. One out of two studies found that late sleep timing increased the risk of acute coronary events. The sole study that reported on stroke found an increased risk with both early (at/before 9 PM) and late (after 12 AM) bedtime.

Conclusions: We found that both early and delayed bedtime/sleep onset timings can increase the risk for cardiovascular events and mortality compared with intermediate sleep timings. Public health interventions to improve sleep health should incorporate measures to optimize both sleep duration and timing.

Reliability and validity of the Chinese version of Global Sleep Assessment Questionnaire in adult patients with sleep disorders

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Introduction: Global Sleep Assessment Questionnaire(GSAQ) is a comprehensive screening tool to assess the presence of sleep disorders in the general population. Nowadays, Sleep disorders are estimated to affect 40% of adults worldwide, estimated nearly the same in China. This, in combination with a consistent association between lower or poor sleep quality and higher burden of multi-morbidity, underscores the need for translation and validation on the Chinese version of GSAQ to screening sleep disorders in China.

Materials and methods: We first translated GSAQ by two native Chinese speakers independently and back translated by two native English translator who had no access to the original English version of GSAQ. Secondly, we recruited a convenience sample of 55 patients complained with sleep disorders to assess the Chinese GSAQ scale's internal consistency and split-half reliability. Then, additional 55 patients were collected for exploratory factor analysis (EFA). Moreover, we obtained more 91 fulfilled questionnaires to perform confirmatory factor analysis (CFA) with total 201 samples. Finally, The Chinese version GSAQ were tested for criterion validity.

Results: The Chinese version of the GSAQ exhibited a Cronbach's α of 0.718 and a split-half reliability of 0.747. The KMO and Bartlett test confirmed that it was fit for applying this technique to this sample (KMO=0.601, Bartlett's Test of Sphericity $\chi^2=395.142$, $p<0.01$), EFA analysis defined four components of the GSAQ items considering the method of the eigenvalues >1 with 68.893% explained variance. The CFA showing the goodness of fit of the GSAQ: $\chi^2=77.559$, $P<0.001$, $\chi^2/df=2.041$, RMSEA=0.072, GFI =0.932, IFI=0.916, CFI=0.913, indicating an acceptable model fit.

To verify criterion validity in the OSA population, correlations between GSAQ and Apnea Hyponea Index (AHI) were analyzed. The results showed that the overall GSAQ had positive correlation with AHI($r=0.312$, $p<0.001$). For insomnia, positive correlation was observed between the total GSAQ score with PSQI($r=0.340$, $p<0.027$).



Conclusions: Chinese version of the GSAQ is an reliable tool for screening sleep disorders, especially for the most common ones, such as insomnia and OSA.

Prevalence and Psychological Profiles of Comorbid Obstructive Sleep Apnoea and Post-Traumatic Stress Disorder in a UK General Population Sample

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Introduction: Post-Traumatic Stress Disorder (PTSD) impacts 4% of UK and 5.6% of adults worldwide. PTSD is strongly linked to sleep disorders, including Obstructive Sleep Apnoea (OSA). Emerging evidence suggests a bidirectional relationship between OSA and PTSD, with overlapping hyperarousal mechanisms exacerbating both conditions. Evidence also suggests the risk of OSA in people with PTSD may have a differential profile to developing OSA. This study examines the prevalence and psychological profiles of comorbid OSA and PTSD in a UK general population sample.

Materials and methods: Three-hundred-eighteen adults (75.8% female; 29.9% aged 34-44 years) completed validated online questionnaires, including the STOP-BANG (OSA risk), PCL-17 (DSM-5 PTSD symptoms classification), PSAS (pre-sleep arousal), ESS (daytime sleepiness), HADS (depression and anxiety), B-PSQI (sleep quality), and EQ-5D-5L (quality of life). Participants were grouped into OSA-only risk (low, intermediate, and high) and OSA+PTSD categories. Chi-square tests were used to examine associations between group classifications and key demographic or psychological factors.

Results: Prevalence: 87.7% of participants were PTSD-symptomatic. High OSA risk (STOP-BANG ≥ 5) occurred in 13.3% of PTSD-symptomatic individuals whereas 5.1% non-symptomatic ($\chi^2=7.899$, $P=0.019$).

Demographic profile:

Males predominantly belonged to (OSA+PTSD), particularly in the high-risk OSA and symptomatic PTSD (35.3% of males), ($\chi^2=79.80$, $P < 0.001$, $ES = 0.354$). Additionally, 77.8% of high-risk OSA and symptomatic PTSD participants were <45 years vs. 50% >45 in OSA-only ($\chi^2=79.04$, $P < 0.001$). Median BMI was significantly higher in (OSA+PTSD) (36.41 kg/m²) vs. OSA-only (25.71 kg/m²; $P < 0.001$).

Psychological characteristics:

Pre-sleep arousal: Somatic arousal affected 98.1% of (OSA+PTSD) in contrast to 73.3% OSA-only ($\chi^2=43.989$, $P < 0.001$).

Daytime sleepiness: Among those with severe excessive daytime sleepiness, 25.0% were classified in the high-risk OSA symptomatic PTSD, while no participants with this level of sleepiness were in the OSA-only group, ($\chi^2(20) = 37.79$, $P = 0.009$, $ES = 0.172$).

Psychological Distress: Individuals with both anxiety and depression were predominantly classified in the (OSA+PTSD) (44.5%), while those with no anxiety or depression were more likely to be in the OSA-only group (30.6%), ($\chi^2(15) = 72.98$, $P < 0.001$, $ES = 0.277$).

Sleep Quality: Poor sleep quality (B-PSQI > 5) was more prevalent in the (OSA+PTSD) group, particularly in the high-risk OSA symptomatic PTSD subgroup (13.1%) and the intermediate- OSA risk symptomatic PTSD subgroup (29.8%), ($\chi^2(5) = 15.68$, $P = 0.008$, $ES = 0.222$).

Quality of Life: "Poor" quality of life was reported exclusively by individuals in the (OSA+PTSD) group (20.0% in both intermediate- and high-risk symptomatic subgroups), while no participants in the OSA-only group reported poor quality of life, ($\chi^2(15) = 43.81$, $P < 0.001$, $ES = 0.314$).

Conclusions: Individuals with comorbid OSA and PTSD represent a distinct psychological and health profile, marked by younger age, male predominance, elevated BMI and heightened somatic arousal. They also exhibit greater psychological distress, excessive daytime sleepiness, and significantly poorer quality of life. findings underscore the urgent need for comprehensive screening protocols to go beyond traditional OSA risk factors, particularly in individuals with PTSD. Early identification and integrated treatment approaches targeting both conditions are essential to reduce the cumulative burden of this complex phenotype and improve health outcomes.

Sleep Hygiene Awareness and Behavior Among Young Adults in Urban India Background

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Introduction: With India's growing youth population and rising prevalence of insomnia and sleep-related complaints, understanding the level of sleep hygiene awareness and behaviour is essential for early interventions and public health strategies.

Objectives: To assess the awareness and practices related to sleep hygiene among urban Indian young adults aged 18–23.

Materials and methods: Survey conducted on Sleep Hygiene Awareness & Practices. Received 1076 responses from students in the age group of 18-23 yr. (54% of respondents are male & 46% are female).

Results:

- Sleep Hygiene is average/ poor for 92% of the respondents – in line with global data of 70-95% non-ideal sleep hygiene practices

- Only 20% of individuals with poor sleep hygiene are seeking help – in line with global data, but very sub-optimal from overall health & wellness perspective
- 38% feel sleepy during the day & 30% have noticed memory/ concentration issues - Clear correlation between daytime sleep and memory/ concentration loss.
- 66% of the respondents mentioned “strongly agree” & 28% mentioned “agree” to the question, “Do you think sleep quality affects your performance?” – but people seeking help is minimal

Conclusions: The study highlights a critical gap in sleep hygiene awareness among urban Indian youth, exacerbated by lifestyle choices, academic pressures, and digital overuse. This behavioural and knowledge disconnect calls for targeted public health interventions — including curriculum-based sleep education, social media awareness campaigns, and digital sleep health tools tailored for youth.

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Healthcare-seeking and paediatric sleep disordered breathing in substandard housing: preliminary findings from an urban cohort

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Introduction: Physical housing environment has a crucial role in sleep health in early life and childhood. However, little is known about the prevalence of parent-reported sleep disordered breathing and its socioeconomic determinants in housing vulnerable populations.

Materials and methods: A territory-wide survey was conducted from April to June 2025 with a convenient sample of Chinese subdivided unit residents and their children aged 2 – 17 years. Household socioeconomic information (income, education, social status), years of residence in substandard houses, children’s sex, age and body mass index (BMI) z-score, healthcare utilisation, and Paediatric Sleep Questionnaire (PSQ)-measured sleep-related breathing disorder (SRBD) symptoms were collected. Logistic regressions were used to examine associations between positive PSQ scores (defined as ≥ 0.33) and household socioeconomic information, after adjusted for the child’s BMI.

Results: Among 164 dyads interviewed (mean age of child [SD]= 8.46 [3.43] years; 57.1% male), 17.1% (n=28) had PSQ score ≥ 0.33 , indicating a high risk for SRBD, but only 2 dyads (3.57%) have sought medical attentions. A positive PSQ score (≥ 0.33) had a marginally significant association with female children (adjusted odds ratio (aORs) [95% confidence intervals (CIs)] = 2.87 [0.99 - 10.22], $p=0.078$). Household income, parental education, self-perceived social status and years of residence had no significant associations with positive PSQ scores after adjusting for children’s BMI z-score.

Conclusions: SRBD symptoms are common among children in subdivided housing, but few seek medical care. Socioeconomic factors showed no significant association with the presence of significant SRBD symptoms, though a marginal gender difference warrants further study.

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Sleep Concordance and Discordance in Dyads of Cancer Patients and Bed-Partner Caregivers: A Systematic Review on Patterns, Health Impacts, and Dyadic Interventions

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Introduction: Optimal sleep is composed of adequate sleep duration (seven to eight hours) that is easily initiated (less than 20 min of sleep onset latency [SOL]) and maintained without disruptions (less than 20 min of wake after

sleep onset [WASO]). Non-optimal, disturbed sleep has been seen at an alarming high level in cancer patients and caregivers. The context of coping with cancer together as a relational system makes the cancer patient-partner dyads unique in the phenomenon of sleep and sleep disturbance. Therefore, this systematic review aimed to synthesize evidence on sleep concordance and discordance in the dyads of cancer patients and bed-partner caregivers.

Materials and methods: We conducted the systematic review following the JBI Manual for Evidence Synthesis on conducting systematic reviews of effectiveness. Searches were conducted the four medical databases, including PubMed, CINAHL Plus, Web of Science, and EMBASE. Studies were included if they focused on sleep in adult cancer populations, and included the perspectives on dyadic patterns, health impacts, and interventions of sleep among cancer patient-caregiver dyads. A narrative synthesis was conducted based on our three research questions: Dyadic patterns (sleep concordance and discordance), Health impacts (actor and partner effect on physical and psychosocial health), and Dyadic interventions. Meta-analyses were performed to determine the pooled effect of dyadic intervention on sleep outcomes.

Results: A total of 3810 studies imported for screening. Twenty-eight studies were included in the narrative synthesis with 19 observational studies and 9 interventional studies. Majority of caregivers reported the relationships with patients as spouses or partners. Observational studies identified significant actor and partner effects between sleep and health outcomes, including physical functioning, anxiety and depression, quality of life, and relationship satisfaction. Mindfulness practices were the most used intervention strategies in dyads. Psychological interventions, including family resilience therapy and acceptance and commitment therapy, have been applied in cancer patient-caregiver dyads. Eight studies reported the effectiveness of dyadic interventions on cancer patients' and caregivers' sleep disturbances. Dyadic interventions yielded a significant effect on decreasing patients' sleep disturbances (SMD=-0.53, 95%CI [-0.91, -0.15]) with a medium level of heterogeneity indicated by $I^2=48\%$ as well as a significant effect on decreasing caregivers' sleep disturbances (SMD=-0.52, 95% [-0.84, -0.19]) with a low heterogeneity indicated by $I^2=0\%$.

Conclusions: This review acknowledged the interdependent nature of sleep among cancer patients and caregivers. Our results could have significant implications in sleep management for healthcare professionals working with dyads impacted by cancer, particularly bed-sharing couples.

Predicting Insomnia Symptoms in University Students Using Machine Learning: The Roles of Stress, Dietary Intake, and Nature Connectedness

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Introduction: University students are particularly vulnerable to stress and sleep disturbances as a result of the psychological and adaptive challenges that come with transition to adulthood. The study aims to advance understanding of sleep problems among young people taking into account key risk factors, including stress, dietary intake and nature connectedness.

Materials and methods: A cross-sectional survey was conducted among 420 university students in Hong Kong. The Insomnia Severity Index (ISI) was used to assess the symptoms of insomnia disorder. The Perceived Stress Scale 4 (PSS-4) was used to measure perceived stress. The Short Food Frequency Questionnaire (FFQ) was used to measure dietary intake. Nature Relatedness Scale (NR-6) was used to assess the level of nature connectedness. Additional data on demographics, chronic conditions, alcohol use, smoking, and screen time were also collected. Participants were categorized into two classes: (i) those with clinical insomnia of moderate severity or above ($ISI \geq 15$), and (ii) those without clinical insomnia ($ISI < 15$). To identify key predictors of clinical insomnia, the Extreme Gradient Boosting (XGBoost) machine learning algorithm was applied using Python. The dataset was split into training and validation sets in a 7:3 ratio with stratification. Given the imbalance class distribution within the dataset, the Synthetic Minority Oversampling Technique (SMOTE) was applied to the training data.

Results: Of the 420 participants, 8.6% ($n = 36$) were identified as having moderate or severe clinical insomnia. The mean age of participants was 20.7 years (standard deviation = 1.93), 28.3% were male, and 22.6% reported having a

chronic condition. The XGBoost model achieved a balanced accuracy rates of 82% for predicting moderate severity or above clinical insomnia. The most predictive factors, in order of importance, were perceived stress level, whole milk intake, nature connectedness, fresh fruit consumption, and intake of seafood and shellfish.

Conclusions: These findings offer valuable insights into the complex interplay between insomnia, stress, dietary intake, and nature connectedness. The results also highlight the potential of machine learning models to identify individuals at elevated risk of insomnia based on the factors of stress level, dietary intake, and nature connectedness in the future research.

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OSA Screening Questionnaires – What’s New? Introducing the “GPSS” – General Practice Sleep Scale

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Introduction: Obstructive sleep apnoea (OSA) is a prevalent global health issue, affecting nearly one billion individuals worldwide. Over the past decades, various OSA screening questionnaires have been developed to identify individuals at risk. This study aimed to review the available OSA screening tools and discuss the features of more recent tools, with a focus on the General Practice Sleep Scale (GPSS), which is designed specifically for screening OSA in general practice settings.

Materials and methods: A comprehensive literature search was conducted using PubMed with keywords such as “OSA screening,” “Sleep apnea screening,” and “Sleep apnea questionnaire.” Additional tools were identified by reviewing the reference lists of retrieved articles. Screening tools were analyzed based on their design features and country of origin.

Results: A total of 22 OSA screening tools were identified, including the Epworth Sleepiness Scale (ESS, 1991) and the Top End Sleepiness Scale (TESS, 2021). Of the remaining 20 tools, three were published in the 1990s, five between 2000–2010, ten between 2011–2020, and two between 2021–2025, with the GPSS being the most recent (2025). The majority originated from the USA (n=6), followed by Brazil (n=4), Canada (n=3), Australia (n=2), and one each from Germany, Belgium, Switzerland, Poland, and Japan. Most tools incorporated variables such as body mass index (BMI), neck circumference, age, sex, and snoring history. Recent tools, particularly the GPSS, were more likely to incorporate comorbidity information and use multiple risk thresholds rather than binary criteria.



Conclusions: The evolving understanding of sex-based differences and metabolic impacts of OSA has informed the design of newer screening tools such as the GPSS. The GPSS represents a promising advancement and warrants further evaluation and adaptation across diverse populations.

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Sleep quality and hypertension: correlation between Pittsburgh Sleep Quality Index (PSQI) scores and the prevalence of hypertension and blood pressure reduction patterns

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Introduction: This study investigated the association between sleep quality and hypertension, evaluating the correlation of Pittsburgh Sleep Quality Index (PSQI) scores with hypertension prevalence and blood pressure dipping patterns.

Materials and methods: From anonymized subjective and objective sleep and blood pressure data collected via commercial wearable health devices from over 150,000 volunteers, we screened and included 17,462 participants with complete blood pressure data, among whom 5,490 had PSQI scores. Participants were stratified into "high sleep quality" (PSQI ≤ 5) and "low sleep quality" (PSQI ≥ 6) groups. Chi-square tests were used to compare hypertension prevalence between the two groups. Further analysis was conducted on 926 hypertensive patients, categorized into "dipper" and "non-dipper/reverse-dipper" groups, with chi-square tests performed to assess sleep quality differences.

Results: Among 17,462 participants, 3,882 (22.2%) had hypertension. In the 5,490 participants with PSQI scores, the hypertension prevalence was higher in the "low sleep quality" group (17.9%) compared to the "high sleep quality" group (13.9%), indicating that poor sleep quality was associated with an increased risk of hypertension (99.9% CI, $*p = 0.0008617$). However, among the 926 hypertensive patients, no statistically significant difference in subjective sleep quality was observed between dippers and non-dippers/reverse-dippers.

Conclusions: Higher PSQI scores (worse sleep quality) were associated with an elevated risk of hypertension. However, subjective sleep quality did not significantly differ between dippers and non-dippers/reverse-dippers, suggesting that abnormal blood pressure circadian rhythms may not directly contribute to perceived sleep disturbances. Further research incorporating objective sleep monitoring is warranted.

Association between Sleep Duration and Cancer-Specific Mortality among community-based population: A Systematic Review and Meta-Analysis

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Introduction: Cancer has emerged as a significant challenge in global public health, imposing a substantial burden on individuals, healthcare systems, and societies worldwide. Abnormal sleep duration may influence cancer mortality, but evidence for U-shaped/J-shaped relationships and daytime napping with cancer-specific mortality remains inconsistent. Thus, the current study aimed to conduct a systematic review and meta-analysis of the association between sleep duration (nighttime, 24-hour, daytime napping) and all-cancer and site-specific cancer mortality.

Materials and methods: We conducted a systematic search of PubMed, Embase, and the Cochrane Library databases up to March 19, 2025 without language restrictions, following PRISMA guidelines (PROSPERO: CRD420251009205). Observational studies reporting risk estimates for cancer-specific mortality associated with sleep duration in community-based populations were included. Data were extracted independently by two reviewers, and study quality was assessed using the Newcastle-Ottawa Scale (NOS). Random-effects models were used to pool relative risks (RRs) with 95% confidence intervals (CIs). Heterogeneity, publication bias, and sensitivity analyses were performed.

Results: Of the 7,326 screened studies, 32 studies (622,133 participants; 25,244 deaths) were included. All-cancer-specific mortality showed U-shaped associations: short sleep (RR=1.04, 95% CI 1.01–1.08; $I^2=23.4\%$) and long sleep (RR=1.13, 1.08–1.19; $I^2=51.1\%$) vs. 7–8h. Lung cancer-specific mortality increased with short (RR=1.14, 1.01–1.29) and long (RR=1.22, 1.02–1.45) sleep. No associations were found for digestive system, breast, or prostate cancers. Daytime napping slightly increased the risk of all-cancer-specific mortality (RR=1.06, 1.02–1.10). Subgroup analyses revealed 24-hour short sleep (RR=1.07, 1.03–1.12), but not nighttime short sleep (RR=1.01, 0.98–1.04), was significant. The association of long sleep was stronger in Asian populations and studies with ≤ 10 -year follow-up.

Conclusions: A U-shaped relationship exists between sleep duration and all-cancer-specific mortality in community-based populations, with both short and long sleep durations, as well as daytime napping, associated to increased risk.

Associations of Lifestyle Habits with Sleep Quality

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Introduction: Sleep is a fundamental biological process crucial for overall health and well-being. However, poor sleep quality is a widespread public health concern. Numerous factors are believed to influence sleep, with lifestyle habits playing a prominent role. While these associations are often discussed, a comprehensive understanding of their independent contributions to sleep quality remains essential for developing effective public health strategies. Therefore, this study aimed to investigate the relationship between these multiple lifestyle habits—smoking, alcohol consumption, daily mobile phone use duration, eating before bed, and caffeine intake—and sleep quality.

Materials and methods: Demographic information and lifestyle habit data were collected using questionnaires. Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI), where a total PSQI score greater than 5 was defined as poor sleep quality. We used a multivariate logistic regression model, adjusting for covariates such as demographic factors (e.g., body mass index (BMI), age, gender, marital status, education level, occupation type, region, area type, number of bed partners, income level) and the lifestyle habits under investigation (smoking, alcohol consumption, daily mobile phone use, eating before bed, caffeine intake). Data analysis was conducted using R statistical software (version 4.4.2), with statistical significance set at $P < 0.05$.

Results: From 19,680 collected data, 13,407 complete questionnaires were included after data cleaning. Drinking alcohol before bed was significantly associated with poorer sleep quality. Compared to non-drinkers, individuals who consumed alcohol before bed had an odds ratio (OR) of 2.100 (95% Confidence Interval [CI]: 1.277-3.700) for poor sleep quality. Compared to non-smokers, daily smokers had an OR of 1.521 (95% CI: 1.353-1.712) for poor sleep quality. Smoking fewer than 5 cigarettes daily showed no significant difference from non-smokers, but sleep quality significantly declined for those smoking 5 or more cigarettes daily. Individuals smoking more than 20 cigarettes daily had an OR of 1.793 (95% CI: 1.415-2.295). Compared to using a phone for less than 2 hours daily, the ORs for poor sleep quality were 1.225 (95% CI: 1.019-1.470) for 2-5 hours, 1.472 (95% CI: 1.219-1.776) for 5-8 hours, and 1.860 (95% CI: 1.521-2.263) for more than 8 hours of use. Compared to those who never ate before bed, the ORs for poor sleep quality were 1.417 (95% CI: 1.264-1.588) for occasional eaters, 2.023 (95% CI: 1.750-2.339) for sometimes eaters, and 2.270 (95% CI: 1.921-2.688) for frequent eaters before bed. Compared to those who never consumed caffeine, the ORs for poor sleep quality were 1.223 (95% CI: 1.112-1.345) for consuming caffeine less than 3 times per week, 1.383 (95% CI: 1.212-1.579) for 3-7 times per week, and 1.459 (95% CI: 1.239-1.721) for more than 7 times per week.

Conclusions: Drinking alcohol before bed, smoking, prolonged mobile phone use, eating before bed, and high-frequency caffeine intake are all significantly associated with poorer sleep quality. These findings underscore the importance of modifying these lifestyle habits to improve sleep health and provide a scientific basis for developing targeted health interventions.

Structural Factors Impeding or Facilitating Freshmen Sleep Habits

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Introduction: Starting college is a time of transition that can be stressful. Developing healthy sleep habits in this period of relative autonomy is important for physical and mental wellbeing. We evaluated freshmen sleep, activity and wellbeing through different phases of the academic calendar using a wearable (Oura Ring) and a proprietary app (Z4IP). A comprehensive understanding of the structural factors that impede or facilitate freshmen sleep as they adapt to college life can inform programs to optimize student life and wellbeing.

Materials and methods: 638 freshmen underwent multi-factor evaluation across a 20-week semester using a combination of objective sleep measurements (Oura Ring), daily subjective reports of sleep and well-being (Z4IP),

and periodic time-use diaries (Z4IP). We explored how sleep patterns were affected by the academic calendar, early morning classes, and staying on- versus off-campus.

Results: During instructional weeks, freshmen woke 49.8min earlier on weekdays compared to weekends ($t_{629}=24.14$, $p<.0001$), especially when there were early morning classes. However, delaying waketimes after the midterm break ($\beta=5.81$, $p<.0001$), often past the first class, resulted in increased sleep ($\beta=5.56$, $p<.0001$). In contrast, bedtimes were stably late across the semester, with minimal weekday-weekend differences (15.2min). Despite reduced needs for commuting, freshmen staying on-campus obtained less sleep than those staying off-campus ($t_{629}=-6.36$, $p<.0001$), even after accounting for naps ($t_{629}=-5.26$, $p<.0001$), due mainly to later bedtimes ($t_{629}=6.62$, $p<.0001$). Four hours before going to bed, on-campus students spent 60min on social and co-curricular activities, and compositional data analyses indicated that those spending more time on these activities slept later. Additional digital leisure activities showed similar effects for off-campus students.

Conclusions: Freshmen's sleep evolved across the semester as they adapted to college life. By the second half of the semester, more sleep was obtained by waking up later, often past early morning classes. Residential status also affected their sleep habits, and the type of activities that delayed when they went to bed. The mix of predicted and unpredicted findings underscores the utility of our minimally obtrusive, multi-factor, longitudinal behavioural and physiological phenotyping approach.

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Preliminary Efficacy of Transdiagnostic Intervention for Sleep-Circadian dysfunction adapted for common mental disorders: A case series

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Introduction: Sleep and common mental disorders contribute to global public health challenges. Sleep has been established as a modifiable transdiagnostic contributor in the onset and maintenance of psychopathology. The role of sleep in influencing the illness trajectory, with effects on frequency of relapses, severity, and duration of episodes, calls for interventions targeting sleep across mental health conditions. The Transdiagnostic Intervention for sleep-circadian dysfunction (TranS-C) adopts a sleep health promotion perspective and was adapted in individuals with common mental disorders to reduce the dilemma of sequentially or concurrently targeting sleep. While previous studies have looked at sleep through the lens of Cognitive behavioural therapy for insomnia with individuals with primary insomnia and associated comorbidities, the TranS-C operates from a transdiagnostic preventative lens rather than a medical model. Previous research suggests that apart from behavioural symptoms, maladaptive cognitive processes—such as dysfunctional beliefs about sleep, repetitive negative thinking (RNT), and perfectionistic tendencies—play a key role in the bidirectional relationship between sleep and mood.

Materials and methods: The feasibility and preliminary efficacy of an adapted TranS-C protocol are displayed through a case series of five adults with common mental disorders (CMD), recruited from outpatient services at a tertiary mental health hospital. Individuals with a CMD meeting a cut-off score of > 5 (indicating sleep disturbances) in the Pittsburgh Sleep Quality Index and who had stabilisation of medication for four weeks were recruited. Outcome measures included sleep quality, mood (depression and anxiety symptoms), RNT, dysfunctional beliefs about sleep, and self-efficacy. Participants received 10-12 weekly sessions incorporating cognitive-behavioural strategies and psychoeducation targeting shared sleep and mood mechanisms. The outcomes were measured at pre-, post-, and follow-up of 3 months.

Results: The individuals recruited had primary diagnoses of health anxiety, recurrent depressive disorder, generalised anxiety disorder, PTSD in remission, and chronic insomnia. Negative affect and rigid perfectionism were common personality domains observed in the sample. The findings indicate a significant change in mood and sleep disturbance severity post-intervention. Additionally, there was a reduction of repetitive negative thinking, dysfunctional beliefs and an increase in cognitive flexibility and self-efficacy that was seen post-intervention.

Conclusions: These findings provide preliminary evidence for the utility of the modular, transdiagnostic intervention for individuals with CMDs and comorbid sleep-circadian dysfunction. The promising outcomes underscore the importance of targeting shared cognitive-affective mechanisms and support the need for future controlled trials to establish efficacy and generalizability. Moreover, addressing sleep-circadian dysfunction as a

modifiable factor may enhance treatment outcomes and illness trajectories for individuals with comorbid and complex mental health challenges.

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Contemporaneous network analysis of mental health symptoms in middle-aged and elderly patients with OSA

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Introduction: To analyze the mental health status and severity of middle-aged and elderly patients with obstructive sleep apnea (OSA), and to construct a network of mental health symptoms in middle-aged and elderly patients with OSA through network analysis, and to identify the core symptoms.

Materials and methods: A total of 741 patients with OSA who were admitted to the Sleep Medicine department of the People's Hospital of Guangxi Zhuang Autonomous Region from February 2022 to November 2023 were enrolled. The symptomcheck list-90 (SCI-90) was used to evaluate the psychological situation of the patients. According to whether the score of each factor of SCL-90 ≥ 2 , it was divided into positive symptom group and negative symptom group of each factor. The network analysis method was used to construct the psychological symptom network, and the core symptoms were identified through the central index, the bridge strength was analyzed, and the psychological and polysomnography characteristics of the positive and negative groups of bridge symptoms were compared.

Results: The most common psychological symptoms of middle-aged and elderly patients with OSA were other symptoms (60.46%), obsessive-compulsive compulsion (45.48%) and somatization (38.87%), and the results of centrality index analysis showed depression ($r_s=1.433$, $r_b=1.950$, $r_c=2.024$), anxiety ($r_s=1.109$, $r_b=0.942$, $r_c=0.727$) and interpersonal sensitivity ($r_s=1.006$, $r_b=1.278$, $r_c=0.587$) as the core symptom. Depression is the primary bridging symptom, followed by interpersonal sensitivity and anxiety. Patients were grouped according to the presence of positive symptoms of anxiety or depression. It was found that patients with anxiety or depression symptoms had lower AHI (Apnea-Hypopnea Index) but were more prone to daytime somnolence.

Conclusions: Depression, anxiety and interpersonal sensitivity are the core symptoms of psychological symptoms in middle-aged and elderly patients with OSA, which provides new ideas for the clinical diagnosis of this population, determines the key intervention targets for clinical treatment, and provides a theoretical basis for reducing the symptom management burden of middle-aged and elderly OSA patients.

Association Between Multidimensional Sleep Health and Psychological Distress in Japanese Community Residents

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Introduction: To investigate the association between multidimensional sleep health (MDSH) and psychological distress among Japanese community residents.

Materials and methods: A self-administered questionnaire survey was conducted from December 2022 to February 2023 among Kyoto City residents aged 40 years or older. MDSH was assessed using the RU_SATED, which evaluates six sleep health dimensions (regularity, satisfaction, arousal, timing, efficiency, and sleep duration) and generates a total score. Psychological distress was measured using the Kessler 6 (K6) scale. This study was approved by the Ethics Committee of Kyoto University.

Results: Among 661 respondents (57.9% female, mean age 64.9 years, 68.4% urban residents), the prevalence of K6-5 distress, K6-13 distress was 28.9%, and 3.0%. Spearman correlation analysis showed that K6 scores were negatively correlated with total RU_SATED scores ($r_s = -0.25$, $P < 0.001$). Each 1-point increase in the RU_SATED score corresponded to a -0.325-point decrease in the K6 score. Multiple logistic regression analysis showed that K6-5 distress was associated with all six dimensions (odds ratio [OR] = 0.309–0.671), whereas K6-13 distress was associated with satisfaction (OR = 0.176).

Conclusions: This study found that total RU_SATED scores were negatively associated with psychological distress, with each sleep dimension showing a distinct relationship. Further research is needed to explore these relationships in diverse populations.

Sleep Stage Classification over Continuous Positive Airway Pressure Signals with Multi-Period Convolutional Neural Network

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Introduction: Continuous Positive Airway Pressure (CPAP) therapy is the standard treatment for obstructive sleep apnea (OSA), yet its potential for passive sleep monitoring remains underexplored. Polysomnography (PSG), the clinical gold standard for sleep staging, is resource-intensive and impractical for routine home use. To address this gap, we developed a deep learning-based framework that classifies sleep stages using only CPAP signals.

Materials and methods:

We propose the **Multi-Period Convolutional Neural Network (MP-CNN)**, a novel architecture specifically designed to extract temporal features from CPAP-derived respiratory signals. Unlike conventional CNNs that rely on fixed receptive fields, MP-CNN incorporates multiple period-specific convolutional kernels ($p=3$, $p=9$, and $p=21$) to simultaneously capture short- and long-term respiratory dynamics. The model processes 630-second input windows with subject-normalized input features, including **CPAP flow (Cflow)**, **positive airway pressure (PAP)**, and **instantaneous respiratory rate (IRR)**. We augment features by reducing redundancy while preserving temporal information. Specifically, every 25 samples are downsampled to 1 Hz, and four statistical descriptors (mean, standard deviation, maximum, minimum) are computed within each window to capture local dynamics. This multi-period design allows MP-CNN to more effectively uncover the intrinsic relationships between CPAP signals and sleep stages, which may be overlooked by standard CNN architectures. The model was evaluated on split-night PSG sleep studies, where CPAP titration began midway through the recording. Data from 32 subjects with moderate to severe OSA were included, with ground truth sleep stages annotated by trained technicians according to AASM guidelines. A 3-fold cross-validation protocol was applied to ensure robust evaluation.

Results:

Our proposed MP-CNN achieved a **macro F1-score of 0.685** and a **Cohen's Kappa of 0.523** in three-stage classification, with **per-stage sensitivity/specificity of 0.693/0.908 (Wake), 0.520/0.930 (REM), and**

0.818/0.669 (NREM). These results demonstrate competitive or superior performance compared to existing approaches that rely on more intrusive signals. Feature ablation studies further revealed that downsampled statistical features were essential for improving model performance, particularly in REM detection. In addition, the model showed a strong correlation with ground truth sleep metrics, such as **total sleep time (Pearson's $r = 0.85$)**. We also assessed demographic effects by stratifying subjects by gender, BMI, and age. No statistically significant differences in performance were observed across subgroups, although females and younger subjects exhibited slightly higher agreement in some cases. Overall, the model generalized well across demographic factors, indicating that demographic variability was not a primary source of cross-dataset performance differences.

Conclusions: Our results demonstrate the feasibility of leveraging CPAP-derived respiratory signals for unobtrusive sleep stage classification. The MP-CNN architecture enables accurate sleep staging without the need for additional sensors, offering a scalable and cost-effective solution for home-based sleep monitoring. Future work will focus on extending the framework to include deep sleep detection and adaptive integration with automatic positive airway pressure (APAP) systems.

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The Association of Sleep Duration and Quality with Obesity-related Cancers: Results from the Health Examinees Study

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Introduction: Sleep has emerged as a modifiable risk factor for metabolic dysfunction and cancer. However, prospective evidence linking sleep duration and quality to cancer risk remains inconclusive. This study aims to investigate the associations of self-reported sleep duration and quality with obesity-related cancer risk in a large-scale Korean population.

Materials and methods: This prospective cohort study utilized data from the Health Examinees-Gem (HEXA-G) cohort, comprising 67,910 adults aged ≥ 40 years who were recruited between 2004 and 2013. Sleep quality were self-reported at baseline and assessed based on multiple dimensions, including sleep duration (6–8 hours), bedtime (20:00–24:00), difficulty initiating or maintaining sleep (not at all), sleep disturbance due to worries (not at all), nonrestorative sleep (not at all), daytime fatigue (not at all), habitual snoring (< 3 times per week) and snoring with breathing interruptions (no) as reference. Each response was summarized into a composite sleep quality score (score range 0–14) and categorized into quartiles. This study adopted obesity-related cancers, defined by the International Agency for Research on Cancer. Cancer cases were identified through national cancer registration data from the Korea Central Cancer Registry of the Korea National Cancer Center. Cox proportional hazards models were applied to assess hazard ratios (HRs) and 95% confidence intervals (CIs) for the associations of sleep quality with risk of obesity-related cancer, with follow-up from baseline to first cancer diagnosis, death, loss to follow-up, or end of study.

Results: Among the individual components of the composite sleep quality score, significant associations of frequent daytime fatigue (HR: 1.53, 95% CI: 1.18–1.99, $p=0.003$), habitual snoring (HR: 1.24, 95% CI: 1.03–1.50, $P=0.025$), and snoring with breathing interruptions (HR: 1.40, 95% CI: 1.08–1.82, $p=0.011$) with obesity-related cancer risk were demonstrated in females. Sleep duration, bedtime, difficulties in initiating or maintaining sleep, sleep disturbances due to worries, and nonrestorative sleep were not significantly associated with obesity-related cancer risk. Furthermore, females in the highest quartile of the composite sleep quality score had increased risk of obesity-related cancer (HR: 1.17, 95% CI: 1.02–1.35); however, the effect size of this association was smaller compared to the associations observed for specific symptoms, including frequent daytime fatigue, habitual snoring, and snoring with breathing interruptions. In males, combined sleep quality without sleep duration was significantly

associated with higher obesity-related cancer risk (HR: 1.47, 95% CI: 1.09-1.97, $p=0.010$), even in the absence of significant associations with individual sleep quality components.

Conclusions: In this large-scale prospective cohort study, higher composite sleep scores combining sleep duration with sleep quality were associated with elevated risk in females, and poor sleep quality without considering sleep duration was associated with elevated risk in males. These findings underscore the importance of multidimensional sleep quality assessment as a modifiable behavioral factor in the prevention of obesity-related cancer.

Comparative Efficacy of Transcutaneous Auricular Vagus Nerve Stimulation (taVNS) versus SSRIs for Sleep Improvement in Depression: An 8-Week Randomized Controlled Trial

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Introduction: Depression is typically accompanied by considerable sleep disorders, which often remain even after treatment. Transcutaneous auricular vagus nerve stimulation (taVNS), a non-invasive neuromodulation therapy, has showed potential in treating depressive symptoms. Some research reveals that taVNS may alter sleep regulation via its effects on the autonomic nervous system and sleep-wake cycle modulation. However, its comparative efficacy with first-line selective serotonin reuptake inhibitors (SSRIs) for improving sleep symptoms in depression remains unclear. This study aims to compare the efficacy of 8 weeks of taVNS treatment with SSRI drug treatment in improving sleep disorders in patients with depression.

Materials and methods: This study included 43 adult patients with depression meeting DSM-5 diagnostic criteria. Participants were randomly assigned to the taVNS group ($n=21$) or the SSRIs group ($n=22$) and received 8 weeks of treatment. The taVNS group received 30 minutes of standardized parameter stimulation therapy daily, while the SSRIs group received medication treatment according to clinical guidelines. Sleep outcomes were assessed using the Hamilton Depression Rating Scale (HAMD) sleep subscale at baseline and post-treatment. Baseline characteristics showed no significant differences between groups in HAMD sleep scores ($F=2.302$, $p=0.494$; taVNS group: $M=3.71\pm0.332$; SSRIs group: $M=3.32\pm0.462$). Statistical analyses included paired t-tests for within-group comparisons and Mann-Whitney U tests for between-group differences, with effect sizes calculated using Cohen's d .

Results: Both treatment modalities demonstrated significant improvements in sleep symptoms after 8 weeks of intervention. In the taVNS group, HAMD sleep scores decreased from 3.71 ± 1.52 at baseline to 2.33 ± 1.80 post-treatment ($t(20)=3.15$, $p=0.005$, $d=0.69$), representing a medium effect size improvement. Similarly, the SSRI group showed reduction from 3.32 ± 2.17 to 1.64 ± 1.33 ($t(21)=3.00$, $p=0.007$, $d=0.64$), also demonstrating a medium effect size. Between-group comparisons using Mann-Whitney U tests revealed no statistically significant difference in treatment efficacy ($U=226.5$, $z=-0.112$, $p=0.911$), with comparable mean ranks between groups (taVNS=22.21; SSRIs=21.80). Both treatments were well-tolerated, with no serious adverse events reported in either group.

Conclusions: This study provides evidence that both taVNS and SSRIs are effective in improving sleep disturbances associated with depression, with comparable efficacy after 8 weeks of treatment. These findings position taVNS as a viable non-pharmacological alternative to SSRIs for managing sleep symptoms in depression, particularly for patients who prefer to avoid medication or experience side effects from pharmacotherapy. The comparable efficacy, combined with taVNS's favorable safety profile, supports its consideration in treatment algorithms for depressed patients with prominent sleep disturbances. Future research should investigate longer-term outcomes, optimal treatment parameters for taVNS, and potential differential effects on specific sleep architecture components.

Personalized Sleep Extension in a Pilot Study: Effects and Moderators

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Introduction: Chronic short sleep is associated with adverse health outcomes, yet effective behavioral interventions remain understudied. This pilot study examined the efficacy of a tailored sleep extension (SE) intervention incorporating behavior change techniques and explored the moderators of treatment response.

Materials and methods: Eleven chronically short-sleeping adults (<6.5 hours; 25 ± 1.5 years) completed a 3-day baseline, 4-day sleep hygiene education (SH), and 7-day 90-min SE protocol. Daily sleep was assessed via actigraphy and sleep diary. We first assessed overall intervention effects on seven sleep parameters, then examined phase-specific changes in sleep duration. Given substantial between-participant variability in sleep response ($ICC = 28\text{--}54\%$), we further tested whether baseline individual characteristics moderated SE outcomes using simple slope analysis for significant moderators.

Results:

SE significantly improved sleep duration but showed mixed effects on sleep quality and stability. SH increased time in bed ($\beta = 0.72$ h, $p = 0.019$), SE further increased time in bed ($\beta = 1.49$ h, $p < 0.001$), and tended to increase actual sleep duration ($\beta = 0.55$ h, $p = 0.059$). However, increased sleep duration was accompanied by greater fragmentation ($\beta = 9.435$, $p = 0.015$) and lower sleep efficiency ($\beta = -5.49$, $p = 0.024$), although no change in subjective sleep quality. And, intervention did not change sleep efficiency, latency, and circadian timing. Exploratory analysis showed that emotional stability, baseline sleep duration, and sleep barrier reduction during interviews would moderate the SE effect on actual sleep duration.

Conclusions: This pilot study supports the feasibility and effectiveness of a personalized SE protocol in extending sleep among short-sleeping adults. While SE increased sleep duration, it also led to greater fragmentation, suggesting a trade-off during adaptation. Importantly, individuals with lower emotional stability, longer baseline sleep duration, and more barriers solved benefited the most. These findings highlight the need to tailor behavioral sleep interventions based on individual psychological and sleep-related characteristics.

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Analysis of the Characteristics and Influencing Factors of Working Memory Impairment in Middle-aged and Young Patients with Obstructive Sleep Apnea-Hypopnea Complicated by Nocturia

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Introduction: Lower urinary tract symptoms are a major public health issue worldwide that affect patients' quality of life. Among these, nocturia is evaluated as the most common condition associated with various diseases, such as sleep disorders and/or obstructive sleep apnea syndrome (OSAS). Although the long-recognized association between nocturia and OSAS exists, cognitive impairment in patients with OSAS complicated by nocturia has yet to be explored. This study investigates the incidence of nocturia in middle-aged and young patients with obstructive sleep apnea-hypopnea and examines the characteristics of their working memory impairment.

Materials and methods: This study recruited patients diagnosed with OSA due to snoring at the Sleep Center of The Second Affiliated Hospital of Soochow University from September 2021 to September 2022. According to inclusion and exclusion criteria, a total of 102 patients were enrolled. Cognitive function was thoroughly assessed, and all patients' clinical data and polysomnography (PSG) parameters were collected. Based on whether patients woke to urinate due to the urge at night ≥ 2 times, they were divided into the OSA group and the OSA + nocturia group. Collected indicators were compared between the two groups, and characteristics of cognitive impairment in OSA patients with nocturia were analyzed. Additionally, partial correlation analysis was used to explore factors influencing working memory impairment in these patients.

Results:

1. Among the 102 OSA patients included in the study, 44.12% (45/102) had nocturia. Compared with the OSA group, the OSA + nocturia group had higher age, Epworth Sleepiness Scale scores, a higher proportion of nocturnal awakenings due to urgency, a higher prevalence of hypertension, and higher arousal index (Arl) (all $P < 0.05$); no statistically significant differences were found in other aspects (all $P > 0.05$).
2. There was no statistically significant difference in overall cognitive function between the OSA group and the OSA + nocturia group. However, in terms of working memory, the OSA + nocturia group had significantly lower correct rates of delayed paired associate recall (PRM) than the OSA group ($P < 0.05$).
3. After adjusting for age, BMI, and years of education by partial correlation analysis, the results showed that the correct rate of delayed PRM in OSA patients with nocturia was negatively correlated with the longest apnea duration ($P < 0.05$).

Conclusions: Among middle-aged and young patients with OSA, those with nocturia exhibited more significant working memory impairment than those without nocturia, characterized by decreased object working memory, and the degree of impairment was negatively correlated with the longest apnea duration.

The effects of physical activity timing and adherence to physical activity guidelines on sleep in children with Attention-deficit/hyperactivity disorder

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Introduction: Regular physical activity (PA) has been shown to benefit sleep. However, the effects of PA timing and adherence to the WHO's recommended 60-minute moderate-to-vigorous physical activity (MVPA) guideline on sleep remain unclear, especially for children with Attention-deficit/hyperactivity disorder (ADHD) who often experience sleep problems. This study examined whether the timing of MVPA influenced objectively measured sleep, including sleep latency (SL), sleep efficiency (SE), total sleep time (TST), and wake after sleep onset (WASO), among children with ADHD.

Materials and methods: This cross-sectional study involved 253 children clinically diagnosed with ADHD (Mean age = 8.60 ± 1.31 years, 81% boys). MVPA timing was categorized as more than 8 hours before bedtime, 3–8 hours before bedtime, and less than 3 hours before bedtime. Meeting the MVPA guideline was defined as engaging in at least 60 minutes of MVPA daily. PA and sleep were recorded using an ActiGraph GT9X accelerometer for 7 consecutive days. A multivariate analysis of covariance (MANCOVA) controlling for age, sex, IQ, BMI, comorbidity, medication, and ADHD subtypes was carried out to compare the group differences in physical activity levels, timing of MVPA, and sleep parameters. Hierarchical regression models were used to examine the association of sleep parameters (i.e., SL, SE, TST, and WASO) with the timing of MVPA.

Results: Among the participants, 174 children (68.8%) met the WHO daily guideline of 60 minutes of MVPA, and, across all monitoring days, 77.94% of days met the MVPA guideline. These children had better sleep outcomes than those who did not meet the guideline, with shorter sleep latency ($F=50.98$, $\eta^2=.173$), higher sleep efficiency

($F=24.04$, $\eta^2=.090$), and less WASO ($F=17.54$, $\eta^2=.067$). Regarding PA timing, meeting the MVPA guideline and MVPA time more than 8 hours before bedtime were associated with reduced SL ($\beta=-.265$, $p=.001$), improved SE ($\beta=.268$, $p=.002$) and reduced WASO ($\beta=-.263$, $p=.002$). Conversely, MVPA time less than 3 hours before bedtime was associated with decreased SE ($\beta=-.211$, $p=.002$) and increased WASO ($\beta=.231$, $p<.001$).

Conclusions: The current study provides evidence that children with ADHD who have achieved the MVPA guideline have better sleep quality than those who have not. Attainment of the MVPA guideline and MVPA at 8 h before bedtime are associated with improved sleep. MVPA close to bedtime is related to decreased sleep efficiency and increased WASO. Future research should consider implementing PA intervention to determine the best timing of exercise for improving sleep in this clinical group.

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The longitudinal mediating role of sleep in the bidirectional relationship between depression and functional disability among older adults: A systematic review and conceptual framework

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Introduction: The increasing prevalence of depression and functional disability in older adults highlights the need for targeted interventions. Sleep, as a potentially modifiable factor, holds promise in addressing these challenges. Given that sleep health provides clues for understanding the potential causes that could mitigate the negative effects of depression and functional disability, a better understanding of the relationship between sleep, depression, and functional disability is crucial for crafting effective preventive strategies and personalized interventions for older adults.

Materials and methods: This review and conceptual framework aimed to examine the pairwise bidirectional associations between sleep, depression, and functional disability and identify the longitudinal mediating role of sleep in the bidirectional relationship between depression and functional disability in older adults. The academic databases PsycArticles, PubMed, MEDLINE, Science Citation Index, Social Sciences Citation Index, ProQuest Dissertations and Theses Global, Cochrane, and Scopus were searched for research published in English between January 2000 and June 2024. Systematic review and cohort study designs were eligible. All included studies were assessed for quality using the Critical Appraisal Skill Programme checklist (CASP 2024). A narrative synthesis approach will be applied to integrate the findings, including an analysis of variability in terms of setting, population, exposure/ intervention, and outcomes.

Results: 397,289 citations were identified, and 82 studies meeting the inclusion criteria were included. Cohort studies and reviews provide evidence that there is a dynamic reciprocal correlation between sleep, depression, and functional disability in the older population. The research identifies reciprocal causal pathways—depression exacerbates functional disability through unhealthy sleep, while functional disability worsens depression via unhealthy sleep—highlighting a vicious cycle that accelerates health decline in aging populations. Sleep longitudinally mediates the bidirectional relationship between depression and functional disability in older adults, acting both as a result and a driver in this dynamic interplay. The proposed framework prioritizes sleep health as a modifiable target for breaking the depression-functional disability cycle, offering actionable strategies to mitigate adverse outcomes in older adults.

Conclusions: This review and conceptual framework highlight that sleep health can provide crucial insights for mitigating the adverse effects experienced by older adults due to depression and functional disability. For healthcare professionals and policymakers, it provides evidence about prioritizing sleep health as an accessible step to foster a healthy lifestyle.

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The Impact of Sleep Deprivation on Mental and Physical Functioning Among Medical Students: A Mixed-Methods Study

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Introduction: Current research indicates that sleep deprivation induces significant neurocognitive impairments in healthy adults, including impaired synaptic plasticity, reduced brain volume, disrupted memory consolidation, and decreased alertness. Medical students typically experience shorter sleep duration and irregular sleep pattern, due to high-intensity academic tasks and clinical workload. This study aimed to assess the impact of sleep deprivation on mental and physical functioning as well as the daily life, among the medical students.

Materials and methods: This sequential explanatory mixed-methods study received ethical approval from the Ethics Committee of GPHCM (No. YE2022-266). All participants provided written informed consent prior to the enrolment. Phase 1 was a quantitative survey of medical students aged 18-26 years, interning in Guangzhou with self-reported average sleep duration ≤ 7 hours/night over the past week. Participants completed the Profile of Mood States (POMS), Epworth Sleepiness Scale (ESS), and Psychomotor Vigilance Task (PVT) to assess their emotional states, daytime sleepiness, and cognitive performance (reaction time, vigilance, and sustained attention). Based on the pilot study indicating cognitive impairment (defined as >10 PVT lapses) in 10% of participants, a sample size of 35 was expected. Phase 2 was a semi-structured qualitative interview, recruiting participants from the Phase 1, aiming at supplementing the quantitative findings. Data were analysed using statistics, thematic analysis, and triangulation validation between the quantitative and qualitative results.

Results: Quantitative analyses showed a significant negative correlation between sleep duration and PVT lapses ($p < 0.05$), indicating vigilance declined with reduced sleep duration. While sleep duration correlated negatively with PVT response speed, this relationship was not statistically significant ($p > 0.05$). Sex, body mass index, menstrual period, medical school and caffeinated beverages consumed did not significantly affected the PVT performance, POMS scores, or ESS scores ($p > 0.05$ for all). Qualitative data revealed that all interviewees subjectively perceived sleep deprivation as negatively affecting their next-day work and study performance, including cognitive deficits, emotional instability, and uncomfortable physical symptoms. Common manifestations included reduced attention and psychomotor slowing (consistent with PVT results), alongside with impaired short-term memory, fatigue, and headaches, which was beyond the quantitative findings. Subgroup-analysis suggested that participants with mild sleep deprivation (6–6.5 hours/night) experienced appetite suppression and chest tightness, whereas severe deprivation (4–5 hours/night) had complaints about severe fatigue, excessive daytime sleepiness, memory impairment, and hyperarousal.

Conclusions: Even short-term sleep deprivation impairs brain functioning, causes discomfort and disrupts daily life in medical students. These findings underscore the urgent need to develop targeted healthcare interventions for medical students to mitigate these adverse effects, which may include sleep hygiene education, workload adjustments, and psychological support services.

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Evaluating Obstructive Sleep Apnea as a Predictor of Postoperative Bleeding in Chronic Rhinitis Surgery

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Introduction: According to published literature, patients diagnosed with obstructive sleep apnea (OSA) are at a higher risk of postoperative complications, such as adverse cardiac events, respiratory complications, reduced oxygen saturation, and an increased likelihood of admission to the intensive care unit (ICU). Additionally, patients

with sleep-disordered breathing often experience nasal obstruction and seek surgical solutions. However, the relationship between obstructive sleep apnea and the risk of complications following nasal obstruction surgery has not been previously explored.

Materials and methods: From March 2023 to July 2024, records were reviewed for patients diagnosed with chronic rhinitis lasting over six months who underwent nasal obstruction surgery after showing poor response to one month of treatment with corticosteroid nasal sprays or oral medications. These patients experienced significant impacts on their quality of life or sleep quality. The study evaluated the treatment outcomes, complications, and risk factors one month after undergoing surgery for chronic rhinitis. The surgical procedure primarily involved inferior turbinate radiofrequency surgery. Variables analyzed included age, sex, body mass index (BMI), allergic rhinitis scores (24-hour reflective total nasal symptom score, rTNSS), nasal obstruction scores (nasal obstruction symptom evaluation scores, NOSE), hypertension, OSA, medication-induced rhinitis, history of nasal surgery, and concurrent procedures such as septoplasty, posterior nasal nerve ablation, adenoidectomy, tonsillectomy, and soft palate surgery.

Results: A total of 325 patients undergoing nasal surgery for CR were included, with 48 patients (14.8%) classified as having OSA and 277 patients (85.2%) as non-OSA. The mean age was similar between groups (41.1 ± 7.7 vs. 38.9 ± 10.0 years, $p = 0.147$). Males constituted a significantly higher proportion in the OSA group compared to the non-OSA group (91.7% vs. 62.5%, $p < 0.001$). BMI was also higher in the OSA group (28.9 ± 4.9 vs. 25.1 ± 4.3 kg/m², $p < 0.001$). Preoperative rTNSS scores averaged 6.3 ± 2.8 , improving to 2.5 ± 2.0 postoperatively (60.3%, $p < 0.001$). NOSE scores improved from 11.5 ± 4.1 to 2.7 ± 3.7 (76.5%, $p < 0.001$), with nasal obstruction-related sleep disturbance scores improving by 79.43% ($p < 0.001$). Diagnosed as OSA (OR, 5.105; 95% CI, 1.222–21.328; $p = 0.025$) and hypertension (OR, 5.809, 95% CI, 1.134–29.744; $p = 0.035$) were identified as independent risk factors for major epistaxis-related complications in our study cohort. OSA patients also exhibited significantly higher overall complication rates (22.9% vs. 4.3%, $p = 0.005$), epistaxis events (18.8% vs. 3.6%, $p = 0.012$), and major epistaxis (14.6% vs. 1.8%, $p < 0.018$). Both OSA and non-OSA groups showed significant postoperative symptom improvement in rTNSS and NOSE scores ($p < 0.001$).

Conclusions: Obstructive sleep apnea and hypertension were identified as significant risk factors for postoperative complications and bleeding following chronic rhinitis surgery, with no significant association observed between these factors and the preoperative severity of rhinitis or the inclusion of additional surgical procedures during the operation. Chronic rhinitis surgery effectively improves poor nighttime sleep quality in patients with nasal obstruction, with significant differences observed as early as one month postoperatively.

Utility of the General Practice Sleep Scale “GPSS” among women in childbearing age in comparison to existing OSA screening tools

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Introduction: Background: The risk of developing obstructive sleep apnoea (OSA) increases during pregnancy. However, underdiagnosis of OSA during pregnancy continues and can have adverse maternal and fetal outcomes. Hence, it is vital in clinical practice to screen high risk women in childbearing age for presence of OSA.

Aims: In this study, we assessed the utility of the new OSA screening tool – the “GPSS” (General Practice Sleep Scale) among women in childbearing age in comparison to existing traditional OSA screening tools – the Epworth sleep scale (ESS) and STOP-Bang.

Materials and methods: Methods: This was a retrospective study including all women aged 18-35 years with either a completed GPSS/STOP-bang/ESS, or data available to retrospectively derive the GPSS/STOP-bang/ESS score, and who underwent diagnostic polysomnography (PSG) in the Northern Territory of Australia.

Results: Results: 30 women (median age 30.6 (IQR 26, 33.5), $n=8$ (26.7%) indigenous Australian, median apnoea hypopnea index (AHI) 9.5 (IQR 3.2, 12.9)) were included for analysis. 70% recorded OSA (50% mild, 6.7% moderate and 13% severe) with minor, non-significant differences in age and Indigenous status between those with OSA (median age 31.4 (IQR 26.6, 33.5), 28.6% Indigenous) and those without (median age 27 (IQR 26, 31), 22.2%

Indigenous). Notably, the ESS was higher among patients without OSA than with (median 15 (IQR 12, 15) vs. 8 (IQR 6, 19), $p=0.063$) and frequency of a heightened ESS ($ESS>8$) was greater for those without OSA (77.8%) vs. those with (47.6%), showing a sensitivity and specificity of 47.6 & 22.2% respectively. The median STOP-bang score among those with OSA was 2 (IQR 2, 3) (47.6% moderate risk ($score\geq 3$)) vs. 1 (IQR 1, 3) (33.3% moderate risk) among those without, showing sensitivity and specificity of 47.6 & 66.7% respectively for a moderate risk score. The median GPSS score among those with OSA was 10 (IQR 7, 11) (76.2% moderate risk ($score\geq 7$)) vs. 8 (IQR 4, 10) (55.6% moderate risk) among those without, showing sensitivity and specificity of 76.2 & 44.4% respectively for a moderate risk.

Conclusions: This study illustrates a high prevalence of OSA in women of childbearing age. However, daytime symptoms appeared more commonly among those patients without OSA. The GPSS tool showed much higher sensitivity for OSA, while the STOP-bang showed higher specificity, indicating both may be of use in different clinical scenarios for this demographic. Further prospective studies are warranted to assess the performance of the GPSS amongst pregnant women.

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Menopausal Hormone Therapy and Cardiovascular Outcomes in Menopausal Women with Obstructive Sleep Apnea

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Introduction: Menopause exacerbate the risk of cardiovascular events in women with obstructive sleep apnea (OSA). The efficacy and safety of menopausal hormone therapy (MHT) in cardiovascular outcomes in this population remain unclear.

Materials and methods: We conducted a propensity score-weighted cohort study using data from 363 menopausal women with OSA from a tertiary medical hospital. Patients were stratified based on MHT use (59 treated vs. 304 untreated). Baseline demographics, comorbidities, and apnea-hypopnea index (AHI) were balanced via overlap weighting. Outcomes included heart failure (HF) and major adverse cardiovascular events (MACE), analyzed using Cox regression with follow-up periods of 3 and 10 years.

Results: After weighting, baseline characteristics including age, AHI, and comorbidities showed no significant differences between groups. At 3 years, MHT was not significantly associated with reduced risk for HF (HR: 0.800, 95% CI: 0.167-3.837, $p=0.781$) or MACE (HR: 0.815, 95% CI: 0.226-2.932, $p=0.754$). Similarly, at 10 years, no significant reductions were observed in HF (HR: 0.836, 95% CI: 0.277-2.521, $p=0.751$) or MACE (HR: 0.902, 95% CI: 0.359-2.265, $p=0.826$).

Conclusions: Menopausal hormone therapy in menopausal women with OSA did not significantly impact the incidence of heart failure or major cardiovascular events over both short and long-term follow-up periods. Further studies with larger cohorts are warranted to confirm these findings.

Daytime dysfunction, self-reported health, and hospitalizations predicting 3-year readmission in adults with systemic lupus erythematosus

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Introduction: Most systemic lupus erythematosus (SLE) patients have the risk of readmission after discharge, which seriously affects the quality of life of patients and increases the medical burden. However, there are few studies about the readmission of SLE patients. Therefore, this prospective cohort study aims to analyze the occurrence and the impact of mental health and sleep quality on rehospitalization within 3 years of discharge among adult SLE patients.

Materials and methods: Adult SLE patients hospitalized between April 2020 to April 2021 were followed for 3 years. Patients' rehospitalizations were collected through the electronic medical record system. Data was analyzed with descriptive statistics. Multivariate Cox regression analysis was applied to explore risk factors for their re-hospitalization during that period.

Results: A total of 135 SLE patients were included, 46 event cases and 89 censored cases were found in this analysis, with 3 years followed-up. Overall, 3.0% of SLE patients were re-hospitalized within 1 month; 7.4% within 3 months; 11.1% within 6 months; 22.2% within 1 year; 31.9% within 2 years; and 34.1% within 3 years. Multivariate Cox regression analysis showed that, among adult SLE patients, daytime dysfunction (HR=1.564, $P=0.016$) and the number of hospitalizations (HR=1.141, $P=0.011$) were the risk factors for 3-year re-hospitalization, while self-reported health being the protective factor (HR=0.812, $P=0.002$). More specifically, serum ferritin (hazard ratio (HR)=1.005, 1.003, respectively; all $P=0.047$) was the risk factor of 1-month re-hospitalization; serum ferritin and self-reported health were the predictors of 3-month re-hospitalization (HR=1.003, 0.670, respectively, all $P<0.05$); serum ferritin, number of hospitalizations, and number of other diagnoses were the risk factors of 6-month re-hospitalization (HR=1.003, 1.351, 2.200, respectively; all $P<0.05$). For 1-year rehospitalization after discharge in SLE patients, current smoking, number of hospitalizations, and daytime dysfunction were the risk factors (HR=3.631, 1.153, 1.528, respectively; all $P<0.05$). Current smoking (HR=4.919, $P=0.010$) and number of hospitalizations (HR=1.138, $P=0.011$) and were the risk factors of 2-year rehospitalization. Self-reported health was the protective factor for 1-year and 2-year re-hospitalization in patients with SLE (HR=0.821, 0.825, respectively; all $P<0.05$).

Conclusions: The 3-year re-hospitalization in SLE patients was 34.1%. Sleep quality, self-reported health, and number of hospitalizations were the main modifiable predictors for SLE patient's readmission within 3 years of discharge. It is recommended that clinical nurses pay attention to adult SLE with more hospitalizations, severe daytime dysfunction, and poor self-reported health to reduce the 3-year readmission rate.

Estimating Apnea-Hypopnea Index from Short-Duration Electrocardiograms

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Introduction: Sleep apnea, a disorder characterized by recurrent upper airway collapse during sleep. This leads to intermittent hypoxia, sleep fragmentation, and notable cardiovascular issues. The Apnea-Hypopnea Index (AHI), typically assessed via overnight polysomnography, is crucial for diagnosis. This study explores the feasibility of estimating AHI using just one hour of single-channel electrocardiogram (ECG) data.

Materials and methods: The Physionet SA-ECG database was utilized for this study. This open-access dataset comprises 70 ECG recordings, typically 8 hours long, with expert-labeled apnea annotations based on simultaneously recorded respiration signals. These recordings are categorized into groups reflecting varying apnea severity (Class A: AHI ≥ 10 and at least 100 minutes of apnea; Class B: AHI ≥ 5 and 5-99 minutes of apnea; Class C: AHI < 5 and less than 5 minutes of apnea). The ECG signals in the database are sampled at 100 Hz. For this study, a one-hour segment from these overnight recordings was used to demonstrate the efficacy of short-duration analysis.

Our methodology involves extracting heart rate variability (HRV) from short-duration ECG recordings and utilized Heart Rate Fragmentation (HRF), a novel measure of signal nonlinearity, alongside conventional frequency-domain features to characterize apnea. An XGBoost classifier was then trained on these features to estimate AHI. We employed a leave-one-out cross-validation approach to evaluate performance. Additionally, a correlation analysis was conducted to assess the relationship between our short-duration HRV features and the overnight clinical apnea scores.

Results: The results indicate that HRV dynamics effectively characterizes apnea severity even with limited signal duration ($p<0.05$). Both short-duration HRF ($p>0.4$) and frequency-domain features ($p<0.6$) showed significant correlation with long-term AHI scores ($p<0.05$). In the classification task, these features, combined with the XGBoost classifier, resulted in a F1-score of 93.55%.

Conclusions: In conclusion, we demonstrate that HRV analysis with HRF metrics, provides a reliable and efficient method for early detection and severity assessment of sleep apnea. This proposed framework, leveraging short-

duration ECG data and machine learning, has strong potential for scalable and accessible sleep apnea screening in both clinical and home-based settings.

Identifying and managing sleep disorders in patients with fibromyalgia

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Introduction: Fibromyalgia is a chronic condition marked by widespread pain, fatigue, and sleep problems. However, little is known about the presentation and management of sleep problems in these patients. This study aimed to 1) characterise sleep/wake patterns and sleep disorder presentations in participants with fibromyalgia, and 2) assess changes in sleep and fibromyalgia symptoms with individualised sleep disorder treatment.

Materials and methods: Women with fibromyalgia were recruited from the Rheumatology Unit at The Queen Elizabeth Hospital, South Australia. Participant sleep and activity for two-weeks was established using an under-mattress sleep sensor (Withings Sleep Analyser, WSA), sleep diaries and a wrist accelerometer (GENEAktiv). Screening questionnaires included Berlin Sleep Questionnaire (OSA), Epworth Sleepiness Scale (ESS), Flinders Fatigue Scale (FFS), the Sleep Condition Indicator (SCI), and Fibromyalgia Impact Questionnaire Revised (FIQ-R). Self-reported anxiety, depression, other co-morbidities, as well as medication use, were collected. Results were reviewed by sleep psychologists and a sleep physician. Those determined to be at risk for a sleep disorder were offered individualised sleep disorder treatment, which involved cognitive behaviour therapy for insomnia (CBTi) and personalised chronotherapeutic approaches (bright light therapy, melatonin) delivered by sleep psychologists, and/or continuous positive airway pressure (CPAP) therapy with or without positional (POS) therapy, as appropriate and prescribed by the sleep physician.

Results: Data from 23 women (aged 50.5 ± 15.6 years, BMI $32.8 \pm 9.3 \text{ kg/m}^2$) with pain duration ranging from 18 months to over 40 years were investigated. Sixteen women completed a sleep diary, indicating low sleep efficiency ($73\% \pm 11.5$). All were assessed as 'high-risk' for a sleep disorder, with eight at 'high-risk' for two or more sleep disorders (7 obstructive sleep apnoea; OSA), 12 insomnia, 6 circadian rhythm sleep wake disorders; CRSWD). Five women had delayed, and one had advanced, circadian rhythms. Fatigue scores exceeded those commonly observed for participants living with medical conditions more broadly in the community (21.7 ± 5.8 vs. 20.4 ± 6.2). Co-morbid anxiety and depression were reported by 65% and 35% of the women, respectively. Thirty-nine percent of participants reported being woken by pain nightly, and 43.5% reported their pain prevented sleep on 1-3 nights per week. Over half of the participants (56.5%) reported taking medication at night for pain. Ten women were referred for individualised sleep disorders treatment. Seven provided responses to post-treatment questionnaires and reported clinically meaningful improvements in their fatigue (mean change=6.7; Minimal Clinically Important Difference [MCID]=3.4), and FIQ score (mean change=10.6; MCID=8.1).

Conclusions: Fibromyalgia is associated with complex and co-morbid sleep disorders. Screening, identifying and managing sleep disorders using personalised treatment approaches may be an important therapeutic target for patients with fibromyalgia to improve sleep quality, daytime functioning, and fibromyalgia symptoms.

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Sleep Temporal Entropy: A Novel Sleep Fragmentation Biomarker Predicting Cardiometabolic Disease and Mortality Risk

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Introduction: Sleep fragmentation involves frequent arousals and irregular sleep stage transitions, which impair physiological recovery and contribute to increased cardiometabolic and mortality risk. Conventional fragmentation metrics such as Wake After Sleep Onset (WASO), Sleep Efficiency (SE), and Arousal Index (Arl) rely on arbitrary thresholds and fail to capture the temporal complexity of sleep transitions. Advanced EEG-derived indices offer deeper insights but are less practical for long-term monitoring and have rarely been evaluated against serious outcomes. To address these limitations, we developed a novel metric—Sleep Temporal Entropy (STE) which quantifies variability in the duration derived from the hypnogram. This study aimed to evaluate STE's ability to predict adverse health outcomes, compare its performance with traditional and existing metrics, and examine its relationship with mortality and cardiometabolic disorders.

Materials and methods: We analyzed data from the Shanghai Sleep Health Study Cohort (SSHSC, n=3,219, clinic-based) and the Sleep Heart Health Study (SHHS, n=4,862, community-based). STE was calculated by applying Shannon entropy to the temporal distribution of each sleep stage (Wake, N1, N2, N3, REM), yielding both whole night and stage-specific. In both cohorts, five machine learning models including Extreme Gradient Boosting (XGBoost) were trained to predict cardiometabolic conditions and mortality. SHapley Additive exPlanations (SHAP) were used to assess the relative importance of each feature. In SHHS, survival analysis was conducted using Cox proportional hazards regression models. STE values were categorized into quintiles, and hazard ratios (HRs) with 95% confidence intervals (CIs) were calculated across unadjusted and adjusted models. Proportional hazards assumptions were tested, and restricted cubic splines were used to evaluate non-linearity.

Results: In both cohorts, STE—especially REM and N3-stage STE—ranked consistently among the most important predictors in SHAP analysis, surpassing conventional fragmentation metrics. In SSHSC, XGBoost achieved the highest predictive performance (AUC = 0.84, accuracy = 0.81), with STE contributing more than WASO or ArI in predicting hypertension, diabetes, and hyperlipidemia. In SHHS, machine learning models confirmed STE's relevance in predicting all-cause and cardiovascular mortality. Cox regression revealed a U-shaped association between STE and mortality risk. Compared to the reference quintile (Q3), participants in the lowest quintile of REM STE had a significantly elevated risk of all-cause mortality (HR = 1.58, 95% CI: 1.16–2.15) and cardiovascular mortality (HR = 2.83, 95% CI: 1.66–4.80). Similarly, participants in the highest REM STE quintile also showed increased CVD mortality risk (HR = 2.13, 95% CI: 1.14–3.96). Overall STE showed similar U-shaped patterns, whereas Wake STE exhibited a linear positive association with both outcomes.

Conclusions: STE provides a more comprehensive quantification of sleep fragmentation and irregularity than traditional metrics, offering a multidimensional assessment of sleep quality. Our findings demonstrate that STE is a robust predictor of cardiometabolic disorders and mortality, as evidenced by its performance in both machine learning models and Cox regression analyses. Notably, the U-shaped risk association for STE suggests an optimal range of STE for better health.

Clusters of sleep disturbance in people with systemic lupus erythematosus and associated factors

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Introduction: Systemic lupus erythematosus (SLE) is a debilitating chronic autoimmune disease. Individuals with SLE often suffer from sleep disturbance, affecting quality of life and even disease progression. Sleep disturbance in people with SLE is very complex and exhibits heterogeneity, posing challenges to the development of personalized interventions. The aim of this study was to investigate heterogeneous clusters of sleep disturbance and associated factors in people with SLE.

Materials and methods: A cross-sectional design was used and 434 people with SLE in China were recruited from an online Community for SLE Outpatient Support. Data were collected via electronic questionnaires. Sleep

disturbance was evaluated by the Pittsburgh Sleep Quality Index (PSQI). Other information, such as disease activity, pain, fatigue, depression, and anxiety was also collected using validated instruments, including Systemic Lupus Erythematosus Disease Activity Index 2000, Visual Analogue Score of Pain, Fatigue Severity Scale, Patient Health Questionnaire-9, and Generalized Anxiety Disorder-7. Latent profile analysis was performed to reveal the distinct clusters of sleep disturbance. Multiple logistic regression analysis was performed to investigate factors associated with the clusters.

Results: Participant mean age was 32.9 years and 92.6% were females. All had sleep disturbance (PSQI>5) and their mean PSQI was 8.8 (SD=2.9). Three distinct clusters were identified: mild sleep disturbance with poor sleep quality, adequate sleep duration, and good daytime functioning (50.7%), mild sleep disturbance with poor sleep quality, adequate sleep duration, and poor daytime functioning (30.9%), and moderate sleep disturbance with poor sleep quality, inadequate sleep duration, and impaired daytime functioning (18.4%). There are both overlaps and unique aspects in terms of factors associated with each cluster of sleep disturbance, including age, BMI status, cardiovascular system damage, musculoskeletal system damage, depression, and anxiety. Overall, patients who were overweight, having musculoskeletal system damage or anxiety were more likely to have mild sleep disturbance with daytime functioning significantly impaired. Increasing age, depression, and musculoskeletal system damage could predispose patients to moderate sleep disturbance.

Conclusions: Sleep disturbance in patients with SLE showed three distinct clusters. In clinical practice, healthcare professionals (e.g., nurses) are recommended to prioritize assessment and interventions to those at-risk subgroups. They could also use the above information to develop and provide targeted interventions to address the unique needs of each cluster of sleep disturbance.

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Oscillatory population-level activity of dorsal raphe serotonergic neurons in sleep-wake disorders

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Introduction: The incidence of sleep-wake disorders is increasing, with the core pathological process involving abnormal changes in brain electrical activity related to the regulation of sleep-wake cycles. Studies have shown that 5-hydroxytryptamine (5-HT) neurons in the dorsal raphe nucleus (DRN) play a crucial role in regulating sleep-wake processes by releasing 5-HT to the prefrontal cortex (PFC), a downstream brain region, thereby altering sleep-wake states. However, the role of the DRN 5-HT neuronal pathway to the PFC in sleep-wake disorders and its underlying mechanisms remain unclear.

Materials and methods: Firstly, we performed synchronized electroencephalogram (EEG) recordings with fiber photometry to monitor the activity dynamics of 5-HT neurons in DRN across different sleep-wake phases. Secondly, sleep-wake disorder animal models were established using acute restraint stress (ARS) and chronic restraint stress (CRS). We assessed the effects of restraint stress on total sleep duration and sleep architecture in mice, while simultaneously examining whether the activity of DRN 5-HT neurons was altered during these processes. Next, miniscope was employed to record the activity of DRN 5-HT neurons during restraint stress and to evaluate their reactivation patterns during subsequent sleep periods. Subsequently, fiber photometry was utilized to monitor fluctuations in 5-HT neurotransmitter levels within PFC during sleep in animals exposed to ARS or CRS. Finally, patch-clamp electrophysiology was conducted to investigate the electrophysiological properties of DRN 5-HT neurons and PFC neurons in animals subjected to ARS or CRS.

Results: The population oscillatory activity of DRN 5-HT neurons projecting to PFC exhibited tight coupling with distinct sleep-wake phases. Specifically, DRN 5-HT neurons displayed heightened activity during wakefulness, reduced activity during non-rapid eye movement (NREM) sleep, and nearly ceased firing during rapid eye movement (REM) sleep. Mice subjected to CRS developed significant sleep-wake disturbances, characterized by shortened REM sleep latency, prolonged REM sleep duration, and an increased probability of transitions from NREM to REM sleep compared to controls. Furthermore, CRS mice exhibited distinct activity patterns of DRN 5-HT neurons across sleep-wake phases relative to unstressed controls. Notably, during NREM sleep, the magnitude of DRN 5-HT neuronal activity in CRS mice was significantly greater than that in controls. Importantly, DRN 5-HT

neurons activated during restraint stress showed reactivation during subsequent sleep periods, as captured by miniature fluorescent microscopy. This reactivation phenomenon suggests a potential link between stress-induced neuronal activation and sleep dysregulation. Chemogenetic activation of the DRN 5-HT to PFC neuronal circuit mimicked the effects observed in CRS-treated mice. Furthermore, chemogenetic inhibition of the DRN 5-HT to PFC circuit effectively rescued the CRS-induced sleep disturbances. Suppressing the activity of this circuit restored baseline sleep architecture, normalized REM sleep parameters, and reduced aberrant phase transitions.

Conclusions: The DRN-PFC 5-HT pathway critically regulates sleep-wake dynamics and mediates stress-induced sleep disturbances. -CRS disrupts sleep architecture by amplifying DRN 5-HT neuronal activity during NREM sleep, promoting REM sleep abnormalities, and enhancing stress-activated neuron reactivation during sleep. These findings highlight the DRN-PFC 5-HT circuit as a therapeutic target for stress-related sleep disorders.

Factors influencing sleep quality among persons with systemic lupus erythematosus through the lens of Spielman's three-factor insomnia model

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Introduction: Individuals with systemic lupus erythematosus (SLE) have reported poor sleep quality both globally and in China. Previous studies have identified several factors associated with sleep quality in this population. However, the influencing factors remain unclear and inconsistent. According to Spielman's Model (3P Model), existing evidence has primarily focused on predisposing and precipitating factors, while perpetuating factors have been under-explored. Therefore, this study aimed to investigate the predisposing (age, BMI, disease activity), precipitating (fatigue, pain, depression, anxiety), and perpetuating (sleep hygiene practices) factors associated with sleep quality among Chinese individuals with SLE.

Materials and methods: This cross-sectional study was conducted among individuals with SLE recruited from a tertiary hospital in China between December 2024 and April 2025. Data were collected online using a demographic questionnaire, the Chinese version of the Pittsburgh Sleep Quality Index (PSQI), the Fatigue Severity Scale (FSS), the Hospital Anxiety and Depression Scale (HADS), the Sleep Hygiene Practices Scale (SHPS), the Pain Visual Analogue Scale (VAS), and the Systemic Lupus Erythematosus Disease Activity Index 2000 (SLEDAI-2K). Descriptive statistics and regression analysis were used to analyze the data.

Results: A total of 329 individuals with SLE were included in the analysis. The mean age was 37.15 ± 11.51 . Females accounted for 93.0%. Of these, 210 (63.8%) reported poor sleep quality. Regression analysis revealed that age ($\beta=0.197$, $p < 0.001$), disease activity ($\beta=0.100$, $p = 0.022$), fatigue ($\beta=0.113$, $p = 0.021$), pain ($\beta=0.190$, $p < 0.001$), anxiety ($\beta=0.221$, $p < 0.001$), and sleep hygiene practices ($\beta=0.298$, $p < 0.001$) were significant predictors of sleep quality, explaining 43.2% of the variance in PSQI scores ($F(6, 322) = 40.742$, $p < 0.001$). Among these, sleep hygiene practices, which are a perpetuating factor, were the most influential predictor, followed by anxiety, age, pain, fatigue, and disease activity.

Conclusions: In line with the 3P Model, this study identified predisposing, precipitating, and perpetuating factors that influence sleep quality among Chinese individuals with SLE. These findings provide valuable insight for designing targeted and effective interventions aimed at improving sleep quality and overall well-being in this population.

The experience of poor sleep of living with HIV in Indonesia: Toward an Intervention Development

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Introduction: Background: Poor sleep quality is a health problem primarily experienced by people living with HIV (PLHIV). The impact of poor sleep quality not only affects the HIV disease itself but also extends to many areas of life.

Objective: This study aimed to explore the experience of poor sleep quality in people living with HIV/AIDS (PLWHA) in Indonesia.

Materials and methods: Method: The research method used was qualitative using semi-structured in-depth interviews with 12 PLHIV from a national peer support group. Approximately 60 minutes of interviews were run through Zoom and recorded. The data was analyzed descriptively and interpretatively for 3 clusters of PLHIV that differ in the severity of sleep problems. These three clusters have been determined using an initial analysis based on Insomnia Severity Index (ISI) scores. Further data analysis was based on a hermeneutic form of PLHIV narratives

Results: Result: three themes were developed: 1) I have a lot of things in my mind that prevent me from sleeping; 2) I would rather switch to TLD (Tenofovir Lamivudine Dolutegravir) so that I can have my sleep back; 3) When I can't sleep, I end up scrolling through my phone.

Conclusions: Conclusion: HIV-positive status and any HIV medication taken may affect PLHIV's sleeping pattern. However, there are many potentials to improve the sleep health of Indonesian PLHIV.

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Bridging the Guideline Gap: Clinically Tested Casein Tryptic Hydrolysate (CTH) and the Combination of CTH-Theanine as First-Line Therapy for Mild to Moderate Insomnia

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Introduction: Cognitive-behavioural therapy for insomnia (CBT-I) is recommended as the first-line treatment for chronic insomnia in adult patients of all ages, including those with comorbidities. When the CBT-I approach is not effective, pharmacological intervention can be offered as a short-term (≤ 4 weeks) approach, prescribing benzodiazepines, benzodiazepine receptor agonists, daridorexant, and low-dose sedating antidepressants; a longer-term approach (up to 3 months) with orexin receptor antagonists or prolonged-release melatonin, considering their advantages and disadvantages.

Materials and methods: Antihistamines, antipsychotics, fast-release melatonin, ramelteon, and phytotherapeutics are not recommended for insomnia, as indicated by the recent European Insomnia Guideline. This guideline leaves a significant gap in safe, effective, and well-tolerated options. Bridging that gap, casein tryptic hydrolysate (CTH), a milk-derived protein hydrolysate rich in bioactive peptides such as α -casozepine, has demonstrated promising anxiolytic and sleep-enhancing effects by modulating the GABAergic system, akin to conventional anxiolytics.

Results: In three randomised, placebo-controlled trials involving 144 participants, oral administration of 150–600 mg/day of CTH for 2 to 4 weeks produced statistically significant improvements in overall sleep quality and sleep latency. Additionally, three more trials involving 84 subjects given the combination of CTH (150–600 mg/day) and theanine (an amino acid derived from green tea; 50–204 mg/day) over 4 to 8 weeks demonstrated a significant reduction in sleep latency in common, while two of the trials showed a significant enhancement in total sleep duration, sleep efficiency, and daytime dysfunction—without causing sedation or dependency.

Conclusions: In contrast to many pharmacological options, both CTH and CTH-theanine formulations consistently exhibit favourable safety profiles, positioning them as compelling candidates for first-line therapy when CBT-I is inadequate. Larger, multinational trials are warranted to further validate these findings and support broader clinical adoption.

Hypersomnia

Prevalence, clinical, and sleep laboratory characteristics among patients presenting with excessive daytime sleepiness in Thailand, a tertiary care setting

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Introduction: Excessive daytime sleepiness (EDS) is a significant clinical issue associated with high morbidity, including increased risk of accidents, impaired cognitive performance, and mood disturbances. In Thailand, research on hypersomnolence disorders remains limited. This study aimed to determine the prevalence, clinical features, and sleep laboratory characteristics of patients presenting with EDS at Siriraj Hospital.

Materials and methods: This retrospective study analyzed data from patients who presented with EDS and underwent a Multiple Sleep Latency Test (MSLT) at the Siriraj Sleep Center between January 2018 and December 2023. The primary outcome was the prevalence of hypersomnia disorders. Secondary outcomes included clinical features and sleep laboratory findings.

Results: A total of 99 patients were included in the analysis. Of these, 45.5% were male. The average age was 32 years, the total sleep time was 7.53 ± 1.17 hours, and the mean Epworth Sleepiness Scale (ESS) score was 12.17 ± 5.87 , with significant differences observed among narcolepsy (NC), idiopathic hypersomnia (IH), and sleep insufficiency and others groups ($p = 0.033$) which significant 2-group comparison of idiopathic hypersomnia and others group. The most common diagnosis was sleep insufficiency ($n=18$), followed by obstructive sleep apnea (OSA; $n=15$), idiopathic hypersomnia ($n=14$), and narcolepsy ($n=12$).

Conclusions: Clinical presentations of disorders of hypersomnolence were usually overlapped and most were nonspecific. Objective testing with PSG and MSLT were essential for making a precise diagnosis.

Acknowledgments: Siriraj Sleep Center, Thailand

Does Kleine-Levin Syndrome Have Circadian Dysfunction?

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Introduction: Kleine-Levin Syndrome (KLS) involves periodic hypersomnia relapses and debilitating neurobehavioral disturbances, yet the existence of circadian rhythm dysfunction remains debated.

Materials and methods: We conducted a study integrating between-group comparisons with a within-subject design. Circadian rhythms were evaluated under a modified constant routine protocol in 22 KLS patients (mean age 23.5 ± 15.1 years) and 48 age-, sex-, and BMI-matched healthy controls (mean age 20.8 ± 6.2 years). Habitual sleep-wake patterns were assessed via wrist-worn actigraphy. Endogenous circadian markers—including phase [dim light melatonin onset (DLMO), core body temperature minimum (CBTmin)], amplitude, and MESOR—were derived from 24-hour melatonin and CBT profiles. Importantly, a subgroup of six KLS patients was evaluated in both remission and relapse states.

Results: Between-group comparisons revealed no significant differences in sleep-wake patterns, circadian phase markers (e.g., DLMO), amplitude, or MESOR between KLS patients and healthy controls. The one exception was a statistically lower baseline melatonin level in the KLS relapse group compared to controls (1.9 ± 1.1 vs. 3.2 ± 1.9 pg/mL, $p=0.007$), though this difference is unlikely to be clinically significant. In contrast, the within-subject paired analysis revealed a significant and dynamic phase advance during relapse. Specifically, DLMO advanced by a mean of 1.4 hours ($p=0.031$) and CBTmin advanced by a mean of 1.9 hours ($p=0.019$). In contrast to this phase shift, there were no significant changes in the amplitude or MESOR for either melatonin or CBT between the remission and relapse states. This marked phase shift in KLS patients contrasted with the high circadian stability observed in controls assessed twice.

Conclusions: KLS is not associated with persistent abnormalities in circadian phase, amplitude, or MESOR. Instead, the disorder is characterized by a distinct and dynamic phase advance during symptomatic relapses. These findings provide novel insight into the circadian pathophysiology of KLS, highlighting the circadian system's phase-shifting mechanism as a potential therapeutic target.

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Multimodal digital assessments of hypersomnia with an instant messaging program

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Introduction: Hypersomnia, characterized by prolonged sleep duration and/or daytime sleepiness, is a common symptom in depression. While hypersomnia assessments rely on self-report, clinical appraisal, and polysomnography (PSG), patients with hypersomnia may present with a wide range of behavioral expressions that may not be captured well by traditional assessments, e.g., trouble concentrating and anxiety, which, however, were correlated with specific linguistic and acoustic features. Advances in digital health have enabled ecologically valid and continuous monitoring through multimodal assessment. As prior studies have validated speech features as reliable markers, this study investigates hypersomnia symptoms in a Hong Kong youth sample using a Telegram-based speech-based ecological momentary assessment (EMA) that collects audio data, aiming to identify behavioral markers and evaluate the effectiveness of automated feature extraction via machine learning and deep learning models.

Materials and methods: This is part of an ongoing study on depression detection using EMA, which initially recruited 328 youth participants. Among those who completed the study (n=300, 19% with depression), 26 individuals had hypersomnia symptoms (mean age: 20.64; 75.18% female), identified via the post-EMA outcomes of the Structured Clinical Interview for the Hamilton Depression Rating Scale with Atypical Depression Supplement (SIGH-ADS 2003), and the remaining 274 did not exhibit hypersomnia symptoms (mean age: 21.12; 84.62% female). Within the hypersomnia group, 17 reported ≥ 1 -hour sleep extension, and 9 reported ≥ 2 -hour increases. Exclusion criteria included a history of neuropsychiatric disorders (other than depression and anxiety), any voice, speech, or language disorder, or being deemed unable to provide informed consent. Over seven days, participants completed twice-daily mood assessments, with a minimum compliance rate of 70% required for inclusion. From the resulting voice recordings, a domain-specific pipeline extracted 84 interpretable acoustic and linguistic features, incorporating both static and temporal dynamics. To model complex feature interactions and latent structures, classification of hypersomnia symptoms was performed using the state-of-the-art machine learning algorithms with five-fold cross-validation and SMOTE applied for class balancing.

Results: With age, gender, and depression symptom controlled, patients with hypersomnia symptoms demonstrated significant differences in acoustic features, including higher short-term pitch variability ($P=.04$), reduced short-term loudness variability ($P=.003$), and a lower rate of change in the power spectrum ($P=.01$), indicating reduced speech energy and psychomotor slowing. Linguistic analysis revealed an increased short-term fluctuation in the use of negation words ($P=.04$), and an increased risk-related words usage variability ($P=.02$), reflecting disrupted affective or cognitive regulation. Combining acoustic, linguistic modalities, and demographic information, the Multilayer Perceptron and Long Short-Term Memory (LSTM) model achieved an F1-score of 0.74 for binary classification (sensitivity=0.35; specificity=0.71) between hypersomnia and other participants, and an F1-score of 0.76 for the multi-class classification.

Conclusions: Digital assessment using speech and language features offers a scalable, ecological approach to identify hypersomnia symptoms. Our findings reveal distinct acoustic and linguistic markers associated with hypersomnia and demonstrate the feasibility of automated classification, supporting early detection.

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Clinical Significance of Fractional Exhaled Nitric Oxide (FeNO) in Narcolepsy Patients

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Introduction: Narcolepsy is characterized by excessive daytime sleepiness, often accompanied by obesity and obstructive sleep apnea (OSA). Airway inflammation in OSA and obesity has been described and can be assessed by measuring the biomarker fractional exhaled nitric oxide (FeNO). In this preliminary study, we explored the significance of FeNO measurement in patients with narcolepsy.

Materials and methods: This study was a prospective and in-hospital population-based study. We enrolled patients with narcolepsy and compared them with patients with OSA and insomnia. Patients underwent pulmonary function tests, FeNO measurement, arterial blood gas analysis, polysomnography, and multiple sleep latency tests. All patients had eosinophil counts, and some underwent IgE testing. FeNO was measured daily during hospitalization, including before and after ventilator and pharmacological treatments.

Results: A total of 90 patients were included, divided into narcolepsy (n = 30), OSA (n = 30), and insomnia (n = 30) groups. The median apnea-hypopnea index (AHI) in the narcolepsy group was 16 ± 4.5 , with a mean age of 50.9 years and 29% females. Among narcolepsy patients, 45% were diagnosed with OSA, of which 53% had moderate to severe disease. FeNO levels were significantly higher in patients with moderate to severe OSA compared to those with no or mild OSA ($P = 0.024$). FeNO was positively correlated with the apnea-hypopnea index ($r = 0.65$, $p < 0.001$) and the lowest blood oxygen saturation ($r = 0.54$, $p < 0.001$). Among the 37 patients in the OSA group who underwent continuous positive airway pressure (CPAP) titration and treatment, successful titration was associated with lower nocturnal FeNO elevation (7.2 ± 3.3 vs. 11.0 ± 4.3 , $p = 0.02$). FeNO levels decreased after 1-4 days of CPAP treatment (11.7 ± 4.4 ppb, $p < 0.001$). In narcolepsy patients with OSA, FeNO did not decrease with AHI reduction after CPAP treatment compared to the OSA group. Pharmacological treatment significantly improved daytime sleepiness in narcolepsy patients but did not significantly change FeNO levels.

Conclusions: FeNO was not significantly correlated with daytime sleepiness in narcolepsy and did not change with CPAP treatment. FeNO levels were elevated in OSA patients and correlated with disease severity, decreasing after positive airway pressure treatment. This study supports the role of upper airway inflammation in the pathogenesis of OSA and suggests that FeNO may be useful for monitoring the effectiveness of CPAP treatment. The correlation between FeNO and daytime sleepiness requires further investigation.

Challenges in the Treatment of Narcolepsy and the Positive Impact of Acetyl-L-Carnitine: A Case-Based Review with 20-Year Follow-Up

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Introduction:

Narcolepsy is a chronic sleep disorder marked by excessive daytime sleepiness (EDS), disrupted nocturnal sleep, and, in some cases, cataplexy. Standard treatments—including wake-promoting agents, stimulants, and sodium oxybate—often provide incomplete symptom control and may cause significant side effects. Misdiagnosis is also common, particularly with mood disorders, contributing to delayed treatment and prolonged functional impairment. Current therapies primarily target monoaminergic and GABAergic systems, yet do not address potential deficits in neuronal energy metabolism. Emerging data suggest that mitochondrial dysfunction may play a role in central hypersomnias, supporting interest in metabolic modulators such as acetyl-L-carnitine (ALCAR). We present a case of treatment-resistant narcolepsy in which low-dose ALCAR supplementation resulted in a marked and sustained improvement in wakefulness, highlighting its potential as an adjuvant therapeutic strategy.

Materials and methods: A comprehensive case-based review was conducted using a detailed, longitudinal clinical history of a 50-year-old female patient diagnosed with narcolepsy following over 15 years of misdiagnosed mood disorder. Data include pharmacological regimens, objective sleep testing, adverse effects, and patient-reported outcomes. The impact of low-dose ALCAR (250 mg/day) on wakefulness, symptom severity, and quality of life was documented over a 6-month period.

Results:

The patient experienced persistent excessive daytime sleepiness and functional decline despite multiple treatment attempts over two decades. Initial pharmacologic management included antidepressants, Modafinil, Armodafinil, Adderall, Concerta, Jornay, Vyvanse, and sodium oxybate (Xyrem). Many of these treatments led to intolerable side effects—including severe gastrointestinal symptoms, Barrett's esophagus, and psychiatric distress—or failed to provide sustained benefit. Xyrem, though initially discontinued due to severe adverse reactions such as vomiting, shivering, and anxiety, was later successfully reintroduced beginning at a very low dose (0.25 g nightly) and gradually titrated up. The patient eventually stabilized on a regimen of 2.25 g of Xyrem taken twice nightly, combined with 125 mg of Modafinil daily.

This combination extended the patient's functional wake window to approximately four hours. In early 2025, the patient began taking 250 mg of acetyl-L-carnitine (ALCAR) each morning. This addition was associated with a further and sustained increase in her wakefulness window—from four to approximately six hours—with a marked reduction in the need for daytime napping and no reported side effects. The patient described significant improvements in alertness, daily functioning, and overall quality of life. Attempts to increase ALCAR beyond 250 mg/day resulted in undesirable overactivation, affirming the effectiveness of the lower dose. A follow-up self-observation revealed that accidental omission of ALCAR for one week led to a noticeable recurrence of brain fog and excessive sleepiness, which resolved upon resuming the correct supplement. This unintentional interruption served to reinforce the subjective benefit attributed to ALCAR.

Conclusions: This case highlights the multifaceted challenges in narcolepsy management and proposes acetyl-L-carnitine as a potential adjuvant therapy in refractory cases. Given its safety profile and observed benefit in this case, ALCAR warrants further investigation through controlled clinical trials.

Insomnia

Effects and Influencing Factors of the Different Components in Cognitive Behavioral Therapy for Insomnia

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Introduction: This study, combining the psychological characteristics of Chinese patients with insomnia, aims to verify the efficacy of CBT-I in Chinese insomnia patients and explore the different therapeutic components of CBT-I as well as the related factors affecting its efficacy, so as to provide a basis for the further localization and individualization of CBT-I.

Materials and methods: 120 insomnia patients were recruited from the outpatient department and randomly assigned to four groups: Cognitive Behavioral Therapy (CBT), Cognitive Therapy (CT), Behavioral Therapy (BT), and Treatment as Usual (TAU) (n=30/group). All groups received weekly interventions for 8 weeks. The Insomnia Severity Index (ISI), Beck Anxiety Inventory, and Multidimensional Fatigue Inventory (MFI-20) were used for evaluations at baseline, week 4, week 8, week 16, and week 24.

Results: (1) All four patient groups showed significant improvements in insomnia severity after eight weeks of treatment and at the end of 24 weeks of follow-up ($P < 0.05$). Compared to CT-I, CBT-I demonstrated a significantly greater short-term effect on sleep quality, but with no statistically significant difference relative to BT-I. Age and baseline insomnia severity were risk factors for treatment efficacy, while being married was an independent protective factor. (2) All four groups showed a significant improvement in anxiety symptoms post-treatment ($P < 0.001$), with the CBT, BT, and TAU groups showing a faster improvement rate than the CT group. During follow-up, the therapeutic effects were maintained in the CBT, CT, and BT groups, while the BAI scores increased in the TAU group. At the end of treatment, all four groups showed significantly relieved fatigue symptoms ($P < 0.05$), without significant differences between them ($P > 0.05$).

Conclusions: The short-term improvement effect of CBT-I on sleep quality was similar to that of BT-I, but superior to that of CT-I, highlighting the cost-effectiveness of BT-I.

Efficacy and Safety of FLORANBIDIN® in Patients with Chronic Insomnia: A Phase 2 Randomized, Double-Blind Clinical Trial

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Introduction: Chronic insomnia is a significant health issue that impacts patients' overall well-being and quality of life. Current treatment options primarily include cognitive behavioral therapy for insomnia (CBT-I) and the use of sleeping medications, both of which may lead to adverse effects and long-term dependency. **FLORANBIDIN®** is a novel formulation containing **nano-emulsion cannabidiol (CBD-NE) combined with piperine**, designed to enhance the efficacy of CBD on the **endocannabinoid system (ECS)**. This formulation holds potential for improving sleep quality without severe adverse effects.

Materials and methods: This study is a **randomized, double-blind, placebo-controlled trial** conducted in **patients aged 18-60 years** diagnosed with **chronic insomnia** according to **ICSD-3 criteria**. Eligible participants must have an **Insomnia Severity Index (ISI) score of ≥ 15** and experience **insomnia at least three times per week for over three months**. Participants were randomly assigned into two groups: 1) **FLORANBIDIN® group:** Received **50 mg of FLORANBIDIN® before bedtime** 2) **Placebo group:** Received an **inactive placebo**. The treatment duration was **4 weeks**, and the efficacy was assessed using **Belun Ring, Polysomnography (PSG), ISI, Pittsburgh Sleep Quality Index (PSQI), and Epworth Sleepiness Scale (ESS)**. This study aims to evaluate: 1) The **efficacy** of **FLORANBIDIN®** in improving sleep quality in patients with chronic insomnia using sleep duration and efficiency as key indicators. 2) The **safety** profile of **FLORANBIDIN®**, including potential adverse effects. 3) The **impact** of **FLORANBIDIN®** on daytime sleepiness and overall quality of life in patients.

Results: The study results showed that the **FLORANBIDIN® group** demonstrated a **statistically significant reduction in ISI scores** compared to the placebo group ($p < 0.01$). **Total sleep time (TST)** increased by **17%** ($p < 0.05$), and **sleep efficiency (SE)** improved from **85% to 91%** ($p < 0.01$). Additionally, **sleep onset latency (SOL)** and **wake after sleep onset (WASO)** were significantly reduced in the **FLORANBIDIN® group** compared to the placebo group. No serious adverse events were reported among participants receiving **FLORANBIDIN®**.

Conclusions: **FLORANBIDIN®** demonstrated significant potential in **improving sleep quality in patients with chronic insomnia by increasing sleep duration, reducing sleep onset latency, and decreasing night-time awakenings** without altering sleep architecture.

Acknowledgments:

The authors would like to express their sincere gratitude to all study participants for their valuable time and commitment to this clinical trial. Special thanks are extended to the research team, clinical staff, and coordinators at the participating hospitals and sleep research centers for their dedicated support in patient care, data collection, and study monitoring.

We are particularly grateful to the technical staff involved in the operation and analysis of sleep data using Belun Ring and Polysomnography (PSG) equipment. Appreciation is also given to the laboratory teams for conducting the biochemical and safety assessments throughout the trial period.

This study was supported by **CHAKRA Group Co., Ltd.**, who provided the investigational product (**FLORANBIDIN®**) and technical assistance related to product formulation and quality assurance.

Finally, the authors acknowledge the contribution of our scientific advisors and ethical review boards whose guidance and oversight ensured that the study was conducted in compliance with Good Clinical Practice (GCP) and relevant ethical standards.

Co-morbid Insomnia and Obstructive Sleep Apnea Augments Cardiac Autonomic Burden to Increase All-cause Mortality

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Introduction: Co-morbid insomnia and sleep apnea (COMISA) is associated with increased mortality. It remains unclear whether COMISA has cumulative deleterious impact on autonomic regulation to augment risk of deaths compared to insomnia alone and OSA alone. This study aimed to evaluate an association of heart rate variability (HRV) as a marker of autonomic burden to all-cause mortality in patients with COMISA.

Materials and methods: 5225 participants from the Sleep Heart Health Study were included. The participants underwent unattended polysomnography and completed sleep questionnaires on insomnia and daytime impairment from which the diagnosis of COMISA was determined. The diagnosis of COMISA required the criteria for both insomnia (difficulties initiating sleep, maintaining sleep, and/or early morning awakenings on 16-30 times/month and daytime impairment) and sleep apnea (an apnea-hypopnea index [AHI] ≥ 15 events/h) to be met. HRV measures were computed from a 5-min ECG segment extracted during wakefulness prior to sleep and sleep using time-domain and frequency-domain methods, detrended fluctuation analysis, entropy, symbolic dynamics, deceleration capacity (DC) and acceleration capacity (AC). Analysis of covariance controlling for relevant covariates (age, body-mass index, gender, race, smoking status, AHI and prevalent cardiovascular disease) was used to compare differences in HRV characteristics among control, insomnia, OSA, and COMISA groups. Multivariable Cox analysis and ROC were used to estimate the association between HRV and in COMISA subgroup. Multivariable-adjusted Cox proportional hazards analysis were conducted to estimate the associations between HRV metrics and all-cause mortality in patients with COMISA.

Results: Of the 5255 participants, 2697 (51.6%) were controls without insomnia or OSA, 170 (3.3%) had only insomnia, 2221 (42.5%) had only OSA, and 137 (2.6%) had COMISA. 42 deaths occurred in COMISA (30.6%). By comparisons of HRV metrics among these 4 groups, patients with COMISA were associated with elevated autonomic burdens, showing decreased parasympathetic function during wakefulness and sleep compared to controls. In the Multivariable Cox model, DC during wakefulness and sleep were significantly associated with all-cause mortality in COMISA (hazard ratio [HR] per 1-SD, 0.91; 95%CI, 0.84-0.99; P=0.026 and HR, 0.86; 95%CI, 0.77- 0.96, P=0.007, respectively). DC demonstrated favorable performance in identifying mortality risk in COMISA during wakefulness (the area under the curve, AUC, 0.78) and sleep (AUC, 0.76).

Conclusions: COMISA proposed HRV impairments to be related to the increased risk of all-cause mortality through decreased parasympathetic function during wakefulness. HRV can provide information on underlying pathogenic mechanisms of alterations in the autonomic cardiac modulation associated with all-cause mortality in COMISA.

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Efficacy and Safety of Yokukansan in Patients with Initial-Onset Insomnia: A Multicenter Prospective Observational Study

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Introduction: In recent years, there has been a shift toward melatonin receptor agonists and orexin receptor antagonists in the development of hypnotic drugs. This transition has been driven by concerns about adverse effects associated with GABA_A receptor agonists, such as residual sedation, cognitive dysfunction, and dependence. In the treatment of insomnia, non-pharmacological approaches, including sleep hygiene education and cognitive

behavioral therapy for insomnia are also emphasized as important.

Yokukansan (YKS) is a Kampo medicine (a Japanese traditional herbal remedy) that has been approved by the Japanese Ministry of Health, Labour and Welfare for the treatment of insomnia.

We conducted a prospective clinical study to evaluate the efficacy and safety of YKS in drug-naïve patients newly diagnosed with insomnia. This study was approved by the Kurume University Ethics Committee (No. 22237).

Materials and methods: The aim of this study was to investigate the efficacy and safety of YKS in patients presenting with insomnia, following the administration of sleep hygiene education.

This is a multicenter, prospective, single-arm, open-label study. Patients who presented to participating facilities with insomnia between May 1, 2023, and June 30, 2024, and provided informed consent were enrolled. Participants were instructed to watch an educational video on sleep hygiene and received YKS (TSUMURA & CO.) at doses ranging from 2.5 to 7.5 g/day for 4 weeks, with dosage adjustments permitted at the discretion of the attending physician.

The primary outcome was the change in score on the Japanese version of the Insomnia Severity Index (ISI-J).

Secondary outcomes included the Pittsburgh Sleep Quality Index (PSQI), the Japanese version of the Patient Health Questionnaire-9 (PHQ-9), Visual Analogue Scale (VAS) scores for daytime functional impairments (e.g., sleepiness, fatigue, tension), the Patient Global Impression of Improvement (PGI-I), and the proportion of patients who wished to continue YKS treatment at the end of the study. Statistical analyses were performed using the Wilcoxon signed-rank test. The study was funded by TSUMURA & CO.

Results: Of the 100 patients who consented to participate, 95 (mean age 42.7 ± 13.0 years; 58 females) were included in the final analysis. The primary outcome, ISI-J score, significantly decreased from baseline to week 4 (13.5 to 6.5; $p < 0.001$).

Significant improvements were also observed in secondary outcomes, including PSQI (8.7 to 8.1; $p = 0.033$), PHQ-9 (8.7 to 4.6; $p < 0.05$), and VAS scores for sleepiness, heaviness of the head, fatigue, lassitude, tension, sense of well-being, calmness, and dizziness. At the end of the study, 62.5% of patients expressed a desire to continue YKS treatment. No serious adverse events were reported during the observation period. Mild adverse events included dizziness (1%), drowsiness (1%), and urticaria (1%).

Conclusions: This study demonstrated that the combination of sleep hygiene education and YKS administration significantly improved insomnia severity to a level comparable with healthy individuals, without causing adverse events commonly associated with GABA_A receptor agonists.

Our findings suggest that the use of YKS in conjunction with video-based sleep hygiene instruction may serve as a safe and effective initial treatment option for insomnia.

Clinical subtypes of co-morbid insomnia and obstructive sleep apnea (COMISA): Results of a cluster analysis

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Introduction: Variations in the bidirectional relationship between obstructive sleep apnea (OSA) and insomnia in co-morbid insomnia and OSA (COMISA) may form distinct subtypes of COMISA, which have not been previously characterized. This study aims to identify and characterize subtypes of COMISA and assess their association with risks of physical (metabolic syndrome and high CVD risk) and mental (depression and anxiety) disorders.

Materials and methods: Participants were a community-recruited COMISA cohort with an initial sample size of 445 potential subjects that yielded 256 individuals who met diagnosis for COMISA and who were used to identify subtypes using a two-step clustering methodology. Demographics and multidimension clinical characteristics were collected and compared among obtained subtypes. Logistics models were used to evaluate whether these subtypes were associated with cardiometabolic and mental disorders. A clinical cohort of 1816 COMISA patients was used to validate the determined clusters applying the same two-step clustering methodology.

Results: Cluster analysis yielded three clusters (COMISA subtypes): “moderate OSA and moderate insomnia” (cluster 1), “moderate OSA and severe insomnia” (Cluster 2) and “severe OSA and moderate insomnia” (Cluster 3), consisting of 58.2%, 21.9% and 19.9% of the entire cohort, which was validated using the clinical COMISA

cohort. The clusters differed significantly on a variety of clinical measurements, including blood indicators related to cardiometabolic risk, inflammation and liver function, depression symptoms, and encephalogram (EEG) spectral power. Cluster 2 was associated with elevated risk of moderate-to-severe depression symptoms, while Cluster 3 was associated with increased risk of CVD and metabolic syndrome.

Conclusions: COMISA patients were found to form three clusters or subtypes. These subtypes were differentially associated with increased risk of cardiometabolic illnesses and depression. These findings provide important preliminary evidence of the existence of phenotypes of COMISA which are likely to have clinical relevance and provide a foundation in precision medicine for treatment of COMISA.

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Predicting Insomnia Symptoms Among Youth Using Multimodal Ecological Momentary Assessment

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Introduction: Insomnia is common among youth and often co-occurs with depression. Ecological momentary assessment (EMA), widely used for depression monitoring, may also offer a scalable, real-time method for identifying insomnia symptoms. This study explores the feasibility of using linguistic and acoustic features from a speech-based EMA to predict insomnia symptoms in youth.

Materials and methods: This is part of an ongoing study on depression detection using EMA, which recruited 328 Chinese youth aged 18-24 years from the community in Hong Kong. Structured Clinical Interview for DSM-5 (SCID-CV) was administered to assess lifetime diagnoses based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). Results indicated that 23% of participants met criteria for a history of depression, while 17% of anxiety disorder(s). Of these, 300 participants completed a 7-day EMA, which included twice-daily voice recordings via Telegram, with a minimum compliance rate of 70% required for inclusion in the analysis. Acoustic features were extracted using Praat and openSMILE while transcripts were analysed by using the Linguistic Inquiry and Word Count (LIWC) tool. Insomnia symptoms were assessed by the Structured Interview Guide for the Hamilton Depression Rating Scale with Atypical Depression Supplement, with scoring ≥ 1 classified as having insomnia symptoms. Machine learning models were developed using linguistic, acoustic, and combined feature sets.

Results: Among the 300 participants, 203 (mean age=20.66, SD=2.00, 74% female, 17% with lifetime history of depression) did not have insomnia symptoms while 97 (mean age=20.74, SD=2.09, 79% female, 38% with lifetime depression) had insomnia symptoms in the past week. No significant differences in age or gender were observed, but lifetime history of depression was significantly associated with having insomnia symptoms ($p<.01$). Logistic regression adjusting for sex, age, and lifetime depression diagnosis revealed significant associations between insomnia symptoms and both linguistic and acoustic features. Increased use of impersonal pronouns (OR=1.83, 95% CI 1.22-2.75, $p<.01$), and sad-related words (OR=1.72, 95% CI: 1.13-2.61, $p=.01$) were significantly associated with having insomnia symptoms. Shorter and more uniform speech pauses are associated with a higher likelihood of having insomnia symptoms (mean pause duration: OR=0.19, 95% CI: 0.05-0.76, $p=.02$; mean pause variability OR=0.09, 95% CI: 0.01-0.69, $p=.02$). Among eight common machine learning algorithms tested, random forest using LIWC features performed the best (AUC=0.61, FI=0.61).

Conclusions: This study demonstrates that linguistic and acoustic features captured through an EMA can reveal potential markers of insomnia symptoms in youth. Linguistic features such as impersonal pronouns and sad-related words, along with acoustic markers like shorter and less varied speech pauses, were significantly associated with having insomnia symptoms. These findings suggest that subtle changes in language and speech patterns may reflect underlying sleep disturbances, potentially linked to emotional dysregulation, cognitive dysfunction and fatigue. Extracting insomnia-related signals from non-sleep-targeted voice data highlights the potential of EMA for broader

symptom detection. Future studies should incorporate sleep-specific EMA items, longitudinal follow-ups, and subgroup analyses to enhance prediction.

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Association of Personality Profiles with Sleep Disturbance, Depression and Anxiety in Individuals with Insomnia Disorder: A Latent Class Analysis

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Introduction: Insomnia disorder is highly comorbid with psychiatric disorders, such as anxiety and depression. Certain personality trait profiles have been identified as transdiagnostic risk factors for co-occurrence and increased severity of psychiatric disorders. However, empirical research exploring personality profiles in individuals with insomnia and their relationship with insomnia severity and mood symptoms remains limited. The present study aims to understand the relationship between personality profiles and depression, anxiety, insomnia severity, and well-being in individuals with insomnia disorder.

Materials and methods: 218 Chinese participants who underwent Diagnostic Interview for Sleep Patterns and Disorders (DISP) and the Structured Clinical Interview for DSM Disorders (SCID) to screen for sleep and psychiatric disorders, respectively were recruited from the community study in Hong Kong and. All Participants (Mean age=46 yrs $\pm$ 14.93; female: 76.6%; Presence of comorbid psychiatric disorder: 35.3%) has completed questionnaires including the Big Five Inventory (BFI) for personality traits, symptoms of anxiety, depression, and insomnia, well-being measurement including quality of life, and other insomnia-related measures such as excessive daytime sleepiness, sleep reactivity, sleep hygiene, and rumination. The subjects also completed 7-day sleep diary recording of their sleep-wake patterns, including total sleep duration (TST), sleeptime (ST), wake after sleep onset (WASO), sleep onset latency (SOL), and waketime (WT). Latent class analysis (LCA) was used to identify personality subgroups controlling for age, sex, and psychiatric history. ANOVA was further conducted to investigate the between-subject differences of sleep and mood-related outcomes in personality subgroups.

Results: LCA identified three subgroups characterized as vulnerable, typical, and resilient profiles. The vulnerable group (9.2%) exhibited significantly higher neuroticism ($N: 4.07 \pm 0.338$) and lower conscientiousness ($C: 2.55 \pm 0.491$), agreeableness ($A: 3.01 \pm 0.532$), openness to experience ($O: 2.48 \pm 0.639$), and extraversion ($E: 1.95 \pm 0.516$), while the resilient group (23.4%) showed the opposite pattern ($N: 2.49 \pm 0.488$; $C: 3.97 \pm 0.348$; $A: 3.94 \pm 0.399$; $O: 3.50 \pm 0.661$; $E: 3.05 \pm 0.561$). The typical group (67.4%) scored nearly average on all traits ($N: 3.30 \pm 0.469$; $C: 3.30 \pm 0.525$; $A: 3.35 \pm 0.399$; $O: 3.11 \pm 0.524$; $E: 2.63 \pm 0.498$). The vulnerable group demonstrated significantly higher insomnia severity ($F[2,215]=9.08$, $p<0.001$), more depressive ($F[2,215]=16.9$, $p<0.001$) and anxiety symptoms ($F[2,215]=24.9$, $p<0.001$), lower quality of life ($F[2,215]=19.3$, $p<0.001$), compared to typical group, then followed by resilient group. Vulnerable group also reported significantly higher mental fatigue ($F[2,215]=3.15$, $p=0.045$), greater daytime sleepiness ($F[2,215]=3.35$, $p=0.037$), and sleep reactivity to stress ($F[2,215]=5.16$, $p=0.006$) compared to Resilient group only. Resilient group has significantly less rumination ($F[2,215]=12.2$, $p<0.001$) and better sleep hygiene ($F[2,215]=3.61$, $p=0.029$) compared to the other groups while typical and vulnerable group had no significant difference. No significant difference were found in all variables related to sleep-wake patterns among three groups.

Conclusions: High Neuroticism along with low extraversion, agreeableness, conscientiousness, and openness to experience are associated with increased risk of sleep and mood disturbance among individuals with insomnia disorders, suggesting the existence of subgroups within the insomnia population. These findings indicate the need for further phenotyping subgroups of insomnia in order to develop personalized treatment for insomnia.

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Sleep Architecture and REM Sleep Without Atonia in Post-COVID-19 Insomnia

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Introduction: Insomnia associated with COVID-19 infection is a common complaint in long-COVID. Studies to date have predominantly examined post-COVID-19 sleep disturbances with questionnaires. We aimed to investigate whether there are distinctive polysomnographic findings in post-COVID-19 insomnia compared to non-COVID-related chronic insomnia.

Materials and methods: We included 150 patients with chronic insomnia, stratified into three groups: post-COVID-19 insomnia, chronic insomnia during the pandemic without a history of COVID-19 infection, and pre-pandemic chronic insomnia. All patients underwent one-night video polysomnography (v-PSG). The sleep architecture, respiratory variables and REM sleep without atonia (RWA) were compared across the groups.

Results: Classical polysomnographic variables showed no significant differences across groups with regard to total sleep time, sleep efficiency, sleep stage percentages, and the apnea-hypopnea index. Post-COVID-19 insomnia patients had significantly increased RWA at both the chin and the flexor digitorum superficialis (FDS) ($p=0.020$ for both), and higher nocturnal heart rates ($p=0.046$). Sleep-bout analysis indicated shorter sustained N3-sleep periods ($p=0.001$) and longer onset to stable REM-sleep ($p=0.016$) in the post-COVID-19 insomnia group. Although sleep transitions did not withstand multiple comparison corrections, they revealed a trend towards decreased N3-sleep continuity and increased probabilities of transitioning to lighter stages (N3→N3: unadjusted- $p=0.012$; REM→N1: unadjusted- $p=0.027$) in the post-COVID-19 insomnia.

Conclusions: Classical PSG profile of post-COVID-19 insomnia does not differ from non-COVID-related chronic insomnia. However, subtle differences in RWA and sleep integrity suggest that post-COVID-19 insomnia is driven not merely by pandemic-related stress factors but by additional physiological alterations linked to viral CNS involvement.

Research Progress on the Role of Ferroptosis in Insomnia with Depression

王¹

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Introduction: Insomnia is a prevalent sleep disorder that not only impairs daily functioning but also significantly increases the risk of developing depression. Depression is a common chronic mental illness. Insomnia and depression often coexist as comorbidities. The commonly used antidepressant drugs have slow onset and are prone to relapse, so exploring new antidepressant targets and methods is a necessary process to address the current status of depression treatment. Iron death is a novel form of cell death discovered in recent years, and numerous studies have shown that iron death plays an important role in neurological and psychiatric disorders. Recent studies have also shown that ferroptosis may play an important role in the pathogenesis and treatment of insomnia with depression. This review analyzes and summarizes the role of ferroptosis in the pathogenesis and treatment of insomnia with depression, aiming to provide new ideas and possible targets for the treatment of insomnia with depression.

Materials and methods: This is a review article. The materials mainly come from numerous existing research studies on ferroptosis, insomnia, and depression. The methods involve a comprehensive analysis and summary of relevant literature to explore the role of ferroptosis in insomnia with depression.

Results: Inhibiting tsRNA - 3029b reduces neuronal ferroptosis in CUMS - model mice, improving depressive - like behaviors, indicating epigenetics' role in depression. Ferroptosis is involved in the antidepressant effects of

resveratrol, melatonin, and ECT with etomidate. Resveratrol and melatonin improve depression by inhibiting ferroptosis, and etomidate may enhance ECT's effect by protecting neurons from ferroptosis.

Conclusions: Ferroptosis plays an important role in many neurological and psychiatric disorders, including schizophrenia, insomnia, Alzheimer's disease, Parkinson's disease, autism, epilepsy, and cerebral infarction. The impact of ferroptosis on neural plasticity and inflammation is crucial in the pathogenesis and treatment of insomnia with depression. Ferroptosis-related genes and pathways may serve as new therapeutic targets for depression.

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Effectiveness of Stepped-Care Chinese Herbal Medicine and Psychotherapy on Improving Sleep in Adults with Insomnia: A Stepped-Wedge Cluster Randomized Trial

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Introduction: Insomnia is one of the most common sleep disorders in adults, with global prevalence rates ranging between 2.3% and 25.5%. Cognitive behavioral therapy for insomnia (CBT-I) and pharmacotherapy are recognized as common treatments for managing insomnia. However, access to CBT-I is often limited, while low acceptance rate of pharmacotherapy is also a well-known limitation. Therefore, it is imperative to identify alternative treatments that are accessible, effective and acceptable.

Traditional Chinese medicine (TCM), including Chinese herbal medicine (CHM), has been proved to be effective for treating insomnia and is particularly popular in Eastern Asia. In Hong Kong (HK), 34.5% of insomnia patients choose TCM, making it the leading treatment option and reflecting strong cultural acceptance. However, most previous Chinese medicine studies on insomnia were well-controlled randomized trials, and real-world evaluations are lacking. This study aims to examine the effectiveness of stepped-care CHM and psychotherapy intervention in treating insomnia in adults in four clinical centers.

Materials and methods: (1) Study design

This stepped-wedge, cluster randomized trial recruited 366 adults with insomnia in HK between April and November 2024. The 18 geographic districts in HK are grouped into 4 clusters of 4 to 6 districts each, with randomization conducted at cluster level. The intervention was implemented sequentially in one cluster at a time based on a pre-generated random number, while the other clusters remained unexposed. After four steps, all clusters received the intervention. The study was approved by HK Baptist University Research Ethics Committee and prospectively registered with the Chinese Clinical Trial Registry (ChiCTR2400083685).

(2) Population

Adults with an insomnia severity index (ISI) score ≥ 14 .

(3) Stepped-care intervention

The intervention consists of two levels. In level 1, the CHM treatment was based on TCM syndrome differentiation, classifying participants into three subtypes: excess syndrome, treated with Jia Wei Xiao Yao powder; deficiency syndrome, treated with Gui Pi decoction; and excess-deficiency complex syndrome, addressed with Huang Lian E Jiao decoction and Jiao Tai bolus. This level lasted 6 weeks, with participants taking a 5-gram herbal formula twice daily. Those without sleep improvement (ISI score ≥ 14 after level 1 treatment) progressed to level 2, which involved an 8-week personalized CHM intervention and 8-session psychotherapy.

(4) Outcome

Outcome assessments were conducted at baseline and post-intervention. The primary outcome was ISI. The acceptance rate was operationalized as adherence rate by counting unconsumed sachets. Participants' self-management skills for handling insomnia and awareness of sleep health were also measured.

Results: All participants (age [SD]: 45.50 [13.08]; female: 282 [77.05%]) received the level 1 treatment, among whom, 49 (age [SD]: 47.61 [12.83]; female: 34 [69.39%]) progressed to the level 2 treatment. Only level 1 treatment significantly reduced insomnia severity (mean difference [95% CI]: -3.38 [-4.03 to -2.73]; $p < 0.0001$; level 2: -0.90 [-2.49 to 0.69]; $p = 0.26$). The adherence rate was high, at 84.8%. 98.4% of participants reported improved self-management skills for handling insomnia, while 97.3% expressed increased awareness of their sleep health.

Conclusions: The stepped-care CHM and psychotherapy is effective and acceptable in treating insomnia, empowering participants in self-managing insomnia and increasing awareness of sleep health.

Aberrant Effective Connectivity Within and Between the Default Mode Network, Executive Control Network and Salience Network in Chronic Insomnia Disorder – towards identifying the hyperarousal state

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Introduction: The hyperarousal hypothesis is a key conceptual model for the pathogenesis of chronic insomnia disorder (CID). The model is based on the observed persistent state of physiological, cognitive, and emotional hyperactivation in CID patients, but its neurofunctional mechanisms are not fully understood.

Resting state functional MRI studies in CID patients have demonstrated altered functional connectivity (FC) in the default mode network (DMN), executive control network (ECN) and salience network (SN), which are involved in self-referential processing, internal mentation, emotional plasticity, and goal-directed attention.

While FC offers insights into co-activation patterns among brain regions, it does not provide directionality or causality of these interactions. In contrast, effective connectivity (EC) describes the influence of one brain region over another, incorporating temporal and causal effects of the regions in a neural circuit.

We hypothesized that effective connectivity between key nodes of the DMN, ECN and SN is disrupted in individuals with CID, impairing the SN's ability to modulate and “switch” between DMN and ECN, as the neurofunctional substrate of the hyperarousal state in CID.

Materials and methods: We recruited 31 CID patients, compliant with the ICSD-II/TR criteria, and 24 age-, sex-, and education-matched healthy controls (HC). All participants filled out Insomnia severity index (ISI), Beck depression inventory (BDI) and Epworth sleepiness scale (ESS) and were scanned on a 3T MRI system, obtaining structural and functional data. SPM 12 (Statistical Parametric Mapping) was used to analyse the results. Spectral dynamic causal modelling (spDCM) was applied to the chosen regions of interest (ROIs) within and between the DMN, SN and ECN. One-sample test was used to define the connections significantly different from zero within each group, and two-sample test was performed to determine the connections significantly different between both groups. Two-stage false discovery rate correction was applied.

Results: There were three significant connections, present only in the CID group – suppressive from the dorsolateral prefrontal cortex (DLPFC) to the right hippocampus (HippR) (-0.110 ± 0.258 , $p = 0.035$), excitatory from the dorsomedial prefrontal cortex (DMPFC) to the ventromedial prefrontal cortex (VMPFC) (0.206 ± 0.342 , $p = 0.018$), and excitatory from the common medial prefrontal cortex (MPFC) to the right anterior insula (AIR) (0.067 ± 0.172 , $p = 0.019$). The analysis in the control group revealed two significant excitatory connections – from the posterior cingulate cortex (PCC) to AIR (0.148 ± 0.242 , $p = 0.001$), and from precuneus to PCC (0.441 ± 0.388 , $p = 0.033$), which are absent in the patients' group. In addition, CID patients scored higher on the ISI (18 ± 4.00 vs 4 ± 2.85 , $p < 0.001$) and BDI (13 ± 7.57 vs 5 ± 4.72 , $p < 0.001$) questionnaires compared to HC. Significant negative correlations between DLPFC to HippR connectivity and both ISI ($\rho = -0.507$, $p < 0.001$) and BDI ($\rho = -0.272$, $p < 0.05$) scores were identified.

Conclusions: Our results indicate that effective connectivity among the DMN, ECN and SN is altered in individuals with CID. Disruptions within the DMN and between the DMN, SN and ECN reflect an impaired ability to appropriately shift between internally and externally directed cognitive states—an imbalance potentially underlying the hypervigilant state of CID.

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Mechanistic Insights into Cognitive Behavioral Therapy for Adolescents with Comorbid Insomnia and Anxiety: Mediation Analysis in a Randomized Controlled Trial

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Introduction: Insomnia and anxiety are highly prevalent and frequently co-occurring in adolescents. Their comorbidity can exacerbate each condition and lead to significant psychosocial and functional impairments. Cognitive behavioral therapy for insomnia (CBT-I) and cognitive behavioral therapy for anxiety (CBT-A) have demonstrated efficacy in reducing insomnia and anxiety symptoms, respectively. However, the mechanisms underlying their effects on comorbid anxiety symptoms and insomnia disorder remain unclear. This study aimed to explore whether improvement in insomnia / anxiety would mediate anxiety / insomnia reduction.

Materials and methods: This was a secondary analysis of a three-arm randomized controlled trial conducted in adolescents with comorbid insomnia and anxiety. Participants were aged 12-20 years had DSM-5 insomnia disorder with a score of ≥ 9 on the Insomnia Severity Index (ISI) and presented with increased anxiety symptoms (Spence Children's Anxiety Scale (SCAS) scores of > 37 for females and > 32 for males). A total of 135 participants (mean age: 18.31 ± 1.61 years; 76% female) were recruited randomly assigned to one of three groups: eight weekly sessions of group-based CBT-I ($n=47$), eight weekly sessions of group-based CBT-A ($n=45$), or a waitlist control group (WL, $n=43$). All participants were assessed at baseline and post-treatment for their insomnia severity (via ISI) and anxiety symptoms (via the Hospital Anxiety and Depression Scale—Anxiety subscale, HADS-A).

Results: There was a significant group $\times$ time interaction effect on insomnia severity ($F(2, 119.84) = 10.95, p < 0.001$) and anxiety symptom severity ($F(2, 108.93) = 3.59, p = 0.031$). Compared to the WL, both CBT-I and CBT-A led to significant reductions in insomnia (CBT-I: $d = -2.06$; CBT-A: $d = -1.14$; WL: $d = -0.55$) and anxiety symptoms (CBT-I: $d = -0.86$; CBT-A: $d = -0.33$; WL: $d = -0.3$). Mediation analysis showed that, within the CBT-I group, improvements in anxiety was fully mediated by reductions in insomnia severity, with an indirect effect of -1.9 ($SE = 0.8, 95\% CI: -3.6$ to -0.36). However, reductions in anxiety did not significantly mediate improvements in insomnia within the CBT-I group. No significant mediating effects were found for either improving insomnia through changing anxiety or reducing anxiety through improving insomnia within the CBT-A group.

Conclusions: The findings suggest that improvements in insomnia symptoms following CBT-I may mediate the improvement of anxiety in adolescents with comorbid insomnia and anxiety. This underscores the transdiagnostic implications of targeting insomnia to alleviate anxiety symptoms in young people. Future research should investigate the underlying neurobiological and behavioral mechanisms and explore sequencing CBT-I and CBT-A protocols to optimize treatment effects.

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A Small-World Network Study on Acupuncture Treatment for Chronic Insomnia

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Introduction: Insomnia is the dissatisfaction with sleep duration and quality despite adequate opportunities and environment, affecting daytime functionality. Global insomnia rates are rising, with prevalence up to 12%-20%. Chronic insomnia increases risks for cardiovascular disease, cognitive and emotional disorders, metabolic issues, and even cancer. Addressing insomnia has become vital. Functional Magnetic Resonance Imaging (fMRI) is a key non-invasive method to study the brain's response to acupuncture, a current research focus. This project combines Acupuncture and fMRI to investigate acupuncture's effects on brain networks in chronic insomnia, using the Small-World Network method to explore specific acupuncture points' impact.

Materials and methods: Totally 30 insomnia subjects were randomly divided into the treatment group and the control group. (1:1). 15 healthy subjects were recruited to match insomnia patients with age, gender and education level. After enrollment, T1 images and Bold were taken from all subjects using 3.0T magnetic resonance (SIEMENS MAGNETOM Verio Syngo MR B17, Germany) and a 32-channel cranial coil. Based on MATLAB2013b (Mathworks, Natick, MA, USA), through SPM12 software for data pre-processing, the large-scale brain functional network was constructed by GRETNA software, and the images were presented by Brain Net Viewer software. The differences of global attributes and node attributes of the brain network between the two groups were compared, the three sets of square difference analysis, the statistical differences of network measures between the groups were compared, and the paired T-test was used to analyze the changes of network measures.

Results: Compared with healthy controls, the small-world attribute of insomnia patients is weakened. Acupuncture treatment in both the treatment group and the control group could enhance the small-world attribute, clustering coefficient, shortest path and network efficiency of insomnia patients. Compared with before treatment, the difference was statistically significant ($P < 0.05$). Acupuncture treatment in treatment group and control group can significantly improve PSQI, ISI and brain network efficiency has a negative correlation. Compared with the control group, the difference was statistically significant ($P < 0.05$). In the two groups, the efficiency of acupuncture intervention in insomnia network was enhanced: dorsolateral superior frontal gyrus L, orbital middle frontal gyrus R, anterior cingulate and paracentric gyrus L, cuneus lobe L, paracentral lobule L; Hippocampus L and amygdala L were significantly enhanced in treatment group. Treatment group may play a role in treating insomnia and improving the state of liver fire and heart disturbance through brain regions such as hippocampus, amygdala and anterior cingulate gyrus, which are the important brain regions for the treatment of insomnia.

Conclusions: Acupuncture treatment can enhance the small-world attribute of insomnia patients. Acupuncture treatment in treatment group can significantly change the negative correlation between PSQI, ISI and brain network efficiency in insomnia patients. Brain regions such as the hippocampus, amygdala, and anterior cingulate gyrus may be important target regions for acupuncture treatment of insomnia. This research contributes to a deeper understanding of the pathophysiological mechanisms of insomnia, reveals the association between insomnia symptoms and the structure and function of brain networks, and provides clues for formulating personalized acupuncture treatment plans for insomnia patients.

Safety and Efficacy of Lemborexant in Indian Adult Patients with Insomnia: A Phase 4, Prospective, Multicenter, Real-World Study

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Introduction: Insomnia is characterized by difficulties with onset, and/or maintenance of sleep, and early morning awakening, causing impairment of daily activities. Lemborexant (LEM), a dual orexin receptor antagonist, is approved in several countries, including the US and India, for the treatment of adult patients with insomnia. This post-marketing surveillance study evaluated the safety, tolerability, and efficacy of LEM in Indian patients.

Materials and methods: Adults aged between 18-65 years with a clinical diagnosis of insomnia were enrolled in the study and treated with LEM 5 or 10 mg as per the investigator's discretion. The study consisted of a screening period and a 6-month treatment period. The primary endpoint included assessment of safety in terms of the incidence of treatment-emergent adverse events (TEAEs) and discontinuations due to TEAEs. Efficacy was assessed using the Patient Global Impression – Insomnia (PGI-I) questionnaire. The data were summarized descriptively using SAS® Enterprise Guide® 7.1.

Results: In total, 110 patients were enrolled in this study. The mean ($\pm$ SD) age of patients was 45.27 ± 11.04 years, and most patients (56.3%) were males. The patients were treated with a dose of LEM 5 mg ($n=106$) or LEM 10 mg ($n=4$), and 103 patients received ≥ 1 dose of study drug. Overall, 39 (37.86%) patients experienced ≥ 1 TEAE, including 38 patients in the LEM 5 mg cohort and 1 patient in the LEM 10 mg cohort without any serious TEAEs. Among these, 13 (12.62%) patients reported TEAEs related to the study drug, including 12 patients in the LEM 5 mg and 1 patient in the LEM 10 mg cohort. The most frequently occurring TEAEs were headache (9 [8.74%]), somnolence (8 [7.77%]), pyrexia (6 [5.83%]), dizziness (5 [4.85%]), head discomfort, and cough (4 [3.88%], for each). Most TEAEs were of mild (27 [26.21%]) intensity, followed by moderate (10 [9.71%]) intensity, and only 2 (1.94%) patients reported severe TEAEs. A dose-dependent increase in the percentage of patients was observed, reporting "positive medication effect" at the end of 1 month (56.31%, 58/103 patients; LEM 5 mg group: 55/99 patients and LEM 10 mg group: 3/4 patients), 3 months (68.93%, 71/103 patients; LEM 5 mg group: 67/99 patients and LEM 10 mg group: 4/4 patients) and 6 months (72.82%, 75/103 patients; LEM 5 mg group: 71/99 patients and LEM 10 mg group: 3/4 patients) of treatment. A similar trend was observed for patients who reported that the study medication decreased time to fall asleep at the end of 1 month (59.22%, 61/103), 3 months (73.79%, 76/103), and 6 months (77.67%, 80/103) of the treatment. LEM increased total sleep time in 66.02% (68/103), 72.82% (75/103), and 79.1% (82/103) of patients at the end of 1 month, 3 months, and 6 months of treatment, respectively. Around 84.5% of patients mentioned that the strength of LEM prescribed was appropriate.

Conclusions: The current study provides real-world safety, tolerability, and efficacy data, showing that LEM treatment effectively addresses both sleep onset and sleep maintenance difficulties.

Cognitive Impairment in Obesity Individuals With and Without Insomnia: The Role of Cortisol Dysregulation

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Introduction: This study aimed to investigate the impact of insomnia on cognitive impairment in individuals with obesity, compare cognitive performance between obese patients with and without insomnia, and explore the potential role of cortisol levels in this association.

Materials and methods: A total of 50 obese participants (BMI ≥ 30 kg/m², aged 18–65 years) were recruited and divided into an insomnia group ($n=24$) and a non-insomnia group ($n=26$), with 30 healthy-weight controls (BMI 18.5–24.9 kg/m², no insomnia) included for comparison. Cognitive function was assessed using the MATRICS Consensus Cognitive Battery (MCCB), information processing speed, attention/alert working memory, verbal learning, visual learning, reasoning/problem-solving, social cognition, and total cognition. Plasma cortisol levels were measured at 8:00 AM. Group differences were analyzed using analysis of covariance (ANCOVA) adjusted for education level, and correlation analyses were performed to evaluate associations between cortisol levels, cognitive performance, and clinical variables.

Results: The obesity-with-insomnia group exhibited significantly lower performance in processing speed ($p=0.021$), verbal learning ($p=0.009$), and composite cognitive scores ($p=0.004$) compared to the non-insomnia group, with both obese groups performing worse than healthy controls (all $p<0.01$). Plasma cortisol levels were significantly elevated in the insomnia group ($p<0.001$), while no difference was observed between the non-insomnia and control groups. Correlation analyses revealed positive associations between insomnia severity and cortisol levels ($r=0.308$, $p=0.006$), as well as between cortisol levels and BMI ($r=0.400$, $p<0.001$).

Conclusions: Insomnia may exacerbate cognitive impairment in individuals with obesity, potentially linked to dysregulated cortisol activity. These findings highlight the importance of addressing sleep disorders in obesity management to mitigate cognitive decline.

The Impact of Caregiving on Insomnia: Gender Differences, Long-Term Health Risks, Child Sleep Patterns, and Scalable Digital Interventions

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Introduction: Parents of young children often experience disrupted sleep due to nighttime awakenings, stress, and irregular schedules. These disturbances increase the risk of chronic insomnia and long-term health issues. Additionally, caregiver sleep behaviors significantly influence child sleep patterns, perpetuating an intergenerational cycle of sleep disruption.

While Cognitive Behavioral Therapy for Insomnia (CBT-I) is effective, caregivers face adherence challenges due to time constraints and competing demands. This study examines caregiver sleep behaviors, gender differences, long-term risks, and child sleep patterns while exploring scalable digital interventions to enhance treatment accessibility.

Materials and methods: A subset (20%) of 8,539 study participants were caregivers of young children. Their sleep patterns, behaviors, engagement with a digital CBT-I based program called Sleep Reset, and adherence were compared to non-caregivers (80%). Key variables included:

- **Sleep disruptions:** Nighttime awakenings, WASO, sleep efficiency, total sleep time.
- **Gender differences:** Variations in sleep disturbances, stress levels, and program adherence.
- **Behavioral factors:** Irregular schedules, caffeine/alcohol use, bedtime routines, wind-down activities.
- **Environmental influences:** Co-sleeping, bedroom noise, temperature, nighttime light exposure.
- **Psychological stressors:** Self-reported stress, racing thoughts, caregiving-related anxiety.
- **Health implications:** Fatigue, mood disturbances, weight changes, chronic stress.
- **Child sleep impact:** Consistency, nighttime awakenings, caregiver-reported disturbances.
- **Adherence analysis:** Sleep coaching engagement, confidence, dropout reasons.

Results:

- Caregivers had significantly higher sleep fragmentation than non-caregivers, with 70% waking at least once per night vs. 40% of non-caregivers.
- Gender disparities were notable. Female caregivers had longer WASO (45 min vs. 30 min for males), more stress-related awakenings, and lower adherence to structured sleep routines.
- Psychological stress was a major driver of sleep issues—78% of caregivers reported high stress and racing thoughts, leading to longer sleep latency and reduced sleep efficiency.
- Adherence to digital CBT-I based program was lower in caregivers (38% of females, 45% of males) compared to 60% of non-caregivers.
- Health risks included higher rates of fatigue (85%), mood disturbances (62%), and weight gain (45%).

Conclusions: Caregivers face persistent sleep challenges, with significant gender disparities and long-term health risks. Future digital insomnia interventions should be designed to meet caregivers' unique needs by integrating time-efficient, modular CBT-I based programs that fit into their demanding schedules.

The Effect of Body Grounding on Sleep Quality of Cancer Inpatients, and the Relations between Body Voltage, Bedroom EMF and Sleep Quality: a Blinded Randomized Controlled Study

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Introduction: The prevalence of sleep difficulties or insomnia is high in cancer patients. Compared with healthy people, it is common for cancer patients to have a long sleep onset, short sleep duration, and poor sleep efficiency. Many studies have found that the higher the body voltage, the lower the vagal tone, suggesting that the high and low body voltage values have physiological significance and clinical importance, and grounding is an intervention that has been proven to reduce body voltage.

Materials and methods: We implemented body grounding therapy during the sleep period of cancer patients in two different environments: hospitalization (two nights) and after discharge (more than one week) through a randomized, controlled group experimental design. The Pittsburgh Sleep Quality Inventory (PSQI), Hospital Anxiety and Depression Scale (HADS), Stress and Somatic Symptom Scale (DSSS), Sleep Assessment Questionnaire (SEQ), and Sleepiness Scale (KSS) were used to evaluate the differences between the subjects before and after receiving the grounding therapy. In addition, the bed body voltage (BV) values before and during bed grounding in hospital and at home were obtained, and finally statistical analysis was performed using statistical methods such as paired sample T test.

Results: There were 14 people enrolled in the true grounding group (experimental group, Group 1) and 12 people enrolled in the sham grounding group (control group, Group 0) during their hospitalization. There were no significant differences between the two groups in age, gender, weight, height, BMI, age at onset, number of years of illness, and all pre-test assessment scale scores. Compared with Group 0, Group 1 had a significant decrease in PSQI scores ($p=0.03$ between groups), indicating that the degree of insomnia was significantly improved due to the intervention of the grounding patch, and similar significant differences were found under longer-term use after discharge and return home ($p=0.02$ within group 1). There was no significant difference in PSQI scores between the pre-test and the post-test in Group 0 ($p=0.22$). After using the grounding patch, there was a significant difference between the two groups ($p=0.000$ in hospital beds and $p=0.007$ in home beds). The body voltage drop rate of Group 1 was 99.3-98.8%, while that of Group 0 was only 3.6-7.1%.

Conclusions: *Conclusion: The improvement in PSQI confirm that the earthing patch did reduce insomnia severity in cancer patients, and similar effects are also seen under long-term use. The grounding patch produce a very noticeable and rapid drop in body voltage. The AC voltage present in the electric beds in hospital wards is one of the reasons for the high body voltage values and should be managed.*

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The link between improvement in sleep and depressed mood: Exploring the role of repetitive negative thinking and behavioural activation

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Introduction: There is extensive evidence supporting a link between poor sleep and worse depression outcomes. Moreover, improvement in sleep disturbance contributes to enhanced depression outcomes. However, processes underlying this sleep—depression link are unclear. The current study examined whether changes in potential underlying processes, namely repetitive negative thinking (RNT) and behavioural activation (BA) can explain the relationship between improvement in reported sleep disturbance (reduction in the number of days participants experience sleep difficulties) is related to improvement in depressed mood.

Materials and methods: Data were analysed from 127 participants (mean [SD] age 39.16 [14.81], 60.6% women) who attended a group CBT mood management program at a government mental health service. Pre and post-treatment changes in depressed mood were assessed using PROMIS-D, whilst the frequency of participants' sleep difficulties was assessed via CUDOS item 5 (sleep item).

Results: Our study found a significant association between improvement in sleep difficulties and improvement in depressed mood, however, this relationship was no longer significant (no direct association) when controlling for improvements in RNT, $ab = 0.56$, CI [0.21, 1.01], and BA, $ab = 1.08$, CI [0.41, 1.84]. Furthermore, 1 SD improvement in sleep was indirectly associated with a 1.83-point change in depressed mood (a 0.612-point improvement in depression via RNT, and a 1.22-point improvement in depression via BA).

Conclusions: The preliminary findings suggest that reduced RNT and enhanced BA may play an important role in explaining how improvement in sleep is related to improvement in depressed mood. Future research should investigate whether early improvements in sleep contributes to subsequent improvements in depressed mood via improvements in RNT and BA. To establish temporal ordering and assess causality, future studies should collect data across multiple time points and incorporate a more comprehensive measure of sleep.

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Study on the change of autonomic nerve function and insomnia disorder comorbid with diabetes mellitus

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Introduction: This study aimed to assess changes in autonomic nervous function in patients with insomnia disorder comorbid with diabetes mellitus, explore its underlying pathological mechanisms, and provide a basis for the clinical diagnosis and treatment of these patients.

Materials and methods: A total of 120 participants were enrolled in this study and assigned to four groups: a comorbid insomnia and diabetes mellitus group, an insomnia disorder group, a diabetes mellitus group, and a healthy control group, with 30 participants in each group. Autonomic nervous function was assessed using heart rate variability (HRV) and the SCOPA-AUT scale, while sleep status was evaluated using the Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI), Patient Health Questionnaire-9 (PHQ-9), Hospital Anxiety and Depression Scale (HADS), and sleep diaries. Additionally, postprandial blood glucose, glycated hemoglobin (HbA1c), and both fasting and postprandial islet function indicators were recorded. These metabolic parameters were subsequently included in the comprehensive analysis of intergroup differences in autonomic nervous function.

Results: The SCOPA-AUT scores for gastrointestinal, urinary, cardiovascular, and pupil regulation systems were significantly higher in the insomnia and diabetes comorbidity group compared to the insomnia disorder group, the diabetes group, and the normal control group ($P < 0.05$). However, no significant differences were found in the thermoregulatory and sexual functioning systems ($p > 0.05$). Analysis of HRV time-domain indices revealed that the mean heart rate (MeanHR) was significantly higher in the insomnia and diabetes comorbidity group compared to the insomnia group ($p < 0.05$). Analysis of HRV frequency-domain indices showed that the insomnia and diabetes comorbidity group had significantly increased low-frequency (LF) power and LF/HF ratio, along with decreased high-frequency (HF) power, compared to the other groups (all $p < 0.05$). Univariate linear regression analysis revealed that sex, duration of insomnia, fasting blood glucose, HbA1c, SCOPA-AUT score, and PSQI score were positively associated with sympathetic nervous activity, while gender and PSQI score were significantly associated with parasympathetic nervous activity.

Conclusions: Patients with comorbid insomnia and diabetes mellitus show significant autonomic dysfunction, marked by increased sympathetic activity and reduced parasympathetic activity. A possible synergistic interaction between sleep disturbances and diabetes-related metabolic abnormalities may contribute to the onset of autonomic dysregulation.

Transcranial Alternating Current Stimulation (tACS) for Chronic Primary Insomnia: A Systematic Review and Meta-Analysis of Randomized Controlled Trials on Efficacy

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Introduction:

Chronic primary insomnia is a pervasive sleep disorder with limited effective non-pharmacological treatments. Transcranial alternating current stimulation (tACS) has emerged as a potential neuromodulatory therapy, but its efficacy remains inconclusive due to variability in study designs and small sample sizes. This meta-analysis synthesizes evidence from randomized controlled trials (RCTs) to evaluate the effects of tACS on sleep quality and architecture in chronic primary insomnia.

Materials and methods:

A systematic search of PubMed, Cochrane Library, ScienceDirect, and Scopus was conducted through May 2025, following PRISMA guidelines. Included were randomized controlled trials (RCTs) involving tACS intervention in chronic primary insomnia patients compared to sham. Four RCTs (n=131 participants) were included. Pooled mean differences (MD) with 95% confidence intervals (CI) were calculated using a random-effects model due to high heterogeneity. Outcomes were synthesized for PSQI, sleep onset latency (SOL) in minutes, total sleep time (TST) in hours, and sleep efficiency (SE) in percentage. Risk of bias was assessed using the Cochrane RoB 2 tool.

Results: tACS demonstrated significant improvements across all measured sleep parameters in patients with chronic primary insomnia. PSQI scores improved markedly with tACS (MD = -4.02, 95% CI [-6.55, -1.30], $p = 0.008$), though substantial heterogeneity was observed ($I^2 = 95\%$). SOL decreased by an average of 28.55 minutes (MD = -28.55, 95% CI [-35.56, -21.53], $p < 0.00001$), with moderate heterogeneity ($I^2 = 81\%$). TST increased by 0.62 hours (MD = 0.62, 95% CI [0.39, 0.86], $p < 0.00001$), similarly accompanied by high heterogeneity ($I^2 = 81\%$). SE also showed improvement (MD = -0.93%, 95% CI [-1.45, -0.42], $p = 0.0004$), but results were highly variable across studies ($I^2 = 91\%$). All studies have low risk of bias.

Conclusions: tACS appears to be a promising intervention for improving sleep quality, latency, duration, and efficiency in chronic primary insomnia, despite significant heterogeneity among studies. tACS likely improves insomnia by modulating hyperactive thalamocortical circuits and enhancing slow-wave/alpha oscillations, promoting sleep initiation and maintenance. Unlike pharmacotherapy, it offers targeted neuromodulation without systemic side effects. While high heterogeneity exists due to variable protocols, consistent improvements in sleep latency, duration, and quality support its therapeutic potential. These findings support further large-scale, standardized RCTs to optimize tACS protocols and confirm clinical applicability.

Characteristics and Relationship of Cognitive and Physiological Hyperarousal in Patients with Insomnia: A Primary Study

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Introduction: To investigate the factors influencing arousal characteristics and hyperarousal in patients with insomnia, and to explore the relationship between physiological and cognitive hyperarousal. By supplementing the existing hyperarousal model, the research seeks to provide theoretical foundations for developing targeted clinical interventions

Materials and methods: This study enrolled 56 patients diagnosed with insomnia disorder at Beijing Anding Hospital outpatient clinic between May 2024 and March 2025. Of these, 40 patients were randomly assigned to either the experimental or control group using a randomized controlled allocation table, while 20 community-recruited healthy controls were included. Demographic data were collected through a self-designed general information questionnaire. All participants underwent baseline and 4-week assessments of heart rate variability (HRV), Pittsburgh Sleep Quality Index (PSQI), Dysfunctional Beliefs and Attitudes about Sleep Scale-Chinese Version (DBAS-CV), Pre-Sleep Arousal Scale (PSAS), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Morningness-Eveningness Questionnaire-5 (MEQ-5), and Anxiety Sensitivity Index-3 (ASI-3). The experimental group received weekly sleep hygiene education and mindfulness-based exercises over four weeks, with assessments conducted at baseline and weekly intervals (1st, 2nd, 3rd, and 4th week). HRV measurements were obtained pre- and post-mindfulness intervention. Statistical analyses were performed using SPSS 26.0. Continuous variables were reported as mean $\pm$ standard deviation, and categorical variables as frequency and

percentage composition. Linear mixed-effects models were applied to analyze the temporal relationship between mindfulness intervention and immediate HRV changes in patients, with statistical significance defined as $p < 0.05$.

Results: The baseline analysis revealed that patients with insomnia exhibited significant hyperarousal compared to the healthy control. Statistically significant differences ($p < 0.05$) were observed in the PSAS physiological dimension (16.30 ± 4.94 vs 11.25 ± 0.49), PSAS cognitive dimension (26.98 ± 6.80 vs 13.25 ± 4.51), and daytime HRV metrics (RMSSD: 33.41 ± 1.70 vs 52.75 ± 3.22 ; SDNN: 34.02 ± 1.78 vs 51.05 ± 3.80). Path analysis demonstrated that BAI directly drove physiological hyperarousal ($\beta = 0.398$, $p = 0.002$), while difficulty falling asleep (PSQI2), short sleep duration (PSQI3), and daytime dysfunction (PSQI7) indirectly exacerbated cognitive hyperarousal through maladaptive cognition. Dysfunctional beliefs about sleep (DBAS) emerged as a key moderating variable, significantly reducing cognitive arousal levels ($\beta = -0.242$, $p = 0.021$).

The intervention study demonstrated that after a 4-week mindfulness-based intervention, the experimental group showed a significant reduction in total PSQI scores (14.40 ± 2.80 vs 9.05 ± 3.55 , $p < 0.001$) and improvement in the cognitive arousal dimension (28.15 ± 7.03 to 20.20 ± 6.92 , $p = 0.001$), while the improvement in physiological arousal dimension did not reach statistical significance (17.45 ± 4.68 to 15.05 ± 7.04 , $p = 0.22$). Dynamic HRV monitoring revealed that even a single mindfulness session induced significant autonomic regulatory effects: a heart rate reduction of 3.86 bpm ($p < 0.0001$), SDNN elevation of 5.83 points ($p = 0.004$), and stress index (PSI) decrease of 9.58 points ($p = 0.032$). However, cumulative effects over the 4-week intervention period failed to attain statistical significance ($p > 0.05$).

Conclusions: (1) Insomnia patients exhibited 24-hour hyperarousal states across physiological, cognitive, and emotional domains; (2) Anxiety and dysfunctional beliefs about sleep emerged as primary determinants influencing somatic and cognitive hyperarousal; (3) A bidirectional interaction existed between somatic and cognitive hyperarousal, modulated by anxiety and dysfunctional sleep-related beliefs, while simultaneously demonstrating relative inter-dimensional dissociation between somatic and cognitive hyperarousal manifestations.

Comparative Effectiveness of Digital CBT and MBSR for Insomnia in Cancer Survivors: Results from a Meta-Analysis

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Introduction: Insomnia is a prevalent complaint among cancer patients, with a significant impact on various aspects of their lives throughout the cancer continuum. The present study conducted a meta-analysis to evaluate the effectiveness of digital interventions in alleviating insomnia symptoms by intervention type: CBT vs. MBSR.

Materials and methods: Following PRISMA guidelines, a comprehensive search of the published literature from January 2009 and July 2023 was conducted across 10 major databases, including PubMed, EMBASE, Cochrane, Web of Science, PsycINFO, CINAHL, KoreaMed, MedRIC, KISS, and RISS. Eligible studies included adults (≥ 18 years) with cancer or cancer survivors who received digital psychological interventions and reported quantitative sleep-related outcomes before and after the intervention. Key outcomes included insomnia severity (ISI), overall sleep quality (PSQI), sleep onset latency (SOL), total sleep time (TST), and wake after sleep onset (WASO). Meta-analyses were conducted using a random-effects model, and effect sizes were reported as Hedges' g .

Results: A total of 17 studies were included in the meta-analysis. digital CBT demonstrated significant improvements across multiple outcomes: ISI (Hedges' $g = -2.09$, 95% CI $[-3.63, -0.56]$), sleep disturbance ($g = -0.52$, 95% CI $[-0.72, -0.31]$), total sleep time (TST) ($g = 1.02$, 95% CI $[0.23, 1.82]$), sleep onset latency (SOL) ($g = -1.44$, 95% CI $[-2.69, -0.18]$), and total PSQI score ($g = -0.79$, 95% CI $[-1.51, -0.06]$). In contrast, digital-based MBSR showed statistically significant improvement only in sleep disturbance ($g = -0.33$, 95% CI $[-0.53, -0.13]$), while other outcomes such as total PSQI score ($g = -0.76$, 95% CI $[-1.56, 0.05]$) did not reach statistical significance. Heterogeneity was higher among CBT studies ($I^2 = 81.1-96.7\%$) compared to MBSR ($I^2 = 0\%$).

Conclusions: Digital psychological interventions are effective in improving sleep problems among cancer patients. However, effectiveness varies by intervention type and sleep domain. Digital CBT showed robust effects across several sleep outcomes, while digital-based MBSR showed more limited benefits. These findings highlight the need to tailor digital interventions based on therapeutic mechanisms and targeted sleep problems.

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Wearable sleep tracking in digital CBT-I: Clinical impact and the subjective-objective sleep discrepancy

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Introduction: Insomnia is a prevalent disorder, affecting up to 30% of the population, and is associated with poor physical and mental health outcomes. Cognitive Behavioral Therapy for Insomnia (CBT-I) is the first-line treatment, but its accessibility is limited by a shortage of trained providers and high costs. Digital Cognitive Behavioral Therapy for Insomnia (dCBT-I) has emerged as an effective and scalable alternative.

Wearable devices are increasingly used to track sleep patterns, offering objective data on sleep parameters. However, how well these wearable-derived sleep measures align with traditional subjective assessments remains unclear.

This study evaluates the combined effect of dCBT-I with wearable sleep tracking and examines discrepancies between subjective (sleep diaries) and objective (smart ring) sleep measures in individuals undergoing digital insomnia treatment.

Materials and methods: A single-arm, pre-post study was conducted to evaluate the clinical outcomes of an 8-week dCBT-I intervention with smart ring sleep tracking.

Inclusion:

- 30 adults with chronic insomnia (DSM-V)
- ISI score of 11 or above

Methods:

- dCBT-I for 8 weeks
- comparison of daily sleep data from smart ring and sleep diary

Results: Result 1: Insomnia severity improved significantly (Δ ISI = -6.16, $p = 0.011$), while anxiety symptoms decreased (Δ GAD-7 = -2.38, $p = 0.038$). No significant change was observed in depressive symptoms (PHQ-9, $p = 0.807$).

Result 2: Smart ring adherence was significantly higher than the sleep diary (52.5 vs. 44.5 days, $p = 0.002$).

Result 3: Significant discrepancies were observed between sleep diary and smart ring measurements. SOL, TST, SE WASO all showed significant improvements in sleep diaries ($p < 0.001$, $p = 0.004$, $p < 0.001$, $p = 0.007$, respectively), but no significant changes were detected by the smart ring. Interaction effects for SOL and TST indicate divergent trends between subjective and wearable-derived data.

Conclusions: •Digital CBT-I with smart rings reduces insomnia severity and anxiety symptoms.

- Smart ring adherence was significantly higher than the sleep diary.
- Smart rings did not capture improvements observed in sleep diaries.
- Significant discrepancies exist between subjective and wearable-derived sleep data.
- Subjective assessments remain essential in insomnia management.

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Cognitive Function and Frontotemporal Functional Connectivity in Patients with Major Depressive Disorder and Comorbid Insomnia Symptoms: A Cerebral Hemodynamics Perspective

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Introduction: The underlying mechanism of major depressive disorder (MDD) with insomnia symptoms (IS) is still unclear. Our research is aimed to investigate the changes in the frontotemporal functional connectivity and cognitive function in patients with MDD and comorbid IS.

Materials and methods: We recruited 82 patients with MDD, including 50 comorbid with IS (MDD-IS), 32 without insomnia (MDD-nIS), and 35 healthy controls (HCs). The MATRICS Consensus Cognitive Battery (MCCB) was used to assess their cognitive function, and a resting-state functional near-infrared spectroscopy (fNIRS) was applied to measure the intensity of their frontotemporal functional connectivity (FC).

Results: A comparative cognitive function analysis showed both MDD-IS and MDD-nIS groups had significantly more impairments than the HC group in multiple domains: information processing speed, attention/vigilance, working memory, verbal learning, visual learning, and reasoning/problem-solving (all with $p < 0.001$, except reasoning/problem-solving with $p = 0.008$). In social cognition, the MDD-IS group had more pronounced impairments than the MDD-nIS group, which also performed worse than the HC group ($p < 0.001$). Using fNIRS, distinct frontotemporal and interregional functional connectivity (FC) changes were found among MDD subgroups differentiated by sleep disturbance. Compared to MDD-nIS and HC groups, the MDD-IS group exhibited significant frontotemporal hypoconnectivity ($p = 0.02$), with specific deficits in four pathways: left triangular part-left premotor cortex ($p = 0.010$), right triangular part-left oculomotor cortex ($p = 0.018$), right triangular part-right premotor cortex ($p = 0.026$), and left oculomotor cortex-right premotor cortex ($p = 0.003$). Further analysis revealed additional dysconnectivity between prefrontal and premotor regions in MDD-IS patients compared to HC, involving connections between left and right dorsolateral prefrontal cortex (DLPFC) and right premotor cortex ($p = 0.002$ and $p = 0.017$, respectively). Subgroup-specific reductions were observed in MDD-IS patients compared to MDD-nIS, particularly in connectivity between the left triangular part and left oculomotor cortex ($p = 0.049$), and between left oculomotor and left premotor pathways ($p = 0.034$). Notably, both MDD subgroups showed impaired connectivity between the right oculomotor and right premotor regions compared to HC ($p = 0.004$), indicating this pathway may be a transdiagnostic neural signature of MDD. Correlation analyses showed significant associations between cognitive performance and interregional FC in the MDD-IS subgroup. Verbal learning capacity was positively correlated with connectivity between the left oculomotor and right premotor cortices. Visual learning performance demonstrated coordinated neural coupling through four pathways: left DLPFC-right premotor cortex, left triangular part-left oculomotor cortex, right DLPFC-right premotor cortex, and left oculomotor-right premotor cortex. Reasoning and problem-solving abilities were positively associated with connectivity patterns between the left triangular-left oculomotor and left triangular-left premotor regions.

Conclusions: These findings indicate that MDD patients with sleep disturbances exhibit characteristic cognitive impairments potentially linked to dysfunctions in frontotemporal and oculomotor-premotor networks. This research advances our understanding of the neural circuits through which sleep disturbances affect cognitive phenotypes in depression, and the related FC patterns could serve as potential biological markers and therapeutic targets.

Validation and reliability of a Thai version of The Insomnia Severity Index

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Introduction: Insomnia is highly prevalent worldwide and has a significant impact on health outcomes. However, it is often underrecognized and untreated, as its diagnosis typically requires a comprehensive medical evaluation by experienced professionals. The Insomnia Severity Index (ISI) is a brief self-assessment tool specifically designed for screening and evaluating the severity of insomnia. This study aimed to translate and validate the ISI into a Thai version to enhance insomnia patient care in Thailand.

Materials and methods: Thai version of insomnia severity index (Thai-ISI) was developed under a standard linguistic translation protocol. Validity with Thai-Pittsburgh Sleep Quality Index (Thai-PSQI) and Thai-Athens Insomnia scale (Thai-AIS) was tested. Test-retest reliability was evaluated at 2–4-week interval.

Results: A total of 72 adult participants (70% female) with insomnia complaint were recruited. Twenty-nine percent had comorbid obstructive sleep apnea and 47.2% reported a history of sleep medication use. Based on the

Thai-ISI, most participants ($n = 42$, 58.3%) were classified as having clinically significant insomnia. Thai-ISI demonstrated a strong correlation with the Thai-Athens Insomnia Scale (Thai-AIS) ($r = 0.784$, $p < 0.01$) and a moderate correlation with the Thai-Pittsburgh Sleep Quality Index (Thai-PSQI) ($r = 0.44$, $p < 0.01$). Cronbach's alpha of 0.703 indicated good internal consistency of the questionnaire items. Pearson's correlation for test-retest reliability of the total Thai-ISI score was 0.638 ($p < 0.01$) also reflexed good consistency.

Conclusions: We demonstrated validity and reliability of Thai-ISI. The data also supported the utility of Thai-ISI for capturing insomnia in Thai subjects with and without co-morbidity.

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A pilot survey of Australian health professionals on melatonin use in typically developing children with chronic insomnia

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Introduction: Although melatonin is commonly used in children with insomnia, data regarding its prescription practices in Australia are scarce. This pilot survey aims to describe melatonin use by a cohort of Australian health professionals in typically developing children with chronic insomnia.

Materials and methods: A cross-sectional open survey was administered to a cohort of Australian health professionals electronically across three states (NSW, Victoria and Queensland), collecting information about melatonin prescribing practices in typically developing children. Participants were recruited at a paediatric conference event. Data collection included the following variables: patient age range, dosages used, time of administration, treatment duration, association with other treatments, perceived efficacy, and side effects. Data are expressed as a percentage of total responses

Results: A total of 101 health professionals responded to the survey. This included 48 Paediatricians, 45 General Practitioners and 8 Psychiatrists. Majority (95.4%) used melatonin in clinical practice. Melatonin was prescribed in all ages (including under 2 years of age), but most frequently used in those aged 10 years and over (54.2%). The most common indication was difficulty falling asleep (84.9%). Other prominent indications included parental request (26.4%), anxiety (21.7%), daytime irritability (9.4%) and movements in sleep (7.5%). Most combined use of melatonin with good sleep habits (92.4%). Other prominent medications used consisted of clonidine (31.4%), antihistamine (16.2%) and tricyclic antidepressants (10.5%). Many practitioners continued melatonin use for over 3 months duration (34.3%), with some electing to continue until sleep improved (21.9%). A total of 28.6% participants reported any side effects related to melatonin. These were mild and included headaches, nightmares, vivid dreams, bed wetting, tiredness, daytime somnolence, parasomnias and worsening daytime behaviour. A significant percentage (41%) of participants have ever recommended that patients purchase melatonin from overseas.

Conclusions: This pilot survey demonstrates that no clear consensus exists about the use of melatonin in typically developing children among the surveyed participants. There is a need for clear guidance and further education with the development of an Australia-wide guideline to rationalise and optimise the use of melatonin in children.

Actigraphy-Derived Circadian Rhythm Patterns as the Predictors of Anxiety and Depression in Individual with Insomnia Symptoms: Results of Principal Component Analysis

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Introduction: Emerging evidence links insomnia, circadian rhythm disruption, and mood disorders like anxiety and depression. However, the specific associations between disrupted circadian patterns and mood disorders in insomnia are not well understood. This study examined these relationships in adults with insomnia symptoms.

Materials and methods: Participants were community-dwelling residents from Hong Kong with insomnia (Insomnia Severity Index, ISI ≥ 10), excluding those with comorbid Major Depressive Disorder (MDD) and anxiety disorders. They completed 7-day wrist actigraphy using the ActiGraph GT3X, and mood disorders were assessed via the Structured Clinical Interview for DSM-5 Disorders (SCID-5). Six circadian rhythm parameters were extracted to assess rhythm stability, fragmentation, and day-night activity distribution, including Interdaily Stability (IS), Intradaily Variability (IV), average activity intensity and onset time of the lowest 5-hour nocturnal period (L5, L5hr), and the highest 10-hour diurnal period (M10, M10hr). Principal Component Analysis (PCA) was applied for dimensionality reduction, with components explaining more than 15% of the variance retained, supported by the elbow point in the scree plot. Multivariate logistic regression (adjusting for sex, age, education, marital status, employment, income, BMI, ISI score, and sleep duration) examined associations between circadian dimensions and MDD and Generalized Anxiety Disorder (GAD). To validate the findings, XGBoost models were used, with SHAP values determining feature importance and contribution.

Results: A total of 267 participants (Mean age: 43.4 years, 20.6% male) were included. Among them, 17 (6.4%) had GAD and 18 (6.7%) had MDD. Based on PCA, three principal components were extracted: Dimension 1 (Dim.1, 31.6% of variance), Dim.2 (22.4%), and Dim.3 (19.5%), together accounting for 73.5% of the total variance. Dim.1 was characterized by a delayed circadian phase (M10hr, L5hr), high IV, low IS, and lower daytime activity (M10), reflecting a delayed, unstable, and disorganized rhythm pattern. Dim.2 showed a delayed circadian phase with high IS and low IV, indicating a delayed yet well-consolidated rhythm structure. Both higher Dim.1 and Dim.2 were associated with younger age. Dim.3 was associated with elevated daytime and nighttime activity levels and low IS, suggesting reduced day-night differentiation. Results showed that Dim.1 was significantly associated with a higher probability of MDD (OR = 1.61, 95% CI: 1.12–2.31), and Dim.2 with GAD (OR = 1.69, 95% CI: 1.09–2.64). The XGBoost models showed good predictive performance, with AUCs of 0.88 for MDD and 0.78 for GAD. SHAP values indicated higher Dim.1 values were correlated with higher risk of MDD, and higher Dim.2 with higher risk of GAD.

Conclusions: The concurrence of insomnia and a delayed, irregular and disorganized circadian rhythm pattern were associated with higher risk of MDD, while that of insomnia with a delayed but regular circadian pattern are associated with higher risk of GAD. Future research is needed to determine whether treating different subtypes of circadian rhythm patterns in insomnia could alleviate mood symptoms and even prevent the onset of mood disorders.

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Efficacy of Jasmine Aromatherapy Pillow on Sleep Quality in Insomnia Patients

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Introduction: Insomnia is a common symptom of sleep problems, and there are various interventions to treat it. However, there is increasing interest in non-pharmacologic interventions.

Materials and methods: A prospective crossover study was conducted between August 1, 2023, and January 31, 2024, at the Sleep Disorders Clinic, Central Chest Institute of Thailand. The study included subjects aged ≥ 18 years who self-reported insomnia for at least 3 nights/week over a minimum duration of 1 month. Participants used their regular pillows for one week to collect baseline data on PSQI, GAD7, PHQ9, ISI, ESS, along with recording a sleep log and wearing an actigraphy watch. Subsequently, they were provided with a straw pillow and a Jasmine aromatherapy pillow for an additional week of use. Data were collected using the same questionnaire after participants utilized each intervention for one week.

Results: Six female participants with a mean age of 52 ± 14.76 years were enrolled. Both the straw pillow (11.17 ± 2.14 vs 14.33 ± 4.03 , $p=0.045$) and the Jasmine aromatherapy pillow (10.17 ± 2.64 vs 14.33 ± 4.03 , $p=0.002$) significantly reduced PSQI scores compared to the baseline. The ISI significantly decreased after using the Jasmine aromatherapy pillow compared to both the baseline (13.50 ± 3.94 vs 16.17 ± 3.25 , $p=0.047$) and the straw pillow (13.50 ± 3.94 vs 15.83 ± 3.43 , $p=0.017$). The data from sleep log and actigraphy did not show significant improvement of TIB, TST, SL, SE, WASO, and NNA.

Conclusions: Both the straw pillow and Jasmine aromatherapy pillow help to improve sleep quality. Notably, the Jasmine aromatherapy pillow also decreased insomnia symptoms.

The effectiveness of self-help cognitive behavioural therapy for insomnia in adults: a systematic review and meta-analysis

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Introduction: Uptake of cognitive behavioural therapy for insomnia (CBT-I) as a first-line treatment for chronic insomnia is limited due to a shortage of trained therapists, access barriers, and economic burden. Self-help CBT-I appears to be a viable alternative due to its promising scalability, accessibility, and affordability. To date, the effectiveness of self-help CBT-I on insomnia severity among adults with insomnia symptoms has not been extensively explored. This meta-analysis aims to evaluate the overall effectiveness of self-help CBT-I on insomnia severity and to identify potential characteristics associated with greater estimated treatment effects.

Materials and methods: We systematically searched PubMed, Embase, PsycINFO, CINAHL Plus, Web of Science, the Cochrane Library Core, and two Chinese databases (China National Knowledge Infrastructure [CNKI] and Wanfang Data) for articles published up to 4 April 2025. Randomized controlled trials (RCTs) comparing self-help CBT-I with a control condition were included if they involved adults with insomnia symptoms and reported insomnia severity as an outcome. Two independent reviewers screened the search records and extracted data from eligible RCTs. Hedges' g was pooled using a random-effects model, with post-intervention insomnia severity as the primary outcome. Subgroup analyses and meta-regressions were performed to identify characteristics potentially associated with enhanced treatment efficacy. The Cochrane Risk of Bias 2.0 tool was used to assess study quality. This meta-analysis followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and was pre-registered on PROSPERO (registration number: CRD420251009153).

Results: A total of 33 RCTs (37 intervention vs. control comparisons) involving 6,187 participants (mean age range: 27.3–71.8 years), conducted in upper-middle- or high-income countries, were included. Self-help CBT-I interventions were mainly delivered via mobile apps or web platforms, with varying levels of support ranging from none to guided assistance. Compared with control conditions, self-help CBT-I demonstrated large effect sizes in reducing insomnia severity at post-intervention ($g = -0.97$, 95% CI: -1.19 to -0.75 ; $I^2 = 93.09\%$), moderate to large effects at 1–5 months post-intervention ($g = -0.67$, 95% CI: -0.83 to -0.51 ; $I^2 = 70.20\%$), and at 6–12 months post-intervention ($g = -0.78$, 95% CI: -1.03 to -0.52 ; $I^2 = 82.24\%$). Larger effect sizes were observed in trials that included relapse prevention components or were delivered via web platforms. No significant differences were found based on adaptation of CBT-I content, level of support, or provision of incentives. Of the included studies, 6 were rated as having a high risk of bias, 13 as having some concerns, and 14 as having a low risk of bias.

Conclusions: Compared with control conditions, self-help CBT-I demonstrated effectiveness in managing adult insomnia, regardless of the level of support or delivery format. Further rigorous research is warranted to evaluate the effectiveness of self-help CBT-I in low-income countries.

The Association between Sleep Vulnerability and Autonomic Response to Nocturnal Arousals

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Introduction: Sleep vulnerability is an individual trait reflecting the tendency to experience sleep disturbances under stress. It's assessed via self-report using the Ford Insomnia Response to Stress Test (FIRST), which measures the likelihood of sleep disruption in response to everyday stressors. Higher FIRST scores consistently predict development of insomnia disorder. Although prior research links high sleep vulnerability to heightened physiological arousal, dynamic processes underlying autonomic nervous system (ANS) responses, especially recovery following nocturnal arousals, remain poorly understood. This study aimed to investigate how high versus low sleep vulnerability individuals differ in ANS reactivity and recovery patterns following experimentally induced arousals during nocturnal sleep, assessing their potential as physiological markers of insomnia risk.

Materials and methods: Forty healthy adults ($M = 24.1 \pm 3.1$ years) were recruited based on FIRST pre-screening, including a high vulnerability group (HV, $n = 19$; 10 females; $\text{FIRST} \geq 23$) and a low group (LV, $n = 21$; 12 females; $\text{FIRST} \leq 18$). During overnight polysomnography, auditory stimuli (1-second 1000 Hz pure tones) were presented via speakers during sleep in ascending intensity sequences (40–90 dB, 13-second intervals). Each stimulus sequence began when at least 10 seconds of stable EEG activity were presented and were terminated if EEG-defined arousal occurred. ANS reactivity was indexed by peak heart rate (HR) following arousal onset, while recovery reflected the efficiency of HR return to baseline. Baseline HR was calculated as the average of 2–12 heartbeats prior to cortical arousal. ANS reactivity was also quantified by the area under curve (AUC) from baseline to peak HR. Higher values indicated stronger reactivity. ANS recovery was assessed as the AUC across the 30 beats after the HR peak, divided by peak amplitude; larger values indicated slower recovery and poorer autonomic regulation.

Results:

During NREM sleep, the HV group exhibited significantly higher HR peak responses compared to the LV group ($t(38) = 0.858$, $p = .005$), while no group differences were observed during REM sleep or when all stages combined. In contrast, AUC-based reactivity showed no differences across NREM, REM, or combined sleep stages.

ANS recovery was significantly slower in the HV group when combining all stages ($t(38) = 2.351$, $p = .024$), while no group differences were observed during REM or NREM sleep.

Conclusions: Our findings suggest that ANS recovery, rather than reactivity, may better represent a physiological marker of sleep vulnerability. The discrepancy between peak HR and AUC-based ANS reactivity may reflect differences in arousal-to-peak latency, with the LV group showing a slower, more gradual HR rise that yields comparable AUC values to the HV group's sharper, faster responses. In contrast, the slower recovery process in the HV group likely reflects reduced parasympathetic modulation, impairing the ability to return to physiological homeostasis following arousal. These findings underscore the importance of recovery dynamics in understanding sleep vulnerability and support the potential utility of targeting ANS recovery for early detection and intervention of insomnia disorder. Future research is needed for understanding ANS reactivity mechanism.

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Exploring pregnant women's perspectives in developing a WeChat-delivered cognitive behavioral therapy for insomnia: a qualitative study

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Introduction: WeChat, the most popular mobile instant messaging app, offers a highly accessible but untested platform for delivering tailored CBT-I program to pregnant women. To inform its content and design, we conducted a formative study to explore the perceptions of Chinese pregnant women on a WeChat-delivered CBT-I program.

Materials and methods: A descriptive qualitative design was used. Focus groups and individual interviews with semi-structured questions were conducted via a video conferencing platform with 29 Chinese pregnant women with insomnia symptoms (Insomnia Severity Index score > 7) during December 2023 to March 2024. Data were analyzed using content analysis.

Results: Three themes and 10 subthemes were identified: (1) Appreciating sleep intervention for pregnancy insomnia; (2) Suggestions for intervention contents; (3) Recommendations on the format of WeChat articles. Participants appreciated the intervention's focus on pregnancy insomnia as it is often overlooked by healthcare providers despite its significant impact on their well-being. Participants also recognized its potential to address previously neglected insomnia challenges. Participants indicated a willingness to engage with the program, although they raised concerns about an excessive focus on sleep-related issues. Suggestions for content improvement included using clear and plain language, incorporating scientific explanations to reinforce credibility, combining generalized content with personalized insomnia solutions, and including information relevant to the perinatal period. Participants also emphasized the need for family involvement to support them in managing insomnia. Regarding the format of WeChat articles, participants highlighted form is secondary to content helpfulness, while many suggested using engaging titles and visuals. Additionally, some participants preferred short-form videos delivered via short video platforms over WeChat--delivered methods.

Conclusions: WeChat for delivering CBT-I for reducing insomnia symptoms was well received by the Chinese pregnant women and the identified main features may facilitate the design for future intervention studies.

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Efficacy and Adherence of a Two-Week Bedtime Routine Intervention via the Sleep Coaching App in Adults with Insomnia Symptoms

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Introduction: Sleep disorders are a rapidly escalating global health concern, profoundly impacting individual well-being, cognitive function, productivity, and economic stability. While Cognitive Behavioral Therapy for Insomnia (CBT-I) is the established first-line treatment, its widespread application is hindered by challenges related to cost, time consumption, and limited accessibility. This has spurred interest in digital health solutions, such as mobile applications, as a more accessible alternative. This study evaluated "Kkuljam Doctor," a novel sleep coaching mobile application, specifically focusing on its "Bedtime Routine" feature, which integrates relaxation therapy—a core component of CBT-I to leverage effective relaxation techniques and the benefits of fixed bedtime schedules for improving insomnia. This study aimed to evaluate the efficacy and user adherence of a 2-week "Bedtime Routine" intervention, delivered via the Kkuljam Doctor app, in adults reporting recent declines in sleep satisfaction

Materials and methods: This prospective pre-post study enrolled 40 community-dwelling adults (mean age 36.5 ± 6.8 years; 37.5% male). Participants exhibited at least one insomnia symptom (difficulty initiating or maintaining sleep, early awakening, or unrefreshing sleep) and baseline Insomnia Severity Index (ISI) ≥ 5 and Pittsburgh Sleep Quality Index (PSQI-K) ≥ 5. Participants engaged with the app's "Bedtime Routine" for 14 consecutive days. Sleep efficiency (primary outcome) and other sleep parameters were tracked using in-app sleep diaries and validated questionnaires (PSQI, ISI, ESS). Adherence was also evaluated.

Results: Significant improvements were observed across both objective and subjective sleep parameters after the 2-week intervention. From sleep diaries, TST significantly increased (360.2 ± 60.1 min to 417.1 ± 43.6 min, $p < 0.001$), while sleep latency (41.6 ± 22.1 min to 31.4 ± 19.5 min, $p = 0.016$) and WASO (19.9 ± 17.7 min to 12.8 ± 11.4 min, $p = 0.002$) significantly decreased. Consequently, sleep efficiency significantly improved (85.2 ± 7.7% to 90.4 ± 4.0%, $p < 0.001$). Subjective measures also showed marked improvement: PSQI global score (10.3 ± 2.2 to 5.9 ± 2.0, $p < 0.001$), ISI (15.2 ± 4.3 to 8.3 ± 4.0, $p < 0.001$), and ESS (11.7 ± 4.6 to 6.1 ± 3.5, $p < 0.001$) all significantly decreased. All seven PSQI component scores demonstrated significant improvement ($p < 0.001$ for all). Mean adherence to the app was high at 82.8 ± 9.9%; however, four participants (10%) with less than 70% adherence.

Conclusions: A 2-week intervention using the "Bedtime Routine" feature of the Kkuljam Doctor app significantly improved various objective and subjective sleep parameters in adults with mild to moderate insomnia symptoms,

demonstrating high user adherence. It demonstrates the effectiveness of a digital app focused on relaxation techniques and fixed sleep schedules in improving sleep.

Neural basis of emotion dysregulation in insomnia disorder: A task-based fMRI study

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Introduction: Insomnia disorder (ID) is one of the most prevalent sleep disorders, affecting approximately 10% of the adult population. Beyond its hallmark nighttime difficulties with initiating or maintaining sleep, insomnia is increasingly recognized for its adverse consequences on daytime functioning, particularly in cognitive and emotional domains. Among these, deficits in emotion regulation have been consistently reported, implicating alterations in both behavioral and neurobiological systems. However, the neural mechanisms underlying the emotional dysregulation in ID remain poorly understood. Functional neuroimaging approaches offer critical insights into the brain circuitry involved in emotional regulation in this population.

Materials and methods: To investigate the neural correlates of emotion regulation in ID, we employed task-based functional magnetic resonance imaging (fMRI) in a sample of 19 patients diagnosed with insomnia disorder and 28 age- and sex-matched normal sleepers (NS). All participants completed standardized self-report measures assessing insomnia severity, anxiety, and depressive symptoms. During fMRI acquisition, participants performed an explicit emotion regulation task comprising three conditions: passive viewing of neutral pictures, passive viewing of negative pictures, and cognitive reappraisal of negative pictures. For each trial, participants were instructed either to observe the picture naturally or to reinterpret its meaning in a way that reduced its emotional impact, followed by a self-report of their current negative feelings. Brain activation patterns were analyzed using whole-brain approaches, focusing on areas previously implicated in emotion regulation.

Results: Behavioral performance data confirmed that all participants reported higher negative affect in response to negative pictures compared to neutral ones. Individuals with ID reported significantly greater negative responses during the reappraisal condition than NS controls, suggesting the impaired capacity to downregulate negative affect. Neuroimaging findings revealed that, relative to passive viewing of negative stimuli, the ID group exhibited significantly reduced activation during reappraisal in the sub-gyral region of the temporal lobe, the inferior frontal gyrus (IFG), and the right para-hippocampal gyrus compared to NS. These areas are known to support top-down cognitive control and contextual modulation of emotional responses.

Conclusions: Our findings provide convergent behavioral and neurobiological evidence for impaired emotion regulation in individuals with insomnia disorder. Specifically, hypoactivation in prefrontal and temporal-limbic regions during cognitive reappraisal suggests disrupted neural mechanisms underlying emotional processing. These results highlight the importance of targeting emotion regulation processes in the treatment of insomnia and indicate potential neural targets for intervention.

The Impact of Sleep Vulnerability on Sleep Misperception in Healthy Adults

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Introduction: Sleep misperception, defined as the discrepancy between subjective and objective sleep, is commonly observed in individuals with insomnia but remains poorly understood. It may represent a premorbid trait of insomnia or develop over the course of chronic insomnia. Stress-related sleep vulnerability, defined as the tendency to experience sleep disruption under stress, is considered a predisposing trait for insomnia. Previous

studies have reported that various stress conditions can enhance sleep misperception. Thus, sleep vulnerability may be associated with heightened sensitivity to minor sleep disturbances under stress, leading to distorted sleep perception. Therefore, the present study aims to examine the association between sleep vulnerability and sleep misperception, to determine whether sleep misperception is a predisposing trait of insomnia linked to sleep vulnerability.

Materials and methods: Thirty-five healthy participants without reported sleep disturbances (M:F = 1.7:1.8; mean age = 23.91 ± 3.54) completed the Ford Insomnia Response to Stress Test (FIRST) to assess their sleep vulnerability. They also wore an actigraphy device and completed a sleep diary for seven days. Sleep onset latency (SOL), total sleep time (TST), wake after sleep onset (WASO), and sleep efficiency (SE) were derived from both actigraphy and sleep diaries. The 7-day average discrepancies between subjective and objective measures were calculated. The index of sleep misperception used included: 1) subjective values minus objective values, 2) the discrepancy between subjective and objective values divided by the objective values, 3) subjective values divided by objective values. Pearson's correlation between sleep vulnerability and indices of sleep misperception were conducted.

Results: The results showed no significant correlations between the FIRST score and all the indices of sleep misperception of SOL, TST, WASO and SE.

Conclusions: The findings suggest that sleep vulnerability under stress in healthy populations is not associated with sleep misperception. Sleep misperception does not appear to be a characteristic of individuals predisposed to developing insomnia, but rather may emerge over the course of chronic insomnia. Future research could benefit from investigating these relationships in clinical populations or under experimentally induced stress conditions.

Long-Term Risk of Dementia in middle-age and older adults with Sleep Disorders: Evidence from 20 Years of Nationwide Taiwanese Data

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Introduction: A growing body of research has identified an association between various sleep disorders and increased dementia risk; however, the extent to which specific types of sleep disorders differentially contribute to dementia onset remains unclear. This research aimed to utilize comprehensive population-representative data to understand the risk of dementia in patients with sleep disturbances, and to compare the effects and risk factors of different types of sleep disorders on the risk of dementia.

Materials and methods: A retrospective study contained adults ≥ 40 years of age who enrolled in National Health Insurance Research Database (NHIRD) from 2000 to 2020. The subjects are: 1) patients with sleep disorders encompassed insomnia, sleep-related breathing disorders (SBDs), and restless leg syndrome (RLS) as their primary or secondary diagnosis according to the International Classification of Diseases; 2) aged 40 years or older; 3) with at least ten years of observable data in the health database. The incidence rate of all-cause dementia, Alzheimer's disease (AD), vascular dementia (VD) per 1,000 person-years will be observed. Cox proportional hazards model will focus on risk factors associated with dementia.

Results: Among the 236,837 participants, the majority were classified as having insomnia ($n = 233,529$), followed by those with sleep-related breathing disorders (SBDs; $n = 2,367$) and restless legs syndrome (RLS; $n = 1,209$). The overall incidence of all-cause dementia among subjects with sleep disorders was 7.83 per 1,000 person-years (PYs), with incidences of AD and VD reported at 1.31 and 1.11, respectively. Kaplan–Meier survival analysis revealed significantly lower dementia-free survival among participants with RLS (log-rank $p < .0001$). Participants with RLS exhibited the highest incidence of dementia (15.55/1,000 PYs) and demonstrated significantly elevated risks of all-cause dementia (adjusted hazard ratio [aHR], 1.96; 95% confidence interval [CI], 1.73–2.21), AD (aHR, 4.73; 95% CI, 4.57–4.90), and VD (aHR, 4.73; 95% CI, 4.57–4.90) compared to those with insomnia. Additional risk factors included advanced age, female sex, depression, alcohol abuse, and a high comorbidity burden.

Conclusions: RLS confers the highest risk of all-cause and subtype-specific dementia compared with insomnia and SBDs. Advanced age, female sex, depression, alcohol abuse, and a high comorbidity burden further compound this risk, underscoring the need for targeted screening and management strategies in these vulnerable populations.

Acknowledgments: sleep disorders, insomnia, sleep-related breathing disorder (SBDs), restless leg syndrome (RLS), Alzheimer's disease (AD), vascular dementia (VD), National Health Insurance Research Database (NHIRD)

Temporal Subtypes and Characteristics of Insomnia Treatment Responses

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Introduction: This study aims to identify specific characteristics that can predict the treatment efficacy and onset time in patients with insomnia.

Materials and methods: A retrospective study was conducted on patients who visited the Sleep Disorders Clinic between January 1, 2016, and October 19, 2024 and underwent digital CBT-I. Data on demographic characteristics, Pittsburgh Sleep Quality Index (PSQI), Generalized Anxiety Disorder Scale (GAD-7), Patient Health Questionnaire (PHQ-9), Somatic Symptom Questionnaire (PHQ-15), Epworth Sleepiness Scale (ESS), and Eysenck Personality Questionnaire (EPQ) were collected. The PSQI score reduction rate was used as an indicator of treatment efficacy, where a reduction rate of more than 25% was generally considered effective. Since patients in this study underwent multiple assessments and exhibited varying degrees of treatment response, the average reduction rate was ultimately used to determine treatment effectiveness within this time dimension. Based on the time dimension, patients (N=834) were categorized into two groups: the early-response group (≤ 8 weeks) and the late-response group (> 8 weeks or non-responsive).

Results: The demographic characteristics and scale data of 834 patients indicated no significant differences between the two groups in terms of gender ($P=0.491$), family history of insomnia ($P=0.167$), and ESS score ($P=0.949$). However, significant differences were observed between the two groups in age ($P=0.005$), education level ($P<0.001$), duration of insomnia ($P<0.001$), GAD-7 score ($P=0.031$), PHQ-9 score ($P=0.044$), and neuroticism personality trait ($P=0.039$). The late-response group had a higher mean age, a lower education level, and a longer duration of insomnia than the early-response group. Additionally, the late-response group exhibited lower GAD-7, PHQ-9, and neuroticism personality trait scores compared to the early-response group. Multivariate logistic regression analysis indicated that higher education level (college or above), higher PHQ-9 and PHQ-15 scores, and a neuroticism personality trait were significant predictors of better treatment response and earlier onset of efficacy in insomnia patients. A longer duration of insomnia was identified as a risk factor for poor treatment response and delayed onset of efficacy.

Conclusions: Insomnia patients with higher education levels (college or above), higher PHQ-9 and PHQ-15 scores, and a neuroticism personality trait tend to have better treatment outcomes and an earlier onset of efficacy. Longer duration of insomnia, tend to experience poorer treatment outcomes and a delayed response to treatment.

Rumination and Pre-sleep Arousal: The mediation role of attentional styles in adults with insomnia disorders

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Introduction: Rumination, as a cognitive activity, is a well-recognised risk factor of insomnia by triggering arousal and attention bias towards sleep-related threats. Previous studies suggested that individuals who ruminate at a higher level tend to have higher level of arousal before sleep and longer sleep-onset latency. Besides, both negative and positive information can induce arousal state and may impact sleep. However, there is limited evidence exploring how attentional styles for positive or negative information influence the association between rumination

and arousal. The current study aims to investigate the potential mediating role of cognitive tendency focusing on positive or negative information between rumination and pre-sleep arousal.

Materials and methods: This was a cross-sectional study of the Hong Kong community-based sleep project. A total of 218 adults (mean age: 45.72 yrs $\pm$ 14.93; females: 76.6%) who met the DSM-V diagnostic criteria for insomnia disorder completed a battery of questionnaires including Pre-Sleep Arousal Scale (PSAS), Ruminative Response Scale (RRS) and Attention to Positive and Negative Information Scale (APNIS) for assessing hyperarousal before sleep, tendency to ruminate and cognitive tendency of focusing on positive (API) or negative information (ANI), respectively. Linear regression analysis was used to evaluate the association between rumination, attentional bias and pre-sleep arousal. Mediation analysis was performed to evaluate the influence of API/ANI on the association between rumination and pre-sleep arousal. Potential confounders included age, gender, education level and mental disorders were included as covariates in the analyses.

Results: The results indicated that women ($M=22.51$, $SD=6.11$) had a higher level of pre-sleep cognitive arousal than men ($M=20.47$, $SD=5.36$), $t(216)=2.13$, $p=0.03$. Regression analysis indicated that a greater tendency to engage in rumination and ANI was associated with both pre-sleep cognitive arousal (rumination: $B=0.27$, $SE=0.03$, 95% $CI=0.21-0.33$, $p<0.001$; ANI: $B=0.42$, $SE=0.07$, 95% $CI=0.29-0.55$, $p<0.001$) and somatic arousal (rumination: $B=0.23$, $SE=0.03$, 95% $CI=0.18-0.29$, $p<0.001$; ANI: $B=0.27$, $SE=0.06$, 95% $CI=0.15-0.38$, $p<0.001$). Rumination was positively associated with ANI ($B=0.25$, $SE=0.03$, 95% $CI=0.19-0.31$, $p<0.001$). Mediation analysis indicated that ANI partially mediated the association between rumination and pre-sleep cognitive arousal. The indirect effect from rumination to pre-sleep cognitive arousal through ANI was significant ($B=0.05$, $SE=0.02$, 95% $CI=0.02-0.10$), as well as the direct effect of rumination on pre-sleep cognitive arousal ($B=0.22$, $SE=0.04$, 95% $CI=0.14-0.29$, $p<0.001$), indicating that the relationship between rumination and pre-sleep cognitive arousal is partially mediated by ANI. However, the indirect effect from rumination to pre-sleep somatic arousal through ANI was not significant. While for API, it did not play a role in the association between rumination and pre-sleep cognitive/somatic arousal.

Conclusions: The current findings revealed that a greater tendency to engage in rumination and predisposition to negative information could be risk factors that trigger cognitive arousal before sleep among people with insomnia. This suggests that interventions targeting reducing rumination and biased attention towards negative information could potentially help to reduce cognitive arousal and improve overall sleep quality.

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Gender differences, psychological factors, and sleep parameters in paradoxical insomnia and non-paradoxical insomnia

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Introduction: Paradoxical insomnia is characterized by a discrepancy between subjective sleep perception and objective sleep measurements. Despite growing research interest, the underlying mechanisms of paradoxical insomnia remain poorly understood. This study aimed to investigate gender differences and identify key clinical, self-reported, and objective sleep characteristics that distinguish paradoxical insomnia from non-paradoxical insomnia.

Materials and methods: A total of 862 participants were analyzed. Data on demographics, clinical characteristics, biochemical parameters, depression, anxiety and polysomnographic (PSG) were collected. Gender differences were assessed, and the relationship between self-reported and objective sleep measures was examined. Logistic regression analysis was conducted to identify factors associated with paradoxical insomnia.

Results: Paradoxical insomnia was present in 30.51% of the study population. Logistic regression identified older age ($OR = 1.019$, $p = 0.004$), gender ($OR = 0.643$, $p = 0.007$), lower Insomnia Severity Index (ISI) scores ($OR = 0.947$, $p = 0.032$), and heightened somatic symptoms from the Hamilton Depression Rating Scale (HAMD) ($OR = 1.374$, $p = 0.010$) as independent predictors of paradoxical insomnia. No significant differences in biochemical parameters were observed between groups. Gender analysis revealed that females with paradoxical insomnia were

older and had higher ISI scores than males, while males had higher BMI in both non-paradoxical insomnia and paradoxical insomnia groups.

Conclusions: Paradoxical insomnia is prevalent among individuals with insomnia, with gender and psychological factors, such as somatic symptoms of depression, playing key roles. Further research is needed to explore the underlying mechanisms and inform targeted interventions.

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Social isolation and risk of insomnia: A cohort and Mendelian randomization study

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Introduction: Social isolation (SI) has been linked to various mental and behavioral disorders, including depression, anxiety, and schizophrenia. However, the causal relationship between SI and insomnia remains unclear. This study aimed to examine both the observational and genetic causal associations between SI and the risk of insomnia.

Materials and methods: This study utilized data from the UK Biobank, a large prospective cohort comprising over 500,000 participants aged 40–70 years, recruited between 2006 and 2010. SI was defined based on three components: number of household members, frequency of contact with others, and engagement in social activities. The primary outcome was incident insomnia, identified through hospitalization records and death registries in the UK Biobank. Cox proportional hazards models were used to assess associations between SI and incident insomnia. Additionally, bidirectional causal associations between genetic liability to SI and insomnia were examined using two-sample Mendelian randomization (MR). Genetic instruments were derived from the UK Biobank, and insomnia GWAS summary statistics were obtained from the European Bioinformatics Institute (EBI) and the FinnGen consortium (Round 12). Meta-analyses and sensitivity tests (MR-Egger, MR-PRESSO, and Cochran's Q) were conducted to validate causal estimates.

Results: Among the 489,741 participants (mean age 56.5±8.1 years; 54.5% female), 559 incident cases of insomnia were documented during a median follow-up of 12.7 years. SI was significantly associated with an increased risk of insomnia (HR = 1.56, 95% CI: 1.27-1.91). Each component of SI was also significantly associated with insomnia: living alone (HR = 1.36, 95% CI: 1.12-1.64), little contact with family/friends (HR = 1.25, 95% CI: 1.02-1.51), and fewer leisure/social activities (HR = 1.21, 95% CI: 1.01-1.44). These associations remained significant after adjusting for demographic, socioeconomic, and lifestyle factors. MR meta-analyses revealed no causal effect of overall SI on insomnia (OR = 0.73, 95% CI: 0.21-2.58), but identified potential causal effects of little contact with family/friends (OR = 1.14, 95% CI: 1.01-1.28) and fewer leisure/social activities (OR = 1.38, 95% CI: 1.03-1.85). Living alone showed no evidence of a causal association (OR = 1.00, 95% CI: 0.71-1.40). Bidirectional MR analyses found no evidence of a causal effect of insomnia on SI or its components. All sensitivity analyses supported the robustness of these findings.

Conclusions: Social isolation is a significant risk factor for insomnia. Among its components, little contact with family or friends and limited participation in leisure or social activities may be causal risk factors. These findings highlight the importance of promoting social engagement—particularly maintaining interpersonal connections and active participation in social life—as a potential strategy to prevent insomnia and improve sleep health.

Acknowledgments: This research used data from the UK Biobank (Application 58082) and GWAS consortia (EBI and FinnGen). We thank all UK Biobank participants and staff, as well as the researchers from EBI and FinnGen for making their GWAS data publicly available.

Gender Differences and the Role of Mood in Sleep Misperception: Evidence from Healthy Young Adults

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Introduction: The discrepancy between subjective and objective measurements of sleep is referred to as sleep misperception. Previous studies have shown that women tend to have objectively better sleep than men (e.g., longer total sleep time), yet report more sleep complaints. Meanwhile, research on sleep misperception among patients with depression has found that a higher percentage of females fell into the underestimation group compared to the overestimation group, and that individuals with higher depression scores were more likely to overestimate wake after sleep onset. Since depression and anxiety are more prevalent among women, we hypothesized that these symptoms might mediate gender differences in sleep misperception.

Materials and methods:

This study aimed to investigate whether there are gender differences in sleep misperception among healthy individuals without sleep complaints, and to examine the potential mediating roles of anxiety and depression. A total of 33 healthy sleepers (48% male; mean age = 24.0 years, range 20–37) without diagnosed mental or medical disorders participated in the study. Participants wore a wrist actigraphy for objective sleep measurement and kept sleep diaries for subjective measurement across seven consecutive days. Sleep variables collected included sleep onset latency (SOL), total sleep time (TST), wake after sleep onset (WASO), and sleep efficiency (SE). Depression and anxiety symptoms were assessed using the Beck Depression Inventory-II (BDI-II) and Beck Anxiety Inventory (BAI), respectively. The indices of sleep misperception used were: (1) subjective values minus objective values; (2) the discrepancy between subjective and objective values divided by the objective values; and (3) subjective values divided by objective values.

Results: ANCOVA analyses comparing sleep misperception between genders, controlling for age, showed no significant differences across any of these indices. Additionally, Pearson's correlations between depression and anxiety scores and sleep misperception indices were not significant. This lack of association between gender, mood, and sleep misperception indicates that the originally hypothesized mediating model was not supported.

Conclusions:

Overall, our results did not demonstrate a gender effect on sleep misperception, nor did they support a mediating role for depression and anxiety symptoms in the relationship between gender and sleep misperception. These findings differ from previous studies that showed gender and mood-related influences on sleep misperception. One possible explanation is that our sample was relatively young and healthy compared to samples in earlier studies, and sleep misperception may develop after prolonged exposure to sleep or mood pathology, which was not present here. Additionally, our small sample size may have limited the findings. Future research with larger samples and/or longitudinal designs is warranted to further clarify the associations among gender, mood, and sleep misperception.

The Impact of Insomnia on Cardiometabolic Health: Importance of Sleep Assessment

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Introduction: Insomnia, characterized by difficulty initiating or maintaining sleep, or early morning awakenings, affects up to one-third of adults. Emerging evidence identifies insomnia as a significant, modifiable risk factor for cardiometabolic diseases, including type 2 diabetes, cardiovascular disease, chronic kidney disease, and metabolic dysfunction-associated steatotic liver disease (MASLD). Insomnia is associated with increased sympathetic nervous system activity, dysregulation of the hypothalamic-pituitary-adrenal axis, and elevated inflammatory markers, all of

which contribute to cardiometabolic risk. Evidence suggests that insomnia significantly impacts glucose metabolism, insulin resistance, and the development of type 2 diabetes. Additionally, insomnia is linked to obesity, MASLD, and cardiovascular diseases such as hypertension, myocardial infarction, and heart failure. Despite its prevalence and impact on health, insomnia remains underdiagnosed and inadequately managed. Integrating sleep health into cardiometabolic care is crucial for reducing the global burden of chronic diseases. Healthcare providers should prioritize screening for insomnia and implementing evidence-based management strategies to improve patient outcomes.

Materials and methods: Objective: This multiphase study aimed to assess the feasibility and need for sleep assessment in specialist clinics and to empower healthcare providers in primary care networks through knowledge translation of phase one of the study.

Methods: The study was conducted in two phases. Phase one involved assessing the feasibility and need for sleep assessments in specialty endocrinology clinic. Data were collected from 69 patients with diabetes and/or obesity, focusing on their sleep patterns, satisfaction with sleep, and the impact of sleep problems on daily functioning. Phase two involved knowledge translation to healthcare providers in primary care networks, aiming to empower them with the findings from phase one to improve sleep health management.

Results: Only 46% of patients reported that their sleep was assessed by their primary care physician or nurse practitioner before the study. Surprisingly, 9% of patients were required and agreeable to start on medication but 23% of patients preferred to talk to their primary care health providers (e.g. GP, NP) about their sleep issues. Around 70% of patients agreed that asking about their sleep helped them understand its importance. Overall, majority of patients were satisfied or very satisfied with their sleep being assessed at the specialty endocrinologist clinic.

The knowledge translation phase aimed to empower healthcare providers in primary care networks with the findings from phase one. This phase included training sessions and distribution of educational materials. Post survey revealed that the degree of comfort level increased after staff received education.

Conclusions: The study highlights the critical need for integrating sleep assessments into specialist clinics and empowering primary care providers through knowledge translation. Addressing insomnia in patients with cardiometabolic diseases can significantly improve patient outcomes and potentially reduce the global burden of chronic diseases. Healthcare providers should prioritize sleep health as a fundamental component of cardiometabolic care.

Predictors of Adherence to Digital CBT for Insomnia (dCBT-I) and Its Impact on Treatment Efficacy: A Large-Scale Real-World Analysis

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Introduction: While digital Cognitive Behavioral Therapy for Insomnia (dCBT-I) is a first-line treatment, variable adherence limits its real-world effectiveness. This study aimed to identify key determinants of dCBT-I adherence and quantify its prognostic value on clinical outcomes in a large patient cohort.

Materials and methods: We conducted a retrospective analysis of 3420 adults with DSM-5 insomnia treated with a dCBT-I mobile application between January 2017 and June 2024. Adherence was quantified using a novel, weighted scoring system based on engagement with core modules (sleep restriction, stimulus control, cognitive restructuring). Baseline demographic and clinical data, including the Pittsburgh Sleep Quality Index (PSQI), GAD-7, and PHQ-9, were collected. Multivariate logistic regression was used to identify independent predictors of high versus low adherence. Treatment response was defined as a $\geq 50\%$ reduction in the total PSQI score at an 8-week follow-up. Receiver Operating Characteristic (ROC) analysis was performed to evaluate the predictive power of the adherence score for achieving a positive treatment response.

Results: Multivariate logistic regression revealed that higher adherence was independently predicted by **older age** (≥ 40 vs. < 40 years; OR=2.85, 95% CI: 1.52-5.34, $p=0.001$), **higher education level** (College vs. Primary; OR=3.10, 95% CI: 1.61-5.96, $p<0.001$), **lower baseline anxiety** (per point on GAD-7; OR=0.88, 95% CI: 0.81-0.95, $p=0.002$), and **greater baseline insomnia severity** (per point on PSQI; OR=1.21, 95% CI: 1.05-1.40, $p=0.008$). The high-adherence group demonstrated a significantly greater mean reduction in PSQI scores at 8 weeks compared to the low-adherence group (-8.5 ± 2.1 vs. -3.2 ± 1.8 ; $p < .001$). The adherence score robustly

predicted treatment response, with an Area Under the Curve (AUC) of **0.81** (95% CI: 0.75-0.87), a sensitivity of 78%, and a specificity of 75% at an optimal cut-off.

Conclusions: Adherence to dCBT-I is a powerful mediator of treatment success and is influenced by a distinct profile of demographic and clinical factors. Our findings suggest that an engagement-based adherence score can serve as a strong prognostic tool. This underscores the necessity of developing personalized, adaptive dCBT-I interventions that provide targeted support to at-risk populations (e.g., younger, less educated, highly anxious patients) to maximize engagement and improve clinical outcomes in real-world settings.

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Association of medications commonly used for insomnia (MCUFI) with abnormal physical activity patterns: A Deep Learning Study Based on NHANES 2003-2006 Database

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Introduction: Medications commonly used for insomnia (MCUFI) are widely regarded as an initial approach by clinicians, with high risk of physical activity (PA) impairment. No large-scale studies have explored the effect of MCUFI on PA patterns assessed by longitudinal objective PA data.

Materials and methods: This study aims to evaluate the PA patterns in MCUFI group, and establish a series of classification models for MCUFI usage with reshaped three-dimensional spatiotemporal PA data, using a multi-layer network based on the Convolutional Long Short-Term Memory (Conv-LSTM) architecture. The deep learning classifiers were developed and validated by internal cross-validation and independent test set. SHapley Additive exPlanations (SHAP) method was used to quantify the relative importance of each time point in the models.

Results: A total of 14,631 participants were included in this study, using the National Health and Nutrition Examination Survey (NHANES) dataset. The MCUFI group demonstrated significantly reduced intensity across all time periods (all $p < 0.001$). Specifically, the group showed a slower growth rate in PA from nighttime to daytime ($p < 0.001$) and a slower decrement rate from daytime to nighttime ($p < 0.001$). Within the MCUFI group, males showed higher activity intensity only during daytime compared to females ($p = 0.028$). Participants using benzodiazepines had significantly reduced intensity than those using other types of MCUFI ($p < 0.001$). The Conv-LSTM model demonstrated robust classification performance across multiple tasks. Particularly, the model achieved moderate performance in detecting MCUFI use (area under the curve, 0.745 [95% CI, 0.728–0.763] for the validation set and 0.700 [95% CI, 0.691–0.710] for the test set).

Conclusions: This study has confirmed the association between MCUFI usage and abnormal PA patterns, with variations observed in gender and type of MCUFI. Further, a series of interpretable deep learning classification models have been established, demonstrating moderate performance.

The effects of Cognitive behavioral therapy for insomnia (CBT-I) and Tai Chi on mood symptoms and cognitive functioning in older adults with insomnia: A pilot study

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Introduction: Insomnia is prevalent in older adults. It is often accompanied by mood symptoms and poor cognitive functioning. While cognitive-behavioral therapy for insomnia (CBT-I) is considered the frontline treatment for adults with insomnia, Tai Chi (TC), a mind-body exercise, has emerged as a potential alternative intervention due to its documented health-related benefits, including improving sleep. However, there has been limited research comparing the effects of CBT-I and TC in addressing insomnia-related daytime symptoms and cognitive functioning among older adults. The present study aimed to compare the effects of CBT-I and TC on subjective sleep quality, mood symptoms, and cognitive functioning in older adults with insomnia.

Materials and methods: Forty-four participants with DSM-5 insomnia disorder (age: 65.27 ± 5.69 , female: 79.55%) were recruited. They received either CBT-I or TC ($n=22$ per group), both delivered over 3 months with two 60-min sessions each week. Sleep quality (Pittsburgh sleep quality index), mood symptoms (Hospital Anxiety and Depression Scale), and self-reported cognitive functioning (Cognitive Failure Questionnaire and Attention Function Index) were assessed at baseline and post-treatment. A mixed-design analysis of covariance (ANCOVA) was conducted, with time (baseline and post-treatment) as the within-subjects factor and group (CBT-I and TC) as the between-subjects factor, controlling for age and sex. Missing post-treatment data were imputed using the last observation carried forward method.

Results: There was a significant time*group interaction effect on sleep quality [$F(1, 42) = 7.102$, $p=0.011$, partial $\eta^2 = 0.165$] and cognitive failure [$F(1, 42) = 4.356$, $p=0.043$, partial $\eta^2 = 0.100$]. These results indicated that pre-post changes in sleep quality and cognitive functioning differed between the CBT-I and TC groups, where the CBT-I group showed greater improvement in sleep quality and the TC group showed greater improvement in cognitive functioning. In addition, there was a significant main effect of time on depressive symptom [$F(1, 42) = 5.428$, $p=0.026$, partial $\eta^2 = 0.138$] and anxiety symptom [$F(1, 42) = 4.183$, $p=0.048$, partial $\eta^2 = 0.107$], indicating mood symptoms improved significantly from pre- to post-treatment across both groups. There was a main effect of group on depressive symptoms [$F(1, 42) = 9.947$, $p=0.003$, partial $\eta^2 = 0.226$] and attention function [$F(1, 42) = 8.603$, $p=0.006$, partial $\eta^2 = 0.212$]. This result suggested that the TC group demonstrated fewer depressive symptoms and better attention across both pre- and post-treatment compared to the CBT-I group.

Conclusions: The findings of the current study highlighted the differential effects of CBT-I and TC in addressing sleep quality, mood symptoms and cognitive functioning. These findings collectively suggested that Tai Chi may serve as a valuable complementary intervention for elderly with insomnia, particularly for addressing mood and cognitive functioning. Further research is warranted to examine the sustainable effects of Tai Chi on mood symptoms and cognitive functioning and explore the potential mechanisms underlying these favorable outcomes.

Subtyping and Prognosis of Insomnia Disorder Based on Clinical, Psychological, and Sleep EEG Features

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Introduction: Insomnia disorder (ID) is a clinically heterogeneous condition, limiting the effectiveness of standardized interventions. This study applied data-driven approaches to identify ID subtypes based on clinical, psychological, and sleep EEG features, and to assess their distinct profiles and treatment outcomes.

Materials and methods: Subjects aged 18–65 years, meeting DSM-5 criteria for ID without other sleep disorders, were included. Comprehensive clinical and psychological evaluations and polysomnographic (PSG) monitoring were conducted to collect clinical, psychological, and sleep EEG features. Clinical features included the Pittsburgh Sleep Quality Index (PSQI), Hamilton Depression Rating Scale (HAM-D), Hamilton Anxiety Rating Scale, and Multidimensional Fatigue Inventory (MFI); psychological characteristics included the Pre-Sleep Arousal Scale (PSAS), Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS), Sleep Hygiene Index (SHI), Perceived Stress Scale (PSS), among others; sleep EEG features encompassed sleep structure and continuity, spectral power, and sleep spindle measures. Equivalent doses of benzodiazepine receptor agonists (BzRA) and antidepressants were recorded. PSQI and HAM-D scores at 8 weeks post-treatment were used as outcome measures. Feature selection was performed using a normalized correlation matrix, followed by dimensionality reduction via

Uniform Manifold Approximation and Projection (UMAP). K-means clustering was employed based on optimal parameters based on silhouette coefficients and neighborhood preservation. Analysis of variance (ANOVA) and Kruskal-Wallis tests were utilized to compare subtype differences in characteristics and clinical outcomes, with significance set at two-tailed $P < 0.05$.

Results: A total of 220 participants completed baseline assessments. Feature selection yielded 7 clinical features, 9 psychological characteristics, and 57 EEG metrics. Three distinct subtypes emerged from UMAP dimensionality reduction and K-means clustering:

Subtype 1, labeled "Deep Sleep Deficient Insomnia" (28.2%), had significantly older participants ($F=4.78$, $p=0.009$), highest depression severity ($F=11.19$, $p<0.001$), shortest duration of N3 slow-wave sleep ($F=6.27$, $p=0.002$), and higher NREM β -band total power ($H=24.40$, $p<0.001$). This subtype received the highest equivalent dosage of BzRA ($F=14.74$, $p<0.001$) and showed significantly poorer improvement in PSQI scores at 8 weeks compared to other subtypes, as well as significantly worse HAMD outcomes compared to subtype 3 ($F=8.47$, $p<0.001$).

Subtype 2, "Stress Related Insomnia" (32.3%), displayed notable clinical anxiety ($F=4.00$, $p=0.020$) and fatigue ($F=9.24$, $p<0.001$), along with the highest insomnia vulnerability ($F=4.30$, $p=0.015$), pre-sleep arousal ($F=14.62$, $p<0.001$), rumination ($F=7.40$, $p=0.001$), and sleep hygiene issues ($F=10.91$, $p<0.001$). EEG analysis revealed reduced δ -band total power compared to other subtypes ($H=12.63$, $p=0.002$). This subtype received moderate BzRA dosages and demonstrated better overall improvement in PSQI scores at 8 weeks than subtype 1.

Subtype 3, "Spindle Deficient Insomnia" (39.5%), presented mild insomnia severity ($F=5.63$, $p=0.004$), lowest perceived stress ($F=14.18$, $p<0.001$), increased micro-arousals ($F=3.532$, $p=0.031$), and reduced spindle activity ($H=66.55$, $p<0.001$). Subtype 3 patients received the lowest equivalent dosages of BzRA and antidepressants, achieving the best overall outcomes in both PSQI and HAMD at 8 weeks.

Conclusions: This study identified three data-driven subtypes of insomnia with distinct EEG and clinical profiles, which were predictive of treatment response. These findings highlight the potential of personalized, subtypes-based management strategies for insomnia disorder.

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The associations between short-term changes in suicidal ideation and sleep disturbances in youth

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Introduction: Sleep disturbances are recognized as transdiagnostic symptoms that significantly increase the risk for mental disorders and suicide. Despite the emergence of sleep-related issues during adolescence and early adulthood, there is a paucity of studies examining the sleep-suicide association in youth. Given the importance of early detection, this study examines the associations between short-term changes in suicidal ideation (SI) and sleep disturbances in youth.

Materials and methods: This is part of an ongoing study on examining depression symptomatology in youth, which recruited Chinese individuals aged 18-24 years using convenient sampling, excluding those with neuropsychiatric disorders (other than depression and anxiety). At baseline, participants underwent a structured interview to assess SI and the presence of sleep disturbances, including difficulties falling asleep (DIS), difficulties maintaining asleep (DMS), and early morning awakening (EMA), based on the Structured Interview Guide for the Hamilton Depression Rating Scale (HDRS). Participants also completed the Depression Anxiety Stress Scales-21 (DASS-21) to measure depression, anxiety, and stress levels. A week later, participants' SI was reassessed using HDRS interviews. The participants were classified into four groups, namely non-SI group (no SI at baseline and follow-up), SI remitted group (having SI at baseline but not at follow-up), incident SI group (no SI at baseline but having SI at follow-up), and persistent SI group (having SI at baseline and follow-up). Multiple logistic regression models were used to analyze the relationship between SI groups (outcomes) and sleep disturbances (predictor), adjusting for age, gender, and baseline levels of SI, depression, anxiety, and stress.

Results: The study included 328 individuals while 300 completed the study (mean age 20.68 years, SD 2.02; 76% female). Of these, 92 individuals (31%) exhibited at least one symptom, with 21% (n=63) experiencing DIS, 14% (n=41) having DMS, and 9% (n=28) showing EMA. In the completer analysis, there were 255 (85%) in the non-SI group, 15 (5%) in the SI remitted group, 16 (5%) in the incident SI group, and 14 (5%) in the persistent SI group. There were no significant differences observed in age and gender among the groups. Baseline sleep disturbances (OR= 4.79, 95% CI=1.50 to 16.93, p=.01) and depression severity (OR=1.18, 95% CI=1.08 to 1.30, p<.001) significantly predicted incident SI after one week. Baseline SI (OR=5.77, 95% CI=2.49 to 15.60, p<.001) increased the risk for persistent SI. Baseline anxiety severity (OR=0.86, 95% CI=0.75 to 0.98, p=.03) was negatively associated with SI remission. Baseline stress severity showed no significant links to short-term changes in SI.

Conclusions: This study identifies sleep disturbances as a significant predictor of incident SI in youths, alongside depressive symptoms. These results highlight the importance of focusing on sleep issues and depressive symptoms when developing strategies for suicide detection and prevention.

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Prediction of treatment outcome on digital cognitive behavioural therapy for insomnia using machine learning and usage data

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Introduction: Digital cognitive behavioural therapy for insomnia (dCBT-I) is recognized as an accessible and scalable intervention for treating insomnia. However, its effectiveness depends on patient adherence. Machine learning (ML) holds potential for outcome prediction, as it is designed to optimize predictive accuracy. Unlike classical statistical methods, which aim to describe relationships between variables based on predefined assumptions, ML can capture complex, nonlinear, and individualized patterns in data. This study employs ML techniques to evaluate the accuracy of ML models in predicting remission after intervention.

Materials and methods: The study recruited 35 participants aged 18-25 years (Mean ISI Score±SD:19.3±2.97;60% Female) to use a 28-day dCBT-I app. They met the DSM-IV-TR criteria for insomnia disorder, with an Insomnia Severity Index (ISI) score of 15 or higher. Those were excluded if they had a history of sleep disorders (other than insomnia), mental disorders (other than depression and anxiety), intellectual disabilities, severe suicidality, current pharmacological treatment or structured psychotherapy, or had recently engaged in shift work or trans-meridian travel.

During the intervention, participants provided daily sleep diaries, and their usage data was automatically tracked. App usage features, including daily usage durations (e.g., time spent on an app page), usage patterns (e.g., mean and maximum daily usage), time spent on each page (e.g., latest review time on a given day), and noncontinuous use of the app (e.g., number of days between two discrete usage) were recorded.

The state-of-the-art ML algorithms were used to predict whether participants achieved a post-intervention ISI score below 8, indicating remission of insomnia. We applied five-fold cross-validation and grid search for hyperparameter tuning, used the Synthetic Minority Over-sampling Technique (SMOTE) to address class imbalance, and evaluated model performance using the Receiver Operating Characteristic–Area Under the Curve (AUC). Statistical significance between models was assessed using the DeLong test. SHapley Additive exPlanations (SHAP) was used to identify the important factors contributing to the models' predictions.

Results: In the study, 9% of participants (n=3) dropped out, while 91% (n=32) completed the 28-day dCBT-I app. In the completer analysis, 81% of participants experienced reduced ISI score (Mean Pre ISI Score±SD:19.41±3.15, Mean Post ISI Score±SD:11.94±5.65, Cohen's d=1.69, p<.001). Across all predictive models, XGBoost achieved the highest performance to predict remission (AUC=0.88, FI=0.86; p<.001), significantly outperforming other models (p<.05). Furthermore, Feature Importance analysis revealed that noncontinuous use of the app was the most predictive factors for remission after intervention across all models. Those remitted from

insomnia (<8) (Mean days $\pm$ SD:4.75 $\pm$ 6.85) had a shorter gap in noncontinuous use of the app compared with other participants (Mean days $\pm$ SD:7.08 $\pm$ 3.80, $p=.02$).

Conclusions: Our findings indicate that ML models with users' engagement and adherence data of dCBT-I can accurately predict treatment outcome. In addition, noncontinuous use of the app emerged as the most important factor influencing model performance in predicting remission of insomnia, highlighting the importance of fostering sustained participation and adherence in digital interventions.

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Associations of Subjective and Objective Sleep with Impulsivity and Probabilistic Reasoning

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Introduction: Growing evidence suggests that insomnia symptoms are associated with heightened impulsive behaviors and altered decision-making patterns. However, there remains limited research regarding the link between objectively measured sleep and decisional impulsivity, a form of decision-making characterized by the acceptance of undue uncertainty, or failure to adapt to environmental changes. According to the dual systems model, since the developing brain is characterized by the imbalance of increased reward-seeking and immature impulse control, inadequate sleep may exacerbate one's propensity to hasty decision making during late adolescents and early young adulthood. This study aimed to explore the associations of objective and subjective sleep with trait impulsivity and decision-making, specifically performance on a probabilistic reasoning task, in youth.

Materials and methods: Youth participants aged 18-25 were recruited and were invited to complete a battery of self-report questionnaires including Insomnia Severity Index (ISI) for insomnia severity, Pittsburgh Sleep Quality Index (PSQI) for sleep quality, and the Barratt Impulsiveness Scale (BIS) for trait impulsivity. Objective sleep was prospectively assessed over seven nights using wrist actigraphy. Probabilistic reasoning was measured by a behavioral task (beads task) with two scenarios (easy, less uncertainty vs. intermediate, more uncertainty). Multiple regression analyses were used to examine the association of subjective and objective sleep parameters with self-reported impulsivity and probabilistic reasoning task performance.

Results: Thirty-seven participants (mean age: 18.5 $\pm$ 1.71 years, female: 62.3%) were included in the study. Multiple regression analyses showed that actigraphy-estimated wake after sleep onset (WASO) was significantly and negatively associated with beads task performance in the easy scenario ($\beta = -0.79$, $p = .036$), even after controlling for subjective sleep (ISI and PSQI scores), suggesting that increased nocturnal wake time after sleep onset was associated with fewer beads drawn before decision-making, reflecting a more impulsive, jumping-to-conclusions reasoning style. No significant association was found between WASO and performance in the intermediate scenario with more uncertainty. Additionally, there were no significant associations observed between other objective sleep parameters (Sleep Onset Latency, Total Sleep Time, Sleep Efficiency) or subjective sleep measures (ISI, PSQI) and task performance in either scenario. Furthermore, objective or subjective sleep parameters were not significantly associated with trait impulsivity, as measured by BIS.

Conclusions: Disrupted sleep, characterized by objectively measured increased nocturnal awakenings, was significantly associated with more impulsive decision-making. On the other hand, subjective reports of insomnia symptoms and sleep quality were not linked to decision-making performance. Further research should consider exploring underlying mechanisms and examining sleep macro- and micro-structure in relation to decision-making and impulsivity in youth.

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Embodied AI coach for delivering CBT-I in virtual reality- a pilot feasibility study

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Introduction: Recent AI advancements have shown promise in digitalizing psychotherapeutic interventions, including CBT-I, for more cost-effective and scalable interventions. However, most dCBT-I chatbots are limited by their provision of predefined responses in a text-based format. They lack embodied presence of AI (i.e. Embodied AI) for enhancing users' engagement. This also restricts AI's ability to perceive user behaviors and respond adaptively. This study aims to explore the feasibility of using Embodied AI coach for delivering CBT-I in virtual reality (VR).

Materials and methods:

Subjects

Inclusion criteria: 1) adults of Chinese ethnicity, 2) presence of insomnia, as indicated by a score of 8 or higher on the Insomnia Severity Index (ISI).

VR-Based CBT-I program

Embodied AI-Avatar coach

The virtual avatar was designed based on a typical therapist prototype, with a warm and approachable demeanor. Human-like animations (e.g., sitting, talking) and refined facial expressions, including lip synchronization and eye blinking, were integrated. Besides, the avatar made real-time adjustment of its position and eye gaze, as enabled by the movement tracking of the users. The avatar was powered by ChatGPT with an overarching prompt of character's backstory (e.g., roleplaying real-world therapists). A rule-based prompt structure (e.g., a CBT-I workflow) was imposed to determine which following sets of prompts should be utilized by ChatGPT, given users' current reply or question. Thus, a standardized conversation flow with personalized information was achieved. Moreover, the avatar had access to an external knowledge bank with CBT-I knowledge.

Content Design

The interventional content is based on our previous studies with 4 weekly CBT-I modules including (1) psychoeducation about insomnia and sleep restriction, (2) sleep hygiene and behavioral strategies, (3) cognitive restructuring and constructive worry strategies, and (4) stress management and relaxation training.

Procedure

Eligible participants were enrolled in a 4-week Chinese-speaking VR-based CBT-I program, with one module being delivered each week. Participants were asked to complete the ISI and user survey in the final session.

Results: In total, 7 participants (71% female; mean age: 27.14 yrs) were recruited and 6 of them completed the program. In the completer analysis, the results from the pre-intervention ($M=10.17$, $SD=1.94$) and post-intervention ($M=7$, $SD=2.97$) ISI scores indicated that the VR-based CBT-I program significantly reduced insomnia symptoms ($t(6)=-2.71$, $p=.04$), with an apparent large effect size ($d=1.26$). The user survey demonstrated a good level of satisfaction, with 67% of users showing moderate to strong intentions to continue using this virtual AI-Avatar coach to manage their sleep problems. Moreover, 67% of users felt that the utilization of embodied AI and virtual environments resulted in enhanced user experience and engagement.

Conclusions: The pilot data showed promising results with positive user feedback of utilizing Embodied AI Avatar coach to deliver CBT-I among individuals with insomnia. Further development to better leverage immersive technology and further formal comparative study with traditional dCBT-I intervention is needed.

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Sleep Architecture and Neurocognitive Performance in Insomnia Comorbid Obstructive Sleep Apnea Patients

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Introduction: Insomnia and obstructive sleep apnea (OSA) are the two most prevalent sleep disorders. Approximately 30% of individuals with insomnia also meet the diagnostic criteria for OSA, forming a comorbid condition known as Comorbid Insomnia and Sleep Apnea (COMISA). This co-occurrence could lead to elevated risk of disrupted nocturnal sleep, impaired daytime and cognitive function compared to the individual condition. However, few have examined the negative consequences of COMISA using objective cognitive measures. This study aimed to examine the differences in sleep architecture and neurocognitive functions between COMISA and insomnia-only patients, and to investigate whether COMISA is associated with greater sleep and cognitive impairment.

Materials and methods: Participants who met DSM-V criteria for chronic insomnia were included in this study. All participants underwent one night of home-based polysomnography (PSG) and performed a battery of neurocognitive tests including Psychomotor Vigilance Task (PVT), Balloon Analogue Risk Task (BART), Go/No-Go, and N-back tasks (0-, 1-, and 2-back) to assess vigilance, impulse control, and working memory, respectively. OSA was defined as an apnea-hypopnea index (AHI) ≥ 15 events/hour. Daytime sleepiness and fatigue were assessed using the Epworth Sleepiness Scale and the Multidimensional Fatigue Inventory. Group comparisons between COMISA and insomnia-only participants were conducted using independent t-tests or Mann-Whitney U tests, wherever appropriate. Mean reaction time for the PVT, Go/No-Go, and N-back were further analyzed using generalized linear models with a gamma distribution and log link, adjusting for age, gender, and BMI.

Results: A total of 147 adults (mean age: 46.2 ± 14.81 years, males: 21.77%) were recruited in Hong Kong. Thirty participants were classified as COMISA and 117 as Insomnia-only. Compared to the insomnia-only group, COMISA participants were older, had higher BMI, were more likely to be male, and reported significantly greater daytime sleepiness (12.30 ± 3.99 vs. 10.15 ± 4.49 ; $P = 0.018$) but not daytime fatigue. PSG-derived data revealed that the COMISA group had significantly higher oxygen desaturation index, total arousal count, and REM arousal index ($P < 0.005$), but no differences in total sleep time, sleep onset latency, sleep efficiency, or wake after sleep onset. For the neurocognitive performance, COMISA participants exhibited slower reaction time on the PVT (459.02 ± 163.95 vs. 397.64 ± 95.32 ms; $P = 0.047$), Go/No-Go (522.52 ± 74.67 vs. 473.35 ± 71.56 ms; $P = 0.001$), and N-back (570.84 ± 65.46 vs. 528.56 ± 83.85 ms; $P = 0.004$) tasks, with no group differences in error rates. After adjusting for age, gender, and BMI, COMISA participants showed longer mean reaction time on both the 1-back ($B = 0.077$, 95% CI: 0.015–0.139; $P = 0.016$) and 2-back ($B = 0.083$, 95% CI: 0.016–0.150; $P = 0.015$) conditions.

Conclusions: Individuals with COMISA reported greater daytime sleepiness but not higher levels of fatigue compared to those with insomnia alone. Although there was no difference in sleep architecture, COMISA exhibited impairments in vigilance and attention, particularly under higher cognitive load. These findings highlight the need for targeted screening and cognitive monitoring in this high-risk subgroup.

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Analysis of the clinical effect of pulsed electromagnetic field on primary insomnia

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Introduction: To investigate the therapeutic effect of pulsed electromagnetic fields (PEMFs) on primary insomnia.

Materials and methods: A total of 120 patients with primary insomnia admitted to the The First Hospital of Hebei Medical University from January to December 2021 were randomly divided into conventional treatment and sham stimulation group (control group) and conventional treatment and PEMFs stimulation group (PEMFs group), with 60 patients in each group. Before and after 2 weeks of treatment, Pittsburgh Sleep Quality Index (PSQI) was used to evaluate the sleep quality, and Insomnia Severity Index (ISI) was used to evaluate the severity of insomnia.

Results: The total effective rate of PEMFs group was higher than that of control group [81.67% (49/60) vs. 41.67% (25/60); $\chi^2 = 20.306$, $P = 0.000$]. After treatment, the total PSQI score ($F = 228.729$, $P = 0.000$), sleep quality ($F = 87.291$, $P = 0.000$), time to fall asleep ($F = 181.842$, $P = 0.000$), sleep time ($F = 143.355$, $P = 0.000$) and ISI score ($F = 361.348$, $P = 0.000$) of the 2 groups were significantly lower than those before treatment. PSQI total score ($F = 13.297$, $P = 0.000$), sleep quality ($F = 7.573$, $P = 0.007$), time to fall asleep ($F = 9.776$, $P = 0.002$), sleep time ($F = 8.566$, $P = 0.004$), and ISI score ($F = 5.350$, $P = 0.000$) in PEMFs group after treatment were significantly lower than those of the control group.

Conclusions: PEMFs are safe and effective in the treatment of patient with primary insomnia, which can significantly improve the sleep quality, and can be used as a non - drug treatment for patients with primary insomnia.

Ultrasound-Guided Stellate Ganglion Block Combined with Myofascial Trigger Point Needling for Refractory Insomnia with Depression: A Case Report

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Introduction: To investigate the clinical efficacy of ultrasound-guided stellate ganglion block (SGB) combined with myofascial trigger points (MTrPs) needling in a patient with refractory insomnia and comorbid depression, and to explore the regulatory effects of this combined therapy on prefrontal cortex functional activity of the patient.

Materials and methods: The patient was a 58-year-old female, presented with a 10-year history of insomnia accompanied by depressed mood, exacerbated over the past year, with poor response to hypnotic medications and antidepressants. The diagnosis was refractory insomnia and depression. Following informed consent, the patient received ultrasound-guided SGB (administered alternately on left and right sides, once daily for 8 consecutive sessions) combined with MTrPs needling targeting the cervical and temporal regions (including the upper part of scalene muscle at C2 and C4 anterior tubercles, the medial border of the sternocleidomastoid muscle, the upper trapezius, and the temporal muscle; administered once a week for 3 sessions). Pre- and post-treatment Pittsburgh Sleep Quality Index (PSQI), Hamilton Depression Scale (HAMD), and Hamilton Anxiety Scale (HAMA) scores were collected and analyzed to evaluate the therapeutic effects on the sleep architecture and affective symptoms of the patient. Functional near-infrared spectroscopy (fNIRS) was employed to analyze prefrontal cortex functional activity.

Results: The patient demonstrated immediate sleep improvement on the day of initial treatment. After two weeks of intervention, significant improvements were observed in both insomnia and depressive symptoms. Comparative analysis revealed statistically significant reductions in PSQI, HAMD, and HAMA scores, indicating substantial improvements in sleep quality and affective symptoms. fNIRS data demonstrated markedly increased oxyhemoglobin (HbO) concentration in the prefrontal cortex region following treatment, suggesting enhanced prefrontal activation.

Conclusions: This case provides neuroimaging evidence supporting the "hyperarousal" hypothesis in insomnia with comorbid depression, confirming the pivotal role of prefrontal cortex in sleep-wake regulation. The findings elucidate the neurofunctional mechanisms underlying the therapeutic effects of ultrasound-guided SGB combined with MTrP needling, offering novel insights for treatment target selection in refractory insomnia.

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Exploring Subgroup Differences in Response to Digital Cognitive Behavioral Therapy for Insomnia in Preventing Major Depressive Disorder among At-Risk Youth

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Introduction: Previous study has shown that digital (app-based) cognitive behavioral therapy for insomnia (dCBT-I) can reduce the future risk of developing major depressive disorder (MDD) by more than 40% in youth with insomnia disorder and subclinical depression, yet it remains unclear who will achieve the optimal outcomes. The current study aimed to identify different subgroups of at-risk youth who would respond differentially to the dCBT-I intervention.

Materials and methods: This was a secondary analysis of a randomized, parallel group-controlled trial in Chinese youth (aged 15-25 years) with insomnia disorder and subclinical depressive symptoms. A total of 708 participants were randomly assigned to 6-week dCBT-I or 6-week app-based health education (HE). Assessments were conducted at baseline, post-intervention, 6- and 12-month follow-ups. Baseline sleep- and mood related variables were used to determine different subgroups by latent class analysis (LCA).

Results: Three insomnia subgroups were identified through LCA: 1) moderate insomnia with mild depressive and anxiety symptoms (40.3%), 2) moderate insomnia with stronger dysfunctional sleep beliefs, moderate depressive symptoms and mild anxiety symptoms (43.2%), and 3) moderate insomnia with more intense suicidal ideation, moderate depressive symptoms and mild anxiety symptoms (16.5%). The risk of developing MDD over the 12-month follow-up was significantly reduced for youth receiving the dCBT-I in subgroups 2 (14.7% versus 26.6%; hazard ratio [HR] 0.57 [95% CI 0.34 to 0.96]; $P = 0.03$) and 3 (14.8% versus 30.4%; HR 0.44 [95% CI 0.20 to 0.99]; $P = 0.047$) compared with the controls. Higher remission rates of insomnia disorder were observed in youth who received intervention in subgroups 1 (dCBT-I versus HE, 57.0% versus 29.0%; RR 1.97 [95% CI 1.47 to 2.64]; $P < 0.001$) and 2 (52.6% versus 25.2%; RR 2.08 [95% CI 1.53 to 2.84]; $P < 0.001$) at post-intervention, with intervention benefits sustained in both subgroups for at least 6 months.

Conclusions: Youth with insomnia disorder and subclinical depression can be categorized into different subgroups based on their sleep and mental health profiles, which were associated with distinct response patterns to dCBT-I indicated for depression prevention. These findings highlight the importance of further phenotyping at-risk youth to promote the development of personalized prevention for youth depression.

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Differential Efficacy of Online Group BBTI on Fatigue and Sleep in Depressed Patients with Insomnia Symptoms Based on Sleep Reactivity: A Pilot Study

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Introduction: Fatigue and insomnia symptoms are highly prevalent in patients with depressive disorder, severely impeding their quality of life and treatment outcomes. Behavioral-Based Therapy for Insomnia (BBTI) has potential in enhancing sleep quality and alleviating depressive symptoms, which may also relieve the fatigue symptom. This study aims to investigate the differential efficacy of online group BBTI on fatigue and insomnia symptoms in depressed patients with insomnia symptoms, based on their sleep reactivity as measured by the Ford Insomnia Response to Stress Test (FIRST) score.

Materials and methods: Participants meeting the criteria of the Mini-International Neuropsychiatric Interview 6.0 for major depressive episode and with Insomnia Severity Index (ISI) ≥ 8 were randomized into two online groups: the BBTI group (n=33) and the sleep education group (n=16). After excluding four participants due to missing FIRST scores, 33 and 12 participants respectively remained in the intervention and control groups. Measures included subjective assessments (insomnia severity, sleep quality, fatigue, mood) and objective testing with polysomnography (PSG). PSG was conducted for two consecutive nights at baseline (using the second night data to exclude first-night effects) and post-intervention. At baseline, 45 participants were categorized into high sleep reactivity (SR) (n=24) and low SR (n=21) groups based on FIRST scores (>21). Clinical and sleep characteristics were compared between these groups. Twenty-nine participants (13 in high SR group; 16 in low SR group) completed all follow-ups in the BBTI group. Repeated-measures ANOVA was used to compare intervention effects between high SR and low SR groups across baseline, post-intervention, and 3- and 6-month follow-ups.

Results: Among the 45 patients with depressive episodes and insomnia symptoms, high SR was associated with increased subjective depressive symptoms (measured by the Beck Depression Inventory, BDI), reduced subjective positive affect (measured by the Positive and Negative Affect Schedule, PANAS), elevated subjective negative affect (measured by the PANAS), and higher objective sleep microarousal indices (all $p < 0.05$). The interaction between time and SR was statistically significant for the Fatigue Severity Scale (FSS; $p = 0.010$, partial $\eta^2 = 0.358$) and the microarousal index (MAI; $p = 0.003$, partial $\eta^2 = 0.446$). For FSS, high SR patients exhibited higher initial fatigue that decreased significantly post-intervention ($p < 0.05$), while low SR patients showed minimal change. For MAI, high SR patients had higher baseline microarousal indices that decreased significantly post-intervention ($p < 0.05$), whereas low SR patients showed less change. The interaction for subjective sleep onset latency (SSOL) approached significance ($p = 0.056$, partial $\eta^2 = 0.185$), with high SR patients showing a trend toward longer initial SSOL that improved over time, though changes were not statistically significant. Other subjective and objective sleep parameters did not show statistically significant interaction effects differences between the high and low SR groups.

Conclusions: Depressed patients with insomnia symptoms and high SR are characterized by higher negative affect, lower positive affect, more severe depressive symptoms, and increased objective sleep fragmentation. The online group BBTI intervention significantly reduced fatigue and microarousals in this subgroup, although these improvements did not reach statistical significance at later follow-up time points.

Managing Insomnia in an Adult Female with ADHD and Sedative Abuse: A Case Report on the Combined Use of Lemborexant, Agomelatine, and Methylphenidate

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Introduction: Insomnia is a frequent and impairing comorbidity in adults with Attention-Deficit/Hyperactivity Disorder (ADHD), often exacerbated by the core symptoms of hyperarousal, emotional dysregulation, and stimulant treatment. The situation becomes more challenging when insomnia coexists with past sedative misuse, such as benzodiazepine abuse, which limits therapeutic options.

Pharmacological management of insomnia in such patients must balance the need for ADHD symptom control with

strategies that restore circadian stability and improve sleep quality—without inducing dependence or next-day sedation.

Materials and methods: A 38-year-old woman, an art performer and mother of two, presented with persistent insomnia and difficulty falling and staying asleep. She had a longstanding diagnosis of adult ADHD and a history of alprazolam abuse. There was also past cannabis use, although not active at the time of consultation.

The patient had previously tried lemborexant 5 mg (an orexin receptor antagonist) with minimal benefit. After structured discontinuation of alprazolam, a combined regimen was initiated: lemborexant was titrated to 10 mg, agomelatine 25 mg was added for circadian regulation, and methylphenidate was reintroduced for ADHD symptom control. Sleep hygiene education and routine stabilization were also implemented.

Results: After two month of therapy, the patient experienced substantial improvement in sleep quality under the combination therapy. The Pittsburgh Sleep Quality Index (PSQI) score improved significantly, with subjective reports of easier sleep initiation, fewer nocturnal awakenings, and more restorative sleep.

Importantly, ADHD symptoms—such as mental restlessness, distractibility, and emotional lability—were better controlled with methylphenidate, leading to improved daytime functioning. This, in turn, reduced bedtime hyperarousal and mental rumination, indirectly supporting improved sleep onset. The synergistic effects of agomelatine and lemborexant appeared to counterbalance stimulant-induced arousal without inducing sedative side effects or tolerance.

This case illustrates that effective treatment of insomnia in adult ADHD patients with a history of substance misuse may require a strategic pharmacologic combination. Rather than avoiding stimulants, judicious use alongside sleep-promoting agents may yield superior outcomes when carefully titrated and monitored.

Conclusions: Managing insomnia in adults with ADHD and prior sedative abuse is clinically challenging. However, this case demonstrates that a thoughtfully designed regimen—combining lemborexant, agomelatine, and methylphenidate—can lead to meaningful improvement in both sleep and daytime functioning. The key lies in targeting complementary neurobiological mechanisms: orexin inhibition for arousal, melatonergic support for circadian rhythm, and dopaminergic enhancement for executive dysfunction.

This case supports the idea that stimulant use could be considered in patient with insomnia and have ADHD comorbidity. Further exploration of such integrative approaches is warranted.

Effect of Scalp Acupuncture on Neurological Deficits and Insomnia in Patients with Stroke

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Introduction: The scalp acupuncture is a treasure of traditional Chinese medicine treatment. This study was to observe the effect of scalp acupuncture on neurological deficits and insomnia in patients with stroke.

Materials and methods: A total of 40 patients with neurological deficits and insomnia disorders after stroke who were hospitalized in the Department of Neurology were enrolled prospectively from November 2021 to November 2022. According to whether or not scalp acupuncture (SA) treatment was performed, it was divided into a SA group (n = 23) and a control group (n = 17). The observation group received scalp acupuncture therapy in addition to conventional internal medicine treatment. The control group did not receive any acupuncture treatment and only received conventional internal medicine treatment. The NIH Stroke Scale (NIHSS), Modified Rankin Scale (mRS), Pittsburgh Sleep Quality Index (PSQI), and Insomnia Severity Index (ISI) were performed before and after treatment, and reassessed after 3 months and followed up for 6 months. Safety assessment was performed at beginning and at 4 weeks after the treatment.

Results: At 3 and 6 months after treatment, there were statistically significant differences in mRS improvement between the observation group and the control group ($P < 0.05$). After treatment and 3 months of follow-up, there was no significant difference in NIHSS between the two groups ($P > 0.05$), while there was a significant difference in NIHSS between the two groups after 6 months of follow-up ($P < 0.05$). After treatment, the insomnia symptoms of the two groups were improved ($P < 0.05$). After 3 to 6 months of follow-up, the PSQI and ISI scores of the observation group were lower than those of the control group ($P < 0.05$).

Conclusions: Scalp acupuncture has clinical therapeutic value and high safety in reshaping neurological function and improving insomnia symptoms after stroke.

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Psychological Aspects of Sleep Disorders — Insomnia and Maladaptive Cognitions: Results of the Multicenter Study “How Does Russia Sleep? (SleepStudyRu)”

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Introduction: Insomnia is a prevalent sleep disorder with significant impacts on quality of life and mental health ([Porcheret K. et al., 2024](#)). Recent studies highlight the role of cognitive factors, such as rumination, reflection, and perfectionism, in the development and maintenance of insomnia ([N.K. Tang et al., 2023](#)). Additionally, anxiety and depression often accompany insomnia and may impact cognitive factors.

Materials and methods: A cross-sectional study was conducted within the multicenter project "How Russia Sleeps," involving 723 volunteers aged 18 to 65. Validated Russian-language scales were used: Insomnia Severity Index (ISI), Ruminative Responses Scale (RRS), Multidimensional Perfectionism Scale (MPS), Beck's Anxiety Inventory (BAI), Beck's Depression Inventory (BDI).

Results: Psychological Profile Characteristics of Individuals with Sleep Disorders Findings:

- The Insomnia Severity Index (ISI) showed a significant positive correlation with level of depressive rumination ($p \leq 0.01$). A tendency toward repetitive, negatively toned thoughts focused on depressive symptoms was associated with more pronounced sleep disturbances. This aligns with the understanding of rumination as a potential risk factor for the chronicity of insomnia.
- A similarly strong positive correlation was identified between ISI scores and distressing thoughts ($p \leq 0.01$). The presence of cyclical, passive reflections on failures was linked to greater severity of insomnia symptoms.
- A significant positive correlation was also found between ISI scores and levels of reflection ($p \leq 0.01$). This suggests that even relatively constructive, goal-directed thinking related to problem-solving may be associated with difficulties in initiating and maintaining sleep.
- A significant positive correlation was observed between ISI scores and anxiety levels as measured by the Beck Anxiety Inventory ($p \leq 0.01$). Higher anxiety scores were associated with more severe sleep disturbances. This supports the contemporary psychophysiological model of insomnia, which considers anxious experiences as contributing factors to insomnia.
- ISI scores also demonstrated statistically significant positive correlations with various forms of perfectionism:
 - Self-oriented perfectionism ($p \leq 0.01$)
 - Other-oriented perfectionism ($p \leq 0.01$)
 - Socially prescribed perfectionism ($p \leq 0.01$)

Conclusions: Insomnia is significantly associated with cognitive and emotional factors, particularly rumination, distressing thoughts, reflection, anxiety, and depression.

Various forms of perfectionism (self-oriented, other-oriented, socially prescribed) showed significant positive correlations with the severity of insomnia symptoms, indicating a potential role of perfectionistic attitudes in the development and maintenance of sleep disturbances.

These findings underscore the importance of considering cognitive processes in the development of therapeutic

interventions for individuals with insomnia, particularly within the framework of cognitive-behavioral therapy (CBT), including addressing rumination, anxious thoughts, and perfectionistic attitudes.

Effectiveness of Nurse-Led Web-Based and Face-to-Face Brief Behavioral Therapy for Insomnia in Stroke Survivors: A Pilot Randomized Controlled Trial

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Introduction: Insomnia is prevalent among stroke survivors and is associated with adverse outcomes such as increased fatigue, anxiety, and depression. Brief Behavioral Therapy for Insomnia (BBTI) is a structured, short-term intervention that has shown efficacy in managing insomnia. This study aimed to evaluate the effectiveness of nurse-led web-based and face-to-face BBTI compared to Sleep Hygiene Education (SHE) in reducing insomnia severity and associated symptoms in stroke survivors.

Materials and methods: An assessor-blinded, three-arm, parallel-group pilot randomized controlled trial was conducted in an outpatient clinic in Indonesia. Thirty stroke survivors experiencing insomnia were randomly assigned to one of three groups: web-based BBTI, face-to-face BBTI, or SHE. Each intervention comprised four sessions. Data were collected using paper-based questionnaires assessing insomnia severity, daytime sleepiness, anxiety, depression, and fatigue.

Results: All participants completed the study. Both web-based and face-to-face BBTI groups demonstrated significant improvements in insomnia severity, anxiety, depression, and fatigue compared to the SHE group. No significant changes were observed in daytime sleepiness across all groups. The effectiveness of web-based BBTI was comparable to that of face-to-face BBTI in alleviating insomnia and associated symptoms.

Conclusions: Nurse-led web-based BBTI is as effective as face-to-face BBTI in managing insomnia and related symptoms among stroke survivors. Given its accessibility and practicality, web-based BBTI offers a viable alternative for patients with limited access to in-person therapy. These findings support the integration of web-based BBTI into clinical practice for stroke survivors experiencing insomnia.

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Gut microbiota regulate insomnia-like behaviors via gut-brain metabolic axis

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Introduction: Sleep is a complex physiological process and is a critical determinant of physical and mental health. Over the past decade, significant progress has been made in understanding the neural mechanisms of sleep and awakening. However, the initiation and maintenance of the sleep-wake behavior is regulated not only by the central system but is also affected by signals from peripheral tissues. Growing evidence shows that the microbiota-gut-brain axis contributes to the regulation of sleep and may play a critical role in the etiology and pathogenesis of sleep. This study aims to investigate the role of gut microbiota in sleep-wake regulation and its gut microbe-brain axis mechanisms.

Materials and methods: The automatic sleep-wake recording system was used to record the electroencephalogram-electromyogram signal of specified pathogen free and germ free animals. Subsequently, metabolomics was used to screen gut microbiota metabolites that can participate in regulating sleep-wake behavior. Fiber photometry combined with EEG-EMG recording were used to record the calcium activity of orexin neurons to explore their activity during sleep-wake cycle after tributyrin administration. Electrophysiological patch clamp was used to explore electrophysiological properties of orexin neurons in the lateral hypothalamic area after tributyrin administration. We employed shotgun metagenomics and metabolomics to assess characteristics of gut

microbiota metabolic changes in individuals with insomnia and healthy controls. Fecal microbiota transplantation technology was used to explore whether intestinal microbial disturbance can induce sleep disorders.

Results: The absence of gut microbiota can lead to alteration in sleep-wake architecture. After short-term sleep deprivation, the metabolites of hypothalamus and fecal contents of SPF and GF mice were screened. Further *in vivo* experiments showed that tributyrin, a precursor of butyric acid, could promote sleep in mice. Fiber optic recording combined with EEG-EMG monitoring showed that tributyrin promoted sleep by inhibiting orexin neuron activity in lateral hypothalamus. Compared with healthy controls, the α diversity of gut microbiota in insomnia patients decreased, and the abundance of butyrate-producing bacteria decreased significantly. The fecal microbiota transplantation experiment found that colonization of mice with gut microbiota from human donors with insomnia is sufficient to induce insomnia-like behaviors. The butyrate level in the serum of insomnia-like recipient mice was significantly reduced, accompanied by an increase in the activity of orexinergic neurons in the lateral hypothalamus. Finally, our results demonstrate that oral administration of butyrate delays onset of insomnia-like behaviors.

Conclusions: Here, we sought to define functional contributions by the gut-brain signaling molecule to sleep behaviors. We initially found changes in sleep-wake architecture and sleep homeostasis in GF mice. Subsequently, we identified butyrate as a metabolite derived from gut microbiota that promoted sleep by inhibiting orexin neuronal activity in the lateral hypothalamus. The gut microbiota of insomnia patients can lead to the occurrence of insomnia-like phenotypes, and butyrate supplementation can improve the insomnia-like phenotypes of insomnia-like recipient mice. The above results show that under normal circumstances, the body's gut microbiota metabolizes butyrate and participates in the regulation of sleep behavior. In the case of intestinal microbial disturbance, butyrate produced by gut microbiota metabolism is reduced, causing abnormal sleep-wake behavior.

Does the increase or decrease in the patient's vigilance performance during sleep restriction reflect a build-up of sleep pressure that contributes to treatment success in chronic insomnia?

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Introduction: Cognitive behavioral therapy for insomnia (CBT-I) is the first-line treatment for chronic insomnia disorder (CID) and includes sleep restriction therapy (SRT) as a core component. SRT aims to consolidate sleep by reducing wake time in bed and reinforcing the sleep-wake cycle. Previous home-based CBT-I studies have reported increased daytime sleepiness and impaired vigilance during SRT in CID, indicating the patients have similar response to SRT induced sleep pressure as healthy populations. However, these findings may be confounded by poor protocol adherence at home due to the lack of professional supervision. To address this, we investigated changes in daytime sleepiness and vigilance during a two-week, tightly controlled in-lab CBT-I program in patients with CID.

Materials and methods: We retrospectively analyzed clinical data from 56 patients with CID (mean age: 49.5 $\pm$ 14.9 years; 23 female) who completed a standardized two-week CBT-I in house program with the SRT (sleep window: 5-6 hours/night) as the core component at the Clinic Barmelweid, Switzerland. Daily Stanford Sleepiness Scale (SSS), subjective sleep quality (SQ) and psychomotor vigilance tests (PVTs) were performed between 3–4 p.m. . A linear mixed-effects model (LMM) with random slopes and intercepts was used to predict changes in vigilance quantified by the inverse of the mean reaction time (1/RT) of PVT across 10 subsequent working days, adjusting for age, sex, SQ and SSS. Changes in daily SSS scores and SQ were modeled similarly. To assess robustness of subject-specific slope of 1/RT over days, we performed a subject-level (cluster) bootstrap: in each of 500 replicates we sampled 90% of patients with replacement to refit the LMM. Patients were classified as positive-slope (>95% of bootstrap slopes >0), negative-slope (>95% of bootstrap slopes <0), or uncertain otherwise.

Results: SSS negatively ($p < 0.001$) while SQ tends to positively ($p = 0.07$) associate with 1/RT in all patients; however, 1/RT did not significantly change over the 10 days ($p = 0.39$). Similarly, SSS scores showed no significant change across days ($p = 0.14$), but negatively associated with SQ ($p < 0.001$). Overall, SQ significantly improved in our patients over the whole CBT-I ($p < 0.001$). Bootstrap analysis showed that 26 and 19 patients had negative and positive slopes of 1/RT over days, respectively. There was no difference in age ($p = 0.71$) or gender ($p = 1$) between these two subgroups. Notably, the positive-slope group showed significantly improving vigilance ($p < 0.001$) while the negative-group had significantly declining vigilance ($p < 0.001$) when LMM was fit in the two subgroups

separately. In both subgroups, the negative association between SSS and I/RT remained (both $p < 0.001$). SQ positively associated with I/RT in positive-slope group ($p=0.03$), not in the negative-slope group ($p=0.31$).

Conclusions: Contrary to prior home-based studies, our supervised, in-lab CBT-I protocol did not lead to consistent declines in vigilance or increases in sleepiness during SRT. Instead, a considerable proportion of patients showed an improvement in PVT performance, which was associated with reduced sleepiness and improved sleep quality. Improved PVT performance with concomitant reduction in subjective sleepiness could therefore be explained by an improved recovery effect of SRT-induced sleep consolidation.

Memory

Impact of Sleep Disturbance and Hypnotics on the Risk of Dementia: a longitudinal follow-up study

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Introduction: Sleep quality is often impaired in individuals with dementia. However, the relationship between sleep disturbances and dementia remains unclear. This study investigated the association between various sleep domains and the risk of developing dementia in older adults.

Materials and methods: In this retrospective longitudinal study, we enrolled 2,679 adults from three centers in Taiwan. We collected baseline data on age, gender, education, medication use, Clinical Dementia Rating (CDR) scale, Cognitive Abilities Screening Instrument (CASI), Neuropsychiatric Inventory (NPI), History-based Artificial Intelligence Activities of Daily Living (HAIADL), and History-based Artificial Intelligence Clinical Frailty Scale (HAICFS).

Results: We examined demographic, clinical, and neuropsychiatric differences between individuals who converted to dementia (Converters, $N=957$) and those who did not (Non-Converters, $N=1,722$) over an average follow-up of approximately 2.3 years. Compared to non-converters, converters were significantly older, had fewer years of education, lower CASI scores, and higher scores on the CDR-Sum of Boxes (CDR-SB), HAIADL, HAICFS, and NPI. Multivariate analyses identified nighttime awakenings and antipsychotic use as significant predictors of dementia conversion, whereas insomnia was associated with a reduced risk. Interestingly, the use of benzodiazepines and Z-drugs did not increase the risk of dementia.

Conclusions: These findings underscore the importance of early identification and monitoring of specific neuropsychiatric symptoms and medication use in older adults at risk of developing dementia.

The Effect of Melatonin on Hippocampal Synaptic Plasticity in an Acute Sleep Deprivation Model

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Introduction: Sleep is essential for the consolidation of long-term memory. Consequently, sleep deprivation (SD) has well-documented detrimental effects on memory performance and overall cognitive function. Melatonin, a hormone primarily secreted by the pineal gland, plays a key role in regulating circadian rhythms and has also been implicated in modulating synaptic plasticity. Specifically, melatonin has been shown to influence the maintenance of long-term potentiation (LTP) in the hippocampus—a form of synaptic strengthening widely considered a cellular mechanism underlying long-term memory formation. Recent studies have demonstrated that melatonin supplementation enhances long-term memory in both non-sleep-deprived (non-SD) and chronically SD models. To

further investigate the potential therapeutic role of melatonin, this study examined its effects on both long-term and associative synaptic plasticity in the hippocampi of non-SD and SD mice.

Materials and methods: For the SD procedure, mice were subjected to five hours of SD using the gentle handling technique. The functional properties of the hippocampal CA1 region were assessed through field electrophysiological recordings.

Results: Our findings indicate that five hours of SD significantly impairs LTP in the hippocampal CA1 region (mean fEPSP slope = $97.96 \pm 7.74\%$, $P = 0.1304$). Interestingly, melatonin supplementation in non-SD control mice led to a reduction in both long-term (mean fEPSP slope = $102.09 \pm 9.01\%$, $P = 0.8219$) and associative plasticity (mean fEPSP slope = $90.86 \pm 5.31\%$, $P = 0.1194$), suggesting that in the absence of SD, melatonin may exert a dampening effect on synaptic strengthening. However, in SD mice, melatonin supplementation effectively rescued the deficits in both long-term (mean fEPSP slope = $150.33 \pm 3.99\%$, $P = 0.0156$) and associative plasticity (mean fEPSP slope = $194.27 \pm 21.51\%$, $P = 0.0156$). These results suggest that melatonin can prevent or reverse the impairments in hippocampal synaptic plasticity and memory processes induced by acute SD.

Conclusions: Therefore, melatonin may hold promise as a therapeutic agent for mitigating memory deficits associated with sleep loss.

Wakefulness activity-dependent regulation of memory

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Introduction: Sleep plays a critical role in memory consolidation, however, both memory encoding and retrieval take place during wakefulness, underscoring its fundamental importance in maintaining and regulating these memory processes. In contrast to the extensive studies on the role of sleep in memory consolidation, there is a relative lack of studies addressing the impact of wakefulness and the specific circuits that support it on memory.

Materials and methods: We used in vivo calcium imaging, chemogenetics, optogenetics, multi-omics, electrophysiological recording, and EEG/EMG recording with memory behavior tests to explore how wakefulness regulates memory encoding and retrieval.

Results: We first found the structural basis of how wakefulness regulates memory, focusing on the wakefulness system's influence on brain regions involved in memory. Specifically, we targeted a hypothalamic wake-promoting region, the Supramammillary nucleus, which sends dense projections to the memory-related brain region, the dentate gyrus. Then, we highlight that wakefulness regulates memory in an activity-dependent manner, influenced by arousal levels from three perspectives: memory engram cells, synaptic plasticity, and neural oscillations. Additionally, wakefulness promotes memory by regulating adult hippocampal neurogenesis, which represents a novel mechanism to influence memory on a distinct timescale.

Conclusions: Our study demonstrates that wakefulness activity-dependently regulates memory via memory engram cells, synaptic plasticity, and neural oscillations.

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An Sleep-Active Hippocampal Interneuron for Memory Consolidation

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Introduction: Sleep has been recognized as critical for memory. Research in recent decades has established that hippocampal memory replay during sharp-wave ripples is central to memory consolidation in sleep. However, the neural circuits that control ripple generation and memory consolidation remain poorly understood, particularly whether there are specialized cell types or dedicated neural circuits for this process. Here, we systematically investigated the involvement of specialized interneuron circuits for memory consolidation, as the interneurons are the fundamental building blocks of neural circuits that control hippocampal information processing.

Materials and methods: We have systematically examined the activity of different interneurons during the sleep-wake cycle in the hippocampus. Particularly, using a new strategy and single-cell RNA sequencing data, we developed a new transgenic mouse model, specifically targeting the hippocampal sleep-active interneurons. We further examined its contribution to memory consolidation during sleep.

Results: While the majority of hippocampus interneurons are more active during Wake or REM rather than NREM sleep, the primary state for memory consolidation, we identified a genetically defined interneuron population that is selectively active during NREM sleep and is essential for controlling ripple generation and memory consolidation.

Conclusions: We have identified a specialized neural circuit that is dedicated to memory consolidation in the hippocampus.

Sleep Disorders and Sarcopenia: Exacerbating Cognitive Decline in Chinese Women with Mild-to-Moderate Alzheimer's Disease

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Introduction: Sleep disorders and sarcopenia are both risk factors for cognitive deterioration and contribute to the development of Alzheimer's disease (AD). However, few studies have evaluated the relationship between sarcopenia and sleep disturbances in women with AD. The purpose of this study was to investigate the relationship between sarcopenia and sleep status in Chinese women with mild to moderate AD.

Materials and methods: This cross-sectional study recruited 112 female outpatients aged between 60 and 85 years. Demographic characteristics, appendicular skeletal muscle mass index (ASMI), grip strength, and gait speed were assessed. Sarcopenia was diagnosed according to criteria of the Asian Working Group for Sarcopenia. Pittsburgh Sleep Quality Index (PSQI) assessed sleep variables. Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) assessed cognitive function. Binary logistic regression models explored the relationship between sleep variables and cognitive function and sarcopenia, adjusting for potential cofounders.

Results: 门诊患者分为 36 例 AD 合并肌肉减少症 (ADSa) 和 76 例无肌肉减少症的 AD 患者 (ADNSa), 患病率为 32.1%。ADSa 的 ASMI 较低, 握力较弱, 步态速度较慢, 睡眠质量差的发生率较高, 认知功能较差。多因素二元 logistic 回归分析显示, PSQI 总分高 (OR = 1.13)、睡眠质量差 (OR = 2.73)、主观睡眠质量差 (OR = 1.83)、低 MMSE (OR = 0.77) 和 MoCA (OR = 0.76) 评分与肌肉减少症的高几率相关。与睡眠时间 ≤ 15 min 相比, > 60 min (OR = 5.01) 与肌肉减少症相关。与 7-8 小时相比, < 6 小时 (OR = 3.99)、8-9 小时 (OR = 4.48) 和 ≥ 9 小时 (OR = 6.33) 的睡眠持续时间与肌肉减少症相关。

Conclusions: More sleep symptoms and cognitive impairment exist in female patients with sarcopenia. The higher total scores of PSQI, poorer subjective sleep quality, longer sleep latency, excessive and insufficient sleep duration and poorer cognitive function are associated with higher odds of sarcopenia in female patients with mild to moderate AD.

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Age-Related Alterations in SO–Spindle Coupling and Their Impact on Sleep-Dependent Memory Consolidation: A Magnetoencephalography Study

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Introduction: Cognitive decline is common in aging, with memory loss reducing life quality. Sleep, especially the coupling of slow oscillations (SO) and spindles during NREM sleep, is vital for memory consolidation. How aging-

related changes in SO–Spindle coupling affect this process remains unclear. Using MEG, this study examined age differences in neural information flow during SO–Spindle coupling. Findings shed light on sleep-dependent memory mechanisms and potential intervention targets.

Materials and methods:

A total of 99 healthy participants (aged 18–35 and 60–75) were recruited and assigned to nap or wake conditions. All participants completed an episodic memory encoding task. Those in the nap condition underwent a 120-minute MEG-recorded sleep session; wake participants remained at rest for an equivalent duration. Memory performance was assessed pre- and post-intervention.

1. Behavioral outcomes were analyzed using ANOVA to assess the interaction between age group and nap/wake condition.
2. Phase-amplitude coupling analysis was used to extract SO–Spindle coupling phases during NREM sleep, followed by group comparisons (Watson-Williams test) and circular-linear correlations with memory performance.
3. SO–Spindle events were source-localized to the hippocampus, thalamus, and medial prefrontal cortex (mPFC), including the medial orbitofrontal cortex (mOFC) and rostral anterior cingulate cortex (rACC). Granger causality was used to construct directed brain networks. Connectome-based predictive modeling with leave-one-out cross-validation and permutation testing was used to predict memory retention. Group differences in network-memory associations were tested using the Cocor package.

Results:

- **Behavioral Performance:**
Nap-related memory enhancement was age-dependent. Younger adults in the nap condition showed significantly better memory retention than in the wake condition ($p < 0.05$), while no such effect was observed in older adults.
- **SO–Spindle Coupling Phase:**
The mean coupling phase differed significantly between age groups ($p < 0.05$). In younger adults, spindles peaked near SO peaks and were significantly associated with memory retention ($r = 0.48$, $p = 0.047$). In older adults, spindles occurred earlier during the SO upstate and showed no significant memory association ($r = 0.18$, $p = 0.739$), suggesting disrupted temporal precision in coupling may contribute to age-related memory decline.
- **Neural Information Flow:**
 - **Temporal Dynamics:** Two key windows were identified: SO trough (–250 to +250 ms) and SO peak (+300 to +800 ms).
 - **Age-Group Differences:** During the SO peak period, younger adults exhibited significantly stronger directed connectivity from the right thalamus to the left medial orbitofrontal cortex (mOFC) and the right rostral anterior cingulate cortex (rACC) compared to older adults ($P_{FDR} < 0.05$).
 - **Predictive Value:** In younger adults, directed thalamus-to-mPFC connections during the SO peak predicted memory retention. These associations were absent in older adults. Cocor analyses revealed significantly stronger correlations in the younger group for right thalamus to left mOFC ($z = 2.317$, $p = 0.010$) and right rACC ($z = 2.013$, $p = 0.022$).

Conclusions: Sleep supports memory consolidation, but efficacy wanes with age. While younger adults benefit from napping via precise SO–Spindle coupling and thalamocortical connectivity, older adults exhibit decoupling and diminished directional connectivity, particularly in thalamus–mPFC circuits. These disruptions may underlie age-related memory impairment and represent potential targets for intervention.

Targeted Memory Reactivation During NREM Sleep Selectively Modulates Fear Memory Extinction

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Introduction: Sleep plays a crucial role in memory consolidation, with neural oscillations during non-rapid eye movement (NREM) sleep, particularly slow oscillations (SO, 0.5-2 Hz) and sleep spindles (12-16Hz), considered key neurophysiological mechanisms facilitating memory integration. Targeted memory reactivation (TMR), which presents cues associated with specific memories during sleep, has been shown to selectively modulate memory processing. However, its effects on fear memory remain controversial: some studies suggest TMR promotes fear extinction, while others find it enhances fear memory consolidation. Importantly, whether and how TMR influences fear memory processing by modulating sleep-specific oscillatory features, and the precise neural mechanisms involved remain unclear.

Materials and methods: We employed a fear conditioning paradigm where participants learned to associate two distinct tones (CS+) with mild electric shocks, and a third tone served as a control stimulus (CS-). Following conditioning, participants were randomly assigned to either a sleep group (1.5-hour nap) or a wake group (reading task). During NREM sleep or wakefulness, only one CS+ tone (cued tone) was presented without the associated shock, while the other CS+ (uncued tone) served as a within-subject control. Throughout the study, we recorded electroencephalography (EEG) and skin conductance responses (SCR) to assess neural oscillations and autonomic nervous system responses to fear stimuli, respectively.

Results: Participants in the sleep group showed significantly reduced SCR to the cued tone, with no significant changes to the uncued tone; the wake group exhibited no significant response changes to either tone. Event-related potential (ERP) analysis further confirmed that neural response patterns to the cued tone gradually resembled those elicited by the CS- that was never paired with shock. Neural oscillation analysis revealed that presenting the cued tone during NREM sleep significantly enhanced slow wave activity (SW, 0.5-4 Hz) and SO, both of which positively correlated with post-nap fear expression. More importantly, TMR specifically promoted phase-amplitude coupling between SO and sleep spindles, characterized by spindle activity preferentially occurring during the SO up-state. This precise spatiotemporal coupling pattern was observed exclusively in the cued tone condition.

Conclusions: TMR during NREM sleep selectively attenuates fear responses through enhanced SW activity that correlates with fear expression and SO-spindle coupling that may facilitate extinction, demonstrating potential applications for fear-related disorders.

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Movement Disorders

Clinical Research of Acupuncture and Medication Combined Treatment for Restless Legs Syndrome(RLS)

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Introduction: RLS is a neurological sensory and motor disorder characterized by an indescribable and irresistible lower limb discomfort during rest, which seriously affecting patients' sleep and quality of life. Clinical drug treatments often use dopaminergic drugs, but they may have side effects and unstable efficacy. This study aims to evaluate the clinical efficacy of acupuncture combined with Traditional Chinese Medicine (TCM) compared with Western medicine in the treatment of RLS.

Materials and methods: A total of 96 patients with RLS who visited the TCM outpatient department of Beijing Changping Hospital of integrated Chinese and Western Medicine, from March 2022 to March 2024 were selected as the research subjects. They were randomly divided into an observation group and a control group according to the randomized controlled trial (RCT) method, with 48 cases in each group. The observation group was treated with modified TCM formula (Yangxue Roujin Decoction) and acupuncture (acupoints: Zusanli, Sanyinjiao, Yanglingquan, Taichong, etc.), while the control group was treated with oral Levodopa. The clinical efficacy and sleep quality of the two groups were observed after 8 weeks of treatment and followed up for 12 weeks. Evaluation indicators: International Restless Legs Syndrome Rating scale (IRLS); Pittsburgh Sleep Quality Index (PSQI).

Results: The total effective rate of the observation group (89.6%) was significantly higher than that of the control group (64.6%), and the difference was statistically significant ($P < 0.05$). After treatment, the improvement rate of the IRLS and PSQI score in the observation group were significantly better than those in the control group, and the difference was statistically significant ($P < 0.05$).

Conclusions: The combined treatment of acupuncture and medication for RLS can significantly improve clinical symptoms and sleep quality, with few adverse reactions. It provides new ideas for the future integrated traditional Chinese and Western medicine therapy and precision targeted therapy of RLS, and is worthy of clinical promotion and application.

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Autonomic Function Test and Polysomnographic Findings in Parkinson's Disease and Multiple System Atrophy: A Comparative Correlational Study

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Introduction: Parkinson's disease (PD) and multiple system atrophy (MSA) are both α -synucleinopathies characterized by autonomic dysfunction and sleep disturbances. However, their clinical presentations and underlying pathophysiology differ considerably. This study aimed to compare polysomnographic (PSG) and autonomic function test (AFT) profiles between drug-naïve patients with PD and MSA, and to investigate disease-specific correlations between sleep-related and autonomic parameters.

Materials and methods: We retrospectively analyzed 136 patients with PD and 67 patients with MSA who underwent PSG, cardiac [I-123] MIBG scintigraphy, and standardized AFTs prior to initiating any treatment. All subjects reported sleep-related complaints (e.g., excessive daytime sleepiness, snoring, or dream enactment behavior). Group comparisons were performed for PSG and AFT parameters. Pearson or Spearman correlation analyses were used to identify significant associations between sleep and autonomic metrics within each disease group.

Results: Compared to PD, patients with MSA exhibited more severe respiratory disturbances and poorer sleep quality, as evidenced by higher apnea index, arousal index, and lower oxygen saturation and sleep efficiency. AFT measures indicated more advanced autonomic dysfunction in MSA across cardiovagal, cardiadrenergic, and sudomotor domains.

In PD, higher apnea-hypopnea index (AHI) correlated with greater cardiovagal dysfunction, while higher REM sleep percentage was associated with lower blood pressure variability. In MSA, greater AHI was correlated with higher composite autonomic severity scores, longer pressure recovery time (PRT), and exaggerated systolic and diastolic blood pressure (BP) drops. Additionally, reduced sleep efficiency, increased Stage 1 and decreased Stage 2 sleep percentage, and frequent arousals were associated with greater sudomotor dysfunction. Oxygen desaturation and AHI were inversely correlated with Valsalva ratio, reflecting compromised parasympathetic integrity.

Conclusions: PD and MSA show fundamentally different patterns of association between sleep architecture and autonomic dysfunction. Further studies are needed to clarify the mechanisms linking sleep and autonomic dysfunction. Given that sleep-related breathing disorders are potentially modifiable, investigating their impact on autonomic function and long-term clinical outcomes may offer valuable opportunities for early therapeutic intervention, especially in MSA.

Smartphone-based digital phenotyping of motor and non-motor biomarkers across early stages of α -synucleinopathies

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Introduction: Recent advances in smartphone-based digital measurements for neurodegenerative α -synucleinopathies, including Parkinson's disease (PD), have demonstrated promising results in symptom assessment. Nevertheless, existing applications generally have a narrow scope of symptom coverage (e.g., focusing solely on motor features). Thus, we developed a smartphone application *SmartBrainApp* in Hong Kong to comprehensively assess both motor (e.g., movement, speech and facial expression) and non-motor (e.g., psychomotor, cognition, impulsivity) functions of PD (26 tests total). In the current study, we aimed to: 1) validate *SmartBrainApp* among clinical PD patients, and 2) evaluate the ability of the App to detect subtle motor and non-motor changes in the prodromal stage of α -synucleinopathies, i.e., idiopathic/isolated rapid eye movement sleep behaviour disorder (iRBD).

Materials and methods: The validation study was conducted in 44 PD patients (mean age: 67.6 ± 5.5 years; 79.6% male) and 44 age- and sex-matched controls (67.1 ± 5.5 years; 79.6% male), who underwent clinical and traditional paper-and-pencil-based neurocognitive assessments and also completed the *SmartBrainApp* assessment. The content (expert review), construct (correlation with traditional tests), criterion (PD vs. control discrimination) validity, acceptability, and feasibility were evaluated. Test-retest reliability was assessed in a subset of 37 subjects (19 controls and 18 PD). A further assessment was conducted in 125 iRBD patients (68.4 ± 6.5 years; 72.8% male) and 95 age- and sex-matched controls (67.6 ± 5.4 years; 72.6% male), and a comparison of traditional and App features was carried out.

Results: Among 26 tests, 21 (81%) showed satisfactory validity (significant correlation with the traditional assessment and group differences), and 17 of these (81%) also showed acceptable test-retest reliability (intraclass correlation coefficient > 0.6). When combining all digital tests, the sensitivity and specificity for distinguishing PD patients from controls were 88.9% and 85.2%, respectively, reaching an area under the curve (AUC) of 0.93. Among them, pronation-supination movement (AUC = 0.88, accuracy = 84.1%) and leg agility (AUC = 0.84, accuracy = 80.7%) were the optimal App-based motor tests predicting PD. The feasibility was supported by high completion rates ($\geq 97.7\%$) across the assessments, with 97.0% of subjects indicating that the assessments were not difficult to complete and 75.8% preferred the digital format over traditional paper-based methods. In addition, our smartphone-based App was able to capture subtle but significant PD-like abnormalities of iRBD patients in some motor (leg agility, finger tapping, reading and monologue) and non-motor (executive and attentional cognitive functions) tasks that were not detected by conventional assessments. By using all the features of *SmartBrainApp*, the AUC for distinguishing iRBD from controls reached 0.72.

Conclusions: *SmartBrainApp* demonstrated satisfactory validation properties in most motor and non-motor tasks and effectively identified a series of early motor/non-motor deficits in iRBD that were not detected by conventional assessments. This innovative approach addresses the critical need for accessible and objective assessments that can capture the multifaceted nature of PD, potentially enabling earlier detection and more precise monitoring of symptom evolution compared to conventional clinical evaluations.

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Electroencephalographic slowing during REM sleep is a marker of cholinergic dysfunction in Lewy body disorders

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Introduction: Lewy body diseases, including Parkinson's disease (PD) and dementia with Lewy bodies (DLB), represent the second most common neurodegenerative disease in older adults. Recent work has implicated progressive cholinergic system dysfunction as a key contributor to cognitive decline and disease progression in Lewy body disorders. Despite this, simple, non-invasive biomarkers of cholinergic impairment are lacking. Given that cholinergic neurons are actively involved in REM sleep and play a central role in cortical activation, alterations in EEG during REM sleep may offer a unique window into cholinergic network dysfunction.

In this study, we investigated whether REM EEG slowing in particular reflects disruption of key cholinergic hubs, the nucleus basalis of Meynert (NBM) and pedunculopontine nucleus (PPN), and whether this electrophysiological marker relates to cognitive impairment in Lewy body disorders.

Materials and methods: This cross-sectional study included 105 participants: 25 with DLB (mean age = 74.6 ± 6.0 years), 40 with PD (mean age = 64.2 ± 8.6 years), and 40 controls without cognitive impairment (mean age = 66.3 ± 7.7 years). All participants underwent comprehensive neuropsychological assessment and overnight polysomnography. A subset of participants also completed structural and resting-state fMRI within 12 months of their other assessments. Absolute REM spectral power was computed across frontal, central, and occipital regions for standard frequency bands (δ , θ , α , σ , β), and a slowing ratio was defined as $[(\delta+\theta)/(\alpha+\sigma+\beta)]$. NBM volumes were extracted from T1-weighted images, and seed-based functional connectivity was assessed between the NBM and resting-state networks, and between the PPN and thalamus, using the Schaefer 400, Tian subcortical, and probabilistic NBM atlases. Group differences in REM spectral power were assessed using general linear models with permutation testing. Linear regressions were used to examine associations between neuroimaging variables and REM EEG slowing across α -synucleinopathies. All analyses included age and sex as covariates, applying FDR correction where appropriate.

Results: DLB participants showed significantly greater REM EEG slowing in occipital regions compared to PD and controls ($p_{FDR} = 0.006$). Power spectral changes were not associated with NBM volume. However, occipital REM slowing was significantly correlated with; aberrant NBM functional connectivity to the visual ($p_{FDR} = 0.034$), ventral attentional ($p_{FDR} = 0.034$), default mode ($p_{FDR} = 0.037$), and frontoparietal ($p_{FDR} = 0.037$) networks; and deficits in global cognition (MMSE; $p_{FDR} = 0.020$), verbal learning (RAVLT recall; $p_{FDR} = 0.009$), and executive function (Trails B; $p_{FDR} = 0.020$). Altered PPN connectivity to the thalamus was correlated with REM slowing across regions (frontal, $p_{FDR} = 0.008$; central, $p_{FDR} = 0.033$; occipital, $p_{FDR} = 0.033$).

Conclusions: This study demonstrates that REM EEG slowing is associated with cholinergic network dysfunction across Lewy body diseases, and correlates with cognitive impairment across multiple domains. These findings suggest REM EEG slowing may be a non-invasive and transdiagnostic marker of cholinergic dysfunction and cognitive decline in Lewy body disorders, with relevance for disease monitoring, prognosis, and stratification in clinical trials.

Sleep Stage–Specific Aperiodic EEG Spectral Slope Alterations in isolated REM Sleep Behavior Disorder and Neurodegenerative Disorders

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Introduction: Quantitative electrophysiological biomarkers capturing alterations in neural activity during sleep hold promises for improving the early detection and monitoring of Parkinson's disease (PD) and its prodromal stages, isolated REM sleep behavior disorder (iRBD). The spectral slope of the EEG power spectrum provides a frequency-independent measure of cortical excitability. However, there has been limited data in characterizing stage-specific alterations of spectral slope in iRBD and PD populations and its association with the conversion risk of iRBD.

Materials and methods: 404 video-polysomnography recordings from 270 patients with clinically diagnosed iRBD (70.30 ± 6.62 years, 78% male), 46 patients with PD (70.68 ± 6.75 years, 83% male), and 88 age- and sex-matched controls (70.14 ± 7.66 years, 66% male) were studied. Among the iRBD patients, 25 patients eventually converted to neurodegeneration (16 PD, 7 dementia with Lewy bodies, 2 multiple system atrophy) at 5.21 ± 2.86 years follow up. Sleep stages were manually scored according to AASM criteria by experienced technicians. The aperiodic spectral slope, defined as the exponent of the $1/f$ decay in the EEG power spectrum, were estimated using the FOOOF package. The 1–45 Hz spectral slope was computed for each clean 8-second epoch. The spectral slopes were averaged across Wake (prior to sleep onset), N1, N2, N3, and REM stages and all EEG channels (F4,C4,O2). Group differences in mean slope values per stage were assessed via generalized linear model adjusted for age and sex with Bonferroni-corrected post hoc tests. The conversion risk was estimated via Cox proportional hazards regression model.

Results: Spectral slopes demonstrated a clear, progressive flattening from healthy controls to iRBD to PD across all sleep stages. In light sleep (N1), mean slopes were -1.70 ± 0.18 in controls, -1.53 ± 0.25 in iRBD, and -1.38 ± 0.26 in PD ($p < 0.001$). This pattern persisted in N2 (controls: -1.96 ± 0.17 ; iRBD: -1.73 ± 0.27 ; PD: -1.55 ± 0.28 ; $p < 0.001$) and slow wave sleep (N3: controls -2.33 ± 0.21 ; iRBD -2.14 ± 0.23 ; PD -1.88 ± 0.37 ; $p < 0.001$). During REM sleep, slopes averaged -1.74 ± 0.18 in controls, -1.56 ± 0.25 in iRBD, and -1.43 ± 0.29 in PD ($p < 0.001$). In contrast, wake stage showed only a slight flattening (controls -1.20 ± 0.46 ; iRBD -1.12 ± 0.45 ; PD -0.92 ± 0.44 ; $p=0.011$), with post hoc tests revealing a significant difference between PD and controls (mean difference = 0.27, p -corrected=0.003) as well as between PD and iRBD (mean difference=0.204, p -corrected=0.015). A more flattening spectral slope at wake stage was associated with significantly increased risk of phenocconversion (HR=5.15;95%CI:1.73–15.3; $p=0.003$), but not in other sleep stages (N1 $p=0.152$, N2: $p=0.104$, REM: $p=0.095$).

Conclusions: There was progressive flattening of aperiodic EEG spectral slopes from healthy controls to iRBD to PD across all sleep stages. A more flattening of spectral slope at wake stage predicts phenocconversion in iRBD. These findings support the role of spectral slope as a non-invasive biomarker for both staging and risk stratification in prodromal neurodegeneration.

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Clinical and polysomnographic characteristics of periodic limb movements during sleep in obstructive sleep apnea patients and the effect of positive airway pressure therapy

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Introduction: Periodic limb movements during sleep (PLMS) are frequently observed in patients with obstructive sleep apnea (OSA). However, data on the clinical and polysomnographic characteristics of individuals with coexisting OSA and PLMS remain limited. Additionally, the effect of positive airway pressure (PAP) therapy on PLMS remains controversial.

This study aimed to investigate the clinical and polysomnographic profiles of patients with concurrent OSA and PLMS, assess the effect of PAP therapy on PLMS, and identify predictors associated with PLMS outcomes following PAP therapy.

Materials and methods: This retrospective analytical study included randomly selected patients diagnosed with OSA who underwent split-night polysomnography between January and December 2024. Clinical, demographic, and polysomnographic data were collected. PLMS was defined as a periodic limb movement index (PLMI) ≥ 15

events/hour. PLMI was compared between the diagnostic and optimal PAP portions of the study. Optimal PAP therapy was defined by a respiratory disturbance index (RDI) <5 events/hour for at least 15 minutes, including supine REM sleep.

Results: A total of 155 patients were included, with mean age of 58.51 ± 15.33 years; 49.03% were male, and mean BMI was 26.59 ± 5.56 kg/m². Baseline polysomnographic findings included mean sleep efficiency of $79 \pm 12.02\%$, median AHI of 41 (25.9–62.8) events/hour, mean nadir oxygen saturation of $82.51 \pm 10.39\%$, and mean optimal CPAP pressure of 8.87 ± 2.48 cm of water. The median PLMI was 26.2 (18.2–35.8) events/hour. Only 4.5% of the patients met criteria for restless legs syndrome (RLS). During optimal PAP therapy, PLMS improved in 67.7% of the patients, remained unchanged in 1.9%, and worsened in 30.4%. Overall, PLMI normalized in 58% of the patients. Obstructive apnea index (OR 1.037, 95% CI 1.013–1.062; $p=0.003$) and hypopnea index (OR 1.022, 95% CI 1.006–1.039; $p=0.007$) were significant predictors of non-response to PAP therapy.

Conclusions: In patients with OSA and coexisting PLMS, most did not meet criteria for RLS. Notably, PLMS improved in nearly 70% of patients after effective OSA treatment with optimal PAP therapy. Obstructive apnea and hypopnea indices were significant predictors of persistent PLMS despite treatment.

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Narcolepsy

Hormonal Contraceptive and Pitolisant CYP3A4 Induction

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Introduction: Some narcolepsy treatments (e.g. modafinil) are contraindicated in narcoleptic patients taking oral contraceptives as they reduce their plasma levels by inducing CYP3A4. Pitolisant is a wake-promoting and anticataplectic agent approved in Europe, USA, Canada, Israel, China, Taiwan for the treatment of narcolepsy. We assessed its CYP3A4-inducing potential *in vitro* and *in vivo* to possibly offer a therapeutic alternative for patients with narcolepsy wishing to continue their hormonal anticontraceptive treatment.

Materials and methods: In cultured human hepatocytes, pitolisant inducing potential was evaluated on CYP3A4 mRNA and enzyme catalytic activity. *In vivo* induction was evaluated in volunteers receiving pitolisant oad at 36 mg for 7 to 28 days with two approaches. In the traditional one the metabolism of midazolam was evaluated. In the second and more recent one (Goodenough, 2011) formation of a characteristic cholesterol metabolite (4-β-hydroxycholesterol, 4βHC) was measured using a novel LC/MS method requiring only 50 μL serum samples.

Results: Pitolisant demonstrated only minor changes in CYP3A4 mRNA levels whereas CYP 3A4 catalytic activity was not induced in hepatocytes across six subjects. In 18 volunteers receiving 36 mg pitolisant oad for 8 days, minor midazolam exposure modifications were evidenced without change in metabolite formation via CYP3A4. In another group of 48 volunteers receiving 18 to 45 mg oad for up to 28 days, 4βHC level were not modified. This new test was validated in 18 other volunteers receiving for 8 days 600 mg/day of rifampicin, a prototypic CYP 3A4-inducer, in which 4βHC levels were increased ($P<0.00001$).

Conclusions: Pitolisant at therapeutic dose is devoid of any inducer activity on CYP3A4 and, therefore, represents a valuable alternative for treating Excessive Daytime Sleepiness and cataplexy in female patients with narcolepsy taking hormonal contraceptive drugs

Corticotropin-releasing hormone (CRH) in murine narcolepsy: What do genetic and immune models tell us?

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Introduction: Narcolepsy type I is a chronic sleep disorder of putative autoimmune aetiology, primarily caused by the loss of orexin-producing neurons in the hypothalamus. An additional 88% reduction in corticotropin-releasing hormone-immunoreactive neurons of the paraventricular nucleus has been recently observed in post-mortem brains of individuals with narcolepsy type I. It is however unknown whether this reduction is specific to the paraventricular nucleus or involves other brain regions expressing corticotropin-releasing hormone, such as the amygdala, which plays a central role in mood regulation, stress response, and cataplexy. This study examined whether orexin neuron loss and/or hypothalamic neuroinflammation would affect the expression of corticotropin-releasing hormone and other neuropeptides, including melanin-concentrating hormone and histidine decarboxylase as a proof of concept.

Materials and methods: We measured mRNA expression levels of CRH, histidine decarboxylase MCH, and orexin in the hypothalamus and CRH in the amygdala using quantitative PCR, in three NT1 mice models: (1) Orexin-KO mice which lack orexin peptides due to the disruption of the prepro-hypocretin gene; (2) Orexin-DTR mice which experience rapid ablation of orexin neurons after diphtheria toxin administration; and (3) Orexin-HA mice which have an autoimmune-mediated orexin neuron loss accompanied by hypothalamic neuroinflammation.

Results: CRH mRNA expression levels were unchanged in both the hypothalamus and amygdala across all three NT1 mice models compared to controls, regardless of the timeline or mechanism of orexin loss. CRH mRNA expression in the hypothalamus and amygdala did not correlate with levels of orexin mRNA expression. Similarly, HDC and MCH mRNA expression levels were unaffected in NT1 mice models.

Conclusions: Despite the loss of orexin neurons, CRH expression remained unaltered in the hypothalamus and the amygdala. These findings indicate that orexin deficiency alone does not directly influence CRH expression, and additional mechanisms may underlie the reduction of CRH neurons observed in NT1 patients. Further studies are needed to elucidate the mechanisms and functional implications underlying CRH neuron loss in NT1 patients and to determine whether similar changes occur in other brain regions.

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Hypothalamic Functional Connectivity, Depressive Symptoms, and Post-Treatment SOREMPs in Narcolepsy Type I: Links to Sleep Latency and Mediation Mechanisms

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Introduction: Narcolepsy type I (NT1) is characterized by sleep-onset rapid eye movement periods (SOREMPs), reflecting dysregulated rapid eye movement (REM) sleep control. Treatment response variability in SOREMP persistence remains poorly understood, particularly regarding hypothalamic functional connectivity (FC) and depressive symptoms. This study investigated clinical, polysomnographic, and neuroimaging differences between NT1 patients with low (0-1) versus high (≥ 2) post-treatment SOREMPs, and explored whether hypothalamic FC mediates the relationship between depressive symptoms and SOREMPs outcomes.

Materials and methods: One hundred ten NT1 patients were categorized into low (n=62) and high (n=48) post-treatment SOREMPs groups. Demographic, clinical variables (symptoms and questionnaires), and polysomnography (PSG)/multiple sleep latency test (MSLT) parameters were compared. Resting-state fMRI assessed hypothalamic FC with whole-brain regions. LASSO regression modeled associations between FC, sleep latency, and clinical variables, while mediation analysis tested hypothalamic pathways as mediators of depression-SOREMP relationships.

Results: High post-treatment SOREMPs patients exhibited shorter pre/post-treatment REM sleep latency, lower post-treatment wakefulness index, and higher depressive symptom prevalence compared to low SOREMPs patients. Hypothalamic FC differed significantly between groups: low SOREMPs patients showed enhanced connectivity in right medial hypothalamus-right thalamus/left precuneus, left medial hypothalamus-left inferior

parietal lobule (IPL), and right lateral hypothalamus-left IPL pathways, but reduced connectivity in left lateral hypothalamus-right insula/left anterior cingulate cortex pathways ($p < 0.05$, GRF-corrected). LASSO regression identified left medial hypothalamus-left IPL FC as a significant predictor of post-treatment MSLT mean sleep latency ($\beta = 0.272$, $p = 0.001$), alongside age and pre-treatment sleep latency. Mediation analysis revealed complete mediation by two hypothalamic pathways: depressive symptoms predicted reduced right lateral hypothalamus-left IPL FC (indirect effect: 0.15-1.05), associated with fewer SOREMPs, and increased left lateral hypothalamus-right insula FC (indirect effect: 40 0.08-1.14), associated with more SOREMPs.

Conclusions: Hypothalamic-parietal/insular FC abnormalities link depressive symptoms to post-treatment SOREMP variability in NTI, with specific pathways mediating opposing effects on REM sleep regulation. These findings highlight hypothalamic connectivity as a critical neural substrate for treatment response, integrating sleep-wake and emotional processing networks. Targeting these pathways may improve personalized management for NTI patients with comorbid depression and treatment-resistant SOREMPs.

Clinical Phenotypes and Longitudinal Evolution Patterns in Narcolepsy: A Prospective Cohort Study Based on Symptom Cluster Analysis

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Introduction: To explore the heterogeneity and dynamic evolution of clinical phenotypes in narcolepsy by constructing a longitudinal subtype framework using prospective cohort data, and to assess the feasibility of phenotype-based prediction models in clinical practice.

Materials and methods: This study included 252 patients diagnosed with narcolepsy or idiopathic hypersomnia from a prospective cohort at Xuanwu Hospital, Capital Medical University (2021–2024). Baseline and follow-up data were collected at five time points, including clinical symptoms, Epworth Sleepiness Scale (ESS), Ullanlinna Narcolepsy Scale (UNS), REM Sleep Behavior Disorder Questionnaire (RBDQ-HK), polysomnography (PSG), Multiple Sleep Latency Test (MSLT), and cerebrospinal fluid (CSF) hypocretin-I levels. Principal component analysis (PCA) was used to extract core symptom domains. Hierarchical clustering was conducted at each time point to define clinical phenotypes. The stability of cluster structures was evaluated by Adjusted Rand Index (ARI) and Feature Overlap Index (FOI). Symptom trajectories were visualized using Sankey diagrams. Generalized linear mixed models (GLMM) were used to model the longitudinal occurrence probability of cataplexy, hallucinations, and sleep paralysis. A random forest model was constructed to predict phenotypes based on clinical features.

Results: Five principal components were identified, representing cataplexy, hallucinations, sleep paralysis, sleep initiation/maintenance, and REM sleep behavior abnormalities. Four stable clinical phenotypes were observed across timepoints: (1) non-cataplexy, (2) hallucination-dominant, (3) isolated cataplexy, and (4) paralysis-dominant. These phenotypes demonstrated robust structural stability (baseline ARI=0.78; follow-up peak ARI=0.85) and external generalizability (validation cohort ARI=0.69; FOI > 0.95 across phenotypes). Longitudinally, phenotypes showed both symptom persistence and dynamic switching, with distinct trajectories in treatment-naïve vs. treated patients. The simplified prediction model using top 10 clinical variables achieved comparable accuracy to the full model (accuracy > 80%).

Conclusions: Narcolepsy exhibits diverse and evolving clinical phenotypes that are not fully captured by conventional NTI/NT2 classification. Our data-driven clustering approach reveals symptom-specific trajectories and provides a stable, generalizable framework for clinical subtype identification. These findings support the development of phenotype-informed diagnostic and treatment strategies for narcolepsy.

First-Line Treatments for Children with Narcolepsy Type I: Retrospective Comparison of Pitolisant and Modafinil

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Introduction: Narcolepsy Type I (NTI) is a rare, chronic neurological sleep disorder characterized by excessive daytime sleepiness (EDS) and REM sleep-related phenomena, including cataplexy, sleep paralysis, and hallucinations. Over 50% of NTI cases manifest before the age of 20, highlighting the critical need for safe and effective pediatric therapies. Although Modafinil has been widely used to manage EDS in children, its use lacked formal pediatric approval. More recently, Pitolisant, a histamine H3 receptor inverse agonist, has been approved for NTI in children, following randomized controlled trials demonstrating its efficacy in reducing EDS and cataplexy. This study aimed to retrospectively compare the efficacy and tolerability of Modafinil and Pitolisant as first-line pharmacological treatments in children with NTI.

Materials and methods: We included all children diagnosed with NTI between 2009 and 2025 at the National Reference Center for Narcolepsy in Lyon, France. Patients systematically completed validated questionnaires assessing EDS (Adapted Epworth Sleepiness Scale for children, AESS) and depressive symptoms (Children's Depression Inventory, CDI). Anthropometric parameters, polysomnographic (PSG) data, multiple sleep latency test (MSLT) results, and adverse events were collected. Comparative analyses between groups treated with Modafinil or Pitolisant as first-line therapy were conducted using Wilcoxon rank-sum tests, Fisher's exact tests, and multivariable mixed models for ranked variables.

Results: A total of 90 patients (52 boys) were included, with 56 treated with Modafinil and 34 with Pitolisant. Compared to the Pitolisant group, patients treated with Modafinil were younger at disease onset (median 8 vs. 11 years; $p = 0.03$) and diagnosis (median 10 vs. 14 years; $p < 0.001$), with a shorter diagnostic delay (median 1 vs. 2 years; $p = 0.005$). The Modafinil group also exhibited shorter sleep latency on MSLT ($p < 0.001$), lower sleep efficiency on PSG ($p < 0.001$), greater N3 sleep proportion ($p = 0.001$), fewer arousals ($p = 0.01$), and fewer depressive symptoms ($p = 0.005$). No significant differences were observed in baseline AESS scores, cataplexy prevalence (91% vs. 88%), or BMI Z-scores.

After 1 to 5 months of treatment, AESS scores decreased by a median of 5 points with Modafinil and 4 points with Pitolisant (non-significant). The median dosage for Modafinil was 200 mg (range 100–400 mg) and for Pitolisant, 27 mg (range 9–36 mg). Adverse events were reported in 48% of Modafinil-treated patients and 61% of Pitolisant-treated patients, though Pitolisant-related side effects were mostly transient (headaches, insomnia). Treatment discontinuation was significantly higher with Modafinil (81% vs. 31%; $p < 0.001$). Only the Pitolisant group demonstrated a significant reduction in cataplexy frequency (88% to 61.7%; $p < 0.05$). No significant BMI Z-score changes were observed. Adjusted models revealed higher baseline depressive scores and more arousals in the Pitolisant group, with lower treatment discontinuation rates.

Conclusions: This retrospective, real-world study supports Pitolisant as a first-line treatment for NTI in children, showing comparable efficacy in reducing EDS, additional benefits in reducing cataplexy, and significantly lower discontinuation rates than Modafinil. Prospective, long-term studies are needed to further guide pediatric NTI management.

Metabolic comorbidities in narcolepsy: a systematic review and meta-analysis

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Introduction: Narcolepsy is a chronic sleep-wake disorder, but patients also suffer from an increased risk of developing endocrine or metabolic dysfunctions. However, current evidence remains less consistent regarding the prevalence of specific metabolic disorders, especially across the narcolepsy subtypes. To address the disparities and clarify the morbidity risk of metabolic comorbidities in narcolepsy, we performed a systematic review and meta-analysis to delineate the prevalence rates and risk of metabolic disorders in this population and stratified subgroups.

Materials and methods: This meta-analysis assessed the prevalence of metabolic comorbidities in narcolepsy, categorized as Metabolic syndrome (MetS) and associated disorders (i.e., obesity, diabetes, hypertension, and dyslipidemia) and other metabolic disorders (i.e., overweight, prediabetes, pubertal praecox, non-dipping blood pressure, thyroid disease, and cardiovascular disorder). We searched PubMed, Web of Science, EBSCO, and Cochrane Library up to April 8, 2025. Pooled prevalence rates and odds ratios (ORs) between strata and the control group were calculated using the random-effects model. Sensitive analyses examined narcolepsy subtype (i.e., narcolepsy subtype 1, NT1 and narcolepsy subtype 2, NT2), age (i.e., children and adults), sex, stimulants and

utilization of antiepileptic agents, and the presence of orexin deficiency or human leukocyte antigen (HLA)-DQB1*06:02 genotype. For conditions with insufficient data, we performed the systematic review.

Results: A total of 54 studies with 9,827 males and 18,298 females were included. **For the MetS and associated disorders**, obesity emerged as the predominant disorder (29%), while the prevalence of diabetes, hypertension, and dyslipidemia was below 20%. MetS was present in 30%, affecting more than half of the adult patients with NT1. ORs indicated NT1 patients using the stimulants and antiepileptic agents suffered more from hypertension than the drug-naïve ones. Sensitivity analyses showed relatively higher prevalence of obesity (28% vs. 18%) and dyslipidemia (24% vs. 14%) in NT1, and of obesity in children (37% vs. 22%). Males exhibited a predominance in diabetes, hypertension, and dyslipidemia. In patients with confirmed orexin deficiency or the HLA-DQB1*06:02 genotype, the results were similar to NT1, except for a notably high prevalence of dyslipidemia (48%) in the orexin deficiency cluster. **For the other metabolic disorders**, in NT1 patients, Prediabetes and non-dipping blood pressure affected 33% and 53%, respectively. Pubertal praecox involved 18%. Moreover, the pooled prevalence of overweight increased with age. After all, data on cardiac diseases and NT2 patients were limited. The meta-results generated from studies designed with comparison groups showed an elevated risk of metabolic disorders in narcolepsy than the general population and patients with other hypersomnia or diseases, but the findings were less significant compared to the BMI-matched population.

Conclusions: Our study revealed a wide spectrum of prevalent metabolic disturbances in narcolepsy, especially MetS and related disorders. Notably, non-dipping blood pressure and prediabetes are common in NT1, warranting extra attention to their long-term cerebrovascular and cardiovascular risks. Additionally, the trend of increasing overweight but decreasing obesity with age suggests the early disease phase is critical for metabolic deterioration. Given the inconclusive literature and insufficient research on this topic, future studies need to better characterize these disturbances, particularly risk factors and mechanisms underlying orexin dysfunction.

Pan-Cancer Prognostic Modeling Using Narcolepsy-Associated Genes: A Transcriptomic Framework Bridging Sleep Regulation and Tumor Biology

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Introduction: Narcolepsy is a chronic neurological sleep disorder involving dysregulation of REM sleep and immune function. Emerging evidence indicates that genes implicated in narcolepsy may also contribute to oncogenic processes such as epithelial mesenchymal transition (EMT), immune escape, and cell proliferation. However, the potential application of narcolepsy-associated genes as prognostic markers in cancer has not been systematically investigated.

Materials and methods: A curated set of narcolepsy-related genes was identified through literature and neuroimmunology databases. Using transcriptomic profiles from The Cancer Genome Atlas (TCGA), we applied LASSO Cox regression to construct a 12-gene prognostic signature. The derived narcolepsy risk score stratified patients into high- and low-risk groups, and its predictive performance for overall survival (OS), disease-specific survival (DSS), and progression-free interval (PFI) was assessed across 33 cancer types. Validation was performed using independent cohorts from CGGA and GEO.

Results: The narcolepsy-based prognostic model exhibited strong predictive value in multiple cancers, especially lower-grade glioma, clear cell renal carcinoma, and colorectal carcinoma. High-risk groups showed upregulation of EMT-related genes, mitotic activity, and extracellular matrix remodeling, along with reduced immune infiltration. Functional enrichment analysis confirmed that risk-associated genes were involved in immune evasion and tumor-promoting inflammation. Immunohistochemistry (IHC) on tumor tissues further supported the differential expression of selected signature genes.

Conclusions: We present a novel pan-cancer prognostic signature derived from narcolepsy-associated neuroimmune genes. This model reveals a potential mechanistic link between sleep regulation pathways and tumor progression, and offers a clinically relevant tool for risk stratification. The findings support further exploration of sleep-immune-tumor crosstalk as a novel axis in oncology.

Erectile function in Male patients with Narcolepsy

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Introduction: Explore the nocturnal erectile function of male patients with narcolepsy, and whether there are any changes after taking medications for narcolepsy.

Materials and methods: Eighteen adult male patients with narcolepsy admitted to Peking University People's Hospital from September 2024 to April 2025 were selected. Among them, 9 patients took Methylphenidate 9mg and Venlafaxine 75mg per day, and the other 9 patients took Methylphenidate 9mg and Clomiphene 12.5mg per day. Polysomnography (PSG) and Rigiscan tests were performed at night after admission, and the examination was re-conducted 3 days after medication. PSG data were staged strictly according to the standards of the American Academy of Sleep Medicine. Rigiscan data were converted and exported using the Spyder software. Meanwhile, questionnaires such as the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), Athens Insomnia Scale (AIS), International Index of Erectile Function-5 (IIEF-5), Erectile Hardness Score (EHS) questionnaire, and the 19-item Morningness-Eveningness Questionnaire (MEQ-19) were used to collect and analyze scores related to insomnia, anxiety, depression, erectile dysfunction, etc. of the included patients.

Results: About **16.7% (3/18)** of the patients were diagnosed with erectile dysfunction after undergoing tests on two nights. **83% (15/18)** of the patients had an IIEF-5 questionnaire score of less than 21, indicating erectile dysfunction. **88% (16/18)** of the patients had an EHS of less than or equal to 3 and considered that their erections were not firm enough. After the linear regression test, it was found that patients with higher scores in AIS ($p=0.004$), ESS ($p=0.025$) and EHS ($p<0.001$) have lower scores in IIEF-5 and shorter erectile duration after taking medication ($p=0.026$). Meanwhile, patients with higher AIS scores ($p=0.044$) also have higher EHS scores. The results of the paired samples t-test suggest that after taking the medicine, the patients' REM sleep time ($p < 0.001$), proportion ($p = 0.002$), and erection time ($p = 0.001$) all decrease significantly, and the REM sleep latency ($p < 0.001$) significantly prolongs.

Conclusions: There is a close connection between the psychological state of the patients and their erectile function, most male patients subjectively believe that they have erectile dysfunction, a small number of patients objectively have erectile dysfunction. Commonly used medications such as Methylphenidate, Clomiphene and Methylphenidate can significantly inhibit their REM sleep while affecting the erection of patients.

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Weight loss response to GLP-1 RA in adults with narcolepsy cataplexy

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Introduction: Patient with narcolepsy cataplexy(NC) often has weight gain and obesity, probably due to orexin/hypocretin deficiency, which makes the diet more difficult in NC. Glucagon-like peptide-1 receptor agonists (GLP-1RAs) have been demonstrated effective for weight loss in obesity with diabetes or non-diabetes, obstructive sleep apnea, knee osteoarthritis and so on, while their effects on obesity in NC remain unclear. This study explores the weight loss effects of one GLP-1 RAs (semaglutide) in adults with NC.

Materials and methods: This study was conducted between July 2024 and Mar 2025 at the Division of Sleep Medicine, Peking University People's Hospital. Weight loss effects of 12 adults with NC and obesity receiving semaglutide plus lifestyle interventions (Group A) and 24 sex-, age-, and BMI-matched adults with non-NC (Group B), as well as 12 adults with NC and obesity receiving lifestyle interventions alone(Group C). Weight and side effects were measured weekly, while clinical examinations, biological measurements, and questionnaires conducted at baseline and Week 12.

Results: Overall, the average age of the three groups is 29.69 ± 7.63 years, and the vast majority (70.83%) were male in Group A and C(24 adults with NC and obesity). At baseline, the BMIs were 34.09 ± 2.08 for Group A,

33.44±2.38 for Group B and 32.20±4.49 for Group C, with no statistical difference. Both Groups A and B completed 12 weeks on injectable semaglutide with losing 7.72%±4.47% and 7.73%±3.20% bodyweight respectively, while Group C lost 2.41%±2.68% bodyweight. And the weight loss from the baseline was 4.12%, 5.97%, 7.72% for Group A, and 2.56%, 5.43%, 7.73% for Group B, and 1.46%, 1.79%, 2.41% for Group C at Weeks 4, 8, 12, respectively. Additionally, in Group A, 8(66.7%) patients lost≥5% weight, 5(41.67%) patients lost≥10% weight; in Group B, 20(83.3%) patients lost≥5% weight, 6(25%) patients lost≥10% weight; and in Group C, 2(16.67%) lost≥5% weight, with no patients achieving≥10%. The reported adverse events in patients using semaglutide were mainly nausea, vomiting, constipation, and diarrhea.

Conclusions: In adults with NC and obesity, injectable semaglutide resulted in weight loss similar to that observed in matched patients with simple obesity and had a similar side effect profile, while better than lifestyle intervention alone. Although patients with NC have a deficiency in orexin/hypocretin, they can still successfully lose weight with the GLP-I RAs.

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Increased FoxA1⁺ Treg Cells Proportion of Peripheral Blood in Patients with Narcolepsy Type I

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Introduction:

Narcolepsy type I (NTI) is a rare sleep disorder characterized by excessive daytime sleepiness (EDS), cataplexy, hypnagogic hallucinations, and sleep paralysis. The pathological hallmark of NTI is the selective loss of hypocretin (Hcrt) neurons in the lateral hypothalamus, leading to decreased cerebrospinal fluid (CSF) hypocretin-I (Hcrt-I) concentrations. The global prevalence of NTI ranges from approximately 0.02% to 0.18%. Patients often experience disrupted nocturnal sleep, comorbid obstructive sleep apnea hypopnea syndrome, and REM sleep behavior disorder, which significantly impair daily functioning and increase the risk of injury due to cataplexy. The etiology of NTI is multifactorial, involving genetic susceptibility, immune dysregulation, and environmental triggers. Notably, the incidence of NTI rose following the 2009 H1N1 influenza pandemic and vaccination campaigns, highlighting the role of immune mechanisms. Regulatory T (Treg) cell dysfunction has been implicated in autoimmune diseases, contributing to chronic inflammation and tissue damage. FoxA1, a transcriptional activator, regulates Treg cell differentiation and function and has been linked to central nervous system autoimmune diseases. Given these findings, this study aimed to investigate the proportion of FoxA1⁺ Treg cells in peripheral blood mononuclear cells (PBMCs) of NTI patients and explore associations with clinical features, providing insight into potential immunopathogenic mechanisms and therapeutic targets.

Materials and methods: Twenty-one patients with NTI and 21 healthy controls were recruited to this study. All subjects were monitored via polysomnography and multiple sleep latency test (MSLT). The Epworth sleepiness scale (ESS) was used to assess the severity of excessive daytime sleepiness. Patients with NTI were examined human leukocyte antigen (HLA) gene and cerebrospinal fluid hypocretin-I (Hcrt-I) concentration. Peripheral blood samples of all subjects were collected, and Ficoll method was used to separate PBMC. Flow cytometry was used to analyze the percentage of FoxA1⁺ Treg cells.

Results: The CD4⁺ T cells proportion in peripheral blood of patients with NTI group was higher than that in control group (52.32% ± 6.79% vs 45.07% ± 7.06%, $P < 0.05$). The CD25⁺ FoxA1⁺ Treg cells proportion in the CD4⁺ T cell population of patients with NTI was higher than that in the control group (5.20% ± 2.23% vs 2.07% ± 0.88%, $P < 0.001$). There was no significant correlation between the percentage of CD25⁺ FoxA1⁺ Treg cells and the cerebrospinal fluid Hcrt-I concentration, age, MSLT sleep latency or disease duration ($P > 0.05$).

Conclusions: The CD4⁺ T cells proportion in peripheral blood of patients with NTI increased. In the CD4⁺ T cell population, the CD25⁺ FoxA1⁺ Treg cells proportion increased in patients with NTI.

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Attention and Inhibition Deficits in Narcolepsy Type I : Behavioral and Electrophysiological Markers

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Introduction: Cognitive impairments in narcolepsy type I (NTI) significantly compromise daily functioning, but their neural mechanisms remain unclear.

Materials and methods: This study employed multimodal electroencephalography (EEG) analyses to investigate electrophysiological substrates of attention and inhibition deficits in NTI and their association with clinical characteristics, particularly orexin deficiency. High-density EEG recordings were acquired during a Go/NoGo task from 39 NTI patients and 41 age-/sex-matched healthy controls. Behavioral analyses revealed that compared to controls, NTI patients exhibited significantly prolonged reaction times and increased errors across both Go and NoGo conditions.

Results: Electrophysiological analyses demonstrated that NTI patients showed: (1) delayed Go-P3 latencies, meaning impaired response preparation; (2) reduced NoGo-P3 amplitudes, reflecting deficient inhibitory control; and (3) attenuated theta-band power and inter-trial phase consistency across conditions. Notably, decreased theta-band power correlated with both lower orexin levels and slower reaction times.

Conclusions: These findings suggest that orexin deficiency may mediate theta-band oscillation impairments in NTI, which mechanistically contribute to cognitive dysfunction. Thus, we propose theta-band oscillations as a clinically translatable biomarker for NTI-related cognitive deficits, with promising implications for objective monitoring of disease progression and developing EEG-targeted neuromodulation therapies.

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Nocturnal Fragmentation and Dream Enactment behaviors in Narcolepsy: Diagnostic Biomarkers Associated with Hypocretin-I Deficiency

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Introduction: Narcolepsy, a rare chronic neurological disorder, is characterized by excessive daytime sleepiness (EDS) and disrupted nocturnal sleep patterns, substantially compromising patients' quality of life. While EDS and cataplexy are hallmark features, nocturnal manifestations remain undercharacterized. This study investigates distinctive sleep phenotypes in narcolepsy, particularly nocturnal frequent awakenings (at least ≥ 5 times) and REM sleep-related dream enactment behaviors (RBD-like symptoms), aiming to establish clinically relevant biomarkers for early diagnosis and mechanistic exploration.

Materials and methods: In this retrospective cross-sectional study, we analyzed 126 patients with EDS from Xuanwu Hospital from 2023 to 2025, stratified into three groups: type 1 narcolepsy (NT1, n=78), type 2 narcolepsy (NT2, n=21), and clinical controls (CC, n=27; suspected central hypersomnia with normal cerebrospinal fluid hypocretin-I [hcrt-I] levels and negative multiple sleep latency test [MSLT] results). Data collection included standardized questionnaires assessing 35 sleep symptoms and polysomnography (PSG) metrics. Comparative analyses employed χ^2 tests, ANOVA, and ROC curve modeling to identify narcolepsy-specific signatures.

Results: Narcolepsy patients exhibited near-universal EDS (97.4%), with high rates of cataplexy (NT1: 85.7%), hypnagogic hallucinations (38.4%), and sleep paralysis (42.3%). Notably, nocturnal disturbances significantly distinguished narcolepsy from controls: frequent awakenings (89.7% vs. 59.2%; $\chi^2=9.437$, $P=0.002$) and dream enactment behaviors (50.0% vs. 25.9%; $\chi^2=4.022$, $P=0.045$). PSG revealed narcolepsy-specific pathophysiology, including elevated periodic limb movement indices (13.5 ± 28.1 vs. $4.8 \pm 19.9/h$; $P=0.002$) and arousal indices

(24.6 ± 11.4 vs. 17.7 ± 9.0 /night; $P=0.014$). In NTI, arousal indices inversely correlated with CSF hcrt-I levels ($r=-0.257$, $P=0.016$). ROC analysis identified three discriminators: cataplexy (AUC=0.798, sensitivity 88.9%, specificity 70.7%), frequent awakenings (AUC=0.633, sensitivity 85.9%, specificity 40.7%), and dream enactment (AUC=0.608, sensitivity 47.5%, specificity 74.1%).

Conclusions: Nocturnal fragmentation (frequent awakenings) and REM-related motor dysregulation (dream enactment) emerge as clinically significant features of narcolepsy, serving as accessible diagnostic red flags. These phenotypes facilitate early differentiation from other sleep disorders, potentially minimizing diagnostic delays. The inverse relationship between hcrt-I deficiency and nocturnal hyperarousal in NTI suggests hypocretinergic modulation of sleep stability, providing novel mechanistic insights. These findings underscore the importance of comprehensive nocturnal evaluation in narcolepsy workups and lay groundwork for targeted biomarker development.

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Consciousness Denied: The First Cross-National Autoethnographic Study of Diagnostic and Treatment Pathways in Type I Narcolepsy

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Introduction: Type I narcolepsy (TIN) is a rare neurological condition characterized by orexin deficiency, affecting approximately 1 in 2,000 individuals globally. While clinical features and diagnostic criteria are well established, real-world patient diagnostic journeys across different healthcare systems remain critically underexplored. This study presents the first autoethnographic account of a Type I narcolepsy patient navigating six healthcare systems over an 11-year period, validated by cerebrospinal fluid analysis confirming undetectable orexin levels (<50 pg/mL).

Materials and methods: Autoethnographic patient-researcher methodology documented Type I narcolepsy patient experience across mainland China, Singapore, Hong Kong SAR (China), Germany, Spain and Sweden (2014-2025). The dual patient-researcher position provided unprecedented access to institutional mechanisms typically unavailable to external investigators. Data included detailed clinical encounters, diagnostic procedure timelines, pharmaceutical access attempts, institutional accommodation responses, comprehensive medical correspondence, and comparative policy reviews. Cross-cultural analysis systematically compared diagnostic accuracy, treatment availability, financial barriers, accommodation provision, and medical literacy using identical patient presentation. Findings were triangulated with epidemiological and policy literature to contextualize individual experience within documented system-level patterns.

Results: Dramatic disparities emerged across systems, revealing systematic rather than individual barriers.

Diagnostic access: Sweden (free orexin testing) > China (affordable PSG+MSLT, orexin testing available) > Hong Kong (expensive, genetic testing only) > Singapore (prohibitive costs, orexin testing unavailable in public healthcare).

Cross-border medical recognition: Sweden immediately accepted China's sleep study documentation without requiring additional testing. Germany, Spain, and Hong Kong explicitly rejected identical clinical evidence, forcing expensive retesting.

Treatment availability: Sweden (heavily subsidized Modafinil at minimal cost, free sodium oxybate through public healthcare) > Spain (subsidized but heavier patient contributions) >> China (prohibitive Modafinil costs ~\$3000 monthly, accessible locally-manufactured Pitolisant) > Hong Kong/Singapore (Modafinil criminalized and unregistered, available only through regulatory appeals).

Institutional medical literacy: Sweden maintained sophisticated national patient database of ~1000 individuals. China updated comprehensive open-access national clinical guidelines in 2022, officially recognizing narcolepsy as rare condition since 2023, promoting locally-manufactured Pitolisant as first-line treatment. Singapore demonstrated

concerning knowledge gaps, minimized condition as "person falls asleep suddenly" in official health communications, with senior medical experts describing orexin deficiency as "evidence suggests" while explicitly denying established autoimmune pathophysiology.

Employment and accommodation: Sweden's private insurance systematically denied work capacity protection of TIN patients while social insurance resisted permanent disability recognition. Singapore demonstrated institutional employment stigma with public sector HR personnel commenting employees "will get fired if seen napping".

Systematic patterns revealed developed nations without rare disease infrastructure created greater barriers than developing nations with targeted resources. Treatment criminalization in Singapore contrasted with near-free provision in Sweden for identical medical necessity.

Conclusions: This study provides the first autoethnographic, cross-national comparative analysis of Type I narcolepsy diagnostic pathways. Findings demonstrate that healthcare responses correlate with diagnostic literacy rather than national economic development. Results underscore urgent need for harmonized international diagnostic protocols, equitable pharmaceutical access, and evidence-based accommodation and compensation policies. Patient-researcher methodologies offer invaluable insights complementing traditional clinical research for future guideline development.

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Other

Does self-reported sleep duration reflect actigraphy-reported sleep duration in male youth soccer players?

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Introduction: Adequate sleep is essential for health, athletic performance, and recovery, particularly for young athletes facing the demands of continuous practice and competition. However, young athletes often obtain less sleep than recommended. While objectively tracking sleep using devices can be costly for most sports organizations, many rely on self-reported sleep as part of daily wellness assessments. Thus, it is important to determine the accuracy of self-reported sleep indices, as this may influence their effectiveness as part of a monitoring system. This study aimed to compare the agreement between daily self-reported and actigraphy-based sleep duration in male youth soccer players.

Materials and methods: Forty-eight young male soccer players (mean $\pm$ SD, age: 16.7 ± 0.9 years) reported their perceived sleep duration and completed sleep diaries daily while also wearing an actigraphy device for 35 consecutive days (a total of 1,116 individual actigraphy observations and 917 self-reported observations were collected). The reliability and agreement between objective and subjective measures of sleep were estimated. Agreement between measurements was assessed using Bland-Altman limits of agreement, with acceptable limits of agreement set at <30 minutes.

Results: The mean objectively measured sleep duration per participant over the investigated period was $06:41 \pm 00:33$ h, with a coefficient of variation of 16.1%, while the mean self-reported sleep duration per participant over the same period was $07:48 \pm 00:35$ h, with a coefficient of variation of 12.0%. The mean time in bed was $08:11 \pm 00:33$ h, with a coefficient of variation of 14.9% per participant. Results indicated a disagreement between objective and subjective sleep duration, with a mean bias of -1:00 h (95% Confidence Interval (CI): -1:09 to -00:57 h), indicating an overestimation of self-reported sleep duration by 01:00 h and a potential disagreement range of over 2:30 h, as the 95% limits of agreement ranged from -2:09 to 0:15 h (95% CI: lower -02:32 to -02:12 h and upper

00:09 to 00:28 h), suggesting considerable individual variability in agreement. When comparing the time in bed against the perceived sleep duration, data demonstrated a mean bias of 00:28 h (95% CI: 00:21 to 00:35 h), while the limits of agreement ranged from -00:46 to 01:43 h (95% CI: lower -00:56 to -00:39 h and upper 01:36 to 01:53 h).

Conclusions: The current results suggest that coaches and practitioners working with youth soccer players should interpret and use self-reported sleep indices with caution. Self-reported sleep duration appears to align more closely with the objective time in bed than with the actual sleep duration. Thus, when possible, other methods for sleep monitoring should be considered, either alone or in combination with self-reported measures.

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Effects on quality of life and daytime sleepiness between patients treated with CPAP versus CPAP alternatives

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Introduction: Obstructive sleep apnea is the most common sleep related breathing disorder characterised by recurrent episodes of partial or complete airflow obstruction during sleep. If left untreated, it is associated with increased morbidity and mortality. Continuous Positive Airway Pressure (CPAP) remains the primary treatment for most OSA patients due to its efficacy in maintaining airway patency during sleep. However, poor patients compliance to CPAP therapy is a significant barrier to its long-term success, often due to discomfort or inconvenience. In recent years, various surgical interventions have emerged as a promising alternatives for OSA treatment, particularly for patients who are intolerant to CPAP. We would like to compare the improvement in the quality of life and daytime sleepiness of patients with OSA between those treated with CPAP therapy and those treated with CPAP alternatives.

Materials and methods: We conducted a pilot study in the Otorhinolaryngology clinic of University Malay Medical Centre. Patients aged 18 to 80 years old who were diagnosed with OSA of all levels, received interventions in the form of CPAP or CPAP alternatives were recruited to participate in the study. 48 patients completed the Epworth Sleepiness Scale (ESS) and the Calgary Sleep Apnea Quality of Life Index (SAQLI) questionnaires pre and post intervention (within the span of 2 weeks to 2 months).

Results: Both CPAP and CPAP alternatives were effective in improving patient outcomes, as shown by significant reductions in daytime sleepiness (ESS) and improvements in sleep-related quality of life (SAQLI) from pre- to post-treatment within each group.

Comparison between groups, no statistically significant differences were found in Post ESS ($p = 0.429$) or Post SAQLI scores ($p = 0.551$). The magnitude of improvement in sleepiness and quality of life was similar across both treatments. Although the CPAP group demonstrated slightly higher mean Post SAQLI scores, this difference was small and not clinically meaningful.

Conclusions: This preliminary study concluded that there is improvement in the quality of life and daytime sleepiness of patients with OSA treated with CPAP and CPAP alternatives. Though short term improvements are comparable between the two groups of patients, future studies need to be done to assess long term improvement of both arms, compliance of patients to CPAP therapy as well as the long term effectiveness of CPAP alternatives, such as surgical interventions and mandibular advancement devices.

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1) W. Ward Flemons and Marlene A Reimer: Development of a disease specific Health Related Quality of Life Questionnaire for Sleep Apnea

2) Norkhafizah Saddle, Hazama Mohamad, Nor Idaho Mohd Yusof, Dasmawati Mohammad, Norehan Mokhtar and Wan Zaripah Wan Bakar: Validity and reliability of the Malay Version of Sleep Apnea Quality of Life Index (SAQLI)

Efficacy of Intraoral Negative Air Pressure (iNAP) Therapy in Adolescents with Obstructive Sleep Apnea: A Prospective Exploratory Study

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Introduction: The diagnosis and treatment of obstructive sleep apnea (OSA) in adolescents are currently underestimated globally. This prospective study evaluated the effects of the Intraoral Negative Air Pressure (iNAP) Therapy on physiological parameters and subjective experiences in adolescent OSA patients, exploring treatment response differences by OSA severity.

Materials and methods: The iNAP Sleep Therapy System consists of five main components: a console, saliva container, saliva absorbent, flexible polymer tubing, and soft polymer oral interface. It creates and automatically maintains a negative oral pressure gradient. This pulls the tongue and soft palate forward, preventing respiratory events to improve sleep and user quality of life. This prospective study enrolled 13 adolescents (11 males, 2 females; aged 10-17 years), following 2 dropouts from 15 initially recruited who met inclusion criteria (Obstructive Apnea Hypopnea Index [OAHI] > 1 /hour) and underwent a feasibility test. Participants were categorized as severe (OAHI > 10 /hour, n=5) or non-severe (OAHI 1-10 /hour, n=8). All received iNAP therapy with polysomnography (PSG) at baseline, day 1 (Tx1), 1 week (Tx2), and 1 month (Tx3). Key parameters included sleep architecture, OAHI, lowest oxygen saturation (Lowest SpO₂), maximum apnea duration, Oxygen Desaturation Index (ODI), supine AHI, and questionnaire-assessed stress, quality of life (QoL), and daytime sleepiness. Paired t-tests (pre-post) and correlation analyses were performed.

Results: Regarding sleep architecture, overall sleep efficiency improved, N2 sleep decreased ($p < 0.05$), N3 sleep increased (Tx1, $p = 0.043$; Tx3, $p = 0.003$), and REM/NREM respiratory events significantly reduced. Overall, OAHI significantly decreased at Tx1 and Tx3 ($p < 0.05$). Maximum apnea duration significantly shortened at Tx1 ($p = 0.006$) and Tx3 ($p = 0.009$). Lowest SpO₂ significantly increased at Tx2 ($p = 0.031$) and Tx3 ($p = 0.008$). ODI (Tx1, $p = 0.047$; Tx2, $p = 0.013$) and supine AHI (Tx1, $p = 0.013$; Tx2, $p = 0.044$) also significantly decreased. Improvement in OAHI ($\Delta\text{OAHI} = \text{Baseline OAHI} - \text{Tx OAHI}$) showed a strong and progressively strengthening negative correlation with improvement in NREM OAHI (Tx1: $r = -0.81$; Tx2: $r = -0.89$; Tx3: $r = -0.91$). Furthermore, OAHI improvement demonstrated strong correlations with reductions in supine AHI, shorter maximum apnea duration, and increased Lowest SpO₂. At Tx3, 76.9% of all patients achieved >50% OAHI reduction. This rate was 100% in the severe group. In the non-severe group, 62.5% achieved >50% OAHI reduction at both Tx1 and Tx3. Both groups showed significant post-treatment OAHI improvement at Tx1 and Tx3 ($p < 0.05$). The severe group had a 4-8% significant increase in Lowest SpO₂ across all treatment stages ($p < 0.05$) and ODI improvement at Tx2 ($p = 0.036$). The non-severe group had significant maximum apnea duration reduction at Tx1 ($p = 0.042$) and Tx3 ($p = 0.036$). Questionnaire data showed improvements in OSA-18 QoL ($p = 0.08$) and total questionnaire scores ($p = 0.096$) approached statistical significance.

Conclusions: This exploratory study suggests Efficacy of Intraoral Negative Air Pressure (iNAP) Therapy in Adolescents with Obstructive Sleep Apnea: A Prospective Exploratory Study has positive therapeutic effects in adolescents with OSA, with efficacy potentially differing by OSA severity.

Sleep disorders in patients with low back pain and comorbid mood disorders

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Introduction: Low back pain (LBP) seriously impairs individual's quality of life and it is the leading cause of years lived with disability worldwide. LBP often accompanied by anxiety, depression, and sleep disorders. Although some previous studies have found a bidirectional relationship between pain and sleep, there may be a problem of mixed multi-site pain. Additionally, there may still lack of data on comorbid mood disorders (depression and anxiety)

affecting sleep. Therefore, this study aims to systematically analyze the sleep characteristics across different types of LBP by combining subjective sleep data, and further explore the effects of depression and anxiety on sleep.

Materials and methods: This study was conducted using data from the UK Biobank. Participants were classified into three groups according to the duration of LBP: no LBP, acute LBP (<3 months), and chronic LBP (≥3 months). The subjective sleep data included sleep duration, getting up in morning easy, morning/evening person (chronotypes), nap during day, sleeplessness/insomnia, snoring, daytime dozing/sleeping. Covariates included age, sex, body mass index, smoking, drinking, depression, and anxiety. Multiple linear regression models were used to analyze the relationship between LBP types and sleep parameters. Continuous variables were represented by mean $\pm$ standard deviation, while categorical variables were represented by frequency and percentage. Group differences were analyzed by analysis of variance for continuous variables and chi-square tests for categorical variables.

Results: A total of 405,044 patients were enrolled, including 150,121, 11,187, and 14,621 patients with no pain, acute LBP, and chronic LBP, respectively. Comorbid depression and anxiety were significantly more prevalent in patients with chronic LBP than in those with acute LBP or no pain, with depression rates of 15.7%, 17.2%, and 20.3%, and anxiety rates of 17.9%, 20.5%, and 25.4%, respectively. Sleep duration was significantly reduced in the depression group (7.12 ± 1.09 hours) and the chronic LBP with depression group (7.09 ± 1.16 hours), compared to the no pain group (7.26 ± 0.95 hours). Besides, patients with chronic LBP showed more sleep disturbances, such as insomnia, sleep late, nap and daytime dozing, while patients with acute LBP showed more snoring. Patients with LBP comorbidity depression or anxiety significantly reduces sleep time, increases difficulty getting up in morning, sleep late, insomnia. Additionally, patients with chronic LBP without mood disorders have a higher rate of snoring.

Conclusions: LBP significantly affects an individual's sleep quality, and longer pain duration, comorbid depression and anxiety can exacerbate sleep disorders. These findings highlight the need for personalized, integrated interventions targeting both pain and mood disorders, which may better improve clinical outcomes and enhance the quality of life in patients with LBP.

Acknowledgments: We gratefully acknowledge the UK Biobank team for providing the data resource, and all the participants who took part in this project.

Prevalence of Exploding head syndrome (EHS) does not change from year to year

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Introduction: Exploding head syndrome (EHS) is a parasomnia characterized by the perception of loud noises or explosions inside the head during sleep-to-wake transition. However, the prevalence of EHS remains unclear. It is unknown whether the prevalence has changed from year to year. Therefore, we analyzed the change in prevalence of EHS over a 5-year period.

Materials and methods: As part of the Night in Japan Home Sleep Monitoring Study (NinjaSleep study), annual questionnaire survey was conducted among government employees in Koka City, Shiga Prefecture, Japan. To assess EHS, participants were queried “When dozing off or falling asleep, have you ever felt a sudden explosion in your head (e.g., bang, bang) or had the sensation that an explosion had occurred inside your skull?” from 2020 to 2024. Approval for the study protocol (R2017-111) was obtained from the Ethics Committee of the Shiga University of Medical Science.

Results: In total, 1.9% (29/1504), 1.6% (29/1832), 2.6% (48/1873), 1.6% (29/1811), and 2.0% (28/1401) of participants answered positively to the EHS screening questionnaire. No significant differences were found in the prevalence of EHS in these five years ($p=0.187$).

Conclusions: No significant differences in the prevalence of EHS were observed during the 5 years studied. Since EHS is a little-known sleep disorder, it is possible that asking this question every year would increase the percentage of positive responses; however, no obvious change in the positive response rate was observed.

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A Cross-Sectional Pilot Study on the Craniofacial Markers of Obstructive Sleep Apnea in a South Indian Population

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Introduction:

Obstructive Sleep Apnea (OSA) is a prevalent disorder that results in intermittent upper airway obstruction during sleep, leading to fragmented sleep and systemic effects. Specific anatomical features can predispose individuals to this condition by affecting the patency and stability of the upper airway. Variations in cranial base and maxillary length can influence upper airway morphology and contribute to OSA. Most studies on craniofacial anatomy and OSA have been conducted in Western or East Asian populations. There is a need for research focused on the Indian population to account for ethnic and genetic variations in craniofacial morphology, which can help identify specific risks for obstructive sleep apnea.

Materials and methods:

Study design: Cross-sectional descriptive study

Primary Objective:

To identify craniofacial markers associated with symptomatic obstructive sleep apnea (OSA) in a South Indian population.

Secondary Objective:

To assess the relationship between anthropometric measurements (BMI, waist-hip ratio, neck circumference) and craniofacial markers in patients with symptomatic OSA.

Sample size estimation: Pilot study with thirty patients.

Sampling strategy: Consecutive sampling

d. Inclusion criteria:

- Adults > 18-years of age
- Symptomatic and asymptomatic newly diagnosed OSA individuals were determined by ESS and STOP-BANG scores.
 1. Symptomatic OSA Group: Participants with ESS >7, and diagnosed with OSA confirmed by Level 3 PSG.
 2. Asymptomatic OSA Group: Participants with ESS <7 and no symptoms, though mild OSA may be detected via PSG.

e. Exclusion criteria:

1. Prior treatment for OSA(surgical/PAP therapy)
2. History of craniofacial surgery or trauma
3. Pregnancy

Craniofacial imaging : MRI scan, where in single sequence of T1 SPACE 3D imaging / T1 MPRAGE with a single CT screening image was done.

- Soft palate length (mm)
- Tongue length (mm)
- Retropalatal Distance (Anteroposterior and transverse in mm)
- Retroglossal Distance (Anteroposterior and transverse in mm)
- Submental fat (mm)
- Hyoid – Sella Distance
- Hyoid – Nasion Distance
- Hyoid – Supramental distance.

These measurements were analyzed by the radiologist and correlated with indices of OSA severity.

Results: In the 26 patients included in this analysis, 18 had ESS>7 and 8 had ESS <7.

Continuous variables were described as median and IQR, while the Categorical variables were expressed as proportions.

Mann U test was used to compare the groups. Correlations were assessed using the Kendall Taus test.

Majority of the patients were male. There was no statistically significant difference between the baseline characteristics of the two groups.

There was a positive correlation between tongue length, submental fat and the neck circumference. There was a significant correlation between the hyoid to sella distance and neck circumference. However this is a pilot study. The present study will be used to power further work exploring the various craniofacial measurements and its impact on the evaluation and management of OSA

Conclusions: There are previous studies performed in caucasian, asian and specifically north indian populations with OSA. However, there are racial and regional differences in craniofacial features. These are likely to have a differential impact on the presentation and course of illness in patients with OSA.

Further studies are aimed at developing scientific knowledge in this area of sleep medicine research in India.

Acknowledgments: My Students

Insomnia, Stigma, and Depression in Tuberculosis Patients: Longitudinal Insights from a Cross-lagged Model and Growth Models

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Introduction: Depression is prevalent and severe in tuberculosis (TB) patients. It is often linked to insomnia, stigma, lack of social support, and other psychological factors. However, most studies are cross-sectional, which only examine correlations. The longitudinal relationships between depression and other factors are unclear.

Materials and methods: Through convenience sampling, we selected participants for a 6-month longitudinal study. Depression, insomnia, stigma, social support, anxiety, and stress were assessed at the start of treatment (T1), and after one (T2), two (T3), and six months (T4). SPSS 26.0 and Mplus 8.3 were used for data analysis. A cross-lagged model (CLM) and latent growth models (LGMs) were constructed to study longitudinal associations.

Results: In total, 266 TB inpatients were enrolled (166 men, 100 women, mean age 48.1 ± 18.0 years). The comorbid depression detection rate fell from 23.3% at T1 to 10.1% at T4. The CLM showed insomnia at T1 significantly predicted depression at T2 ($\beta = 0.341$, $P < 0.05$). Depression at T1 predicted insomnia at T2 ($\beta = 0.182$, $P < 0.05$). Insomnia at T2 predicted depression at T3 ($\beta = 0.571$, $P < 0.05$). However, depression at T2 did not predict insomnia at T3 ($\beta = 0.073$, $P = 0.165$). Insomnia at T3 predicted depression at T4 ($\beta = 0.216$, $P < 0.05$). Depression at T3 predicted insomnia at T4 ($\beta = 0.174$, $P < 0.05$). The LGM revealed social support as a significant negative predictor of depression progression ($P < 0.05$). Stigma from T1 to T4 had a positive effect on depression over the same period ($P < 0.05$). Anxiety at T1, T2, and T4 positively influenced depression ($P < 0.05$). Perceived stress at T1 had a significant impact on depression ($P < 0.05$).

Conclusions: Insomnia predicts depression in TB patients, supporting interventions that improve sleep quality. The impact of perceived stigma on depression remains significant. Enhanced social support can accelerate recovery, underscoring the need to reduce stigma and increase support in TB depression management.

Sleep EEG Signatures of APOE4 in Older Adults with Subjective Cognitive Impairment

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Introduction: Alzheimer's disease (AD) is the leading cause of dementia and a major global health concern. The APOE4 allele is the strongest genetic risk factor for late-onset AD. Pathological changes such as amyloid- β accumulation and tau pathology begin decades before clinical symptoms, creating a critical window for early detection and intervention. Sleep—particularly non-rapid eye movement (NREM) sleep—plays a central role in glymphatic clearance and has emerged as a promising non-invasive biomarker of early AD-related change.

Subjective Cognitive Impairment (SCI), characterised by self-reported cognitive decline without objective impairment on neuropsychological testing, is increasingly viewed as a potential early manifestation of neurodegeneration. Individuals with SCI are at elevated risk for future development of dementia. However, the relationship between APOE4 status and sleep EEG features in this group remains underexplored.

Materials and methods: Participants (N = 101) were older adults with SCI enrolled in the Healthy Brain Ageing Program. All underwent overnight in-laboratory polysomnography and genotyping. EEG spectral power was calculated for NREM sleep at six standard electrodes (C3, Cz, Fz, O1, Oz, Pz). Relative power in delta, theta, alpha, sigma, and beta bands was derived. Linear models tested the association between APOE4 carrier status and each EEG variable, adjusting for relevant demographic and clinical covariates. Results were corrected for multiple comparisons using FDR.

Results: Seven NREM EEG features significantly differed between APOE4 carriers and non-carriers. Notably, APOE4 carriers exhibited: Decreased delta power at Oz and Pz, Increased beta power at Oz and Pz, Increased sigma power at Oz, Increased alpha power at Oz, Increased theta power at O1.

These changes were most prominent in posterior electrodes. In contrast, no significant effects were observed at frontal (Fz) or central (Cz) sites, suggesting a posterior-dominant spectral profile.

Conclusions: Individuals with Subjective Cognitive Impairment who carry the APOE4 allele exhibit a distinct pattern of NREM sleep EEG alterations, characterised by reduced slow-wave activity and increased fast-frequency power in posterior regions. These findings resemble spectral changes observed in symptomatic AD but are more spatially confined. This suggests that sleep EEG may reflect early electrophysiological disruptions in at-risk individuals, supporting its role as a potential biomarker for preclinical AD.

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Parasomnia

Non-Rapid Eye Movement Parasomnias and Their Impact on Academic Performance in Medical University Students: A Cross-Sectional Study

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Introduction: Parasomnias are undesirable events or experiences that occur during sleep transitions, classified into rapid eye movement (REM) and non-rapid eye movement (NREM) types. NREM parasomnias (arousal disorders) include confusional arousals, sleepwalking, and sleep terrors. Despite knowing that parasomnias can negatively impact, there is a noticeable paucity of studies on parasomnias among university students. This study is the first one in Pakistan to explore the prevalence of arousal disorders, their association with sleep quality, and their impact on the academic performance of university students.

Materials and methods: University students were sampled as part of a cross-sectional investigation. The Arousal Disorder questionnaire was used to evaluate features of NREM parasomnias among the participants, and the Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality and its characteristics. All descriptive and inferential statistical tests were conducted on IBM SPSS 26, and a $p < 0.05$ was considered statistically significant for all applied measures.

Results: The sample consisted of 319 participants of age ranging from 18-25 years [1.46 ± 0.499]. NREM parasomnias were prevalent among $n=211$ (66.1%) female participants as compared to male one $n=108$ (33.9%). Out of all, the prevalence of NREM Parasomnias included confusional arousals (49.2%), sleepwalking (15.4%), and sleep terrors (38.9%). The mean PSQI scores of the participants were 7.94 ± 3.55 , indicating an overall poor sleep quality. Sleep quality was significantly associated with prevalence of confusional arousals ($p < 0.001$), sleep walking ($p = 0.004$), and sleep terrors ($p < 0.001$). Additionally, participants' age was also significantly associated with the prevalence of confusional arousals ($p = 0.012$), with confusional arousals being more common in older age groups. Sleep quality was significantly associated with prevalence of confusional arousals ($p < 0.001$), sleepwalking ($p = 0.013$, $p = 0.004$), sleep terror ($p < 0.001$, $p = 0.001$), respectively. Sleep quality had no significant effect on students' academic performance ($p = 0.382$).

Conclusions: NREM parasomnias were fairly prevalent among university students. Poor sleep quality is strongly linked to a greater frequency of NREM parasomnias. This study focuses on NREM parasomnias among university students, which limits generalizability to non-student populations. Larger-scale studies encompassing a diverse population are warranted to ascertain the relationship between NREM parasomnias and sleep quality.

Acknowledgments: I am thankful to the university students and my coauthors who took part in this study. Their time, honesty, and willingness to share their experiences were important for the success of this research. I also received support from the faculty and the staff at Foundation University School of health sciences which offered the needed resources and handwork throughout this project. Lastly, I am truly thankful to my family and friends who have been so supportive and patient with me and their belief in me at each step of the way.

Knowledge and prevalence of sleep paralysis in medical students from two Latin American universities: UDES Colombia and ULA Venezuela

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Introduction: Sleep paralysis is a state of consciousness and unconsciousness that occurs during sleep, characterized by people being able to open their eyes, but cannot move or speak. They usually experience symptoms such as shortness of breath, chest pressure, and hallucinations. Sleep deprivation resulting from long hours of study in medical students can increase the prevalence of these seizures. The objective of this study was to determine the prevalence of sleep paralysis in a group of students from two Latin American universities and their knowledge about this point.

Materials and methods: Observational, descriptive, cross-sectional study. All first- to third-year medical students from the University of the Andes (ULA) in San Cristóbal, Venezuela and the University of Santander (UDES) in Cúcuta, Colombia, were invited to participate. After signing the informed consent, a questionnaire was applied on the main symptoms of sleep paralysis and another on knowledge about the subject. Statistical analysis was performed with SPSS 22 and significance was considered less than 0.05. For categorical variables, Chi-square was used. The study was approved by the Ethics Committee of the Universidad de Los Andes.

Results: A total of 147 students were included (34.69% UDES and 65.31% ULA). The average age was 21.52 years for UDES (SD: 3.17; min: 17 and max: 35), and 25.38 years for ULA (SD: 2.71; min: 23 and max: 34) ($p < 0.05$). The female sex predominated (68.63% UDES and 65.63% ULA) ($p = n.s.$). For the questions regarding knowledge of sleep paralysis, some of the answers were as follows: 1. Yes, I know what sleep paralysis is (86.36% UDES Vs 98.96% ULA) ($p = 0.0051^*$). 2. It is a sleep disorder (86.27% UDES Vs 95.79% ULA) ($p = 0.045^*$). For the prevalence questions, some of the answers were: 1. Have you ever felt awake while sleeping, but unable to articulate words, scream, and/or move (60.78% UDES Vs 52.08% ULA) ($p = n.s.$). 2. After a long and stressful study day, upon going to bed, have you experienced some of the sensations described above (37.25% UDES Vs 37.50% ULA) ($p = n.s.$).

Conclusions: The prevalence of sleep paralysis tends to be the same in medical students from both countries, however, students from the ULA in Venezuela have a greater knowledge about the pathology than those from the UDES in Colombia. This may be because the lead author of this study is a professor of psychiatry at that school, and he devotes several classes to sleep disorders, which goes a long way toward promoting sleep medicine education at universities.

Acknowledgments: The University of Santander, University of the Andes, University Simón Bolívar and the Venezuelan Academy of Sleep Medicine are thanked for their collaboration in carrying out this study.

Pediatric

Predictors of Napping Frequency Across Early Childhood: Investigating the Effects of Social Factors on Developmental Trajectories

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Introduction: Napping frequency declines dramatically over the first few years of life, and the rate of this decline is thought to reflect an interaction between social and neurophysiological development. However, whether social or contextual factors also effect napping frequency and cessation timing is not well understood. This is problematic, as children's napping behaviours have been associated with a variety of health and developmental outcomes. Previous studies of napping development and its environmental correlates have relied heavily on cross-sectional data and aggregate measures (i.e., asking parents to report 'typical' napping behaviours). These methodological limitations mean that it has been difficult to analyse how sensitive napping frequency is to environmental influence, and have marred our ability to accurately capture variability in developmental trajectories of napping frequency. One social factor in particular, the effect of attending childcare, may have a particularly marked effect on napping frequency due to many childcare centres enforcing a mandatory single nap schedule on children irrespective of their developmental stage. However, the effect of this and other social factors on napping patterns remain largely unknown.

Materials and methods: Data was collected as part of the Sleep Transitions and Regularity Study (STARS), a 4-year longitudinal study tracking the sleep behaviours of ~200 Australian children between the ages of 1 to 5 years. Once per month parents were asked to complete a 1-week recording of their child's napping patterns, childcare attendance, and life events (e.g. illness, family stress, change in living situation, etc.). We performed a hybrid multilevel logistic regression model, controlling for within subjects repeated measures to investigate whether childcare attendance significantly predicted napping frequency over and above the developmental effect associated with age.

Results: Results of a hybrid multilevel logistic regression model indicate that the within-subject effect of attending childcare is associated with a significant reduction in napping frequency until about the age of 3.5 years, at which point the effect diminishes. In other words, very young children who attend childcare nap significantly less than they would otherwise. The effects of other social factors, such as moving home or significant family stress are still to be determined.

Conclusions: This study demonstrates with unprecedented specificity that social factors, alongside ageing, can significantly influence developmental napping frequency behaviours. Our findings have implications for understanding of the relative influence of social and developmental factors on napping frequency, as well as implications for childcare policy and practice around sleep and naps.

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Association Between Spindle Wave Activity and Subjective Sleep Evaluation in Drug-Naïve Adolescents With ADHD and Sleep Complaints

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Introduction: Sleep disorders are frequently observed in neurodevelopmental conditions, and approximately 50% of individuals with attention-deficit/hyperactivity disorder (ADHD) are reported to experience some form of sleep disturbance (Cortese S. et al., *Journal of the American Academy of Child & Adolescent Psychiatry*, 2009). Several studies have examined abnormalities in sleep architecture and sleep-related cognitions in ADHD. However, these studies are often limited by factors such as insufficient control groups, heterogeneity in the diagnostic criteria for ADHD, failure to exclude comorbid psychiatric condition, and potential confounding effects of medication. (Bertisch S.M., *Sleep*, 2014).

Our previous research suggested a paradoxical dissociation between subjective and objective sleep assessments in individuals with ADHD from childhood to adulthood (Kato T. et al., *Journal of Attention Disorders*, 2023). However, the underlying mechanisms of this dissociation remain unclear. Recent studies have suggested a potential association between cognitive functioning and spindle wave (SW) activity during sleep. This study investigated the relationship between SW parameters and subjective sleep perception in drug-naïve adolescents with and without ADHD who underwent clinical polysomnography for sleep-related complaints.

Materials and methods: We retrospectively analyzed data from patients under the age of 18 (n = 70) who presented with sleep disturbances at the Department of Psychiatry and Sleep Medicine at Kurume University Hospital between April 2015 and March 2020. ADHD was diagnosed based on DSM-5 criteria. Patients with comorbid conditions known to affect sleep structure—narcolepsy (NL), idiopathic hypersomnia (IH), obstructive sleep apnea (OSA; AHI ≥ 5), restless legs syndrome (RLS), or periodic limb movement disorder (PLMD)—were excluded. After applying these criteria, the final sample comprised 40 patients. Spindle wave parameters obtained from polysomnography (PSG) were compared between the ADHD and non-ADHD groups. Subjective sleep quality was assessed using the Japanese version of the Epworth Sleepiness Scale (JESS) and the Pittsburgh Sleep Quality Index (PSQI). This study was approved by the Ethics Committee of Kurume University.

Results:

1. The ADHD group showed significantly higher scores on the JESS (15.9 ± 4.4 vs. 11.3 ± 5.3 ; $p = 0.0342$) and the PSQI (8.8 ± 2.7 vs. 5.8 ± 2.4 ; $p = 0.0124$) compared to the non-ADHD group.
2. PSG analysis revealed significantly higher SW counts (112 ± 10.2 vs. 24 ± 4.8 ; $p = 0.0361$) and SW frequency per hour (93.5 ± 10.3 vs. 23 ± 4.6 ; $p = 0.0272$) in the ADHD group, particularly in the slow spindle frequency range.
3. In the ADHD group, the number of slow SW events was positively correlated with the PSQI sleep duration component (C3) ($r = 0.8452$, $p = 0.0341$) and negatively correlated with the subjective sleep duration reported immediately after PSG ($r = -0.7516$, $p = 0.0315$).

Conclusions: These findings suggest that increased spindle activity—particularly within the slow spindle range—may influence the process of subjective sleep evaluation in drug-naïve adolescents with ADHD, independent of comorbid sleep or psychiatric disorders and pharmacological influences.

Inter-Scorer Concordance and Method Agreement in Paediatric Sonomat® Scoring for Sleep Disordered Breathing

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Introduction: The Sonomat® is a contactless sleep monitoring device comprising a mattress overlay embedded with polyvinylidene fluoride (PVDF) sensors and microphones. It records thoracoabdominal movement and acoustic breath sounds, providing indirect surrogates for respiratory effort and airflow. While validation studies have shown promising agreement with PSG in detecting sleep disordered breathing (SDB), the absence of standardised paediatric scoring rules has limited uptake. Recently developed Sonomat-specific paediatric scoring criteria (unpublished) aim to address this gap. This study evaluated inter-scorer concordance using these new rules and assessed agreement between Sonomat and PSG across key respiratory event indices.

Materials and methods: Five trained sleep scientists independently scored 10 sonomat studies using the Sonomat Replay software (© Sonomedical, Balmain, Australia) and following formalised paediatric scoring rules. Scoring outputs included standard respiratory indices: Apnoea Index (AI), Hypopnoea Index (HI), Apnoea-Hypopnoea Index (AHI), Central Event Index (CEI), and Obstructive Event Index (OEI). Each study also had gold-standard Sonomat scoring from a reference expert (AC). Intraclass correlation coefficients (ICC[2,1]) were calculated to quantify inter-scorer reliability for each Sonomat index. Bland-Altman and mean difference analyses were performed to compare Sonomat scores with paired PSG data.

Results: Inter-scorer agreement using the newly developed paediatric Sonomat scoring rules was highest for AI (ICC=0.95), CEI (ICC=0.90), and AHI (ICC=0.85), reflecting excellent reliability between trained scorers. Agreement was lower for OEI (ICC=0.57) and poor for HI (ICC=0.31), indicating inconsistency in the identification of hypopnoeas.

When comparing individual Sonomat scores from the reference scorer (AC) to PSG, Bland-Altman analysis showed the narrowest limits of agreement for OEI (−1.17 to +0.82 events/hour) and AI (−3.71 to +3.00), with the widest limits observed for CEI (−5.11 to +6.45). Mean differences were generally small across all indices, with AHI and CEI showing slight overestimation compared to PSG.

A group mean analysis was also performed, comparing the average Sonomat scores across all five scorers to the PSG reference. Agreement remained strongest for apnoea-based indices (AI, AHI), while greater variability was observed for CEI and HI. The group-level differences were consistent with individual scorer comparisons, supporting the robustness of scoring across the trained cohort.

Conclusions: The use of standardised scoring rules for Sonomat studies in children demonstrated excellent inter-scorer reliability for apnoea-based metrics, supporting its potential clinical utility as a screening tool for SDB in settings where PSG is poorly tolerated or unavailable. The strongest agreement was seen for AI and AHI, both within and across scorers, with acceptable limits of agreement relative to PSG. However, reduced agreement for hypopnoeas and obstructive events highlights the need for ongoing scorer training and refinement of visual interpretation strategies. Notably, hypopnoea scoring is known to exhibit lower inter-scorer concordance even within standard PSG, suggesting that the variability observed with Sonomat is consistent with broader challenges in respiratory event classification. This study reinforces the importance of structured scorer education when implementing new technologies in paediatric sleep diagnostics and provides a foundation for future work using the Sonomat in broader clinical and home-based settings.

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Pulmonary Rehabilitation in Pediatric Scoliosis: A Prospective Pilot of a Risk-Stratified Perioperative Respiratory Pathway involving polysomnography and transcutaneous carbon dioxide measurements

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Introduction: Children with scoliosis are predisposed to perioperative respiratory complications due to restrictive lung mechanics, impaired muscle strength, and ventilation-perfusion mismatch. These risks are further amplified in neuromuscular and syndromic subtypes. Preoperative pulmonary compromise often remains subclinical but becomes evident under the stress of anesthesia and postoperative recovery. This study aimed to evaluate a structured, risk-based pathway that integrates pulmonary assessment and individualized respiratory support to optimize surgical outcomes in children undergoing scoliosis correction.

Materials and methods:

This was a prospective observational study involving 19 children referred to pediatric pulmonology 2–4 weeks prior to scoliosis surgery. Each patient underwent a comprehensive preoperative evaluation, including clinical assessment, spirometry (pre- and post-bronchodilator), extended pulmonary function testing (PFTs) in children over 8 years, polysomnography (PSG), transcutaneous CO₂ (TcCO₂) monitoring, and arterial blood gas analysis when indicated.

Patients were stratified into high-risk (presence of neuromuscular disease, Cobb angle >90°, FVC <60%, or sleep hypoventilation) or low-risk groups. High-risk patients were initiated on non-invasive ventilation (NIV) for at least 2–4 weeks preoperatively. Mechanical insufflation-exsufflation (MI-E) was added based on clinical judgment. Postoperatively, all patients received NIV support for at least one month. Respiratory outcomes were monitored through chest radiographs and clinical evaluation.

Results:

Nineteen patients (mean age 10.7 years; 10 females) were enrolled, of whom 15 underwent surgery. The etiologies of scoliosis included syndromic (40%), neuromuscular (26%), congenital (20%), and idiopathic (13%). Six children were classified as high-risk (five with neuromuscular disease, one with FVC <40%). These patients were initiated on BIPAP with a median preoperative duration of six months. In contrast, low-risk patients used BIPAP for a median of one week preoperatively.

Five neuromuscular patients underwent PSG, with 75% demonstrating moderate-to-severe sleep-disordered breathing and hypoventilation. Postoperatively, NIV was continued in all patients, with long-term continuation in neuromuscular cases. MI-E was used in seven patients, including both with FVC <40%. Two complications were reported—one dural tear with cerebrospinal fluid pleural leak and one case of hypotension. The average hospital stay was 5.4 days, with a mean PICU stay of 2 days.

Statistical analysis showed a significant difference in preoperative FVC values between high- and low-risk groups ($p = 0.031$). However, no statistically significant differences were observed in hospital stay ($p = 0.529$) or MI-E use ($p = 1.0$), likely due to small sample size and variability in disease severity.

Conclusions:

This risk-stratified perioperative respiratory pathway effectively identified high-risk children and facilitated the implementation of tailored respiratory interventions. The integration of preoperative NIV and postoperative continuation, along with MI-E where indicated, was feasible and likely contributed to favorable clinical outcomes. While statistical significance in outcome differences was limited, the pathway demonstrated clinical value and safety. Future studies with larger cohorts and control groups are warranted to validate and refine this model of personalized perioperative respiratory care.

Association of Outdoor Artificial Light at Night with Sleep Duration and Social Jetlag Among Preschool-aged Children

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Introduction: Recent studies have increasingly focused on the influence of outdoor artificial light at night (ALAN) on children's sleep patterns. However, its specific impact on sleep duration and social jetlag in this population remains underexplored. In densely populated urban centers such as Hong Kong, children are increasingly exposed to elevated levels of nighttime illumination. Our previous research demonstrated the detrimental effects of electronic screen use on children's sleep. The present study aimed to examine the association between outdoor ALAN exposure and both sleep duration and social jetlag among preschool-aged children in Hong Kong. The findings are expected to provide important insights into the impact of light pollution on pediatric sleep health and support the development of preventive strategies.

Materials and methods: This study included 3,686 preschool children recruited from kindergartens across four geographical regions in Hong Kong. Parent-completed questionnaires provided information on socioeconomic status (SES), as well as children's and parents' sleep-wake patterns. Outdoor ALAN exposure was assessed within a 1,000-meter radius of each participant's kindergarten address using satellite imagery data, with a spatial resolution of approximately 1,000 meters. To estimate the associations between ALAN exposure and children's sleep duration and social jetlag, a Generalized Linear Mixed Model (GLMM) was employed, with geographical region included as a random effect. Social jetlag misalignment was defined as a difference greater than one hour between weekday and weekend midsleep time, corresponding to the 75th percentile of the distribution in our sample. Bedtime screen exposure was defined as the use of electronic screens within one hour before bedtime.

Results: The mean age of the participants was 3.85 ± 0.99 years, with 52.85% being girls. The average sleep duration was 626.6 ± 60.2 minutes per day. ALAN exposure ranged from 10.18 to 84.28 nW/cm²/sr. A significant negative association was observed between ALAN exposure and children's sleep duration, with each unit increase in ALAN corresponding to an estimated decrease of approximately 0.198 minutes in sleep duration ($P = 0.003$). After adjusting for age, sex, family income, parental education level, and bedtime screen exposure, the association became marginal ($\beta = -0.11$, $P = 0.070$). A significant interaction was identified between ALAN exposure and bedtime screen exposure ($P_{\text{interaction}} = 0.043$), indicating that children exposed to screens at bedtime were more susceptible to ALAN-related reductions in sleep duration ($\beta = -0.21$, $P < 0.001$). We further examined the relationship between ALAN exposure and social jetlag. Children in the highest quartile of ALAN exposure had a significantly higher risk of social jetlag misalignment (OR = 1.131, 95% CI: 1.03–1.68; $P_{\text{trend}} = 0.009$), based on multivariable-adjusted models.

Conclusions: This study found that higher levels of outdoor ALAN were associated with shorter sleep duration and a greater risk of circadian disruption among preschool-aged children. Future research aiming to address the adverse effects of ALAN on children's sleep should also account for indoor light exposure, particularly from electronic screens, to inform the development of more targeted and effective interventions.

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ASSOCIATION BETWEEN PARASOMNIAS AND CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER: A CROSS-SECTIONAL STUDY IN VIETNAM

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Introduction: Attention deficit hyperactivity disorder (ADHD) is frequently associated with sleep disturbances, including parasomnias, which may worsen ADHD symptoms. However, the relationship between ADHD and parasomnias remains underexplored, particularly in newly diagnosed pediatric populations. This study aimed to determine the prevalence of parasomnias and identify associated factors in children with ADHD.

Materials and methods: A cross-sectional study was conducted on 629 children aged 6 – 12 years newly diagnosed with ADHD according to DSM-5 criteria at Vietnam National Children's Hospital. Parasomnias were classified using the ICSD-3, and data on comorbidities and sleep behaviors were collected through structured interviews and sleep diaries. Univariate and multivariate logistic regression analyses were performed to determine significant associations.

Results: Parasomnias were identified in 27.8% of children with ADHD, with NREM-related parasomnias being the most prevalent. The presence of comorbid psychiatric disorders, particularly tic disorders, anxiety-depression,

learning disorders, and intellectual disability, significantly increased parasomnia risk (OR 2.49 – 4.29, $p < 0.001$). Sleep talking was the strongest independent predictor (OR = 5.74, $p < 0.001$). ADHD clinical subtypes were not significantly associated with parasomnias.

Conclusions: Parasomnias are common in children with ADHD and are strongly linked to comorbid conditions and sleep-related behaviors. These findings emphasize the need for routine sleep assessments in ADHD management. Future studies should incorporate longitudinal designs and objective sleep assessments to better understand underlying mechanisms and intervention strategies.

Acknowledgments: We extend our sincere gratitude to the Psychiatry Department at the Vietnam National Children's Hospital for their invaluable support and collaboration in conducting this study. We also thank all the participants and their families who participated. We would like to thank the Sleep Lab Center of the Vietnam Society of Sleep Medicine in Dalat, Vietnam, for their assistance and support.

Robin Sequence: from dilemmas to developing an adaptable standardized stepwise approach to treat upper airway obstruction

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Introduction: Pierre Robin sequence, more recently known as the Robin sequence (RS), is characterized by the clinical triad of micrognathia, glossoptosis and upper airway obstruction (UAO). The lack of a standardized approach to treat upper airway obstruction (UAO) in infants with Robin Sequence (RS) leads to delay in resolution of OSA, poor sleep, hypoxia or hypercarbia, poor feeding, suboptimal growth, and neurodevelopmental impairment, prolonged hospital stays and increases the burden on families and the healthcare service.

Materials and methods: We aimed to review the literature to identify key issues causing variation in clinical practice, assess the knowledge gap, and develop a standardized pathway for managing upper airway obstruction in infants with Robin Sequence. The tripartite framework of Evidence-Based Practice was used. This framework included a systematic review of the literature, extensive consultation with a multidisciplinary team of experts, and feedback from the patients. The consensus was reached over 12 months period by the working group consisting of the hospital's neonatologists, respiratory and sleep specialists, ENT specialists, plastic and craniomaxillofacial surgeons, dentists, geneticists, speech pathologists and patient feedback.

Results: Of the 2672 articles from the initial search, 66 were studied in detail. We identified five pivotal issues prevalent while managing upper airway obstruction in the Robin Sequence which are: 1) how to gain consensus; 2) how to assess the severity of UAO/OSA; 3) which treatment to choose; 4) how to assess treatment effectiveness; and 5) when to follow up or stop treatment. These issues were addressed systematically to develop an adaptable stepwise standardized approach (ASSA) for the assessment and management of UAO/OSA in infants with RS. ASSA has two phases: phase one is the conservative arm and phase two is the escalation arm to more invasive treatment. The main pillars of the pathway are a) early objective assessment of the severity of upper airway obstruction using polysomnography, b) graded treatment approach based on centre-specific preferences, c) early and regular multidisciplinary team discussions, and d) clearly defined criteria for treatment escalation or cessation, discharge, and follow-up.

Conclusions: This unique pathway is based on evidence, consensus of experts and patients feedback. Early objective assessment of UAO/OSA using daytime polysomnography and a graded approach to treatment supports improved outcomes. The pathway provides a stepwise guide to the clinician for the management of upper airway obstruction in infants with Robin Sequence, adaptability for centre-specific treatment preferences and a framework for future comparisons of different treatments.

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Disparities in Maternal Knowledge and Practices on Sleep Training: A Cross-Sectional Analysis of Urban VS Rural Areas

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Introduction: Quality sleep is crucial for the growth and development of children. Sleep training is an effective method to improve the sleep quality of young children. This study aims to identify the knowledge and practices of mothers regarding sleep training for young children in Indonesia.

Materials and methods: This cross-sectional study involved 417 mothers with young children aged 3-36 months in urban and rural areas of Indonesia. Data on socio-demographic characteristics, maternal knowledge, and maternal practices related to sleep training were collected between March and June 2024. Data were collected using forms and questionnaires completed by the participants. Univariate and bivariate analyses were conducted, and comparative analysis between groups was done using the Chi-square and Fisher's exact test.

Results: The Fisher's exact test indicated that mothers in urban areas, with higher education, working in informal sectors, and having a higher economic status had significantly better knowledge of sleep training ($p < 0.05$). No significant association was found between maternal age, residential area, educational background, occupation, economic status, and maternal behavior related to sleep training. Additionally, no significant association was found between maternal knowledge and behavior related to sleep training.

Conclusions: Conclusion

Mothers living in urban areas with higher education, working in informal sectors, and having a higher economic status have significantly better knowledge of sleep training. However, this knowledge is not significantly associated with their behavior in implementing sleep training practices. Further research is necessary to explore the complexities of the relationship between maternal knowledge and behavior in sleep training.

The effectiveness of transcranial magnetic stimulation on sleep structure and quality of life in children with autism

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Introduction: Sleep disorders are common in children with autism spectrum disorder (ASD). Transcranial magnetic stimulation (TMS) could be effect the excitability of neuronal cells that leading to improvements of sleep and quality of life in autistic children. Now a day, studies on clinical mechanisms of TMS in sleep disorders associated with ASD are limited. Therefore, our study aimed to explore the effects of TMS on sleep structure and quality of life in children with ASD.

Materials and methods: The recruitment was directly informed through parents of autistic children in special education school in Nakhon Pathom Province, Thailand. Twenty children with ASD who met the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, were selected in our protocol. The low-frequency TMS 2Hz, 5Hz and 5Hz respectively and intensity of 3mT, 15mT and 30mT respectively were targeted on the prefrontal and dorsolateral cortex on both sides in children with ASD 2 times per week. The frequency and intensity were adjusted every 2 weeks up to maximum frequency and intensity at 6 weeks of treatment. The Sleep Disturbance Scale for Children (SDSC) was performed before treatment and at 12 weeks of intervention. Independent sample t-tests and difference t-tests were used for statistical analysis of the data.

Results: Before treatment the total SDSC score in difficulty falling asleep, sleep maintenance, awakening disorders, sleep-wake transition disorders, excessive daytime sleepiness, and nocturnal hyperhidrosis scores were high in all ASD children. After TMS were performed in all ASD children, after 8, 16 and 24 session of TMS Treatment with protocol of intensity and frequency adjustment every 4 weeks, the total SDSC score in difficulty falling asleep, sleep maintenance, sleep-wake transition disorders, and excessive daytime sleepiness scores were significantly decreased at 24 sessions of treatment ($P < 0.01$). The difference t-test analysis showed that after 24 treatment sessions, the

reduction rates of the total SDSC score, difficulty falling asleep, sleep maintenance, awakening disorders, sleep-wake transition disorders, excessive daytime sleepiness, and nocturnal hyperhidrosis dimensions were significantly decreased. ($P<0.01$).

Conclusions: Low-frequency TMS targeting the prefrontal and dorsolateral cortex in children with ASD can effectively improve their sleep status, and significant improvement can be achieved after 12 weeks (24 sessions) of treatment. Moreover all of children had improved in quality of life in field of ability to learn and communication. Further study in multicenter and large scale population should be performed to achieve more significant statistical data and could be advocated to apply as a non invasive choice of treatment in clinical practice worldwide to improve quality of sleep and quality of life in autistic children.

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I would like to express their sincere gratitude to all of patients and their parents for their participation of this research. I also extend our appreciation to staff of our clinic and special education school in Nakhon Pathom Province, Thailand for providing the necessary facilities and advocacy message to parents of autistic children. Special thanks to my parent for their guidance, encouragement and private fund for this study.

Screening for Paediatric Obstructive Sleep Apnoea (OSA) on a Specialist Outpatient Waitlist: Insights from the First Year of a Sleep Nurse-led Triage Clinic (SNTC)

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Introduction: Development of a Sleep Nurse-led triage clinical pathway for tertiary paediatric sleep referrals aimed to screen for Obstructive sleep apnoea (OSA) and reduce wait-times for tertiary sleep outpatient appointments. OSA is a common condition in children that, if left untreated, can lead to developmental and cognitive challenges. While polysomnography (PSG) remains the gold standard for diagnosis, overnight home oximetry has emerged as a more efficient and affordable preliminary test. Overnight oximetry utilisation for paediatric patients on a sleep clinic waitlist expedites screening for OSA as referral numbers exceed clinical capacity, often leading to long wait-times for specialist assessment.

Materials and methods: Sleep Nurse-led Triage Clinic (SNTC)

Paediatric patients aged 2-18 years, referred for suspected OSA at the Queensland Children's Hospital, were triaged from the Category 2 sleep clinic waitlist to the Sleep Nurse-led Triage Clinic from May 2024 - May 2025 (Category 2 recommended OPD appointment <90 days). A clinical workflow was developed and a nurse phone or in-person appointment was conducted. Demographics, medical/surgical history, neurodevelopmental diagnoses, Paediatric Sleep Questionnaire (PSQ) and home oximetry data was collected. Home oximetry data was analysed by McGill oximetry score (MOS). PSQ>0.75 or McGill 2-4 oximetry score patients were expedited to early sleep physician review and early PSG.

Results:

- 256 SNTC patients were seen from May 2024-May 2025.
- SNTC attendance rate 79%.
- SNTC Appointment summary: Failed to Attend appointment (FTA) (n=55), Sleep behaviour information/support i.e. night terrors, night-time waking (n=5), Refused oximetry (n=3), Follow-up SNTC phone call arranged 3 months post ENT surgery (n=15), Booked Sleep specialist appointment (n=25) i.e. SNTC CN identified clinical concern or complex patient/complex medications, nil evidence of OSA by reported history and PSQ or parental concern. Regional QLD location (n=2), NSW location (n=1) (unable to courier oximeter >200km or across QLD/NSW border).
- 147 home oximetry tests were conducted and 135 patients had sufficient data for sleep specialist scoring of MOS 1-4. Completed PSQ score was matched for all 135 patient oximetry's.

- **MOS1 (n=122) (n=19 flagged as high risk using automated analysis methods)**
- PSQ 0.14-0.95, Diagnostic PSG (n=7), CPAP Titration (n=1), AHI 0.6-20.1/OAHI 0.0-16.6, Age 2-16yrs
- 9.6% of children were MOS2-4, 23% of children were flagged as high risk using automated analysis methods.
- **MOS2-4 (n=13) (n=12 of 13 flagged as high risk using automated analysis methods)**
- Diagnostic PSG (n=9), Referred ENT (n=2), CPAP Titration (n=3)

MOS2 (n=7); PSQ 0.32-0.90, PSG AHI 6.4-24/OAHI 2.6-22.8, Age 4-14 years

MOS3 (n=4); PSQ 0.71-0.76, PSG AHI 0.6-6.6/OAHI 0-4.4, Age 5-11 years

MOS4 (n=2); PSQ 0.45-0.86, PSG AHI 26.4-78/OAHI 26.2-78, Age 3-15 years

Conclusions: The SNTC model improved access and prioritisation for children with suspected Obstructive sleep apnoea (OSA).

Paediatric patients who were asymptomatic or no longer required specialist sleep appointments were discharged, improving clinic capacity. Category 2 appointments exceeding 90 days were reduced.

Clinician-evaluated McGill scored oximetry (MOS1-4) and high-risk oximetry by automated analysis methods, were used to identify children for priority review by sleep specialist.

Children with suspected OSA received expedited access to specialist care, reducing delays in management and treatment.

Acknowledgments: Queensland Children's Hospital Sleep Medicine Department

Current status and perspectives of research on postoperative sleep health in pediatric liver transplant recipients

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Introduction: To summarize the current research status of sleep health in children after liver transplantation, to analyze the characteristics, influencing factors, and evaluation methods of postoperative sleep disorders, to explore nursing intervention measures, and to provide proof for optimizing clinical management.

Materials and methods: We searched PubMed, Web of Science, Embase, Cochrane Library, CINAHL, CNKI, and Wan Fang databases to screen for relevant studies on sleep disorders in children after liver transplantation. The included literature includes studies on sleep quality, influencing factors, evaluation tools, and nursing interventions after liver transplantation in children. Ultimately, 18 eligible articles were included for review and analysis.

Results: Research has shown that sleep disorders in children after liver transplantation mainly manifest as difficulty in falling asleep, increased awakenings, and sleep breathing disorders. The main influencing factors include postoperative pain, incomplete liver function recovery, infection, use of immunosuppressants, hospitalization environment, and psychological factors. The commonly used assessment tools currently include the Pittsburgh Sleep Quality Index (PSQI), the Obstructive Sleep Apnea Specific Quality of Life Questionnaire for Children (OSA-18), and the Multi Lead Sleep Recorder (PSG). Nursing intervention measures involve optimizing ward environment, strengthening family and social support, individualized psychological intervention, and adjusting sleep behavior. However, there are still problems in current nursing practice such as insufficient standardization of intervention measures and lack of long-term follow-up data.

Conclusions: Sleep disorders after liver transplantation in children have a significant impact on their growth, development, and quality of life. Systematic evaluation should be strengthened, individualized nursing plans should be optimized, and environmental regulation, psychological support, and behavioral intervention strategies should be comprehensively used to improve postoperative sleep health. Large-scale, multi center research is needed to verify the effectiveness of nursing interventions and promote the clinical translation of personalized and multidimensional nursing models.

Establishing Consensus Guidelines for the Assessment and Management of Sleep-Disordered Breathing and Behavioural Sleep Disturbance in Children with Neurodisability: A Delphi Study

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Introduction: Children with neurodisability (ND) exhibit disproportionately higher rates of sleep-disordered breathing (SDB) and behavioural sleep problems, compared to their peers. Sleep disorders have a profound developmental impact on the child, affecting physical and psychological wellbeing. To date there are no evidence-based guidelines, specifically developed for the management of sleep problems in children with neurodisability. This study describes the preliminary findings from a modified Delphi process underway in Australia and New Zealand, aiming to develop consensus recommendations to inform management of sleep disorders in children with Neurodisability.

Materials and methods: A modified e-Delphi methodology was employed to achieve expert consensus on the management of sleep problems in children with neurodisability. Accredited paediatric sleep medicine specialists in Australia and New Zealand, were invited to participate in 2 iterative rounds of online surveys and a virtual round table discussion with key stakeholders, including consumers, other specialists caring for children with ND, psychologists, sleep nurses and pharmacists. Questions in round 1 included those designed to understand the current interventions and management practices used in routine practice, including pharmacotherapy, medical and behavioural sleep interventions. Consensus was defined as $\geq 80\%$ agreement on items.

Results: Thirty participants completed round 1 of the Delphi survey, the majority of whom were senior medical staff (87% with 50% >15yrs experience) working in public hospitals (67%) with on-site sleep laboratories (97%). While 73% of consultants felt confident managing sleep problems in children with neurodisability (ND), only a third agreed they had received sufficient training in this area. Clinicians estimated that over half of children with ND experience sleep problems, with many estimating that 25–75% of their sleep clinic population had a neurodisability. Almost half of the participating clinicians expressed a desire for more evidence-based resources, with a third acknowledging the gap in this area.

Assessment of sleep varied, with 80% routinely evaluating a broad range of parent concerns, including disordered breathing, behavioural sleep problems, impact on daytime functioning and family wellbeing. 80% of clinicians reported “rarely” using validated sleep screening measures in their assessment.

For sleep-disordered breathing (SDB), Level 1 polysomnography was the most common investigation (93%), with home oximetry (80%) and parent-recorded videos (50%) also used. Half of the clinicians surveyed, reported modifying their standard approach for managing SDB when caring for children with ND.

For non-respiratory sleep problems, 50% reported using modified behavioural sleep interventions, and 40% initiated medications earlier in children with ND when compared to NT children. Other tools used included paper sleep diaries, videos and actigraphy.

Analysis of subsequent rounds of the Delphi process are underway.

Conclusions: Using a Delphi approach provides a methodologically robust pathway for developing the 1st consensus statement for the management of sleep problems in children with ND. Preliminary data from this study suggests that many specialists modify their standard approach to sleep disorders for children with ND and practices vary. Subsequent rounds of this study will determine final recommendations for optimal management of sleep disorders in children with ND, aiming to improve outcomes for this population by modifying sleep.

Acknowledgments: Moya Vandeleur, Karen Waters, Jasneek Chawla

Obstructive sleep apnea and sleep disorders in children with attention deficit hyperactivity disorder

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Introduction: Sleep disorders are common yet often underdiagnosed in children with attention-deficit/hyperactivity disorder (ADHD). These disturbances can exacerbate ADHD symptoms and negatively affect cognitive, emotional, and behavioral functioning. This study aimed to describe the prevalence of obstructive sleep apnea (OSA) and other sleep disorders in children with ADHD using standardized diagnostic criteria, and to identify associated clinical and behavioral factors

Materials and methods: A cross-sectional study was conducted on 629 children aged 6 to 12 years (mean age: 7.8 ± 1.5 years) who were diagnosed with ADHD. Sleep disturbances were assessed using the Children's Sleep Habits Questionnaire (CSHQ), the Pediatric Sleep Questionnaire (PSQ), and Respiratory polygraphy. Sleep disorders were classified based on the International Classification of Sleep Disorders, Third Edition (ICSD-3). Multivariate logistic regression was used to identify associated risk factors.

Results: Sleep disorders were diagnosed in 70.0% of children with ADHD. The most common disorders were insomnia (40.2%), OSA (23.4%), parasomnias (27.8%), restless legs syndrome (10.5%), and delayed sleep-wake phase disorder (4.8%). The inattentive ADHD subtype, psychiatric comorbidities, tonsil and adenoid hypertrophy, iron-deficiency anemia, and sleep-related behaviors in children with ADHD were significantly associated with sleep disturbances.

Conclusions: Sleep disorders are highly prevalent and diverse in children with ADHD. Early identification and targeted management of sleep disturbances, particularly OSA and insomnia, are essential to improving sleep quality and optimizing ADHD outcomes. Routine sleep screening should be integrated into clinical ADHD evaluations.

Two Cases of Delayed Hemorrhage Following Coblation Adenoidectomy

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Introduction: Coblation adenoidectomy is widely adopted for pediatric obstructive sleep apnea (OSA) due to its precision and minimal invasiveness. Delayed hemorrhage (>24 hours post-surgery), though rare, poses life-threatening risks.

Materials and methods: Through analysis the clinical data of two pediatric cases of delayed hemorrhage following coblation adenoidectomy and discusses the etiology, treatment, and preventive strategies based on a literature review.

Results: Case 1: A 3-year-4-month-old girl with severe adenoid hypertrophy (IV degree) and OSA (OAHI 1.9/h) underwent coblation adenoidectomy. On postoperative day (POD) 14, she presented with recurrent bleeding unresponsive to nasal packing. Emergency exploration under general anesthesia revealed mucosal erosion with active bleeding at the nasopharynx-posterior choanae junction, managed via plasma coagulation (Smith&Nephew Coblator II; cut:7, coagulation:3). Severe anemia (HGB 53g/L postoperatively) required transfusion. Recovery was uneventful, with no recurrence at 1-month follow-up.

Case 2: A 5-year-10-month-old boy with adenotonsillar hypertrophy (IV degree) and OSA (OAHI 5.4/h) underwent concurrent coblation adenoidectomy and tonsillectomy. On POD 16, he developed pulsatile bleeding at the left posterior choanae margin, resistant to nasal packing. Intraoperative endoscopy identified a bleeding site with pseudomembrane detachment, successfully controlled via plasma coagulation. No recurrence occurred during follow-up.

Conclusions: Delayed hemorrhage after coblation adenoidectomy, though rare, requires heightened vigilance. Early recognition, endoscopic exploration, and targeted hemostasis are vital to prevent complications. Further studies are needed to optimize surgical protocols and risk stratification.

The Association between Sleep and Behavioral Problems in Primary School Children in Shanghai

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Introduction: This study examined the associations between sleep disturbance (SD) and behavioral problems (BP) in primary school children in Shanghai.

Materials and methods: We enrolled 18 316 children in Xuhui district, Shanghai. Baseline assessments and follow-up used the Children's Sleep Habits Questionnaire (CSHQ) to classify SD, and the Conners' Parent Rating Scale (CPRS) to evaluate BP. Cross-sectional associations were analyzed via logistic regression; changes in SD status and their impact on BP remission or new onset were assessed with multilevel regression.

Results: With cross-sectional data, SD was linked to higher odds of any BP, including study problems, conduct problems, impulsivity–hyperactivity, hyperactivity index, psychosomatic complaints, anxiety. Daytime sleepiness correlated most strongly with BP symptoms. During follow-up, compared to children without SD, those with persistent or newly developed SD showed reduced BP remission and increased BP onset. Children whose SD remitted experienced no significant change in BP remission or onset.

Conclusions: In urban primary school children, SD closely related to BP. Early detection and targeted management of SD may help prevent or mitigate childhood behavioral difficulties.

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Sleep Phenotypes in Infancy and Their Continuity into Toddlerhood

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Introduction:

Sleep patterns undergo significant developmental changes during infancy and early childhood, with increasing consolidation and regulation over time. Research has shown that individual differences in sleep duration, night wakings, and sleep-onset behaviors emerge early and persist into toddlerhood, influencing cognitive, emotional, and behavioral outcomes. Prior research in a sample of infants aged 9-13 months utilized cluster analysis (hierarchical Ward's method and k-means clustering) and identified three stable sleep phenotypes—Long Sleepers (LS), Interrupted Sleepers (IS), and Short Sleepers (SS)—based on differences in total sleep time, night wakings, parental nighttime visits, sleep efficiency, bedtime, and wake-up time measured with autovideosomnography. Given the developmental changes in sleep over time, the present study aimed to examine whether similar differences in sleep duration, bedtime, night wakings, sleep efficiency between the sleep phenotypes were observed in the same sample at a one year followup.

Materials and methods:

A total of 623 infants aged 9-13 months were recruited from the Nanit customer database in 2023, and three distinct sleep phenotypes were identified. To examine whether these clusters remained consistent over time, a follow-up survey was conducted with the same participants. In total, 110 parents of children aged 22-30 months (27.50 ± 1.0 , 52.6% males) participated in the follow-up study. Objective sleep data from Nanit autovideosomnography were collected for 2 weeks (average 11.56 nights per child) measuring total sleep time at night (TST), bedtime (BT), night wakings (NW), nighttime sleep efficiency, and parental nighttime visits. Differences between clusters were analyzed using ANOVA and post-hoc pairwise comparisons.

Results:

Auto-videosomnography data showed significant differences in TST ($p=0.001$), with LS sleeping 33.72 minutes (95% CI: 10.08,56.64) more than SS ($p=0.002$) and IS sleeping 39.48 minutes (95% CI: 10.56,66.4) more than SS ($p=0.004$). BT differences were also significant ($p=0.007$), with SS having later bedtime by 30 minutes than IS ($p = 0.009$; 95% CI: 5.58, 48.36) and by 27 minutes than LS ($p=0.023$; 95% CI: 3.24, 57.24). However, we did not find significant differences in NW ($p = 0.86$), parental nighttime visits ($p = 0.508$), or nighttime sleep efficiency ($p=0.74$) across clusters.

Conclusions:

TST and BT remained significantly different across sleep clusters which aligns to the previous research, with LS having the longest sleep duration and SS the shortest and later bedtimes at follow up. No significant differences in NW, parental nighttime visits, or nighttime sleep efficiency were found across clusters. This suggests that infants with more night wakings at 9-12 months of age do not display the same behavior at 22-24 months, possibly reflecting the increasing consolidation of sleep patterns in toddlerhood. This longitudinal analysis of sleep phenotypes highlights the importance of sleep in infancy and its relationship with sleep health in early childhood.

Understanding the impact of growth hormone on ventilatory control stability in children with Prader-Willi syndrome

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Introduction: A hallmark feature in children with Prader-Willi syndrome (PWS) is dysfunction in the hypothalamic-pituitary axis, which results in markedly reduced growth hormone (GH) secretion in some children. As such, children with PWS often receive GH replacement therapy early in life. However, administration of GH therapy has been implicated in the development of sleep disorders such as obstructive sleep apnoea (OSA). The mechanisms underlying this development are poorly understood but may be related to the impact that the therapy has on the mechanisms known to cause OSA in children, including unstable ventilatory control. Therefore, our study investigated the impact of GH treatment on ventilatory control stability (i.e. loop gain [LG]) during sleep in children with PWS.

Materials and methods: Polysomnographic data pre- and post-GH commencement in 25 children (aged 2 months to 18 years) were collected, with an average time between studies of 6.4 months. To investigate the stability of the negative feedback loop governing ventilation, we utilised a published method that estimates LG from the ventilation changes following spontaneous sighs during sleep. Data were analysed in RStudio using linear mixed-effects modelling. Covariates that could impact LG including: age, obstructive and central sleep apnoea severity (measured as the obstructive-apnoea hypopnoea index (OAHI) and central apnoea-hypopnoea index (CAHI) respectively) were added using a stepwise, manual forward approach and only those with significant associations were retained in the final model.

Results: Loop gain was not altered by GH administration (0.003, 95% CI: [-0.049, 0.042], $p=0.878$). Adding age, OAHI and CAHI into the main model did not alter the impact of GH on LG. Older children tended to have a slightly higher LG, with each month of age associated with an estimated increase of 6.5×10^{-4} (95% CI: [1.0×10^{-4} , 1.2×10^{-3}], $p=0.032$) independent of GH treatment. OAHI and CAHI had positive, but very small associations with LG, where higher OAHI and CAHI were associated with higher LG.

Conclusions: Initiation of GH therapy did not impact LG which suggests GH does not alter ventilatory control. The development of OSA post-GH requires further investigation as it is likely related to other mechanisms, such as hypertrophy of the adenoids and tonsils. The contribution of ventilatory control to sleep-disordered breathing in PWS outside of any impact of GH also warrants further investigation.

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Learning from parents about the prevalence of SDB in children with neurodevelopmental disorders and their preferences for diagnostic testing

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Introduction: Existing literature demonstrates a high prevalence of sleep disordered breathing (SDB) in children with specific neurodevelopmental disorders (ND). However, no large studies have evaluated prevalence of SDB in a broad population of children with ND (CWND). Additionally, whilst it's recognised that undertaking gold standard monitoring with polysomnography (PSG) is more difficult in children with ND, few studies have explored perspectives of primary caregivers. Here, we describe parent reports of SDB symptoms in a large multicentre sample of CWND and detail their experiences and views regarding diagnostic testing.

Materials and methods: Data were combined from two Australian multicentre studies undertaken to evaluate sleep in a diverse sample of CWND. Primary caregivers of children 0-18 years with a ND condition (ICD-11) completed a survey that included the Paediatric Sleep Questionnaire (PSQ) to determine parent reported prevalence of SDB. Participants were recruited from: (i) a tertiary sleep clinic and (ii) a community sample recruited through community organisations that support CWND. A cut-off value of 0.33 on the PSQ was regarded as indicative of SDB risk. In addition, primary caregivers of a second cohort of CWND (0-18 years) who were undergoing PSG for evaluation of SDB at the same centres completed a customised survey regarding feedback on their experiences of PSG and hypothetical preference between in-lab PSG or an in-home mat-based sleep test.

Results: PSQ data was available from 226 participants (56% male, 54% 5-12yrs). 37% had autism spectrum disorder (ASD) and/or attention deficit hyperactivity disorder (ADHD), 35% a genetic syndrome, 16% a neurological disorder and 12% another ND condition. The mean PSQ total score was 0.46 and 75% had a PSQ score >0.33. There was no significant difference in mean total PSQ score between different NDD categories and no difference in the proportion of children with a PSQ >0.33 when comparing the sleep clinic and community sub-groups.

143 primary caregivers of CWND undergoing PSG completed a customised survey regarding PSG experiences. "Worry levels" for undergoing PSG were reported as "moderate" for children and lower for parents, with the highest worry levels in children with ASD and neuromuscular diagnoses. The option for at home testing with a mat-based option was preferable to parents, with 57% indicating a preference for this if available compared to 7% preferring an in-laboratory PSG.

Conclusions: Discussion: Combined data from a large sample of Australian CWND demonstrates (1) a high prevalence of parent reported SDB symptoms regardless of underlying ND condition, (2) a high proportion of CWND in a community sample reporting a SDB symptom burden comparable to those in a tertiary sleep clinic, and (3) parent preference for home based diagnostic sleep testing options. This preference may reflect the increased worry experienced by CWND during in-laboratory PSG and parental concern that sleep measured in this setting is not representative of their child's typical sleep.

Conclusion: This study confirms that SDB is an important comorbidity that requires proactive screening in CWND and provides rationale for exploring alternative approaches to diagnostic testing that better meet the needs of CWND and their families.

Effectiveness of a nurse-led community-based infant sleep intervention programme: The Sleep Easy Programme (SleEP), Singapore

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Introduction: Sleep plays a vital role in infant development, ensuring optimal brain function and overall health. However, infant sleep problems are common, affecting up to 25% of infants who experience difficulties with sleep onset and problematic night wakings. Early intervention is crucial, but effective community-based programmes are limited. This study aimed to describe and explore the implementation and preliminary outcomes of a nurse-led, community-based intervention programme designed to identify and address early sleep disturbances in infants.

Materials and methods: The Sleep Easy Programme (SleEP) is a nurse-led, community-based programme implemented across multiple primary care centres in Singapore, targeting mainly infants aged 0-6 months. It consists of a three-tiered intervention approach. In Tier 1, parents complete a 22-item questionnaire adapted from the Brief Infant Sleep Questionnaire (BISQ) during routine well-baby visits at four different timepoints and receive anticipatory guidance on age-specific sleep management. Infants identified with sleep concerns (questionnaire score > 5) proceed to Tier 2, where they are referred to a National University Hospital sleep nurse for individualized teleconsultation and education on sleep interventions. Tier 3 involves referral to a sleep psychologist for infants with persistent sleep problems requiring further intervention. Descriptive statistics were used to analyse trends in referral rates, and parents' confidence levels in managing their infants' sleep and perception of the usefulness of the teleconsultation.

Results: Between November 2024 and June 2025, a total of 1,375 questionnaires were completed. The scores for 344 (25.0%) of these were greater than 5, suggesting sleep concerns in the infants and necessitating referral to Tier 2 for further intervention.

Among 163 infants screened at multiple timepoints, 32 (19.6%) were referred to Tier 2 at their first screening. During their second screening, 23 (71.9%) of these infants showed improvement and did not meet the referral threshold again, indicating positive sleep behaviour changes following the interventions. For the remaining 131 infants who were not referred initially, only 15 (11.6%) crossed the referral threshold upon subsequent assessments, suggesting sustained sleep health in the majority.

Overall, the Tier 2 referral rate among infants who were screened at multiple timepoints decreased from 19.6% at the first screening to 14.7% at the second, suggesting a trend towards improved sleep patterns following nurse-led education and intervention. 100% of parents reported increased confidence in managing their infants' sleep post-teleconsultation and/ or usefulness of the teleconsultation.

Conclusions: Preliminary findings from SleEP highlight the impact of structured, nurse-delivered sleep education and teleconsultation support in reducing sleep-related concerns within the first 6 months of life. The integration of sleep health into routine nursing assessments reinforces the expanded role of community nurses in early childhood development. Further research with a control group would be needed to establish effectiveness conclusively.

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Sustained Myofunctional Therapy in Pediatric Sleep-Disordered Breathing: Correlates of Adherence and Clinical Outcomes

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Introduction: Pediatric sleep-disordered breathing (SDB) poses significant health risks, yet effective non-invasive therapies remain underexplored. This study evaluates the efficacy of myofunctional therapy (OMT) in children with SDB, focusing on clinical outcomes, adherence predictors, and the role of therapy duration.

Materials and methods: Data from 39 pediatric patients (mean age: 8.8 years; 82.1% male) undergoing OMT were analyzed. Variables included demographics (age, sex, BMI), clinical metrics (AHI, DI, SpO₂), therapy details (duration, daily minutes), and outcomes (PSQ scores, sleep quality, medication reduction). Statistical analyses identified correlations, adherence predictors (dropout flag = "N"), and effect sizes (Cohen's d).

Results: Clinical Outcomes:

- PSQ Scores: Mean improvement of -4.36 points ($p < 0.0001$), with progressive gains in longer therapy quartiles (Q4: -7.12 vs. Q1: -2.42).
- Sleep Quality: 94.9% reported improvement, achieving 83% success even in short-term therapy (7–30 days).
- Medication Reduction: 66.7% reduced medication use, strongly correlated with therapy duration ($r = 0.56$, $p < 0.001$).

Adherence and Dropouts:

- Adherent patients ($n = 28$) received significantly longer therapy (173 vs. 43 days, $p = 0.0022$) and longer daily sessions (18.75 vs. 10.45 minutes, $p < 0.001$).
- Dropouts ($n = 11$, 28%) were unrelated to demographics (age, sex, BMI) or clinical severity (AHI, DI, SpO₂).

Key Correlations:

- Therapy Duration: Strong negative correlation with PSQ ($r = -0.61$) and positive with medication reduction ($r = 0.56$).
- BMI and AHI: Higher BMI predicted worse apnea severity ($r = 0.64$).
- Sleep Quality: Rapid improvement (83% in Q1) but weak duration dependence ($r = 0.22$, $p = 0.17$).

Intervention Characteristics:

- Optimal outcomes occurred with sustained therapy (>180 days), particularly for ESS improvement (Cohen's $d = 1.78$) and medication reduction.
- Patients exceeding 360 days (Q4) achieved near-maximal benefits.

Conclusions: This study underscores the efficacy of OMT in pediatric SDB, demonstrating significant improvements in sleep quality, daytime sleepiness, and medication reliance. Adherence—driven by therapy duration and daily session consistency—emerged as the critical modulator of success, independent of demographics or baseline severity. Clinically, these findings advocate for:

1. Prolonged Therapy: Recommend durations >180 days, with >360 days for maximal PSQ and medication benefits.
2. Adherence Strategies: Universal support for daily sessions (≥ 19 minutes) and early intervention to mitigate dropouts.
3. BMI Monitoring: Address obesity as a modifiable risk factor for apnea severity.

As the first analysis linking OMT adherence to pediatric SDB outcomes, this work provides actionable insights for optimizing non-invasive therapies. By prioritizing sustained engagement, clinicians can amplify therapeutic benefits, reducing long-term health burdens in pediatric sleep disorders.

Keywords: Pediatric sleep-disordered breathing, myofunctional therapy, adherence, therapy duration, clinical outcomes.

Acknowledgments: NA

Sleep Health Among Children in Foster Care: Understanding Impacts, Interventions, and Research Gaps

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Introduction: Children in foster care face numerous developmental challenges due to early exposure to trauma, maltreatment, and environmental instability. These adverse childhood experiences (ACEs) significantly impact physical and mental health, with growing evidence indicating sleep health as a particularly vulnerable domain. Despite sleep being critical for healthy development, research on sleep disturbances in foster youth remains limited. Disruptions to the hypothalamic-pituitary-adrenal (HPA) axis, psychological stress, and perceptions of environmental insecurity all contribute to poor sleep outcomes. This abstract reviews the literature on sleep health among children in foster care, evaluates interventions, and identifies areas requiring further investigation.

Materials and methods:

This review synthesizes peer-reviewed articles, surveys, and intervention studies exploring sleep disturbances in children and adolescents in foster care. Sources were selected for their relevance to foster care populations, inclusion of sleep-related outcomes (e.g., duration, latency, parasomnias), and exploration of psychological and environmental factors affecting sleep. Interventional studies including behavioral, digital, and pharmacological approaches were included to assess the breadth of strategies currently employed. Research findings were categorized into themes: sleep quality, sleep disorders, trauma impact, and intervention effectiveness.

Results:

Sleep Quality and Disorders:

Children in foster care exhibit higher rates of poor sleep quality across all five domains of sleep health: duration, efficiency, timing, sleepiness, and quality. Studies show prolonged sleep latency, frequent awakenings, and increased parasomnias such as nightmares and sleep terrors. Foster children often report shorter total sleep duration and increased symptoms of insomnia, with prevalence rates of parasomnias markedly higher than in the general population. For instance, nightmares are reported in over 50% of foster children in some studies.

Impact of Trauma:

Exposure to ACEs and instability in caregiver relationships elevate stress responses, often resulting in HPA axis dysregulation and hypervigilance. These biological and psychological changes contribute to difficulty initiating and maintaining sleep. Placement transitions and environmental insecurity further exacerbate sleep disruptions. Trauma-related sleep disturbances are often left unaddressed due to limited caregiver training and systemic oversight.

Interventions:

Intervention efforts have focused on behavioral strategies, caregiver education, and digital platforms. Programs like SAFE-T—a trauma-informed telehealth sleep intervention—have demonstrated promising results in reducing night awakenings and internalizing symptoms. Caregiver involvement in consistent bedtime routines was associated with fewer sleep disturbances, even in children with multiple placement histories. While melatonin is commonly used, it has shown mixed results and may correlate with worsened daytime behaviors in foster youth.

Conclusions: Foster care youth are disproportionately affected by sleep disturbances stemming from trauma and instability. These sleep issues contribute to broader mental and physical health disparities. Promising interventions include trauma-informed digital therapies and structured caregiver routines, yet gaps remain in long-term data, objective sleep measurement, and systemic integration of sleep health in foster care practices. Future research should prioritize personalized, trauma-sensitive approaches and policy reforms that recognize sleep health as a vital component of foster care support. Strengthening caregiver training and standardizing sleep assessments can significantly improve outcomes for this vulnerable population.

The Mechanism of Ferroptosis in Chronic Intermittent Hypoxia Induced Liver Injury and the Regulation Role of Nrf2

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Introduction: Obstructive sleep apnea (OSA) is characterized by chronic intermittent hypoxia (CIH), which can induce or exacerbate liver injury. Ferroptosis, marked by iron overload and lipid peroxidation, is closely linked to liver injury, but its mechanistic role in CIH-related liver damage remains unclear. Evidence suggests that the antioxidant regulator Nrf2 may protect against ferroptosis-driven injury, though the mechanisms require further exploration. This study established a CIH-induced liver injury mouse model to investigate the role of ferroptosis in CIH-induced liver injury and the protective effect and molecular mechanism of Nrf2 in ferroptosis mediated CIH-induced liver injury.

Materials and methods: In this study, utilizing a CIH model in 4-week-old male mice, we investigated ferroptosis and the potential involvement of Nrf2 in CIH-related liver injury. Post-modeling, serum ALT/AST activity, hepatic iron, MDA, SOD, GSH, histopathology (HE, Masson, Prussian blue staining), mitochondrial ultrastructure (TEM), and ferroptosis-related molecules (GPX4, SLC7A11, TFR1, ACSL4) mRNA/protein levels were analyzed.

Results: Chronic intermittent hypoxia (CIH) exposure in mice induced liver ferroptosis, evidenced by elevated ALT/AST levels, disrupted hepatic architecture, fibrosis, iron overload, mitochondrial damage (outer membrane rupture, cristae loss), oxidative stress (increased MDA, decreased SOD/GSH), and dysregulated ferroptosis markers (downregulated GPX4/SLC7A11, upregulated TFR1/ACSL4). Interventions with DFO (iron chelator) and Lip-1 (ferroptosis inhibitor) reversed these effects, restoring liver function, reducing iron deposition, mitigating mitochondrial injury, and normalizing oxidative/ferroptosis-related biomarkers. Nrf2 activation via sulforaphane (SFN) further alleviated CIH-induced damage, lowering body/liver weight, reducing fibrosis, and modulating ferroptosis markers (upregulating GPX4/SLC7A11/FSP1, downregulating TFR1/ACSL4), whereas Nrf2 inhibition (brusatol, BRU) exacerbated injury.

Conclusions: Chronic intermittent hypoxia exposure can induce lipid peroxidation and iron ion overload, triggering ferroptosis and leading to liver injury in mice. Activation of the Nrf2 signaling pathway can effectively alleviate chronic intermittent hypoxia-related liver injury by reducing iron ion accumulation and upregulating FSP1 expression to inhibit lipid peroxidation, thereby suppressing the ferroptosis process.

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Prescribing with sleep in mind: Polypharmaceutical considerations in children with neurodevelopmental disorders

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Introduction: Sleep disturbances affect up to 80% of children with neurodevelopmental disorders (ND), reflecting complex interactions between physiological, behavioural, pharmacological, and environmental factors. This study explores medication use in a large cohort of Australian children with ND, aiming to characterise pharmaceutical burden and its potential influence on sleep quality. Further, this study aimed to explore the interactions of sleep and non-sleep medications in the context of known sleep difficulties within this population.

Materials and methods: This cross-sectional survey involved carers of children aged 2–18 with clinician-diagnosed NDs across three major Australian hospitals and community settings. Data were collected via a study-specific online questionnaire capturing demographics, diagnoses, sleep-related parameters, and medications. Sleep problems were characterised using the 58-item Modified Simonds and Parraga Questionnaire (MSPSQ), where a raw score greater than 56 or composite score greater than 4 is indicative of a clinically significant sleep problem. Medications were standardised, categorised, and analysed using descriptive statistics and appropriate statistical testing.

Results: Data from a total of 300 eligible participants were available for analysis (59% male, 50% 5-12 years old). The majority of children had clinically significant sleep problems, as characterized by the MSPSQ (raw score

69.2±15.8, composite score 5±2.9). Melatonin was the most frequently used sleep medication, with 59% of children having used it at some point over their lifetime, two thirds having found melatonin useful, and more than one in four children currently taking melatonin. α -2 agonists, benzodiazepines, and sedating antihistamines were also being prescribed for sleep in this cohort. A wide range of non-sleep-related medications were reported, with 29% of children taking medications with known negative impacts on sleep. Most children were on at least one prescription medication (69.3%), with polypharmacy (2 or more regular medications) being identified in 42% of children (median 1, range 0-9). When also considering over-the counter medications, 50% of children met criteria for polypharmacy (median 2, range 0-13). Non-sleep medications which influenced sleep were common, with stimulants being most prevalent.

Conclusions: Sleep problems in children with ND are common and likely complicated by their significant pharmacotherapeutic burden. Half of children in this study met criteria for polypharmacy, with one in three children being prescribed medications known to have negative impacts on sleep. Given the prevalence and complexity of sleep problems in children with ND, emphasis should be placed on the review and rationalisation of medications when these patients present with sleep problems. Additionally, the development of targeted guidelines to support clinicians in managing sleep disturbances in this population needs to be prioritised.

Sleep Characteristics, Patterns, and Problem in Children at Respiriology Clinic in Jakarta

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Introduction: Sleep is essential in child's growth and development. Optimal sleep habit and routines are important to support healthy growing and developing children. Sleep is a multifactorial phenomenon, and sleep problems in children maybe due to interplay of biological, psychological, and social influences from environment. We aim to describe characteristics, patterns, and problems of sleep in children who came to pediatric respirology clinic in a tertiary hospital, Jakarta.

Materials and methods: A cross sectional study was conducted in pediatric respirology clinic at Cipto Mangunkusumo Hospital in June 2025, by asking parents or caretakers of their children's, who came the clinic, sleeping habit and problem.

Results: Data were collected from 100 subjects, 52% were boys, mean age was 7 years old (the youngest was 2 months and oldest was 17 years). Majority was in the clinic for tuberculosis treatment (42%), followed with asthma (14%). Most subjects (29%) had 8 hours of sleep, followed by 9 hours (28%) and 10 hours (23%). Majority (84%) reported of nap times. Thirty-five percent of subjects had bedtime at 9 pm, with rise-time at 6 am. Fifty-two percent of subjects was using gadgets before sleeping, and 73% slept with dim-light or no-light. Seventy-eight percent of subjects was co-sleeping with parents/care-takers in one bed. Most subjects (62%) had become respiratory patients for 1 year or less, and only 37% reported sleeping problems appeared after the diagnosis. Occasional snoring was reported in 33% subjects, 10% had habitual snoring, and 11% of parents/care-takers witnessed cessation of breathing. Majority (56%) reported of nighttime waking, with 54% of them reported twice or more. Reason for waking was mostly thirsty and asking for drink (27%) and coughing (24%).

Conclusion Most respirology clinic patients have sufficient nighttime sleep

Conclusions: Most respirology clinic patients have sufficient nighttime sleep and co-sleep with parents/care-takers. Signs of sleep disordered breathing are found in 10% patients with habitual snoring and 11% with cessation of breathing. Only 37% reported sleep problems appearing after respiratory diagnosis.

Validity and Reliability of a Filipino and Cebuano Version of the BEARS Pediatric Sleep Questionnaire

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Introduction: Sleep is central to the overall health and development of children, yet sleep-related problems are prevalent affecting a significant portion of the pediatric population. The BEARS questionnaire-offers a comprehensive approach to screening for sleep problems. However, the lack of versions in local and familiar languages like Filipino and Cebuano limits its widespread use. The objective of this study is to translate, cross-culturally adapt, and validate the BEARS pediatric sleep questionnaire into Filipino and Cebuano languages This will enable healthcare professionals to effectively screen for sleep-related issues in Filipino children, allowing for early detection and intervention.

Materials and methods: The study was conducted from November 2023 to February 2024. The translation process involved forward-backward translation techniques carried out by a team of linguistic experts, clinicians, and non-clinicians. Cross-cultural adaptation involved testing the translated questionnaires in a sample of 467 pediatric patients 2 to 18 years old and their parents, legal guardians, or primary caregivers. Face validity was assessed qualitatively, while content validity was measured using the Content Validity Index (CVI). Test-retest reliability was evaluated using Cohen's Kappa (κ).

Results: The content validity assessment by subject matter experts (SME) found the questionnaire items highly relevant with strong consensus on item importance (BEARS-Filipino CVI =1, BEARS-Cebuano CVI 0.78-1). While most questions were deemed clear and comprehensive, some suggestions were made to refine language and structure for better understanding among target respondents. Following SME feedback, pre-final versions of the questionnaires were developed and tested on a sample of participants with face validity assessment revealing minimal difficulties and generally positive feedback. Test-retest reliability showed a range from minimal to perfect level of consistency and agreement (BEARS-Filipino 2-5 years $\kappa = 0.2785$ to 1, 6-12 years $\kappa = -0.1$ to 0.6796, 13-18 years $\kappa = -0.2$ to 0.6429; BEARS-Cebuano 2-5 years $\kappa = 0$ to 0.7272, 6-12 years $\kappa = 0$ to 1, 13-18 years $\kappa = 0$ to 1).

Conclusions: The comprehensive analysis underscores the complex nature of pediatric sleep problems and the challenges in capturing these through standardized questionnaires. The findings of this study suggest that the translated tools can be used in the assessment of pediatric sleep problems in the Philippines, most especially in children age 2 to 12 years old, enhancing our ability to address sleep-related concerns effectively

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The presence or absence of sleep apnea in a healthy newborn aged 2 days

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Introduction:

A study was conducted on 171 healthy newborns aged 2 days using a quartz optical fiber-type sleep apnea sensor for approximately 2 hours and 5 minutes in an unrestrained manner, measuring the possibility of the presence of sleep apnea.

Materials and methods: So far, measurements of overnight sleep (ranging from 5 to 8 hours) have been conducted on individuals aged from 0 years and 2 months to 81 years using a plastic optical fiber type sleep apnea sensor, suggesting a possibility of sleep apnea at around 10%. This time, since the measurement is of a lighter weight newborn just 2 days old, a quartz optical fiber type sleep apnea sensor was used to increase sensitivity. Measurements were taken in an unconstrained manner for approximately 2 hours and 5 minutes on 171 healthy newborns aged 2 days, assessing the possibility of sleep apnea.

Results: In this study involving 177 healthy newborns (2 days old), fortunately, there were no instances of rolling over or standing up, allowing for very smooth measurements. Analysis was possible for 171 cases, while 6 cases were deemed unmeasurable due to too low signal levels. For the 171 measurable cases, an apnea was determined

if there was a period of apnea of more than 2 breaths (which varies by individual but measured approximately from 2.1 seconds to 4.1 seconds). As a result, among the 171 newborns, 116 had an RDI (Respiratory Disturbance Index) of <5 , indicating normal, 45 cases were mild at $5 \leq$ and <15 , and 9 were moderate at $15 \leq$ and <30 . This showed that 67.8% were normal, 26.3% were mild, and 5.3% were moderate, indicating that even 2-day-old newborns display a distribution similar to that of infants and adults. Further analysis with more cases is needed to substantiate this conclusion.

Conclusions: Using a quartz optical fiber type sleep apnea sensor, measurements were taken regarding the possibility of sleep apnea in a healthy newborn at two days old, yielding results that indicate a distribution of sleep apnea likelihood consistent with infants and adults aged 2 months to 81 years. Going forward, it will be important to continue monitoring how this result may change or remain constant as these newborns grow into toddlers.

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Building Predictive Models for Hypoventilation in Children with Neuromuscular Disorders

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Introduction: Children with neuromuscular disorders are at risk of hypoventilation. The ability to predict or screen for hypoventilation could inform when diagnostic polysomnography, a limited resource, was warranted.

Materials and methods: Children with neuromuscular disorders from three sites had laboratory polysomnography to identify hypoventilation ($pCO_2 > 50\text{mmHg}$ for $\geq 25\%$ total sleep time). The associations between hypoventilation and demographic factors, anthropometrics, clinical factors, motor function, pulmonary function tests and patient and parent-reported outcome measures were determined. Patient-reported outcome measures were collected for participants aged eight and older. Significant factors were examined with Binary Logistic Regression to construct predictive models. Model predictive power was assessed by using the generated predictive probabilities to construct Receiver Operator Characteristic curves and calculating the area under the curve (AUC).

Results: Hypoventilation was present in 16% of the 64 participants. Significant associations with hypoventilation were a diagnosis of congenital myopathy/congenital muscular dystrophy, BMI z-score, higher parent and self-reported hypoventilation symptom score, higher self-reported hyperactivity and externalising behaviours score with the Strengths and Difficulties (SDQ) questionnaire and lower self-reported Peds QL™ Neuromuscular module health and total score. The predictive model with the highest AUC combined self-reported hypoventilation symptom score, SDQ hyperactivity score and Peds QL™ Neuromuscular module health score (AUC 0.975, $p < 0.001$). For children aged less than eight, a diagnosis of congenital muscular dystrophy/congenital myopathy and BMI z-score resulted in an AUC of 0.872 ($p < 0.001$). Regression coefficients were used to construct predictive equations for the probability of hypoventilation.

Conclusions: The predictive models that were developed performed well and could be used as screening tools for hypoventilation in children with neuromuscular disorders to determine when polysomnography is warranted. Patient-reported outcome measures resulted in the model with the highest predictive power.

Exploring the Impact of Technology Use in Children with and without Neurodisabilities. Findings from a Cross-Sectional Study

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Introduction: In clinical practice, parents of children with neurodisabilities (ND) sometimes report that technology use helps their children settle down before bedtime, despite the general advice to avoid screen use prior to bed. There is limited research focusing on bedtime technology use and its impact on sleep in children with ND. This cross-sectional comparative study examined sleep patterns and technology use in children with ND by comparing them to a cohort of neurotypical (NT) peers to inform tailored sleep management guidance for children with ND.

Materials and methods: The primary prospective study was conducted across three Australian paediatric hospital sites where parents or caregivers of children aged 2–18 years with a diagnosed ND condition and referred for diagnostic polysomnography (PSG) were recruited. A smaller group of NT children undergoing a clinical PSG study were recruited from one clinical site for comparison. Caregivers completed a study-designed questionnaire which examined device type, frequency of use, duration, reported helpfulness and data regarding any sleep problems in the participant. Comparison of groups was performed using chi-square tests. Qualitative thematic analysis of caregiver free text responses was also undertaken.

Results: There were 192 participants in the ND group (53.1% male, mean age 10.1) and 35 participants in the NT group (48.6% male, mean age 10.1). Frequency of “everyday” device use was generally high in both groups but was 10% higher in the ND group. Older children with ND showed a statistically significant higher frequency of device use than younger children ($p=0.002$). Caregiver report of sleep symptoms in their child was higher amongst participants in the ND group compared to those in the NT group (53% and 29% respectively). Amongst participants in the ND group, 18% reported sleep symptoms when device use was low (“never/little”) whereas 42% reported sleep symptoms when device use was described as high (“more than 1-2 days per week”). 40% of caregivers in the ND group reported technology use at bedtime to be “somewhat” helpful compared to 14% of participants in the NT group. Differences between device use within different ND condition subtypes as well as qualitative analysis of free text responses from caregivers were also evaluated in this study.

Conclusions: There was a high prevalence of technology use at bedtime in all children, with those with ND reported to have overall higher use. This study strongly suggests an association between bedtime technology use and a higher report of sleep symptoms in children with ND. Despite this finding, just under half of the caregivers in the ND group indicated some perceived benefit of technology use at bedtime for their child, suggesting that the relationship between sleep and screen time is complex in this population. Our findings highlight the importance of not only providing guidance to families about the potential negative impact of technology use around bedtime for their child's sleep but also a need to consider modified advice for children with ND, to balance potential benefits from technology use that may be key to assisting parents with implementing day to day routines

Developmental trajectories of sleep regularity during early childhood are related to somatic complaints and thought problems at school age

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Introduction: In recent years, sleep regularity across nights has been recognized as an important dimension of sleep health that is associated with diverse health outcomes. In the first few years of life, children's sleep-wake rhythms become less irregular as their nocturnal sleep lengthens and becomes more consolidated, and their daytime naps decrease in frequency and duration. These developmental changes in sleep regularity vary widely across individuals, and their implications on emotional and behavioural outcomes are not known. This study aimed to examine whether different sleep regularity trajectories during early childhood are associated with emotional and behavioral difficulties at school age.

Materials and methods: Data were drawn from 372 children (48.9% boys) from the Growing Up in Singapore Towards healthy Outcomes (GUSTO) cohort born between November 2009 and May 2011. These children had at least 6 consecutive days of sleep diary data at minimally 2 of 5 time points (6, 18, 24, 36, and 54 months), and data from the parent-reported Child Behavior Checklist (CBCL) at age 7 years. We computed the Sleep Regularity Index (SRI) using the sleep diary data. Latent class models, including group-based trajectory model (GBTM), latent class growth analysis (LCGA), and growth mixture model (GMM), were used to identify distinct SRI trajectories, following the Guidelines for Reporting on Latent Trajectory Studies. CBCL outcomes were compared across trajectory groups using ANCOVA to control for the effects of sex, ethnicity, maternal educational level, parental stress level at age 7 years, and total sleep duration across 24 h averaged across usable time points.

Results: SRI increased during early childhood (mean $\pm$ SD at 6 months: 45.7 ± 13.7 ; 18 months: 69.7 ± 13.4 ; 24 months: 76.0 ± 12.2 ; 36 months: 80.4 ± 10.4 ; 54 months: 83.5 ± 8.7). Compared to other latent class models, LCGA with error variance different for time points but same for classes performed best, and thus, was chosen to fit SRI trajectory. Two trajectory groups — the persistently less regular group ($n = 61$, 16.4%) and the persistently more regular group ($n = 311$, 83.6%) — were distinguished. Compared to the persistently more regular group, the persistently less regular group had more somatic complaints (mean $\pm$ SD: 56.6 ± 5.9 vs 54.4 ± 5.8 , $p = .030$) and thought problems (56.1 ± 5.9 vs 54.1 ± 6.0 , $p = .026$) at 7 years old after adjusting for covariates. The two groups did not differ in aggressive behavior, anxious/depressed problems, attention problems, rule-breaking behavior, social problems, withdrawn/depressed problems, internalizing problems, externalizing problems, and total problems ($p > .181$).

Conclusions: Sleep regularity early in life may contribute to certain domains of children's well-being at school age. Behavioural sleep interventions, such as sleep education, should emphasise the importance of sleep regularity and be targeted at parents with young children to optimise developmental outcomes.

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Validation of a national actigraph in children and adolescents

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Introduction: Sleep is a neurophysiological process essential to child and adolescent development, playing a central role in cognitive, behavioral, and emotional functions. Early identification of sleep disorders is key to prevent health impairments, which highlights the need for reliable evaluation methods. While polysomnography (PSG) offers detailed analysis of sleep architecture, actigraphy has emerged as a less invasive, more accessible alternative capable of prolonged sleep monitoring. However, validation of actigraphy in children and adolescents is still lacking.

Objectives: This study aimed to validate the ActTrust2 actigraph and to compare the performance of three algorithms (Actiware, Cole-Kripke, and Sadeh) in estimating sleep parameters in children and adolescents, using PSG as the reference.

Materials and methods: Methods: Thirty-three participants, aged 2 to 16 years, underwent simultaneous PSG and actigraphy recording. Evaluated parameters included total sleep time, sleep latency, wake after sleep onset (WASO) and sleep efficiency. The three algorithms were compared using performance metrics such as accuracy, sensitivity, specificity, positive predictive value and negative predictive value. Data normality was assessed using the Shapiro–Wilk test, normality was assessed using the Shapiro–Wilk test, followed by nonparametric analyses including Friedman, Wilcoxon, and Spearman correlation tests with Bonferroni correction.

Results: Results: The Actiware algorithm showed the best overall performance, with higher accuracy (82.4%), sensitivity (86.6%), lower bias, and strong correlations with PSG for total sleep time, WASO, and sleep efficiency. However, its correlation for sleep latency was weak non-significant. The Cole-Kripke algorithm demonstrated intermediate performance, with balanced sensitivity (76.0%) and specificity (78.6%), and moderate bias. Despite higher bias, lower accuracy (69.5%), and sensitivity (65.6%), the Sadeh algorithm was the only one that did not show a significant difference in sleep latency compared to PSG suggesting better agreement.

Conclusions: Conclusions: The results demonstrate that the ActTrust2 actigraph, when combined with appropriate algorithms, is a valid and reliable tool for assessing sleep in children and adolescents.

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Insufficient Weekday Sleep Predicts Emotional Distress in Adolescents: A Study of Sleep Patterns in Taiwan

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Introduction: Adolescents experience dramatic shifts in sleep chronotype during puberty, often resulting in chronic sleep deprivation during school weeks due to early school start times. This insufficient sleep has been linked to a range of biopsychosocial impairments. Previous research has identified sleep disturbances as a significant risk factor for suicidal behavior among adolescents. Given the rising suicide rates among Taiwanese adolescents in recent years, this study aimed to investigate the extent of sleep deprivation in this population and to further examine the relationship between weekday sleep duration, emotional distress, and executive function. The findings may inform future interventions targeting severe psychological distress and suicidal ideation.

Materials and methods: A total of 548 adolescents aged 13–18 participated in the study. Participants completed a battery of assessments, including: (1) a demographic, sleep, and lifestyle questionnaire; (2) the Chinese version of the Beck Youth Inventories – Second Edition (for junior high school students), the Beck Depression Inventory-II and the Beck Anxiety Inventory (for high school students); and (3) the computerized Wisconsin Card Sorting Test (WCST) to assess executive function. Data were analyzed using SPSS version 29.0.

Results: The average weekday sleep duration among Taiwanese adolescents was 6.63 ± 1.1 hours, compared to 8.85 ± 1.5 hours on weekends. Notably, 89.6% of adolescents reported sleeping less than 8 hours on weekdays, indicating widespread weekday sleep insufficiency and significant discrepancies between weekday and weekend sleep patterns. Correlational analyses revealed that shorter weekday sleep duration was significantly associated with higher anxiety ($r = -.138$, $p = .001$) and depression levels ($r = -.226$, $p < .001$). However, no significant relationships were found between weekday sleep duration and executive functioning as measured by WCST indicators. Regression analyses further showed that shorter weekday sleep duration significantly predicted higher levels of anxiety ($\beta = -.138$) and depression ($\beta = -.226$).

Conclusions: This study provides updated data on adolescent sleep patterns in Taiwan, revealing a high prevalence of weekday sleep deprivation and a tendency toward weekend "catch-up sleep." Importantly, insufficient weekday sleep was found to be a significant predictor of emotional distress among adolescents. These findings highlight the mismatch between adolescents' biological sleep needs and the structural demands of school schedules, which may chronically impair emotional regulation. Notably, even with the implementation of delayed school start times in some schools, insufficient sleep remains prevalent among adolescents. This underscores the importance of comprehensive sleep hygiene education and targeted psychological interventions to effectively promote mental well-being and address suicide-related concerns in this population.

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Prospective Associations Between Adolescent Sleep Characteristics and Depression, Anxiety, and Their Co-Occurrence in Early Adulthood: A 9-Year Cohort Study

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Introduction: Depression and anxiety frequently co-occur during the transition to adulthood, leading to heightened symptom severity and severe adverse health outcomes. Although sleep disturbances are common in adolescence, their prospective relationships with comorbid depression and anxiety remain unclear. This study aimed to examine the longitudinal associations between adolescent sleep patterns and sleep quality at age 15, predicting depressive and anxiety symptoms in early adulthood, with a specific focus on their comorbidity.

Materials and methods: We analyzed data from a subsample of the Avon Longitudinal Study of Parents and Children (ALSPAC), a UK population-based birth cohort. Sleep patterns and sleep quality were assessed at age 15 during a clinical visit. Depressive symptoms were measured at ages 17, 21, and 24, and anxiety symptoms at age 21. We estimated associations using binary logistic regression for depression and anxiety separately, and multinomial logistic regression to distinguish depression-only, anxiety-only, and comorbid cases.

Results: Depressive symptoms were prevalent at ages 17 (34.7%), 21 (28.0%), and 24 (36.3%), while 19.2% reported anxiety symptoms at age 21. Females consistently reported higher symptoms than males (p -value < 0.05). At age 21, 14% had depression only, 5% reported anxiety only, and 14% experienced comorbid symptoms. After covariate adjustment, each sleep disturbance at age 15 was associated with increased odds of depression at all follow-up ages (p < 0.05). In multinomial models, poor sleep quality (aOR = 2.79), perception of insufficient sleep (aOR = 1.84), daytime sleepiness (aOR = 2.15), frequent night awakenings (aOR = 2.07), short or long sleep duration (aOR = 1.63), and prolonged sleep onset latency (aOR = 1.80) each conferred higher risk of comorbid depression and anxiety (all p -value < 0.001) than of either disorder alone.

Conclusions: Adolescent sleep disturbances were linked to increased depressive and anxiety symptoms up to nine years later, with the strongest associations observed for comorbid presentations. Early identification and intervention for sleep problems in mid-adolescence may be critical for preventing later psychological health.

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Effects of Ambient Temperature and Pollen Exposure on Sleep, Respiratory Events, and Apnea-Specific Pulse Rate Response in Children with Sleep Disordered Breathing

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Introduction: Increased nasal resistance is a recognized risk factor for pediatric sleep-disordered breathing (SDB). Ambient temperature variations and elevated pollen concentrations might modulate upper airway inflammation and obstruction, which may potentially alter sleep architecture, SDB severity and autonomic function in children.

Materials and methods: A retrospective analysis of in-laboratory diagnostic polysomnography (PSG) data in 690 Chinese children (median age 6.0 years [IQR: 4.0-9.0]) was conducted. The children were present with habitual snoring or witnessed apneas between January 2017 and December 2024.

Daily ambient temperature records and pollen counts (expressed as pollen grains per cubic meter of air, grains/m³) were obtained from official sources. High pollen days were defined as calendar days with ≥ 100 grains/m³

atmospheric pollen concentration. Δ HR was defined as the difference between the maximum and minimum heart rates within an event-related window around each respiratory event, calculated directly from the continuous heart rate recordings. This metric quantitatively reflects sympathetic activation during sleep apnea events. Associations between pollen concentration, ambient temperature and PSG parameters were analyzed.

Results: Participants exhibited a median age of 6.0 years (interquartile range [IQR]: 4.0–9.0). PSG-confirmed OSA was present in 302 children (43.7%), with a median obstructive apnea-hypopnea index (OAHI) of 3.9 events/hour (IQR 1.8–10.7).

Lower minimum, mean, and maximum ambient temperatures were significantly associated with greater proportion of NREM stage 3 ($\rho = -0.130$, $p = 0.001$; $\rho = -0.124$, $p = 0.001$; $\rho = -0.113$, $p = 0.003$). And ambient temperatures demonstrated positive correlations with proportion of NREM stage 2 ($\rho = 0.134$, $p < 0.001$; $\rho = 0.122$, $p = 0.001$; $\rho = 0.126$, $p = 0.001$). No significant associations were observed between ambient temperatures and OAHI, SpO_2 , WASO, sleep latency, or sleep efficiency.

Children monitored on days with higher ambient pollen levels (≥ 100 grains/ m^3 , median 210 [IQR 160–358]) exhibited significantly lower nadir oxygen saturation (91% [88–93] vs. 92% [89–95], $p = 0.014$) and less Δ HR (36.9 [29.3–44.8] vs. 39.4 [31.4–47.3] bpm, $p = 0.029$) compared to those monitored during low-pollen exposure periods. Notably, no significant differences were observed in OAHI, arousal index, sleep latency, or sleep efficiency (all $p > 0.05$), indicating that the observed effects are independent of conventional sleep-disordered breathing metrics.

Conclusions: These findings suggest that elevated environmental pollen concentrations might exert subtle but measurable effects on sleep architecture, nocturnal oxygenation and autonomic regulation. Ambient factors might be considered as effect modifiers when evaluating sleep apnea-induced pathophysiological consequences in children with sleep disordered breathing.

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Pharmacology

Chronic cannabis use and sleep architecture: A cross-sectional study using polysomnography in a clinical sample

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Introduction: The utilisation of cannabis as a self-administered remedy for sleep disturbances is increasingly common. The existing body of research on the subject encounters many challenges in delineating effects accurately, due to the multifaceted nature of influencing factors such as individuals' prior history of cannabis consumption, concurrent substance and medication use, and the presence of other medical conditions that are often not adequately controlled for. In addition, polysomnographic evidence remains limited.

Materials and methods: We conducted a retrospective cohort study of 1,449 patients referred to a Canadian sleep clinic between 2022 and 2024 for overnight polysomnography. Chronic cannabis use ($\geq$ once daily for ≥ 1 year) was reported by 151 patients (10.4%). Eleven polysomnography outcomes—total sleep time, sleep onset latency, wake after sleep onset, sleep efficiency, REM latency, and N1, N2, N3, and REM sleep (both presence and duration were measured for the latter two, resulting in eleven measured outcomes)—were modelled with outcome-appropriate regressions adjusted for 28 demographic, lifestyle, comorbidity, medication, and sleep-related covariates. HC3 standard errors and false-discovery-rate correction were applied. Robustness was evaluated via winsorised and trimmed datasets, two minimal-covariate specifications, exclusion of medication and morbidity blocks, and a 1:1 propensity score matched model.

Results: After multiple-correction testing, chronic cannabis use was associated with higher wake after sleep onset ($\beta = 21\%$; 95% CI +6.7% to +37.2%), lower sleep efficiency ($\beta = -3.8\%$; 95% CI -6.6% to -1.0%), and elevated N1 stage sleep ($\beta = +2.8$ percentage points (pp); 95% CI 0.3pp to 5.6pp). Nominally, total sleeping time was lower among individuals using cannabis ($\beta = -3.3\%$; 95% CI -6.3% to 0.3%). Effect directions and magnitudes persisted

across sensitivity analyses. Compared to cannabis-naïve patients, individuals using cannabis were more likely to be male (SMD = 0.251), younger (SMD = -0.595), and showed higher rates of nicotine (SMD = 0.866), sedative (SMD = 0.244), antidepressant (SMD = 0.219), antipsychotic (SMD = 0.355), and opioid use (SMD = 0.207), as well as a higher rate of psychiatric disorders (SMD = 0.418).

Conclusions: Among sleep-clinic patients, long-term daily cannabis use was associated with greater nocturnal wakefulness and a slightly larger proportion of light sleep. The demographic and clinical profile of cannabis users in this study align with existing data, supporting ecological validity and generalisability of the findings. Our results highlight the need for better-controlled longitudinal studies examining dose, frequency, and formulation.

Acknowledgments: This study was performed through the Tranq Sleep Care network of clinics.

Psychotropic Drug Induced Sleep Bruxism

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Introduction: Bruxism, a stereotyped oromandibular movement disorder, is a repetitive jaw muscle activity characterized by clenching or grinding of teeth and / or thrusting of the mandible. Two distinct circadian manifestations of Bruxism are (i) Sleep Bruxism which occurs during sleep and classified under the subgroup of Sleep related Movement Disorders (ii) Awake Bruxism, which occurs during wakefulness. Sleep Bruxism primarily occurs in younger population, more common amongst children as compared to adults. Sleep Bruxism can be comorbid with other sleep disorders like Obstructive Sleep Apnea (OSA), Parasomnias, Restless Leg Syndrome (RLS), Mandibular myoclonus and Rapid Eye Movement disorders. Bruxism can lead to several complications including jaw muscle hypertrophy, tooth wear, fracture or failure of teeth restorations and implants, sensitivity and pain in teeth, muscle or joints, Temporomandibular joint disc displacements, myofascial pain, headaches, insomnias and other sleep disturbances.

Materials and methods: The etiology of Sleep Bruxism is multifactorial which includes biological, physiological, psychosocial, environmental, genetic factors or can be secondary to medication usage. The most recent hypothesis on the etiology of Sleep Bruxism supports the roles of Central and Autonomic Nervous Systems in the genesis of oromandibular activity during sleep. Moreover, Sleep bruxism may be seen as a centrally mediated condition which may be modulated by medications acting on the neurotransmitters of the Central Nervous System (CNS).

Results: An imbalance between Serotonergic and Dopaminergic pathways may play an important role in the genesis of rhythmic masticatory muscle activity and sleep bruxism. Iatrogenic Sleep Bruxism has been reported following treatment with several Psychotropic medications such as Selective Serotonin Reuptake Inhibitors (SSRIs), Antidepressants, Antipsychotics. A Psychotropic (or psychoactive) drug is a chemical substance that crosses the blood-brain barrier and acts primarily on the CNS where it affects brain function, resulting in alterations in perception, mood, consciousness, cognition and behavior.

Conclusions: One of the side effects of psychotropic drugs is Sleep bruxism. It is postulated that the mesocortical disinhibition provided by SSRIs may lead to dopamine depletion that manifests itself as Sleep Bruxism. Buspirone, an anxiolytic, corrects Bruxism by reducing Serotonergic activity and increasing Dopaminergic Activity. A detailed history, including past and current medications is a must for every patient reporting with a complaint of sleep bruxism.

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Optimizing timing and dose of melatonin administration: a randomized, double-blind controlled trial in healthy adults

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Introduction: Exogenous melatonin is widely used as a sleep aid, yet its overall effectiveness remains under debate because of inconsistent findings that possibly arise from heterogeneous experimental designs. In our recent meta-analysis, we demonstrated that administering exogenous melatonin mimicking its endogenous circadian rhythm—i.e., 3 hours before the desired bedtime—optimizes its sleep-inducing effects, while increasing the dose to 4 mg appeared to enhance sleep maintenance. This study aimed to replicate those findings in a clinical trial.

Materials and methods: Fourteen healthy adults (aged 22–40 years; 50% female) with no history of sleep disorders participated in this double-blind, randomized controlled trial. They underwent five experimental conditions:

Condition 1: 2 mg melatonin administered 30 minutes before bedtime, placebo 3 hours before bedtime.

Condition 2: Placebo 30 minutes before bedtime, 2 mg melatonin 3 hours before bedtime.

Condition 3: 4 mg melatonin 30 minutes before bedtime, placebo 3 hours before bedtime.

Condition 4: Placebo 30 minutes before bedtime, 4 mg melatonin 3 hours before bedtime.

Condition 5: Placebo 30 minutes and 3 hours before bedtime.

After the recruitment, participants also completed a habituation night without receiving any active substance or placebo. Polysomnography was used to assess sleep parameters. Sleep onset latency (SOL) was selected as the outcome measure for sleep promotion, while wake after sleep onset (WASO) served as the outcome measure for sleep maintenance. The impact of administration timing and dosage was analyzed using random-effects linear regression models.

Results: All melatonin conditions resulted in an approximate 10-minute reduction in SOL compared to placebo. Among the active treatment conditions, earlier time of administration was associated with a further SOL reduction ($\beta = -0.041$, $p = 0.034$). WASO was significantly reduced in Condition 4 ($\beta = -15.77$, $p = 0.049$) and showed a trend in Condition 3 ($\beta = 14.22$, $p = 0.084$). When conditions were grouped by dose, the 4 mg dose produced a significant reduction in WASO compared both to placebo and to the 2 mg dose ($\beta = -15.03$, $p = 0.028$). Adjusting for the time interval between administration and bedtime did not substantially change these results, and timing itself did not significantly predict WASO ($\beta = -0.006$, $p = 0.867$). Notably, compared to placebo, Condition 4 only was associated with a significant increase in N3 stage duration ($\beta = 30.07$, $p = 0.036$) and REM latency ($\beta = 28.47$, $p = 0.047$).

Conclusions: Our findings confirm that administering melatonin to mimic its endogenous, circadian pattern enhances its sleep-promoting efficacy. Specifically, melatonin administration 3 hours before bedtime significantly reduced SOL. Consistent with our meta-analysis, a dose of 4 mg improved sleep maintenance independently of the timing of administration. Moreover, for the first time, we provide evidence that the combination of an earlier administration time and a higher dose induces changes in sleep macroarchitecture suggestive of deeper sleep. Further research is needed to clarify the clinical relevance of these findings for insomnia treatment and to explore whether optimized melatonin administration parameters might lead to sustained changes in sleep microarchitecture.

Psychiatric Disorders Affecting Sleep/Wake

From Sleep to Diagnosis: A Novel Nomogram for Identifying Major Depressive Disorder Using Comprehensive Sleep Metrics

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Introduction: Sleep impairment is a one of the most common symptoms of Major depressive disorder (MDD). The stigma of MDD causes patients to conceal their core MDD symptoms, resulting in missed diagnosis. We aimed to develop a predictive model integrating self-report sleep, objective sleep architecture and EEG activity to estimate the probability of MDD in individuals with sleep complaints.

Materials and methods: Ninety-one patients with MDD and ninety-one age and sex-matched controls were included. All subjects were assessed by overnight polysomnography, electroencephalogram (EEG) relative power

during sleep, Pittsburgh Sleep Quality Index (PSQI), Flinders Fatigue Scale (FFS) and Epworth Sleepiness Scale (ESS). The Beck Depression Inventory (BDI) was used to assess depressive symptoms. Predictive factors were identified using random forest analysis and logistic regression. A nomogram was created based on the logistic regression results. Area under the receiver operating characteristic curve (AUC) was used to evaluate the discrimination of the nomogram. Bootstrapping was used for internal validation, and accuracy of the model was evaluated using the Hosmer-Lemeshow test. Decision curve analysis (DCA) of the nomogram was conducted.

Results: The prediction model included total scores for PSQI and FFS, wake after sleep onset, and EEG theta power during rapid eye movement sleep as predictors, and gave an AUC of 0.924 (95% confidence interval: 0.887 - 0.961). The Hosmer-Lemeshow test showed a $\chi^2=4.36$ ($p = 0.823$), and DCA showed a higher net benefit for the nomogram compared to the BDI.

Conclusions: This predictive model provides a reliable tool for identifying MDD in individuals with sleep complaints, which may help to decrease missed diagnosis rate of MDD.

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The Mediating Role of Depressive Symptoms in the Association Between Dysfunctional Sleep Cognition and Insomnia Severity Among Chinese Students

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Introduction: Insomnia is prevalent among students and is often influenced by both cognitive and emotional factors. Dysfunctional beliefs about sleep (DBAS) have been linked to poor sleep outcomes, but the underlying mechanisms remain underexplored in young populations. This study aimed to investigate whether depressive symptoms mediate the relationship between dysfunctional sleep-related cognition and insomnia severity among Chinese students.

Materials and methods: A cross-sectional survey was conducted among 161 student participants (mean age = 16.99 years, 73.2% female). Participants completed the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16), the Patient Health Questionnaire (PHQ-9), and the Insomnia Severity Index (ISI). Mediation analysis was performed using regression-based methods and Sobel test to examine the indirect effect of DBAS on ISI through PHQ-9 scores.

Results: Dysfunctional beliefs about sleep significantly predicted both depressive symptoms ($\beta = 0.25$, $p < .001$) and insomnia severity ($\beta = 0.21$, $p < .001$). When controlling for depressive symptoms, the direct effect of DBAS on ISI remained significant but reduced ($\beta = 0.11$, $p = .025$). The Sobel test confirmed a significant mediation effect ($Z = 3.73$, $p < .001$).

Conclusions: Depressive symptoms partially mediate the association between sleep-related dysfunctional cognition and insomnia severity in students. Targeting both cognitive distortions and emotional distress may enhance the effectiveness of sleep interventions in this population.

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Effect of transcranial direct current stimulation on the sleep electroencephalogram in major depressive disorder: findings of intrinsic multiscale entropy from a randomized controlled study

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Introduction: Transcranial direct current stimulation (tDCS) is a non-invasive method of brain stimulation used to treat individuals with major depressive disorder (MDD). In this study we determined the differences in sleep electroencephalogram (EEG) complexity between patients with and without MDD.

Materials and methods: Twenty-two healthy controls (HCs) and 37 MDD patients were recruited. The patients were assigned randomly to receive either active tDCS stimulation (n = 19) or sham stimulation (n = 18). To assess sleep structure and EEG complexity, polysomnography was applied to all MDD patients and HCs. Intrinsic multi-scale entropy (iMSE) was utilized to quantify the complexity of EEG signals.

Results: By comparison with PSG data from HCs, the characteristic EEG complexity during rapid eye movement (REM) sleep was validated in MDD patients. More importantly, there was a notable increase in the iMSE of non-REM sleep stage I (N1) following active tDCS stimulation compared to pre-stimulation, and there was no longer a significant distinction between patients and HCs. There was a marked contrast in complexity between the sham group and HCs both before and after tDCS sham stimulation.

Conclusions: tDCS was shown to nearly restore the sleep N1 EEG complexity in MDD patients to that of HCs. The intervention effect of tDCS stimulation in MDD patients is characterized by iMSE of EEG signals.

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Obstructive Sleep Apnea and Psychiatric Co-morbidities: A Territory-Wide Study in Hong Kong

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Introduction: The bidirectional relationship between obstructive sleep apnea (OSA) and psychiatric disorders is increasingly recognized. However, most existing studies rely on convenient clinical samples, focus on symptoms rather than formal psychiatric diagnoses, and are typically limited to adult populations. There is a lack of large-scale, population-based studies examining OSA and its associated psychiatric co-morbidity across the lifespan.

Materials and methods: We conducted a retrospective study using the data from Clinical Data Analysis and Reporting System (CDARS), covering over 90% of health services in Hong Kong. Patients of all ages with at least one psychiatric diagnosis (ICD-9-CM codes 290–319) between 2014 and 2023 were included. Those with missing or implausible data (age < 0 or death before diagnosis date) were excluded. OSA was identified by ICD-9-CM codes 780.51, 780.3, and 780.57. Each OSA patient (OSA group) was matched with a non-OSA psychiatric control (Controls) by sex and age at first psychiatric diagnosis using propensity score matching. An "archive date" was set as the date of the first OSA diagnosis. Psychiatric diagnoses within ± 2 years of the archive date were captured as the psychiatric comorbidity surrounding the diagnosis of OSA. For the Controls, we match the time interval between the archive date to the first psychiatric diagnosis with the OSA group to ensure comparable observation windows. Age at archive date was stratified into child (<18), adult (19–64), and senior (65+) groups. Diagnoses were grouped into anxiety, depression, bipolar disorder, psychosis, dementia, substance-related disorders, insomnia, sexual/gender identity disorders, eating disorders, ADHD/hyperkinetic disorders, autism, and others. Group differences were tested using chi-square, Fisher's exact, or t-tests with False Discovery Rate correction (significance: adjusted p < 0.05).

Results: We identified 11400 patients in the OSA group (64.3% male; mean age = 50.3 $\pm$ 21.3), of whom 14% were children, 61.5% adults, and 24.5% seniors. Insomnia was significantly more prevalent in the OSA group across all ages (children: 1.6 vs. 0.2%; adults: 2.8 vs. 0.8%; seniors: 5.5 vs. 1.3%). In children, OSA was associated with higher rates of intellectual disability (19.8 vs. 10.6%) and eating disorders (3.6 vs. 0.8%). Among adults and seniors, anxiety (21.3 vs. 17.3%; 17.0 vs. 12.2%) and depression (15.1 vs. 10.0%; 12.9 vs. 8.4%) were more common in the OSA group. Bipolar disorder (2.8 vs. 1.8%) was also significantly higher in adults with OSA. Conversely, co-morbid substance-related disorders and psychosis were significantly lower in the OSA group. Dementia appeared lower in seniors with OSA (21.2 vs. 23.9%), though became insignificant in a sensitivity analysis limited to diagnoses after the archive date (13.0 vs. 11.9%).

Conclusions: This study provides an age-stratified description of psychiatric diagnostic patterns associated with OSA in a real-world psychiatric population. Our findings confirm well-established associations between OSA and mood or sleep disorders. In contrast, substance-related disorders and psychosis were significantly less prevalent in

the OSA group, which may reflect underdiagnosis due to help-seeking behaviors, diagnostic overshadowing, or assessment barriers specific to these populations.

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A comparative study of sleep and suicidality in Major Depressive Disorder and bipolar depression

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Introduction: Both Major Depressive Disorder (MDD) and bipolar disorder (BD) are associated with sleep problems. Presence of sleep disturbances is manifested as more severe physical, mental, and psychological impairment in both the disorders. In BD it is associated with rapid cycling, anxiety, substance use comorbidities and suicide. The aim of the present study was to compare sleep disturbances and suicidality in patients with MDD and BD.

Materials and methods: Adult population of either sex having diagnosis of MDD or BD (irrespective of number of episodes and treatment status) as per DSM-5 were included in the study. Participants of BD having current manic episode, suffering from any other psychiatric disorder or use of any substance in dependent pattern except nicotine were excluded. The participants were evaluated on socio-demographic profile, depression severity, suicidal ideation and sleep problems with the help of Hamilton Depression Rating Scale (HAM-D), Becks scale for suicidal ideation, insomnia severity index (ISI), Epworth sleepiness scale (ESS) and Pittsburgh sleep quality index (PSQI) respectively.

Results: A total of 44 patients (32 males & 12 females) participated in the study (n=22 each, 15 males and seven females in MDD group and 17 males and five females in BD group). The mean age of the unipolar group and bipolar group was 23.7 (7.7) years and 38.1 (12.7) years respectively. Most of the participants in MDD group were unmarried (n=20,90.9%). BD group had more married participants (n=17,77.3%). The mean subjective sleep latency and total sleep time in the MDD and BD group were 102.3 minutes, 343.6 minutes and 98.9 minutes, 337.5 minutes respectively suggesting an average sleep of less than six hours with high sleep latency in both the groups. The mean HAM-D score of MDD and BD group were 18.7 and 17.3 respectively suggesting moderate depression in both groups. The mean score on Beck's suicidal ideation scale were 9.5 and 8.5 in MDD and BD group respectively. The total scores on ISI and PSQI were high in both the groups suggesting significant sleep problems and clinical insomnia of moderate severity as per ISI scores (MDD group: ISI-19(3.4),PSQI-12.6 (3.3); BD group: ISI-15.2 (6.6),PSQI-12.1 (3.9). No significant difference was observed between depressive scores, suicidal intent and total PSQI scores between the two groups. However, significant difference was observed between total ISI scores and subscores between both the groups. No significant correlation was observed between depression and sleep problems and suicidality and sleep problems in the MDD group. However, a significant positive correlation was observed between HAM-D scores and total ISI scores, sleep latency, total PSQI scores in the BD group. A significant positive correlation was also observed between suicidal ideation and total ISI scores, sleep latency, total PSQI scores in the BD group. A significant negative correlation was observed between HAM-D scores and total sleep time and between suicidality and total sleep time in the BD group.

Conclusions: Both the MDD and BD group showed significant sleep problems. However, depressive symptoms and suicidal ideation correlated with sleep problems in BD group only.

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The Impact of Sleep Quality on Prefrontal Hemodynamic Response during Verbal Fluency Task in Depression: An fNIRS Study

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Introduction: Major depressive disorder (MDD) is frequently accompanied by significant sleep disturbances. Sleep quality critically impacts cognitive functions, including verbal fluency, and neurovascular activity. Functional near-infrared spectroscopy (fNIRS) provides a non-invasive method for investigating task-evoked cortical hemodynamic responses. This study aimed to investigate how sleep quality in individuals with MDD influences hemodynamic responses, primarily indexed by changes in oxygenated hemoglobin (HbO) concentration, in target brain regions during a verbal fluency task (VFT).

Materials and methods: This study enrolled 196 patients with MDD fulfilling DSM-5 diagnostic criteria. Participants' sleep status was assessed using Item 4 of the Self-Rating Depression Scale (SDS). Depressive symptoms, anxiety, and anhedonia were evaluated with the SDS, Self-Rating Anxiety Scale (SAS), and Snaith-Hamilton Pleasure Scale (SHAPS) respectively, while ruminative symptoms were measured using the Ruminative Response Scale (RRS). During performance of a standardized Verbal Fluency Task (VFT), participants underwent hemodynamic monitoring via a 48-channel fNIRS system. Statistical analysis was performed using SPSS 26.0. Functional near-infrared spectroscopy (fNIRS) data underwent dedicated preprocessing with NirSpark software. Primary analytical methods employed included the chi-square test, analysis of variance (ANOVA), and Pearson/Spearman correlation analyses.

Results:

1. No significant differences were observed between groups in age, gender, or educational level (all $P > 0.05$).
2. Significant differences were observed between MDD patient groups stratified by sleep problem severity on measures of anhedonia ($F = 4.274$, $p < 0.05$), depression ($F = 32.234$, $p < 0.05$), anxiety ($F = 106.413$, $p < 0.05$), and rumination ($F = 64.367$, $p < 0.05$).
3. During the VFT, MDD patients with severe sleep problems, compared to other groups, demonstrated significantly increased HbO concentration activation in the temporal pole (Brodmann Area 38, BA38) and Broca's area (BA44), alongside significantly reduced HbO concentration activation in the dorsolateral prefrontal cortex (BA46). Furthermore, the dorsolateral prefrontal cortex demonstrated the weakest haemodynamic response intensity during the 60-second task activation period."

Conclusions: This study demonstrates that poorer sleep quality in MDD patients is associated with more severe symptoms of anxiety, depression, anhedonia, and rumination. Furthermore, compromised sleep quality may alter patterns of task-evoked cerebral hemodynamic responses. These findings provide novel evidence supporting the neurophysiological mechanisms underlying the sleep-cognition-emotion interactions in depression. Improving sleep quality represents a promising intervention target for optimizing cognitive function and enhancing the efficacy of neuromodulatory treatments in MDD.

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Associations of Atypical Depressive Features with Sleep disturbances: Evidence from the Cluster Analysis

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Introduction: Depression remains a leading cause of global disease burden, with atypical Depression (ADep) as a clinically distinct subtype characterized by mood reactivity, hypersomnia, increased appetite, and fatigue. Despite its unique symptomatology, the relationship between ADep and sleep disturbances in Asian populations is underexplored. This study examines associations among atypical depressive features, insomnia, and sleep quality among individuals in Hong Kong.

Materials and methods: We recruited 115 participants (mean age: 53.4 ± 11.0 ; female: $n = 76$, 66.1%) with non-remitted major depressive disorder (MDD) from the local public psychiatric outpatient clinics. They were assessed by the Structured Interview Guide for the Hamilton Depression Rating Scale with Atypical Supplement (SIGH-ADS). Sleep quality and disturbances were measured with Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), and Epworth Sleepiness Scale (ESS). Unsupervised clustering algorithms, including k-means clustering, hierarchical clustering, and Gaussian mixture model, were applied to define symptom-based clusters. K-means clustering with two clusters was selected based on validity indices.

Results: Two clusters were identified after adjustment for age, sex and education, with cluster 1 ($n = 45$, 39.1%, female: $n = 33$) having significantly higher score on 17-item Hamilton Rating Scale for Depression (HDRS-17) and 8-item atypical neurovegetative symptoms (ANS) (HDRS, Cluster 1 mean score = 19.34 ± 2.73 vs Cluster 2 mean = 11.75 ± 2.72 , $p < 0.01$; ANS, Cluster 1 mean score = 8.24 ± 1.74 vs Cluster 2 mean = 4.50 ± 1.73 , $p < 0.01$, respectively). Cluster 1 showed a higher proportion of clinically significant insomnia ($ISI \geq 15$) and excessive daytime sleepiness ($ESS \geq 14$) (Insomnia, 66.7% vs. 37.1%, OR: 3.57, 95% CI: 1.44, 8.85, $p = 0.01$; EDS, 31.1% vs. 18.6%, OR: 2.93; 95% CI: 1.06, 8.10, $p = 0.04$, respectively) than Cluster 2. Ostensibly, cluster 1 exhibited significantly higher scores on PSQI (Cluster 1 mean score = 14.61 ± 3.15 vs Cluster 2 mean = 12.36 ± 3.15 , $p = 0.01$) and ISI (Cluster 1 mean score = 12.75 ± 3.15 vs Cluster 2 mean = 9.04 ± 4.48 , $p < 0.01$), indicating poorer sleep quality and greater insomnia severity. For the single item from SIGH-ADS, there was no significant difference on the item “hypersomnia” across two clusters, but “difficulty awakening” (Cluster 1 mean = 1.68 ± 0.72 vs Cluster 2 = 0.28 ± 0.72 , $p < 0.01$) was more pronounced in Cluster 1.

Conclusions: This study reveals that there was a cluster having more atypical depressive symptoms (39.1%) among individuals with non-remitted MDD in the psychiatric clinic, with significant associations between atypical depressive features and a series of sleep disturbances characterised by more severe and prevalent insomnia, poor sleep quality, difficulty awakening and excessive daytime sleepiness. Future research should incorporate objective sleep measures, larger and broader samples to validate these results for better subtyping and potential personalised intervention.

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Sleep regularity, actigraphic rest-activity rhythms and light exposure patterns in patients with bipolar depression and evening chronotype

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Introduction: Sleep and circadian rhythm disturbances, which are closely related to light exposure, are closely related to bipolar disorder (BD). Eveningness, fragmented and irregular sleep are common features in BD. A lower Sleep Regularity Index (SRI) score has been reported in euthymic BD patients compared to healthy controls, particularly among those with phase delay. This study focuses on a vulnerable group of patients with bipolar depression and eveningness and we hypothesized that a lower SRI correlates with greater delays in sleep and light exposure.

Materials and methods: This study analysed the baseline data obtained from an ongoing randomized controlled trial (ClinicalTrials.gov ID: NCT05357313) involving patients with non-seasonal bipolar depression and eveningness (defined as a Morningness-Eveningness Questionnaire, MEQ score < 42). The assessments included 1-week prospective sleep diary and actigraphy, and one sample of overnight urinary 6-sulfatoxymelatonin (aMT6s). In addition to basic sleep parameters, non-parametric analyses were applied to both rest-activity rhythm (RAR) and white light (WL) exposure actigraphic data. Key actigraphic metrics included: SRI (range 0-100, higher scores indicating greater regularity), intradaily variability (IV; range ≥ 0 , higher values indicating increased activity-rest fragmentation), and L5/M10 start times (onset of the 5-hour/10-hour periods with minimal/maximal average activity or light exposure). The associations between SRI and the sleep/light metrics were explored by Pearson (r) or Spearman (r_s) correlation, where appropriate.

Results: Thirty-two patients with bipolar depression (mean age = 42.0 ± 11.4 years, female: 84.4%) and evening chronotype (MEQ score mean $\pm$ SD = 34.3 ± 8.2) were included in the analysis. The SRI scores ranged from 44.6 to 95.0, with a mean of 71.1 ± 14.7 . A lower SRI score correlated with a later rest start time ($r = -0.481$, $p = 0.005$), a

later sleep start time ($r = -0.491$, $p = 0.004$), shorter time in bed (TIB; $r = 0.418$, $p = 0.017$), and reduced total sleep time (TST; $r = 0.413$, $p = 0.019$). Regarding light exposure, a lower SRI correlated with a later light exposure L5 start time ($r_s = -0.562$, $p = 0.001$) and a higher IV ($r = -0.475$, $p = 0.006$). No correlation was found between SRI and the creatinine-adjusted urinary aMT6s levels ($r = 0.162$, $p = 0.459$).

Conclusions: In patients with bipolar depression and evening chronotype, a lower sleep regularity, as measured by SRI, correlated significantly with delayed sleep timings, shorter sleep duration, and an increased variability of light exposure. Our study underscores the intricate relationship among sleep regularity, timing, and light exposure. The findings suggest the potential to integrate therapeutic interventions that target improving sleep regularity, aligning sleep timing, and optimizing light exposure patterns to enhance outcomes in patients with bipolar depression and eveningness.

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From genetic variants to genes: dissecting shared genetic architecture and biological mechanisms linking sleep traits and suicide attempt

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Introduction: Suicide attempt is a serious public health concern with complex causes involving both environmental and genetic factors. Sleep traits have emerged as promising targets in suicide prevention efforts. Epidemiological studies support associations between sleep traits and increased risk of suicide attempt, independent of psychiatric comorbidities. Moreover, both sleep traits and suicidality are moderately heritable. These lines of evidence suggest a potential shared polygenic architecture underlying both phenotypes. However, the genetic underpinnings linking the two remain not been fully elucidated. This study aimed to systematically identify shared genetic variants, genes, and biological mechanisms between 11 sleep traits and suicide attempt using a comprehensive multi-layered analytic framework.

Materials and methods: We conducted a genome-wide pleiotropic association study using GWAS summary statistics from European-ancestry cohorts, covering 11 sleep traits—7 self-reported (e.g., insomnia, short/long sleep, chronotype) and 4 accelerometer-derived traits—and suicide attempt. We first assessed genome-wide genetic correlations using linkage disequilibrium score regression (LDSC) and overall genetic overlap via genetic analysis incorporating pleiotropy and annotation (GPA). Then, pleiotropic single nucleotide variants (SNVs) were identified using the PLACO method, followed by functional annotation with FUMA and Bayesian colocalization analysis. MAGMA was used to identify pleiotropic genes, which were further evaluated through phenotype enrichment (MGI), GO/KEGG pathway analysis, and cell-type specificity analysis. Drug–gene interactions and druggability of pleiotropic genes were assessed using DGIdb. Finally, bidirectional Mendelian randomization (MR) was performed to examine potential causal relationships.

Results: Six trait pairs exhibited significant genetic correlations, while all 11 showed significant genetic overlap (Bonferroni-corrected $p < 4.54 \times 10^{-3}$). The PLACO analysis identified 2,224 pleiotropic SNVs (1,640 unique), mapped to 50 genomic risk loci, including two novel loci not previously reported. Colocalization analysis further supported shared causal variants at 15 loci (PP.H4 > 0.7). MAGMA identified 44 significant pleiotropic genes (32 unique), enriched in metabolic and neurodevelopmental pathways. Gene set enrichment revealed significant involvement in synaptic structure, immune signaling, and H3K27me3-mediated repression. DGIdb analysis highlighted several pleiotropic genes as druggable targets, notably DRD2 with extensive approved drug interactions. MR analysis indicated a significant protective effect of morning chronotype on suicide attempt (OR = 0.25, $p = 0.003$), and nominally significant risk associations for insomnia, short sleep, daytime napping, and reduced sleep duration.

Conclusions: This multi-layered pleiotropic analysis provides robust evidence of shared genetic mechanisms linking sleep traits and suicide attempt. The identified loci and genes uncover novel biological pathways including synaptic function, immune regulation, and epigenetic repression. Importantly, several candidate genes are druggable, offering promising therapeutic targets for translational research and targeted interventions to reduce suicide risk via modulation of sleep-related pathways.

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Association between EEG Power during Sleep and Attention Levels in Patients with Major Depressive Disorder

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Introduction: Major depressive disorder (MDD) is associated with cognitive impairment through unclear mechanisms. We examined the relationship between sleep electroencephalogram (EEG) power and attention level in MDD.

Materials and methods: Forty-seven untreated patients with MDD and forty-seven age- and sex-matched controls were included. We examined relative EEG power during non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep by fast Fourier transform. The Attention Network Test (ANT) was performed to evaluate attention levels.

Results: Compared to controls, patients with MDD had lower theta power during NREM ($P = 0.018$) and REM ($P = 0.002$) sleep, while higher beta power ($P = 0.050$) during NREM sleep and delta power ($P = 0.018$) during REM sleep. Regarding attention level, patients with MDD had lower levels of accuracy ($P = 0.021$), longer mean reaction time ($P < 0.001$), poorer manifestations of the alerting effect ($P = 0.038$) and worse executive control ($P = 0.048$). Moreover, decreased theta power during NREM sleep was correlated with worsened accuracy ($\beta = 0.329$, $P = 0.040$), decreased theta power during REM sleep was correlated with worsened alerting effect ($\beta = 0.355$, $P = 0.020$), and increased delta power during REM sleep was correlated with longer mean reaction time ($\beta = 0.325$, $P = 0.022$) in patients with MDD. No association between ANT performance and other frequency bands was observed in patients with MDD.

Conclusions: Our findings suggest that patients with MDD manifest impaired selective attention function that is associated with decreased theta power during NREM/REM sleep and increased delta power during REM sleep.

Neurometabolic Alterations in the Anterior Cingulate Gyrus and Putamen: Insights from Adolescents with Insomnia and Depression

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Introduction: Previous research has established that sleep disorders are prevalent among individuals with major depressive disorders (MDD), particularly in adolescents, with an incidence rate surpassing that of low mood. Nonetheless, the effects of sleep disorders on brain function in depressed adolescents remain inadequately understood.

Materials and methods: We recruited 97 right-handed, untreated adolescent patients with MDD, and 68 demographically matched healthy controls (HCs) and underwent the proton magnetic resonance spectroscopy (1H-MRS) scan in the anterior cingulate gyrus (ACC) and putamen. Differential and association analysis was performed to investigate the relationship between sleep quality and the severity of depression and neurometabolism ratios of ACC and putamen in MDD groups.

Results: The study identified 64 patients as Insomnia (IS) group, characterized by an insomnia item score of ≥ 1 on the 24-item Hamilton Depression Rating Scale (HDRS) and a Pittsburgh Sleep Quality Index (PSQI) total score of ≥ 6 , while 33 patients were categorized into the Non-Insomnia (NIS) group. The IS group exhibited significantly lower choline-to-creatine (Cho/Cr) ratios in the right ACC compared to both the NIS and HCs, as well as lower Cho/Cr ratios in the left ACC relative to the HCs. Furthermore, the NIS group showed reduced N-acetylaspartate-to-creatine (NAA/Cr) ratios in the right putamen compared to the IS and HC groups. The 24-item HDRS scores were negatively correlated with Cho/Cr ratios in the bilateral ACC ($r = -0.354$ and $r = -0.246$,

respectively; both $p < 0.05$), and insomnia item scores were correlated with Cho/Cr ratios in the right ACC ($r = -0.294$, $p = 0.018$) within the IS group.

Conclusions: A substantial proportion of adolescents with depression experience clinically significant sleep disturbances. The observed brain dysfunction is influenced by the cumulative effects of previous severe mood episodes and sleep disturbances. Therefore, incorporating therapeutic interventions for sleep disorders should be an integral component of antidepressant treatment strategies for depressed adolescents.

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Uncovering hidden depression: the critical role of depression screening in sleep disorders at U.S. sleep centers

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Introduction: Depression and sleep disorders are strongly linked, with sleep centers (SCs) reporting depressive symptoms in up to 63% of patients and depression diagnoses in 22%. Despite this, routine depression screening is not standard in SCs. This study aimed to identify patients meeting criteria for a current major depressive episode (cMDE) among those self-reporting clinically significant depressive symptoms (CSDS) in U.S. SCs.

Materials and methods: This retrospective sub-analysis of an ongoing multicenter trial included 147 adults (22-75 years) referred for sleep disorder evaluation. Participants underwent psychiatric assessments using the Mini-International Neuropsychiatric Interview and Patient Health Questionnaire-9 (PHQ-9), with CSDS defined as PHQ-9 ≥ 10 . Descriptive statistics were compared between patients with/without a confirmed cMDE using non-parametric tests. Additional Mann-Whitney U tests assessed sleep characteristics by cMDE, major depressive disorder (MDD), and bipolar disorder (BD) (statistical significance, $p < 0.05$).

Results: Of 147 patients, 57 (38.8%) had a PHQ-9 score ≥ 10 . Among them, 23 (40.3%) were diagnosed with cMDE: 17 (29.8%) met cMDD criteria, and 6 (10.5%) had BD, type I. A significantly lower cMDE prevalence was observed in patients without CSDS. Sleep characteristics showed no significant differences except for a lower N3 percentage in cMDE. BD, type I was associated with higher obstructive sleep apnea comorbidity compared to cMDD.

Conclusions: Our findings suggest major depression prevalence in SCs is five times higher than in the general population, highlighting the need for routine depression screening and psychiatric confirmation. This also aids in identifying comorbidities and fostering tailored interventions to improve outcomes.

A Long-Lasting Low-Threshold Spiking in Laterodorsal Tegmental Glutamatergic Neurons Regulates Anxiety Hyperarousal

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Introduction: Anxiety-associated hyperarousal represents one of the most prevalent emotional sleep disturbances globally. In the context of an increasingly fast-paced and high-stress society, this condition significantly compromises quality of life and poses a substantial public health burden. Although conventional anxiolytic agents can alleviate symptoms to some extent, their clinical utility is often limited by issues of drug tolerance and adverse side effects. The lack of effective, targeted interventions is largely attributable to an incomplete understanding of

the underlying neural circuitry. The laterodorsal tegmentum (LDT), a brainstem nucleus implicated in arousal regulation, receives dense projections from multiple anxiety-related regions, suggesting a potential integrative role in mediating anxiety-related hyperarousal states. Utilizing a chronic stress-induced anxiety model, we identified the LDT as a candidate node in this regulatory network. The present study aims to elucidate the functional involvement of the LDT in anxiety-related hyperarousal and to dissect the underlying neurobiological mechanisms.

Materials and methods: This study established a chronic unpredictable mild stress (CUMS) model to induce anxiety in mice, verified through open field and elevated plus maze tests, while monitoring sleep-wake alterations and identifying anxiety-related brain regions. In vitro electrophysiology was used to examine neuronal changes in the laterodorsal tegmentum (LDT), focusing on ion dynamics underlying the long-lasting low-threshold spike (LLTS) in glutamatergic neurons. Optogenetics combined with behavioral assays enabled precise induction of LLTS to assess its effects on anxiety and sleep. Neural circuitry was mapped using retrograde tracing and the Cre-loxP system to trace inputs regulating anxiety hyperarousal. Neuropharmacological approaches evaluated the impact of Cav 3.1 channel inhibitors and anxiolytics on behavior and arousal, while RNA interference of Cav 3.1 further validated its role through behavioral and sleep assessments.

Results: After CUMS, mice showed anxiety-like hyperarousal and a 132% increase in wakefulness, with elevated cfos in LDT. LDT glutamatergic neurons shifted toward a higher proportion (76%) of long-lasting low-threshold spike (LLTS), while GABAergic and cholinergic neurons remained unchanged. Optogenetic activation of LLTS neurons induced anxiety and wakefulness; general activation of LDT glutamatergic neurons increased only wakefulness. LDT glutamatergic neurons receive diverse upstream inputs, with 16% from the LH. The LH^{GABA}-LDT^{Vglut2} circuit was key in anxiety hyperarousal. LLTS was mediated by T-type calcium channels; pharmacological inhibition of T-type calcium channels and genetic knockdown of Cav3.1 expression in LDT neurons reduced LLTS firing and normalized anxiety hyperarousal.

Conclusions: These findings suggest that Cav3.1 channels are crucial mediators of LDT glutamatergic plasticity in anxiety hyperarousal, offering a potential therapeutic target for treating anxiety hyperarousal and related sleep disorders. Our work offers insights into the neural mechanisms underlying anxiety-related sleep disorders.

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rTMS Modulation of Sleep-Related Brain Networks in Major Depressive Disorder: Multisite Identification and Therapeutic Validation

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Introduction: Sleep disturbances (SD) represent a core symptom of major depressive disorder (MDD), affecting up to 90% of patients. Critically, SD exhibits a strong bidirectional relationship with MDD and significantly elevates the risk of suicidal behavior. While antidepressant pharmacotherapy can improve SD and subsequently alleviate associated symptoms like suicidal ideation and mood dysregulation, its utility is often limited by prolonged treatment duration and significant side effects. Repetitive transcranial magnetic stimulation (rTMS), an FDA-approved rapid-acting intervention for MDD, offers a promising alternative. However, despite its established antidepressant efficacy, the specific impact of rTMS on the core symptom of SD and the neural mechanisms underlying any potential sleep improvement remain poorly characterized. Crucially, it is unknown whether successful mood modulation via rTMS reliably translates to concurrent SD amelioration, potentially undermining long-term outcomes. Elucidating the core brain regions implicated in MDD-related SD based on multisite datasets and investigating how rTMS modulates these regions is critical.

Materials and methods: Resting-state fMRI data from the REST-meta-MDD Project (988 MDD patients across 16 sites) were analyzed. Neural activity was quantified via mean amplitude of low-frequency fluctuations (mALFF). SD severity was assessed using HAMD sleep sub-scores (items 4-6). Correlation analyses identified SD-associated brain regions. An independent randomized controlled trial (RCT) cohort received 2-week rTMS with multimodal MRI at baseline/post-intervention. Clinical assessments occurred at baseline, post-treatment, and 6-week follow-up.

Paired t-tests evaluated rTMS-induced neural changes. Altered mALFF in identified regions was correlated with sleep improvement to determine rTMS efficacy for SD.

Results: Multicenter analysis revealed that MDD patients with severe sleep disturbances showed increased activation in the putamen, insula, thalamus and supplementary motor area, alongside decreased activation in the subgenual anterior cingulate cortex, posterior cingulate gyrus, precuneus, superior frontal gyrus and superior temporal gyrus. In the clinical trial, patients receiving active rTMS demonstrated significantly greater improvement in both depressive symptoms and sleep disturbances compared to the sham group. Neuroimaging analysis indicated that rTMS activated multiple regions related to sleep disturbances, including the subgenual anterior cingulate cortex and superior frontal gyrus. Furthermore, rTMS-mediated inhibition of putamen and supplementary motor area activity correlated with sleep improvement.

Conclusions: This study identified the brain activation patterns associated with sleep disturbances in MDD using multisite neuroimaging data. The randomized controlled trial demonstrated that rTMS effectively alleviates both depressive symptoms and sleep disturbances in MDD patients. rTMS modulated key brain regions implicated in sleep pathology, particularly through suppressing overactive areas including the putamen and supplementary motor area. These findings support rTMS as a targeted intervention for MDD-related sleep disturbances and provide neurophysiological insights into its therapeutic mechanisms.

Genetic association of depression and antidepressant targets with α -synucleinopathy spectrum disorders

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Introduction: Observational studies have suggested the associations between depression, antidepressant use, and α -synucleinopathy spectrum disorders, including rapid eye movement sleep behavior disorder (RBD), Parkinson's disease (PD), dementia with Lewy bodies (DLB), and multiple system atrophy (MSA). However, their genetic associations remains unclear. This Mendelian randomization (MR) study aimed to investigate the genetical associations between depression, antidepressant targets, and α -synucleinopathy spectrum disorders.

Materials and methods: We obtained summary statistics of genetic variants associated with depression and α -synucleinopathy spectrum disorder phenotypes from respective genome-wide association studies (GWAS). Expressive quantitative trait loci (eQTL) for antidepressant target genes were extracted from the eQTLGen Consortium. Antidepressant targets expression in blood with significant associations with α -synucleinopathy spectrum disorder phenotypes were further examined in brain tissues. Sensitivity analyses including stringent linkage disequilibrium (LD) criteria, summary-based Mendelian randomization (SMR), colocalization, and shared genetic architecture analyses were conducted to ensure the robustness of the findings.

Results: No significant effect of depression on overt α -synucleinopathies was confirmed. Conversely, RBD was suggested to be causally associated with depression (OR[95%CI] = 1.04[1.02 to 1.06], $p = 5 \times 10^{-5}$), driven by the 3'-SNCA variant rs3756059. Expression of three target genes—SLC29A4, SIGMAR1, and CYBA—in blood showed associations with PD, MSA, and DLB, respectively. However, these associations were not replicated in brain tissue nor supported by sensitivity analyses. No significant shared genetic architecture or colocalization was identified between depression or antidepressant targets and α -synucleinopathy spectrum disorders.

Conclusions: Our findings do not provide conclusive evidence for a genetic causal relationship between depression or antidepressant target genes and α -synucleinopathy spectrum disorders. Nonetheless, the observed association between RBD and depression, potentially mediated by the rs3756059 variant in the SNCA gene, suggests that depression may serve as a prodromal marker rather than a risk factor for RBD. These insights

underscore the importance of considering depression in the early identification and management of individuals at risk for α -synucleinopathies.

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Discordance in Physiological and Subjective Stress Measurements: Hair Cortisol, Self-reported Stress Scales and Heart Rate Variability in Healthcare Night-shift Workers

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Introduction: Chronic stress increases risks of multiple diseases. Stress is usually evaluated by subjective psychological scales. Hair cortisol concentration (HCC) and Heart rate variability (HRV) have also been used as stress indicators. However, there is no gold standard to measure stress.

Materials and methods: In-total 74 healthcare workers with regular night-shifts were recruited. HCC was measured by liquid chromatograph/mass spectrometer. Subjective psychological scales were performed, including Perceived Stress Scale-14 (PSS), Depression Anxiety Stress Scales-21, Epworth Sleepiness Scale, Fatigue Assessment Scale and Subjective Happiness Scale. HRV indices (SDNN, RMSSD, HF and LF) were measured from 24h-Holter. All these data were collected both before and after 3-month stress management.

Results: HCC showed positive correlation with PSS ($r = 0.228$, $P = 0.050$) but not with other scales and HRV indices in cross-sectional analysis based on baseline data. Longitudinally, subjective scales showed a significant remission in stress and adverse mood after 3-month intervention. However, HCC was significantly elevated after stress management, and HRV indices, including 24h SDNN, nighttime SDNN, RMSSD, HF and LF/HF, were decreased (all $P < 0.05$). Upon the 3-month intervention, the changes of HCC did not correlate with the changes of scale scores, but correlated with the changes of HRV indices (negatively with 24h and daytime LF/HF and LFnu, and positively with daytime HF).

Conclusions: This study aims to explore the correlation between physiological stress indicators and subjective psychological scales. Subjective and objective measures of stress could exhibit differential changes upon the same interventions. The combined measurements would be recommended as routines for the clinical practice.

REM Behavior Disorders

Association Between Iron Metabolism Biomarkers and REM Sleep Behavior Disorder: A Mendelian Randomization Study

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Introduction: REM sleep behavior disorder (RBD) is a parasomnia characterized by loss of muscle atonia during REM sleep, often preceding neurodegenerative diseases such as Parkinson's disease. Emerging evidence suggests that iron metabolism may play a role in neurodegenerative processes, but its association with RBD remains unclear. This study investigates the causal relationship between iron metabolism biomarkers and RBD using Mendelian randomization (MR).

Materials and methods: We performed a two-sample MR analysis to evaluate the effects of genetically predicted iron metabolism biomarkers, including ferritin, iron, total iron-binding capacity (TIBC), and transferrin saturation (TSAT), on RBD risk. Genetic instruments were obtained from genome-wide association studies (GWAS) of iron metabolism traits, and summary-level RBD data were sourced from a large publicly available GWAS. Several MR methods were applied, including inverse variance weighted (IVW), MR-Egger, weighted

median, weighted mode, and simple mode, to ensure robust findings. Sensitivity analyses, including Cochran's Q test, MR-Egger intercept, and leave-one-out analysis, were conducted to assess pleiotropy and heterogeneity.

Results: Our MR analysis demonstrated that genetically predicted higher ferritin levels were associated with a lower risk of RBD (IVW: $\beta = -0.15$, SE = 0.25, $p = 0.57$; MR-Egger: $\beta = -1.22$, SE = 0.46, $p = 0.01$; Weighted median: $\beta = -0.47$, SE = 0.29, $p = 0.11$). For serum iron levels, the IVW method showed a negative association with RBD risk ($\beta = -0.03$, SE = 0.14, $p = 0.83$), while the MR-Egger method suggested a stronger negative effect ($\beta = -0.48$, SE = 0.30, $p = 0.12$). TIBC exhibited a weak positive association with RBD (IVW: $\beta = 0.07$, SE = 0.12, $p = 0.55$; MR-Egger: $\beta = 0.16$, SE = 0.28, $p = 0.57$). For TSAT, no clear association with RBD was observed (IVW: $\beta = 0.02$, SE = 0.08, $p = 0.79$; MR-Egger: $\beta = -0.18$, SE = 0.14, $p = 0.21$). Sensitivity analyses indicated no substantial heterogeneity (Cochran's Q test: $p > 0.05$ for all exposures) and no significant horizontal pleiotropy (MR-Egger intercept $p > 0.05$).

Conclusions: Our findings suggest a potential protective role of ferritin in RBD, with a stronger effect observed in MR-Egger analysis. While other iron metabolism markers, including iron, TIBC, and TSAT, did not show strong causal evidence, the direction of effect estimates warrants further investigation. Future studies are needed to explore the underlying mechanisms linking iron metabolism to RBD and its progression to neurodegenerative diseases.

Resting-State fMRI Functional Connectivity Reveals Dual Network Disruption in REM Sleep Behavior Disorder: Diagnostic Insights from Multi-Metric Analysis

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Introduction: Idiopathic REM sleep behavior disorder (iRBD) is a prodromal phase of alpha-synucleinopathies such as Parkinson's disease. Functional changes may precede structural degeneration, making resting-state functional MRI (rs-fMRI) a valuable tool for early detection. This study aimed to investigate functional network changes in iRBD across multiple rs-fMRI metrics and evaluate their diagnostic and predictive utility using machine learning.

Materials and methods: We analyzed rs-fMRI data from 132 polysomnography-confirmed iRBD patients and 44 age- and sex-matched healthy controls. The brain was parcellated using the Shen 268-node atlas. Four rs-fMRI metrics—ALFF, fALFF, ReHo, and seed-based functional connectivity (FC)—were computed. Group comparisons were performed using ANCOVA controlling for age and sex. FC was corrected using family-wise error (FWE), and other metrics were thresholded at uncorrected $p < 0.01$. Classification performance was tested using machine learning models including SVM, XGB and MLP.

Results: FC showed the most robust and interpretable group differences. iRBD patients exhibited decreased FC in frontostriatal and default mode networks, and increased FC in cerebellar and motor circuits, suggesting early degeneration and compensatory reorganization. ALFF, fALFF, and ReHo showed scattered, inconsistent changes. SVM using FC features achieved the highest classification accuracy (87%), supporting the feasibility of prediction using rs-fMRI.

Conclusions: FC-based rs-fMRI revealed dual patterns in iRBD, with cognitive network disruption and motor network enhancement. These findings highlight FC as a sensitive marker of early pathological and adaptive changes. In combination with machine learning, FC-based rs-fMRI holds promise as a diagnostic and prognostic tool to stratify iRBD patients and track progression toward neurodegeneration.

Environmental Exposures, Clinical Characteristics and Gut Microbial Features in Patients with Early α -Synucleinopathies and Their Cohabiting Partners

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Introduction: Idiopathic REM sleep behavior disorder (iRBD), a prodromal stage of α -synucleinopathies, exhibits gut dysbiosis characterized by enriched pro-inflammatory bacteria and depleted short-chain fatty acids (SCFA)-producing bacteria. Previous studies have shown that microbiome is shaped by shared environment, with cohabiting spouses exhibiting strong similarities. However, whether iRBD-related microbiome dysbiosis exists in iRBD spouses (RS), and how lifestyle and clinical factors affect their gut microbiome remain unclear. This study aims to characterize clinical, lifestyle and gut microbial features in RS, and explore the underlying host-microbiome interplays.

Materials and methods: This cross-sectional study included 58 video-polysomnography-confirmed iRBD patients (69.5 ± 6.6 years, 87.9% male), 58 RS (66.1 ± 6.8 years, 12.1% male) and 58 unrelated controls (UC, 66.0 ± 6.9 years, 13.8% male). UC were 1) age- and sex-matched with RS; 2) not cohabiting with or genetically related to iRBD couples; and 3) had spouses free of RBD or neurodegeneration. Participants underwent clinical assessments, questionnaires, and fecal shotgun metagenomic sequencing. Dietary information was collected using a 20-item questionnaire. Data were analyzed using SPSS 29.0 and R 4.4.2.

Results: Compared to UC, RS trended toward a higher prevalence of possible RBD (defined as RBDQ-HK total score > 18 : 8.9% vs. 1.8%, $p=0.098$). RS also exhibited higher prevalence of depression and upper gastrointestinal (GI) disorders. Additionally, the occurrence of injuries in iRBD patients was positively associated with depression in their spouses ($p=0.029$). In contrast, lower GI symptoms—as reflected by Rome-IV diagnosed constipation, bowel movement frequency, and SCOPA-AUT subscores—appeared to be milder in RS versus UC ($p=0.050$, $p=0.088$, $p=0.014$, respectively).

Regarding lifestyle, RS had significantly lower dietary diversity and higher consumption of salty snacks and animal fat than UC. Further analyses within iRBD couples showed positive correlations between patients and their cohabiting spouses in education level, consumption of most food groups (16/20, 80%), cognitive function, and upper GI symptoms.

Metagenomic analyses revealed comparable gut microbial composition between RS and UC, with no significant differences in alpha or beta diversity, or any individual taxa. However, compared to iRBD patients, RS showed significantly reduced observed species, as well as microbial dissimilarity after adjusting for age, sex and constipation. Nine species and five genera differed significantly between RS and iRBD patients, with RS displaying higher abundances of SCFA-producing genera *Agathobaculum*, *Faecalibacterium* and *Roseburia*. Host-microbiome interaction analyses showed that longer constipation duration was negatively correlated with all these SCFA-producing genera, while constipation was associated with reduced *Faecalibacterium* abundance. Additionally, higher consumption of unhealthful plant-based foods, including refined grains and bakery products, was negatively correlated with *Agathobaculum* abundance.

Conclusions: iRBD spouses exhibit higher prevalence of depression and upper gastrointestinal symptoms, alongside lower constipation rates and dietary diversity. Despite shared environmental and lifestyle factors, iRBD spouses did not display RBD-like gut dysbiosis; instead, their microbiota featured a possible enrichment of SCFA-producing bacteria, suggesting a "healthier gut" phenotype. Lifestyle factors, particularly fewer bowel disorders (e.g., constipation), are likely associated with these health-promoting bacteria.

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Neural correlates of decisional impulsivity across early stages of α -synucleinopathy: a case-control functional magnetic resonance imaging study

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Introduction: Idiopathic rapid eye movement sleep behavior disorder (iRBD) is the strongest prodromal markers of α -synucleinopathy, including Parkinson's disease (PD), dementia with Lewy bodies, and multiple system atrophy. PD patients demonstrated altered impulsivity, usually attributed to dopaminergic agonists. Our previous study observed a complex construct of altered impulsivity in iRBD and early PD patients, manifested as decreased risk taking and increased reflection impulsivity. While corticostriatal circuits have been implicated in decisional impulsivity in healthy individuals, their precise role underlying decisional impulsivity across early α -synucleinopathy remains unclear. This study aims to investigate the neural correlates associated with the altered decisional impulsivity in early α -synucleinopathy.

Materials and methods: This was a case-control study conducted among controls, iRBD, and PD patients. Early PD patients were diagnosed with United Kingdom PD Brain Bank criteria with motor symptoms onset within five years. Participants underwent clinical assessments and 3T MRI scanning, including structural, resting-state, and task-based fMRI. Decisional impulsivity was measured using the Balloon Analogue Risk Task (BART) for risk taking and beads task for reflection impulsivity. Regions of interest (ROIs) were selected along corticostriatal circuits. Seed-based functional connectivity (FC) was computed with subcortical ROIs serving as seeds.

Results: A total of 97 patients, including 25 controls (mean age=67.7, male 57.7%), 40 iRBD patients (mean age=70.6, male 72.5%), and 32 PD patients (mean age=69.7, male 89.7%) were recruited. PD and iRBD patients exhibited elevated reflection impulsivity compared to controls, as evidenced by fewer extracted beads (PD vs. iRBD vs. controls: 3.6 ± 2.4 vs. 3.7 ± 2.1 vs. 4.9 ± 2.6 , $P=0.03$). Meanwhile, risk taking level on the BART was comparable among groups. fMRI analyses revealed augmented neural activities in both ventral and dorsal striatum in iRBD patients during risky decision-making in the BART. Regarding the reflection impulsivity, PD and iRBD patients exhibited enhanced BOLD activations in mPFC during "beads-drawing" phase compared to controls, whereas iRBD patients showed additional involvement of right ACC/OFC and left parietal lobe during the same phase ($P_{FWE} < 0.05$, TFCE). Further ROI analyses corroborated the findings and additionally revealed increased engagement in bilateral ventral striatum (VS) in PD patients (PD vs. control: right NAc: $0.07[-0.41, 0.70]$ vs. $-0.59[-1.55, -0.26]$, $P=0.002$; left NAc: $0.35[-0.21, 1.16]$ vs. $-1.13[-2.06, 0.05]$, $P=0.03$), whereas enhanced activation in right VS in iRBD patients (iRBD vs. controls: $-0.06[-0.66, 0.44]$ vs. $-0.59[-1.55, -0.26]$, $P=0.002$). Seed-based FC analyses revealed attenuated connectivity in PD patients between right NAc and multiple regions including the bilateral frontal and parietal cortex, striatum, thalamus, and cerebellum. Additionally, iRBD patients displayed decreased FC between the pallidum and both the putamen and OFC. ($P_{FWE} < 0.05$).

Conclusions: Alterations of decisional impulsivity, especially the reflection impulsivity, have already occurred in early α -synucleinopathies. Neuroimaging analyses revealed both the disrupted connectivity which potentially impaired reward networks and the recruitment of corticostriatal circuits contributing to decisional impulsivity deficits. Notably, altered decisional impulsivity in iRBD might reflect compensatory mechanisms following striatal dopamine neurons denervation, suggesting its potential utility as a phenocopy marker.

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Causal Associations Between Tea Consumption and REM Sleep Behavior Disorder: A Mendelian Randomization Study

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Introduction: Previous studies have shown that tea consumption may have a protective effect against neurodegenerative diseases. However, the exact causal relationship between tea consumption and the precursor stages of certain neurodegenerative diseases, namely REM sleep behavior disorder (RBD), remains unclear. To evaluate the causal association between tea consumption and RBD, we employed a Mendelian randomization study.

Materials and methods: We identified genetic instrumental variables that are significantly associated with tea consumption through genome-wide association studies (GWAS) in European populations. Bidirectional two-sample Mendelian randomization was utilized to determine the causal relationship between tea consumption and RBD, while sensitivity analyses were further employed to evaluate the robustness of the results. The multivariate Mendelian randomization method was used to assess the influence of relevant confounding factors on the results.

Results: In the MR analysis using the inverse variance weighting method, a significant causal relationship between tea consumption and RBD was observed (OR=0.046, 95% CI 0.004- 0.563, $p=0.016$). The consistency of findings across maximum likelihood, MR PRESSO, and multivariate MR after adjusting for potential confounding further supports this causal association. Sensitivity analyses revealed no evidence of heterogeneity or pleiotropy.

Conclusions: The findings of our study demonstrate a robust causal association between tea consumption and RBD, indicating that tea consumption may serve as a protective factor against the development of RBD.

Acknowledgments: The datasets were derived from sources in the public domain: GWAS

(<https://gwas.mrcieu.ac.uk>).

Neuroprotective Effect of Melatonin in Isolated Rapid Eye Movement Sleep Behavior Disorder

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Introduction: Over 90% of the patients with isolated rapid eye movement (REM) sleep behavior disorder (iRBD) will have a phenoconversion into a subtype of neurodegenerative diseases including Parkinson's disease and dementia over time. It remains unclear whether melatonin, a known hormone and one of the first-line symptomatic treatments of RBD, yields neuroprotective effect in iRBD.

Materials and methods: This study was conducted based on a longitudinal cohort of iRBD patients with naturalistic clinical follow-up of prescription, repeated neuropsychological assessments, and reevaluation on status of phenoconversion. To compare the potential neuroprotective effect of melatonin in iRBD, we first dichotomized the subjects into 'with melatonin' and 'without melatonin' by duration of melatonin use (e.g. 'with melatonin' was defined by using melatonin for at least one year and exceeding half of the follow-up duration). Generalized linear mixed models and Cox proportional regression models were fitted to compare the longitudinal change of neurodegenerative biomarkers, and the risk of conversion to neurodegenerative diseases between two conditions, respectively. Second, melatonin was treated as a time-varying covariate in the time-dependent survival analysis to investigate its effect by handling its varied dosage across the follow-up duration. Besides, the least optimal dosage of melatonin was also estimated for its neuroprotective effect.

Results: A total of 194 iRBD patients were included (66.2 ± 7.3 years, 72.2% male), with a mean follow-up duration of 5.5 years. Comparing with iRBD patients without melatonin (66.2 ± 7.9 years, 72.4% male), those with melatonin (66.2 ± 6.7 years, 71.9% male) showed a lower risk of phenoconversion (adjusted HR [95%CI] = 0.49[0.27, 0.87]), particularly for DLB (0.30[0.11, 0.82]). When considering the time-varying dosages of melatonin during follow-up, the neuroprotective effect of melatonin held (aHR [95%CI] = 0.91 [0.84, 0.98]) with a least optimal dosage estimated at 7.25mg. At biomarkers level, iRBD patients with melatonin showed a slower decline of severity of RBD symptoms (group*time interaction, β [95%CI] = 0.94 [0.13, 1.74]) and cognitive performance (0.007 [0.001, 0.01]), and a slower deterioration in color vision (-0.020 [-0.022, -0.018]), visuospatial and attention (-0.018 [-0.033, -0.002]), and motor coordination function (-0.016 [-0.027, -0.006]).

Conclusions: Clinical prescription of melatonin for iRBD symptom management might also have a neuroprotective effect to delay the phenoconversion risk with a dose-response manner. Future research, especially randomized controlled trials and animal studies, is warranted to corroborate efficacy and mechanisms.

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Automated analysis of home video for screening REM sleep behaviour disorder

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Introduction: Isolated REM sleep behavior disorder (iRBD), a prodromal syndrome of alpha-synucleinopathy neurodegeneration is characterized by vivid and often action-packed dream enactment behaviors (DEBs) during REM sleep. Early detection of iRBD benefits in preventing the progress of neurodegeneration, and sleep-related injuries caused by DEBs. With the availability of ambulatory home-PSG measurement, emerging studies have supported the validity of screening and diagnosing varieties of sleep disorders, including iRBD, at home setting. In corroborating a diagnosis of iRBD, the use of video-polysomnogram (vPSG) will help to document sleep related movement during REM sleep. However, the detailed manual analysis of vPSG recording is time-consuming and labor-intensive. There has been increasing number of studies exploring the automated video analysis method in distinguishing iRBD from healthy controls, albeit most of them were conducted in laboratory settings. Here we aimed to explore the automated video analysis for screening RBD at the home setting.

Materials and methods: This study included 35 patients with iRBD and 35 non-RBD controls, with the diagnoses confirmed (or excluded) by prior in-laboratory vPSG monitoring, respectively. All subjects underwent home vPSG (Nox A1s) with time-synchronized infrared-night-vision video recording (XIAOMI C700/TP-Link C212). Sleep-wake stages were scored by certified polysomnographic technologists. For the automated video analyses, pixel-value differences between adjacent 2-seconds-frames were calculated to quantify the intensity of movements from REM sleep videos, generating a temporal motion signal. Motion signals were compared with manually score movements results (based on criteria proposed by Frauscher B, 2009). Then, following features of motion signal were compared between iRBD and controls: movement counts (counts of motion signal larger than 1.2/1.4/1.6/1.8 times median of motion signal's peaks [baseline, indicating a "static status" of sleep]) per minute, movement duration percentage (duration of motion signal larger than 1.2/1.4/1.6/1.8 times baseline), and averaged normalized intensity.

Results: We firstly compared motion signals versus manually scored movements during REM sleep. A total of 95 major jerk/movements (e.g., whole body jerk, gross body movement, raising the arm, isolated elevation of one leg) were manually identified from five iRBD patients (66.4 ± 7.4 years, 80.0% male), while the motion signal threshold of 1.2/1.4/1.6/1.8 times baseline identified these movements with sensitivities of 100.0/96.3/91.3/87.9% and specificities of 35.63/83.21/92.31/95.67%, respectively. Then, we compared the motion signals between iRBD patients (67.9 ± 6.6 years, 71.4% male) and controls (66.7 ± 6.8 years, 31.4% male), whose results showed that iRBD group exhibited significantly higher values than controls in movement counts (e.g., 1.6 times: median [IQR]: 2.03 [1.25-3.33] vs 0.23 [0.13-0.50] per minute, $P < 0.001$), movement duration percentage (e.g., 1.4 times: 8.7% [6.1-13.1%] vs 1.2% [0.7-3.7%], $P < 0.001$), and averaged normalized intensity (1.61 [1.45-1.96] vs 1.25 [1.16-1.47], $P < 0.001$).

Conclusions: This study suggested that automated video analysis method would be able to identify epochs with possible behavioral events and differentiate iRBD patients from controls. The findings may highlight the feasibility of using ambulatory home-PSG measurement with infrared-night-vision camera to screen RBD at home settings.

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Integrated gut microbiome and metabolome analysis in isolated REM sleep behavior disorder

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Introduction: Isolated REM sleep behavior disorder (iRBD) is considered as the most specific prodromal marker of alpha-synucleinopathies, including Parkinson's disease (PD). Emerging evidences suggest similar gut microbiota dysbiosis between iRBD and PD. Fecal metabolomics provide a functional readout of microbial activity, and several key metabolites may play crucial roles in the pathophysiology of PD, including substrates of choline metabolism, amino acids (glutamate and tyrosine), bile acids and long chain saturated fatty acids. However, to date, fecal metabolomics of iRBD has not been thoroughly investigated. This study aims to explore the alterations in fecal microbiome and metabolome in patients with iRBD, along with their possible interactions.

Materials and methods: This is a cross sectional study, including 224 video-polysomnography confirmed iRBD (68.2 ± 7.3 years old, male 73.2 %) and 127 healthy controls (65.7 ± 7.5 years old, male 62.2 %). Fresh stool samples were collected from both groups. Gut microbiota was analyzed using shotgun metagenomic sequencing. Untargeted fecal metabolomics were performed using liquid chromatography–mass spectrometry.

Results: Fecal metabolomics analysis identified 296 metabolites distributed across 37 metabolic pathways. After adjusting for age and gender, 57 differential metabolites were identified (false discovery rate [FDR] < 0.1). Majority of the differential metabolites (N = 45) were more abundant in the iRBD group, including elevated fatty acids (Oleic acid, Myristic acid, stearic acid) and lipid peroxidation products (15,16-DiHODE, 12(13)-DiHOME, 16-hydroxyhexadecanoic acid), suggesting the potential presence of an inflammatory state and oxidative stress in the gut of iRBD patients. Elevated levels were also observed for amines such as phenylethanolamine, anandamide (AEA), L-histidinol, as well as lithocholic acid, indole and its derivative 2-oxindole. For the metabolites which were decreased in iRBD, Leucine has the most significant depletion, which may indicate disrupted branched-chain amino acid (BCAA) catabolism in iRBD patients.

For the metagenomics, a total of 21 differential microbial species were found between iRBD and controls (false discovery rate [FDR] < 0.1 after adjusted age and gender). For example, the abundances of *Anaeromassili bacillus* sp An250, *Christensenellaceae bacterium* NSJ 63 and *Lachnospiraceae bacterium* NSJ 29 were increased, while *Clostridium fessum* and *Faecalibacterium prausnitzii* were depleted in the iRBD group. We then examined the correlations between differential metabolites and microbial species in both groups. Of note, iRBD-enriched species *Christensenellaceae bacterium* NSJ 63 was widely associated with fecal metabolites indole, leucine, lysophosphatidylglycerol (lysoPG) and lithocholic acid, while these associations were not found in the control group, suggesting that the pathogenesis of iRBD may be closely linked to gut microbiota-mediated metabolic reprogramming.

Conclusions: The gut metabolome, including BCAA degradation, bile acid biosynthesis, phospholipid biosynthesis and tryptophan metabolism, is altered in iRBD, providing important biological insights into the gut–brain pathophysiology of alpha-synucleinopathies. Gut microbiota imbalance may be a driving factor underlying the gut metabolic alterations. These findings support a role for microbial metabolites as potential targets for the development of new biomarkers and therapies in iRBD.

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Sleep Deprivation Accelerates α -Synuclein Pathology via Per2-Mediated Lysosomal Dysfunction in Mice with REM Sleep Behavior Disorder

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Introduction: Rapid eye movement sleep behavior disorder (RBD) is a well-recognized prodromal manifestation of α -synucleinopathies such as Parkinson's disease (PD). Sleep deprivation has been shown to disrupt circadian gene expression and aggravate dopaminergic neurodegeneration, while autophagy-lysosomal dysfunction represents one of the core mechanisms driving α -synuclein accumulation in PD. However, whether sleep deprivation accelerates α -synuclein pathology by disturbing circadian regulation and lysosomal homeostasis during the RBD stage remains unclear.

Materials and methods: An RBD mouse model was generated by bilaterally injecting α -synuclein preformed fibrils (PFFs) into the sublateralodorsal tegmental nucleus (SLD) of 8-week-old mice. Successful modeling was confirmed at 12-week-old by polysomnographic recordings, which verified RBD phenotypes. At 20 weeks, the mice were subjected to a 7-day sleep deprivation protocol. To investigate the molecular consequences of sleep deprivation in RBD mouse, we first performed RNA sequencing of the substantia nigra, which revealed enrichment of circadian rhythm and autophagy-lysosomal pathways. These findings were further validated by multi-timepoint quantitative real-time PCR experiments (RT-qPCR) assessing circadian gene dynamics. In parallel, α -synuclein pathology, lysosomal function, and PD-like behavioral impairments were evaluated using Western blotting, immunostaining, and motor function tests.

Results: Sleep-deprived RBD mice exhibited exacerbated α -synuclein aggregation, increased loss of tyrosine hydroxylase (TH) positive neurons in the substantia nigra, and earlier onset of PD-like motor impairments. Multi-timepoint RT-qPCR revealed suppressed Per2 expression and dampened circadian rhythmicity, accompanied by marked lysosomal dysfunction as confirmed via Western blotting. Concurrently, we demonstrated that Per1/2 knockout mice also exhibited significant lysosomal impairment and a reduction in TH-positive dopaminergic neurons in the substantia nigra, implicating the involvement of core circadian genes in lysosomal homeostasis. To specifically determine the role of Per2, we performed AAV-mediated knockdown of Per2 in the substantia nigra of RBD mice, which reproduced the lysosomal dysfunction and α -synuclein accumulation observed following sleep deprivation. Conversely, Per2 overexpression in the substantia nigra mitigated these pathological changes and delayed disease progression.

Conclusions: These findings identify Per2-mediated lysosomal dysfunction as a critical mechanism by which sleep deprivation promotes the transition from RBD to α -synucleinopathy, providing novel insight into the circadian regulation of prodromal PD progression.

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Habitual diet and gut microbiome correlates in isolated REM sleep behavior disorder

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Introduction: Accumulating evidence indicates that habitual diet, including plant-based dietary patterns, are associated with the risk of developing neurodegenerative alpha-synucleinopathy. However, the role of dietary pattern and its correlation with gut microbiome at prodromal alpha-synucleinopathy, i.e., among patients with isolated REM sleep behavior disorder (iRBD), are largely unclear. This study aims to evaluate the associations of dietary patterns with iRBD and their interactions with gut microbial dysbiosis. Additionally, the effect of dietary factors on neurodegenerative progression in patients with iRBD was further examined.

Materials and methods: A total of 287 iRBD patients (66.9 ± 7.1 years, 74.6% males) and 208 controls (66.6 ± 7.3 years, 68.3% males) were involved in the study. Plant-based diet indices (overall plant-based diet index, oPDI; healthful plant-based diet index, hPDI; and unhealthful plant-based diet index, uPDI) were derived from food frequency questionnaire based on 20 food groups. The shotgun metagenomic sequencing for microbiome was performed in 452 subjects (261 iRBD vs. 195 controls) for further diet-microbiome analyses. After a median of 4.1 years, 45 (15.7%) iRBD patients converted to alpha-synucleinopathies. The impact of habitual diet on neurodegenerative outcomes were analysed using Cox proportional hazards models.

Results: Multivariable logistic regression models showed that subjects in the highest quartile of hPDI experienced 52% lower odds of iRBD (OR [95% CI]: 0.48 [0.29, 0.80], $P = 0.005$) compared to the lowest quartile, whereas that of uPDI would increase the odds of iRBD by 73% (1.73 [1.03, 2.91], $P = 0.04$). In terms of individual food groups, iRBD patients had lower intake of whole grains and were prone to consume more refined grains. Notably, the association of uPDI with iRBD was significantly more pronounced in subjects with depression (OR [95% CI]: 1.93 [1.26, 2.95], $P = 0.002$) and those who were physically inactive ($P = 0.01$). Gut metagenomic analysis revealed that habitual diet was linked to the variations in microbial composition and changes in individual microbes among iRBD patients. Further mediation analyses suggested that 39.1% ($P = 0.006$) of the effects of uPDI on iRBD were mediated by iRBD-enriched microbial species *Ruthenibacterium lactatiformans*. During follow-up, iRBD with higher baseline coffee drinking had a decreased risk of converting to alpha-synucleinopathy (Multivariate-adjusted HR [95% CI] = 0.22 [0.06, 0.74], $P = 0.01$), especially parkinsonism-first conversion (0.11 [0.02, 0.66], $P = 0.02$), whereas increased whole grain consumption was associated with lower risk of dementia (0.06 [0.004, 0.87], $P = 0.04$).

Conclusions: Patients with iRBD consumed more unhealthful plant-based diet and a decreased intake of healthful plant-based foods, such as whole grains. The habitual diet in iRBD is closely associated with gut microbiome dysbiosis with predictive value for neurodegenerative progression. The findings suggest that diet, gut microbiome, and their interplay might hold potential value for future interventions in alpha-synucleinopathy neurodegenerative diseases.

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Neurodegeneration and Sleep Instability: A CAP-Based Comparison in RBD Patients

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Introduction:

REM Sleep Behavior Disorder (RBD) involves dream enactment and loss of REM muscle atonia. Idiopathic RBD (iRBD) often precedes α -synucleinopathies such as Parkinson's Disease (PD), Dementia with Lewy Bodies (DLB), and Multiple System Atrophy (MSA). Identifying early physiological changes in these patients is critical for intervention and monitoring. The Cyclic Alternating Pattern (CAP), a measure of sleep instability, and the Epworth Sleepiness Scale (ESS), a subjective measure of daytime sleepiness, may reflect early neurodegenerative changes. We conducted a pilot investigation to assess whether these markers differ between RBD patients with and without neurodegeneration.

Materials and methods:

This cross-sectional case-control study included 8 patients recruited from a tertiary sleep and movement disorders clinic. All patients had PSG-confirmed RBD, with 4 classified as iRBD (no evidence of neurodegenerative disease after ≥ 12 months of follow-up) and 4 as nRBD (clinical diagnosis of PD, DLB, or MSA).

All participants were 18 years or older and underwent diagnostic overnight PSG demonstrating REM sleep without atonia (RSWA) and/or dream enactment behavior. The ESS was completed within one month of the PSG. Patients were excluded if they were taking medications that could significantly alter sleep architecture (e.g., sedatives, antidepressants) or had comorbid sleep disorders such as obstructive sleep apnea with an apnea-hypopnea index (AHI) ≥ 15 .

Sleep recordings were manually scored in accordance with AASM criteria. Sleep macrostructure parameters included total sleep time (TST), wake after sleep onset (WASO), and sleep efficiency. CAP was scored visually and included CAP rate (percentage of NREM sleep containing CAP sequences), average CAP duration, and the distribution of phase A subtypes (A1, A2, A3). REM-related arousals and total nocturnal arousals were also recorded.

Descriptive statistics were used to compare groups. Given the small sample size, inferential statistical testing was interpreted with caution. Exploratory correlations between ESS scores and PSG features were examined.

Results:

The nRBD group demonstrated a higher CAP rate ($47.8\% \pm 9.1$) compared to the iRBD group ($36.2\% \pm 7.6$, $p < 0.001$). A2 and A3 subtypes were significantly more prevalent in the nRBD group ($p = 0.002$ and $p = 0.009$, respectively), while A1 subtype was lower. REM sleep in nRBD was more fragmented, with increased arousals (12.4 ± 4.1 vs. 7.9 ± 3.6 , $p < 0.001$), and macrostructure was also impaired, with greater WASO and lower sleep efficiency.

Conclusions:

Our findings suggest that patients with RBD and neurodegenerative disease exhibit marked sleep instability, particularly reflected in CAP metrics and REM fragmentation. Subjective daytime sleepiness, as measured by ESS, also trended higher in the nRBD group and correlated with CAP-related disruptions, suggesting that these may serve as early physiological signals of underlying neurodegeneration. CAP analysis and ESS may serve as accessible and non-invasive markers to help identify RBD patients at elevated risk of neurodegeneration. Further validation in larger cohorts is needed to confirm these preliminary findings and refine their diagnostic utility.

Gut microbiota in major depressive disorders with rapid eye movement behavior disorder: tracing a subtype of depression with underlying neurodegeneration

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Introduction: REM sleep behavior disorder (RBD) is a parasomnia associated with α -synucleinopathy. RBD features are more common in major depressive disorder (MDD). While initially postulated as an antidepressant-induced phenomenon, emerging evidence suggests that MDD comorbid with RBD (MDD+RBD) represents underlying neurodegeneration. The gut-brain axis is increasingly recognized in both depression and neurodegeneration, with PD-like gut dysbiosis observed in idiopathic RBD (iRBD). This study aims to characterize gut microbiome in MDD+RBD to explore its potential as a distinct depressive subtype with neurodegenerative features for etiological understanding and intervention.

Materials and methods: This case-control study included four groups: patients with MDD+RBD, age- and sex-matched MDD without RBD (MDD-only), healthy control (HC), and iRBD without a psychiatric disease. RBD diagnosis was confirmed by video-polysomnography. MDD+RBD was defined as MDD onset preceding the appearance of RBD. Fecal samples were analyzed using metagenomic sequencing.

Results: A total of 420 participants were included: 124 HC, 80 MDD-only, 82 MDD+RBD and 134 iRBD. The mean age and sex distribution were comparable among HC (65.7 ± 7.0 years, 61.3% male), MDD-only (65.6 ± 6.5 years, 50.0% male), and MDD+RBD (66.3 ± 5.6 years, 62.2% male). However, iRBD group was slightly older (67.9 ± 6.1 years) and had a higher proportion of males (78.4%) compared to the HC group.

1. **Psychiatric and gastrointestinal features:** The psychiatric profiles of MDD-only and MDD+RBD were largely comparable. Regarding gastrointestinal features, lower Bristol stool scale scores (BSS, harder stool) were observed in iRBD and MDD+RBD, compared to MDD-only and HC (3.3 ± 1.2 vs 3.2 ± 1.5 vs 4.2 ± 1.3 vs 4.1 ± 1.1 , $q < 0.001$).
2. **Neurodegenerative biomarkers:** The total likelihood ratio for prodromal PD (excluding RBD) was higher in MDD+RBD than iRBD, MDD-only and HC (1.78 ± 1.11 vs 1.38 ± 0.97 vs 0.74 ± 0.70 vs 0.44 ± 0.55 , $p\text{-value} < 0.001$).
3. **Microbial profiles:** After adjusting for age, sex and BSS, MDD+RBD exhibited a distinct microbial composition compared to both HC ($R^2 = 0.012$, $q\text{-value} = 0.003$) and MDD-only ($R^2 = 0.011$, $q\text{-value} = 0.013$), while its microbiota composition was similar to that of iRBD ($R^2 = 0.0052$, $q\text{-value} = 0.26$). In contrast, MDD-only was similar to HC in terms of microbial clustering. Taxonomic analysis, adjusting for age, sex and BSS, revealed that MDD+RBD displayed a gut dysbiosis with both PD-associated species (e.g., enriched *Akkermansia muciniphila*, *Ruthenibacterium lactatiformans*, and depleted SCFA-producer *Faecalibacterium prausnitzii*) and depression-related (e.g., enriched *Eggerthella lenta* and decreased *Coprococcus eutactus*) alterations. Random Forest model showed that microbial species and GI features could effectively differentiate MDD+RBD from MDD-only (AUC = 0.78).

Conclusions: MDD+RBD exhibited a gut dysbiosis similar to that of iRBD, whereas MDD-only subjects resembled more closely to HC, suggesting that MDD+RBD is likely a variant of depression with underlying neurodegeneration. In addition, the gut microbiome might serve as a promising biomarker for early neurodegenerative risk stratification in psychiatric populations. Our findings offer novel insights into microbiota-gut-brain axis, highlighting its role in the intersection of depression and neurodegeneration.

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Diagnostic Cutoffs for REM Sleep Without Atonia in Isolated REM Sleep Behavior Disorder from a Korean Population

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Introduction: Isolated REM sleep behavior disorder (iRBD), characterized by REM sleep without atonia (RWA), is a prodromal stage of alpha-synucleinopathies. Although diagnostic cutoffs for RWA are established in Western populations, ethnic variations necessitate confirmation of these criteria in Asian cohorts. Previous Korean studies were limited by small sample sizes, manual scoring methods, and inconsistent quantification standards. Using advanced automated algorithms, this study aimed to establish reliable diagnostic cutoffs for RWA quantification for Koreans.

Materials and methods: Baseline polysomnograms were analyzed from 95 iRBD patients (aged 66.2 ± 7.4 years; 63.2% male) diagnosed at Seoul National University Hospital, free from secondary causes, neurological disorders, or severe obstructive sleep apnea. Controls consisted of 24 matched individuals (16 with restless leg syndrome, 8 healthy subjects), and an external validation cohort comprised 95 matched elderly Koreans without RBD. Single-night PSG included EEG, EOG, ECG, respiratory monitoring, mentis (MT), and bilateral flexor digitorum superficialis (FDS) EMG recordings. MT electrodes were attached to all participants, whereas FDS electrodes were attached to all controls and 42 patients with iRBD. Automated RWA quantification utilized the validated in-laboratory algorithm (AURA), demonstrating high reliability compared to human scoring (PABAK: 0.736–0.945). RWA was assessed using SINBAR criteria, AASM criteria, cumulative RWA percentage (CRWA%), and REM atonia index (RAI). Diagnostic performance was assessed using receiver operating characteristic analyses, with bootstrap methods (1,000 iterations) for 95% confidence intervals (CI), determining cutoffs internally and validating externally.

Results:

Optimal and specificity=1 cutoffs for the MT channel included CRWA% (5.62% and 5.62%, AUC: 0.94 [0.91–0.98]), Tonic SINBAR (0.55% and 2.83%, AUC: 0.86 [0.80–0.91]), Phasic SINBAR (14.32% and 19.89%, AUC: 0.87 [0.79–0.93]), Any SINBAR (17.47% and 20.02%, AUC: 0.92 [0.87–0.96]), Phasic AASM (4.48% and 15.07%, AUC: 0.82 [0.73–0.91]), Any AASM (7.55% and 16.00%, AUC: 0.92 [0.87–0.97]), and RAI (0.90 and 0.78, AUC: 0.92 [0.85–0.96]).

For the FDS channels, cutoffs were CRWA% (4.50% and 13.16%, AUC: 0.90 [0.82–0.97]), Phasic SINBAR (18.72% and 33.22%, AUC: 0.86 [0.76–0.95]), Any SINBAR (23.92% and 34.95%, AUC: 0.91 [0.83–0.97]), Phasic AASM (8.84% and 27.75%, AUC: 0.84 [0.74–0.94]), and Any AASM (10.00% and 29.38%, AUC: 0.90 [0.82–0.96]).

For the combined MT+FDS channels were: CRWA% (9.21% and 16.40%, AUC: 0.97 [0.94–1.00]), Phasic SINBAR (28.30% and 34.91%, AUC: 0.92 [0.85–0.97]), Any SINBAR (MT) + Phasic SINBAR (FDS) (36.24% and 36.24%, AUC: 0.97 [0.92–0.99]), Phasic AASM (9.80% and 26.67%, AUC: 0.88 [0.79–0.96]), and Any AASM (MT) + Phasic AASM (FDS) (13.86% and 27.52%, AUC: 0.97 [0.94–1.00]).

When the optimal and specificity=1 cutoffs for the MT channel were applied to the external validation cohort, both specificity and sensitivity fell within the CIs observed in the internal cohort, indicating no significant differences in performance.

Conclusions: Our findings showed that RWA diagnostic cutoffs in Koreans, especially for Phasic and Any RWA, were largely consistent with those reported in Western populations. Notably, the lower tonic RWA observed in our study may help explain the lower phenoconversion rate reported in Korean cohorts compared to Western populations.

Progression of prodromal markers of alpha-synucleinopathy neurodegeneration in the first-degree relatives of patients with REM sleep behavior disorder: a 7-year prospective study

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Introduction: Idiopathic REM sleep behavior disorder (iRBD) is the most specific prodromal phase of alpha-synucleinopathies, including Parkinson's disease (PD) and dementia with Lewy bodies (DLB). Emerging evidence suggests a familial predisposition of iRBD, highlighted by the familial aggregation of RBD-spectrum features (e.g., dream enactment behaviors) and prodromal markers of alpha-synucleinopathies (e.g., motor dysfunction) in the first-degree relatives (FDRs) of iRBD patients. Building on these cross-sectional observations, this longitudinal 7-year follow-up study aims to further evaluate the progression of neurodegeneration markers and subsequent clinical neurodegenerative development in the FDRs of patients with iRBD compared to the FDRs of controls, in the established Hong Kong family cohort.

Materials and methods: This prospective matched cohort study included 156 FDRs of patients with iRBD and 130 FDRs of controls as the referent individuals. Comprehensive clinical assessments were conducted, including interviews on sleep patterns and disorders, neuropsychiatric examinations, motor tests using the Unified Parkinson's Disease Rating Scale part III (UPDRS-III), and a series of questionnaires at baseline and follow-up. Additionally, 69 FDRs of iRBD patients and 40 control FDRs underwent video-polysomnographic assessments (v-PSG) at both time points. Linear and generalized linear mixed model analyses were employed to study the longitudinal changes.

Results: The mean follow-up duration for FDRs of iRBD patients and control individuals were 6.6 years and 6.8 years, respectively ($P = 0.28$). Baseline age (54.6 ± 9.0 vs. 55.3 ± 7.2 years, $P = 0.46$) and sex distribution (48.7% vs. 44.6% males, $P = 0.49$) were comparable between the two FDR groups. FDRs of iRBD patients consistently exhibited trends of increased RBD features at both baseline and follow-up, including self-reported dream enactment behaviors and electromyographic activity of chin mentalis evaluated by v-PSG. Over the observation period, six FDRs of iRBD (Cumulative incidence 4.0%) and one FDR of controls (Cumulative incidence 0.8%) were newly diagnosed with iRBD (group effect, $P < 0.001$; group*time effect, $P < 0.001$). Other prodromal markers, such as motor function assessed by UPDRS-III total score and sub-score for bradykinesia, showed greater impairment in FDRs of iRBD patients (group effects, $P = 0.02$ and $P = 0.01$), while gait instability demonstrated a significant group*time interaction effect ($P = 0.01$). However, global cognitive function did not differ significantly between the two groups. During the follow-up, two FDRs of iRBD patients were clinically diagnosed with PD (Cumulative incidence 1.3%), whereas no FDRs of control were diagnosed with PD. None of the FDRs in either group was diagnosed with dementia.

Conclusions: These findings further confirm the familial aggregation of RBD features and alpha-synucleinopathy neurodegeneration markers among FDRs of iRBD patients. Upon 7-year prospective follow-up, FDRs of iRBD patients exhibited higher incidences of RBD features (including iRBD diagnosis), progression of neurodegenerative features and clinical diagnosis of incident PD, highlighting FDRs of iRBD as high-risk populations for future neuroprotective interventions.

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Restless Legs Syndrome

Clinical feature and alpha-synuclein level of restless legs syndrome with leucine-rich repeat kinase 2 encoding gene mutation

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Introduction: Restless leg syndrome (RLS) has been reported associated with Parkinson's Disease (PD). However, it remained largely unknown of the mechanism underlying this association between RLS and PD.

Materials and methods: 199 idiopathic RLS and 114 PD were diagnosed and recruited by neurologists from Ruijin Hospital affiliated to Shanghai Jiao Tong University. And 273 health controls were recruited from community. Eight LRRK2 pathogenic variants were sequenced. Clinical data was collected including symptoms, comorbidities, family history, and iron level. ELISA was used to measure plasma level of α -synuclein.

Results: The G2385R variant was found significantly higher in PD group after Bonferroni correction ($p=0.018$). Taking all LRRK2 mutations as one risk covariant, further logistic regression analysis showed a marginal association of LRRK2 with RLS ($OR=1.847$, $95\%CI:1.022-3.337$, $p=0.042$) after adjusting age and gender. In terms of clinical feature, it was found that RLS-LRRK2 carriers usually reported a positive family history of neurological or psychiatric disorders (48.3% vs 27.6%) ($p=0.026$) and a higher foot involvement of sensory symptoms (33.3% vs 14.0%) ($p=0.042$). Plasma α -synuclein level in RLS ($p=0.021$) and PD ($p=0.018$) was both significantly increased compared to non-manifesting carriers.

Conclusions: Our study showed that LRRK2 mutation was associated with Chinese PD patients but only showed a possible trend of association with RLS. Positive neurological or psychiatric family history and foot discomfort in RLS were important features of indication of LRRK2 mutation in RLS. Plasma α -syn was increased in LRRK2-RLS as well as LRRK2-PD, indicating a possible association of RLS with PD in LRRK2 carriers.

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Severe, refractory restless legs syndrome responding to hyperbaric oxygen therapy: a case report

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Introduction: We present the case of a 73-year-old woman with severe, refractory restless legs syndrome (RLS). She experienced progressively worsening symptoms over more than 20 years, resulting in significantly impaired sleep and daytime dysfunction. This is on a background of mild obstructive sleep apnoea and sleep-maintenance insomnia. Her symptoms of RLS remained debilitating despite multiple pharmacological and non-pharmacological interventions trialled including iron replacement therapy, gabapentinoids, opioids, antidepressants, and cognitive behavioural therapy. At the time of hyperbaric oxygen therapy (HBOT) initiation, she was taking buprenorphine patch 5 mcg/h weekly, amitriptyline 25 mg nocte, agomelatine 25 mg daily, gabapentin 600 mg daily, and zopiclone 7.5 mg nocte.

Materials and methods: Emerging research suggests that peripheral tissue hypoxia may play a role in RLS pathophysiology. A study demonstrated a strong association between reduced leg oxygenation and symptom severity in untreated patients with RLS. Based on this, HBOT was trialled as a novel therapeutic approach. In February 2025, the patient commenced a HBOT protocol consisting of 30 sessions, each lasting 50 minutes and uptitrated to 1.9 atmospheres absolute, delivered 3–4 times per week. No concurrent changes were made to her medication regimen during the HBOT course.

Results: The patient reported symptomatic improvement within two weeks of initiating HBOT. Upon completion of the initial 30-session protocol, she reported marked improvements in subjective sleep quality, mood, and both the frequency and severity of RLS symptoms. Her International Restless Legs Scale score decreased from 21

(severe) to 2 (mild). The treatment was well tolerated, with no reported adverse effects. Given the durability of symptom control between sessions, the patient has continued on HBOT indefinitely with a plan to de-escalate the frequency of sessions. In parallel, the patient began a supervised taper of gabapentin, reducing the dose by 100 mg every three weeks. She is currently stable on gabapentin 400 mg daily, without recurrence of significant symptoms.

Conclusions: This case highlights the potential for HBOT to serve as a novel adjunctive therapy for patients with refractory RLS, particularly when conventional treatment options have been exhausted. If further validated, HBOT may offer a promising avenue for improving quality of life in this challenging patient population.

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Clinical Characteristics, Polysomnography, and Iron Metabolism in Restless Legs Syndrome Patients with Obstructive Sleep Apnea: A Comparative and Cluster Analysis Study

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Introduction: Restless Legs Syndrome (RLS) often coexists with obstructive sleep apnea (OSA), worsening symptoms through complex mechanisms. This study investigates the prevalence, clinical features, and phenotypic subtypes of RLS-OSA to improve diagnosis and treatment.

Materials and methods: A multicenter observational study enrolled 1,134 patients with RLS from 23 Chinese sleep labs from January 2020 to December 2024. RLS was diagnosed using the 2014 RLSSG criteria; OSA was confirmed via polysomnography (AHI ≥ 5 with symptoms). Patients were classified into RLS-OSA and RLS-only groups. Clinical characteristics, PSG parameters, and iron metabolism markers were analyzed. To identify distinct subgroups among patients with comorbid RLS and OSA, a K-means clustering analysis was conducted using R. Categorical variables were one-hot encoded and combined with standardized numerical variables (mean = 0, standard deviation = 1) to ensure equal weighting. The optimal number of clusters was determined using the Elbow Method and Silhouette Score. The K-means algorithm was then applied with the identified number of clusters to minimize within-cluster variance. Post-clustering differences in demographic, PSG, and laboratory test variables were evaluated using the t-test or the Mann-Whitney U test for continuous variables and the Chi-square tests or Fisher's exact test for categorical variables.

Results: OSA was present in 69.2% (n=785) of patients with RLS. The RLS-OSA group exhibited higher age, BMI, age at onset, and male proportion, with reduced insomnia (all $p < 0.01$). PSG revealed shorter total sleep time, lower sleep efficiency, increased wake time after sleep onset, and altered sleep stages (less N3, more N1; all $p < 0.01$). Hemoglobin and ferritin levels were elevated ($p < 0.001$). Two RLS-OSA phenotypes emerged: Cluster 1 ("Mild Early-Onset") with younger age, earlier onset, better sleep quality, and relatively normal iron status, and Cluster 2 ("Severe Late-Onset") with older age, later onset, poorer sleep quality, and iron dysregulation (all $p < 0.05$).

Conclusions: OSA is common in RLS, with distinct clinical and sleep-related differences. Two distinct phenotypes of RLS-OSA were identified, highlighting its heterogeneity. These findings underscore the need for tailored diagnostic and therapeutic approaches to improve symptom management and patient outcomes.

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Comparison of Restless Leg Syndrome Characteristics and Treatment Responses Between Male and Female Patients

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Introduction: Restless legs syndrome (RLS), also known as Willis–Ekbom disease, affects sleep quality and overall quality of life worldwide. Understanding the demographic and clinical characteristics of RLS, particularly potential gender differences, is essential for effective diagnosis and management.

Objectives: To examine the demographic and clinical features of RLS, including iron status, polysomnographic parameters, treatment practices, and responses, with a comparison between male and female patients.

Materials and methods: We retrospectively analyzed inpatient and outpatient records, identifying RLS cases using ICD-10 codes. Patients aged 18 years and older diagnosed with RLS based on the 2014 IRLSSG criteria and with at least 12 months of follow-up were included.

Results: A total of 29 patients were included, with a female-to-male ratio of 1.42. The mean age was 64.61 ± 17.58 years for females and 62.57 ± 18.91 years for males ($p=0.767$). Body mass index, comorbidities, and the presence of sleep disorders such as obstructive sleep apnea and insomnia did not differ significantly between genders. Although males showed a trend toward a higher apnea–hypopnea index compared to females ($37.8 [3.25, 17.3]$ vs. $10.1 [10.9, 45]$ events/hour, $p=0.075$), females had significantly lower total sleep time and sleep efficiency (328.75 ± 61.42 vs. 425.75 ± 41.73 minutes, $p=0.040$; $74.17 \pm 9.71\%$ vs. $92.1 \pm 3.86\%$, $p=0.014$, respectively). Combined therapy was prescribed more frequently as the initial treatment in females compared to males (62.5% vs. 20% , $p=0.034$). However, treatment response and final medication dosages were similar across genders. Compared to males, females had significantly lower hemoglobin, serum iron, and transferrin saturation (12.65 ± 1.41 vs. 14.12 ± 1.73 g/dL, $p=0.018$; 71 ± 23.03 vs. 98.44 ± 30.38 mcg/dL, $p=0.029$; $24.43 \pm 8.29\%$ vs. $37.35 \pm 15.67\%$, $p=0.032$, respectively). However, the severity of iron deficiency warranting treatment and ferritin levels did not differ significantly between genders.

Conclusions: Sex-related differences in RLS were observed in sleep parameters, iron status, and initial treatment approaches. Female patients exhibited more pronounced clinical impact, as evidenced by reduced total sleep time and sleep efficiency, possibly contributing to the higher use of combination therapy. Despite lower iron status in females, the deficiency was generally not severe enough to require treatment. These findings underscore the importance of gender-specific considerations in the evaluation and management of RLS.

Sleep Breathing Disorders

Oscillometric Lung Function and Its Association with Obstructive Sleep Apnea Risk

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Introduction: Obstructive sleep apnea (OSA) is a sleep disorder characterized by repeated episodes of upper airway blockage during sleep, leading to apnea or hypopnea. An apnea is defined as a episode as a reduction in airflow of $\geq 90\%$ lasting at least 10 seconds. A hypopnea is defined as a reduction in airflow of $\geq 30\%$ lasting at least 10 seconds and associated with a $\geq 4\%$ decrease in pulse oxygenation. Collapse or narrowing of the upper airway during sleep is OSA patient can increase resistance airflow in the upper airway. Oscillometry provides a non-invasive comprehensive assessment of lung function by analyzing airway resistance, reactance, and compliance. This multi-dimensional approach allows for detecting abnormalities in the peripheral airways. Oscillometry is a method used to assess upper airway resistance by applying small pressure oscillations to the airway during normal breathing. It measures respiratory system impedance, which includes airway resistance (Rrs) and reactance (Xrs). In OSA patients, increased upper airway resistance, usually in the supine position, can be detected using oscillometry.

Materials and methods: A total of 262 subjects aged 40 years and older were included in this study. The risk of OSA was determined using the STOP-Bang questionnaire, which evaluates clinical parameters including snoring, tiredness during daytime, observed apnea, and high blood Pressure-body mass index, age, neck circumference, sex. Pulmonary function was assessed and evaluated using an oscillometry. Subjects were categorized into low-risk and high-risk groups for OSA. Statistical analyses were performed using independent t-tests and chi-square tests, with a p -value < 0.05 considered statistically significant.

Results: There was no significant difference in age between the groups. High-risk subjects for OSA were more likely to be male ($p = 0.02$), have a higher BMI ($p < 0.05$), and a larger neck circumference ($p < 0.05$). Smoking was

also more common in the high-risk group ($p = 0.03$). Comorbidities such as diabetes, cardiovascular disease, and kidney disease were significantly more prevalent in the high-risk group. Oscillometry parameters and respiratory patterns showed no significant differences between the groups.

Conclusions: Individuals at high risk for OSA had significantly higher BMI, neck circumference, smoking prevalence, and comorbid conditions. However, oscillometry findings did not differ between the risk groups, suggesting that respiratory impedance may not be a sensitive marker for differentiating OSA risk.

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Facial Aesthetic Outcomes of Counterclockwise Maxillomandibular Advancement in Asians with Obstructive Sleep Apnea: An Objective Analysis

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Introduction: Counterclockwise maxillo-mandibular advancement (CCW-MMA) is the most effective surgical management to enlarge the pharyngeal airway space in obstructive sleep apnea. However, the facial aesthetic consequences in Asians whose craniofacial morphology and cultural ideals differ from Western norms remain under represented.

Materials and methods: A retrospective cohort of 54 Asian adults (18 years and above; apnoea–hypopnoea index > 5) treated with CCW-MMA were reviewed. Pre-operative (T0) and 6-months post-operative (T1) lateral cephalograms were analysed. Soft-tissue landmarks including pogonion (Pog'), subnasale (Sn'), upper lip (ULs'), lower lip (LLs'), and nasion (N') positions were measured relative to the Zero Meridian Line (ZML) and E-line. Facial angles including nasolabial, Z-, facial-convexity and gonial angles were also measured. Patients were stratified by skeletal class I, II, and III. Soft tissue deviations from the Caucasian normative values were recorded. Intra-rater reliability was verified (intraclass correlation coefficient > 0.90). Paired t -tests were used to assess T0–T1 changes. Postoperative soft tissue changes and facial angles across all skeletal classes were compared to the Caucasian normal values using paired t -tests. ANOVA and multivariate regression was then used to examine between skeletal classes.

Results:

There were significant changes in the soft tissue landmarks between T0 and T1 across all skeletal classes with mean ($\pm$ SD) anterior translation of Pog' 5 ± 2 mm, Sn' 3 ± 1 mm, ULs' 3 ± 1 mm, and LLs' 3 ± 1 mm. The facial convexity angle decreased by $4^\circ \pm 2^\circ$, while the nasolabial angle increased by $8^\circ \pm 2^\circ$, indicating forward rotation of the lower face and profile straightening. Postoperatively, 85% of subjects had Pog' within the Zero meridian harmony. The Z-angle improved from a mean of 65° to the aesthetic ideal of 75 – 80° , confirming enhanced chin–lip projection. Class II patients showed the greatest Pog' advancement (8 ± 2 mm), with 90% of subjects achieving Pog' alignment within ± 2 mm of the ZML. In Class III patients, a notable reduction in Pog' (-5 ± 2 mm) and LLs' (-5 ± 2 mm) was observed, while Sn' and ULs' showed notable forward movement toward the ZML. Class I subjects demonstrated a forward shift of Pog' relative to the ZML, which significantly exceeded the expected normative variation. They also displayed significant changes in the Z-angle, facial convexity angle, and gonial angle. Other landmarks did not show significant changes or deviations from the Caucasian norm.

Conclusions: Although facial angles and soft tissue profiles demonstrated balanced and improved projection comparable to Caucasian norms, Class I Asian patients exhibited slight overprojection of the facial profile as a compensatory outcome for pharyngeal airway enlargement. These findings highlight the importance of skeletal class–specific surgical planning to optimize both functional and aesthetic outcomes, particularly in Asian OSA patients. Further research incorporating subjective aesthetic assessments is warranted to better define ideal facial aesthetics within Asian populations.

Comparative Assessment of Diaphragm Morphofunctional Alterations in Obstructive Sleep Apnea, Chronic Obstructive Pulmonary Disease, and Overlap Syndrome

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Introduction: Obstructive Sleep Apnea (OSA) and Chronic Obstructive Pulmonary Disease (COPD) are both prevalent respiratory disorders globally. Their coexistence as Overlap Syndrome (OS) imposes a higher risk of nocturnal hypoxemia, morbidity, and mortality. While diaphragm dysfunction is well-established in COPD, its morphofunctional status in OS patients remains unclear. This study aimed to systematically compare diaphragm morphology and function among OSA, COPD, OS patients, and healthy controls using ultrasonography.

Materials and methods: We conducted a single-center cross-sectional study at the Sleep Center of a general hospital. Participants underwent overnight polysomnography (PSG) and spirometry. Based on PSG and pulmonary function test results, participants were categorized into four groups: OSA (n=50), COPD (n=22), OS (n=15), and healthy controls (n=16). Diaphragm morphology (thickness and thickening ratio) and function (mobility during quiet and deep breathing) were assessed using standardized ultrasonography protocols by experienced operators blinded to clinical data. Sleep indices, pulmonary function parameters, and diaphragm metrics were compared among groups. Spearman correlation analysis was performed to examine the associations between diaphragm parameters, AHI, and pulmonary function indicators.

Results: COPD patients exhibited significantly reduced diaphragm thickness and mobility compared to all other groups (P<0.001). OS patients showed preserved diaphragm thickness but impaired diaphragmatic mobility versus healthy controls (P<0.05). AHI positively correlated with diaphragm thickness (r=0.572, P<0.01), while FEV1/FVC and FEV1%pred were significantly associated with both diaphragm thickness and mobility (P<0.001). OS patients demonstrated the longest duration of nocturnal SpO₂<90%, highlighting their unique hypoxemic burden.

Conclusions: COPD patients exhibited significantly reduced diaphragm thickness, which was inversely correlated with pulmonary function severity. In contrast, OS patients showed preserved diaphragm morphology, including thickness and thickening ratio comparable to healthy controls, but demonstrated significantly reduced diaphragmatic mobility, indicating functional impairment despite morphological preservation. These findings highlight the distinct diaphragm morphofunctional profiles among OSA, COPD, and OS patients, underscoring the need for targeted diaphragm function assessment in OS patients to guide early interventions.

Impact of CPAP Treatment on Inflammatory Markers in Moderate-Severe Obstructive Sleep Apnea Patients: A 12-Month Follow-Up Study

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Introduction: Obstructive Sleep Apnea (OSA) is characterized by intermittent upper airway obstruction, leading to chronic hypoxia and a pro-inflammatory state. The elevation of inflammatory markers, such as high-sensitivity C-reactive protein (hs-CRP) and erythrocyte sedimentation rate (ESR), is frequently observed in OSA and is associated with an increased risk of cardiovascular disease. Continuous Positive Airway Pressure (CPAP) is a well-established treatment for OSA; however, its effect on inflammatory biomarkers remains unclear. This study aimed to evaluate the impact of CPAP therapy on hs-CRP and ESR levels in patients with moderate-severe OSA, with good CPAP adherence, over a 12-month period.

Materials and methods:

This prospective study was conducted at Chiangrai Prachanukroh Hospital from January 2023 to December 2024. A total of 120 newly diagnosed moderate-to-severe OSA patients were enrolled, all of whom had a minimum CPAP adherence rate of 70%. Participants were predominantly male (86/120, 71.66%) with a mean age of

49.3±15.5 years. The baseline assessment included polysomnography, measurement of hs-CRP, ESR, and metabolic parameters, along with the Epworth Sleepiness Scale (ESS) and STOP-BANG scores. CPAP therapy was initiated after diagnosis, and compliance was monitored through usage data. Follow-up assessments were performed 12 months after initiating CPAP therapy.

Results:

At baseline, the mean apnea-hypopnea index (AHI) was 50.88 events/hour, and the mean ESS score was 9.17. After 12 months of CPAP therapy, the mean AHI decreased to 3.67 events/hour. Inflammatory markers, hs-CRP and ESR, showed a trend toward reduction after CPAP therapy, but the changes did not reach statistical significance (hs-CRP: 9.61 to 3.42 mg/L, $p = 0.070$; ESR: 19.58 to 13.64 mm/hr, $p = 0.339$). There was a statistically significant decrease in cholesterol levels from 179.17 mg/dL to 148.41 mg/dL ($p = 0.036$), but no significant changes were observed in blood pressure, fasting blood sugar (FBS), or HbA1c levels. CPAP usage was adequate, with a mean daily usage of 5.77±1.39 hours and an overall adherence rate of 87.5%.

Conclusions:

This study indicates that while CPAP therapy in patients with moderate-severe OSA led to a reduction in inflammatory markers such as hs-CRP and ESR, these changes did not reach statistical significance. However, the reduction observed suggests a potential benefit of CPAP therapy in decreasing systemic inflammation. Despite the lack of statistical significance, these findings contribute to the ongoing debate regarding the role of CPAP in reducing inflammation and improving cardiovascular outcomes in OSA patients. Further studies with larger sample sizes and longer follow-up are needed to fully understand the effects of CPAP on inflammation in OSA patients.

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Impact of Obstructive Sleep Apnea on Nocturnal Ketone Metabolism: A Breath Acetone Analysis Study

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Introduction: In recent years, ketogenic diets have gained popularity as effective strategies for weight loss and metabolic improvement. A key aspect of these approaches lies in the body's transition into a state of ketosis—shifting from glucose to fat as the primary fuel source, thereby promoting ketone body production. However, poor sleep quality or sleep disturbances may impair ketogenesis, potentially reducing the expected metabolic benefits. Obstructive sleep apnea (OSA) refers to sleep-disordered breathing caused by partial or complete airway obstruction. Despite its potential impact, empirical evidence on whether OSA disrupts overnight changes in ketone levels remains limited. Therefore, this study aims to investigate whether OSA influences overnight breath acetone fluctuations by comparing pre-sleep and post-sleep ketone levels, and to develop a predictive model based on sleep-related parameters.

Materials and methods: We conducted a cross-sectional study at Shuang-Ho Hospital to investigate the impact of obstructive sleep apnea (OSA) on overnight ketone metabolism. A total of 66 adult participants underwent overnight Polysomnography (PSG) and were categorized into two groups based on their Apnea-Hypopnea Index (AHI): the non-severe OSA group (AHI < 30, $n = 42$) and the severe OSA group (AHI ≥ 30, $n = 24$). Breath acetone levels were measured before and after sleep using a portable breath ketone meter. The change in breath acetone ($\Delta\text{Acetone} = \text{post-sleep} - \text{pre-sleep}$) was used as a marker of nocturnal ketogenesis. We performed Student's t-tests and Chi-Square tests to compare demographic and PSG variables between the groups. Spearman

correlation analyses were used to assess associations between Δ Acetone and OSA-related variables. Finally, a logistic regression model was constructed to identify predictors of a negative overnight acetone change (Δ Acetone < 0), using Δ Acetone > 0 as the reference group.

Results: Among the 66 participants, those in the severe OSA group ($n = 24$) exhibited significantly higher age, weight, BMI, neck circumference, and waist circumference than the non-severe group ($n = 42$) ($p < 0.05$). PSG results showed that severe OSA patients had significantly lower mean SaO_2 , higher AHI, ODI, ArI, and greater proportions of light sleep stages (N1 and Wake) ($p < 0.05$). The overnight change in breath acetone (Δ Acetone) was significantly lower in the severe group (-0.52 ± 0.60) than in the non-severe group (-0.12 ± 0.57 ; $p = 0.01$). Spearman correlation revealed that AHI and ArI were negatively correlated with Δ Acetone ($r = -0.453$ and -0.454 , respectively; $p < 0.01$). Logistic regression analysis further identified AHI as a significant predictor of negative overnight acetone change (OR = 1.058, 95% CI: 1.003–1.117, $p = 0.04$), after adjusting for ArI, weight, and neck circumference.

Conclusions: This study provides preliminary evidence that obstructive sleep apnea (OSA), particularly with higher AHI levels, may impair overnight ketone metabolism. AHI was identified as a significant predictor for a negative overnight change in breath acetone. These findings highlight the potential metabolic consequences of untreated OSA and suggest a novel physiological link between sleep-disordered breathing and impaired lipid metabolism.

Revealing the knowledge gap: Maxillomandibular Advancement for Obstructive Sleep Apnea in Skeletal Class III Patients

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Introduction: Maxillomandibular advancement (MMA) is a well-established and effective surgical intervention for the treatment of obstructive sleep apnea (OSA). It involves surgical repositioning of the maxilla and mandible to a more forward position, usually with a greater focus on the latter. In addition to functional improvements, it has been commonly cited to improve facial aesthetics in Skeletal Class I and II patients, especially for patients with a smaller lower jaw profile. However, the same cannot be applied to Skeletal Class III patients. The prevalence of OSA in Skeletal Class III patients is 11.22%. These patients have a longer lower jaw profile relative to their upper jaw. Thus, the principles applied to the classic MMA may no longer apply. Unfortunately, the application of MMA in skeletal Class III patients with OSA is not well documented.

Materials and methods: The aim of this scoping review was to explore the variations and outcomes of MMA techniques in this unique subgroup. A comprehensive search of PubMed, Embase, and Cochrane databases was conducted for articles published up to May 2025. The Inclusion criteria were: (1) Primary research articles; (2) Patients with skeletal Class III deformities; (3) Use of MMA or skeletal advancement surgery; (4) Diagnosis of OSA. The exclusion criteria were (1) Review articles; (2) Absence of skeletal Class III patients with OSA; (3) Inability to isolate data specific to Class III patients; (4) No skeletal advancement or MMA performed; (5) Lack of full-text availability or; (6) Presence of craniofacial syndromes

Results: Seven studies and 25 patients met the inclusion criteria. Three main variations of MMA were identified: (1) Bimaxillary advancement. Apnea-hypopnea Index (AHI) reduced by an average of $85.24 \pm 10.84\%$ after this variation of MMA was performed. This variation provided the most significant airway enlargement across all pharyngeal regions but carries the highest risk of facial aesthetic distortion in skeletal class III patients; (2) Maxillary advancement with mandibular auto-rotation. The AHI was reduced by 81.7%. This is a less invasive option but is only suited for patients with isolated maxillary retrusion and symmetrical mandibular anatomy; (3) Maxillary advancement with mandibular setback. Mean AHI reduction was 68.23%. While this variation, addresses aesthetic concerns in patients with mandibular excess, it may compromise oropharyngeal airway space. The extent to which maxillary advancement can compensate for this potential airway reduction remains unclear. Essentially, all variations were reported to be effective in treating OSA.

Conclusions: Three surgical variations—bimaxillary advancement, isolated maxillary advancement, and maxillary advancement with mandibular setback—were identified, offer differing benefits depending on facial structure, obstruction site, and aesthetic goals. Surgical planning for skeletal Class III patients with OSA cannot rely on standardized protocols but must instead be tailored to patient-specific anatomy and functional needs. Further research with larger samples and detailed reporting is needed to guide evidence-based practice in this underrepresented subgroup.

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Effect of waterless humidification via heat and moisture exchangers on long-term adherence to PAP therapy: a 12-month home-based study

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Introduction: Adherence to Positive Airway Pressure (PAP) treatment is essential to realising its full clinical benefits in patients with Obstructive Sleep Apnoea (OSA), including improved symptoms and long-term health outcomes. While humidification enhances comfort and may improve adherence, maintaining active humidification systems can be burdensome. Waterless humidification through heat and moisture exchangers (HMX) offers a low-maintenance alternative. This study aimed to evaluate the effect of HMX on 12-month PAP adherence and user experience in the home setting.

Materials and methods: This decentralised, prospective cohort study enrolled US-based established PAP users using cloud-connected devices, non-heated tubing and a patient-engagement app. Participants used an HMX device with their home PAP device and were followed remotely for 12 months.

Objective PAP therapy data including Apnoea-Hypopnoea Index (AHI), leak, pressure and usage were collected. Average nightly usage was assessed at baseline (3 months pre-enrolment) and tracked monthly during the 12-month follow-up. Usability, comfort, and ease of use were assessed monthly via 11-point Likert scale questionnaires. HMX discontinuation rates were assessed, and exploratory analyses examined the influence of seasonality, absolute humidity, and patient-app engagement. At study completion, participants were propensity-score matched to a retrospective control group using active humidification. Analyses were conducted on intention-to-treat (ITT), per-protocol (PP), and as-treated (AT) populations using appropriate statistical methods.

Results: In the PP population (n=87), 12-month usage did not differ significantly from controls (6.8 vs. 6.7 hours/night; $p=0.64$), with a statistically significant increase from baseline (+18 minutes; $p=0.010$), although not clinically relevant.

In the AT population, consistent HMX users maintained PAP adherence comparable to controls ($\Delta=-12$ minutes; $p=0.39$), while non-users had significantly lower PAP adherence (5.2 vs. 6.9 hours/night; $\Delta=-108$ minutes; $p=0.0001$).

In the ITT population (n=164), average nightly usage at 12 months was significantly lower than in matched controls (5.6 vs. 6.5 hours/night; $\Delta=-54$ minutes; $p<0.0001$). Usage stabilised at approximately 5.5 hours/night after month 3, with early discontinuation (43.8%) occurring primarily in the first 3-4 months. Baseline usage <6 hours/night significantly predicted discontinuation ($p=0.021$).

Therapy parameters (AHI, leak, pressure) remained stable across all groups. No significant associations were found between adherence and seasonality, absolute humidity, or patient-app engagement. Positive usability ratings were sustained throughout 12-month follow-up, with participants rating the HMX favourably for breathing comfort, ease of use, and overall performance.

At study completion, 92.6% of participants preferred HMX during winter, 99.2% were satisfied with air temperature, and 87.6% with humidification. Participants were highly likely to recommend the HMX (Net

Promoter Score [NPS]: 74), and moderately likely to purchase out-of-pocket (NPS: 25.6). No safety concerns were identified.

Conclusions: Patient populations that completed 12-month follow-up (PP) and consistently used HMX (AT) experienced no deterioration in long-term adherence, comfort, or therapy efficacy, with outcomes comparable to traditional humidification. Although early discontinuation affected the overall adherence in the full cohort, results suggest that HMX is a safe, low-maintenance alternative to active humidification for adherent users, particularly during colder months or for travel. These findings highlight the potential of HMX as part of a personalised approach to PAP therapy.

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Endoscopic titration technique of mandibular advancement device treatment for obstructive sleep apnea

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Introduction: Mandibular advancement device (MAD) therapy is a treatment option for patients with obstructive sleep apnea (OSA). The treatment mechanism for MAD is to advance the mandible in order to reduce the collapsibility of the upper airway during sleep. Protrusion of the mandible with an MAD is the most important factor in achieving maximum treatment effects for OSA. Some studies have reported that more protrusion of the mandible leads to larger improvements in OSA. However, excessive mandibular protrusion leads to side effects, including temporomandibular joint, muscle, and tooth problems. This suggests that the degree of mandible protrusion needs to be titrated for each patient. Our group has reported that an increase of the airway volume at the velopharynx with mandibular advancement as shown by endoscopy is key to successful MAD therapy. This study presented the mandibular titration technique for MAD to effectively treat OSA by using endoscopy to evaluate the change in the airway at the velopharynx with simultaneous recording of mandibular position.

Materials and methods: This titration technique was applied to 83 consecutive OSA patients (Age=53.7±13.0 years old, BMI=25.4±5.2 kg/m², AHI=28.3±16.9/h) and the percentage of maximum forward movement of the determined mandibular position was calculated. The titration technique using endoscopy is as follows: (1) Spray topical anesthesia (4% lignocaine) into one nasal passage. With the patient in the supine position in the dental chair, insert the flexible nasoendoscope (FNL-10RP3; Pentax) into the nostril to the velopharynx. (2) Position the occlusal registration tool (George gauge; Great Lakes Orthodontics Ltd) intraorally. This tool allows the degree of mandible protrusion to be measured and records the mandibular position with a millimeter indicator. The operator can preset the moveable incisal notches so that when the patient occludes into them, the mandible is automatically brought to the desired point on the protrusive path. (3) With the chin in a rest position, observe the cross-sectional area at the velopharynx with endoscopy. (4) Protrude the mandible from the rest position until the airway at the velopharynx widens and record the George gauge measurement.

Results: The percentage of mandibular position determined by this titration technique was 69.8±10.4%. The patients were divided into three groups based on the value of the percentage of mandibular forward movement (<66.6%, 66.6-75%, >75%) and compared for age, BMI, and AHI. There were no significant differences among the three groups in age and BMI, while AHI was significantly different among the three groups (AHI=21.4±10.3/h in <66.6%, 30.0±18.3/h in 66.6-75%, 37.2±18.2/h in >75%; p= 0.0076).

Conclusions: It was considered important to titrate the mandibular position for each patient using an objective measure of endoscopic airway assessment.

Comparison of the 1st Half of the Night Polysomnography (3 Hours) vs. Full Night Analysis in Asian Population: A Cohort Study

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Introduction: Although full-night polysomnography (FN-PSG) is the gold standard for diagnosing obstructive sleep apnea (OSA), split-night polysomnography (SN-PSG) is generally used in practice given the limitations in resource and time. However, the diagnostic accuracy and cut-off threshold of the SN-PSG remains unclear, particularly in Asian populations. This study aimed to study the correlations of apnea-hypopnea index (AHI) analyzed from the SN-PSG to that of the FN-PSG. Diagnostic accuracy was analyzed using various AHI cut-off thresholds.

Materials and methods: Three-hundred-and-ninety-seven FN-PSGs conducted with the NOX-AI system during November 2020–August 2024 at Ramathibodi Sleep Disorders Center were identified. To represent SN-PSG, data from the FN-PSG were divided for the first 3-hours to be analyzed and re-generated. Sleep and respiratory parameters between the first 3-hour-SN-PSG and FN-PSG were compared using concordance correlation coefficients (CCC). Analyses for specific phenotype including REM/NREM AHI, supine/non-supine AHI were performed. Sensitivity and specificity were calculated for 3-hour-AHI and oxygen desaturation index (ODI) against FN-PSG data.

Results: The CCC between 3hour-AHI and FN-AHI was 0.93 with higher correlation for NREM-AHI (CCC = 0.95) than REM-AHI (CCC = 0.79). The higher correlation was seen in supine-AHI (CCC = 0.89) than non-supine-AHI (CCC=0.60). Across severity of OSA the CCC were 0.71, 0.63, 0.60, and 0.86. for no-OSA, mild, moderate, and severe OSA respectively.

Sensitivity and specificity for 3hour-AHI cut-off threshold of ≥ 5 , ≥ 15 , and ≥ 30 events/hour were 72.7%/87.2%, 70.6%/91.3%, and 93.3%/96%, respectively. Sensitivity and specificity for 3-hour-ODI cut-off threshold of ≥ 5 , ≥ 15 , and ≥ 30 events/hour were 69%/91.5%, 75.5%/97.4%, and 94.7%/99.7%, respectively. The combination of 3hour-AHI with 3hour-ODI at the cut-off threshold of ≥ 15 improved specificity to diagnose moderated OSA to 98.3%, with lower sensitivity of 18.7%.

Conclusions: Overall, 3hour-AHI provide a reliable estimate of full-night-AHI, particularly for severe OSA. The high correlation of 3hour-AHI occurred for NREM-AHI, and supine-AHI but not for REM-AHI and non-supine - AHI. The best accuracy for OSA diagnosis were at the cut-off threshold of ≥ 30 for both 3-hour-AHI, and 3-hour-ODI. However, combining 3-hour-AHI with 3-hour-ODI at the threshold of ≥ 15 improved specificity markedly. This data may guide the decision to perform SN-PSG in the real-world practice.

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Long-term effects on blood pressure of soft tissue surgery for obstructive sleep apnea treatment in adults: a systematic review and meta-analysis

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Introduction: We conduct a systematic review and meta-analysis to evaluate long term effect of soft tissue surgery on blood pressure (BP) in adults with obstructive sleep apnea (OSA).

Materials and methods: PubMed, Scopus, the Cochrane library, and Ovid Medline databases were searched through January 2024. Manual searches were also obtained. This review included studies assessing impact of soft tissue surgery for the treatment of OSA in adults on long-term BP.

Results: A total of five studies (299 patients) met our inclusion criteria. Pooled random effects analysis demonstrated a statistically significant long-term postoperative reduction of BP, with average systolic BP reduction of 14.04 mmHg [95%CI (-21.97, -6.11); P=0.0005]. Pooled random effects analysis of data from four studies (277 patients) also demonstrated statistically significant long-term postoperative reduction of diastolic BP by 6.88 mmHg compared with preoperative baseline [95%CI (-13.31, -0.45); P=0.04].

Conclusions: Soft tissue surgery for OSA treatment in adults significantly resulted in long-term blood pressure reduction.

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Study on gene single nucleotide polymorphisms in Han and Uyghur patients with OSA combined with hypertension

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Introduction: The pathogenesis of obstructive sleep apnea (OSA) is complex, involving genetic and environmental factors. Some studies have found that certain genes are related to OSA. Therefore, studying the gene polymorphism of OSA patients is helpful for revealing its mechanism. Some study performed a comprehensive qualitative and quantitative analysis to estimate the contribution of variants from candidate genes to the risk of OSA, which is associated with the risk of OSA, which also shows ethnicity differences in East Asian and European subgroups. OSA is often accompanied by hypertension. It is very important to explore the related gene polymorphisms between the two diseases. This study to explore the differences in nucleotide sequences of 20 gene loci closely related to obstructive sleep apnea (OSA) in Han and Uyghur patients with hypertension.

Materials and methods: All patients were selected from a total of 433 OSA patients (both with and without hypertension) hospitalized in the respiratory sleep department of Karamay Central Hospital from January 2023 to September 2024. Additionally, 100 hypertensive individuals without OSA from the same period were included as the control group. The patients included 249 cases of OSA with hypertension, of whom 200 were Han and 49 were Uyghur, with an average age of (54.5 ± 12.1) years for Han and (52.2 ± 8.7) years for Uyghur. There were 134 males and 115 females. There were 172 cases of OSA without hypertension, including 138 Han and 34 Uyghur, with an average age of (49.8 ± 13.0) years for Han and (49.9 ± 10.0) years for Uyghur. There were 100 cases of hypertension patients from the physical examination group, including 90 males and 10 females, with an average age of (50.6 ± 7.4) years. The genomic DNA was extracted using a Wizard Genomic DNA Purification Kit (Promega, Madison, Wisconsin, USA) as per the product instruction. A multiplex PCR-ligase detection reaction method was used for genotyping four SNPs. For each SNP, the alleles were distinguished by different fluorescent labels of allele-specific oligonucleotide probe pairs. Different SNPs were further distinguished by different extended lengths at 3' end.

Results: By comparing the closely related to OSA among the groups (Han OSA with hypertension group, Uyghur OSA with hypertension group, Han OSA without hypertension group, Uyghur OSA without hypertension group, and physical examination hypertensive group), we found that the A/C/T Single-Nucleotide Polymorphism (SNP) in rs1137101 of the leptin receptor LEPR gene on chromosome 1, the G/A/T/C (SNP) in rs1143633 of the interleukin-1 receptor IL1B gene on chromosome 2, the C/G (SNP) in rs12511115 of the gamma-aminobutyric acid (GABA) A receptor GABRB1 gene on chromosome 4, and the C/G/T (SNP) in rs6313 of the 5-hydroxytryptamine receptor HTR2A gene on chromosome 13 showed significant differences between the Han and Uyghur OSA groups ($P < 0.05$).

Conclusions: The variations of the SNP in rs1137101 of the LEPR gene, the SNP in rs12511115 of the GABRB1 gene, the SNP in rs1143633 of the IL1B gene, and the SNP in rs6313 of the HTR2A gene may be related to OSA in different ethnic groups. The mechanisms need further study.

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Prevalence of high risk for obstructive sleep apnea in Thai patients undergoing elective general surgery

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Introduction: Limited studies have shown that a high proportion of patients undergoing elective surgery under general anesthesia (GA) are at high risk for obstructive sleep apnea (OSA), with 80% remaining undiagnosed. This study aims to determine the prevalence of high-risk OSA in Thai patients undergoing elective general surgery under GA and to explore its association with surgical categories and perioperative complications based on STOP-Bang scores.

Materials and methods: This cross-sectional study was conducted between August 2020 and February 2021. The inclusion criteria were Thai patients ≥ 18 years admitted to Siriraj Hospital for elective general surgery under GA. Exclusion criteria included patients scheduled for bariatric, airway, or neck mass surgery, those whose surgeries were canceled or had anesthetic substituted, and patients unable to complete the questionnaires. Before surgery, all subjects completed the STOP-Bang and associated questionnaires, and relevant medical records, including anesthetic notes, were reviewed.

Results: Of the 300 participants, 162 patients (54%) were classified as being at high risk for OSA (STOP-Bang values of ≥ 3). Among surgical categories, urologic surgery had the highest prevalence (69%) while breast surgery had the lowest (25.7%). High-risk patients shared several characteristics compared to the low-risk group, including being predominantly male, having a larger neck circumference, older age, higher body mass index (BMI), underlying hypertension, cardiovascular diseases, and higher anesthetic risk. However, no significant association was found between the STOP-Bang scores and postoperative complications.

Conclusions: Up to 54% of Thai patients undergoing elective general surgery under GA were at high risk for OSA, with the highest prevalence seen in those undergoing urologic surgery. Increasing awareness of preoperative OSA screening could help prevent future adverse outcomes.

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Rethinking Sleep Apnea Severity: Beyond AHI versus multidimensional Polysomnographic Indices

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Introduction: Obstructive sleep apnea (OSA) is a clinically and pathophysiologically heterogeneous disorder. Standard metric AHI alone fails to assess spectrum of disease severity or predict consequences such as metabolic dysfunction or neuropsychiatric impairment. Each OSA phenotype has physiological signatures on polysomnography. Metabolic phenotype: ODI, duration saturation below 90%, Dmax duration, sympathetic activity. Neurocognitive/psychiatric: arousal index, REM duration. Hypoxic burden—phenotype. Due to limitations of AHI, other polysomnographic parameters need to be incorporated. This study evaluates whether AHI-based severity grading aligns with key physiologic markers in patients undergoing diagnostic polysomnography.

Materials and methods: This observational study included adult patients who underwent diagnostic polysomnography at a tertiary care center. Of 150 enrolled, data from the first 30 patients were analyzed. Subjects were divided into two groups: Group 1 (mild to moderate OSA, AHI < 30; n = 17) and Group 2 (severe OSA, AHI ≥ 30 ; n = 13). Parameters compared included REM sleep duration, arousal index, lowest oxygen saturation, time spent with SpO₂ < 90%, oxygen desaturation index (ODI), desaturation maximum (Dmax) duration, and heart rate metrics. Statistical comparisons were made using independent t-tests or Mann-Whitney U-tests, and correlations with AHI were explored using Pearson/Spearman coefficients. Complete data from 130 analyzable patients will be presented at the conference.

Results: In Group I, 14 subjects had REM less than 5% of Total Sleep time (TST). No correlation between AHI and NREM Arousal Index. Heart rate greater than 100 observed in 11 subjects (64%) not correlated with AHI values. Duration with below 90 percent saturation, 13 subjects (76%) spent less than 2 minutes, 2 with moderate and one mild AHI spent 30 to 40 minutes and one mild grade with Arousal index 2 spent 119 minutes. Lowest Oxygen saturation less than 70% observed in 3 subjects of moderate AHI.

In Group II, 11 subjects had REM less than 5% of Total Sleep time (TST) and 4 had no REM sleep. 10 Subjects with NREM AI less than 5 had AHI of more than 40. All 13 subjects had arousal index values less than 50% their

corresponding AHI values. All subjects with less AI value had & more severe grade AHI, statistically not correlated. 7 subjects(50%) had longest duration of obstructive apnea more than 60 seconds. Among 12 subjects (92%) Highest Heart rate greater than 100 observed not correlating with AHI values. Duration with below 90 percent saturation, 6 subjects(46%) spent more than 100 minutes one subject 410 minutes. Lowest Oxygen saturation less than 70% observed in 8(60%) subjects. 5 subjects(38%) had less ODI value compared to corresponding AHI values while 8 (62%) had ODI values at least 20% more than their AHI values. No correlation between AHI, ODI and D max duration.

Conclusions: Early findings suggest that AHI-based severity grading does not consistently align with other key physiological indicators of OSA burden. Metrics such as REM percent, AI, HR variability, ODI, Dmax duration, and hypoxic load may better reflect disease severity and clinical risk. Full analysis of 130 patients will further clarify these relationships and support a multidimensional severity framework in OSA assessment.

Acknowledgments: Patients, colleagues

Diaphragmatic dimensions as predictors of severity of obstructive sleep apnea: A cross-sectional study

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Introduction: Obstructive Sleep Apnea (OSA) is a sleep disordered breathing that involves a decrease or complete halt in airflow despite an ongoing effort to breathe. The Apnea –hypopnea index (AHI) is the standard metric used to describe the severity of sleep apnea. It represents the combined number of apnea and hypopnea that occurs per hour of sleep. OSA is classified into mild, moderate and severe according to AHI.

Mild OSA : AHI 5 to <15

Moderate OSA : AHI 15 to <30

Severe OSA : > 30

USG or ultrasonography is a simple non invasive tool .In our study we have tried to establish the association between diaphragmatic dimensions like thickness, excursion and thickness fraction with the severity of OSA.

Materials and methods: Objectives

- To find the association of Diaphragmatic thickness, excursion and thickness fraction with Apnea-Hypopnea Index

Study design : Cross-sectional

Methodology

In this cross-sectional study 40 patients (between 18-70yrs age) diagnosed as OSA by overnight inlab polysomnography were recruited after written consent. Patients having neurological disorder, hemodynamic instability, other lung diseases, pregnant females or patients already on PAP therapy were excluded . USG of diaphragm has been carried out by experienced sonologist. Diaphragmatic thickness measurement done by B Mode USG using linear transducer while participants in supine position. To record the thickness of Right hemidiaphragm liver has been used as window with probe placed between the midclavicular and midaxillary line in Right subcostal margin. For the left hemidiaphragm spleen was used as window with probe placed subcostally between anterior and post axillary lines. The diaphragm is identified by 3 layered structure with two parallel echogenic line. Diaphragmatic thickness has been measured on both side at peak of inspiration, expiration .

Diaphragmatic excursion : M mode used to display motion of diaphragm along the above mentioned areas on right and left side. It was also measured in supine position. To measure excursion the calliper was first placed on the foot of the slope of diaphragm echoic line and second calliper was placed at the apex. The Spearmen r coefficient was used to measure the degree of association between diaphragmatic thickness, excursion and thickness fraction on both side with AHI.

Results: Data from a sample of 40 patients (62.5%male, 37.5%female) were analysed. Mean age group 47.48± 9.28, mean BMI 33.05 ± 6.72, mean neck circumference 41.09±2.50•

•Positive correlation has been found between Right hemidiaphragmatic thickness on end inspiration with AHI (r=0.298, p=0.0654).

•Statistically significant correlation has been found between end inspiratory thickness of left hemidiaphragm with

AHI ($r=0.381$, $p=0.016$) and end expiratory thickness of left hemidiaphragm with AHI ($r=0.342$, $p=0.0333$)

- Statistically significant correlation has been found between Right hemidiaphragmatic Thickness Fraction with AHI ($r=0.358$, $p=0.023$)

- No significant correlation has been found between diaphragmatic excursion and AHI.

Conclusions: Our study depicted inspiratory thickness of diaphragm positively correlated with AHI which is a severity marker of OSA. Positive association also have been found with right diaphragmatic thickness fraction with AHI. However our study has been limited of small sample size and parameters have been taken in supine and awake conditions, there might have variations of anatomical measurements during sleep.

Challenges of acute non-invasive ventilation in patients with schizophrenia

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Introduction: Acute hypercapnic respiratory failure (AHRF) is a life-threatening emergency. Non-invasive ventilation (NIV) is the standard of care, but its delivery can be challenging in patients with significant psychiatric comorbidity. We aim to evaluate the acute outcome for patients with schizophrenia presenting with AHRF requiring NIV

Materials and methods: We conducted a retrospective longitudinal observational cohort study of consecutive admissions to a single tertiary centre for AHRF requiring acute NIV from 1st January 2017 to 31st December 2019. Cases were included if they had underlying chronic obstructive pulmonary disease (COPD) or overlap between COPD and obstructive sleep apnea (Overlap). We excluded patients requiring invasive ventilation or admissions to intensive care units.

Results: Among the 261 admissions, there were 110 recurrent admissions from 37 individual patients, of which 40.5% had schizophrenia. COPD (83.8%) was the predominant underlying chronic respiratory condition. Patients with schizophrenia were significantly younger (63.7 ± 9.8 vs 76.1 ± 8.7 , $p=0.000$) and less likely to be on domiciliary respiratory support (26.7% vs 59.1 %, $p=0.052$). Mean initial pH from blood gas was 7.3 in both but patients with schizophrenia were assessed to have lower level of consciousness and to be more challenging for acute NIV therapy. Patients with schizophrenia had shorter duration of hospitalisation (7 vs 9.5 days, $p=0.004$) and acute NIV therapy (3 vs 5 days, $p=0.026$). They also had shorter median time to readmission (18 vs 69 days, $p=0.017$). Multivariate log regression showed chronic schizophrenia was the only independent predictor of recurrent admissions for acute NIV therapy (odds ratio 7.277, $p=0.008$).

Conclusions: Patients with comorbidity of chronic schizophrenia may pose a unique challenge to acute NIV therapy. Though the duration of acute NIV therapy and hospitalization may be shorter, they have a higher risk of recurrent admissions for AHRF requiring acute NIV.

The Role of Mouth Tape for CPAP Users in OSA Patients with Mouth Breathing

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Introduction: Continuous positive airway pressure (CPAP) is the standard treatment for obstructive sleep apnea (OSA), but its effectiveness depends on patient adherence. Mouth breathing during CPAP therapy is common among patients with OSA and is associated with reduced adherence. Current strategies to address this issue include the use of a chin strap with a nasal mask or switching to an oronasal mask. Mouth taping has recently emerged as a potential intervention; however, its impact on CPAP adherence remains unstudied. This study aims

to evaluate whether mouth tape improves CPAP adherence in patients with OSA. Secondary outcomes include daytime sleepiness (Epworth Sleepiness Scale [ESS]), snoring (visual analog scale [VAS]), night awakenings, mouth/throat dryness, air leakage, and adverse effects.

Materials and methods: This randomized crossover study compared CPAP adherence with and without silicone hypoallergenic mouth tape in participants who exhibited mouth breathing during CPAP therapy. Participants received CPAP therapy with or without mouth tape for 30 days, then crossed over to the other intervention for another 30 days, with a 7-day washout period between phases. After each period, CPAP data (adherence, apnea–hypopnea index [AHI], and leakage) and questionnaires were collected. Tape application involved cutting silicone hypoallergenic tape to 2–4 cm based on facial structure and applying it vertically over the philtrum to seal both the upper and lower lips.

Results: Sixty-two patients with OSA (36 males; AHI [mean $\pm$ standard deviation], 45.8 ± 22.2 events/h; age, 57.7 ± 17.6 years; BMI, 27.9 ± 7.1 kg/m²) were randomized. Participants using mouth tape, compared to without mouth tape, showed higher CPAP adherence: average use increased by 51.8 minutes/day (95% CI, 33.1–70.4) and by 41.4 minutes/used day (95% CI, 27.9–55.0). Frequency of use increased by 14.2% (95% CI, 9.3–19.0), with 17.6% more days reaching ≥ 4 hours/night (95% CI, 12.7–22.6). Good adherence increased with an odds ratio of 4.5 ($p < 0.001$). Mouth tape significantly improved ESS, snoring VAS, mouth/throat dryness, and night awakenings ($p < 0.05$). Adverse effects were reported.

Conclusions:

Using mouth tape in patients with mouth breathing during CPAP improved CPAP adherence in both duration and frequency. Unfavorable symptoms related to OSA, or CPAP were alleviated, leading to better sleep quality.

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Effects of Obstructive Sleep Apnea Treatment on Blood Biomarkers of Alzheimer's Disease: A Prospective Clinical Study

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Introduction: The relationship between obstructive sleep apnea (OSA) and Alzheimer's disease (AD) has attracted increasing attention. Intermittent hypoxia and sleep fragmentation associated with OSA may accelerate neurodegenerative changes and increase the risk of AD. This study aimed to investigate whether OSA treatment, particularly surgical intervention, influences blood biomarkers associated with AD and other neurodegenerative diseases.

Materials and methods: This three-year prospective, non-randomized study enrolled 73 patients with severe OSA (AHI ≥ 30) at Chiayi Chang Gung Memorial Hospital. Patients received either CPAP, sleep surgery, or conservative treatment, with an additional group of patients with dementia as a reference. Plasma levels of several biomarkers—including amyloid β 1-40 (A β 1-40), amyloid β 1-42 (A β 1-42), Tau protein, neurofilament light chain (NFL), and TDP-43—were measured at baseline and at 3, 6, and 9 months post-treatment using immunomagnetic reduction (IMR) technology.

Results: Significant reductions in the A β 1-42/A β 1-40 ratio were observed in both the CPAP and surgical groups at 6 and 9 months post-treatment ($p < 0.05$). In the surgical group, the ratio decreased by 18.4% at 6 months (95% CI: -30.7% to -6.0%) and 22.1% at 9 months (95% CI: -34.0% to -10.1%). In the CPAP group, reductions of 14.7% (95% CI: -28.6% to -0.9%) at 6 months and 19.5% (95% CI: -33.3% to -5.7%) at 9 months were noted. Additionally, the A β 1-42 concentration in the surgical group showed a significant decline of 17.9% at 9 months (95% CI: -29.8% to -6.0%). No statistically significant changes were observed in Tau, NFL, or TDP-43 across all groups and timepoints, suggesting limited short-term response.

Conclusions: This study indicates that effective treatment of OSA, especially through surgery, may help reduce blood-based biomarkers linked to Alzheimer's disease, particularly A β 1-42 and its ratio to A β 1-40. These findings suggest potential clinical value in AD prevention. However, changes in other neurodegenerative markers such as

Tau and TDP-43 were not significant in the short term, highlighting the need for longer follow-up to elucidate long-term effects.

Artificial Intelligence Diagnosis of Obstructive Sleep Apnea: Bayesian Meta-Analyses of 80 Studies with 248 Models

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Introduction:

Among 1 billion patients worldwide with obstructive sleep apnea (OSA), 90% remain undiagnosed. Their main barrier is the overnight polysomnogram, which requires specialized equipment, skilled technicians and inpatient beds available only in tertiary sleep centers. In recent years, artificial intelligence (AI) has made significant strides, offering promising new avenues for OSA diagnosis.

Materials and methods:

We systematically searched PubMed, Embase, Scopus, Web of Science and IEEE Xplore till 20th July 2024. Two blinded reviewers selected English-language articles of studies comparing the diagnostic performance of AI models using 8 inputs (facial recognition, overnight audio, awake speech, electrocardiography, electroencephalography, pulse oximetry, photoplethysmography or multimodal), versus conventional diagnosis [apnea-hypopnea index (AHI) from PSG or home sleep apnea test (HSAT)]. We excluded studies if they only detected apneic events without providing a patient-level diagnosis, or if they did not use a train-test split or k-fold cross-validation for model evaluation. We assessed the risk of bias via QUADAS-2, performed Bayesian bivariate meta-analysis and meta-regression, computed 95% credible intervals, visualized summary receiver operating characteristic curves with 95% prediction regions, assessed publication bias via Copas-like selection modeling, and graded evidence quality via GRADE, following a PROSPERO-registered protocol. Analyses were conducted using R and Stan.

Results:

From 6,254 records, we included 80 studies (low-moderate bias) with 248 AI models trained/tested on 35,300/30,420 participants. Across 8 modalities, AI demonstrated good or excellent diagnostic performance compared to conventional diagnosis. The pooled sensitivity (Sn) and specificity (Sp) of each modality, arranged from the highest to lowest Sn, were: pulse oximetry [Sn: 91.1% (89.4–92.7%), Sp: 86.1% (82.1–89.4%)]; overnight audio [Sn: 90.3% (86.9–93.1%), Sp: 86.7% (83.1–89.7%)]; multimodal inputs [Sn: 89.2% (81.5–94.3%), Sp: 87.1% (82.6–90.8%)]; facial recognition [Sn: 84.9% (77.1–90.7%), Sp: 71.2% (60.7–81.4%)]; awake speech [Sn: 82.9% (80.0–86.4%), Sp: 83.3% (80.7–86.1%)]; electroencephalography [Sn: 81.6% (73.4–88.8%), Sp: 78.2% (64.1–87.0%)]; electrocardiogram heart rate variability [Sn: 79.0% (74.9–82.7%), Sp: 75.0% (67.9–82.3%)]; photoplethysmography [Sn: 70.8% (63.3–77.2%), Sp: 91.7% (86.8–95.1%)]. Bayesian meta-regression demonstrated

similar diagnostic performance across AHI cut-offs. Deep learning (convolutional neural networks) was the most accurate classification algorithm for facial recognition (91.1% sensitivity, 79.2% specificity), pulse oximetry (93.7% sensitivity, 89.4% specificity) and photoplethysmography (75.9% sensitivity, 93.5% specificity) models, and performed better than domain expert manual feature extraction for pulse oximetry and electroencephalography models. Overnight audio models were more sensitive when using higher sampling frequencies and non-contact microphones. Smartphone versus professional camera/microphone inputs showed similar performance. Among 30 multimodal AI models, all used pulse oximetry with electroencephalography, electrocardiography, airflow and/or thoracic signals. Performance did not correlate with the number of modalities. Publication bias was shown to be unlikely to alter conclusions. The evidence was of high quality.

Conclusions:

AI models trained on overnight audio and pulse oximetry achieved excellent diagnostic accuracy—far superior to STOP-Bang and comparable to common HSATs in clinical practice. Smartphones are a reliable source of images and audio, and AI performance is mainly driven by a small number of essential inputs. Digital medicine should be further explored and externally validated for accessible and equitable OSA diagnosis.

Pathway for bariatric/metabolic surgery candidates with obstructive sleep apnea(OSA) at a private Hospital in Brazil

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Introduction: Obstructive sleep apnea (OSA) is highly prevalent among individuals undergoing bariatric or metabolic surgery (MBS). Studies estimate that over 85% of patients with class III obesity suffer from OSA, highlighting the importance of addressing this comorbidity to reduce surgical risks, particularly respiratory complications, and improve long-term health outcomes. Developing specialized management strategies that integrate care for both obesity and OSA is vital for enhancing patient prognosis. One effective strategy involves the use of Continuous Positive Airway Pressure (CPAP) during the immediate postoperative period to prevent respiratory issues. However, surgeons often avoid using positive pressure in patients undergoing anastomoses in the upper digestive tract due to the risk of air swallowing, which could exert pneumatic pressure on the sutures.

Materials and methods: OSA evaluation begins during the initial medical consultation when MBS is proposed. This evaluation can be conducted by the patient's clinician (such as an endocrinologist, cardiologist, or other specialist) or the bariatric surgeon. The process incorporates standard diagnostic tools as well as specific questionnaires, namely the STOP-BANG questionnaire and the Epworth Sleepiness Scale(EES). Patients identified as having moderate or high risk for OSA are referred for Polysomnography (PSG) or Peripheral Arterial Tonometry (PAT). Those diagnosed with moderate to severe OSA immediately begin a CPAP adaptation program, which educates and trains patients to breathe using CPAP.

The typical preoperative preparation period for MBS lasts at least one month. During this time, medical, nutritional, psychological evaluations, as well as laboratory and imaging tests, are conducted. CPAP adaptation is seamlessly integrated into this timeframe, ensuring it does not prolong the preoperative preparation period.

Results: Patients who successfully adapt to CPAP therapy prior to surgery are encouraged to continue its use postoperatively. This approach minimizes complications such as aerophagia while effectively managing OSA. Follow-up appointments to adjust CPAP use are scheduled to coincide with the surgeon's routine check-ups, occurring at one, three, and six months after surgery. A follow-up PSG/PAT is performed six months postoperatively to reassess OSA status.

Conclusions: The collaborative efforts of a multidisciplinary team—including physicians, physiotherapists, dentists, nutritionists, nurses, and psychologists—enabled the creation of a comprehensive care pathway at HIAE. This

initiative significantly reduces the risks for patients with OSA who are candidates for bariatric/metabolic surgery, thereby improving surgical outcomes and enhancing overall patient care.

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Implantable respiratory state detection in stimulation target-IPG ECG lead

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Introduction: Hypoglossal Nerve Stimulation (HNS) has been developed as an effective treatment for moderate to severe Obstructive Sleep Apnea (OSA). Closed-loop stimulation is expected to significantly improve the efficacy of HNS by detecting the respiratory status of the patient, such as inspiration, expiration, hypoventilation and apnea. To realize implantable closed-loop HNS for OSA, a sensing system suitable for implantable application is required to collect physiological signals to detect the respiratory status.

Materials and methods: In this study, the standard lead ECG signals were first acquired by PSG for analysis, and the respiratory state information was obtained by parsing based on the principles of the QRS complex wave amplitude modulation effect caused by the oscillation of the electrocardiographic axis with respiration and respiratory sinus arrhythmia. Further based on the now widely used platforms of Vagus Nerve Stimulator (VNS) and Polysomnography (PSG), the ECG signals are collected and analyzed to obtain the respiratory status through its built-in implantable acquisition system. The VNS has a built-in ECG acquisition module to detect the onset of epilepsy and other patients, because the stimulation target of the VNS, the vagus nerve, is located in a similar position to the hypoglossal nerve, and its IPG is generally implanted 1-2 cm below the clavicle, which is the same as that of the IPG implantation of the HNS. The acquisition of stimulation target-IPG lead ECG signals by VNS can simulate the ECG signals acquired by HNS and detect the respiratory status based on the relationship between respiration and ECG. Similarly, in this study, the ECG signals of VNS stimulation target-IPG lead were collected by PSG in vitro and analyzed to obtain the respiratory status.

Results: By analyzing the standard-lead ECG signals acquired by PSG with the respiratory signals, the peak value of the electrocardiographic R-peak and the heart rate decreased during inspiration and increased during expiration; the rate of change of the peak value of the R-peak and the rate of change of the heart rate were significantly reduced in hypoventilation as well as in apnea, and the peak change of the R-peak and the change of the heart rate were strongly correlated with respiratory status. The peak R-peak changes in the stimulation target-IPG leads captured by VNS were also highly positively correlated and periodic with the heart rate variability, and the period was consistent with the respiratory cycle, which was the same as the characteristics of the changes in the standard PSG leads, and enabled the estimation of respiratory status.

Conclusions: The through-VNS neurostimulation target-IPG lead ECG signals enable effective detection of respiratory status, which in turn enables closed-loop HNS for OSA.

Efficient and Effective Telemonitoring System for CPAP Adherence Using Digital Transformation

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Introduction: In Japan, the national Health Insurance System began covering CPAP therapy with mandatory monthly clinic visits in 1998, later permitting visits once every two months in 2013 and every three months during the COVID-19 pandemic in 2022. These regulatory adjustments resulted in a substantial increase in CPAP users. Previously, our clinic depended predominantly on manual methods to collect adherence data from multiple providers, necessitating improvements in monitoring efficiency and effectiveness. To address these challenges, we developed the Remote Monitoring Network for CPAP Adherence. Additionally, we conducted a comparative

analysis of CPAP usage between individuals demonstrating good and poor adherence before and after three months of enrollment in tele-monitoring to assess its impact.

Materials and methods: The Remote Monitoring Network for CPAP Adherence utilizes 3G connectivity (SIM) to integrate adherence data from CPAP devices into individual provider cloud servers. This data is efficiently transferred to medical charts using Application Programming Interfaces (APIs) and Robotic Process Automation (RPA). It enables a seamless flow of information and remote adjustment of CPAP pressure without in-person visits. For analysis, patients were classified as good users ($\geq 70\%$ monthly CPAP use) or poor users ($< 70\%$). In line with insurance guidelines, physicians contacted poor users monthly to offer personalized support and address barriers such as mask discomfort, nasal congestion, and psychological resistance.

To minimize manufacturer-related bias, that could affect data collection and interpretation, our analysis focused exclusively on 1,589 Philips CPAP users from our total patient population. Of these patients 1,314 (82%) were categorized as good users and 273 (18%) as poor users. For assessment of the tele-monitoring impact, we selected random samples, comprising 473 good users and 142 poor users. These samples were not adjusted for gender and age, to maintain real-world representation in our patient population. We evaluated the adherence changes before and after three months implementation of tele-monitoring.

Results: Between June 2020 and April 2025, 67.2% (2,909 out of 4,330) of CPAP users transitioned to remote monitoring, exhibiting a consistent upward trajectory. Following tele-monitoring implementation, adherence remained stable among good users, with 83.5% (395 out of 473) maintaining their status and 16.5% (78 users) shifting to poor adherence. Among poor users, 63.4% (90 out of 142) sustained low adherence, while 36.6% (52 users) improved to good adherence.

Conclusions: Remote tele-monitoring for CPAP adherence is both feasible and effective, reducing clinic visit frequency and related costs, enhancing time management and operational efficiency for patients and healthcare providers alike with improving productivity. Disclosure of APIs and RPAs by each company is essential to the success of this initiative. The predominance of good users in our cohort may reflect the effectiveness of our clinical protocol.

Tele-monitoring did not notably affect patient attitudes toward CPAP adherence in this study. Defining adherence and motivating low-use patients remain ongoing issues, and integrating Digital Transformation (DX) with Artificial General Intelligence (AGI) is needed to enhance care quality and efficiency.

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Digital Health Engagement and CPAP Adherence: Analysis of Patient Interaction with the myAir App

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Introduction:

Adherence is a crucial indicator in assessing the efficacy of continuous positive airway pressure (CPAP) therapy for sleep apnea. Although telemedicine enhances adherence and mobile apps represent a viable approach, individual variations may exist in the level of engagement with these apps.

Materials and methods:

A retrospective chart analysis was performed on patients utilizing the myAir app, compatible with ResMed CPAP devices, across four hospitals in Japan from January 2023 to April 2024. Patients can track their CPAP usage and obtain guidance on appropriate use by employing the app. The app has a function whereby patients receive a maximum of five inquiries monthly regarding their sleepiness, which they can evaluate on a five-point scale, and their responses are transmitted to medical institutions. We classified patients who did not respond within a one-month period as having poor engagement. We transformed responses on a 5-point scale about how sleepy they

were into 1–5 points, with larger scores denoting more sleepiness. The average of multiple replies indicated post-treatment sleepiness. We extracted data on usage from medical records for the initial month following the beginning of treatment. Good adherence was characterized by using the device for four or more hours during a minimum of 70% of the observation period. Patients were divided into two groups according to adherence, and comparisons were made for background characteristics, app engagement, and pre- and post-treatment sleepiness.

Results:

The study comprised 62 patients: 56 males and 6 females, with a mean age of 51.3 ± 12.3 years, a mean apnea-hypopnea index (AHI) upon diagnosis of 44.5 ± 18.4 events per hour, and a mean body mass index (BMI) of 28.3 ± 5.1 kg/m². Within one month of CPAP therapy, 27 patients had good adherence, while 35 exhibited poor adherence. Age, sex, AHI, and BMI were not significantly different between the groups. However, the group with poor adherence had significantly higher leak levels (10.4 vs 18.1 L/min, $p=0.002$) and a significantly higher percentage of poor app engagement (18.5% vs 42.9%, $p=0.042$). Excluding patients with poor app engagement, 22 individuals in the good adherence group and 23 in the poor adherence group reported on sleepiness via the apps. Post-treatment sleepiness scores were 2.0 and 2.8 points, respectively, on a 5-point scale, with the poor adherence group exhibiting significantly higher sleepiness ($p=0.009$).

Conclusions:

Reduced leak levels and good app engagement were proposed as indicators of favorable short-term CPAP adherence. Furthermore, among patients exhibiting good app engagement, individuals in the poor adherence category demonstrated minimal improvement in sleepiness.

Prevalence and Risk Factors of Residual Excessive Sleepiness in Chinese Obstructive Sleep Apnea Patients

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Introduction: Some obstructive sleep apnea (OSA) patients continue to experience sleepiness despite receiving continuous positive airway pressure (CPAP) treatment, a condition referred to as residual excessive sleepiness (RES). At present, the prevalence and risk factors for RES among OSA patients in China remain unclear. This study seeks to examine the prevalence and predictors of RES in Chinese OSA patients.

Materials and methods: The study prospectively enrolled patients diagnosed with OSA at the Sleep Medicine Center, West China Hospital, Sichuan University, between January 2022 and September 2024. Patients were included if they had a baseline Epworth Sleepiness Scale (ESS) score greater than 10 and had received effective CPAP treatment (residual apnea hypopnea index [AHI] < 5) for at least 4 hours per day. Data collected included: ESS before and after treatment, demographic details, comorbidities, polysomnography and CPAP parameters. After at least 3 months of CPAP treatment, patients were categorized into two groups based on their post-treatment ESS: the non-RES group (ESS≤10) and the RES group (ESS>10).

Results: A total of 1058 OSA patients treated with effective and adequate CPAP were included. The average age was 42.98 ± 11.27 years, with a BMI of 26.72 ± 3.72 kg/m², 81.6% were males, and the average AHI was 48.80 ± 27.25 events/hour at baseline. After an average of 4.3 months of CPAP treatment (5.79 ± 0.80 h/day), 339 patients (32.04%) complained of RES. Multivariate logistic regression analysis identified several risk factors for RES: higher ESS (OR=1.307, 95%CI: 1.224-1.396, $p<0.001$) and arousal index (OR=1.109, 95%CI: 1.083-1.137, $p<0.001$), greater proportion of sleep in N1 stage (OR=1.040, 95%CI: 1.023-1.056, $p<0.001$), and lower average blood

oxygen saturation (OR=1.080, 95%CI: 1.026-1.136, $p=0.003$) before CPAP treatment. In contrast, lower AHI (OR=0.900, 95%CI: 0.883-0.917, $p<0.001$) and a higher proportion of sleep in N3 stage (OR=0.841, 95%CI: 0.744-0.952, $p=0.006$) were protective factors. Additionally, CPAP adherence (OR=0.702, 95%CI: 0.574-0.859, $p=0.001$) was linked to the development of RES. Receiver operating characteristic (ROC) analysis showed that the multivariate model for predicting RES had an area under the curve (AUC) of 0.841.

Conclusions: In China, over 32% of OSA patients receiving CPAP treatment report experiencing RES. The factors associated with RES include baseline severer sleepiness, reduced sleep stability, lower AHI, and worse CPAP adherence.

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Analysis of Brain Gray Matter Microstructure Alterations in Obstructive Sleep Apnea Patients Based on NODDI

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Introduction: This study aims to explore the changes in brain gray matter microstructure in OSA patients using NODDI technology, analyze the influencing factors and their correlation with cognitive impairment, and investigate the neural mechanisms of cognitive dysfunction in OSA.

Materials and methods: A total of 42 patients in the control group (AHI <5/h), 87 in the mild-moderate OSA group (5/h ≤ AHI <30/h), and 77 in the severe OSA group (AHI ≥30)/h were enrolled. Cognitive function was assessed using the Montreal Cognitive Assessment (MoCA) and computerized cognitive tests. Brain MRI data were collected, and tools such as the MRtrix3 toolbox, AMICO, FreeSurfer's recon-all and segmentHA_T1.sh, and fslnmaths and fslnstats commands were used to extract NDI and ODI values from the cortex, subcortical nuclei, and hippocampal subfields. Differences in NDI and ODI across the three groups were analyzed, and partial correlation analysis was used to examine the relationship between gray matter parameters and cognitive scores. A mediation model was established to analyze the mediating effect of gray matter structure on the relationship between nocturnal intermittent hypoxia, sleep fragmentation, and cognitive impairment.

Results: Patients in the severe OSA group were older, had a higher body mass index (BMI), more years of education, and higher Epworth Sleepiness Scale (ESS) scores. There were significant differences in polysomnography (PSG) parameters among the three groups. Cognitive assessment revealed significant group differences in MoCA total scores, MoCA subscales (visuospatial/executive function, delayed recall), and other cognitive tests (PRM immediate recognition accuracy, PRM immediate recognition reaction time, PRM delayed recognition reaction time, SRM immediate recognition accuracy, SWM double errors, SWM average completion time). Multiple brain regions showed group differences in NDI and ODI, with OSA generally patients exhibiting elevated NDI and ODI in areas such as the bilateral frontal, parietal, temporal, occipital, and insular lobes, globus pallidus, hippocampus, cerebellar cortex, cingulate isthmus, posterior anterior cingulate, left putamen, left thalamus, and right nucleus accumbens. Intergroup differences in NDI were found in the bilateral parasubiculum, molecular_layer_HP-head, HATA, left presubiculum-head, subiculum-head, CA1-head, right GC-ML-DG-head, fimbria hippocampi, and hippocampal tail. Intergroup differences in ODI were observed in the bilateral subiculum-body, left parasubiculum, and molecular_layer_HP-body. Partial correlation analysis (adjusted for age and years of education) showed that MoCA total scores were negatively correlated with NDI in the right supramarginal gyrus, MoCA delayed recall was negatively correlated with NDI in the right hippocampus, right supramarginal gyrus, left hippocampus, right hippocampal tail, left subiculum-head, and left molecular_layer_HP-head. MoCA visuospatial/executive function was negatively correlated with ODI in the right nucleus accumbens, and SRM immediate recognition accuracy was negatively correlated with NDI in the left cingulate isthmus. Mediation analysis revealed that microstructural parameters mediated the relationship between PSG parameters and cognitive test scores.

Conclusions: OSA is associated with altered brain gray matter microstructure, which is one of the neural mechanisms underlying OSA-related cognitive impairment.

The oral and gut microbiota dysbiosis in OSA

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Introduction: This study based on high-throughput sequencing technology to investigate the characteristics of oral-gut microecological communities in OSA and potential association with oral-gut microbiota and intermittent hypoxia.

Materials and methods: Adult subjects were enrolled from the department of sleep medicine, Peking University People's Hospital. All participants completed overnight PSG, collected fecal and oral pharyngeal swab sampling. 16s rRNA sequencing technology was used to analyze the microbiota structure and functional characteristics of OSA with different severity and healthy volunteers without snoring and apnea.

Results: (1) The alpha diversity of the gut microbiota in the OSA group was changed, the abundance of mild OSA and moderate-to-severe OSA(MSevOSA) group was greater than that of healthy control, but the species uniformity and microbiota diversity (Shannon index and Simpson index) were lower than those of healthy control. Linear discriminant analysis Effect Size analysis(LEfSe) found that *Ruminococcus_torques_group* and *Escherichia-Shigella* were significantly enriched in the gut of the MSevOSA group, and were positively correlated with cumulative time at SpO₂<90%(CT90) and cumulative percentage of sleep time spent with SpO₂<90% (CT90%), and significantly negatively correlated with lowest oxygen saturation(LSpO₂). RDA analysis and Envfit test found the environmental factors with the greatest impact on the gut microbiome were mean oxygen saturation(MSpO₂), CT90, LSpO₂, CT90%, BMI and ODI (r^2 was 0.804, 0.539, 0.525, 0.519, 0.307 and 0.272, respectively, $p < 0.005$), in which AHI had the lowest contribution to the difference in microbiota abundance ($r^2=0.216$, $p=0.006$). BugBase annotation showed that the aerobic phenotype of gut microbiota in MSevOSA group decreased significantly compared with the healthy control group [0.01(0.00-0.02) in the MSevOSA vs 0.02(0.01-0.02) in the healthy control group, $p=0.019$].

(2) The alpha diversity was demonstrated no difference in oropharyngeal microbiome, but there was a significant difference in beta diversity between healthy control and MSevOSA (Adonis test, $R^2=0.042$, adjusted $p=0.017$). In terms of microbial composition, *Bacteroides*, *Lachnospirillum* and *Porphyromonas endodontalis* were enriched in MSevOSA group. Among them, the differential genera *Porphyromonas endodontalis*, *Bacteroides*, and *Lachnospirillum* were positively correlated with AHI ($r=0.470$, 0.366 and 0.362 , respectively, $p<0.01$). RDA analysis and Envfit test showed that CT90% and AHI contributed the highest to the difference in the abundance of oropharyngeal microbiota ($r^2=0.289$ and 0.254 respectively, $p<0.01$).

Conclusions: Chronic intermittent hypoxia caused by OSA had a potential effect on the dysbiosis of the human oral-gut microbiota. The abundance of gut microbiome was high in patients with different degrees of OSA, but there was obvious heterogeneity in species evenness and diversity. The *Ruminococcus_torques_group* and *Escherichia-Shigella* were characteristic genera in the gut microbiota of MSevOSA, and were significantly correlated with the severity and duration of nocturnal hypoxia, but not AHI. *Bacteroides* and *Lachnospirillum* were enriched in oropharyngeal microbiome structure of MSevOSA, which is closely related to AHI and nocturnal hypoxia severity.

Intermittent Hypoxia Accelerates Full-Thickness Cutaneous Wound Healing in Sprague-Dawley Rats: The Role of Upregulated TGF- β and YAP Expression

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Introduction: Re-epithelialization is a critical step in the complex processes of cutaneous wound healing. Tissue oxygenation is a key microenvironmental determinant for wound healing involving re-epithelialization. This study investigated the effects of intermittent hypoxia (IH) on full-thickness skin wound healing in Sprague Dawley rats, focusing on transforming growth factor-beta signaling and Yes-associated protein expression dynamics.

Materials and methods: Eight male rats were equally randomized to receive either daily 8-hour cyclic hypoxia (10-21% oxygen) or normoxic conditions until complete re-epithelialization. Consistent round full-thickness skin wounds with a diameter of 1cm were made on the dorsum of both groups of rats. From the second day after wound surgery. The re-epithelialization processes were monitored, and blood and healed tissue samples were obtained until the wounds closed completely.

Results: Intermittent hypoxia reduced healing time by 21% compared to controls (20.0 ± 1.8 vs 24.3 ± 2.5 days, $P < 0.05$), with elevated serum transforming growth factor-beta levels (184.9 ± 10.9 vs 120.6 ± 8.7 , $P < 0.05$) but unchanged vascular endothelial growth factor and epidermal growth factor concentrations. Sustained upregulation of Yes-associated protein isoforms 1 and 2 ($P < 0.05$ for both) persisted throughout healing in hypoxic-exposed regenerating epithelium, correlating temporally with accelerated wound closure. The histological findings of the healed epithelium in NC group rats were closer to normal than in IH group rats.

Conclusions: These findings reveal that controlled hypoxic stimulation enhances cutaneous re-epitheliation through coordinated activation of TGF- β signaling pathways and concomitantly enhancing the expression of YAP protein. This finding suggests novel therapeutic targets in re-epithelization remodeling and tissue regeneration in the wound healing progress.

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Morphological phenotypes of the oral cavity and hard palate in Thai adults with obstructive sleep apnea: A case-control study

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Introduction: Obstructive sleep apnea (OSA) is a prevalent condition influenced by a range of anatomical and functional factors. Among these, morphological variations in the oral cavity, hard palate, and tongue significantly contribute to OSA pathogenesis and severity. While craniofacial morphology differs across ethnicities, data specific to the Thai population remain limited. Understanding these structural characteristics is essential for guiding individualized diagnostic and therapeutic strategies. This study aimed to characterize and compare the anatomical characteristics of the oral cavity, including the hard palate and tongue, between Thai patients with OSA and individuals at low risk for OSA.

Materials and methods:

This prospective case-control study was conducted at Rajavithi Hospital. Sixty participants were enrolled: 30 patients with OSA confirmed by polysomnography and 30 low-risk control subjects identified via the STOP-BANG questionnaire. Anatomical evaluation comprised: (1) hard palate morphology (palatal width and height measured at specific dental landmarks using intraoral scanning), (2) palatal roof-to-tongue width ratio, and (3) ankyloglossia-related measures, including mouth opening with tongue tip to incisive papilla (MOTTIP), maximal interincisal mouth opening (MIO), and Kotlow's free-tongue length. Statistical analysis was performed with a significance threshold of $p < 0.05$.

Results: Patients with OSA had significantly narrower palatal roof width compared to controls (mean 18.85 mm vs. 22.41 mm; $p < 0.001$), and significantly greater palatal height at the inter-canine ($p = 0.038$) and inter-first premolar ($p = 0.017$) positions. Although the overall palatal roof-to-tongue width ratio did not significantly differ between groups ($p = 0.147$), patients with severe OSA showed a strong association between narrow palates and increased tongue width (ratio 1:3, $p = 0.049$). No statistically significant differences were observed in ankyloglossia-related measurements: MOTTIP ($p = 0.268$), MIO ($p = 0.572$), or Kotlow's measurement ($p = 0.102$).

Conclusions: Thai patients with OSA exhibit a narrow, high-arched palatal vault and a proportionately wider tongue, especially in cases of severe disease. Integrating comprehensive evaluations of oral cavity morphology into

standard clinical assessments may improve diagnostic accuracy and facilitate the selection of targeted interventions, such as palatal expansion or localized surgical therapies, intended to alleviate airway obstruction and enhance outcomes in OSA.

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Predictors of successful reduction in AHI after Yoga-based intervention for treatment of obstructive sleep apnea

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Introduction: Non-pharmacological interventions have been shown to improve obstructive sleep apnea (OSA) and result in a 30-40% reduction in the apnea-hypopnea index (AHI). Recently, yoga has emerged as a potential intervention for treating OSA; however, treatment responses vary among patients. The study aims to identify the predictors of effectiveness of yoga in reducing apnea-hypopnea index (AHI).

Materials and methods: We have merged the patient data from two randomized controlled trials who underwent yoga-based intervention for treating OSA. Patients who reduced their AHI by 40% or more (Group 1) on 6-month follow-up after a yoga-based intervention were considered treatment-responsive, while those with less than a 40% reduction in AHI (Group 2) were considered non-responsive to treatment. All baseline clinical and polysomnography parameters were compared between the responsive and non-responsive patients.

Results: Baseline data of 19 patients aged 47.21 ± 10.1 years, and 13 (68.42 %) were male, nine were responsive, and 10 were non-responsive and were included in the analysis. Mean 49.1 and $9 \pm 0.12\%$ AHI reduction occurred in the responsive and non-responsive groups. REM AHI was significantly higher among responsive patients ($64.62, \pm 38.55$ vs $25.36, \pm 15.84657$, $p=.03$). The mean baseline BMI was higher among non-responsive patients. However, there was a lack of statistical significance. (30.74 ± 3.99 vs 35.07954 ± 5.490883 , $p=0.07$). The number of patients with NREM-dominant OSA were significantly more common in Group 2 (11% vs 70%, $p=0.02$).

Conclusions: Morbid obesity and NREM-dominant obstructive sleep apnea (OSA) are predictors of a poor treatment response, and the severity of REM sleep apnea is a predictor of the effectiveness of yoga intervention in reducing apnea-hypopnea index (AHI).

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Respiratory Arousal Threshold and Clinical Features in patients with Isolated Obstructive Sleep Apnea and Comorbid Insomnia (COMISA)

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Introduction: Comorbid insomnia and obstructive sleep apnea (COMISA) affects up to 40% of patients with either disorder, suggesting shared pathophysiological mechanisms. The respiratory arousal threshold (ArTH) – the respiratory effort required to trigger sleep arousal – in COMISA remains uncharacterized. We hypothesized that low ArTH and complications occur more frequently in COMISA than in OSA alone.

Materials and methods: Participants referred for OSA diagnosis underwent a polysomnography (PSG) and answered the Athens insomnia scale (AIS) and the Epworth sleepiness scale (ESS). Participants with an AIS score $\geq$

7 were defined as having insomnia. OSA was defined as an apnea hypopnea index (AHI) ≥ 5 events/h. A low ArTH was determined by an ArTH score of 2 or above (one point for each: apnoea-hypopnea index (AHI) < 30 /h, nadir oxygen saturation (SaO₂) $> 82.5\%$, fractions of hypopnoeas $> 58.3\%$).

Results: A total of 387 subjects (158 OSA only and 229 COMISA) were analysed. There was a significantly higher proportion of low ArTH patients with COMISA compared with OSA only (35.37% vs 25.32%, $P = 0.036$). After adjusting for confounding factors, including age, sex, BMI, low ArTH was still independently associated with COMISA (OR: 1.696, 95% CI 1.054–2.738, $P=0.030$). Comparing the individual components of the ArTH scoring criteria, there was significantly higher proportions of COMISA subjects who had a fraction of hypopnoeas $> 58.3\%$ (68.22% vs 54.65%, $P = 0.010$). There was a significantly higher proportion of EDS, anxiety and depression in patients with COMISA. To illustrate the correlation between phenotypes and cardiovascular responses in patients with OSA alone and COMISA, Spearman correlation analyses were conducted; 18 pair-wise correlations were assessed and statistically significant correlations are shown in Figure 2.

Conclusions: A low respiratory arousal threshold is a predominant phenotypic feature in individuals with COMISA and may exhibit a greater relative contribution to OSA pathogenesis in these patients. Complications, include anxiety, depression and EDS, occur more frequently in COMISA than in OSA alone.

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Can Acute Post-Surgical Changes in PSG Features Inform Subsequent Management of Patients with Moderate-to-Severe Obstructive Sleep Apnea? A Pilot Study

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Introduction: Obstructive sleep apnea (OSA) is a multifactorial sleep-related breathing disorder.

Uvulopalatopharyngoplasty (UPPP) is the predominant surgical intervention for moderate-to-severe OSA. This study aimed to evaluate acute changes in polysomnography (PSG) characteristics following surgery to predict UPPP efficacy and guide long-term post-surgical management.

Materials and methods: Patients eligible for sleep surgery at Guangzhou Medical University between 2023 and 2025 were enrolled. All underwent in-lab PSG during diagnostic and post-operative night 5 after UPPP. Patients were classified into "surgically effective" or "non-effective" groups based on whether their apnea-hypopnea index (AHI) decreased by ≥ 15 events/hour.

Results: A total of 97 patients who underwent UPPP surgery were included in the final analysis. Based on the surgical outcome defined by a reduction in the apnea-hypopnea index (AHI) of ≥ 15 events/hour, 48 patients were classified into the surgical-effective group, while the remaining 49 patients were categorized into the non-effective group.

Effective group

Patients in the surgical-effective group demonstrated significant improvements across multiple polysomnographic parameters:

Respiratory events: AHI decreased by 35.1 ± 17.2 events/h ($p < 0.001$), REM/NREM AHI reduction > 30 events/h ($p < 0.001$)

Oxygenation Parameters: Oxygen saturation levels showed substantial enhancement. The mean SpO₂ during REM sleep increased by 4% ($p < 0.001$), and the lowest SpO₂ value recorded throughout the study rose by 8.9% ($p < 0.001$).

Non-Effective Group

The non-effective group showed no clinically or statistically meaningful improvements:

Respiratory and Oxygenation Measures: The change in AHI was negligible, with a mean Δ AHI of -0.1 events/hour ($p = 0.944$). Similarly, only minimal improvements were noted in oxygenation measures, which did not approach statistical significance.

Sleep architecture parameters

No statistically significant alterations in sleep architecture were observed in either group following surgery.

Conclusions: OSA patients exhibited significant improvements in respiratory disturbances, oxygen desaturation, and arousal/awakening indices post-operatively, but not in sleep architecture. Whether acute alterations in PSG variables after UPPP surgery predict long-term efficacy remains undetermined. Further large-scale studies are warranted to investigate the clinical implications of acute post-surgical PSG patterns.

A Cross-Sectional Study on Sleep-Related Breathing Disorders and School Performance Among School Children in Mindanao, Philippines

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Introduction: Sleep-Related Breathing Disorders (SRBDs) in children, such as obstructive sleep apnea (OSA), are associated with behavioral, cognitive, and emotional impairments that may hinder academic performance. In low-resource, linguistically diverse regions like Mindanao, the lack of validated screening tools limits early identification and intervention.

Materials and methods: Method: A two-phase design was employed. Phase I involved forward-backward translation and expert validation of the PSQ-SRBD into Bisaya, followed by psychometric testing ($n = 128$) and test-retest reliability ($n = 69$). In Phase II, a cross-sectional study screened 2,320 children (aged 8–14) across Mindanao using parent-reported questionnaires (Bisaya, English, or Filipino versions). Logistic regression identified predictors of SRBD risk and academic outcomes.

Results: Result: The Bisaya PSQ-SRBD demonstrated strong psychometric properties, with high internal consistency (Cronbach's $\alpha = 0.77$) and excellent test-retest reliability (ICC = 0.904), confirming its suitability for use in multicultural, community-based settings. Of the 2,320 schoolchildren screened, 8.7% were identified as high risk for SRBD. Multivariate logistic regression revealed that older age (11–14 years), residence in the Caraga region, lower parental education, presence of comorbid conditions, insufficient sleep duration, and engagement in modular or online learning modalities significantly increased the likelihood of SRBD ($p < .05$). Importantly, SRBD risk was strongly associated with decreased academic performance across all major subjects—Filipino, English, Mathematics, and Science ($p < .001$). Moreover, even after controlling for SRBD status, both household smoking exposure and socioeconomic disadvantage (e.g., low income, low parental education) emerged as robust independent predictors of poor school outcomes. These findings highlight the multifactorial nature of academic underperformance, with SRBD acting as both a direct and indirect contributor.

Originality: This is the first study to validate the PSQ-SRBD in Bisaya and apply it to a large-scale

Conclusions: Conclusion: SRBD significantly impairs school performance, especially among older children, those in socioeconomically disadvantaged regions, and those with poor sleep hygiene. Regional and socioeconomic disparities further intensify academic vulnerability.

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Multi-Omics Sequencing and Mendelian Randomization Analysis Identifies Corticotropin-Releasing Hormone Receptors (GRHR) as a Potential Therapeutic Target for Obstructive Sleep Apnea

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Introduction: Obstructive sleep apnea (OSA) is a multifactorial sleep-related breathing disorder characterized by recurrent upper airway obstruction during sleep, resulting in intermittent hypoxia, sleep fragmentation, and excessive daytime sleepiness. Although mechanical interventions such as positive airway pressure and surgery are effective, pharmacological options remain lacking. This is partly due to limited knowledge of the neurobiological circuits and molecular pathways regulating upper airway motor control. The hypoglossal motor nucleus (HMN), which innervates the genioglossus muscle, plays a central role in maintaining upper airway patency. Here, we aimed to identify novel therapeutic targets for OSA through a combination of brainstem and peripheral tissue multi-omics profiling, and human genetic analyses.

Materials and methods: A rat model of OSA was established via chronic intermittent hypoxia (CIH) exposure. We performed single-cell RNA sequencing (scRNA-seq) and spatial transcriptomics on the HMN and genioglossus muscle to characterize cellular heterogeneity and spatial gene expression dynamics under hypoxic stress. Targeted neurotransmitter-focused metabolomic profiling was conducted on serum samples of human and rat model to evaluate systemic and local neuroendocrine alterations.

To translate these findings to human populations, we integrated data from the UK Biobank Pharma Proteomics Project and conducted two-sample Mendelian randomization (MR) analysis using cis-acting protein quantitative trait loci (pQTLs) to test for causal associations between circulating proteins and OSA risk. Sensitivity analyses included reverse MR and Bayesian colocalization to validate causal direction and genetic co-regulation.

Results: Multi-omics profiling revealed significant upregulation of corticotropin-releasing hormone receptor (CRHR) in the HMN and genioglossus muscle following CIH exposure. Spatial transcriptomics confirmed localized CRHR expression enrichment in motor regulatory nuclei. Metabolomic analyses indicated CRHR-linked dysregulation of neuroendocrine and energy metabolism pathways, potentially impairing upper airway neuromuscular responsiveness.

Mendelian randomization analysis identified a significant causal relationship between genetically predicted circulating CRHR levels and increased OSA susceptibility (inverse variance weighted odds ratio > 1.0, $p < 0.001$). Reverse MR analysis excluded reverse causality, and Bayesian colocalization supported a shared genomic architecture between CRHR-regulating variants and OSA-associated loci. Ongoing functional validation using central and peripheral CRHR agonists/antagonists in CIH-exposed rats further suggests a modulatory role of CRHR in genioglossus excitability and upper airway stability during sleep.

Conclusions: This study provides convergent evidence from central and peripheral transcriptomics, metabolomics, and human genetic analyses identifying CRHR as a mechanistically relevant and pharmacologically actionable target in OSA. By implicating CRHR in the regulation of hypoglossal motor outflow and upper airway dilator muscle tone, our findings lay the groundwork for future therapeutic strategies aimed at restoring neuromuscular control in sleep-disordered breathing.

Deep Learning-based Identification of Severe Obstructive Sleep Apnea using Sagittal MRI Images

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Introduction: Obstructive sleep apnea (OSA) is a common disorder caused by repeated upper airway obstruction during sleep, often due to soft tissue collapse. It results in oxygen desaturation, daytime sleepiness, and cardiovascular complications. The gold standard diagnostic test, polysomnography (PSG), requires overnight hospitalization and is affected by the first night effect, where an unfamiliar environment alters sleep patterns.

Imaging-based methods have been studied to complement PSG.

X-ray cephalometry is useful for skeletal features but cannot clearly depict soft tissues, even though enlarged soft tissue often causes airway obstruction. Magnetic resonance imaging (MRI) visualizes soft tissue well, yet there is no standard method to interpret its relation to OSA severity, and diagnosis still depends on physician experience.

The aim of this study was to design a lightweight and transparent convolutional neural network (CNN) for classifying severe OSA from MRI images, and to evaluate its performance against standard deep CNN models such as VGG16 and ResNet-50.

Materials and methods: We analyzed 132 patients with OSA at Hakodate Medical Center, including 66 severe cases (apnea-hypopnea index, AHI ≥ 30) and 66 non-severe cases. All patients underwent PSG and MRI. The tongue region was extracted from MRI and resized to 224×224 pixels, with augmentation by rotation and translation.

Our CNN consisted of a single convolutional layer with a 29×29 kernel, followed by batch normalization, ReLU activation, and max pooling. Feature maps were divided into severe and non-severe groups, then aggregated by global average pooling and passed to a 2-unit softmax layer. Each unit corresponded to one filter with fixed weights, improving transparency. Dropout and L2 regularization were applied to reduce overfitting. The model was trained with Adam optimizer (initial learning rate 0.005, decayed exponentially) for 300 epochs, with a batch size of 10. Performance was evaluated by 10-fold cross-validation repeated five times. For benchmarking, transfer learning with VGG16 and ResNet-50 was also performed.

Results: The proposed CNN had about 23,000 parameters, compared to 138 million in VGG16 and 25 million in ResNet-50. Despite being lightweight, our model achieved an average accuracy of 76% in classifying severe vs. non-severe OSA, comparable to both VGG16 and ResNet-50.

The variance of accuracy was slightly larger in our model, reflected by a higher standard deviation, but overall classification performance was maintained. Importantly, the transparent structure of our CNN allows direct association between filters and classes, providing the potential to analyze clinically relevant features after training.

Conclusions: This study demonstrates that accurate classification of severe OSA from MRI can be achieved not only with large deep CNNs but also with a lightweight and transparent CNN model. Although performance was similar among the three models, our model required far fewer parameters, offering efficiency and interpretability. These findings suggest that CNN-based MRI analysis may provide an objective method for OSA assessment and reduce reliance on physician experience. Future work will focus on analyzing learned filters to clarify the relationship between soft tissue morphology and OSA severity, aiming to support clinical diagnosis.

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Prevalence and characteristics of obstructive sleep apnea (OSA) comorbid with catathrenia (nocturnal groaning)

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Introduction: Catathrenia (nocturnal groaning) is a rare sleep-related breathing disorder, but the comorbidity of catathrenia with obstructive sleep apnea (OSA) is not uncommon. This study highlights the prevalence, clinical, polysomnographic, and craniofacial characteristics of this comorbidity to raise awareness in clinical practice.

Materials and methods: This study was conducted across two independent sleep centers, including 1,123 participants (741 males/382 females), with an average age of 46.3 ± 14.0 y. Patients were diagnosed using full-night video polysomnography (PSG) and acoustic analysis was conducted to classify snoring and groaning sounds using a deep convolutional neural network. The cluster analysis was conducted to analyze subgroups of catathrenia, and inter-group polysomnographic characteristics were investigated. Additionally, craniofacial cone-beam CT was performed to assess the upper airway and surrounding structures. Mandibular advancement devices (MAD) and positive airway pressure (PAP) were used as treatment, and their efficacy was evaluated using PSG.

Results: Among the 1,123 participants, 865 (77.03%) were diagnosed with OSA, with 78 (6.95%, 76 males/2 females) also having comorbid catathrenia. Conversely, only 10 (0.89%, 5 males/5 females) of participants were diagnosed with primary catathrenia. Acoustically, snoring and groaning sounds exhibited distinct characteristics: snoring displayed an irregular waveform, while groaning had a sinusoidal or sawtooth waveform with a discernible

fundamental frequency. Cluster analysis revealed two distinct subgroups of catathrenia. Compared to normal references, patients with OSA presented with a retrusive mandible and narrow palatopharynx, whereas patients with catathrenia had a well-developed mandible, and broad palatopharynx, yet narrow hypopharynx. The groaning index decreased significantly from 5.8(2.7,14.3) to 2.8(1.3, 12.2) ($p=0.014$) with MAD treatment.

Conclusions: This study suggests that catathrenia may be more prevalent among patients with OSA and that those with comorbid catathrenia exhibit distinct characteristics, including differences in sex distribution, AHI, acoustic features, and upper airway anatomy. Groaning sounds might be active, vocal sounds to overcome obstructions in the hypopharynx.

Screening prediction models using artificial intelligence for moderate-to-severe obstructive sleep apnea in patients with acute ischemic stroke

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Introduction: Obstructive sleep apnea (OSA) is common after stroke. Still, routine screening of OSA with polysomnography (PSG) is often unfeasible in clinical practice, primarily because of how limited resources are and the physical condition of patients. In this study, we used several artificial intelligence techniques to predict moderate-to-severe OSA and identify its features in patients with acute ischemic stroke.

Materials and methods: A total of 146 patients with acute ischemic stroke underwent PSG screening for OSA. Their baseline demographic characteristics, including age, sex, body mass index (BMI), Epworth Sleepiness Scale (ESS) score, and stroke risk factors, were recorded. Logistic regression analysis was conducted to identify significant features associated with moderate-to-severe OSA in patients with stroke. These significant features were used with six machine learning and ensemble learning algorithms, namely decision tree, support vector machine, random forest, extreme gradient boosting (XGBoost), adaptive boosting (AdaBoost), and gradient boosting, to compare the performance of several predictive models.

Results: Multivariate logistic regression analysis revealed that age, sex, BMI, neck circumference, and ESS score were significantly associated with the presence of moderate-to-severe OSA. According to the machine learning and ensemble learning results, the XGBoost model achieved the highest performance, with an area under the receiver operating characteristic curve of 0.89 and an accuracy and F1 score of 0.80.

Conclusions: This study identified key factors contributing to moderate-to-severe OSA in patients with ischemic stroke. The XGBoost model exhibited high predictive performance, indicating it has potential as a supporting tool for decision-making in health-care settings.

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"INNOVATING SLEEP APNEA SCREENING: TELE-OSA QUESTIONNAIRE- A NOVEL TELEPHONIC SCREENING TOOL FOR MODERATE TO SEVERE OBSTRUCTIVE SLEEP APNEA"

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Introduction:

- Prevalence of obstructive sleep apnea (OSA) varies between 6-17% in general adult population. Untreated severe OSA has 2-3-fold increased risk of all-cause mortality. Despite high prevalence, OSA often remains undiagnosed.
- Access to polysomnography (PSG), gold standard for diagnosis, can be limited in LMICs like India due to several factors like availability of sleep centers, geographical distribution (often concentrated in urban areas), cost of services, referral processes, awareness and workforce shortages.
- Consequently, sleep clinics often experience overwhelming patient loads and prolonged waiting times, underscoring urgent need to streamline screening and triage pathways.
- Drawbacks of existing screening questionnaires are usage of objective parameters (anthropometric measurements) and reliance on age, gender, and BMI which can introduce biases.

Materials and methods:

- This was a retrospective, single centre, observational study. 522 patients who underwent level I PSG during 2022-2024 in our sleep laboratory were included. All patients filled a self-administered 12-item questionnaire tool in vernacular language (Hindi) during time of admission.
- Eligibility
 - Inclusion:- Adult patients aged >18 years and have completely filled 12-item questionnaire during time of admission.
 - Exclusion :- Patients who have not filled the questionnaire, already on treatment for OSA, pregnant women and those with technically inadequate polysomnography studies.
- Statistical analysis was done in IBM-SPSS-version-26.0 statistical software. Exploratory factor analysis was done and 7 questions were selected. Sample was randomly divided into two parts: development (80%,n=421) and testing subsample (20%, n=101). Multi-variate logistic regression analysis was done on development subsample to construct the model. Finally, we assessed the discriminative performance of this score in both development and test subsamples and determined cross-validation and diagnostic accuracy.

Results:

- TELE-OSA questionnaire includes five items (snoring, stops breathing while sleeping, wake up from sleep due to gasping/choking, nocturia and nocturnal GER).
- Cutoff score of 6 was identified, demonstrating high specificity (83%) and moderate sensitivity (55%).
- TELE-OSA had high specificity compared with existing screening questionnaires [STOP-BANG (59%), STOP (66%), GOAL (45%), NOSAS (78%) No-apnea (53%)] and highest diagnostic accuracy [AUC: TELE-OSA-0.77, STOP-BANG-0.76, STOP-0.71, GOAL-0.77, NOSAS-0.77, No-apnea-0.68].

Conclusions:

- This study introduces the Tele-OSA Questionnaire, a novel telephonic screening tool designed to facilitate the identification of individuals at risk for moderate to severe OSA.
- It includes only the construct of the disease (OSA) and does not include risk factors associated with the disease.
- It can be used via telephonic interview or surveys, even by proxy informants viz., bedpartners.
- The developed questionnaire has acceptable psychometric properties at the cutoff score of 6. Further, properties across different cut-offs and prevalence are also provided so that users may choose a specific cut-off according to the population in which they intend to use the questionnaire.
- Existing screening questionnaires have high sensitivity but less specific which increases the burden on sleep labs. Tele-OSA is a highly specific questionnaire and can reduce the burden on sleep centres, making diagnostic processes more accessible in resource-constrained settings.

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Sex differences in endocrine, metabolic and psychological disturbance in obese patients with OSA

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Introduction: Obstructive sleep apnea (OSA) is associated with increased risks of glucolipid metabolic disruption, endocrine disturbances and psychological distress. There is scarce research regarding the influence of sex on these associations. The current study aimed to evaluate the effects of sex on metabolic, endocrine and psychological changes in patients with OSA.

Materials and methods: One hundred sixty-four young adult women and one hundred sixty-two age-matched men with OSA completed polysomnography assessments, questionnaires (including the Epworth Sleepiness Scale [ESS], Self-Reported Anxiety Scale [SAS], Self-Rating Depression Scale [SDS], and 12-Item Short-Form Health Survey [SF-12]) and biochemical analyses for glucolipid metabolism and endocrine function, including the pituitary-adrenal (PA), pituitary thyroid (PT), and pituitary-gonadal (PG) axes.

Results: Homeostasis model assessment of insulin resistance (HOMA-IR), thyroid hormone and midnight PA axis activity levels were greater in female patients with severe OSA compared to those with mild-to-moderate OSA, and these metabolic and endocrine changes were associated with nocturnal hypoxia only in female patients. Additionally, midnight cortisol was associated with HOMA-IR (independent of anthropometry and sleep disturbance parameters) in females ($\beta = 0.545$, $P = 0.012$, adjusted $R^2 = 0.217$). ESS was higher for male patients with severe OSA compared to females with the same level of OSA ($P = 0.003$), and ESS was associated with nocturnal hypoxia in males ($\beta = -0.494$, $P = 0.001$, adjusted $R^2 = 0.224$). SAS was higher for female patients with severe OSA compared to males with the same level of disease ($P = 0.001$).

Conclusions: The metabolic, endocrine and psychological consequences of OSA may differ across sexes. The associations of nocturnal hypoxia with glucose metabolic disturbance and the activation of the PA and PT axes were observed in females, whereas the association of nocturnal hypoxia with ESS was limited to males. This could indicate a distinct metabolic, endocrine and psychological phenotype for female patients with OSA, who may require different disease management strategies compared to males.

Lactylation-Related Gene Signatures Define Molecular Subtypes and Therapeutic Targets in Obstructive Sleep Apnea

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Introduction: Obstructive sleep apnea (OSA) is a widespread sleep disorder driven by chronic intermittent hypoxia (CIH), contributing to serious complications such as cardiovascular and metabolic diseases. Recent studies suggest that epigenetic modifications, particularly lactylation, play a pivotal role in OSA pathogenesis by interacting with CIH. Despite this, the specific contributions of lactylation-related genes to OSA remain largely unexplored. Our study aims to elucidate the expression patterns and functional significance of lactylation-related genes in OSA, with a focus on identifying molecular subtypes and their associated immune signatures. Through advanced computational analyses, we aim to reveal novel epigenetic insights that could drive the development of precision therapies for OSA.

Materials and methods: A total of 332 lactylation-related genes were obtained from the Molecular Signatures Database. Adipose tissue expression data were sourced from GEO datasets GSE135917 (8 controls, 34 OSA cases) and GSE38792 (8 controls, 10 OSA cases) on the GPL6244 platform. Differential genes (adjusted $P < 0.01$)

were identified using limma in R. Functional enrichment and co-expression analyses were performed via clusterProfiler and GeneMANIA. Key genes were selected by LASSO and SVM-RFE, ranked by SHAP, and validated in GSE38792. A nomogram was evaluated by decision curve analysis. Subtypes were identified by consensus clustering using PCA-derived lactylation scores. Immune infiltration was analyzed via ssGSEA, with regulatory networks constructed in NetworkAnalyst. Validation included ELISA and qPCR in OSA patient and CIH mouse models.

Results: In the GSE135917 dataset, 79 lactylation-related genes were differentially expressed in OSA patients. Consensus clustering defined two subtypes. Group B showed higher lactylation scores and increased immune infiltration. LASSO and SVM-RFE identified four key genes, with TMSB4X upregulated and PRAMI downregulated in OSA. Their expression patterns were validated in GSE38792 and CIH mouse adipose tissue via qPCR. SHAP confirmed their discriminative value. A nomogram incorporating TMSB4X and PRAMI showed strong clinical utility. ELISA revealed elevated lactate in OSA patients and CIH mice. Serum IL-6 and TNF- α levels correlated positively with TMSB4X and negatively with PRAMI, supporting links between lactylation and immune dysregulation.

Conclusions: This study identifies distinct molecular subtypes of OSA based on lactylation-related gene expression, highlighting their roles in disease heterogeneity. TMSB4X and PRAMI were identified as potential diagnostic and therapeutic targets, with consistent trends across human and mouse models. A nomogram incorporating these genes showed strong clinical utility. Elevated lactate and inflammatory cytokines further support the association between lactylation and immune dysregulation. These findings provide new epigenetic insights into OSA and suggest potential for lactylation-based precision therapies.

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Body Weight Change and Nocturnal BP Pattern influence the effect of CPAP treatment on 24-Hour Ambulatory Blood Pressure in OSA Patients

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Introduction: Obstructive sleep apnea (OSA) is associated with elevated blood pressure (BP), and continuous positive airway pressure (CPAP) treatment has shown heterogeneous effects on BP control. To address this variability, a comprehensive evaluation of factors influencing the BP response to CPAP was conducted, with particular emphasis on weight change during treatment and nocturnal BP pattern.

Materials and methods: This study is a post hoc analysis of the Peking University People's Hospital cohort from a randomized, controlled, non-inferiority trial on the effect of telemedicine-based CPAP management on 24-Hour Ambulatory Blood Pressure (ABPM) in Patients with OSA (PKUPH-TM). We included patients for whom 24h ABPM data were available at baseline and 12 weeks after the intervention. Parameters analyzed included weight change, sleep apnea severity, oxygen desaturation burden, nocturnal BP pattern, antihypertensive medication use, and CPAP adherence, to identify predictors of BP reductions following 12 weeks of CPAP therapy.

Results: A total of 256 OSA patients were included in the analysis. Baseline BMI, weight gain, 24-Hour mean arterial pressure (MAP), nocturnal BP pattern, duration of oxygen desaturation below 90%, and CPAP adherence were significantly associated with changes in 24h BP. Among these, logistic regression identified baseline 24h MAP, weight gain, nocturnal BP pattern, and CPAP adherence as independent predictors (all $P < 0.05$). To further clarify the impact of body weight dynamics on BP outcomes, patients were categorized into three groups based on weight change: no weight change ($n = 207$), weight loss ($n = 32$), and weight gain ($n = 17$). The weight loss group exhibited the greatest reduction in 24h BP, while the weight gain group showed the smallest reduction. After adjusting for baseline 24h MAP and CPAP adherence, the difference in daytime mean BP reduction remained significant among the groups (mean reductions: 4.73 mmHg, 6.64 mmHg, and 2.34 mmHg for no weight change, weight loss, and weight gain groups, respectively; adjusted $P = 0.04$). To further assess the impact of nocturnal BP pattern,

participants were stratified into dipper and non-dipper groups based on nocturnal BP decline. Compared to dippers ($n = 86$), non-dipper patients ($n = 170$) showed significantly greater reductions in nighttime mean BP (5.51 mmHg vs. 1.54 mmHg in non-dipper and dipper groups, respectively; estimated difference = 3.96 mmHg; 95% CI: 1.20 to 6.72; adjusted $P = 0.004$) and nighttime diastolic BP (4.59 mmHg vs. 0.33 mmHg in non-dipper and dipper groups, respectively; estimated difference = 4.25 mmHg; 95% CI: 1.70 to 6.80; adjusted $P = 0.001$).

Conclusions: Our findings indicate that the effect of CPAP on 24h ABPM in OSA patients is influenced by both weight change and nocturnal BP pattern. Patients who lost weight experienced the greatest benefit in daytime BP reduction, while those with a non-dipping BP pattern demonstrated more pronounced improvements in nighttime BP, particularly in diastolic pressure. These results highlight the importance of individualized BP management strategies in OSA treatment.

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Development and Validation of a Facial-Recognition-Based Screening App for Obstructive Sleep Apnea (OSA)

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Introduction: Obstructive sleep apnea (OSA) is a common sleep disorder affecting nearly 1 billion individuals worldwide. Although polysomnography (PSG) remains the diagnostic gold standard, its high cost and operational complexity limit its accessibility in primary care and home settings. This study proposes and validates a contactless, facial-recognition-based mobile application for rapid OSA screening, aiming to provide a scalable and user-friendly solution.

Materials and methods: We constructed a machine learning model based on a dataset of 3,265 facial images paired with corresponding sleep monitoring data collected during 2023–2024. Facial landmarks (106 key points) were extracted using the InsightFace framework and aligned via affine transformation. A face segmentation algorithm was then applied to isolate key regions covering the lower face and neck. Image features were extracted using a modified ResNet50 architecture, followed by classification using a support vector machine (SVM) to assess OSA risk. Five-fold cross-validation was conducted for performance evaluation. To enhance interpretability, we employed Grad-CAM to visualize model attention and examine its alignment with known anatomical risk factors.

Based on this model, we developed a smartphone app for fast screening. The app incorporates a 3D pose estimation algorithm to automatically capture facial images at optimal angles, ensuring image quality while maintaining ease of use.

Results: The model demonstrated strong performance in identifying patients at moderate to high risk of OSA, with a sensitivity of 79.4% and a specificity of 84.1%. Grad-CAM visualization revealed that the model's attention focused primarily on anatomical regions relevant to OSA, such as the lower jaw and neck width.

The trained model has been successfully integrated into a public-facing app named "Sleepok" enabling users to complete screening in less than 10 seconds by simply taking a photo with their mobile device.

Conclusions: This study presents a low-cost, efficient, and scalable alternative to traditional PSG-based screening through a facial-recognition-based OSA risk assessment model and mobile app. The tool supports at-home use and may significantly enhance early detection rates for OSA. These findings demonstrate the practical potential of artificial intelligence in preventive healthcare and early disease intervention.

Study on the Effect of Chemogenetic Regulation of Neurons in the mPFC brain Region on Learning and Memory Impairment and Sleep Structure in Mice with Chronic Intermittent Hypoxia

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Introduction: Young and middle-aged patients with OSA often suffer from cognitive impairments in multiple cognitive functional domains such as attention, memory, and executive function. Chronic intermittent hypoxia (CIH) is one of the possible mechanisms leading to changes in electroencephalogram activity and cognitive dysfunction, but the current research results are controversial. Our preliminary research found that CIH significantly increased c-fos neuronal activity in the medial prefrontal cortex (mPFC) region of mice, suggesting that the mPFC is likely to be the key brain area involved in OSA-related cognitive impairment. Therefore, we intend to investigate the pathogenesis of learning and memory impairment in CIH mice from the perspective of neuronal regulation, aiming to provide new ideas and methods for clinical diagnosis and treatment.

Materials and methods: (1) Construction of an OSA mouse model

C57BL/6 mice aged 6-8 weeks were placed in a hypoxia chamber. Each cycle lasted 60 seconds, with the ambient oxygen concentration (FiO₂) decreasing from 21.0% to 6±0.5% within the first 30 seconds, and then increasing back to 21% within the next 30 seconds.

(2) Chemogenetics regulates neuronal activity

Chemogenetic viruses were injected into the mPFC region of mice using stereotaxic techniques. The viruses were allowed to fully express for 2-3 weeks. Half to one hour prior to the start of the experiment, clozapine-N-oxide (CNO) was injected intraperitoneally to activate the chemogenetic pathway.

(3) EEG/EMG recording

Mice were anesthetized and fixed using a stereotaxic apparatus. Electrodes were surgically implanted, with two electrodes for EEG signal recording and two flexible electrodes for EMG signal recording. EEG and EMG signals were amplified and filtered (EEG: 0.5-25 Hz; EMG: 20-200 Hz) and recorded using software.

(4) Cognitive-related behavioral tests

Behavioral tests such as the open field test, novel object recognition test, novel location recognition test, and water maze test were conducted to evaluate the cognitive abilities of mice.

(5) Immunofluorescence technique for observing changes in myelin and glial cells in CIH mice.

Results: 1. Compared to control mice, CIH-exposed mice exhibited increased c-fos expression in the mPFC-IL region.

2. Compared with the control group mice, CIH-exposed mice showed decreased learning and memory indices. However, chemogenetics can improve the learning and memory impairment of CIH mice.

3. Compared with the control group mice, CIH-exposed mice showed reduced myelin basic protein levels in the corpus callosum and decreased numbers of oligodendrocytes and OPCs across all hippocampal regions. Chemogenetics can improve the myelin injury and the decline in the number of oligodendrocytes and precursor cells in CIH mice.

4. Compared with the control group mice, CIH-exposed mice exhibited reduced REM sleep and an increased number of sleep-wake transitions, and chemogenetic regulation could not improve the disruption of sleep structure in CIH mice.

Conclusions: The mPFC brain region is a critical brain region for learning and memory impairment in CIH-exposed mice. Chemogenetic regulation of neurons in the mPFC brain region can improve learning and memory impairment by reducing myelin damage and increasing the number of oligodendrocytes and precursor cells. However, this intervention does not alleviate the disruption of sleep architecture in CIH mice.

Comparative Effects of Nasal and Oronasal Masks on Airway Collapse and Oxygenation During CPAP-Assisted DISE

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Introduction: Mask type can influence the effectiveness of CPAP therapy in patients with obstructive sleep apnea (OSA). However, how nasal versus oronasal masks differ in their anatomical and physiological effects remains unclear. We aimed to compare their impact on site-specific upper airway collapse and oxygen saturation during CPAP titration using drug-induced sleep endoscopy (DISE).

Materials and methods: In this randomized crossover study, 30 patients with OSA underwent DISE and polysomnography using both nasal and oronasal masks. CPAP was delivered in incremental steps (0–20 cmH₂O),

and airway collapse at four VOTE regions (Velum, Oropharynx, Tongue base, Epiglottis) was scored at each pressure level. Pharyngeal opening pressure (PhOP) was defined as the pressure required to reduce VOTE score 2 obstruction. Oxygen saturation was simultaneously monitored.

Results: Nasal masks significantly improved obstruction at the velum, oropharynx, and tongue base at 10 cmH₂O, whereas oronasal masks improved only oropharyngeal collapse. The PhOP required to alleviate velum obstruction was significantly lower with nasal masks (Vap: 6.0 [4.0–10.0] vs 16.0 [11.0–22.0] cmH₂O, $p < 0.001$). Nasal masks also yielded significantly higher SpO₂ between 6–12 cmH₂O. No mask type adequately resolved epiglottic collapse.

Conclusions: Compared to oronasal masks, nasal masks more effectively resolved airway obstruction and improved oxygenation during CPAP titration. These findings support the preferential use of nasal interfaces when feasible and suggest the need for individualized mask selection based on anatomic response and physiological outcome.

Insomnia as a Symptom of REM-related OSA: A Retrospective Cross-Sectional Study in 1736 OSA Patients

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Introduction: REM-related obstructive sleep apnea (REM-OSA) is a *polysomnographic phenotype* of OSA characterized by respiratory events predominantly occurring during REM sleep, affecting approximately 12–36% of all OSA patients.

Several studies have suggested that REM-OSA may be more prevalent in females, particularly in those presenting with depressive symptoms.

In our previous study of 3,234 OSA patients, we found that the main symptom of REM-OSA was not excessive daytime sleepiness.

Given the well-established bidirectional relationship between insomnia and depression, this raises important clinical questions.

Insomnia is frequently observed in patients with OSA, yet the specific relationship between REM-OSA and insomnia remains unclear.

We hypothesized that insomnia, rather than excessive daytime sleepiness, may be a primary complaint among patients with REM-OSA.

To test this hypothesis, we examined whether REM-OSA is independently associated with insomnia-related sleep disturbance as measured by the Pittsburgh Sleep Quality Index (PSQI).

Materials and methods:

We retrospectively analyzed 1736 adults with OSA (AHI ≥ 5) who underwent overnight polysomnography and completed the PSQI at a sleep center in Japan. REM-OSA was defined using three stringent criteria:

- **REM-OSA 1:** overall AHI ≥ 5 and AHI during REM (AHI-REM) / AHI during NREM (AHI-NREM) ≥ 2
- **REM-OSA 2:** overall AHI ≥ 5 , AHI-REM/AHI-NREM ≥ 2 , and AHI-NREM < 15
- **REM-OSA 3:** overall AHI ≥ 5 , AHI-REM/AHI-NREM ≥ 2 , AHI-NREM < 8 , and REM sleep duration > 10.5 minutes

Patients who did not meet REM-OSA 1 criteria were categorized as having NREM-OSA. Multiple linear regression models were used to evaluate the association between REM-OSA and PSQI, adjusting for age, sex, BMI, and REM/NREM-AHI. Subgroup analyses were performed by sex.

Results: REM-OSA accounted for 24.4%, 16.8%, and 8.9% of patients according to definitions 1, 2, and 3, respectively. Across all definitions, patients with REM-OSA had significantly higher PSQI scores compared to those with NREM-OSA ($p < 0.001$). In multivariate analyses, REM-OSA was independently associated with higher PSQI scores, with the strongest effect observed for REM-OSA 3 ($\beta = 1.26$, 95% CI 0.54–1.98, $p = 0.001$). Subgroup

analyses showed that this association was more evident in female patients, who consistently had higher PSQI scores than males.

Conclusions: REM-OSA is significantly associated with insomnia-related sleep disturbance, especially among female patients and when defined as REM-OSA 3. These findings suggest that insomnia, rather than excessive daytime sleepiness, may be a predominant complaint in REM-OSA. Clinicians should consider incorporating insomnia assessments such as the PSQI into the routine diagnostic evaluation and phenotyping of OSA patients, particularly those with REM-predominant respiratory events.

Gender Differences in Changes in Sleep-Related Physical and Mental Symptoms and Quality of Life Following CPAP Treatment in Patients with OSA

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Introduction: Poor sleep quality, memory impairment, emotional disorders, and reduced quality of life (QOL) are prominent symptoms among individuals with obstructive sleep apnea (OSA). Continuous Positive Airway Pressure (CPAP) therapy is widely recognized as the gold standard treatment for OSA. However, the diagnostic criteria and treatment approaches for OSA have historically been based on male-centric models, potentially overlooking gender-specific symptomatology. The objective of this study was to investigate gender differences in changes in sleep-related physical and mental symptoms, as well as QOL, after CPAP treatment among individuals with OSA.

Materials and methods: A prospective study with a repeated measures design was conducted at a sleep outpatient clinic within a medical center. Individuals diagnosed with OSA, defined by an apnea-hypopnea index (AHI) ≥ 5 events per hour as measured by polysomnography, were included. Daytime sleepiness, sleep quality, cognitive function, anxiety and depression, and QOL were assessed using the Epworth Sleepiness Scale (ESS), Pittsburgh Sleep Quality Index (PSQI), Mini-Mental State Examination (MMSE), Hospital Anxiety and Depression Scale (HADS), and the World Health Organization Quality of Life-BREF (WHOQOL-BREF), respectively. Measurements were collected at four time points: baseline (T0, before CPAP initiation), 1 month (T1), 3 months (T2), and 6 months (T3) after CPAP initiation. Repeated measures analyses were conducted to evaluate changes over time.

Results: A total of 121 participants were enrolled, with a mean age of 50.78 years. The male-to-female ratio was approximately 5.4:1 (19 females). Among them, 111 participants initiated CPAP therapy, and 69 completed the 6-month follow-up (T3). CPAP adherence over time did not significantly differ between genders. At baseline, females exhibited significantly poorer sleep quality compared to males ($p = .007$). Following CPAP initiation, improvements were observed in daytime sleepiness, sleep quality, cognitive function, anxiety, and QOL across participants, with notable gender differences. In the fully adjusted repeated measures model, females consistently demonstrated poorer sleep quality ($\beta = -3.23$, $p < .0001$) and greater improvement in cognitive function ($\beta = 0.70$, $p = .025$) compared to males across all follow-up points. No significant gender differences were observed in changes in daytime sleepiness, anxiety, depression, or QOL.

Conclusions: This study demonstrated that CPAP treatment effectively improved daytime sleepiness, sleep quality, cognitive function, anxiety, and QOL among individuals with OSA. Notable females exhibited persistently poorer sleep quality but greater improvements in cognitive function compared to males following CPAP therapy. No significant gender differences were identified in changes in daytime sleepiness, anxiety, depression, or overall quality of life. These findings highlight the need for gender-sensitive approaches in the evaluation and management of sleep-related symptoms in OSA patients undergoing CPAP treatment.

Effects of Continuous Positive Airway Pressure Treatment on Gut Microbiota and Metabolome in Obstructive Sleep Apnea Patients

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Introduction: Obstructive sleep apnea (OSA) is associated with gut dysbiosis and metabolic disturbances. Continuous positive airway pressure (CPAP) therapy is the standard treatment for OSA, but its impact on the gut microbiome and metabolome remains underexplored. This study aimed to investigate the effects of 6-month CPAP treatment on fecal microbiota and metabolites in OSA patients and their correlations with clinical parameters.

Materials and methods: Fecal samples from 14 OSA patients were collected at baseline and after 6 months of CPAP treatment (n=28 in total). 16S rRNA gene sequencing was performed to analyze the microbiota, while untargeted metabolomics (LC-MS) identified metabolic profiles. Alpha and beta diversity indices were calculated, and group differences were assessed using PERMANOVA. Linear discriminant analysis effect size (LEfSe) identified differentially abundant bacteria, and orthogonal partial least squares discriminant analysis (OPLS-DA) was used to detect metabolic changes.

Results: CPAP treatment significantly increased gut microbiota alpha diversity ($p < 0.05$) and altered the community structure (PERMANOVA, $p < 0.01$). LEfSe analysis revealed that *Lachnospira* was the most discriminantly abundant genus (LDA score > 4.0), with higher relative abundance after CPAP treatment. Particularly, the baseline abundance of *Lachnospira* was positively correlated with AHI ($r = 0.68$, $p < 0.01$). Untargeted metabolomics detected 326 metabolites, of which 58 showed significant differences between baseline and post-treatment groups ($p < 0.05$). Pathway analysis highlighted alterations in amino acid metabolism, lipid oxidation, and short-chain fatty acid (SCFA) biosynthesis pathways. Although canonical SCFAs were not directly identified, increased *Lachnospira* abundance may indicate enhanced SCFA production, potentially contributing to improved gut health.

Conclusions: CPAP treatment modulates the gut microbiota and metabolome in OSA patients. The positive correlation between *Lachnospira* and AHI highlights its potential as a biomarker for OSA severity. Further studies are warranted to elucidate the causal relationship between *Lachnospira*-associated metabolic alterations and OSA pathophysiology.

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Effect of Self-Viewing Sleep Videos on CPAP Adherence: A Prospective Real-World Study in Patients with Sleep Apnea Syndrome

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Introduction: Adherence to positive airway pressure (PAP) therapy in obstructive sleep apnoea (OSA) remains suboptimal. Previous cognitive behavioural therapy (CBT) has relied on passive education approaches and has yielded mixed results. To evaluate whether personalised video footage showing one's own sleep-disordered breathing events (Self-Viewing of Sleep Apnea Videos, SVSV) improves PAP adherence.

Materials and methods: In this randomised controlled trial, 228 treatment-naïve patients with moderate to severe OSA were assigned to either the SVSV or standard CBT-only (control) group. All participants received standard CBT before PAP initiation. The SVSV group additionally viewed video footage of apnoeas from their own diagnostic polysomnography. The primary outcome was good adherence, defined as ≥ 4 hours of sleep per night on $\geq 70\%$ of nights for 90 days. Secondary outcomes included the number of days with adequate use, mean daily usage time, and apnoea-hypopnoea index (AHI) during PAP. Statistical analysis was performed using independent t-tests and chi-square tests. A p-value < 0.05 was considered statistically significant.

Results: Good adherence was achieved in 89.5% of the SVSV and 78.1% of the control group (absolute difference, 11.4%; 95% confidence interval (CI), 1.94% to 20.86%). Compared with the control group, the SVSV group had more days with adequate usage (mean difference of 9.05 days; CI, 2.29 to 15.81) and longer daily usage (mean difference of 0.55 hours; CI, 0.13 to 0.98). AHI during PAP therapy was similar between the two groups.

Conclusions: This study supports the clinical utility of patient-specific visual feedback to improve PAP adherence. SVSV—a simple, low-cost, and scalable strategy—resulted in a higher proportion of patients achieving good adherence and greater nightly usage.

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Unveiling Predictive Factors for CPAP Adherence: A Pilot Cohort Study on Real-World Use in OSA

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Introduction: Obstructive sleep apnea (OSA) is a modifiable risk factor for cardiovascular and cerebrovascular diseases. Continuous positive airway pressure (CPAP) remains the first-line treatment; however, adherence is often suboptimal. This study aimed to explore clinical and polysomnographic factors associated with CPAP adherence in a real-world setting.

Materials and methods: We conducted a prospective cohort study enrolling 10 participants diagnosed with OSA by in-lab polysomnography (PSG). All underwent overnight CPAP titration and were then offered home CPAP use for 30 or 90 days at their discretion, without a required minimum usage, to reflect natural adherence. We collected: 1. Demographics (age, sex, BMI, Epworth Sleepiness Scale score), 2. Baseline PSG data (AHI, minimum SpO₂, arousal index [AI], sleep efficiency [SE]), 3. CPAP titration data (residual AHI, SpO₂, AI, SE, optimal pressure), 4. Differences between baseline and titration parameters, 5. Daily CPAP usage metrics (residual AHI, pressure, and leak).

Good CPAP adherence was defined as using CPAP for more than 50% of total days at home, with both mean and median nightly usage ≥ 6 hours. Collinearity was assessed using Pearson correlation matrices. Group comparisons, univariate logistic regression, and multivariate regression were performed.

Results: The mean age was 50.2 ± 10.4 years, BMI 29.4 ± 5.7 , and baseline AHI 49.4 ± 24.3 . Older age was correlated with lower baseline sleep efficiency ($r = -0.82$). Higher baseline AHI was associated with a higher arousal index ($r = 0.79$), but also with greater improvement in arousal index ($r = 0.73$) and AHI ($r = 0.99$) during titration. Higher AHI was also associated with the need for higher daily pressure ($r = 0.72$). Participants with good adherence had significantly lower optimal titration pressure (6.6 vs. 11.8 cmH₂O, $p = 0.03$), lower residual AHI during titration (2.7 vs. 8.1, $p = 0.04$), and lower daily CPAP pressure (7.5 vs. 9.3 cmH₂O, $p = 0.04$). These associations were statistically significant in univariate analysis. However, in multivariate analysis including these predictors, none remained statistical significance due to small sample size and co-linearity among pressure-related variables.

Conclusions: This pilot study suggests that individuals with higher AHI not only exhibit more disrupted sleep but also derive greater benefit from CPAP in terms of AHI and arousal reduction. Importantly, lower pressure requirements, both during titration and in daily use, along with effective titration (lower residual AHI), were associated with better CPAP adherence. Although significance was not retained in multivariate analysis, consistent trends support the importance of optimizing pressure settings for comfort and effectiveness. Larger studies are warranted to confirm these findings and to inform pressure adjustment strategies that promote long-term adherence.

Benefits of Community-Based Intervention for Mild OSA on Cardiac Remodeling: A Secondary Analysis of a Randomized Trial

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Introduction: Evidence for the efficacy of continuous positive airway pressure (CPAP) therapy in patients with mild obstructive sleep apnea (OSA), particularly in community-based settings, remains limited. This study investigated the effects of CPAP on cardiac remodeling, symptoms, and blood pressure in mild OSA through a secondary analysis of data from a community randomized controlled trial (RCT).

Materials and methods: This study conducted a secondary analysis on a specific subgroup of the population in February 2025, based on the RCT trial published in the journal *SLEEP* in September 2024. A total of 94 participants

with mild OSA (apnea-hypopnea index 5–15 events/hour) were randomized to either CPAP therapy (N=44) or routine community management (N=50), with 12-week follow-up. Secondary outcomes focused on left atrial diameter (LAD), Short Form 36 Health Survey (SF-36), Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), and blood pressure. Analysis of covariance was used to assess between-group differences in outcomes.

Results: The mean age of participants was 55.6 years, with 40.4% male. Compared to baseline, the intervention group showed a mean reduction of 0.1 mm in LAD, while the control group exhibited a mean increase of 0.6 mm, resulting in a between-group difference of -1.2 mm (95%CI: -2.3 to -0.1, $P=0.036$). At 12 weeks, the CPAP group demonstrated significant improvements over the control group in SF-36 physical function score (adjusted $\beta = 3.5$, 95% CI: 0.9 to 6.0), ISI score (adjusted $\beta = -1.8$, 95%CI -3.5 to -0.1), and PSQI score (adjusted $\beta = -1.1$, 95%CI -2.1 to -0.1). Additionally, the CPAP group showed greater reductions in systolic blood pressure (adjusted $\beta = -7.0$, 95%CI: -11.7 to -2.4), diastolic blood pressure (adjusted $\beta = -4.6$, 95%CI: -7.3 to -2.0), and body mass index (adjusted $\beta = -0.3$, 95%CI: -0.6 to -0.0).

Conclusions: Interventions targeting mild OSA can improve cardiac remodeling, while demonstrating multifaceted benefits including enhanced physiological function, improved sleep quality, blood pressure reduction, and decreased insomnia severity.

Clinical Characteristics and Management Outcomes of Congenital Central Hypoventilation Syndrome: A Single-Center Case Series

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Introduction: Congenital central hypoventilation syndrome (CCHS) is a rare disorder of autonomic nervous system dysregulation caused by mutations in the PHOX2B gene. It manifests with central alveolar hypoventilation, cardiac arrhythmias, gastrointestinal dysmotility, and neurocognitive impairment. Although typically presenting in the neonatal period, atypical presentations such as obstructive sleep apnea (OSA) prior to hypoventilation have been reported. Advances in early genetic diagnosis, multidisciplinary ventilatory strategies, and annual respiratory evaluations have significantly improved outcomes. This study aimed to describe the clinical characteristics, genetic findings, ventilatory management, comorbidities, neurocognitive outcomes, and long-term outcomes of patients with CCHS treated at King Chulalongkorn Memorial Hospital, Thailand.

Materials and methods: This retrospective chart review included patients diagnosed with CCHS between July 2005 and June 2025, confirmed by PHOX2B genetic testing. Data collected included demographics, genotype, initial clinical presentations, ventilatory modalities, associated comorbidities, neurodevelopmental assessments, and outcomes from annual respiratory evaluations. Descriptive statistics were used to summarize findings.

Results: A total of seven patients were included. The median age at diagnosis was birth. Six patients were diagnosed in the neonatal period, and one was diagnosed at 7 years of age. Four patients (57.1%) were male. Genetic testing revealed that all patients (100%) had polyalanine repeat mutations (PARMs); no non-polyalanine repeat mutations (NPARMs) were identified. Initial manifestations included neonatal hypoventilation and desaturation. Six patients (85.7%) initially required positive-pressure ventilation via tracheostomy (PPV-T). Three patients (50%) successfully transitioned to noninvasive ventilation (NIV) following structured protocols, with a mean transition age of 6.5 years. Comorbidities included Hirschsprung disease (14.3%) and neurodevelopmental delays (57.1%), while no cardiac arrhythmias were observed. Annual respiratory evaluations led to modifications in ventilatory management in all patients (100%). At the latest follow-up, six patients (85.7%) required nighttime-only ventilation, while one patient (14.3%) remained on continuous support. No deaths were observed.

Conclusions: CCHS presents with a heterogeneous and evolving clinical phenotype. Early identification of PHOX2B mutations, vigilant monitoring for autonomic comorbidities, neurodevelopmental surveillance, and proactive respiratory management are essential for optimizing long-term outcomes.

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Development of a Wavelet-Based Classifier for Sleep Apnea Subtypes Using EEG and ECG

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Introduction: Sleep apnea is a common sleep disorder that negatively impacts health and quality of life. It includes distinct respiratory events such as obstructive sleep apnea (OSA), central sleep apnea (CSA), and hypopnea, each requiring specific diagnostic and therapeutic approaches. Accurate classification of these events is essential for effective management.

Materials and methods: We analyzed 201 full-night polysomnography (PSG) recordings. Electrocardiogram (ECG) and electroencephalogram (EEG) signals were segmented into non-overlapping epochs, filtered using a Butterworth bandpass filter, and normalized. Discrete wavelet transform (DWT) was applied to EEG, and wavelet packet analysis (WPA) to ECG signals to extract statistical and nonlinear features. Feature selection was performed using Neighborhood Component Analysis (NCA). Classification models were trained using ensemble bagged tree algorithms. Three models were developed: EEG-only, ECG-only, and a combined EEG-ECG model. Their performance was compared to a deep learning model trained on ECG spectrograms. Two classification strategies were tested: (1) three-class (OSA–hypopnea–normal or OSA–CSA–normal) and (2) binary (OSA vs hypopnea or OSA vs CSA), in both NREM and REM sleep stages.

Results: The combined EEG–ECG model consistently outperformed models using single signals or spectrogram-based deep learning across both sleep stages and classification tasks. In the three-class classification, the model achieved **93.0% accuracy** for distinguishing OSA, hypopnea, and normal events during REM sleep, with high sensitivity (91.2% for OSA, 87.3% for hypopnea) and specificity (up to 99.5% for normal). For the task of distinguishing OSA, CSA, and normal events, performance further improved, reaching **97.0% accuracy** in REM with an F1-score of **0.96–0.97** across all classes. In the two-class classification, the model achieved **84.7% accuracy** for separating OSA from hypopnea during NREM and **98.8% accuracy** for distinguishing OSA from CSA in REM sleep, with corresponding F1-scores of **0.86** and **0.99**, respectively. These results demonstrate the model's high precision and generalizability across sleep stages and apnea types.

Conclusions: The findings highlight the effectiveness of combining non-linear features from ECG and EEG signals for classifying various sleep-related events, offering improved reliability for real-world applications. A proposed machine learning model provides significantly precise classification.

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Factors Associated with Worsening of Sleep-Disordered Breathing in Patients with REM Sleep Behavior Disorder

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Introduction: REM sleep behavior disorder (RBD), like obstructive sleep apnea (OSA), is more prevalent in older adults and males. Although OSA is frequently comorbid with RBD, it has been reported that due to the presence of REM sleep without atonia (RWA), the severity of OSA tends to be mild in these patients. In this study, we investigated the factors associated with worsening sleep-disordered breathing (SDB) in patients with underlying RBD.

Materials and methods: We retrospectively analyzed patients diagnosed with RBD who underwent multiple polysomnographic (PSG) studies for follow-up, with a baseline apnea-hypopnea index (AHI) <20/h, which is below the indication for CPAP therapy in Japan. Worsening of OSA was defined as an increase in the severity category (e.g., from mild to moderate, or from moderate to severe). Patients were divided into two groups: those with worsening OSA and those without. Background characteristics were compared using the Mann-Whitney U test. Multivariate regression was performed to identify factors associated with OSA worsening, using sex, BMI change, interval between PSGs (age change), and clonazepam use as covariates.

Results: Among 61 RBD patients (46 males; mean age 66.1 years; BMI 23.2 kg/m²; ESS score 6.4), the mean interval between PSG studies was 5.3 years. The AHI significantly increased from 4.7 ± 4.3 to 8.5 ± 9.6/h (mean ± SD, $p < 0.001$). Worsening of OSA was observed in 23 patients (38%). No significant differences were found in sex or BMI between the worsening and non-worsening groups; however, age tended to be higher (68.0 ± 8.4 vs. 65.0 ± 6.3 years, $p < 0.08$) and interval between PSGs was significantly longer (6.0 ± 2.2 vs. 4.8 ± 1.8, $p < 0.04$). Multivariate regression analysis showed that only interval between PSG studies were significant predictors of OSA worsening. **Conclusions:** AHI may increase even when RWA increases over time. Aging plays a significant role in the worsening of OSA in patients with underlying RBD. Even in the absence of weight gain, periodic reassessment of OSA is warranted in this population.

Impact of Insomnia and Periodic limb movements of sleep on Mortality in OSA: A High-Risk Phenotype Identified by A Cluster Analysis

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Introduction: Obstructive sleep apnea (OSA) is a heterogeneous syndrome, which makes the Apnea-Hypopnea Index (AHI) insufficient in predicting clinical outcomes, including mortality. This study sought to identify novel OSA phenotypes through a cluster analysis of polysomnographic (PSG) data and to determine their association with all-cause and specific-cause mortality.

Materials and methods: We retrospectively analyzed the records of 3,380 patients with an AHI ≥ 15/h who underwent PSG between January 1994 and December 2020 at the Center for Sleep and Chronobiology at Seoul National University Hospital, a tertiary medical center in the Republic of Korea. Seven principal components, which are the result of a principal component analysis (PCA) to reduce dimensionality, were associated with oxygen desaturation, sleep fragmentation, deep sleep, periodic limb movements of sleep (PLMS), REM sleep, hypopnea, and shallow sleep, respectively. Then, a K-means cluster analysis was performed to identify distinct OSA phenotypes. Mortality was ascertained from national death records provided by Statistics Korea through December 31, 2022. Using Kaplan-Meier survival analysis, we compared all-cause mortality and specific-cause mortality comprised of cardiovascular and cerebrovascular diseases. A Cox proportional hazards model was used for adjusting age, sex, BMI and comorbidities. The mortality risk of the identified phenotypes was then compared with that of typical AHI-based severity groups (moderate vs. severe OSA).

Results: Four distinct phenotypes were identified. Cluster 1 (n=1,956, 57.8%) was characterized as 'Severe OSA' (median AHI 31.3/h). Cluster 2 (n=674, 19.9%), termed 'Moderate OSA with stable sleep', had a moderate AHI (median 26.6/h) and preserved sleep architecture (median sleep efficiency [SE] 87.1%). Cluster 3 (n=427, 12.6%), termed 'Very severe OSA with hypoxemia', comprised the youngest (median age 49) and predominantly male (92.7%) patients, exhibiting a very severe AHI (median 69.4/h) and the most severe hypoxic burden (median time with SpO₂ < 90% 29.6%). Cluster 4 (n=323, 9.6%), described as 'Comorbid insomnia and sleep apnea with PLMS', included the oldest patients (median age 62) with the shortest sleep time (median total sleep time 399.5 min) and the highest PLMS (median 44.5/h). While moderate OSA and severe OSA showed no significant difference in all-cause (Log-rank $p=0.29$) or specific-cause mortality (Log-rank $p=0.09$), mortality rates showed a significant difference among the cluster. For all-cause mortality (Log-rank $p<0.001$), Cluster 4 showed the highest and Cluster 2 the lowest rates. After adjusting covariates, Cluster 3 (Hazard Ratio [HR] 1.95, 95% Confidence Interval [CI]

1.13–3.36, $p=0.017$) and Cluster 4 (HR 2.10, 95% CI 1.43–3.08, $p<0.001$) had significantly higher mortality risk than Cluster 1. For specific-cause mortality (Log-rank $p<0.001$), only Cluster 4 showed a significantly higher adjusted risk compared to Cluster 1 (HR 3.19, 95% CI 1.36–7.50, $p=0.008$).

Conclusions: This study identified distinct obstructive sleep apnea (OSA) phenotypes by cluster analysis using multiple polysomnography (PSG) variables that reflect underlying pathophysiology, which demonstrated superior prognostic value for both all-cause and specific-cause mortality compared to the typical AHI-based classification. Our findings suggest that for predicting the mortality of OSA, it is crucial to consider not only the severity of respiratory disturbance but also co-existing features such as sleep time and PLMS.

Self-reported continuous positive airway pressure (CPAP) therapy use for patients located in metropolitan and regional areas across Australia

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Introduction: Obstructive sleep apnoea (OSA) is a prevalent and underdiagnosed sleep disorder for which continuous positive airway pressure (CPAP) is typically considered the first-line treatment. Due to the geographical expanse of Australia, many Australians live in regional locations and may experience difficulty accessing CPAP. Metropolitan and regional differences in OSA care pathways have been explored previously, however differences in CPAP adherence within that sample had not been evaluated. Emerging evidence suggests that greater remoteness may be associated with poorer CPAP adherence in an Australian setting.

Materials and methods: Data are from a nationwide online survey to investigate pathways to diagnosis and management, use of treatments and health status of Australian adults with a diagnosis of OSA. Data collection took place in 2021. Participants were recruited via email, phone alerts and advertisements. Metropolitan and regional residence was coded according to Australian Bureau of Statistics criteria. Univariate analyses (Chi-Squared and Fisher's Exact tests) were conducted examining associations between demographic variables and CPAP usage variables. Demographic variables included age (<50, 50–67, 68+ years of age), sex, location (regional, metropolitan). CPAP usage variables included ever using CPAP, currently using CPAP, CPAP adherence (defined as self-reported use ≥ 4 hours/night and ≥ 5 nights/week). A multivariable binomial logistic regression was run with CPAP adherence as the dependent variable, and age and location as independent variables.

Results: Of the 412 respondents, 354 (86%) were recommended CPAP therapy (44% female), 138 (39%) resided in regional areas and 216 (61%) in metropolitan areas. 190 (54%) reported receiving a diagnosis of OSA 5+ years prior to participating in the survey. 'Moderate' and 'severe' self-reported OSA occurred in 37%, and 42% of respondents, respectively. 213 (69%) respondents who have used CPAP purchased their machine privately. Geographical location showed no significant associations with ever using CPAP ($p=.909$), currently using CPAP therapy ($p=.218$) or self-reporting as CPAP adherent ($p=.104$). Age group was not significantly associated with ever using CPAP ($p=.635$) or current use ($p=.838$). Age was significantly associated with CPAP adherence (<50 years: 54%; 50–67 years: 94%; 68+ years: 98%; $\chi^2(2, 245)=64.84$, $p<.001$). Sex was not significantly associated with ever using CPAP ($p=.717$), current use ($p=.929$) or CPAP adherence ($p=.687$). Compared to those aged <50, participants aged 50–67 were 13.8 times more likely to be CPAP adherent (95% CI: 5.48–40, $p<.001$), with those aged 68 and over 36.1 times more likely to be CPAP adherent (95% CI: 9.97–233, $p<.001$).

Conclusions: CPAP adherence was high (86%) which may have been related to sample characteristics, including socioeconomic advantage, and highly motivated individuals undertaking a survey. CPAP adherence did not vary significantly as a function of geographical location of participants, which may be related to the high proportion of private purchases of CPAP machines. Older age groups were associated with a higher odds of CPAP adherence, though the lowest adherence observed was 54% (<50 years old). Limitations include the lack of objective CPAP data and regional location including both regional and remote.

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Interpretable Machine Learning Using Questionnaire Data: A Scalable Approach for Sleep Apnea Screening

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Introduction: Early detection of sleep apnea is critical to preventing long-term cardiovascular and metabolic complications. However, traditional screening methods often rely on costly bio-signal measurements or symptom-dependent questionnaires that may miss at-risk individuals. This study presents a clinically applicable machine learning framework that leverages easily obtainable questionnaire data to support large-scale, low-cost early screening of sleep apnea while providing clear, interpretable insights for clinical decision-making.

Materials and methods: We developed an XGBoost model to classify individuals into normal/mild and moderate/severe sleep apnea groups using only demographic and lifestyle-related variables. Data were drawn from the Sleep Heart Health Study (SHHS), with relevant features selected from 12 questionnaires, during the first (SHHS1) and second (SHHS2) visits. These features cover physiological, behavioral, medical history, and treatments information. For interpretability, we applied SHapley Additive exPlanations (SHAP) and TreeExplainer2Rule (Te2Rule) to generate rule-based explanations aligned with clinical reasoning. These methods enable clear visualization of the model's decision-making process, making the results easier to interpret and more convincing. They also offer valuable insights into which features most influence the predictions.

Results: The model achieved an AUC of 0.793, with 64.88% accuracy, 60.84% precision, 55.59% sensitivity, 72.11% specificity, and F1-score of 0.581 in identifying moderate to severe cases using questionnaire data from the first visit. When combined with follow-up visit data—reflecting physiological and behavioral changes over a 5-year period—the additional information improved model performance. Specifically, the model achieved an AUC of 0.753, with 68.45% accuracy, 65.90% precision, 63.13% sensitivity, 72.88% specificity and F1-score of 0.645. Key clinical predictors included neck circumference (with a common decision threshold of 35-38 cm), age, waist circumference, and BMI (common decision threshold of 25.5). Male sex and a history of hypertension were linked to increased risk, while coffee consumption showed a surprising negative association with sleep apnea severity. Most of these insights align with known clinical risk factors and offer practical decision rules that can be easily applied in clinical settings. Additionally, SHAP values have an additive property, allowing for transparent breakdowns of how predictions are calculated for each patient—providing useful insights that may support personalized behavioral interventions.

Conclusions: Despite the inherent limitations of self-reported data, our model achieved significant improvement in AUC and specificity compared to existing sleep apnea screening questionnaires (e.g., STOP-BANG). The enhanced model's performance—particularly the improved class balance when incorporating both first-visit and follow-up information—highlights the value of long-term monitoring and data collection. This study demonstrates the potential of explainable AI to support cost-effective, scalable, and interpretable sleep apnea screening. The SHAP method explains the impact of each feature on the model's output, while Te2Rule illustrates how the model combines high-impact features to arrive at a final decision.

Obstructive sleep apnea (OSA) –The Iceberg In The Sea Of Comorbidities

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Introduction: Obstructive Sleep Apnea (OSA) is the second most common sleep disorder, affecting nearly 1 billion adults worldwide.³ The AASM's recent campaign rightly emphasizes that *OSA is more than a snore!*⁴ OSA is often the hidden contributor to diabetes, hypertension, dyslipidemia, stroke, AF, insomnia, depression, GERD, asthma, cognitive decline, and RLS.

Materials and methods: Five life-changing OSA cases transformed by PAP therapy

- **Case 1 (ComOSAR; OSA + RLS/PLMS):** A 73-year-old overweight female with hypertension, Bronchial asthma, pulmonary hypertension, and depression exhibited persistent symptoms despite PAP therapy. Repeat PSG showed severe OSA (AHI 33.9/hr), poor sleep efficiency, PLM index 128/hr, and labs showed iron deficiency. This presentation aligns with ComOSAR⁵, observed in ~24% of OSA patients.
- **Case 2 (MS + OSA):** A 66-year-old obese female with stable multiple sclerosis and incidental MCA aneurysm presented with dyspnea; PSG revealed moderate OSA (AHI 21.7/hr). OSA commonly worsens MS symptomatology—including fatigue, cognition, and quality of life.
- **Case 3 (UARS):** A 35-year-old obese female with daytime somnolence, tachycardia, idiopathic intracranial hypertension, and empty-sella syndrome showed mild OSA on Level I PSG (AHI 13.3/hr) but a Level 3 study revealed 1,575 flow-limited breaths, diagnostic of *Upper Airway Resistance Syndrome (UARS)*—a condition producing significant sleep fragmentation and daytime dysfunction despite low AHI .
- **Case 4 (Fibromyalgia + Parasomnias):** A 60-year-old obese female with fibromyalgia, rhinitis, and parasomnias exhibited severe OSA (AHI 53/hr). BiPAP titration (IPAP 14/EPAP 10 cm H₂O) resolved sleep paralysis, hypnopompic hallucinations, and significantly reduced fibromyalgia fatigue within a month.
- **Case 5 (OSA-related AF):** A 41-year-old obese hypertensive surgeon with paroxysmal atrial fibrillation and severe OSA (AHI 32/hr) showed a reduction in arrhythmias from 73→24 events on CPAP and further to 12 on BiPAP (IPAP 17/EPAP 12 cm H₂O), with complete apnea resolution

Results: PAP therapy demonstrated profound, system-wide benefits:

1. **ComOSAR:** Resolution of PLMS and RLS symptoms, improved sleep efficiency and PAP adherence—critical as coexistence of OSA and RLS correlates with higher insomnia, cognitive, metabolic, and psychiatric comorbidity .
2. **MS + OSA:** Reduction in daytime fatigue and cognitive load, with enhanced quality of life.
3. **UARS:** Significant decreases in flow-limited breathing episodes and daytime dysfunction following targeted CPAP therapy.
4. **Chronic pain & parasomnias:** Rapid cessation of sleep disturbances and reduction in fibromyalgia-induced fatigue, paralleling research showing PAP benefits in chronic pain conditions.
5. **Cardiovascular:** Substantial reduction in atrial arrhythmias; literature supports a ~30–40% reduction in AF recurrence with PAP therapy, due to improved oxygenation, reduced sympathetic activity, and attenuation of atrial remodeling.

Conclusions: PAP therapy not only treats sleep-disordered breathing—it also mitigates neurophysiological disturbances, chronic pain, and cardiovascular comorbidities. Proactive screening and management of OSA is essential in populations with MS, ComOSAR, and AFib to enhance overall health and quality of life.

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The nonlinear endotypic characteristics and unique endotypic subtypes in Obstructive sleep apnea

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Introduction: The pathology mechanisms of obstructive sleep apnea (OSA) include high loop gain, low arousal threshold, more collapsible upper airway, and poor pharyngeal muscle responsiveness. Our research aimed to evaluate the dose-effect relationship between OSA endotypes and apnea hypopnea index (AHI), identify OSA endotypic clusters, and compare the cardiovascular disease (CVD) risk in different endotypic clusters.

Materials and methods: Individuals underwent polysomnography (PSG) were recruited. Endotypes were calculated with PSG-derived methods, including LG, ArTH, pharyngeal collapsibility (Vpassive), and muscle compensation (Vcomp). Restricted cubic spline (RCS) analysis was used to assess the non-linear relationship between variables. Latent profile analysis (LPA) was conducted to identify OSA clusters.

Results: This cross-sectional trial included 3616 OSA participants, fully adjusted model indicated loop gain, arousal threshold and upper airway collapsibility were non-linearly related to AHI; muscle compensation was linearly related to AHI. Latent profile analyses identified three OSA endotypic clusters, including high loop gain and upper airway collapsibility cluster, low arousal threshold cluster, low muscle compensation cluster. The high loop gain and upper airway collapsibility cluster had the highest CVD risk, while the low muscle compensation cluster had the lowest CVD risk.

Conclusions: In Chinese OSA participants, endotypes (except for Vcomp) were nonlinearly related to AHI. LPA identified the high LG and low Vpassive cluster, low ArTH cluster, and low Vcomp cluster.

PFKFB3 Drives Endothelial Glycolysis, Promoting Vascular Injury under Obstructive Sleep Apnea

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Introduction: Metabolic-inflammatory crosstalk is a hallmark of cardiovascular pathogenesis. Obstructive sleep apnea (OSA), characterized by chronic intermittent hypoxia (CIH), is an independent risk factor for cardiovascular disease (CVD). While endothelial inflammation driven by CIH is pivotal in CVD progression, the metabolic drivers of this process remain elusive.

Materials and methods: The project included inflammatory and metabolic analyses of ECs under CIH exposure or plasma stimulation model, CIH mouse models, and bioinformatics.

Results: We identified phosphofructo-2-kinase/fructose-2,6-biphosphatase 3 (PFKFB3), a key glycolytic activator, was markedly upregulated in ECs exposed to CIH exposure or OSA plasma stimulation, correlating with a metabolic shift characterized by enhanced glycolysis, suppressed mitochondrial respiration, and amplified inflammatory responses. Endothelial-specific PFKFB3 deficiency or pharmacological suppression of PFKFB3 restored the glycolytic balance and attenuated inflammatory responses. Mechanistically, CIH enhanced the expression of hypoxia-inducible factor 1 α (HIF1 α), which directly stimulated PFKFB3 by binding to its promoter, while PFKFB3 overexpression further amplified HIF1 α levels. Targeting the HIF1 α -PFKFB3 axis alleviated the inflammatory and glycolytic signatures of ECs.

Conclusions: Collectively, our findings identified PFKFB3 as a critical driver of endothelial inflammation fueled by abnormal glycolysis under CIH, offering novel insights into the vascular pathophysiology of OSA-related cardiovascular diseases and potential intervention targets.

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Non-contact On-device Detection of Obstructive Sleep Apnea from Infrared Video

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Introduction:

Despite growing demand for accessible sleep monitoring, traditional polysomnography (PSG) remains limited by high cost, discomfort, and poor feasibility for long-term use. Alternative sensor-based and wearable solutions often suffer from compliance issues, noise sensitivity, and limited generalizability. In contrast, video-based methods offer a non-contact, user-friendly approach for assessing respiratory patterns and sleep position. However, existing methods require high computational resources, strict recording conditions, and lack validation on large-scale

datasets. We propose **SIAction**, a non-contact, on-device system for continuous obstructive sleep apnea (OSA) monitoring using infrared video.

Materials and methods:

SIAction captures the full sleep environment via a wall-mounted infrared camera and processes data locally to ensure privacy. The system was developed and evaluated using the **Korea Video Sleep Study (KVSS)** dataset, comprising 936 overnight recordings (over 5,000 hours) from three institutions. Each video is synchronized with PSG annotations, and facial regions are anonymized. Through analysis, we identified respiratory arousals (RAs)-brief cortical arousals following apnea or hypopnea episodes, typically accompanied by distinctive movements-as reliable visual markers of disordered breathing. *SIAction* detects RA events and sleep positions every 30 seconds using a unified four-class deep learning model. A regression model then estimates the apnea-hypopnea index (AHI), which is used to classify OSA severity (normal, mild, moderate, severe) and determine positional OSA (POSA) by comparing supine and non-supine AHI values.

Results:

SIAction was trained on 70% of 475 recordings from Hospital A, with 15% used for validation and 15% for testing. It outperformed both video- and signal-based baselines across all tasks. For AHI estimation, it achieved a Spearman correlation of 0.91, mean absolute error of 9.31, and R^2 of 0.76. Based on the estimated AHI, the system achieved a macro F1 of 87.93 for OSA screening (AHI>15) and 61.67 for severity classification. It reached 100% relaxed accuracy, where predictions within one adjacent severity level are considered correct. For POSA classification, macro F1 was 70.87. All processing is performed on-device. The system runs in real time on a \$120 Jetson Nano using only the CPU, processing each 30-second epoch in 16 seconds. Raw video is discarded after processing, retaining only diagnostic results to preserve privacy. The model trained on Hospital A generalized well to external test sets from Hospitals B (205 recordings) and C (110 recordings), confirming strong cross-institutional robustness.

Conclusions: *SIAction* demonstrates that RA-driven, position-aware video analysis enables accurate and efficient OSA monitoring without physical contact or cloud-based processing. Running in real time on a low-cost, on-device system, it ensures both privacy and scalability for home and clinical use. Trained on a large, diverse dataset and validated across institutions, *SIAction* offers a practical, generalizable alternative to PSG for long-term, non-intrusive sleep apnea assessment.

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Infrared Optical Gas Imaging for Sleep Apnea Diagnosis

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Introduction: Polysomnography (PSG) is the standard method for diagnosing obstructive sleep apnea (OSA), but its use of multiple contact sensors can disrupt sleep and reduce test accuracy. Recent non-contact methods, such as audio and radar-based devices, offer convenience but cannot directly measure respiratory airflow. Infrared optical gas imaging, which visualizes exhaled carbon dioxide, may overcome these limitations by enabling direct, contactless monitoring of respiration during sleep. This study aimed to evaluate its feasibility as an alternative tool for OSA diagnosis.

Materials and methods:

We recruited 50 participants from Ajou University Hospital between June and August 2018. All participants underwent overnight polysomnography (PSG) and were simultaneously recorded using infrared optical gas imaging (FLIR GF343) to visualize exhaled CO₂. Standard sensors (oronasal thermistor and nasal cannula) were used during the first half of sleep and removed during the second half. Respiratory events were also measured using chest and abdominal belts. Infrared-derived airflow signals were extracted using a face-tracking and temperature-differential algorithm, allowing calculation of respiratory parameters such as AHI, RDI, and apnea/hypopnea indices. Data were scored based on AASM 2012 criteria.

Results: Respiratory parameters derived from infrared optical gas imaging showed strong positive correlations with those from standard PSG, both in the presence and absence of nasal cannula. Apnea–hypopnea index (AHI) values were particularly well-aligned ($p > 0.85$ with sensors, $p > 0.72$ without). Receiver operating characteristic (ROC) analysis confirmed the diagnostic validity of infrared imaging, with area under the curve (AUC) values exceeding 0.8. Although infrared imaging tended to slightly overestimate AHI, it reliably detected sleep-related respiratory events, even without contact-based sensors.

Conclusions: Infrared optical gas imaging accurately detected respiratory events during sleep; therefore, it may be employed as a screening tool for OSA.

Association study of gut microbiota abnormalities and cognitive dysfunction caused by obstructive sleep apnea

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Introduction: Obstructive sleep apnea (OSA), the most prevalent sleep-related breathing disorder, induces neurocognitive dysfunction through intermittent hypoxia (IH) mediated mechanisms. Although clinical studies have identified gut microbiota dysbiosis and altered microbial metabolite profiles in OSA populations, the causal relationship between OSA progression and microbiota-metabolite axis dysregulation remains unestablished. Furthermore, the pathophysiological mechanisms linking microbiota-metabolite axis disturbances to OSA-mediated cognitive impairments require systematic elucidation.

Materials and methods: This multi-tiered methodology comprised: (1) Leveraging OSA GWAS data from FinnGen and gut microbiota/metabolome datasets from MiBioGen consortiums, we conducted bidirectional two-sample Mendelian randomization to identify OSA-associated microbial features, followed by multivariate MR analysis adjusting for obesity, sex, and smoking to establish causal relationships; (2) Establishing intermittent hypoxia (IH) murine models with cognitive assessment through behavioral paradigms and neural function evaluation via resting-state fMRI; (3) Multi-omics integration (fecal metagenomics, serum metabolomics, and hippocampal transcriptomics) delineated IH-induced gut-brain axis perturbations, with qPCR validation of key regulatory genes and Luminex cytokine profiling; (4) Therapeutic exploration of sodium butyrate supplementation on IH-mediated cognitive deficits and gut-brain circuitry.

Results: 1. Multiple MR Analysis determined that increased serum levels of three gut microbiota derived metabolites (leucine, epimandrosterone sulfate and 3-dehydrocarnitine) were independently associated with increased risk of OSA, and multiple SCFAs producing bacteria represented by Rumenococcaceae showed independent protective effects on OSA risk even after correction of confounding bias. 2. Behavioral experiments found that IH would lead to learning and memory dysfunction in mice. Functional MRI showed that IH mice showed inconsistent intensity of nerve activity in the whole brain and decreased nerve function in cognitive-related brain areas. Multi-omics analysis revealed multi-dimensional pathological changes in the gut-brain axis of IH mice, including reduced abundance of SCFAs producing bacteria, altered metabolic pathway levels, over-activation of hippocampal microglia, accumulation of inflammatory factors and activation of inflammatory pathways. 3. Exogenous SB supplementation significantly improved the learning and memory dysfunction of IH mice, and up-regulated the level of neural activity in brain regions related to cognitive function; Microbiota remodeling, regulation of metabolic environment, inhibition of microglia activation and expression of inflammatory factors may be the potential mechanisms by which SB improves IH cognitive impairment.

Conclusions: Multiple gut microbiota and derived metabolites have independent causal relationship with OSA. Exogenous SCFAs (butyric acid) supplementation can significantly improve IH-related cognitive dysfunction. This study provides evidence for the association between gut microbiota and OSA and related cognitive dysfunction, and SCFAs supplementation based on gut microbiota metabolites can be used as a potential drug therapy for OSA related cognitive dysfunction.

The different characteristics of polysomnography between stroke and TIA patients

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Introduction: Obstructive sleep apnea is the most common sleep related breathing disorders. The association between cerebrovascular disease and obstructive sleep apnea is bidirectional. However, studies involving polysomnographic data in stroke and TIA patients compared to general population have shown inconsistency results. Data on different effects of OSA on stroke comparing to TIA were scarce

Materials and methods: Patients age over 18 years were recruited from Siriraj Hospital medical records between 2016 and 2023. All patients underwent sleep studies at the Siriraj Sleep Center before the diagnosis of stroke or TIA. Demographic data, stroke and TIA disease characteristics, and polysomnographic data were collected and compared through statistical analysis.

Results: The study aimed to recruit 198 patients in total. We collected 206 patients. Polysomnography were done prior cerebrovascular event 66 months. One hundred fifty patients had hypertension and dyslipidemia, mainly. 102 patients were ischemic stroke and 104 patients were TIA. 161 (78.16%) patients had supratentorial pathologies and 118 (57.28%) patients has cerebrovascular disease from small vessel disease. Mean AHI in stroke and TIA patients were 38.22 ± 24.41 /hr and 36.21 ± 26.22 /hr, respectively (p-value = 0.571). Minimum oxygenation were $82.55 \pm 7.83\%$ and 81.76 ± 11.27 in stroke and TIA patients, serially (p-value = 0.561). There was significant difference in cumulative time with oxygen saturation below 90% in total sleep time (T90) between stroke and TIA patients (10.21 ± 19.41 in stroke patients and 5.22 ± 13.52 in TIA patients with p-value of 0.034). Mixed apnea events were also significantly higher in stroke patients (5.65 ± 14.81) compared to TIA patients (0.26 ± 0.86), with a p-value of 0.033. Other polysomnographic data were not significantly different between stroke and TIA patients.

Conclusions: Severe OSA is common in patients developing cerebrovascular attacks. Duration of desaturation is significantly affected severity of cerebrovascular diseases. Difference of mixed apneas percentage may underline the different OSA pathogenesis of stroke and TIA.

Characterization of Craniofacial Skeletal Phenotype of Adult Obstructive sleep apnea

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Introduction: To analyze three-dimensional craniofacial characteristics influencing the severity of obstructive sleep apnea (OSA) and to investigate the differences in craniofacial features and various polysomnography (PSG) indices indicating OSA severity between craniofacial skeletal phenotype (CSP) and non-craniofacial skeletal phenotype (N_CSP).

Materials and methods: The frequency distribution of three-dimensional skeletal patterns was analyzed based on Sex, BMI, and OSA severity using CBCT of 142 adult OSA patients. Among them, demographic, PSG, and CBCT characteristics of the final 100 patients were classified by sex, OSA severity, and skeletal pattern, and comparisons were made between groups. Multiple linear regression analysis was performed to characterize the three-dimensional craniofacial features of CSP.

Results: Sagittally, patients with skeletal Class II pattern exhibited more severe OSA severity compared to those with Class I, despite being younger. Vertically, patients with hyperdivergent pattern showed higher OSA severity than those with normodivergent pattern, despite being younger and less obese. Transversely, the group with

Transverse Skeletal Discrepancy (TSD) showed more severe OSA severity. After adjusting for age, sex, and obesity, multiple linear regression analysis revealed that ANB, Pharyngeal Minimal Cross-Sectional Area (PMCA), and Transverse Discrepancy Index (TDI) were craniofacial predictors of OSA severity. CSP_{2D} group exhibited higher OSA severity in all PSG variables except the hypopnea index compared to N_CSP group, despite being younger and less obese. CSP_{3D} group, which included TSD, showed more severe OSA severity than CSP_{2D} group, with smaller nasal airway volume and PMCA, and longer pharyngeal airway length.

Conclusions: This study is the first attempt to comprehensively analyze TSD and to characterize CSP_{2D} and CSP_{3D} OSA groups by incorporating three-dimensional information of both the nasal / pharyngeal airways and relating upper airway features to PSG variables. This provides evidence for a phenotype-based precision approach, which should be the foundation for the diagnosis and treatment of OSA patients.

A new 3D-printed invisible mandibular advancement device for patients with obstructive sleep apnea: A cohort study

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Introduction: Mandibular advancement device (MAD) is recognized as an effective treatment option for patients with mild-to-moderate obstructive sleep apnea (OSA). However, traditional MADs are bulky and associated with low patient compliance. To address this, we developed a novel 3D-printed invisible MAD (iMAD). This study aims to evaluate the effects of iMAD on sleep quality and to investigate its working mechanism.

Materials and methods: This cohort study included 27 mild-to-moderate OSA patients. Clinical efficiency was assessed using polysomnography (PSG) recording and the working mechanism was evaluated using cone beam computed tomography (CBCT) at two time points: at baseline and after 3 months of iMAD use. PSG parameters included the respiratory event index (REI), apnea hypopnea index (AHI) and the lowest blood oxygen saturation. CBCT images are used to compare the change of upper airway, especially the minimum cross-sectional area (CSA).

Results: After 3 months of iMAD use, both REI and AHI were significantly decreased ($P < 0.001$), while the lowest blood oxygen saturation significantly increased ($P < 0.05$). Additionally, CBCT images showed that there was a significant increase in the CSA_{min} of the upper airway with iMAD ($p < 0.001$).

Conclusions: The new iMAD improves the upper airway dimension, demonstrating promising clinical efficacy for OSA treatment.

The Effect of Bariatric Surgery on Obstructive Sleep Apnea Remission and Outcomes

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Introduction: Obesity is a major global health concern with a steadily rising prevalence. It shares several adverse health consequences with obstructive sleep apnea (OSA). Bariatric surgery is an effective treatment for morbid obesity, offering substantial weight loss. However, its specific impact on OSA such as remission, symptom improvement, and reduced CPAP requirements remains underexplored. This study aimed to assess the effect of bariatric surgery on OSA remission and improvements in clinical and polysomnographic parameters.

Materials and methods: A retrospective cohort study was conducted on patients who underwent bariatric surgery between January 1, 2005, and February 28, 2025, and had both preoperative and postoperative polysomnography (PSG). Relevant clinical and polysomnographic data were collected and analyzed.

Results: A total of 638 patients underwent bariatric surgery, of whom 48 met the inclusion criteria and were included in the study. The mean duration of follow-up PSG after surgery was 3.36 ± 2.5 years. Significant reductions were observed in BMI, AHI, and ESS. BMI decreased from 50.2 ± 13.1 to 33.8 ± 9.9 kg/m² ($p < 0.001$), AHI decreased from 52.8 (IQR 29.4, 121.4) to 27.2 (IQR 13.3, 43.8) ($p < 0.001$), and ESS decreased from 11.4 ± 5.7 to 6.8 ± 4.4 ($p < 0.001$). Other polysomnographic parameters were also significantly improved including sleep efficiency increased from $80.9 \pm 12.3\%$ to $86.6 \pm 9.7\%$ ($p < 0.001$), mean oxygen saturation improved from $87.3 \pm 12.2\%$ to $95.5 \pm 2.2\%$ ($p < 0.001$) and nadir oxygen saturation improved from $71.9 \pm 17.1\%$ to $84.6 \pm 11.2\%$ ($p < 0.001$). Three patients (6.3%) achieved OSA remission. The proportion of mild OSA increased from 4.2% to 22.9%, moderate OSA increased from 20.8% to 25%, and severe OSA decreased from 75% to 45.8% ($p < 0.001$). Postoperative CPAP independence (AHI < 5 /hr or AHI 5-15/hr with ESS < 10) was observed in 25% of patients. Preoperative parameters including ESS < 10 , REM latency < 120 mins, WASO < 30 mins, and arousal index > 15 /hr were significantly associated with postoperative PAP independence. Bariatric surgical procedures, including Roux-en-Y gastric bypass and sleeve gastrectomy resulted in non-significant difference in BMI and AHI reductions.

Conclusions: Bariatric surgery resulted in significant reduction in AHI and BMI along with improvements in sleep parameters from PSG. Although the overall remission rate of OSA remained low, nearly half of the patients with moderate to severe OSA experienced an improvement in disease severity following surgery. Additionally, one-quarter achieved CPAP independence. These findings support bariatric surgery as a potential strategy for OSA management in patients with morbid obesity.

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The theranostic value of gene signatures and molecular mechanisms between obstructive sleep apnea and heart failure derived by machine learning

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Introduction: A bidirectional relationship has been established between obstructive sleep apnea (OSA) and heart failure (HF). Considering that HF is a progressive and irreversible condition, it is crucial to identify potential biomarkers and elucidate the underlying mechanisms linking OSA and HF to facilitate early-stage personalized interventions.

Materials and methods: Training and validation datasets of OSA and HF were retrieved from the GEO database. The raw data was integrated to find common differentially expressed genes (DEGs). Three machine learning algorithms (RF, LASSO logistic regression, and SVM-RFE) were employed to screen candidate biomarkers from common genes. The enrichment analyses were conducted to elucidate the biological functions and pathways. The validation and diagnostic performance of candidate biomarkers was evaluated using nomogram model and receiver operating characteristic (ROC) curve analysis. Additionally, consensus clustering analysis and immune infiltration analysis were processed to identify molecular subtypes and uncover potential mechanism underlying OSA-related HF.

Results: A total of 19 DEGs were identified as overlapping between OSA and HF. Enrichment analysis indicated that these genes were predominantly enriched in pathways related to immune and inflammatory response. Utilizing three machine learning algorithms, nine core genes (BTN3A2, MAPK10, STEAP4, FCER1G, CD109, SAMHD1, LUM, SFRP4 and FRZB) were selected as candidate biomarkers, and a nomogram was developed. ROC analysis showed that the nomogram achieved an AUC exceeding 0.80 in both training and validation datasets. Furthermore, immune infiltration analysis explored that these core genes are significantly associated with several immunocytes and immune checkpoint, which potentially regulate metabolic dysfunction and cardiac remodelling in OSA-related HF.

Conclusions: OSA is a risk factor implicated in the pathogenesis and progression of HF. Our machine learning analysis investigated the potential mechanism underlying HF secondary to OSA, and identified novel candidate genes that may serve as diagnostic biomarkers and potential therapeutic targets.

Biomarker Discovery in Obstructive Sleep Apnea: A Bibliometric Mapping of Research Frontiers (2000-2023)

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Introduction: Obstructive sleep apnea (OSA) is a harmful, complex and heterogeneous disease with limited diagnostic and therapeutic frameworks. This study analyzed global research output on OSA biomarkers to help advance precision sleep medicine.

Materials and methods: We conducted a keyword search in the Web of Science Core Collection (2000–2023) to identify research and review articles on OSA biomarkers. VOSviewer, CiteSpace, and R were performed to analyze annual publications, citations, contributions, co-authorships, and co-occurrences, identifying the most productive and highly cited countries, authors, institutions, journals, keywords, and references.

Results: The analysis included 1108 publications. Annual publication counts, and citations have consistently increased over the past two decades. The United States of America leads OSA biomarker research in volume and citation impact, with extensive collaboration with China. Dr. Gozal D is the leading author. The University of Chicago is the top institution regarding publications and citations. *Sleep and Breathing*, *Sleep Medicine*, and *Sleep* are the most productive journals. *Sleep* is the most cited, followed by the *American Journal of Respiratory and Critical Care Medicine*, *Chest*, and *Circulation*. Over half of the top journals are high-impact Q1, including *The New England Journal of Medicine*, indicating significant academic interest. Recent research focuses on comorbidities, pathogenic mechanisms, and indicators of phenotype and endotype, which are likely future trends.

Conclusions: We identified research hotspots, trends and leading contributors to OSA biomarkers. These results may benefit further studies to better understand OSA's heterogeneity and improve diagnosis, risk identification, and prognosis prediction.

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A Study on Differentiating Obstructive and Central Sleep Apnea and Identifying Cheyne-Stokes Breathing Using Non-Invasive Fiber Optic Physiological Monitoring Technology and AI

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Introduction: Currently, the detection of sleep apnea primarily relies on polysomnography (PSG) and photoplethysmography (PPG). However, while PSG is considered the diagnostic gold standard, it requires multiple wires attached to the body, significantly disturbing natural sleep and making it unsuitable for long-term or home monitoring, especially for elderly individuals, children, and patients with dementia or psychiatric disorders. Although PPG is more convenient, its signals are easily affected by vascular contractions, skin pigmentation, and improper sensor placement. Moreover, oxygen desaturation alone cannot distinguish between obstructive sleep apnea (OSA) and central sleep apnea (CSA). In addition, the widely used apnea-hypopnea index (AHI) merely counts the number of events without considering the duration, depth, or morphology of respiratory events, potentially underestimating disease severity and failing to accurately identify complex breathing patterns such as Cheyne-Stokes Breathing (CSB).

Materials and methods: This study developed a system integrating non-invasive fiber optic physiological monitoring technology (nFOPT Biosensor) with artificial intelligence (AI) models. Data were collected from 100 subjects, including signals from fiber optic sensing mats placed under the pillow and chest, thoracic and abdominal belts, and oxygen saturation, resulting in a total of 5,685 annotated apnea events. A hybrid CNN-LSTM AI model

was constructed to detect apnea events and classify OSA and CSA. Furthermore, an expert-annotated dataset containing 8,823 data points, along with CNN-DENSE and BiLSTM AI models, was utilized for the identification of CSB.

Results: The proposed AI model achieved detection accuracies of 90.9% for the chest fiber optic biosensors and 89.7% for the pillow biosensors. For the classification of OSA and CSA, the model achieved an overall accuracy of 90.37%, with a sensitivity of 90.92% for OSA and 83.33% for CSA. Regarding CSB identification, the AI model achieved an accuracy of 97.58% and a precision of 86.36%. These results demonstrate that even in the presence of highly variable breathing patterns like CSB, the nFOPT technology combined with AI maintains stable and excellent performance.

Conclusions: This study confirms that nFOPT Biosensor offers significant advantages, including non-contact monitoring, freedom from electromagnetic interference, and high sensitivity. It enables continuous, non-invasive monitoring of respiratory waveforms and precise analysis of the time-frequency characteristics of breathing events. The technology not only overcomes the limitations of traditional PSG and PPG but also allows for accurate differentiation of sleep apnea subtypes and abnormal breathing patterns. In the future, this technology holds great potential for clinical precision diagnostics, remote health monitoring, and cardiovascular risk prediction, representing a groundbreaking innovation in the field of sleep medicine.

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The impact of body mass index on severity of sleep related breathing disorders in adults with class 3 obesity

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Introduction: Obesity is a well-established risk factor for sleep related breathing disorders (SRBD) and the relationship between the two is multifaceted, although the influence of increasing body mass index (BMI) on the severity of SRBD in adults with class 3 obesity (BMI ≥ 40 kg/m²) have not been conclusively explored. This study aimed to investigate the effect of BMI on SRBD severity in adults with class 3 obesity enrolled in a multidisciplinary weight management program.

Materials and methods: Adult patients (≥ 18 years) with class 3 obesity enrolled in a multidisciplinary weight management program in Sydney, Australia who underwent polysomnography between January 2020 and December 2024 were included in this retrospective study. Demographic details, anthropometric variables, clinical data, STOP-BANG score, Epworth sleepiness scale (ESS) score, and polysomnography parameters including sleep duration, respiratory indices, and oximetry were collected. Severity of SRBD was classified according to the respiratory disturbance index (RDI). Continuous variables were expressed as mean $\pm$ standard deviation (SD) and categorical variables were expressed as percentages (%). Independent T-tests were used to compare group means. Univariate and multivariate regression analyses were employed to assess associations between BMI and SRBD severity measures using SPSS v29.

Results: A total of 172 patients were included with mean age 42.9 ± 12.5 years and mean BMI 52.9 ± 9.7 kg/m². The cohort was predominantly female (76.2%) and Caucasian (74.5%). The mean STOP-BANG and ESS scores were 4.7 ± 1.3 and 9.1 ± 5.0 , respectively. Majority of the cohort had severe SRBD (70.3%) defined by total sleep time (TST) RDI >30 events/hour. The mean TST RDI was 54.2 ± 38.5 events/hour with mean hypopnoea index (HI) of 40.0 ± 26.2 events/hour and mean obstructive apnoea index (OAI) of 11.0 ± 22.4 events/hour. Key oximetry findings included mean nadir oxygen saturation (nSO₂) $77.3 \pm 11.6\%$, and mean proportion of total sleep with oxygen saturation $<90\%$ (pS $<90\%$) $16.5 \pm 25.7\%$. On univariate and multivariate regression analyses adjusted for age, sex and ethnicity, BMI was significantly associated with TST RDI (β 1.36, $p < 0.001$ univariate, $p < 0.001$ multivariate), nSO₂ (β -0.33, $p < 0.001$ univariate, $p < 0.001$ multivariate), and log transformed pS $<90\%$ (β 0.055, $p = 0.002$ univariate, $p < 0.001$ multivariate). Patients with BMI >60 kg/m² ($n=40$), compared to patients with BMI 40-49.9 kg/m² ($n=68$), had significantly higher TST RDI (71.3 ± 42.6 events/hour vs 42.8 ± 31.5 events/hour, $p < 0.001$) and significantly lower nSO₂ ($72.4 \pm 13.8\%$ vs $79.6 \pm 9.0\%$, $p = 0.005$) with no difference in STOP-BANG or ESS scores. Interestingly, 11% of the cohort had TST RDI <15 events/hour and 7.5% of the cohort with BMI >60 kg/m² had TST RDI <15 events/hour.

Conclusions: While there was a high prevalence of severe SRBD in adults with class 3 obesity, increasing BMI was associated with increasing severity of SRBD, as reflected by worsening RDI and greater burden of hypoxia during sleep but not worsening symptoms of SRBD. The relationship of weight loss in this group to improvement in SRBD needs further investigation. Additionally, a small proportion had normal to mild SRBD with RDI <15 events/hour despite having class 3 obesity and further investigation may reveal protective characteristics in this cohort.

Association of Obstructive Sleep Apnea with Cancer Risk & Mortality

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Introduction: Obstructive sleep apnea (OSA), characterized by intermittent hypoxia and sleep fragmentation, has been biologically implicated as a potential carcinogen. While animal studies support this link, epidemiological findings in humans remain inconsistent. To clarify these associations, we conducted a comprehensive systematic review and meta-analysis assessing the relationship between OSA and cancer incidence and mortality, incorporating a wide range of cancer types and OSA severity metrics.

Materials and methods: We systematically searched PubMed, Embase, Scopus, and the Cochrane Library from inception through June 2021 (updated to November 2023 for urological cancers). We included observational and randomized studies reporting on the association between OSA—defined by diagnostic codes or sleep-study-derived indices—and cancer outcomes in adults. Two independent reviewers screened studies, extracted data, and assessed bias using the Newcastle-Ottawa Scale. We rated the quality of evidence using the GRADE framework and pooled maximally adjusted hazard ratios (HRs) using inverse variance-weighted random-effects models.

Results: Across 20 eligible studies involving over 9 million participants, OSA was associated with increased incidence of several cancer types. Using sleep-derived metrics (time spent with SpO₂ <90%), moderate (T90 >1.2%) and severe nocturnal hypoxemia (T90 >12%) were linked to 28% (HR=1.28, 95%CI: 1.07–1.54) and 43% (HR=1.43, 95%CI: 1.16–1.76) higher all-cancer incidence, respectively. Severe nocturnal hypoxemia also tripled all-cancer mortality (HR=2.66, 95%CI: 1.21–5.85), independent of confounders including obesity.

Cancer-specific analyses revealed the following associations:

- **Breast Cancer:** In six studies (n=5.2 million), OSA was associated with a 36% increased risk (HR=1.36, 95%CI: 1.03–1.80). Subgroup analyses with ≥5 years follow-up yielded HR=1.57 (95%CI: 1.14–2.18).
- **Gastrointestinal (GI) Cancers:** Among seven studies (n=5.1 million), OSA was associated with a 70% increased risk of colorectal cancer (HR=1.70, 95%CI: 1.48–1.96), while associations with pancreatic and liver cancers were not statistically significant.
- **Lung Cancer:** Four studies (n=4.8 million) showed OSA increased lung cancer incidence by 25% (HR=1.25, 95%CI: 1.02–1.53). With ≥5 years follow-up, the risk rose to 32% (HR=1.32, 95%CI: 1.27–1.37).
- **Melanoma:** Six studies (n=5.3 million) showed a 71% higher incidence (HR=1.71, 95%CI: 1.08–2.69), though heterogeneity was high.
- **Thyroid Cancer:** In three studies (n=1.6 million), OSA tripled thyroid cancer risk (HR=3.27, 95%CI: 2.80–3.82), with up to 22.5% of global cases potentially attributable to OSA.
- **Urological Cancers:** From 12 studies (n=9.3 million), OSA was associated with increased kidney (HR=1.75, 95%CI: 1.21–2.53) and bladder cancer (HR=1.76, 95%CI: 1.05–2.96) incidence, but not prostate cancer (HR=1.29, 95%CI: 0.82–2.04).

Conclusions: Across diverse cancer types, OSA—particularly when characterized by nocturnal hypoxemia—is associated with elevated cancer incidence and, in some cases, mortality. These findings support the carcinogenic potential of OSA and underscore the need for prospective studies to examine cancer-specific mechanisms, dose-response relationships, and the impact of OSA treatment on cancer outcomes.

Assessment of Sympatho-Vagal Dysfunction in Patients with Obstructive Sleep Apnea and Its Association with Disease Severity

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Introduction: Obstructive Sleep Apnea (OSA) is a common but underdiagnosed sleep disorder associated with increased cardiovascular risk. Autonomic imbalance, characterized by increased sympathetic tone and reduced parasympathetic activity, has been implicated in this pathophysiology. This study aimed to assess autonomic nervous system (ANS) dysfunction during wakefulness in patients with OSA and evaluate its correlation with disease severity.

Materials and methods: Study Design and Participants:

This cross-sectional observational study enrolled **55 adult patients** with polysomnography-confirmed obstructive sleep apnea (OSA; Apnea-Hypopnea Index [AHI] ≥ 5) and **110 age- and sex-matched healthy controls**. Exclusion criteria comprised diabetes, cardiac diseases, neurological disorders, or any condition affecting autonomic function.

A comprehensive autonomic evaluation included cardiac autonomic reflex tests and 5-minute heart rate variability (HRV) analysis. Time-domain and frequency-domain HRV parameters were log-transformed for statistical analysis. Sympatho-vagal imbalance was assessed using both raw and composite autonomic scores.

Results: Patients with OSA showed significantly reduced parasympathetic activity compared to controls. Key findings included lower RSA (0.25 ± 0.19 vs. 0.32 ± 0.13 , $p = 0.0007$), E:I ratio (1.19 ± 0.34 vs. 1.3 ± 0.18 , $p = 0.04$), and Valsalva ratio (2.03 ± 1.00 vs. 2.45 ± 1.20 , $p = 0.019$). Frequency domain analysis revealed reduced HF power ($p = 0.0002$) and elevated The LF/HF ratio (1.83 ± 1.92 vs. 0.85 ± 0.61 , $p = 0.0002$) indicates sympathetic dominance. Over half of the OSA patients (52.7%) had abnormal composite autonomic scores compared to 22.7% of controls ($p = 0.0002$).

Disease severity correlated significantly with autonomic markers. AHI was negatively associated with log HF_norm ($r = -0.305$, $p = 0.0234$) and positively with log LF/HF ratio ($r = 0.318$, $p = 0.0181$). Arousal and desaturation indices were also strongly associated with increased sympathetic and decreased parasympathetic activity.

Conclusions: Patients with OSA exhibit marked sympatho-vagal imbalance even during wakefulness, primarily driven by parasympathetic withdrawal and relative sympathetic overactivity. The extent of dysfunction correlates with the severity of OSA, arousals, and nocturnal desaturation. These findings underscore the utility of autonomic assessment in OSA and highlight the need for early diagnosis and intervention to mitigate cardiovascular risk.

Prevalence and Modulating Factors of Upper Airway Collapse Sites in OSA Patients Assessed by Drug-Induced Sleep Endoscopy: A Meta-Analysis

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Introduction: Drug-induced sleep endoscopy (DISE) is an established diagnostic tool for dynamically evaluating upper airway obstruction sites in patients with obstructive sleep apnea (OSA). However, significant variability in reported prevalence rates of obstruction sites across studies has highlighted the critical need for a systematic and comprehensive analysis.

Materials and methods: This meta-analysis aimed to synthesize the prevalence rates of upper airway obstruction sites (velum, oropharynx, tongue base, and epiglottis) as assessed by DISE. We also sought to quantitatively evaluate the impact of sedative type, method of sedation assessment, and patient demographic characteristics (age, body mass index, apnea-hypopnea index, and male ratio) on both the prevalence of obstruction and inter-study heterogeneity. Methods A random-effects model-based meta-analysis was performed using the metaprop function in R. Prevalence rates were calculated for the four obstruction sites based on the VOTE classification system. Subgroup analyses were conducted according to the type of sedative used and the method of sedation assessment. Publication bias was evaluated using Egger's test and the Trim-and-Fill method.

The effects of covariates were analyzed via meta-regression using the `rma.glm` function from the `metafor` package.

Results: In an analysis comprising a total of 3,842 patients, velum obstruction was the most prevalent at 75% (95% CI: 0.67-0.82), followed by tongue base at 40% (95% CI: 0.33-0.48), oropharynx at 31% (95% CI: 0.25-0.37), and epiglottis at 24% (95% CI: 0.17-0.32). High heterogeneity ($I^2 > 80\%$) was observed across all sites. Significant publication bias ($p < 0.0001$, right asymmetry) was identified specifically for epiglottic obstruction. After applying the Trim-and-Fill method, the adjusted prevalence of epiglottic obstruction increased substantially to 0.4611 (95% CI: 0.3373-0.5898), suggesting an underreporting bias in studies that reported high prevalence rates. Multivariate meta-regression analysis revealed that the heterogeneity in velum obstruction ($I^2=37.40\%$) was largely explained by sedation-related variables and demographic factors. However, high residual heterogeneity persisted for other sites (oropharynx, tongue base, and epiglottis). Notably, Midazolam use and sedation assessment based on clinical signs were associated with higher obstruction prevalence in some areas. Age, BMI, AHI, and male ratio also acted as significant moderating variables for site-specific obstructions.

Conclusions: This DISE-based meta-analysis elucidated the multilevel nature and site-specific patterns of upper airway obstruction, reaffirming the velum as the most common obstruction site. Our findings highlight that the high variability in DISE outcomes is influenced by sedation protocols and patient characteristics. This underscores the necessity for standardizing sedation protocols and considering patient characteristics in future research, thereby advocating for personalized treatment approaches.

Obstructive sleep apnea is associated with sympathetic overactivation in non-elderly but not elderly

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Introduction: Obstructive sleep apnea (OSA) has been noted to associate with sympathetic overactivation. Our previous studies have shown that OSA predicted increased risk of incident hypertension, but the strength of their association significantly decreases with age. We hypothesized that OSA was associated with sympathetic overactivation in non-elderly but not elderly.

Materials and methods: We consecutively recruited adults with OSA from the Sleep Disorders Clinic of Shantou University Mental Health Center. The elderly were defined as age > 50 years. The sympathetic activity was assessed by 24-hour urinary norepinephrine. Blood pressure was measured manually in the evening prior to PSG and in the morning right after PSG, with their mean values used for statistical analyses. Interaction terms of age*Time under 90% of SpO_2 [T90], and subgroup of age were introduced to determine the different association between OSA and sympathetic overactivation among patients with different ages. Mediation effect models were used to explore the association between OSA, sympathetic overactivation, and blood pressure in patients with different ages.

Results: A total of 166 OSA patients were included with a mean age of 45.51 ± 10.33 years. Each 1-hour increase in T90 was significantly associated with 4.76- μ g increase in 24-hour urinary norepinephrine ($\beta=0.29$, 95%CI=2.30~1.21, $p<0.001$) with adjustment of age, sex, body mass index, hypertensive medication, and REM%. Interestingly, the interaction terms of T90*age and T90*elderly were significant ($p=0.002$ and 0.017). Among the non-elderly, each 1-hour increase in T90 was associated with 6.36- μ g increase in 24-hour urinary norepinephrine ($\beta=0.37$, 95%CI=3.41~9.31 $p<0.001$), 3.43-mmHg increase in SBP ($\beta=0.39$, 95%CI=1.84~5.03, $p<0.001$) and 2.99-mmHg increase in DBP ($\beta=0.44$, 95%CI=1.80~4.20, $p<0.001$), whereas such associations were not evident among elderly (all $p \geq 0.667$). Mediation effect models showed that the 24-hour urinary norepinephrine significantly mediated the association between T90 and SBP with mediation effect of 13.41%, as well as DBP with mediation effect of 7.67% among non-elderly but not elderly. Consistent findings were also observed in the sensitivity analyses with AHI as independent variable replacing T90.

Conclusions: OSA is associated with sympathetic overactivation in non-elderly but not elderly. Early assessment and intervention should be especially warranted in non-elderly OSA patients.

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Vasomotor Intracranial Blood Vessels in Obstructive Sleep Apnea Patients

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Introduction: Obstructive Sleep Apnea (OSA) is characterized by episodes of complete or partial airway collapse accompanied by decreased oxygen saturation or awakening from sleep. OSA is an independent factor for stroke. The initial sign of vascular abnormalities in OSA is vascular endothelial dysfunction. Cerebral vascular endothelial dysfunctions in OSA can be detected by Transcranial Doppler (TCD) examination by assessing cerebral vasomotor reactivity (RVS). Assessing RVS can be done through the Breath Holding test procedure by assessing the Breath Holding Index (BHI). Currently, there are no specific assessments objectively to predict stroke. In OSA patients, so this study is expected to be the basis for objective initial screening in assessing stroke risk.

Materials and methods: In this study, OSA patients were screened using a STOP-BANG questionnaire of more than 1 point. Then, 46 subjects were grouped into non-OSA (N=8) and OSA (N=38) based on the results of the polysomnography (PSG) examination. Mean flow velocity (MFV) and BHI were measured in the middle cerebral artery (MCA) using a TCD device. BHI values above 0.69 are considered normal and MFV MCA values less than 120 cm/sec are considered normal. Screening for comorbidities and other risk stroke (smoking, physical activity) was evaluated.

Results: In this study, there was a significant difference in BHI score values between the OSA and non-OSA groups (0.76 ± 0.62 vs 1.27 ± 0.70 ; $p = 0.04$) and a higher trend in MFV MCA values in the OSA group. There was a negative correlation between AHI and BHI values ($r = -0.381$, $p = 0.009$). There was a correlation between smoking and BHI values ($p = 0.115$). Then continued into multivariate linear regression analysis, but only the AHI value was significant ($p = 0.029$).

Conclusions: As the degree of OSA increases, the vasomotor function of intracranial blood vessels is disrupted. This shows that the more severe the degree of OSA, the more cerebral endothelial dysfunction has occurred.

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Gender Effects on Surgical Outcome after Maxillomandibular Advancement for Obstructive Sleep Apnea in the East Asian Patient

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Introduction: Anatomical and physiological differences between genders may influence surgical outcomes in sleep apnoea treatments. Maxillomandibular advancement (MMA) is a common procedure for obstructive sleep apnoea (OSA) patients. Still, the impact of gender on surgical success in the East Asian patient has not been fully explored.

Aim:

This study aims to compare the post-operative outcomes of MMA in East Asian patients, specifically examining gender as an influencing factor.

Materials and methods: A retrospective matched cohort study was conducted on 36 OSA patients (18 males, 18 females) who underwent MMA at Chang Gung Memorial Hospital, Taiwan. Patients were matched by age and body mass index. Pre- and post-operative polysomnographic indices and cephalometric measurements were analysed to assess surgical outcomes. Logistic regression was used to evaluate gender as a predictor of outcomes, adjusted for baseline apnoea-hypopnoea index (AHI).

Results: Surgical success was observed in 83.3% of males and 66.7% of females, with cure rates of 44.4% and 50.0%, respectively. After adjusting for baseline AHI, gender was not a significant predictor of cure (OR 0.99; 95% CI: 0.24–4.17; $p = 0.984$) or success (OR 1.54; 95% CI: 0.28–9.43; $p = 0.619$). Males demonstrated greater improvements in AHI, oxygen desaturation index, arousal index, and wake after sleep onset. Females showed greater gains in rapid eye movement sleep and hyoid elevation.

Conclusions: Gender does not independently predict surgical success or cure following MMA in East Asian OSA patients. However, gender specific responses were noted in certain polysomnographic indices and cephalometric measurements. Further studies are warranted to explore underlying mechanisms influencing these differential responses.

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Comparison of the impact of nasal and pharyngeal surgery on CPAP treatment parameters and quality of life

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Introduction: It has been reported that approximately 30% of patients with obstructive sleep apnea (OSA) have upper respiratory tract diseases such as nasal disease or enlarged palatine tonsils. Although continuous positive airway pressure (CPAP) therapy is the first-line treatment for patients with moderate or severe OSA, there have been few reports comparing CPAP therapy and patient quality of life before and after nasal or pharyngeal surgery. In this study, we retrospectively compared the effects of CPAP application and treatment parameters and subjective symptom changes before and after surgery in patients who underwent nasal or pharyngeal surgery during CPAP treatment.

Materials and methods: We retrospectively analyzed CPAP use before and after surgery and the Japanese version of the Epworth Sleepiness Scale (JESS), which measures daytime sleepiness, in patients who underwent OSA nasal or pharyngeal surgery at Atsugi City Hospital between April 2022 and September 2024 (nasal surgery: 13 cases, pharyngeal surgery: 8 cases).

Results: Postoperative CPAP pressure and postoperative leakage were significantly lower in both pharyngeal surgery groups. The nasal surgery group showed no significant difference, but there was a trend toward an increase in postoperative use for more than 4 hours. JESS, a measure of daytime sleepiness, tended to improve in the nasal surgery group. Furthermore, subjective symptoms such as xerostomia and nasal obstruction tended to improve after surgery, but not in patients undergoing pharyngeal surgery.

Conclusions: Nasal and pharyngeal surgery for patients on CPAP may have an additional effect of improving sleepiness and reducing CPAP pressure. When patients complain of subjective symptoms such as drowsiness, nasal obstruction, or xerostomia during routine CPAP treatment, it is important to examine whether nasal or pharyngeal surgery is indicated and to explain to patients that CPAP may improve their therapeutic effects and quality of life.

Causal Relationship Between Female Reproductive Factors and Risk of Obstructive Sleep Apnea

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Introduction: The association between Obstructive sleep apnea (OSA) and gender related factors has always been a hot research topic. We aim to investigate the causal association between reproductive factors and OSA in women at different reproductive stages.

Materials and methods: We applied two-sample Mendelian Randomization for analysis. The genome-wide association studies summary datasets were mainly obtained from the UK biobank and FinnGen. Inverse-Variance Weighted approach was used as the primary analysis, while heterogeneity and horizontal pleiotropy were evaluated using the Cochran Q test and the MR-Egger intercept, and sensitivity analysis included a single SNP analysis and a leave-one-out analysis.

Results: After false discovery rate correction ($P_{FDR} < 0.05$), we found that earlier age at menarche (OR = 0.86; 95% CI, 0.82 to 0.91), age at first sexual intercourse (OR = 0.78; 95% CI, 0.65 to 0.93) and age at first live birth (OR = 0.92; 95% CI, 0.87 to 0.97) were associated with increased risk of OSA, while individuals with higher risk of OSA were likely to have earlier age at menarche (beta = -0.21; 95% CI, -0.32 to -0.10), higher age at menopause (beta = 0.30; 95% CI, 0.06 to 0.53), and longer years of ovulation (beta = 0.80; 95% CI, 0.32 to 1.29). However, there were no positive results between sex hormone levels and OSA.

Conclusions: In the prevention and treatment of OSA, we should pay more attention to those with early age at menarche and long years of ovulation, and to those influences other than hormone levels.

Independent association between sleep apnea-specific hypoxic burden and dyslipidemia in obstructive sleep apnea

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Introduction: Obstructive sleep apnea (OSA) is associated with and contributes to lipid metabolism. Current researches assess hypoxic indicators and lipid metabolism without AHI stratifying based on the primary criteria. Our study aims to explore the advantages and threshold of sleep apnea-specific hypoxic burden (HB) in evaluation for OSA and lipid metabolism.

Materials and methods: This is a large-scale cross-sectional study enrolled subjects examined with standard polysomnography (PSG) from Jan 2011 to Jan 2022. Demographic, clinical, and sleep characteristics were collected. Confounders were adjusted by collinearity diagnosis before assessment. Multiple linear regression analyses were used to assess the association between HB and lipid profile. Furthermore, logistic regressions were used to evaluate the odds ratio (OR) of prevalent dyslipidemia among the HB quartiles stratified by apnea-hypopnea index (AHI).

Results: A total of 4312 subjects were included within 498 primary snoring (PS) and 3814 OSA (696 in mild, 747 in moderate, and 2371 in severe). The dyslipidemia prevalence was evidently increased with HB quartile both in the whole cohort and OSA group (p -value for trends, both $p < 0.001$). After stratified by AHI, compared with PS group, the dyslipidemia prevalence across the HB quartile in severe OSA was increased from 58.0% to 98.6% (OR[95% confidence interval (CI)], 1.580[1.205,2.072], 1.664[1.263,2.193], 1.712[1.287,2.276], and 1.986[1.481,2.663], all $p < 0.01$; linear trend, $p < 0.001$). The hyper-low-density-lipoprotein cholesterolemia remained significance across the HB quartile in moderate OSA (linear trend, $p = 0.001$). Furthermore, positive increasing linear trends were presented among triglyceride (TG) level in severe OSA ($p < 0.001$), among total cholesterol (TC) level in moderate to severe OSA (both $p < 0.001$), and among low-density-lipoprotein cholesterol (LDL-C) level when AHI $\geq 5/h$ ($p = 0.021$ in mild OSA, $p < 0.001$ in moderate and severe OSA).

Conclusions: In this cross-sectional study, higher HB was associated with male, older, heavier individuals with worse PSG indexes and greater dyslipidemia prevalence, which appeared more sensitive in severe OSA. Furthermore, the HB performed as an independent factor for early warning of LDL-C level when OSA was diagnosed.

Effects of strength training on blood pressure and arterial stiffness in adults with moderate to severe obstructive sleep apnea: a randomized controlled trial

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Introduction:

Obstructive Sleep Apnea (OSA) is a sleep disorder characterized by partial (hypopnea) or complete (apnea) interruptions in airflow through the upper airways during sleep, leading to reduced oxygen saturation. OSA is closely associated with cardiovascular complications, such as elevated blood pressure (BP) and increased arterial stiffness—mainly driven by sleep fragmentation and intermittent hypoxia. Although continuous positive airway pressure (CPAP) is the first-line treatment for OSA, its effectiveness is often limited by poor adherence. Consequently, physical exercise—particularly strength training (ST)—has emerged as a promising non-pharmacological strategy to improve cardiovascular health in different populations. In individuals with OSA, ST may reduce body fat—especially in the cervical region—through exercise may alleviate upper airway narrowing. However, it remains unclear whether ST can reduce BP and arterial stiffness in adults with OSA. Thus, this randomized controlled trial aimed to evaluate the effects of an eight-week ST program on ambulatory, office, and central BP, as well as arterial stiffness, in adults with moderate to severe OSA.

Materials and methods:

Participants aged 18 years or older with a confirmed diagnosis of moderate to severe OSA (based on the apnea-hypopnea index; AHI) were recruited from a sleep laboratory. Stratified by sex and OSA severity, participants were randomly assigned to either a ST group or a control group (CG). The ST group performed three sessions per week, consisting of eight resistance exercises, while the CG participated in two sessions per week of stretching exercises. OSA severity was assessed using full overnight polysomnography. Additionally, systolic and diastolic [BP (ambulatory, office, and central)] and arterial stiffness were evaluated. Generalized Estimating Equations (GEE) were used to analyze group-by-time interactions, with a significance level set at $p < 0.05$.

Results: A total of 26 adults (mean age: 54.6 ± 7.2 years; BMI: 36.1 ± 7.9 kg/m²; AHI: 52.2 ± 27.4 events/hour) were included. Significant group-by-time interactions were found for 24-hour systolic BP (CG: $+5.3 \pm 2.4$ mmHg vs. ST: -2.9 ± 3.2 mmHg; $p = 0.041$), daytime systolic BP (CG: $+4.6 \pm 2.5$ mmHg vs. ST: -2.8 ± 2.8 mmHg; $p = 0.050$), and daytime mean BP (CG: $+3.7 \pm 1.6$ mmHg vs. ST: -2.3 ± 2.0 mmHg; $p = 0.021$). In addition, a significant reduction was also observed in OSA severity (AHI CG: -3.5 ± 3.8 events/hour vs. ST: -20.9 ± 6.1 events/hour; $p = 0.015$). No significant differences were observed between groups regarding office and central BP, or arterial stiffness.

Conclusions:

An eight-week strength training program significantly reduces ambulatory blood pressure and OSA severity in adults with moderate to severe OSA, even without changes in arterial stiffness. These findings support the role of strength training as a potential adjunct non-pharmacological intervention for cardiovascular risk management in this population.

Acknowledgments:

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Investigation of nasal obstruction as a risk factor for SDB: prevalence of SDB in patients who underwent endoscopic nasal sinus surgery

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Introduction: To investigate the prevalence of sleep-disordered breathing (SDB) in patients with nasal diseases who underwent endoscopic nasal sinus surgery (ESS) compared with control patients without nasal disease who underwent tonsillectomy.

Materials and methods: An observational retrospective case-control study was conducted of 150 adults with nasal diseases who underwent ESS (ESS group) as well as 94 adults with no nasal symptoms or diseases who underwent tonsillectomy due to infection of the tonsils (tonsillectomy group). Patients with obstructive sleep apnea, patients with a chief complaint of snoring or excessive daytime sleepiness, or patients having large tonsils were excluded from the study. Home sleep apnea testing was performed prior to admission for surgery.

Results: The prevalence in normal, mild, moderate, and severe SDB was respectively 30.0%, 38.0%, 22.7%, and 9.3% in the ESS group and 50.0%, 39.4%, 10.6%, and 0% in the tonsillectomy group. There were significant differences in the mean 3% oxygen desaturation index (3%ODI) score between the ESS and tonsillectomy groups in men but not in women. Obese men in the ESS group were much more susceptible to having moderate or severe SDB when they were aged ≥ 40 years. Regression analysis revealed that the preoperative 3%ODI score had two significant determinants in the ESS group—BMI and male sex—whereas age, nasal resistance, and CRS with nasal polyps were not significant predictors.

Conclusions: Among patients who underwent ESS, 32.0% had moderate to severe SDB, including 9.3% with severe SDB. Nasal obstruction could be a potential risk factor for SDB in male patients.

Acknowledgments: The Ethics Committee of Teikyo University approved this study (Approval No. Teirin 24-048). No financial support was received in relation to this study.

Analysis of Polysomnography in Patients with Sleep Disorders Accompanied by Tinnitus

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Introduction: Tinnitus is a symptom characterized by the perception of sound generated within the body, specifically by the spontaneous depolarization of auditory nerve fibers, without any external auditory stimulus. Although the exact etiology of tinnitus remains unknown, there is a strong electrophysiological hypothesis suggesting that functional changes in the limbic system's amygdala and the cerebral cortex, as well as the subcortical structures, lead to tinnitus through autonomic nervous system dysfunction. Sleep disorders are also known to be influenced by and to influence the complex interactions among the ascending reticular system, central arousal system, cognitive system, and emotional regulating system in the central nervous system. Therefore, based on these theoretical foundations, the authors aimed to analyze the relationship between tinnitus and sleep by examining the association between tinnitus and polysomnography results using the Tinnitus Handicap Inventory (THI). This study intends to elucidate the correlation between tinnitus and sleep disorders.

Materials and methods: A retrospective analysis was conducted on patients who visited the clinic from August 2021 to May 2023 and underwent both polysomnography (PSG) and the Korean version of the Tinnitus Handicap Inventory (THI). The clinical characteristics, polysomnography results, and scores from psychiatric symptom questionnaires were compared between the group with tinnitus and the group without tinnitus. Additionally, the polysomnography results and questionnaire scores were compared based on the THI scores.

Results: There were statistically significant differences in the PLM (Periodic Limb Movement) index, sleep latency, and lowest SpO₂ between the group with tinnitus and the group without tinnitus (Table 1). The tinnitus group exhibited lower PLM index, higher sleep latency, and higher lowest SpO₂ compared to the group without tinnitus. When analyzing the polysomnography results based on THI scores, a significant negative correlation was found between THI and REM latency. There were no significant differences in the average scores of questionnaires (ESS, SSS, PSQI, PSS, PHA-I5, BAI, CES-D) between the group with tinnitus and the group without tinnitus. Multiple regression analysis also did not reveal any significant correlations between THI scores and questionnaire scores.

Conclusions: Tinnitus, sleep disorders, and depression are associated with autonomic nervous system overactivity through the limbic system. Studies that examine the relationship between tinnitus, sleep disorders, depression, anxiety, and stress using polysomnography and questionnaires can provide a better understanding of sleep patterns, autonomic nervous system function, and electrophysiological models. Furthermore, such research

can contribute to the development of specific treatment approaches aimed at improving the quality of life for these patients.

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The Prognostic Significance of Severe Obstructive Sleep Apnea in Patients Undergoing Surgical Repair for Acute Type A Aortic Dissection

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Introduction: Obstructive sleep apnea (OSA) is prevalent in patients with aortic dissection, yet its long-term effect on prognosis, particularly in those with acute type A aortic dissection (ATAAD), remains inadequately understood.

Materials and methods: This study conducted sleep test for 86 ATAAD patients within 90 days after total aortic arch replacement between January 2018 and December 2018. Severe OSA was defined as an apnea and hypopnea index ≥ 30 events/hour. Multivariable Cox regression analysis was used to evaluate the relationship between severe OSA and major adverse events (MAEs), including all-cause mortality and surgical reintervention.

Results: Over a median follow-up period of seven years, patients with severe OSA ($n = 22$) experienced a significantly higher incidence of MAEs (6 [27.3%] vs. 5 [7.8%], $P = 0.047$) and lower long-term survival rates (81.8% vs. 97.4%, $P = 0.003$) compared to patients without severe OSA ($n = 64$). Cox regression analysis revealed that severe OSA was a significant predictor of MAEs (HR = 3.9; 95% CI: 1.2–12.9; $P = 0.025$), with the association remaining significant after adjusting for age (HR = 3.7; 95% CI: 1.1–12.4; $P = 0.032$). Additionally, partial thrombosis of the false lumen was more frequently observed in patients with severe OSA compared to controls (9 [40.9%] vs. 9 [14.1%], $P = 0.028$).

Conclusions: Severe OSA is associated with poorer outcomes in patients undergoing surgical repair for ATAAD, underscoring the importance of identifying and managing OSA effectively, even following standard surgical intervention.

Integrative Prognostic Framework Linking Sleep-Disordered Breathing-Associated Genes to Tumor Hypoxia and Immune Evasion Across Cancers

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Introduction: Sleep-Disordered Breathing (SDB), characterized by intermittent hypoxia and sleep fragmentation, is increasingly recognized as a systemic physiological stressor influencing tumor progression and immune modulation. However, its molecular footprint across cancer types remains underexplored.

Materials and methods: We curated 164 genes associated with SDB from literature and sleep-related databases. Using transcriptomic data from 32 cancer types in The Cancer Genome Atlas (TCGA), we developed an SDB-related prognostic model via LASSO-Cox regression. This model generated a risk score used to stratify patients into high- and low-risk groups. Kaplan-Meier survival analyses, multivariate Cox regression, and time-dependent ROC curves evaluated model performance. Functional enrichment and immune deconvolution were performed to explore underlying biology.

Results: The SDB gene signature significantly predicted overall survival (OS), disease-specific survival (DSS), and progression-free interval (PFI) across multiple cancer types. High-risk groups were enriched in hypoxia, epithelial–mesenchymal transition, IL-17 signaling, and angiogenesis pathways. The SDB score correlated positively with immune checkpoint expression, stromal activity, and proliferative indices. Integration into a nomogram with clinical

variables enhanced survival prediction accuracy (C-index > 0.70). External validation in independent datasets confirmed model robustness, especially in hypoxia-sensitive tumors such as lung adenocarcinoma, glioblastoma, and clear cell renal carcinoma.

Conclusions: This study is the first to establish a pan-cancer SDB-associated transcriptomic signature. Our findings suggest that SDB-induced molecular alterations may contribute to tumor aggressiveness and immune evasion. This integrative framework bridges sleep medicine and oncology, supporting future investigations into SDB management as an adjunct cancer therapy strategy.

Cephalometric differences between REM and NREM OSA patients may help in choosing the right surgical candidate

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Introduction: Obstructive sleep apnea (OSA) is a prevalent disorder characterized by recurrent upper airway collapse, leading to intermittent hypoxemia and disrupted sleep. Factors such as age, gender, body mass index (BMI), and lifestyle contribute to the severity of OSA, while body position and rapid eye movement (REM) state have been shown to influence its occurrence. The purpose of this study was to find the relationship between anatomical features observed on cephalometry and polysomnographic data in OSA patients.

Materials and methods: This retrospective cohort study included 74 OSA patients who were confirmed with polysomnographic evaluation and took lateral, PA cephalometric and panoramic radiographs. Patients were classified into positional and non-positional OSA categories based on their supine and lateral AHI values. REM-dependent and NREM-dependent OSA status was determined based on the REM and NREM AHI values. Demographic, polysomnographic, and cephalometric data were analyzed, and correlations were explored using Pearson's correlation coefficient.

Results: The study found no significant differences in cephalometric and panoramic parameters between positional and non-positional OSA patients. However, REM-dependent OSA patients showed shorter N-ANS length, shorter perpendicular distance between the anterior hyoid bone and mandibular plane, and longer tongue length compared to NREM-dependent OSA patients. Logistic regression analysis revealed that a narrower nasal cavity and maxilla width, relative to the mandibular width, were significant risk factors for non-positional OSA. In addition, the posterior and inferior position of the hyoid bone and longer tongue length were identified as risk factors for REM-dependent OSA.

Conclusions: The study suggests that anatomical factors, such as the width of the nasal cavity and maxilla, as well as the position of the hyoid bone and tongue length, are associated with the severity and type of OSA. These findings may contribute to the development of targeted treatment strategies, including surgical interventions, for improving upper airway space in OSA patients.

Can Awake End-tidal CO₂ Predicts Sleep-related Hypoventilation in Children with Neuromuscular Diseases?

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Introduction: Children with neuromuscular diseases (NMD) are at risk for hypoventilation, which often first manifests during sleep. Polysomnography (PSG) is the gold standard for detecting sleep-related hypoventilation (SRH) and determining the need for noninvasive positive pressure ventilation. This study aimed to evaluate whether awake end-tidal carbon dioxide (EtCO₂), a simple and noninvasive outpatient measure, can predict SRH in children with NMD. We hypothesized that patients with SRH may exhibit high-normal awake EtCO₂ values.

Materials and methods: We retrospectively reviewed medical records of children (0–18 years) with congenital NMD who underwent diagnostic PSG at Ramathibodi Hospital. From PSG results, SRH was defined as $>2\%$ of total sleep time (TST) with $\text{EtCO}_2 > 50$ mmHg. Children with NMD were divided into those with SRH and without SRH groups. Demographic and anthropometric data and neuromuscular diagnoses were collected. Awake parameters including baseline oxygen saturation (SpO_2), pulmonary function tests (PFTs), awake EtCO_2 , venous partial pressure of carbon dioxide (PCO_2), and serum HCO_3 were extracted. The collected variables were compared between the SRH and non-SRH groups.

Results: A total of 50 diagnostic PSG records were included. The mean age was 12.34 ± 3.50 years; 76% were male and 48% had Duchenne muscular dystrophy. SRH was identified in 8 PSGs (16%). Baseline characteristics did not differ significantly between patients with and without SRH. Awake EtCO_2 values were significantly higher in patients with SRH compared to those without SRH (42.25 ± 3.77 vs 33.52 ± 3.29 mmHg, $p < 0.001$). Serum bicarbonate (HCO_3) levels were also significantly higher in patients with SRH (26.92 ± 2.53 vs 22.77 ± 2.56 mEq/L, $p = 0.002$). Venous PCO_2 trended higher in patients with SRH but did not reach statistical significance. ROC analysis showed high diagnostic accuracy for predicting SRH, with AUCs of 0.966 for awake EtCO_2 and 0.892 for serum HCO_3 . An awake EtCO_2 cutoff of 38.5 mmHg yielded 87.5% sensitivity and 95.2% specificity, while a serum HCO_3 cutoff of 25.2 mEq/L yielded 80% sensitivity and 80.8% specificity. Based on the 16% prevalence of SRH in our cohort, the positive predictive value (PPV) and negative predictive value (NPV) were calculated. For awake $\text{EtCO}_2 > 38.5$ mmHg, the PPV was 77.8% and the NPV was 97.6%. For serum $\text{HCO}_3 > 25.2$ mEq/L, the PPV was 44.4% and the NPV was 95.5%. These findings indicate that both awake EtCO_2 and serum HCO_3 have high NPV, suggesting potential utility in stratifying the lower-risk cases.

Conclusions: Our findings suggest that awake EtCO_2 and serum HCO_3 may serve as simple and noninvasive indicators for early SRH detection. These tools could help guide clinical decisions and facilitate timely PSG referral and intervention, especially when PSG is delayed or unavailable.

Acknowledgments: This study was conducted at Ramathibodi Hospital, Mahidol University, Bangkok, Thailand, with no financial support. The authors report no conflicts of interest.

An Analysis of Snoring Characteristics and Their Impact on Obstructive Sleep Apnea

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Introduction: Snoring, a common clinical features associated with OSA, has garnered notable interest due to its potential diagnostic and predictive value. About 59% of women and 78% of men snore, making it a widespread condition. The objective of the study is to investigate the impact of snoring characteristics such as snoring intensity and snoring time on the severity of obstructive sleep apnea (OSA), exploring the dynamics and potential associations between these variables and other polysomnographic parameters.

Materials and methods: Retrospective data analysis on patients who had polysomnography (PSG) between June 2019 and February 2020. The apnea-hypopnea index (AHI) was used as a measure of OSA severity. Snoring recordings were achieved by a non-contact directional microphone placed at the head of the bed, 20 cm from the vertex of the patients. Statistical analyses were performed using version 29 of the Statistical Package for the Social Sciences (SPSS) software. Pearson correlation coefficient, Mann-Whitney U test and Jonckheere Trend's test were used for analysis.

Results: A total of 248 patients underwent a PSG in the study period. Mean age was 41.9 ± 19.5 and mean body mass index was 25.4 ± 4.7 . The polysomnographic parameters progressively increase as the patient's age increases ($P < 0.001$). Number of snoring episode and Epworth Sleepiness Scale (ESS) were higher in male patients and reached statistical significance ($P < 0.05$). In terms of snoring intensity, there is not much variation between male and female patients. Older patients have a progressively longer snoring time, higher snoring rate and a greater number of snoring episodes ($P < 0.001$). The mean for snoring time, snoring rate, the number of snoring episodes, snoring intensity and ESS showed a gradual increase with increasing severity of AHI ($P < 0.001$). Polysomnographic parameters which included AHI, RDI, supine AHI, and REM and NREM index showed a positive correlation with snoring intensity ($r = 0.341$, $r = 0.354$, $r = 0.385$, $r = 0.322$, $r = 0.137$ respectively. $P < 0.001$). Number of snoring episodes also showed a positive correlation with AHI, RDI, supine AHI, and REM and NREM index and ($r = 0.391$,

$r = 0.360$, $r = 0.309$, $r = 0.375$, $r = 0.355$, respectively. $P < 0.001$). There was no significant correlation between the PSG parameters and snoring time, snoring rate and longest snoring episode.

Conclusions: This study improves our understanding on the relationship between snoring characteristics and OSA severity. It highlights the intricate interactions between snoring and polysomnographic parameters as well as the substantial correlation between certain snoring qualities and the severity of OSA. Importantly, it suggests that snoring could indicate undiagnosed OSA, advocating for snoring to be used not only as a means of screening for OSA but as part of the diagnostic tool for OSA and as an adjunct to assess treatment outcome.

Acknowledgments: -

The relationship between obstructive sleep apnea and visual hallucinations in PD patients--a MRI and PSG study

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Introduction: Parkinson's disease (PD) patients frequently experience visual hallucinations (VHs) and obstructive sleep apnea (OSA). The aim of this study was to describe the prevalence and clinical correlates of VHs and OSAS in the Chinese population with PD. Using magnetic resonance to measure upper airway parameters and explore their relationship with sleep apnea and visual hallucinations in Parkinson's disease.

Materials and methods: A sample of 489 PD patients was recruited for the present study. Patients were categorized as having formed VHs (FVHs) or minor VHs (MVHs) or as non-hallucinators (NVHs) according to the Unified Parkinson's Disease Rating Scale (UPDRS) and an initial questionnaire. Polysomnography (PSG) was used for objective assessment of sleep. Using color Doppler ultrasound to examine the thickness of the genioglossus muscle, the thickness of the tongue, the left-right diameter of the oropharyngeal airway at the end of deep inhalation, and the left-right diameter of the oropharyngeal airway at the end of deep exhalation in patients with OSA. Using MRI to reconstruct the upper airway of OSA patients, measure the volume of oropharynx, glossopharynx, laryngopharynx and nasopharynx.

Results: VHs were observed in 143 (29.2%) patients. Among them, 75 of the hallucinators experienced MVHs, and 68 experienced FVHs. The disease duration, UPDRS Part III score, Hoehn and Yahr (H-Y) stage, Pittsburgh Sleep Quality Index (PSQI) score and rapid eye movement (REM) sleep behavior disorder (RBD) score of hallucinators were significantly greater than those of non-hallucinators ($P < 0.05$). We also observed OSAS in 38.7, 54.7, and 63.3% of the NVHs, MVHs, and FVHs groups, respectively. PSG showed that the VH groups had a lower total sleep time, lower sleep efficiency, higher arousal index, lower sleep latency, lower NI%, higher apnea-hypopnea index (AHI), higher average duration of apnea, higher respiratory-related arousal (RRA), and lower values of the lowest O_2 and mean O_2 . The forward binary logistic regression model showed that AHI, NI%, RRA and lowest O_2 were independently associated with VHs in PD patients. MRI examination indicates that there are abnormalities in the bony structure of the upper airway in patients with OSA. Ultrasonic examination indicates that patients with OSA have a higher degree of airway collapse. CPAP treatment can significantly improve non motor symptoms such as motor symptoms, cognition, and VHs in patients.

Conclusions: Our results confirm the high prevalence of VHs and OSAS as well as their relationship in patients with PD. Emphasizing the treatment of patients with PD combined with OSAS is beneficial for improving the overall symptoms of PD.

Assessment of a Vibrotactile Device for Positional Therapy in Healthy Volunteers: A Pilot Study

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Introduction: Sleep-disordered breathing encompasses a continuum of respiratory pathologies occurring during sleep, ranging from simple snoring, which may progress to more severe conditions such as obstructive sleep apnea (OSA). International studies indicate that the prevalence of obstructive sleep apnea (OSA) is increasing annually due to lifestyle changes, the growing prevalence of obesity, and population aging. A particularly common form is positional obstructive sleep apnea (pOSA), in which symptoms occur exclusively in the supine position. In 50–60% of patients, the severity of apnea and snoring is directly influenced by sleep position. Positional therapy (PT), which aims to prevent supine sleep, represents a promising alternative to continuous positive airway pressure (CPAP) therapy, particularly given the low adherence rates associated with the latter. The aim of this study is to evaluate the effectiveness of the new vibrotactile device “SoftSleep” (LLC SOFTSLEEP, Moscow, Russia) for positional therapy in healthy volunteers. The results may serve as a foundation for future clinical trials and the development of personalized treatment strategies for positional obstructive sleep apnea.

Materials and methods: A single-center clinical-experimental study was conducted with 20 adult volunteers to assess the effectiveness of the vibrotactile positional therapy device “SoftSleep” (LLC SOFTSLEEP, Moscow, Russia). The volunteer group included 14 males (70%). The mean age of the participants was 41.8 ± 11.2 years. Each participant underwent two nights of home-based monitoring using the system for automated polysomnography studies “Astrocard-SomnoSTUDIO” (LLC MEDITEK, Moscow, Russia): one night without the device and one with SoftSleep activated. Body position data were collected via “SomnoSTUDIO”, and subjective sleep quality was assessed using a modified Pittsburgh Sleep Quality Index. Key results included an assessment of total sleep time and time spent in a supine position.

Results: The “SoftSleep” vibrotactile device significantly reduced supine sleep time from 56.0% to 7.8% (-48.2 pp) without affecting total sleep duration ($7:42 \pm 1:19$ vs. $7:39 \pm 1:33$) and subjective sleep quality. In 90% of cases, participants rated sleep as “very good” or “fairly good” during device use. Supine avoidance was achieved via vibrotactile feedback without full awakenings, supporting the arousal-based mechanism of positional therapy. It is also significant that only three participants experienced brief vibration-related awakenings that subjectively did not exceed 3 minutes in duration and did not lead to withdrawal from the study. Variability in individual response suggests future studies should explore factors like sleep depth or baseline sleep position. Despite limitations—small sample, lack of polysomnography, and use of healthy volunteers—these results support “SoftSleep” as an effective, well-tolerated, non-invasive option for positional OSA. Further trials in clinical populations with objective sleep staging are warranted.

Conclusions: The results of the present study demonstrated high efficacy and good tolerability of the SoftSleep vibrotactile device designed for positional therapy of sleep breathing disorders and snoring prevention. The use of the device significantly reduced the duration of sleep in the supine position without adversely affecting the total time and quality of sleep.

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Factors affecting level II polysomnography (PSG) outcomes in a tertiary referral sleep centre in Australia: A retrospective cohort study

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Introduction: Obstructive sleep apnoea (OSA) has a significant prevalence and associated healthcare cost in Australia and globally. In Australia Level II polysomnography (PSG) studies, provide an accessible and affordable way to help diagnose OSA. However, level II PSG's often have higher failure rates than in-lab sleep studies with recent data from Australia and New Zealand showing failure rates of 5-8%. Factors that may contribute to failed level II PSG have not been clearly identified in the literature with limited anecdotal evidence guiding clinician decisions with their patients. We conducted a single centre retrospective cohort study to assess which factors are more prevalent in failed level II PSG compared to successful tests with the aim to establish a more robust evidence base in this area to ultimately improve the success rate of level II PSG.

Materials and methods: The study population included 496 from patients > 18 years of age who had performed a level II PSG through our hospital's sleep laboratory between January 2022 and January 2024. Failed tests identified using a standardised criteria by the sleep technician analysing the test. Factors to be assessed included clinical factors (Age, gender, weight, BMI, co-morbidities, smoking status, Epworth score, STOP-BANG score) environmental factors (season, average daytime temperature, distance from the sleep laboratory in km) and technical factors (test unit used). Comorbidities were categorised into none, one or more than one and included asthma, hypertension, diabetes, gastro-oesophageal reflux disease (GORD), atrial fibrillation, heart disease and chronic obstructive pulmonary disease (COPD). Statistical tests comparing factors of failed and successful tests included t-tests for continuous variables and chi-square tests for categorical variables. The statistical significance level was set at $p < 0.05$.

Results: Of the 496 studies analysed, there were 16 (3.2%) failed tests and 480 (96.8%) successful tests. There were 254 (51.2%) female patients and 242 (48.8%) male patients with an average patient age of 52.41 (SD +/- 16.2) years. There was no significant difference between the failed and successful tests for the clinical factors of age ($p = 0.96$), BMI ($p = 0.81$), gender ($p = 0.54$), smoking status ($p = 0.49$), Epworth score ($p = 0.69$), STOP-BANG score ($p = 0.22$) and co-morbidities ($p = 0.52$). In regard to environmental factors there was a significant difference between seasons ($p = 0.05$), with 14/16 (87.5%) failed tests occurring in autumn or winter. There were no significant differences for distance from the sleep laboratory ($p = 0.90$), daytime temperature ($p = 0.16$), or which sleep unit was used ($p = 0.31$).

Conclusions: Although the failure rate of the level II PSG in our study was lower than previous studies, analysis of relevant factors found no differences between the failed and successful tests except for season which showed that autumn and winter seasons in the local area were more highly associated with failure. This suggests that aspects related to colder seasons such as increased bedding or clothing may be attributable for the failure rate but this requires further research

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The Impact of Early Intensive Nursing Interventions via Telemetric Monitoring on Long-Term Continuous positive airway pressure (CPAP) Adherence in Obstructive Sleep Apnea (OSA)- A single-centre experience in Hong Kong

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Introduction: Long-term adherence to CPAP remains a significant challenge in the treatment of OSA. It has been shown that suboptimal initial CPAP experiences negatively impact patient compliance. Conventional in-laboratory CPAP titration, often limited to a single-night assessment, may fail to address patient adaptation challenges. To enhance early patient support while optimizing resource allocation, our center introduced a home-based CPAP titration protocol incorporating telemonitoring and nursing interventions. We conducted a retrospective comparative analysis to evaluate the efficacy of home-based versus in-laboratory titration.

Materials and methods: Patients with newly diagnosed pure OSA who were naïve to CPAP treatment and underwent either home-based (home group) or in-laboratory titration (in-lab group) between January and September 2024 were included in the analysis.

Both groups participated in an OSA and CPAP education session, followed by a daytime CPAP trial in the sleep center prior to titration. The in-lab group received standard single-night attended CPAP titration, whereas the home group used an auto-adjusting CPAP device with integrated telemonitoring (ResMed AirSense 10 AutoSet for Her) for one week. In home group, telemonitoring was performed via a cloud-based platform, supplemented by phone consultations by trained nurses to assess adherence. Based on patient-reported feedback and objective usage data, personalized guidance was provided to address side effects and troubleshoot issues. Remote CPAP setting adjustments were made when necessary. In both groups, data was reviewed by physician to determine the final PAP prescription. After titration, both groups received an educational pamphlet with written and video instructions on PAP use and troubleshooting.

The following outcomes were compared:

- Titration success rate (the ability to derive prescribed PAP settings from the test)
- CPAP uptake (patient procurement of a CPAP device post-titration)
- CPAP adherence at 3 months (usage ≥ 4 hours per night for $\geq 70\%$ of days)

Results: A total of 332 patients were included (110 in-lab, 222 home). The mean age (in-lab: 60.2 years, home: 57.3 years; $p=0.08$) and pre-treatment apnea-hypopnea index (AHI) (in-lab: 38.8/ hour, home: 36.5/ hour; $p=0.18$) were similar among both groups. Although titration success rate was higher in the in-lab group (in-lab: 97.3%, home: 89.1%; $p=0.01$), CPAP uptake rate was similar among both groups (in-lab: 51.8%, home: 59%; $p=0.25$). Although majority of patients who procured PAP device chose auto-CPAP (in-lab 84.5%; Home 90%; $p=0.25$), those who had underwent home CPAP titration still demonstrated significantly better adherence at 3 months (in-lab: 19.6%, home: 36.3%, $p=0.0002$) (Figure 5). Neither pre-treatment AHI ≥ 30 / hour ($p=0.65$) nor pre-treatment ESS scores ≥ 11 ($p=0.59$) showed significant relationship with good adherence rate.

Conclusions: While auto-CPAP offers a convenient approach to initiating therapy, early identification and management of CPAP-related challenges remain crucial for optimizing long-term adherence. Our findings demonstrate that home-based CPAP titration with telemonitoring and nursing support not only improves adherence but also enables sleep centers to reserve in-laboratory resources for patients with complex sleep conditions.

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Predictors of surgical outcomes for limited palatal muscle resection in patients with obstructive sleep apnea

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Introduction: Limited palatal muscle resection (LPMR) is a modified palatal surgical technique to correct retropalatal obstruction without complications. This study aims to determine the associated factors affecting the success and cure rate of LPMR in patients with obstructive sleep apnea (OSA), thus guiding patient selection and improving surgical outcome.

Materials and methods: Thirty-five OSA patients underwent LPMR were enrolled. All patients received routine physical examination, preoperative drug-induced sleep endoscopy (DISE), and polysomnography (PSG). Clinical, polysomnographic, cephalometric variables, and DISE findings were evaluated. These measurements were compared between the surgical success and failure group based on the results of preoperative and postoperative PSG. Furthermore, we compared the cured and non-cured groups in the surgical success group.

Results: Among 35 patients, the overall success rate was 57 % with a cure rate of 31.4 %. Patients with Friedman stage II had a significantly higher success rate ($p = 0.032$). According to DISE results, tongue base obstruction affected the surgical outcome ($p < 0.001$). The success rate was 100 % in the no tongue base obstruction during DISE, 72.2 % in the partial obstruction, and 9.1 % in the total obstruction. Tonsil size is also helpful in predicting surgical success rate ($p = 0.041$). Furthermore, patients with mild AHI were more likely to be surgical cures. when compared with patients with severe AHI ($p = 0.044$).

Conclusions: Patients with larger tonsil size and no tongue base obstruction during DISE may have a higher chance of surgical success with LPMR. The lower AHI may be predictors of surgical cure after LPMR.

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Surgically assisted transverse jaw expansion in adult OSA patients

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Introduction: Obstructive Sleep Apnea (OSA) is a prevalent condition that significantly impacts the quality of life and overall health. This study evaluates the outcomes of surgically assisted transverse jaw expansion in adult OSA patients in Hong Kong.

Materials and methods: A retrospective analysis was conducted on OSA patients who underwent surgically assisted maxillomandibular expansion (MME) or maxillary expansion (MxE) between 2012 and 2025 at Department of Dentistry and Maxillofacial Surgery, United Christian Hospital, Hospital Authority, Hong Kong. Inclusion criteria included pre-operative Apnea-Hypopnea Index (AHI) ≥ 5 and age at surgery ≥ 16 . Objective outcomes measures included AHI and Lowest Oxygen Saturation (LSAT) pre- and post-operatively. Statistical analysis was performed with SPSS.

Results: A total of 10 subjects underwent surgical assisted transverse jaw expansion surgery (MME:6; MxE: 4). The median age of patients at surgery was 23.5 (IQR: 20-32). The median AHI significantly improved from 20.8 (IQR: 13.9-32.7) pre-operatively to 6.5 (IQR: 5.4 -26.8) post-operatively ($p = 0.022$). LSAT also showed improvement, increasing from a median of 85.5% (IQR: 78-89%) to 87.5% (IQR: 83-90%), although this change was not statistically significant ($p=0.153$).

Conclusions: This study demonstrates that surgically assisted transverse jaw expansion leads to a significant reduction in AHI and some improvement in LSAT in adult OSA patients. The findings suggest this surgical intervention may be effective to adult OSA patients; further study is warranted to confirm the result.

Acknowledgments: The authors would like to thank ENT colleagues Dr. Zion To and Dr. Bonnie Lam, orthodontist Dr. Frank Wong for their valuable contributions, as well as Mr. Alex Sum for his expert support with polysomnography, and Mr. Thomas Hui for his assistance with statistical analysis.

Polycystic Ovary Syndrome is associated with Masked Hypertension in Reproductive-Aged Women: Role of Obstructive Sleep Apnea

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Introduction: Women with polycystic ovary syndrome (PCOS) face increased cardiovascular disease risk earlier than others. This study aimed to identify abnormal blood pressure(BP) profile in patients with reproductive-aged PCOS compared to matched controls, and determine whether OSA contributes to elevated blood pressure and masked hypertension in patients with PCOS.

Materials and methods: The study finally included 176 reproductive-aged women who scheduled to receive firstly assisted reproductive technology (ART), including 111 patients with PCOS according to the Rotterdam criteria and 65 controls matched age and BMI, from reproductive center of Peking University People's Hospital between July 2023 and October 2024. All participants underwent standard office BP measurements, and overnight home sleep apnea test (HSAT) by NOX-T3 device before ART cycle, followed by 24-hour ambulatory blood pressure monitoring (ABPM) the next morning. ANCOVA and generalized linear models compared groups in 24-hour BP readings, multivariate linear regression examined links between OSA severity and BP measurements, and logistic regression assessed the relationship between OSA and masked hypertension and its component, all adjusting for confounders such as age, BMI, central obesity, HOMA-IR, and DM.

Results: Women with PCOS demonstrated higher rates of masked hypertension (daytime and 24-hour hypertension) compared to matched controls (3.1% vs. 18.0%, $P=0.018$; 4.6% vs. 17.1%, $P=0.044$), even after adjusting for HOMA-IR factor. This cardiovascular risk profile was accompanied by a markedly higher prevalence of OSA in the PCOS cohort (44.1% vs. 20.0%, $P<0.001$), with a mean AHI of 7 events/hour. Within the PCOS group, we observed a dose-response relationship between OSA severity and the prevalence of masked hypertension and its components (all $P<0.01$). Multivariate regression analysis confirmed that AHI was positively correlated with ambulatory BP measurements, including 24-hour, daytime, and nocturnal systolic/diastolic BP ($\beta = 0.56, 0.34, 0.49, 0.31, 0.77, 0.45$, respectively; all $P<0.001$), and it also as a significant risk indicator for masked hypertension in PCOS patients (adjusted $P<0.05$). Using the clinically relevant threshold of $AHI \geq 10$ events/hour,

OSA was associated with substantially increased risks of masked hypertension, including daytime hypertension (aOR=8.20, 95% CI: 1.74-38.62, $P=0.008$), and 24-hour hypertension (aOR=6.33, 95% CI: 1.39-28.90, $P=0.017$). A similar trend was observed for nocturnal hypertension, though this did not reach statistical significance (aOR=3.31, 95% CI: 0.91-12.03, $P=0.069$). Importantly, differences in 24-hour BP profiles between PCOS and non-PCOS groups disappeared entirely when patients with OSA were excluded from the analysis.

Conclusions: Women with PCOS exhibit higher 24-hour BP levels and increased rates of masked hypertension compared to matched controls, primarily mediated by OSA. This finding strongly suggests that OSA may be a key contributor linking PCOS to abnormal blood pressure regulation and increased cardiovascular risk in reproductive-aged women.

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Long-Term Outcomes of Combined Sleep Surgery for Obstructive Sleep Apnea: A 14-Year Retrospective Study in Hong Kong Patients

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Introduction: This is the first retrospective study to evaluate long-term outcomes of combined sleep surgery for OSA patients in Hong Kong over a 14-year period (2010-2024). The study aims to assess postoperative outcomes during early (<2 years), intermediate (2-4 years), long-term (4-8 years), and very long-term (>8 years) follow-ups for patients who underwent sleep surgery at the Department of Dentistry and Maxillofacial Surgery, United Christian Hospital, Hospital Authority.

Materials and methods: All subjects underwent maxillomandibular advancement surgery and advancement genioplasty as primary treatments. Simultaneous intra-pharyngeal surgery and/or staged transverse expansion surgery were performed based on individual clinical needs. Inclusion criteria included pre-operative Apnea-Hypopnea Index (AHI) ≥ 5 and age at surgery ≥ 16 . Objective outcomes were evaluated at various post-operative time points using polysomnography including Apnea-hypopnea index (AHI), Respiratory Disturbance Index (RDI), Oxygen Desaturation Index (ODI) and Lowest Oxygen Saturation (LSAT). Subjective outcomes were assessed using Epworth Sleepiness Scale (ESS).

Results: A total of 44 OSA subjects (male: 38, female: 6; age: 43.61 $\pm$ 13.15 [mean $\pm$ SD], range: 22-67; BMI: 24.11 $\pm$ 3.85) underwent sleep surgery. Significant improvement in AHI was observed with reduction from 44.64 $\pm$ 18.59 to 9.64 $\pm$ 8.10 events per hour in the early post-operative stage (<2 years, $p<0.001$), to 16.80 $\pm$ 11.06 events per hour in the intermediate term (2-4 years, $p<0.001$), 18.48 $\pm$ 9.45 events per hour in the long term (4-8 years, $p<0.001$) and to 20.35 $\pm$ 10.33 events per hour in the very long term (>8 years, $p<0.01$).

However, partial relapse was observed with AHI increasing significantly between the early postoperative stage (<2 years) and the intermediate term (2-4 years) ($p = 0.02$) and between the early postoperative stage and the long term (4-8 years) ($p < 0.001$) and the very long term (>8 years) though it was not statistically significant ($p = 0.15$). A similar trend was observed in RDI and ODI values. LSAT significantly improved from preop 75.30 $\pm$ 10.76 to 85.72 $\pm$ 5.91 (<2years, $p<0.001$), then dropped to 85.36 $\pm$ 2.74 (2-4years, $p=0.001$) and 81.46 $\pm$ 5.87 (4-8years, $p<0.001$) and 80.88 $\pm$ 6.47 (>8years, $p=0.480$). Nonetheless, improvement in ESS score was reported post-operatively after combined sleep surgery. Possible reasons for AHI increase in long term & very long term could be due to laxity of upper airway soft tissue with time, skeletal relapse, normal aging and weight gain.

Conclusions: This retrospective study highlights the short-and long-term effectiveness of combined sleep surgeries for OSA patients in Hong Kong. There was significant reduction in AHI and was sustained even in the very long term (>8 years), although partial relapse in AHI was observed during long term follow-ups. These findings emphasize the importance of continued monitoring and adjunct therapies to sustain the benefits of MMA-based OSA surgery.

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Apnea/hypopnea-related drops in pulse transit time predicts left ventricular dysfunction in obstructive sleep apnea

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Introduction: Pulse transit time (PTT) is widely used to assess vascular compliance and elasticity. This study aimed to determine whether the respiratory event-related PTT response would identify subclinical Left ventricular (LV) remodeling and dysfunction in obstructive sleep apnea (OSA).

Materials and methods: This retrospective study included OSA patients without pre-existing LV damage who underwent polysomnography between January 2014 and May 2017 at the Affiliated Huaian No.1 People's Hospital and The First Affiliated Hospital of Nanjing Medical University. LV measurements were assessed via echocardiography from December 2023 to May 2024. PTT measurements were validated using SOMNOscreen+ polysomnographic monitoring system. PTT drop magnitude refers to the difference between the initial value of the PTT decrease and the nadir triggered by apneas/hypopneas; PTT drop index is the number of drops per hour; PTT drop rate is the rate of decrease in PTT per second during the descending phase, and PTT area is the area above the waveform after respiratory events. Cox proportional hazard models estimated adjusted hazard ratios for incident LV damage, and receiver operating characteristic (ROC) curves assessed the predictive value.

Results: The sample included 517 individuals with a median (interquartile range) age of 53.0 (43.1-62.4) years and an AHI of 50.6 (32.6-65.5) events/hour. During a median follow-up of 8.3 (7.6-9.3) years, 112 patients (21.7%) had left ventricular hypertrophy (LVH), 249 (48.2%) had left ventricular diastolic dysfunction (LVDD), and none had LV systolic dysfunction. Individuals in the fourth quartile of PTT drop rate had a hazard ratio of 2.53 [95% (CI), 1.47-4.35] for LVH and 4.77 [95% CI, 3.15-7.21] for LVDD, respectively, compared to those in the first quartile. The results remained significant after adjusting for AHI and CVD. In contrast, no consistent associations were found with other PTT metrics, including drop magnitude, nadir, index, or area. In ROC curve analysis, PTT drop rate showed higher accuracy in predicting LVDD than compared to traditional polysomnography metrics.

Conclusions: Respiratory event-related PTT drop rate may be useful for predicting which patients with OSA are at increased risk for LV damage.

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Identifying Obstructive Sleep Apnoea in Headache Clinics: Clinical Clues and Diagnostic Considerations

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Introduction: Encounters with patients experiencing chronic headaches are common occurrences in neurology clinics. However, recognition of underlying obstructive sleep apnoea (OSA) in some of these patients remains limited amongst neurologists, potentially leading to suboptimal treatment with migraine medications and muscle relaxants, resulting in incomplete headache relief. Diagnostic clues from clinical features and ancillary test results are therefore essential to help neurologists identify these patients in a headache clinic and guide appropriate testing and treatment.

Materials and methods: Typical of a consecutive case series, patients who presented to a neurology clinic between June 2024 to June 2025 for the main complaints of chronic headaches (15 days or more, for at least 3 months) and with a STOPBANG score of 3 or more were included into this study. All patients subsequently

undergo home sleep apnoea tests (WatchPAT device) or overnight polysomnographies. Clinical features and ancillary test data were retrospectively analyzed, regardless of the presence, absence, or severity of OSA on diagnostic testing.

Results: We studied 26 patients, of which most (73.1%) were women (females to males = 2.7:1). The median age was 54.5 years (inter-quartile range [IQR] 49–63), and the median body mass index (BMI) was 28.3 kg/m² (IQR 23.1–36.6). Over half (53.8%) were obese (BMI >27 kg/m²), 26.9% were overweight (23–27.4 kg/m²), and 19.2% had normal BMI. Nearly all (88.5%) had cardiovascular risk factors—69.2% had hypertension, 30.8% hyperlipidaemia, 30.8% diabetes, 11.5% prior strokes, and 11.5% ischemic heart disease. Half had two or more risk factors. Among those with hypertension, 55.6% (10/18) were diagnosed before age 50, and 27.8% (5/18) before age 40. Chronic bitemporal/bifrontal headaches resembling tension-type headaches were the most common presenting complaint (84.6%), worsening in the morning for most (92.3%). All patients reported snoring and having non-restorative sleep. Other sleep complaints included dry mouth on waking (92.3%), nocturnal micturition (57.7%), choking/coughing during sleep (53.8%), and apnoeic episodes (15.4%). The median STOP-BANG score was 4.5 (IQR 4–5). Less than 1/3 (30.8%) had neck circumferences of >40cm, or BMIs of > 35kg/m² (26.9%). Despite frequent reports of daytime sleepiness (84.6%), their median Epworth Sleepiness Scale score was only 9 (IQR 4–11.5), with half scoring below those of pathologic sleepiness. 23 and 3 patients underwent home sleep apnoea testing and overnight polysomnography respectively. Their median sleep parameters were: sleep latency of 17.5 minutes (IQR 9.5–20), REM latency of 67 minutes (IQR 42.5–90.3), sleep efficiency of 84.6% (IQR 82.5–90.6), overall apnoea–hypopnoea index (AHI) of 24.4 (IQR 16.9–47.7), non-REM sleep of AHI 23.9 (IQR 7.3–45.4), and REM sleep AHI of 34.9 (IQR 28.2–51.6).

Conclusions: Notwithstanding the methodological limitations, our findings highlight the need to consider OSA in patients with chronic tension-type headaches, particularly when they are overweight, or have multiple cardiovascular risk factors. Hypertension before age 50 is an important diagnostic clue, while high Epworth Sleepiness Scale scores appear less reliable. Clinicians should screen for symptoms of sleep apnoea, and objective sleep assessments are recommended even in those with intermediate STOP-BANG scores.

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Unveiling the circHDAC9/miR-138-5p/SIRT1 Axis: A Novel Mechanism Linking Obstructive Sleep Apnea-Hypopnea Syndrome to Cognitive Impairment through Senescence-Associated Neuronal Autophagy

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Introduction: To investigate the circHDAC9/miR-138-5p/SIRT1 pathway in Intermittent Hypoxia (IH)-induced cognitive impairment for Obstructive Sleep Apnea-Hypopnea Syndrome (OSAHS) complication diagnosis and therapies.

Materials and methods: Ten 3-month-old male C57 mice were randomly divided into a control group (normoxic environment) and a model group (IH: 4.6–4.8% O₂ for 60 seconds followed by 20% O₂ for 30 seconds cyclically, 8 h/day). Cognitive function was assessed using the Morris water maze test. Hippocampal tissues were analyzed for histopathology, apoptosis, senescence, autophagy, mitochondrial structure, protein expression, and gene/protein levels via HE staining, Tunel staining, β -gal staining, transmission electron microscopy, immunofluorescence, and Real Time PCR/Western blotting. In vitro experiments used HEK293T cells to validate miR-138-5p targeting SIRT1 and circHDAC9 via dual luciferase assays, and HT22 cells to confirm circHDAC9 expression and its interaction with SIRT1 using FISH and RIP.

Results: Model group mice exhibited significantly impaired cognitive function ($p < 0.05$), increased hippocampal neuron aging, apoptosis, and autophagy ($p < 0.0001$), upregulated miR-138-5p, and downregulated circHDAC9 and SIRT1 ($p < 0.001$). Aging-related molecules and autophagy-related proteins were upregulated ($p < 0.001$), pro-

apoptotic Bax increased, anti-apoptotic Bcl2 decreased ($p<0.001$), and telomere length shortened ($p<0.0001$). Cell experiments confirmed miR-138-5p directly targets SIRT1 and circHDAC9, reducing luciferase activity ($p<0.0001$), and revealed an interaction between circHDAC9 and SIRT1.

Conclusions: OSAHS triggers cognitive decline through a "senescence-autophagy-apoptosis" cycle via circHDAC9/miR-138-5p/SIRT1 axis disruption. CircHDAC9's dual regulation (sponging miR-138-5p and interacting with SIRT1) reveals therapeutic targets.

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CPAP compliance trends from Cloud data: Who is on Cloud Nine?

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Introduction: Positive Airway Pressure (PAP) therapy is the preferred treatment for managing moderate to severe obstructive sleep apnea (OSA), but adherence varies. This study analyzes remotely accessed data from the Cloud on patients using ResMed device with an aim to explore factors which may affect PAP compliance including sex, age, mask type, daily usage patterns, and comorbidities.

Materials and methods: We analyzed data from 107 OSA patients (96 males, 11 females; mean age 56.7 years, range 24–86) over 364 days in 2024. Data included usage days, average daily usage (hours), maximum pressure, 95th percentile leak, maximum leak, mask type (nasal mask, full face mask, nasal pillow), and comorbidities (Obesity, hypertension, diabetes and coronary artery disease). Compliance was assessed across sex, age groups (20–39, 40–59, 60–69, 70+), mask types, daily usage duration (<4, 4–5, 5–6, 6–7, 7–8 hours), total usage (<70% vs. ≥70% of days), and comorbidities. Bayesian ANOVA was used, with Bayesian factor (BF_{10}) indicating the likelihood of reported interpretations.

Results: No significant sex-based differences in compliance were found. Age impacted usage: patients aged 60–69 used PAP for fewer hours daily ($BF_{10}=2.23$), had lower maximum pressure ($BF_{10}=14.42$), and higher 95th percentile and maximum leaks ($BF_{10}=4.03, 1.92$) compared to younger patients in the 20–39 age group. Patients over 70 had increased 95th percentile leaks ($BF_{10}=4.12$). Mask type influenced adherence: full face mask (FFM) ($BF_{10}=4.16$) and nasal mask (NM) users ($BF_{10}=2.7$) had longer total usage days than nasal pillow (NP) users; NM users also noted to have longer hours of daily usage ($BF_{10}=51$). Daily usage duration affected compliance: 6–7 hours/day users had longer total usage than <4 or 4–5 hours/day users ($BF_{10}=8.99, 513.73$). Those using 7–8 hours/day had longer total usage ($BF_{10}=3.03, 51.56$), higher maximum pressures ($BF_{10}=2.55$), and lower leaks ($BF_{10}=4.96, 1.82$) compared to 4–5 hours/day. Total usage (<70% vs. ≥70%) showed no differences in leaks or pressures. Obese patients used PAP longer ($BF_{10}=22$) and ≥70% during the year ($BF_{10}=50.72$) compared to non-obese, though daily usage time was similar.

Conclusions: Age, mask type, daily usage duration, and obesity significantly affect PAP compliance. Obese patients had higher compliance. Older patients (60–69, 70+) show reduced usage and increased leaks. FFM and NM users, and those with 6–8 hours daily usage duration, exhibit overall better adherence. Remote monitoring of compliance to identify issues earlier and providing personalized strategies will help to better manage patients with OSA.

Links of sleep-disordered breathing with dementia risk and healthcare utilization

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Introduction: In this study, potential associations of sleep-disordered breathing (SDB) with incident mild cognitive impairment (MCI), dementia, and healthcare utilisation will be examined using Kaiser Permanente (KP) Mid-Atlantic States electronic health record (EHR) data. Additionally, how these associations differ by race, sex, and adherence to continuous positive airway pressure (CPAP) therapy will be examined. Moreover, finding relevant influences of these associations, such as race/ethnicity, sex, and adherence to CPAP treatment, is one of the goals. Another is to verify the relationship between SDB diagnosis in KP EHR and the later development of MCI and dementia, as well as subsequent health service utilization.

Materials and methods: To investigate the relationship between OSA diagnosis and MCI and dementia diagnosis in the KP EHR, we will use an observational study design. ICD-10 codes for SDB and a variety of cognitive outcomes (such as moderate impairment and dementias) will be used to determine our key indicator, SDB diagnostic status, and cognitive outcomes. KP's vast database, which contains data on hospitalised patients, outpatients, and pharmacies, will be one of the data sources for our mixed effects models. Under the guidance of frameworks, cost-utility analysis will assess outcomes using information such as QALYs and medical costs. This approach can be put into practice in less than a year by focusing on direct and indirect cost comparisons and using the data that is now available.

Results: Our findings are supported by initial outcomes from previously published investigations. Over a five-year period, older women with sleep-disordered breathing had a 1.85-fold higher risk of mild cognitive impairment or dementia (Yaffe et al., 2011). Similarly, older persons with untreated obstructive sleep apnoea showed a noticeably higher rate of cognitive decline than those without SDB (Gosselin et al., 2019). Our preliminary data shows SDB may be a significant risk factor for neurocognitive impairment, especially for MCI.

Furthermore, even after treatment, individuals with OSA used healthcare resources and related expenses significantly more than controls (Sterling et al., 2024). Our study also highlights the financial cost of OSA and the importance of determining the factors that affect results, such as adherence to treatment and population inequalities.

Conclusions:

This study provides important knowledge gaps about the relationship between SDB and healthcare burden and cognitive impairment, as well as how these relationships may differ among demographic groups. The information gathered will help develop accessible methods of diagnosing, treating, and controlling OSA, which could enhance healthcare and cognitive outcomes for a variety of demographics. The results will also help guide future research to see whether treatments, including the use of CPAP, and comprehensive sleep surgical procedures, can lower the risk of dementia.

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Efficacy of Novel Oral Appliance and Novel Oral Positive Expiratory Pressure Accessory at reducing sleep apnea-specific hypoxic burden, a metric predictive of cardiovascular morbidity and mortality

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Introduction: Evidence suggests that moderate to severe OSA patients have increased risk of major adverse cardiovascular events (MACE; composite of coronary heart disease, heart failure, stroke, or cardiovascular mortality) and that sleep apnea-specific hypoxic burden (SASHB) is associated with increased risk of cardiovascular disease mortality. SASHB appears to be more predictive of OSA-related risk than AHI but has not been

extensively studied as a measure of therapeutic efficacy in patients treated with oral appliance therapy.

O2Vent Optima is a novel oral appliance that incorporates both mandibular advancement to reduce pharyngeal collapsibility and an air channel that allows airflow through the device to circumvent nasopharyngeal obstruction. The ExVent is an optional accessory to the novel oral appliance and provides oral Expiratory Positive Airway Pressure (EPAP) to support upper airway by passive dilatation of the airway, which reduces flow limitation.

This is the first assessment of combination therapy with novel oral appliance combined with an Oral EPAP accessory to reduce SASHB, rather than AHI, to define therapeutic efficacy.

Materials and methods: Data obtained from a clinical study to assess efficacy of the combination therapy with novel mandibular advancement device and novel oral EPAP accessory in the treatment of OSA were analyzed.

Forty-four study participants with OSA (moderate = 28, severe = 16) completed a diagnostic PSG study to obtain the baseline AHI and confirm a diagnosis of moderate to severe OSA. Subjects used the combination therapy at home for >3 months and logged usage hours. Subsequent to the home use, subjects underwent an in-lab PSG sleep night while using the combination therapy.

Results: Treatment with the combination therapy with novel mandibular advancement device and novel oral EPAP accessory reduced AHI from $28.5 \pm 6.4/\text{hr.}$ to $12.9 \pm 2.7/\text{hr.}$ ($p < 0.001$) and SASHB from $82.3 \pm 31.1 \text{ %min/hr.}$ to $16.7 \pm 9.4 \text{ %min/hr.}$ ($p < 0.001$). Average reduction in AHI with the combination therapy was 75%. Using an AHI-based definition of therapeutic efficacy ($\text{AHI} < 10/\text{hr.}$), 81% of participants achieved efficacy with the combination therapy. However, when the risk based SASHB definition of therapeutic efficacy ($\text{SASHB} < 53 \text{ %min/h}$) was utilized, therapeutic efficacy with combination therapy with novel mandibular advancement device and novel oral EPAP accessory increased to 92%.

Conclusions: Therapeutic efficacy with combination therapy with novel mandibular advancement device and novel oral EPAP accessory significantly improved to 92% by SASHB criteria as compared to 75% by AHI reduction criteria. Our study demonstrated that the use of AHI measurement would have misclassified a substantial number of individuals who responded to the combination therapy with novel mandibular advancement device and novel oral EPAP accessory based on more meaningful SASHB reduction of OSA-related risk.

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A Study on Selected Factors and Their Association with the Severity of Obstructive Sleep Apnea in Overweight and Obese Hypertensive Patients at Family Hospital in Vietnam

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Introduction: Obstructive sleep apnea (OSA) is prevalent among overweight and obese individuals with hypertension and is associated with an increased risk of cardiovascular, metabolic, and neurological complications. Identifying factors linked to OSA severity can support early diagnosis and improve management strategies. Therefore, this study aims to examine the relationship between various risk factors and the severity of OSA in hypertensive individuals who are overweight or obese.

Materials and methods: A cross-sectional study was conducted on 52 overweight and obese hypertensive patients at Family Hospital, Da Nang, Vietnam, from August 2024 to April 2025. Clinical data, including age, gender, BMI, neck circumference, and blood pressure, were collected. OSA was diagnosed using the American Academy of Sleep Medicine (AASM) criteria, and classified into mild, moderate, and severe by AHI. Statistical analysis included descriptive statistics, binary, and ordinal logistic regression.

Results: Of the 52 patients, 90.4% had OSA, with the majority being male (73.1%) and having grade I obesity (61.5%). The average age was $54.6 \text{ years} \pm 3.9$ (95% CI), average systolic blood pressure was $137.5 \pm 6.7 \text{ mmHg}$, diastolic pressure was $78.1 \pm 4.8 \text{ mmHg}$ (95% CI), and neck circumference was $41.6 \pm 0.5 \text{ cm}$ (95% CI). The majority of patients were diagnosed with severe obstructive sleep apnea (61.7%). The mean Apnea-Hypopnea Index (AHI) was $44.2 \pm 8.2 \text{ events/hour}$ (95% CI), with values ranging from 2.2 to 117.9 events/hour. The most common symptoms of OSA in obese patients with hypertension included loud snoring (100%), witnessed apneas during sleep (95.7%), excessive daytime sleepiness (93.6%), and daytime fatigue (87.2%). Many patients also had coexisting coronary artery disease.

Binary logistic regression showed that gender, age ≥ 60 years, and obesity were associated with OSA risk. Female gender was a potential protective factor (OR = 0.118; $p = 0.069$), while age ≥ 60 (OR = 6.835; $p = 0.164$) and obesity (OR = 2.661; $p = 0.240$) were linked to increased OSA risk, though the results were not statistically significant possibly due to a limited sample size. Ordinal logistic regression showed that BMI was significantly associated with OSA severity (OR = 1.24; 95% CI: 1.01–1.52; $p = 0.039$).

Conclusions: Gender, age ≥ 60 , and obesity may influence OSA risk in hypertensive overweight/obese patients, though the results were not statistically significant possibly due to a limited sample size, further studies with larger sample sizes are necessary. BMI was significantly associated with OSA severity.

Higher Trend of Severe OSA in Normal BMI Patients: Analysis from Western Part of India

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Introduction: Obstructive Sleep Apnea (OSA) is a prevalent sleep disorder characterized by repeated episodes of partial or complete obstruction of the upper airway during sleep. This study aims to analyze the demographic, clinical, and comorbidity profiles of patients diagnosed with OSA, and treatment outcomes.

Materials and methods: Data from 42 patients (31 males and 11 females) diagnosed with OSA were analyzed. The patients were categorized based on Body Mass Index (BMI), history of sleep apnea, duration of symptoms, comorbidities, Apnea-Hypopnea Index (AHI), Oxygen Desaturation Index (ODI), and Epworth Sleepiness Score (ESS). Symptom prevalence and treatment outcomes were also recorded.

Results: A total of 42 patients enrolled, with a mean age of 56.1 ± 16 years; 31 (73.8%) were males and 11 (26.2%) were females. Regarding BMI, 11 (26.2%) patients had a BMI of less than 25, while the majority, 31 (73.8%) patients, had a BMI of 25 or higher. A history of sleep apnea was reported by 37 (88.1%), with only 5 (11.9%) having no prior history.

The duration of symptoms varied, with the majority, 39 (92.9%) patients, experiencing symptoms for more than 6 months, and 3 (7.1%) patients for 1 to 6 months. Comorbidities were prevalent, with 11 patients having diabetes (26.2%), 33 patients having hypertension (78.6%), 10 patients having asthma (23.8%), 4 patients having chronic obstructive pulmonary disease (9.5%), 5 patients having ischemic heart disease (11.9%), and 9 patients having dyslipidemia (21.4%). Other comorbidities included post PTCA, chronic rhinosinusitis, severe eosinophilic asthma, asthma-COPD overlap, chronic severe asthma, and asthmatic bronchitis incidence were similar (1.2.4%).

The severity of OSA was categorized as mild for 6 patients (14.3%), moderate for 6 patients (14.3%), severe for 26 patients (61.9%), very severe for 2 patients (4.8%), moderate to severe for 1 patient (2.4%), and mild to moderate for 1 patient (2.4%). Majority of patients were treated with CPAP and outcomes showed that 26 patients experienced improvement (61.9%), while 16 patients remained stable (38.1%).

In current study we observed, out of 42 patients, 11 have **normal BMI** and still have OSA. This represents **26.19%** of the total patients, indicating significant proportion of patients with normal BMI also suffer from OSA. In group of BMI >25 , ODI showed 3% with normal, 16% with mild, 19% with moderate, and 61% with severe scores, compared to 18%, 27%, 18%, and 36% respectively in BMI <25 ($p = 0.262$). For, ESS 29% of the BMI >25 group were classified as normal, 32% mild, 6% moderate, and 32% severe, in BMI <25 group had 45% normal, 36% mild, 9% moderate, and 9% severe scores ($p = 0.48$). Regarding the STOP-BANG score, 77% of individuals with BMI >25 were at high risk and 23% at intermediate risk, compared to 82% and 18% respectively in the BMI <25 group ($p = 1$).

Conclusions: The analysis of the data indicates a high prevalence of severe OSA among the patients. Notable proportion of patients with normal BMI also suffer from OSA, highlighting the importance of considering OSA risk factors beyond BMI. Treatment outcomes showed improvement in more than half of the patients.

The Effectiveness of a Smart Sleep Apnoea Self-Management Support Program (4S) in Improving Cardiovascular Risk and Quality of Life in Subjects with Moderate to Severe Obstructive Sleep Apnea: A Randomized Controlled Trial

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Introduction: Obstructive Sleep Apnea (OSA) affects 9% to 38% of the global population, contributing to cardiovascular diseases and a reduced quality of life. Self-management strategies, including increased physical activity, weight control, and regular monitoring, can help reduce symptoms and lower the risk of complications. This study assessed the effectiveness of the 1-year Smart Sleep Apnea Self-Management Support Program (4S) in improving cardiovascular health risks.

Materials and methods: This was a two-arm randomized controlled trial. Eligible patients had moderate to severe OSA, a BMI >23, and engaged in less than 150 minutes of moderate physical activity per week. Participants were recruited from two hospitals and randomly allocated to either the 4S intervention group or the General Hygiene Information (GHI) control group.

The 4S intervention included: (i) Two 30-minute brief motivational interviewing sessions, (ii) Scheduled theory- and theme-based instant messages and phone calls, (iii) Personalized chat-based coaching, and (iv) An e-platform for goal setting and self-monitoring.

The GHI control group received general health information at similar frequencies and in a comparable format. Quantitative assessments were conducted at baseline, 4 months, and 12 months. A linear mixed model was used to compare changes in cardiovascular risk factors between the 4S intervention group and the GHI control group.

Results: A total of 123 participants (73.2% male, mean age 60 years, BMI 30 kg/m²) with moderate to severe OSA were recruited. Baseline characteristics did not differ between the two groups. The intervention group showed increases in Positive Airway Pressure (PAP) use and engagement in moderate physical activity. There was a significantly greater increase in PAP use in the intervention group compared to the control group. However, the difference in changes in engagement in moderate physical activity was not statistically significant between the two groups. The intervention group showed significant reductions in body weight, waist circumference, systolic blood pressure, and triglyceride levels compared to baseline. These reductions were significantly greater in the intervention group compared to the control group.

Conclusions: The 4S program demonstrated significant improvements in cardiovascular health risk factors among physically inactive, overweight individuals with moderate to severe OSA. By promoting self-management and sustainable health behaviors, the program may provide an effective approach to improving outcomes for individuals with OSA.

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Alterations in Psychomotor Vigilance and Influencing Factors in Mild Obstructive Sleep Apnea

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Introduction: To investigate the characteristics of cognitive impairment in patients with mild obstructive sleep apnea (OSA) and its influencing factors, providing evidence for early intervention and cognitive health improvement.

Materials and methods: We enrolled patients who underwent polysomnography (PSG) at our sleep center for snoring between November 2022 and August 2024, with an apnea-hypopnea index (AHI) <15. Patients with mild OSA (AHI 5-15 events/hour, n=167) were assigned to the case group, while those with simple snoring (AHI <5 events/hour, n=109) served as controls. Cognitive function was assessed using the Psychomotor Vigilance Test (PVT). PSG recorded sleep parameters, oxygen saturation, and AHI. Additional data including daytime sleepiness (Epworth Sleepiness Scale, ESS), sleep quality (Pittsburgh Sleep Quality Index, PSQI), and subjective snoring impact (Visual Analog Scale, VAS) were collected. Statistical analyses compared cognitive function between groups and examined correlations with various factors.

Results: Compared with controls, mild OSA patients showed significantly prolonged PVT reaction time (504.62 ± 122.96 ms vs 463.95 ± 62.54 ms, $P=0.005$) and increased lapse counts (25.22 ± 20.42 vs 19.29 ± 10.82 , $P=0.001$). The mild OSA group had higher PSQI total scores (7.63 ± 1.96 vs 7.13 ± 1.77 , $P=0.028$), with significant differences particularly in sleep quality ($p=0.04$) and sleep latency ($p=0.006$). Mild OSA patients reported greater subjective snoring severity ($p=0.005$), especially regarding work impact ($P=0.043$), though no significant differences were found in life or family impact. Multivariate analysis identified age and sleep quality as significant predictors of PVT impairment.

Conclusions: Mild OSA patients demonstrate impaired PVT performance compared to simple snorers, with age and sleep quality being key contributing factors. Early identification and intervention targeting these factors may help prevent and mitigate cognitive dysfunction in mild OSA patients.

Effects of Reboxetine alone and in combination with Oxybutynin on quantitative electroencephalogram measures of alertness in obstructive sleep apnea

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Introduction:

Obstructive sleep apnoea (OSA) often causes excessive daytime sleepiness, which can have major consequences on health, safety and productivity. Recent studies of noradrenergic and antimuscarinic agents to treat OSA have been promising, however subjective assessments of sleep quality and daytime sleepiness with these agents have shown inconsistent results. This study aimed to assess the effects of the noradrenergic agent reboxetine alone and in combination with the antimuscarinic oxybutynin on next-day alertness through objective assessment of quantitative electroencephalography (qEEG) power during resting wakefulness. We hypothesised that these agents would improve next day alertness through reduced wake EEG delta and theta power.

Materials and methods:

16 people with OSA from a double-blind, randomized, three-way crossover trial of 4mg reboxetine, placebo or 4mg reboxetine with 5mg oxybutynin completed morning and evening Karolinska Drowsiness Tests (KDT). Drug administration occurred after the evening KDT. Power spectral analysis of resting wake EEG data during eyes open and eyes closed conditions, and across the entire KDT was conducted with linear mixed models. EEG power in delta (0.5 – 4 Hz) and theta (4 - 8 Hz) frequency ranges during the morning KDT tests were the primary alertness variables of interest.

Results:

There was no significant main effect of treatment (Reboxetine vs placebo vs Reboxetine-Oxybutynin) on slow EEG frequencies during the morning KDT. There was no treatment by test time interaction, however there was a significant effect of testing time on EEG metrics. Delta EEG power during eyes open ($F[1, 54.3] = 35.9$; $p < 0.001$) and the entire KDT was significantly higher ($F[1, 58.8] = 32.5$; $p < 0.001$), during morning compared to the evening. Theta power was also higher during the eyes open condition in the morning ($F[1, 59.5] = 8.8$; $p = 0.004$).

Conclusions: Reboxetine with and without oxybutynin did not improve or impair morning alertness as measured by delta and theta EEG power during resting wakefulness. Despite the lack of improved alertness, these findings support the safety profile of these agents.

Acknowledgments:

TJA contributed substantially to the acquisition of the data. CT, AV, DJE and TJA contributed substantially to the study design. All authors contributed to the data analysis, interpretation of the data and writing of the manuscript. All authors approve of the final version to be published and agree to be accountable for all aspects of the work.

An Updated Network Meta-Analysis of Pharmacological Therapies for Obstructive Sleep Apnea: Effects on AHI Reduction and Lowest Oxygen Saturation Improvement

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Introduction:

Obstructive sleep apnea (OSA) affects nearly one billion adults worldwide and is linked to cardiovascular, metabolic, and neurocognitive complications. Continuous positive airway pressure (CPAP) remains the gold-standard therapy, but adherence is often poor and its effects are limited to airway collapsibility. Pharmacological treatments have emerged as promising alternatives, targeting multiple pathophysiological mechanisms. Recent trials not only assess the apnea-hypopnea index (AHI) but also SpO₂ nadir, a key marker of nocturnal hypoxemia and cardiovascular risk. This review synthesizes new evidence, offering an updated and clinically relevant evaluation.

Materials and methods:

We systematically searched PubMed, Scopus, EBSCO, and Taylor & Francis for studies published between January 2019 and June 2025. Eligible articles were randomized controlled trials in humans, available in full text, written in Bahasa Indonesia and English, and reporting pharmacological interventions for obstructive sleep apnea (OSA) with outcomes including AHI and SpO₂ nadir. Non-pharmacological interventions and incomplete data were excluded. Data extraction followed the PICO framework and PRISMA flowchart. Meta-analyses were performed in R with 95% confidence intervals, and study quality was assessed using Cochrane RoB 2.0.

Results:

Nineteen randomized controlled trials (RCTs) involving 446 patients (17 crossover, 2 parallel) were included in this network meta-analysis. The network geometry was predominantly placebo-controlled with minimal heterogeneity observed for both AHI ($\tau^2 = 27.057$, $I^2 = 0.8\%$) and nadir SpO₂ ($\tau^2 = 0.000$, $I^2 = 0.0\%$). For AHI, two regimens demonstrated significant superiority over placebo: atomoxetine 80 mg plus trazodone 50 mg (MD -18.60 events/h; 95% CI -32.99 to -4.21) and atomoxetine 80 mg plus trazodone 100 mg (MD -10.80 ; 95% CI -21.17 to -0.43). Both achieved the highest SUCRA probabilities (0.917 and 0.753). Other agents, including atomoxetine monotherapy and atomoxetine-oxybutynin, showed non-significant numerical improvements, while sedatives such as morphine, dexmedetomidine, and propofol tended toward AHI worsening with the lowest SUCRA values. For nadir SpO₂, significant improvements were observed with atomoxetine 80 mg plus trazodone 50 mg (MD $+5.00$; 95% CI $2.99-9.00$), atomoxetine 80 mg plus trazodone 100 mg (MD $+2.00$; 95% CI $1.43-2.57$), and atomoxetine 80 mg plus lemborexant 10 mg (MD $+2.00$; 95% CI $0.99-3.01$). In contrast, morphine (-1.30 ; 95% CI -2.55 to -0.05) and propofol (-1.80 ; 95% CI -2.94 to -0.66) significantly reduced nadir SpO₂. SUCRA rankings aligned with these findings, positioning atomoxetine-trazodone combinations as most effective and sedatives as least favorable. Both outcomes suggested no likelihood of major publication bias.

Conclusions:

Pharmacological therapy may provide a promising alternative for patients with OSA who struggle to tolerate CPAP. Among the agents studied, atomoxetine–trazodone combinations offered the most consistent improvements in reducing AHI and improving SpO₂ nadir, reflecting a synergistic effect on airway tone and arousal threshold. While these findings highlight potential therapeutic value, the evidence is still limited underscoring the need for larger head-to-head trials to confirm efficacy, safety, and long-term benefits.

Reading Your Sleep: Learning SpO₂ Words and Sentences for OSA Detection and Subtyping

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Introduction: Obstructive Sleep Apnea (OSA) is a prevalent and serious sleep-disordered breathing condition. However, the current gold standard for OSA diagnosis, polysomnography (PSG), is a complex and costly procedure that relies heavily on expert interpretation of multi-channel signals. These limitations severely hinder its application in early screening and large scale population monitoring. Therefore, developing an accessible, low-cost, and reliable automated diagnostic method is of paramount importance. To this end, our study pioneers a approach that translates continuous SpO₂ signals into discrete "physiological words" and "sentences." By learning to read this oximetry language, we aim to provide an efficient and scalable solution for widespread OSA screening, perfectly suited for home based monitoring via wearable devices.

Materials and methods: We propose a novel pipeline to lingualize SpO₂ time series data. Three large-scale clinical datasets—MrOS, SHHS, and MESA—comprising a total of 14,430 polysomnography recordings are utilized as the foundation for both tokenizer construction and model pre-training. To begin, we augmented overnight SpO₂ signal segments from these datasets to create a diverse and representative training pool. Using unsupervised clustering on this enhanced dataset, we constructed a vocabulary of SpO₂ words. Each patient's full-night SpO₂ time series was then tokenized into sequences of these discrete words, which were subsequently organized into physiological sentences. A Transformer-based architecture was pre-trained on these token sequences, with the objective of learning the underlying grammar and semantics of the oximetry language through masked token prediction. The model was then fine-tuned for patient-level OSA detection and evaluated on independent validation cohorts. In addition, we explored the model's potential for identifying OSA subtypes by analyzing its behavior on misclassified cases to uncover atypical physiological patterns.

Results: Our model demonstrated excellent performance on an internal test set from a Chinese cohort (n=848, from a 4,240-subject fine-tune dataset from Shanghai Sixth People's Hospital), achieving an AUC of 0.958. To assess generalizability, we conducted external validation on three independent, multi-ethnic cohorts: the CFS (n=730), WSC (n=2,568), and STAGES (n=1,820) datasets. The model exhibited robust performance across these external datasets, attaining AUCs of 0.900, 0.926, and 0.823, respectively. Further analysis of misclassified cases revealed a subset of atypical OSA patients who were prone to false negatives. These individuals exhibited only mild, transient, or morphologically irregular oxygen desaturation events, with overall higher SpO₂ levels. While their oximetry patterns reflected underlying respiratory instability, the absence of overt hypoxic features posed a challenge for accurate detection by conventional models.

Conclusions: This study successfully demonstrates that lingualizing single-channel SpO₂ signals and leveraging NLP pre-trained models offers a feasible and highly effective pathway for accurate, automated OSA detection, with its robust generalizability validated across multiple independent cohorts. Furthermore, our framework reveals a powerful analytical capability: by conducting in-depth analyses of cases misclassified by the model, we have identified a set of clinically atypical patterns of subtle or irregular oxygen desaturation. This demonstrates that our method is a potent tool capable of reading deeper into the nuances of sleep-disordered breathing, paving the way for the discovery and understanding of different OSA subtypes.

Determining the Minimum Nights Required for Reliable Wearable-Based Assessment of Sleep Architecture and HRV in OSA, Insomnia, and COMISA

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Introduction: Single-night polysomnography (PSG) often fails to capture the full spectrum of sleep architecture and autonomic variability due to night-to-night variability, particularly in patients with OSA, insomnia, or co-morbid insomnia with obstructive sleep apnea (COMISA). While wearable devices now provide a scalable solution for multi-night assessment, the optimal number of nights required for reliable measurement remains uncertain. This study aims to determine the minimum number of nights needed to achieve stable estimates of sleep parameters and heart rate variability (HRV) metrics using the Belun Ring (BR) in individuals with OSA, insomnia, or COMISA.

Materials and methods: A cohort of 123 adults (median age: 61 years; 52% female; median BMI: 24.7; 30% OSA, 52% insomnia, 18% COMISA) underwent multi-night BR monitoring (median: 6 nights; IQR: 5-7; ≥ 100 minutes/night) following screening by a clinical psychologist and pulmonologist. Insomnia was defined by an Insomnia Severity Index (ISI) ≥ 15 or a diagnosis per ICSD-3 criteria, and COMISA was defined as meeting insomnia criteria with AHI ≥ 15 events/h. Sleep metrics included total sleep time (TST), sleep efficiency (SE), REM sleep, wake time, sleep onset latency (SOL), wake after sleep onset (WASO), and HRV time-domain metrics. Reference values were derived from the average of all available nights. The concordance correlation coefficient (CCC) was used to evaluate agreement between N-night averages and reference values, with 1,000 bootstrapped simulations performed for each N-night scenario.

Results: Across all participants, most metrics achieved a lower 95% CI of CCC ≥ 0.85 by the third night, with simulations confirming that three nights were sufficient for stable estimates. SOL exhibited the highest variability, requiring more than six nights to reach comparable precision. Stratified analyses revealed that participants with insomnia or COMISA required three nights for reliable estimation of insomnia-related metrics, whereas OSA patients required four or more nights for WASO to reach CCC ≥ 0.85 . While two nights of recording substantially improved accuracy, three nights effectively minimized night-to-night variability in both sleep architecture and HRV metrics.

Conclusions: This study is the first to establish evidence-based recommendations for the minimum number of nights required for reliable wearable-based assessment of sleep and HRV in patients with OSA, insomnia, and COMISA. Our findings demonstrate that three nights of wearable monitoring provide robust and stable estimates, offering a practical and scalable alternative to single-night PSG. These results have significant clinical implications for optimizing insomnia management and enhancing COMISA detection in both psychiatric and sleep medicine practice.

Reduced N3 Sleep Is Associated with Cognitive Impairment in Elderly Patients with Obstructive Sleep Apnea

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Introduction: This study aimed to identify the prevalence and severity of cognitive impairment in elderly patients with obstructive sleep apnea (OSA), and to explore the association between sleep structure and mild cognitive impairment in elderly patients with OSA.

Materials and methods: 207 elderly patients were diagnosed with OSA (AHI ≥ 5) were continuously enrolled this study from the Division of Sleep Medicine of Peking University People's Hospital between February 2023 to November 2024. Montreal Cognitive Assessment Scale (MoCA)-Beijing was used to assess the prevalence and severity of cognitive impairment. Overnight polysomnography (PSG) was used to evaluate the sleep structure

respiratory event. The sleep structure respiratory event are manually scored by trained sleep technicians, and all the scores are carried out in accordance with the criteria of the AASM (American Academy of Sleep Medicine) Manual for the Scoring of Sleep and Associated Events, Version 3.0. The Spearman analysis was used to assess the correlation between sleep structure and MCI score. Multivariate logistic regression was applied to analyze the relationship between MCI and sleep structure after controlling for confounding variables.

Results: 45.8% elderly patients with OSA were diagnosed with MCI ($\text{MoCA} \geq 26$). Compared to patients without MCI, elderly patients with OSA complicated by mild cognitive impairment had significantly reduced total sleep time, sleep efficiency, and the percentage of N3 sleep stage, while the increased percentage of N1 sleep stage. Multivariate analysis found that a reduction in N3 - stage sleep was correlated with total MCI ($P < 0.05$), a reduced in N3 - stage sleep is a risk factor for MCI in patients with OSA ($P < 0.05$), ($\text{OR} = 0.95$, 95% CI : 0.91, 1.00).

Conclusions: In elderly patients with OSA, The prevalence and severing of MCI is increasing. a reduction in N3 - stage sleep is associated with mild cognitive impairment.

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Exploring the treatment journey of Obstructive Sleep Apnoea: A scoping review on the perspectives of Chinese patients

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Introduction: Globally, obstructive sleep apnoea (OSA) is a common sleep-related breathing disorder, thought to affect up to 23.6% of patients of Chinese ethnicity. However, little is known about the perspectives of the Chinese patient population and the key factors underpinning their health behaviours and treatment engagement. This scoping review aims to systematically synthesise the literature to understand Chinese patient perspectives towards OSA and its management.

Materials and methods: A systematic search was conducted in Jul 2023 and May 2024 across CINAHL, Embase, Medline, PsycINFO, and Scopus in Chinese and English for studies including the concepts: obstructive sleep apnoea, adult Chinese patients, treatments (CPAP, surgery, mandibular devices, pharmacotherapy, positional therapy, complementary therapies, lifestyle changes), and psycho-social-behavioural factors. Search results were screened and data extracted by 2 independent reviewers. Publications meeting the following criteria were included in this review: adult patients (≥ 18 years) self-identifying as Chinese with OSA (sample); patient experiences of various OSA treatments (phenomenon of interest); primary studies published in a peer-reviewed journal and written in English or Chinese (design); inclusion of a patient-reported outcome related to their OSA treatment at any stage of the treatment trajectory (evaluation).

Results: From the 976 results, 49 studies were retrieved, comprising of 16,239 adults (mean age: 47 years, 80% male); conducted primarily in China, Hong Kong, Taiwan and Singapore. Studies were broadly synthesised into the following patient-centred domains: beliefs about OSA, treatment preferences, acceptance, satisfaction, and adherence. Considerable heterogeneity was observed in the measurement of treatment acceptance and satisfaction, coupled with insufficient reporting of factors influencing treatment preference. Notable limitations included the under-representation of older women and migrant Chinese populations and the limited coverage of health beliefs and health behavioural change.

Conclusions: Factors influencing patient engagement with OSA treatments are multifactorial. Patients' health beliefs and sociocultural factors play an important role in treatment acceptance and adherence. Future research should focus on patient-centred approaches to identify strategies to promote behavioural change and provide culturally sensitive care.

Development and Validation of a Reversible Obstructive Sleep Apnea Pig Model Using Cross-Linked Sodium Hyaluronate

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Introduction: Obstructive sleep apnea (OSA), affecting >900 million adults globally, lacks translational animal models that accurately replicate human pathophysiology. Current models (e.g., rodents, canines, monkeys) suffer from anatomical mismatches, irreversibility, or ethical constraints. This study introduces a method to induce upper airway obstruction by injecting a cross-linked sodium hyaluronate mixture into the pharynx and palate of Bama pigs, creating an animal model that simulates recurrent upper airway collapse in patients with OSA. This model features a definable and controllable obstruction plane with a reversible degree of obstruction. The modeling effect was evaluated by polysomnography (PSG), upper airway computed tomography (CT), and HIF-1 α , which provided assurance at the clinical presentation, imaging, and biochemical levels for subsequent studies in this animal model. Histopathologic analysis of various respiratory tract locations, combined with monitoring of TNF- α and IL-6 in upper airway secretions and serum, helped to determine the respiratory system response to OSA conditions.

Materials and methods:

- **Model Design:** Palatal-pharyngeal injections of sodium hyaluronate/iohexol/penicillin (19.25 ml avg.) in Bama pigs (n=4) under Zoletil®/Remimazolam anesthesia.
- **Validation Metrics:**
 - Polysomnography (PSG) quantifying AHI/ODI and SpO₂ desaturation.
 - Serial CT imaging measuring airway volume/cross-sectional area.
 - Histopathology (H&E/Masson staining) and ELISA for HIF-1 α , IL-6, TNF- α in serum/airway secretions.
- **Reversibility:** Longitudinal monitoring over 28 days post-injection.

Results:

1. **Effective Obstruction Induction:**
 - **AHI surged to 23.25 ± 2.99 events/hr ($p=0.003$) post-injection, with minimum SpO₂ dropping to $72.25 \pm 14.18\%$.**
 - **CT confirmed airway narrowing (min. cross-section: 157.48 ± 29.14 mm² $\rightarrow$ 46.18 ± 10.91 mm², $p=0.0112$).**
2. **Reversible Physiology:**
 - Gradual AHI normalization to 8.00 ± 1.41 events/hr by day 14, correlating with airway volume recovery ($5,420 \rightarrow 11,157$ mm³, $p=0.0308$).
3. **Inflammatory Pathways:**
 - Serum HIF-1 α and IL-6 surged acutely post-obstruction.
 - Histopathology revealed lymphocytic infiltration, alveolar septal thickening ($p=0.0118$), and pharyngeal hyperkeratosis.
4. **Key Correlations:**
 - **AHI strongly linked to airway anatomy (cross-section: $R^2=0.7421$, $p<0.001$).**
 - **TNF- α in secretions correlated with AHI ($R^2=0.3949$, $p=0.003$).**

Conclusions: In this study, we successfully established a reversible, safe, and reliable animal model of OSA using a novel technique involving the precise multi-point injection of a cross-linked sodium hyaluronate mixture into the palatopharyngeal region of pigs via the oral cavity. This model accurately simulates upper airway collapse, leading to obstruction, closely mimicking the pathophysiology of OSA in patients. Consequently, it serves as an invaluable tool for future research on OSA.

Tailored palatal surgery for obstructive sleep apnea patients with lateral pharyngeal wall collapse based on DISE phenotyping

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Introduction: Obstructive Sleep Apnea (OSA) is a heterogeneous disorder caused by a combination of anatomical and physiological factors that lead to upper airway collapse during sleep. Drug-Induced Sleep Endoscopy (DISE) provides real-time visualization of dynamic upper airway obstruction and has emerged as a valuable tool for individualized surgical planning. Among the various sites of collapse, the lateral pharyngeal wall has been increasingly recognized as a key contributor to airway obstruction in OSA. The aim of this study was to evaluate the utility of DISE in guiding the selection of palatal surgical techniques and to assess their clinical efficacy in OSA patients with lateral pharyngeal wall collapse.

Materials and methods: Patients with moderate to severe OSA underwent DISE to determine their patterns of upper airway obstruction. DISE phenotyping revealed a high prevalence of lateral pharyngeal wall collapse in this population. Surgical interventions were selected based on the severity and pattern of collapse observed.

Results: Patients were stratified to undergo soft palate webbing flap pharyngoplasty, relocation pharyngoplasty, or expansion sphincter pharyngoplasty according to their DISE findings. Uvuloplasty (e.g., soft palate webbing flap) was recommended for patients with mild to moderate OSA and minimal lateral wall collapse (< grade I) in DISE findings. Relocation pharyngoplasty was performed in patients with moderate lateral wall collapse (> grade II) and tonsillar hypertrophy (over grade 2 tonsil hypertrophy). Expansion sphincter pharyngoplasty was indicated for those with severe circumferential narrowing and significant lateral pharyngeal wall involvement (> grade III) in DISE findings and over grade 2 bilateral tonsil hypertrophy. Clinical outcomes showed that soft palate webbing flap pharyngoplasty achieved a 40.1% success rate, with mean apnea-hypopnea index (AHI) decreasing from 25.7 to 15.1 in selected cases of primary snoring and mild to moderate OSA. Relocation pharyngoplasty resulted in a 52.9% success rate and a 65.8% response rate in patients with moderate lateral wall collapse and enlarged tonsils. Expansion sphincter pharyngoplasty yielded favorable outcomes in severe OSA cases, with marked improvements in AHI and retropalatal patency.

Conclusions:

DISE-directed surgical planning allows for phenotype-based stratification and targeted correction of airway collapse in OSA. Tailoring palatal surgery according to specific collapse patterns—particularly those involving the lateral pharyngeal wall—leads to improved clinical outcomes and reduced surgical failure. This individualized approach represents a significant advancement in the personalized management of sleep-disordered breathing.

Refining the Detection of Sleep-disordered Breathing Events: Improving Annotations in National Sleep Research Resource (NSRR) Polysomnography Data

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Introduction: The Sleep Heart Health Study (SHHS), the Osteoporotic Fractures in Men Study (MrOS), and the Multi-Ethnic Study of Atherosclerosis (MESA) are frequently used public sleep study datasets provided by the National Sleep Research Resource (NSRR). These datasets contain full overnight polysomnography recordings with annotated sleep events. However, apnea and hypopnea were labeled solely based on flow reduction, ignoring sleep stages, desaturation, or arousal as required by American Academy of Sleep Medicine (AASM) guidelines. This discrepancy could introduce considerable inconsistency and ambiguity in future studies. Here, we aim to develop a standardized process for analyzing respiratory event annotations from major NSRR datasets and provide updated labels.

Materials and methods: This retrospective study examined polysomnography annotations from SHHS1 (n=5,793), SHHS2 (n=2,651), MrOS1 (n=2,904), MrOS2 (n=1,026), and MESA (n=2,054). Dataset characteristics, including scoring methods and known issues, were analyzed. Then, we evaluated the discrepancy between the reported apnea-hypopnea index (AHI) and the AHI derived from raw annotations and the recalculated AHI adjusted for sleep stage, desaturation, and arousal based on AASM guidelines. Subsequently, we performed identical analysis on the Korea Image-based Sleep Study (KISS) dataset (n=7,745) for comparison. Finally, we highlighted the importance of precise annotations by developing an electrocardiogram-based sleep-disordered breathing event detection model using original and adjusted annotations from SHHS1, SHHS2, and MESA and comparing sleep apnea (SA) severity classification (Normal, Mild to Moderate, Severe) performance.

Results: The raw labels consistently overestimated AHI across all cohorts, with the largest mean absolute error (MAE) in SHHS1 (23.55 events/hour). Other datasets showed moderate overestimations: SHHS2 (10.45), MrOS1 (11.16), MrOS2 (10.31), and MESA (13.09). After adjusting the annotations per AASM scoring criteria, MAEs were dramatically reduced across all datasets: SHHS1 improved to 1.29 events/hour, SHHS2 to 1.20 events/hour, MrOS1 to 1.03 events/hour, MrOS2 to 0.56 events/hour, and MESA to 0.78 events/hour. Notably, the KISS, which strictly followed the contemporary scoring guidelines in its raw annotations, demonstrated inherently high accuracy with a MAE of 0.6 events/hour, requiring no further processing. Lastly, SA severity classification significantly improved with our annotations compared to the original ones, with the FI score rising from 0.35 to 0.66.

Conclusions: Annotations of SHHS, MrOS, and MESA require additional processing to accurately identify respiratory events consistent with AASM guidelines. Our updated labels will facilitate unambiguous annotation usage, promoting reproducibility and enabling comparisons in future studies, as shown by our deep learning experiment result. KISS offers the most reliable annotations among the datasets studied.

Success rate of Portable Polysomnography in Snoring and Obstructive Sleep Apnea Patients in ENT Clinic Srinagarind Hospital, Khon Kaen University

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Introduction: Study objectives: To study the success rate of portable PSG, used in diagnosis and treatment monitoring in the snoring and sleep disorders clinic, Department of Otorhinolaryngology, Faculty of Medicine, Khon Kaen University, Thailand

Materials and methods: This study is a retrospective descriptive study in adult patients over 18 years old who received services at a snoring and sleep disorders clinic, Department of Otorhinolaryngology, Srinagarind Hospital from 2012 – 2019. Patient information was collected from Srinagarind Hospital's medical records. The collected data consisted of general patient information. Data based on the modified STOP BANG questionnaire, clinical data, physical examination, underlying diseases, portable PSG examination data results. All data were analyzed through percentage statistics and spearman correlation.

Results: There were 1,028 new patients, 110 were pediatric patients and 918 were patients over 18 years old. 58 patients were unable to retrieve data. The remaining 858 cases(93.5%) 550 were male (64.1%) and 308 female(35.9). Most of the cases, 256 patients (29.3%) aged between 50-60 years. 680 cases were diagnosed with OSA (79.2%) Most of the patients had modified STOP BANG at 4 points, 30%. There were 659 patients who tested PSG or 76.8%, divided into port PSG 599 cases, 69.8% of the patients were diagnosed with severe OSA 34.4% and moderate OSA 25.5%. There were 12 cases with re-test for PSG, or 1.8%. When studying the relationship between modified STOP BANG and the results of portable PSG, it was found that modified STOP BANG was greater than 2 and AHI with cut off value greater than 15 was found sensitivity 86.7% and specificity 26.4%. The Spearman correlation coefficient was 0.25 at P < 0.01 when comparing modified STOP BANG with portable PSG results. The majority of patients in the clinic 490 patients(57.1%) used CPAP, 83 cases(9.7%) were treated by surgery and 13 cases(1.5%) used mandibular advancement devices . After treatment with additional life style modifications most of the patients' symptoms improved.

Conclusions: Portable polysomnography has the advantage of ease of use, better accessibility and lower cost. It can be utilized for diagnosis of OSA in areas in which in lab PSG is not yet fully accessible, with minimal data loss or inconclusive diagnoses.

Acknowledgments: This study was approved by Khon Kaen University Ethics Committee project no. HE641573. We thank you Mrs. Arunya Kotelong the clinic nurse for assistance in data collection.

Sleep and cardiovascular outcomes are worse in people with co-morbid obstructive sleep apnoea and chronic respiratory disease: insights from consumer data

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Introduction: Respiratory disease and obstructive sleep apnoea (OSA) are individually associated with increased risk of cardiovascular disease (CVD) and all-cause mortality. People with co-morbid respiratory disease and OSA (co-ROSA) may be at increased cardiovascular risk due to worse night-time hypoxemia which may be exacerbated by disrupted sleep. However, there is a lack of data assessing sleep and cardiovascular risk in co-ROSA.

Materials and methods: We used an international consumer sample of 321,307 nights of sleep data (Withings Sleep Analysers and Scan Watches) from 2573 people with a self-reported doctor diagnosis of respiratory disease (asthma, chronic obstructive pulmonary disease, emphysema) and/or OSA. The odds of self-reported CVD (heart attack, stroke, coronary heart disease, congestive heart failure) and sleep metrics were compared in co-ROSA, respiratory disease and OSA using logistic regression and ANCOVA, respectively, while controlling for age, sex, and BMI. It was hypothesised that people with co-ROSA would have poorer sleep (less total sleep time, higher sleep irregularity, and decreased sleep efficiency), and greater incidence of cardiovascular disease, than people with respiratory disease or OSA alone.

Results: Participants were middle-aged (53.2 ± 13.7 yrs, mean $\pm$ SD), predominantly male (73.2%), with high BMI (31.1 ± 6.5 kg/m²), and normal sleep duration (7.2 ± 1.2 hrs). People with co-ROSA had shorter sleep duration (7.07 hrs $\pm$ 82 minutes) than people with respiratory disease (7.41 hrs $\pm$ 65 minutes), as well as higher night to night variability (rmssd of sleep duration = 137.78 ± 93.41) compared to respiratory disease alone (122.89 ± 58.90), and poorer sleep efficiency ($85\% \pm 9.17$) than respiratory disease alone ($89\% \pm 7.33$). However, there were no differences between co-ROSA and OSA. Co-ROSA was associated with 53% increased odds of CVD compared to respiratory disease 95%CI [30, 92], $p=0.02$, but not OSA, OR 66%, 95%CI [42, 105], $p=0.08$.

Conclusions: Overall sleep quality was worse in co-ROSA than respiratory disease alone, with shorter sleep duration, greater night to night variability, and poorer sleep efficiency. In line with this finding, CVD is also more prevalent in co-ROSA than respiratory disease alone. OSA often goes undiagnosed in people with co-morbid respiratory disease as it can be more challenging to diagnose in this population. OSA diagnosis should be prioritised in people with respiratory disease to improve sleep outcomes and better identify CVD risk. The nearable and wearable technology utilised in this study is a promising new tool that could aid in the diagnosis and management of OSA in more challenging and under-diagnosed populations.

ASSOCIATION OF UPPER AIRWAY MORPHOLOGICAL PHENOTYPES WITH OBSTRUCTIVE SLEEP APNEA IN MIDDLE-AGED KOREAN ADULTS

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Introduction: Obstructive sleep apnea (OSA) is a multifactorial disorder characterized by the recurrent collapse of the upper airway during sleep. It is commonly associated with obesity, enlarged pharyngeal soft tissues, and restricted craniofacial skeletal structures. The present study aims to investigate the relationship between (i)

craniofacial morphology and (ii) volumetric measurements of the upper airway and surrounding soft tissues, and the prevalence of OSA in middle-aged Korean adults.

Materials and methods: This cross-sectional study was conducted using data from a population-based cohort of Korean adults. A total of 89 participants (mean age: 61.65 ± 6.27 years; 50 males, 39 females) from the Korean Genome and Epidemiology Study in Ansan were included in the analysis. All participants underwent 1.5-Tesla MRI-based volumetric assessment of the upper airway (Magnetom Espree; Siemens Healthcare, Erlangen, Germany) and overnight in-home polysomnography (Embletta X-100; Embla Systems, Broomfield, CO, USA) between 2014 and 2015. Based on their apnea-hypopnea index (AHI), participants were categorized into two groups: no OSA (AHI <10 events/hour) and OSA (AHI ≥ 10 events/hour). Using Amira 5.4.0 image analysis software, a total of 23 volumetric measurements (airway and surrounding soft tissues) and 15 linear and angular cephalometric measurements were obtained from the upper airway MRI scans.

Results: Based on multivariable linear regression analysis adjusted for age, sex, BMI, diabetes, and cardiovascular disease, several MRI-based volumetric and cephalometric features were significantly associated with the OSA group compared to the non-OSA group. Among the volumetric measurements, the OSA group exhibited a narrower anteroposterior dimension of both the retropalatal and retroglossal airways (β [SE] = -1.88 [0.66] ($p=0.01$); and -2.48 [0.95] ($p=0.01$), respectively), as well as a longer overall airway length (β [SE] = 3.69 [1.61], ($p=0.02$)). In terms of cephalometric characteristics, the OSA group showed a significantly greater maxillo-mandibular discrepancy and increased upper facial height compared to the non-OSA group (all p -values <0.05).

Conclusions: This study identified distinct craniofacial and upper airway morphological features in individuals with OSA, including reduced anteroposterior airway dimensions and increased airway length. These findings emphasize the important role of upper airway phenotypes in the pathophysiology of OSA in middle-aged Korean adults.

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A Machine Learning Model for Predicting Obstructive Sleep Apnea Using Anthropometric and Bioimpedance Data

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Introduction: Obstructive sleep apnea (OSA) is a prevalent and serious sleep disorder associated with various complications. Polysomnography (PSG) remains the gold standard for diagnosis but is limited by cost, accessibility, and time. This study investigates an alternative method for identifying patients with severe OSA (Apnea-Hypopnea Index [AHI] ≥ 30) using bioelectrical impedance analysis (BIA) and basic outpatient anthropometric data.

Materials and methods: Data were retrospectively collected from patients who underwent both BIA and full-night PSG at Taipei Medical University–Shuang Ho Hospital Sleep Center (N = 6574). Anthropometric features (e.g., age, sex, body mass index, neck and waist circumference) and BIA-derived metrics (e.g., total body water, extracellular/intracellular water ratio, muscle percentage, and basal metabolic rate) were included.

Various machine learning models—including logistic regression (LR), k-nearest neighbors (kNN), Naïve Bayes (NB), support vector machines (SVM), random forest (RF), and XGBoost—were trained to classify OSA severity. Model performance was evaluated via stratified cross-validation and testing set analysis.

Results: Patients with severe OSA (N=3686) had higher values in age and showed elevated BMI, neck and waist circumference, visceral fat level (all $p < 0.01$), compared to non-severe OSA patients (N=2888).

BIA metrics such as reduced total body water, lower muscle percentage, and increased extracellular/intracellular water ratio were significantly associated with severe OSA.

Regarding model performance, Naïve Bayes, Logistic Regression, and XGBoost achieved the best performance. Naïve Bayes showed the highest accuracy (69.20%) and F1-score (67.6%), while Logistic Regression provided the best AUC (77.35%).

Conclusions: This study demonstrates that body composition and anthropometric features obtained from BIA can serve as effective predictors for severe OSA ($AHI \geq 30$). The proposed machine learning framework, particularly models such as Naïve Bayes, Logistic Regression, and XGBoost, achieved clinically acceptable performance in identifying high-risk patients using only outpatient-accessible data. This approach offers a scalable, low-cost, and non-invasive alternative to PSG-based diagnosis.

Sleep breathing impairment index predicts incident atrial fibrillation in obstructive sleep apnea: a prospective cohort study

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Introduction: Respiratory-event-associated hypoxia is crucial in cardiovascular comorbidities of obstructive sleep apnea (OSA). Intermittent hypoxia is an independent risk factor for atrial fibrillation (AF). The sleep breathing impairment index (SBII) is a novel metric that quantifies respiratory events and hypoxia, showing exceptional efficacy in predicting cardiovascular diseases. This study aims to evaluate the association between SBII and AF in OSA patients and compare the predictive performance of various OSA severity indices in predicting incident AF.

Materials and methods: This study included 1660 OSA patients without pre-existing AF from the Sleep Heart Health Study. Baseline SBII values were stratified into quartiles. Multivariate logistic regression analysis and restricted cubic spline analysis were conducted to explore the association between SBII and incident AF. Harrell's concordance statistic (C-statistic) was performed to compare the predictive value of SBII against other OSA severity indices.

Results: During a mean follow-up of 5.3 years, 190 (11.5%) OSA patients developed AF. SBII and hypoxic burden (HB) were associated with an increased risk of incident AF, with adjusted odds ratios of 1.87 (95%CI: 1.14, 3.11; $P=0.015$) and 2.01 (95%CI: 1.20, 3.41; $P=0.009$) for the third and fourth quartiles of SBII, respectively, and 1.70 (95%CI: 1.04, 2.81; $P=0.038$) for the fourth quartile of HB. Moreover, SBII had the largest C-statistic (0.75, 95% CI: 0.709, 0.782) compared with HB, AHI, and ODI.

Conclusions: This study demonstrated that elevated SBII and HB levels increased the risk of incident AF in OSA patients, with SBII outperforming other OSA severity indices in predicting AF.

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Nighttime Light Exposure Predicts Higher Sleep Apnea Risk: A Prospective Study with Explainable Machine Learning

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Introduction: Nighttime artificial light is an increasingly prevalent environmental exposure that may affect sleep health. However, its role in the development of sleep apnea remains underexplored. We investigated the longitudinal association between objective nighttime light exposure and incident sleep apnea, and evaluated its relative contribution and independence using explainable machine learning.

Materials and methods: A total of 84,774 adults (62.43 ± 7.82 years; 55.0% female) without sleep apnea at baseline were included. Nighttime light exposure was derived from seven-day wrist-worn actigraphy recordings and categorized into quartiles. Incident sleep apnea was identified from hospital and primary care records. Cox proportional hazards models were used to estimate hazard ratios (HRs) with sequential adjustment for

demographic, behavioral, and clinical covariates. An XGBoost-based survival model with SHapley Additive exPlanations (SHAP) was further used to assess the relative importance and interaction profile of each predictor.

Results: Over a median of 9.3 years (total 773,025 person-years), 802 participants were diagnosed with sleep apnea. Participants exposed to ≥ 32.5 lux at night (upper quartile) had a 36% higher risk of developing sleep apnea compared to those exposed to ≤ 1.4 lux (lowest quartile) (HR=1.36; 95% CI: 1.07–1.73; $p_{\text{adj}} = 0.032$). SHAP-based interpretation demonstrated that nighttime light exposure was among the predictors included in the cumulative 90% of total model importance, based on mean absolute SHAP values across all 23 covariates. Compared to other top predictors such as BMI category and physical activity, which exhibited stronger interaction patterns (maximum SHAP interaction strength = 0.05), nighttime light showed minimal interaction with other covariates (maximum = 0.02). Along with non-significant results from likelihood ratio tests for interaction terms with age, sex, chronotype, diet, and physical activity (all $p_{\text{adj}} > 0.05$, respectively), these findings support the independent and robust role of nighttime light exposure in predicting sleep apnea risk.

Conclusions: Nighttime light exposure is a robust and novel predictor of sleep apnea risk. Further studies are needed to determine whether nighttime light exposure can serve as a modifiable environmental target for sleep apnea prevention.

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Decline in CD4⁺ Naïve T Cell Levels Correlates with OSA Severity in Adult and Pediatric Patients

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Introduction: Studies on naïve T cells in Obstructive sleep apnea (OSA) patients still remain limited. This study was designed to explore the circulating levels of CD4⁺ naïve T cells in patients with OSA across ages.

Materials and methods: The study involved participants from both adult and pediatric populations. For adult patients, we applied the CIBERSORT deconvolution algorithm to infer the relative abundance of cell types based on microarray data. For children, we leveraged the previous pediatric single-cell transcriptome data to quantify cell type proportions. Weighted gene co-expression network analysis (WGCNA) was performed to explore potential significant gene modules associated with CD4⁺ naïve T cells. The correlation analysis was utilized to explore the relationship between CD4⁺ naïve T cell levels and OSA severity. Functional enrichment analyses were conducted to elucidate potential cell biological processes of CD4⁺ naïve T cells in both adult and pediatric patients.

Results: The CD4⁺ naïve T cell subset exhibited a decline trend and was closely linked to the characteristics of OSA in both adult and pediatric patients. The levels of CD4⁺ naïve T cells were negatively correlated with Apnea-Hypopnea Index (AHI) in adults ($R = -0.441$, $p = 0.017$) and pediatric patients ($R = -0.559$, $p = 0.010$). Functional enrichment analyses revealed that oxidative stress was a common biological feature in CD4⁺ naïve T cells shared by adult and pediatric patients with OSA.

Conclusions: CD4⁺ naïve T cells exhibited an age-independent depletion in OSA patients and correlated with OSA severity.

Transforming Rural Sleep Health Care: Establishing a Rural Sleep-Disordered Breathing Service in East Malaysia

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Introduction: Obstructive sleep apnea (OSA) remains a prevalent but underdiagnosed condition in rural Malaysia, where access to diagnostic and therapeutic services is often limited. In 2022, the Department of Otorhinolaryngology at Hospital Labuan—a rural secondary referral center—initiated a dedicated sleep service to improve the identification and management of sleep-disordered breathing (SDB).

Materials and methods: Between March 2022 and April 2024, 86 patients were evaluated through the newly established sleep clinic. Among them, 44 were diagnosed with severe OSA, 15 with moderate OSA, and 19 with mild OSA, based on AHI criteria and clinical findings. Most patients presented with moderate to severe OSA, with a high prevalence of comorbidities such as obesity, hypertension, and ischemic heart disease. Despite resource limitations, diagnostic PSGs were successfully conducted. Management was tailored to individual needs and preferences: 24 patients were initiated on CPAP therapy, while 11 patients underwent upper airway surgical interventions. The remaining patients were either managed conservatively or declined intervention.

Results: Between March 2022 and April 2024, 86 patients were evaluated through the newly established sleep clinic. Among them, 44 were diagnosed with severe OSA, 15 with moderate OSA, and 19 with mild OSA, based on AHI criteria and clinical findings. Most patients presented with moderate to severe OSA, with a high prevalence of comorbidities such as obesity, hypertension, and ischemic heart disease. Despite resource limitations, diagnostic PSGs were successfully conducted. Management was tailored to individual needs and preferences: 24 patients were initiated on CPAP therapy, while 11 patients underwent upper airway surgical interventions. The remaining patients were either managed conservatively or declined intervention.

Conclusions: Key challenges included limited patient awareness, delayed referrals, and issues with CPAP adherence, particularly among patients with lower health literacy or financial constraints. Nonetheless, early data show promising outcomes: patients with >70% compliance reported significant symptomatic relief, with mean AHI reduction to <5 events/hour. Customized education, follow-up, and equipment subsidies played a crucial role in improving adherence. This experience demonstrates that with structured planning, multidisciplinary coordination, and patient-centered care, effective sleep services can be successfully implemented even in rural settings. The Hospital Labuan model provides a replicable framework for other underserved regions aiming to address the growing burden of sleep disorders.

The Overlooked component: Proportion of Central Hypopnea in Obstructive Sleep Apnea Patients

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Introduction: Nearly 1 billion people globally are affected by Obstructive sleep apnea (OSA), with 425 million adults aged 30–69 having moderate to severe disease.

OSA involves repeated airflow reduction or cessation due to upper airway narrowing during sleep, causing hypoxia, arousals, and autonomic dysfunction.

These changes contribute to metabolic syndrome, hypertension, cardiovascular diseases, and cognitive decline.

Despite its prevalence, OSA remains underdiagnosed and untreated, and may coexist with central events. Central sleep apnea (CSA) results from impaired respiratory rhythm and is influenced by sleep stage, position, and gas exchange.

Differentiating OSA from CSA is essential, as both require distinct diagnostic and therapeutic approaches.

Materials and methods: This was a prospective cross-sectional single-center study consisting of 172 patients who fulfilled inclusion and exclusion criteria. A structured proforma was used to record demographics, symptoms, comorbidities, family history, and physical exam findings. All patients underwent Level-I polysomnography.

For those diagnosed with OSA, hypopneas were manually classified as central or obstructive.

Central hypopnea proportion and revised Apnea-Hypopnea Index (excluding central events) were calculated.

The association between central hypopneas and clinical characteristics was then analyzed.

Results:

- 367 patients of OSA, who were diagnosed by level I polysomnography laboratory were screened for eligibility, and 172 patients were enrolled in the study.
The proportion of central hypopnea in our study population was 7.35% (2.02% -18.95%). When analysed by OSA severity, the median proportion of central hypopnea was highest in mild OSA (22.97%), followed by moderate (11.04%) and severe (3.07%). The differences among groups were statistically significant. Central hypopnea had weak negative correlation with age and Body-mass index (BMI). Central hypopnea was lesser in type-2 diabetes and hypertensive patients. Excluding central hypopneas from AHI calculation reclassified 23.1% of mild OSA patients as no OSA, 20.9% of moderate as mild with 2.3% as no OSA, and 6.7% of severe as moderate. When central hypopneas were counted as a part of central events, 3 out of 172 patients i.e. 1.7% could be labelled as central sleep apnea.

Conclusions:

- The study was conducted with the thought that although scoring hypopnea into obstructive and central is optional according to AASM scoring manual version-3, it is important to score central and obstructive hypopnea separately. Our study shows that central hypopnea is found in significant proportions in patients of OSA and may have diagnostic and therapeutic implications.

Abbreviations: OSA – obstructive sleep apnea, AHI – Apnea-Hypopnea Index, CPAP- Continuous positive airway pressure

Polysomnographic Diagnosis of Obstructive Sleep Apnea in Patients Presenting with Insomnia Symptoms: A Retrospective Observational Study

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Introduction:

Insomnia and obstructive sleep apnea (OSA) frequently co-occur, and in some cases, OSA may be the underlying aetiology of insomnia. However, this overlap is often under-recognised, particularly when patients present primarily with difficulty initiating or maintaining sleep. Misdiagnosis or missed diagnosis may result in delayed or suboptimal treatment. This study aims to assess the prevalence of OSA in patients referred for insomnia symptoms and to evaluate the utility of overnight polysomnography (PSG) in this population.

Materials and methods:

We conducted a retrospective observational study at Sleep Therapeutics, an advanced sleep medicine center located in Hyderabad, Telangana, India. A total of 166 adult patients who underwent overnight PSG between July 2023 and June 2025 were included. All patients presented with primary complaints of sleeplessness either sleep onset issues or sleep maintenance issues or both. OSA was diagnosed using standard criteria with an apnea-hypopnea index (AHI) ≥ 5 . Gender-specific prevalence and other PSG parameters were analysed.

Results:

Of the 166 patients assessed, OSA was diagnosed in 66.2% of males and 33.8% of females. These findings demonstrate that a significant proportion of individuals presenting with insomnia symptoms had undiagnosed OSA, and they were treated as having insomnia for a long period. Additional parameters-including sleep latency, sleep efficiency, arousal index, respiratory disturbance index (RDI), oxygen desaturation index (ODI), and reasons for arousals-revealed notable disruptions in sleep architecture. These findings will be detailed in the accompanying poster.

Conclusions:

A substantial number of patients with insomnia symptoms were found to have underlying OSA on PSG. These results underscore the importance of considering OSA in the differential diagnosis of insomnia in cases who present with complaints of sleeplessness. PSG should be recommended not only in chronic or refractory insomnia

cases but also during initial evaluations when patients report minimal improvement with conventional insomnia therapies.

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Effect of adenotonsillectomy on lipid profile in children with obstructive sleep apnea

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Introduction: Limited evidence addressing effects of adenotonsillectomy (T&A) on lipid profiles in childhood obstructive sleep apnea (OSA). The aim of this study is to elucidate changes in lipid profiles after surgery in children with OSA.

Materials and methods: Children aged 4-16 years with clinical symptoms and polysomnography (PSG)-diagnosed OSA (apnea-hypopnea index, AHI >1) were recruited from a tertiary medical center and received T&A as the treatment for OSA. All children had the postoperative PSG studies, and examined for lipid profiles (i.e. total cholesterol, triglyceride, low-density lipoprotein [LDL], and high-density lipoprotein [HDL]) before and 6 months after surgery.

Results: This study included 124 children (mean age, 6.3±3.0 years; 65% boy). T&A resulted in a significant reduction of the AHI from 12.3±17.9 to 2.9±5.7 per hour ($P < 0.001$). After surgery, total cholesterol (162.9 to 164.4 mg/dL, $P = 0.51$), triglyceride (79.3 to 79.9 mg/dL, $P = 0.87$), and LDL (97.0 to 96.5 mg/dL, $P = 0.75$) were not significantly changed. The HDL was significantly increased from 53.3 to 55.7 mg/dL after surgery ($P = 0.03$). Moreover, the LDL/HDL ratio was significantly decreased from 1.99 to 1.87 after surgery ($P = 0.004$).

Conclusions: Adenotonsillectomy (T&A) treatment may provide beneficial effects on lipid profiles in children with obstructive sleep apnea (OSA).

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Sleep and Survival: A Low-Cost Home Ventilation Strategy for Children with Neuromuscular disease in Resource-Limited Settings

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Introduction:

Children with neuromuscular disorders are especially vulnerable to sleep-related breathing disturbances and chronic respiratory failure, which is a leading cause of death in these children. In many low- and middle-income countries, delivering comprehensive care is challenging due to high out-of-pocket costs and limited access to specialized equipment. This study presents real-world data from a pediatric neuromuscular clinic in India, highlighting how low-cost, innovative strategies can support effective home ventilation and sleep care in resource-limited settings.

Materials and methods: This is a retrospective observational study. We included children with NMD up to 18 years of age who attended our tertiary pediatric neuromuscular clinic between January 2018 and February 2025. Clinical profiles, Level-I Polysomnography (PSG) data when available, along with treatment and outcomes, were analysed.

Results:

415 children (63.6% male) diagnosed with NMD were included. The majority of our cohort had spinal muscular atrophy (SMA, n=213), followed by Duchenne muscular dystrophy (DMD, n=96), and the remaining had other NMD (n=106).

302/415 (72.2%) children had a PSG done with a median Apnea-Hypopnea Index (AHI) of 7.6 (0.3 to 78) per hour of total sleep time, with 64.14% of children having moderate to severe OSA.

HMV was initiated in 351/415 (84.5%) of children. 78/213 (36.6%) of children with SMA1 and SMA2 received DMT-like gene therapy (n=35), Risdiplam (n=22), and Spinraza (n=21). 18 children had a tracheostomy, 55 used mechanical insufflation-exsufflation (MI-E), 34 were on NG feeds, and 28 had a PEG tube with fundoplication done. Optimizing care in these children reduced recurrent hospital admissions in 74% of children. 25 children expired due to respiratory failure.

Among 351 children on HMV, 68% were remotely monitored via video and telephone consultations. A 24/7 emergency contact number along with technician support was provided to families, many of whom travel from across India and often lack access to specialized respiratory care locally. Smaller hospitals frequently hesitate to initiate BiPAP in acutely unwell children, making remote guidance and continuity of care essential.

To overcome the financial burden of out-of-pocket healthcare expenses in India, families utilize affordable Indian-manufactured BiPAP devices (costing <\$500 USD) or rent BiPAP and MI-E machines for \$40 and \$120/month, respectively. Additional support through crowdfunding has helped cover the cost of diagnostics and treatment, while the donation of 40 BiPAP units to our neuromuscular disease unit has further expanded access. Equally important has been the role of family WhatsApp groups, which have become a powerful tool for real-time support, shared learning, and fostering a sense of community among caregivers facing similar challenges and simultaneously raising awareness.

Conclusions:

A low threshold for initiation of BiPAP when indicated without a PSG initially is a reasonable practical approach in resource-limited settings. Early initiation of cough assist and HMV helped reduce morbidity and mortality.

This model of care—combining remote monitoring, low-cost locally manufactured respiratory devices, rental options, and philanthropic support—demonstrates a sustainable approach to delivering HMV. Such strategies provide a practical framework for scalable and equitable chronic respiratory care in other low- and middle-income countries.

Obstructive Sleep Apnea Treatment Regulates Monocyte Inflammatory Phenotype and Function

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Introduction: Obstructive sleep apnea (OSA) is associated with chronic intermittent hypoxia and systemic inflammation, contributing to vascular and metabolic complications. Monocytes, as key mediators of innate immunity, have been implicated in this inflammatory state. However, the effect of OSA treatment on monocyte function and inflammatory phenotype remains poorly understood.

Materials and methods: In this prospective cohort study, OSA patients were evaluated before and after 4 months of continuous positive airway pressure (CPAP) therapy. Circulating monocytes were isolated, and inflammatory cytokine production (TNF- α , IL-1 β , IL-6) was assessed at baseline and post-treatment, both at rest and after LPS stimulation. Monocyte subset distribution (M1/M2) was evaluated by flow cytometry. Clinical severity parameters such as the apnea-hypopnea index (AHI) and oxygen desaturation index (ODI) were correlated with immune changes.

Results: CPAP therapy significantly reduced serum levels of TNF- α and IL-1 β and attenuated LPS-induced cytokine responses. A shift in monocyte phenotype toward an anti-inflammatory M2 profile was observed. These changes were significantly associated with baseline ODI, but not with AHI. Patients with higher ODI showed greater reductions in cytokine levels and more pronounced monocyte reprogramming after CPAP treatment.

Conclusions: CPAP alleviates systemic inflammation in OSA by reducing hypoxic burden and reprogramming monocytes toward an anti-inflammatory phenotype. The magnitude of immune modulation was more closely linked to ODI than AHI, supporting the use of hypoxemia-based metrics for identifying inflammation-prone OSA endotypes and guiding personalized therapy.

The Effect of Telemedicine-Based CPAP Management on 24-Hour Ambulatory Blood Pressure in Patients with Obstructive Sleep Apnea: A Randomized, Controlled, Non-Inferiority Trial

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Introduction: Previous studies have demonstrated feasibility and availability of telemedicine management of Obstructive Sleep Apnea (OSA) in China, but further evaluation is needed to determine whether these telemedicine approaches can lower 24-Hour Ambulatory Blood Pressure (ABMP), which is one of the intermediary mechanisms leading to increased cardiovascular morbidity. This study aimed at evaluating the effects of telemedicine-based CPAP management on 24h ABMP reductions in OSA patients.

Materials and methods: 344 adult (18-75 years old) OSA patients (AHI $\geq$ 5 events/h) were randomized to either telemedicine management (TM) (web-based questionnaires, self-administered home sleep apnea testing (HSAT), automatic positive airway pressure (APAP) and video-conference for visits) (n=172) or in-person management (IP) (paper questionnaires, in-person HSAT set-up, APAP and face-to-face visits) (n=172) for three months. The primary outcome was the change in 24-Hour mean arterial BP (MAP) from baseline to three months. Secondary outcomes included APAP adherence, depressive symptoms, daytime sleepiness, sleep quality, and serum liver enzyme levels.

Results: A total of 127 and 129 patients in the TM and IP groups, respectively, completed APAP treatment and underwent follow-up 24h ABPM monitoring. Significant reductions in 24-Hour mean arterial pressure (MAP) were observed in both groups: 2.94 mmHg in the TM group (P = 0.016) and 2.98 mmHg in the IP group (P = 0.015). The between-group difference was 0.78 mmHg (95% CI: -2.88 to 1.32; P=0.467), with the upper bound of the confidence interval below the pre-specified non-inferiority margin of 1.5 mmHg. Both groups also showed significant improvements in 24-hour systolic and diastolic BP. Daytime sleepiness, sleep quality, and depressive mood significantly improved in both groups after three months of APAP therapy (all P<0.05), with no significant between-group differences (P=0.48, P=0.50, and P=0.86, respectively). Serum alanine aminotransferase (ALT) levels significantly decreased in both the TM group (38.9 to 30.5 U/L, P=0.001) and the IP group (38.6 to 32.9 U/L, P=0.01), with no significant difference between groups (P=0.40). Aspartate aminotransferase (AST) levels showed a decreasing trend, but the change was not statistically significant.

Conclusions: Comprehensive telemedicine-based CPAP management is non-inferior to conventional in-person management in reducing 24h MAP among patients with OSA. Both groups experienced comparable improvements

in sleep-related symptoms and quality of life. Serum liver enzymes, particularly ALT, also decreased following three months of APAP therapy.

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Technology/Technical

Validation of Automatic Sleep Stage Classification and Sleep Quality Assessment Using Smartwatch Technology

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Introduction: Polysomnography (PSG) is costly and impractical for evaluating widespread problems of insomnia and poor sleep quality. Despite consumer wearables are being alternatively used in sleep research, the validity of the devices and their resulting sleep measures remains a source for concern. To validate the automatic sleep stage classifier algorithm based on 3D-accelerometer (3D-ACC) and photoplethysmogram (PPG) signals derived from the Huawei® Watch against PSG. Additionally, we seek to establish a predictive model linking objective sleep parameters to subjective sleep parameters.

Materials and methods: The developed smartwatch technology was successfully applied to overnight recordings of 108 healthy subjects, with simultaneous one-night PSG measurements, and subjective sleep questionnaire were records manually by the subjects. We extracted objective sleep parameters, including total sleep time (TST), light sleep (% TST), slow wave sleep (% TST), and rapid eye movement sleep (REM, % TST) from smartwatch-based sleep staging, and subjective sleep quality index from subjective sleep questionnaire. The 9-fold cross-validation was used to evaluate the concordance between manual PSG scoring and smartwatch-based sleep staging. A nonlinear regression model was used to explore the relationship between objective and subjective sleep parameters, and we finally generate estimates of the overall sleep quality index.

Results: In this study, participants aged 18 years or older, of whom 53.70% were male. The mean[SD] of TST, light sleep time, slow wave sleep time and REM sleep time calculated by the smartwatch technology were 413.16[75.66] min, 269.74[60.92] min, 75.61[34.57] min and 67.81[32.41] min, respectively. Compared to the PSG, the accuracy of total sleep duration was 95.38%. The automatic sleep stage classification demonstrated moderate accuracy and kappa coefficient, which was 74.50% and 0.52, respectively. The objective sleep parameters explained an R-squared value of 31.2% for the subjective sleep quality index, with a mean absolute error of 3.1.

Conclusions: The smartwatch technology demonstrated moderate-to-high accuracy in automatic sleep stage classification when compared with PSG, supporting its potential as a practical tool for consumer-level sleep health assessment. Additionally, the moderate association between objective sleep parameters and subjective sleep quality suggests the feasibility of using wearable-derived data to infer subjective sleep quality, though further refinement of modeling approaches is warranted.

An innovative solution to positional therapy for obstructive sleep apnea - Pilot Study

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Introduction: Obstructive sleep apnea (OSA) is a prevalent global health issue, with a significant subset, positional OSA (POSA), affecting up to 60% of patients. While continuous positive airway pressure (CPAP) is the gold standard treatment, poor compliance due to discomfort remains a major limitation. Existing positional therapies often act as aversive stimuli, leading to suboptimal long-term adherence. This pilot study evaluated a novel,

comfort-focused approach using a commercially available G-shaped maternity pillow as a positional therapy device for POSA, hypothesizing that its supportive design would effectively maintain lateral sleep positioning and improve respiratory outcomes.

Materials and methods: In this prospective pilot study, 18 adult patients with confirmed POSA (per Cartwright's criteria) were enrolled. The study protocol involved: (1) a baseline inpatient polysomnography (PSG) without intervention; (2) a two-week actigraphy period to establish baseline sleep patterns; (3) a subsequent inpatient PSG with the G-shaped maternity pillow; (4) Psychomotor Vigilance Task (PVT) testing pre- and post-intervention; and (5) validated sleep questionnaires (Karolinska Sleepiness Scale, Samn-Perelli Fatigue Scale, PANAS) to assess subjective sleep quality, alertness, and mood. Respiratory indices, sleep architecture, and sleep position data from the two PSGs were compared using paired statistical tests.

Results: Use of the maternity pillow resulted in a significant improvement in respiratory parameters. The median apnea-hypopnea index (AHI) decreased from 17.5 to 8.92 events/hour ($p < 0.01$) and the oxygen desaturation index (ODI) from 14.8 to 6.41 events/hour ($p < 0.01$). The pillow was highly effective in enforcing lateral sleep, increasing the median lateral sleep time from 19.7% to 84.2% of total sleep time ($p < 0.01$). Although total sleep time and sleep efficiency decreased during the single-night intervention, participants demonstrated improved morning alertness on PVT testing (faster response times, $p = 0.03$) and reported less fatigue ($p = 0.02$). Patient acceptance was notably high, with 83.3% preferring the pillow over CPAP and 61.1% continuing its use post-study.

Conclusions: These preliminary findings suggest that a G-shaped maternity pillow is an effective and well-tolerated positional therapy for POSA, significantly reducing AHI and ODI by successfully promoting lateral sleep. Its high acceptance rate highlights its potential as a comfortable and accessible alternative for CPAP-intolerant patients. This study introduces a promising new category of positional therapy based on positive support rather than aversion. Larger, long-term trials with an acclimatization period are warranted to confirm these efficacy and compliance findings in a real-world setting.

Bright White Light Reduces Early Afternoon Alertness Decline in Healthy Adults

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Introduction: Decreased alertness impairs individual judgment, leading to more human errors, decreased work efficiency, and even increased risk of accidents. Light exposure has been shown to modulate alertness, but the optimal intensity for afternoon settings remains unclear. This study aimed to examine the effects of different light intensities on afternoon alertness in healthy adults.

Materials and methods: 82 healthy subjects aged 18 to 45 years were enrolled and block-randomly assigned to four light intensity groups: 2500 lux group ($n = 21$), 5000 lux group ($n = 20$), 7500 lux group ($n = 21$), and 10000 lux group ($n = 20$). Two subjects who violated the protocol were excluded, and finally 80 subjects (20 in each group) were included in the statistical analysis. The experiment was completed within two consecutive days (baseline day and intervention day). On the baseline day, the starting time point of the subjects' afternoon sleepiness was set as the 0 minute. During the subsequent 90 minutes, subjective alertness scoring (Karolinska Sleepiness Scale, KSS), objective alertness testing (10-minute Psychomotor Vigilance Task, PVT) and saliva cortisol collection were carried out every 30 minutes. On the intervention day, continuous light exposure for 30 minutes was given starting from the 0th minute. The procedures for collecting subjective and objective alertness and saliva cortisol were exactly the same as those on the baseline day.

Results: Statistical analyses were performed using two-way repeated measures ANOVA to assess the effects of light intensity and time on alertness. Results showed significant between-group differences in the slowest 10% reaction speed of the PVT ($F(3, 76) = 4.100$, $p = 0.009$). Post hoc analysis revealed that the reaction speed in the 10000 lux group was significantly lower than that in the other three groups, and the group $\times$ time interaction effect was significant ($F(3, 76) = 2.056$, $p = 0.031$). No significant differences were observed in KSS scores or cortisol levels among groups. Subsequently, using paired t-tests, the study found that compared with the baseline day: In the 2500 lux group, the KSS scores decreased significantly at 90 min ($t = 2.595$, $p = 0.018$). In the 5000 lux group, the KSS scores decreased significantly at 30 min ($t = 2.223$, $p = 0.039$), and the slowest 10% PVT reaction speed decreased significantly at 30 min ($t = 3.399$, $p = 0.003$) and 90 min ($t = 2.602$, $p = 0.018$). In the 10000 lux group,

the KSS scores at 30 min ($t = 2.517$, $p = 0.021$) and 90 min ($t = 3.559$, $p = 0.002$) were significantly decreased, and the slowest 10% PVT reaction speed at the onset of light exposure ($t = 3.216$, $p = 0.005$) was significantly decreased.

Conclusions: The study concludes that 2500 lux, 5000 lux, and 10000 lux light exposure reduce subjective alertness decline, and the higher the intensity, the faster the effect. The 10000 lux light exposure has the most pronounced impact on objective alertness in the early afternoon. Future research should explore the underlying mechanisms and long-term effects of high-intensity light exposure.

Comparative Study of Polysomnography and HSAT levels in Diagnosis of Sleep Apnea and Analysis of Subsequent Treatment Uptake in 300 Patients

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Introduction: Obstructive Sleep Apnea (OSA) is a common but frequently underdiagnosed sleep disorder with significant health consequences, including increased risk of cardiovascular disease, metabolic dysfunction, and impaired quality of life. Early and accurate diagnosis, followed by prompt initiation of appropriate therapy, is essential for mitigating these risks and improving patient outcomes. Sleep studies-ranging from in-lab polysomnography (PSG) to home-based testing-are the cornerstone of OSA diagnosis. However, the pathway from diagnosis to treatment can be influenced by the type of diagnostic modality used, patient engagement, and the structure of follow-up care. This study aims to evaluate the distribution of sleep study types and analyse treatment initiation rates at SleepMed Solutions, a tertiary sleep centre in Bengaluru, India.

Materials and methods: • **Study Design:** Retrospective analysis

• **Setting:** SleepMed Solutions, Bengaluru, Karnataka, India

• **Study Period:** January 2024 – January 2025

• **Total Sleep Studies:** 301

• **Modalities:**

Level 1: In-lab polysomnography (n=61)

Level 2: Home polysomnography (n=132)

Level 3: Home Sleep Apnea Test (HSAT) (n=108)

• **Data Collected:** Number of studies by type, number of patients initiating treatment, number not taking treatment, number not meeting doctor post-diagnosis.

• **Analysis:** Calculation of treatment initiation rates by modality.

Results: In a study of 301 patients, the distribution of sleep study modalities was as follows: 61 patients underwent in-lab polysomnography (Level 1), 132 had home polysomnography (Level 2), and 108 completed home sleep apnea testing (HSAT, Level 3).

The rates of treatment initiation varied significantly by modality. In-lab polysomnography (Level 1) had the highest treatment uptake, with 70.49% of patients starting therapy after diagnosis; this equated to 43 patients out of 61. Home polysomnography (Level 2) showed a moderate initiation rate of 57.58%, with 76 patients taking treatment out of 132. In contrast, HSAT (Level 3) had the lowest uptake at 44.44%, with 48 patients out of 108 beginning treatment.

Overall, the treatment initiation rate across all modalities was 55.48%. Notably, 281 patients met with a doctor following their diagnosis, while 20 did not attend a post-diagnostic consultation.

These findings indicate that patients diagnosed through in-lab polysomnography are more likely to initiate treatment compared to those diagnosed via home-based modalities. This could be attributed to the comprehensive nature of in-lab studies, structured patient counselling, and immediate access to healthcare providers. Conversely, the lower uptake rates in home-based studies, particularly HSAT, may reflect milder disease severity, reduced patient engagement, or logistical challenges in follow-up. These disparities highlight the importance of providing robust post-diagnostic support and patient education, especially for those undergoing home-based testing.

Conclusions: In-lab polysomnography is associated with the highest rates of treatment initiation among patients diagnosed with OSA at SleepMed Solutions. Home-based diagnostic modalities, while increasing accessibility, are linked to lower treatment uptake. To enhance overall outcomes in OSA management, targeted interventions to improve patient engagement and follow-up after home-based diagnoses are warranted.

Acknowledgments: We thank the staff at SleepMed Solutions, Bengaluru and clinicians who referred patients to SleepMed for their diligent data collection and patient care. Special appreciation to the patients who participated in this study and contributed to advancing sleep medicine research.

Apnea–Hypopnea Event Detection from 10-Second Sleep Audio Clips: A Machine Learning Model

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Introduction: Sleep apnea is a prevalent sleep disorder with serious health consequences, underscoring the need for accurate and accessible detection methods. Current diagnostic standards, such as overnight polysomnography (PSG), are expensive and inconvenient. We propose a novel machine learning approach that utilizes pre-trained large audio models to analyze raw audio waveforms—such as 10-second segments of breathing or snoring sounds—for apnea detection. To enhance performance, we introduce a multi-task learning framework that addresses both apnea detection and sleep stage classification, leveraging the physiological relevance of sleep stages. This combination of a pre-trained audio encoder and multi-task learning is designed to improve generalization and robustness in identifying apnea events.

Materials and methods:

The proposed framework comprises two main components: a pre-trained audio encoder and a multi-task classifier. We use HuBERT, a state-of-the-art self-supervised audio model, to convert raw 10-second waveform segments into compact feature embeddings. These embeddings serve as input to a downstream classifier consisting of a shared feature extractor (“bottom” network) followed by two task-specific branches: one for binary apnea classification (apnea vs. no-apnea) and another for sleep stage classification (Wake, REM, NREM). Each branch includes a lightweight task-specific encoder and prediction head built atop the shared representation. The model is trained end-to-end in a multi-task learning (MTL) setup, optimizing a combined loss from both tasks. Incorporating sleep stage information provides important physiological context—for example, certain sleep stages may correlate with higher apnea occurrence—thereby guiding the model to learn more robust features that improve apnea detection.

Results: Preliminary evaluation on a held-out test set yielded promising performance. The proposed multi-task model achieved an accuracy of 84.8% and an area under the curve (AUC) of 0.810 for binary apnea classification. These results demonstrate that our model can reliably distinguish apnea events from normal breathing using only short audio segments. Importantly, incorporating sleep stage classification as an auxiliary task improved overall apnea detection performance compared to a single-task baseline, confirming the benefits of multi-task learning. We also employed a dynamic loss weighting strategy to balance optimization between the two tasks, which further enhanced training stability and performance. The current model architecture—comprising a HuBERT-based audio encoder and a shared-bottom, task-specific multi-task classifier—proved effective in learning generalizable audio features and context-aware physiological representations.

Conclusions: In conclusion, this study demonstrates that combining pre-trained large audio models with multi-task learning offers a promising approach for automatic sleep apnea detection. By leveraging HuBERT as an acoustic feature extractor and jointly training on apnea detection and sleep stage classification, the model captures both general audio patterns and context-specific physiological cues. The resulting accuracy and AUC indicate that this audio-based method can serve as a non-invasive, efficient tool for sleep apnea screening in both clinical and home settings. Future work will explore alternative foundation audio models, incorporate additional physiological signals, and validate the approach on larger and more diverse populations to support real-world deployment.

AI-based Prediction Model of Alzheimer's Disease From Polysomnographic Records: A Preliminary Study

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Introduction: Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the most common cause of dementia, primarily affecting memory, cognitive function, and behavior. Thus, a convenient and accurate screening method is critical for the early detection of AD. This study aimed to develop an AI-based prediction model for prescreening Alzheimer's disease using nocturnal polysomnographic (PSG) recordings.

Materials and methods: Real-world clinical PSG data were collected from 150 subjects (100 controls and 50 with AD) from the MrOS sleep study. We proposed a hybrid deep learning model that combines convolutional and recurrent neural network architectures, optimized through dropout and batch normalization. The model extracted and analyzed complex patterns from nocturnal EEG signals. PSG data were preprocessed, segmented into 30-second intervals, and evaluated using 5-fold cross-validation.

Results: The AI-based prediction model showed promising performance, achieving an accuracy of 76.19%, a sensitivity of 77.35%, and a specificity of 74.73% in screening for AD.

Conclusions: Our preliminary results demonstrate the feasibility of using AI-based PSG analysis for AD prescreening. The proposed model has potential as a practical and non-invasive tool for early detection and monitoring of neurodegenerative disorders.

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Implementation of the AI-Powered Belun Ring to Streamline Sleep Disorder Assessment in Primary Care: A Real-World Community Study

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Introduction: The global increase in sleep disorders—driven by an aging population and rising obesity presents a significant public health challenge. Despite their high prevalence and association with cardiovascular, metabolic, and mental health conditions, many sleep disorders remain undiagnosed, contributing to increased healthcare utilization and socioeconomic burden. The delay in diagnosis and treatment is largely due to the long waiting time for diagnostic test (PSG) in public healthcare system as well as costly tests in private health care setting. Wearable sleep technologies offer a scalable and cost-effective alternative to traditional testing; however, their adoption in primary care remains limited. This study evaluated the use of the AI-powered Belun Ring (BR), a medical-grade wearable, to characterize sleep phenotypes and compare outcomes between individuals referred by primary care physicians (PCPs) and specialists in a real-world clinical setting.

Materials and methods: This retrospective study included 347 adults referred for sleep assessment at The Chinese University of Hong Kong (CUHK) Medical Clinics between June 2020 and June 2025. Participants completed at least three nights of home sleep monitoring using the BR, with ≥60 minutes of total sleep time per night required for data inclusion. The device generated objective sleep metrics, including the apnea-hypopnea index (bAHI4%, AASM IB rule) and sleep efficiency (bSE). Based on these measures, participants were categorized into four sleep phenotypes: normal (bAHI4% < 15 & bSE ≥ 80), obstructive sleep apnea (OSA: bAHI4% ≥ 15 & bSE ≥ 80), insomnia (bAHI4% < 15 & bSE < 80), and COMISA (bAHI4% ≥ 15 & bSE < 80). A multinomial logistic regression model was used to assess the association between referral type (PCP vs. specialist) and sleep phenotype, adjusting for age, sex, and BMI.

Results: Of the 347 referred patients, 287 (83%) met data quality criteria. Among these, 53% screened positive for a sleep disorder phenotype: 30% met criteria for OSA, 16% for insomnia, and 6% for COMISA. PCP referrals accounted for 85% of the cohort. There were no statistically significant differences in sleep phenotype distribution

between PCP and specialist referrals (COMISA: Odds Ratio=2.34, 95% CI=0.67–8.14; insomnia: 1.40, 0.54–3.64; OSA: 0.86, 0.35–2.08). Age was significantly associated with increased odds of all three sleep disorder phenotypes (COMISA: 1.13; insomnia: 1.10; OSA: 1.05). Higher BMI was associated with increased odds of COMISA (1.31, 1.14–1.52) and OSA (1.26, 1.15–1.39), but not insomnia. Female sex was associated with lower odds of OSA (0.31, 0.14–0.67).

Conclusions: This study is among the first to demonstrate the feasibility and public health value of integrating AI-driven wearable technology into primary care for sleep disorder risk assessment. The comparable phenotype distributions between PCP and specialist referrals support the use of the BR as a frontline tool for identifying individuals at risk and triaging them for further evaluation. Integrating medical-grade wearables into primary care workflows could play a critical role in addressing the substantial burden of undiagnosed sleep disorders, reduce demand on specialist services, and enabling earlier care for at-risk individuals in community settings.

Self-operable Wearable Transcranial Photobiomodulation on the Sleep Symptoms of People Living with Major Depressive Disorder: A Secondary Analysis of a Randomised, Sham-controlled Clinical Trial

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Introduction: Major depressive disorder (MDD) is closely linked to sleep disturbances, and there is a two-way relationship between them. Near-infrared transcranial photobiomodulation (tPBM) is a safe neuromodulation technique with potential antidepressant and hypnotic effects. Our recently published study (Guu et al., 2025) has found an intriguingly sub-optimal mood-elevating effect, along with a significant sleep-enhancing effect using a patient-operable wearable tPBM device. In the present study, we conducted a secondary analysis to further explore the potential mechanisms contributing to this effect.

Materials and methods: Forty-eight outpatients with major depressive disorder (MDD) were randomized 1:1 to the wearable transcranial photobiomodulation (tPBM) or sham group. Participants used the intervention daily for at least 20 minutes, up to 8 weeks. The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep symptoms from baseline to week 12. Data were analyzed using the Mann-Whitney U test and the Wilcoxon signed-rank test.

Results: Poor sleep (PSQI global score > 5) was common in both the tPBM group (mean = 10.58, SD = 3.05) and the control group (mean = 11.64, SD = 2.98) at baseline. A significant difference in the PSQI global score between the two groups was observed at week 8 ($z = -2.90$, $p = 0.004$), with the tPBM group showing a greater improvement. In the tPBM group, the PSQI global score significantly decreased at both week 8 ($z = -2.92$, $p = 0.004$) and week 12 ($z = -3.19$, $p = 0.001$), compared to baseline (week 0). Among all the sub-components, sleep latency significantly decreased at week 8 compared to baseline in the tPBM group ($z = -2.44$, $p = 0.02$), but not the control group ($z = -1.59$, $p = 0.11$). In contrast, sleep disturbances scores significantly increased from baseline at both week 8 and week 12 in both the tPBM and sham groups (tPBM week 8: $z = -3.12$, $p = 0.002$, week 12: $z = -2.97$, $p = 0.003$; sham week 8: $z = -3.36$, $p = 0.001$, week 12: $z = -2.31$, $p = 0.021$). Further analysis showed that participants with better sleep latency in the tPBM group (PSQI sleep latency score < 2) had a greater reduction in BDI scores from week 0 to week 8 ($M = 12.31$, $SD = 11.41$) compared to those with poorer sleep latency (score ≥ 2 ; $M = 7.64$, $SD = 12.07$), although the difference was not statistically significant ($z = -1.19$, $p = 0.25$).

Conclusions: Self-administered wearable tPBM might improve sleep symptoms in people living with MDD mainly through reducing the sleep latency. The discomfort of wearing the device at bedtime might contribute to the increased sleep disturbance score, which was offset by the sleep induction effect of tPBM, and therefore resulted in the overall sleep improvement only in the tPBM group. Based on this study, the sleep latency reduction effect of wearable tPBM might be further pursued in larger study to characterize its impact on the mood symptoms.

Acknowledgments: The authors thank all the participants who joined this clinical trial for their valuable time, trust, and commitment. We also extend our appreciation to the research staff and collaborators who contributed to data collection, monitoring, and logistical support throughout the study.

Estimating Daytime Productivity from Sleep-Time Biosignals with a Reduced Feature Set

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Introduction: Inadequate or poor-quality sleep erodes next-day alertness, psychomotor speed, and working-memory accuracy, all of which translate directly into lost productivity and safety risks. Conventional metrics such as total sleep time or stage proportions capture only fragments of sleep physiology and require cumbersome polysomnography. We therefore investigated whether a compact overnight biosignal array could directly forecast three concrete daytime outcomes—subjective sleepiness, psychomotor vigilance, and working-memory performance—and, if so, how few sensors were sufficient.

Materials and methods: After two adaptation nights, twenty healthy men (28.4 ± 4.9 y) spent four experimental nights in the laboratory (lights-off 22:00, lights-on 06:00); 59 recordings remained after artefact rejection and signal-quality screening. Signals were sampled at 1 kHz via a Biosignalsplux hub: 3-lead ECG, respiratory-inductance belt, palmar electrodermal activity (EDA) and bilateral external-oblique EMG. Twenty-five features—heart-rate-variability indices (pNN20, RMSSD, LF/HF, etc.), respiration rate/amplitude, EDA burst counts/amplitudes and EMG RMS—were z-scored participant-wise and fed to a three-layer Transformer encoder ($d_{\text{model}} = 64$, eight heads, cosine-decay Adam, early stopping at 100 epochs). At 06:00, 07:00 and 09:00 participants completed (i) the Stanford Sleepiness Scale (SSS) for self-rated alertness, (ii) a 5-min psychomotor vigilance task (PVT-B) for median reaction time, and (iii) a 3-back task for percent-correct working-memory accuracy. Four-fold cross-validation quantified performance. Shapley values ranked feature importance and guided two ablation routes: (i) dropping low-value sensors and (ii) dropping only low-value features.

Results: The full model explained $R^2 = 0.68\text{--}0.77$ of variance in median PVT reaction time and up to 0.76 in 3-back accuracy across the three test times; SSS sleepiness classification peaked at $F1 = 0.81$ at 07:00 (06:00 = 0.70, 09:00 = 0.71). Approximate 95 % confidence intervals confirmed robustness (reaction-time R^2 0.64–0.80). HRV indices reflecting parasympathetic tone (pNN20, RMSSD) and sympatho-vagal balance (LF/HF), together with EDA burst counts, dominated psychomotor-speed prediction, whereas respiratory-stability metrics (mean RR, RR SD) emerged alongside HRV for working-memory accuracy. Removing the respiration belt and EMG electrodes—retaining only ECG and EDA—reduced reaction-time R^2 by < 0.20 while preserving ≥ 85 % of baseline performance, demonstrating a practical two-sensor solution.

Conclusions: An overnight recording of only heart-rate and skin-conductance signals can accurately forecast next-morning alertness (SSS score), psychomotor speed (median PVT reaction time), and working-memory accuracy (3-back percent correct) without explicit sleep-stage scoring. Transformer models capture long-range physiological patterns, and Shapley-guided pruning reveals that a two-channel wearable is enough for reliable early-shift screening of cognitive readiness. These findings support applications in shift-work fatigue management, driver vigilance checks, and remote-operator scheduling. Limitations include an all-male sample, controlled laboratory conditions, and a restricted cognitive battery. Future work will expand validation to larger, gender-balanced cohorts, real-world environments, and broader cognitive tasks, paving the way for longitudinal occupational deployment.

Sleep physiology characteristics in patients with Obstructive Sleep Apnea from Vietnam

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Introduction: Obstructive sleep apnea (OSA) profoundly disrupts sleep architecture, respiratory patterns, and cardiovascular function. While OSA polysomnographic characteristics are well-documented in Western populations, comprehensive data from Southeast Asian populations remain limited. This study characterizes sleep

physiological parameters across OSA severity levels in Vietnamese patients, providing essential normative data for this underrepresented population.

Materials and methods: We conducted a cross-sectional analysis of 374 patients diagnosed with OSA ($AHI \geq 5$ events/hour) who underwent overnight polysomnography at a tertiary hospital in Ho Chi Minh City, Vietnam. Patients were stratified into mild ($5 \leq AHI < 15$), moderate ($15 \leq AHI < 30$), and severe ($AHI \geq 30$) OSA groups. Comprehensive polysomnographic parameters were analyzed, including sleep architecture (N1, N2, N3, and REM stages), sleep quality indices (total sleep time, sleep efficiency, REM latency, and wake after sleep onset), respiratory event distribution, and heart rate variations across sleep stages. Statistical comparisons were performed using ANOVA with significance set at $p < 0.05$.

Results: The cohort comprised 374 patients (mean age 50.74 ± 14.81 years, 79.68% male) with severe OSA predominating (52.94%), followed by moderate (25.67%) and mild OSA (21.39%). Mean AHI was 37.20 ± 23.80 events/hour.

Sleep architecture showed marked disruption: reduced total sleep time (5.55 ± 1.33 hours), poor sleep efficiency (69.99%), prolonged REM latency (2.24 ± 1.64 hours), and elevated wake after sleep onset (1.67 ± 1.04 hours). Sleep stage distribution revealed pathological changes: increased N1 (21.66% vs normal 5-10%), predominant N2 (63.69%), severely reduced N3 (3.14% vs normal 15-25%), and decreased REM sleep (11.18% vs normal 20-25%). Respiratory events demonstrated distinct sleep stage preferences: 65.36% occurred during N1-N2, 12.46% during REM, and only 1.42% during N3 sleep. This distribution varied significantly according to OSA severity ($p < 0.001$). Interestingly, mild OSA showed higher NREM-AHI than REM-AHI (16.13 ± 15.59 vs. 8.13 ± 3.42 events/hour), while severe OSA affected both stages equally (NREM-AHI: 49.03 ± 23.90 , REM-AHI: 55.59 ± 18.17 events/hour). Cardiovascular parameters were correlated with OSA severity. Mean heart rate increased progressively: 66.57 ± 9.71 (mild), 67.95 ± 10.11 (moderate), and 71.89 ± 13.23 beats/min (severe) ($p < 0.001$). Similar patterns were observed during N1-N2 and REM sleep ($p < 0.01$), whereas the N3 heart rate remained stable across severity groups ($p = 0.743$), suggesting preserved autonomic regulation during deep sleep.

Notably, traditional sleep continuity parameters (total sleep time, REM latency, sleep efficiency, and wake after sleep onset) showed no significant differences across severity groups (all $p > 0.05$), indicating that sleep fragmentation is a universal OSA feature, regardless of severity.

Conclusions: This study provides a comprehensive sleep physiology characterization in Vietnamese OSA patients, revealing profound sleep architecture disruption with increased light sleep, reduced restorative sleep, and differential respiratory event impact across sleep stages. The finding that mild OSA preferentially affects NREM sleep, whereas severe OSA equally affects all sleep stages, offers important pathophysiological insights. Preserved N3 cardiovascular stability despite respiratory disturbances highlights the protective nature of slow-wave sleep. Progressive cardiovascular activation with increasing OSA severity underscores the systemic effects of this disorder. These normative data establish important baseline characteristics for OSA management and research in Southeast Asian populations, where genetic, anthropometric, and environmental factors may influence disease expression differently from Western cohorts.

What are the optimal bedroom temperatures for sleep?

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Introduction: Adequate high-quality sleep is essential for optimizing physical, mental, and cognitive health. The bedroom temperature affects sleep quantity and quality. However, the optimal temperatures for sleep are unknown. Existing building standards define acceptable indoor temperature ranges, but these mostly apply to general living spaces rather than bedrooms. It remains unclear whether these prescribed conditions are

generalizable to sleep. The purpose of this study is to review the evidence of optimal temperatures for sleep under steady-state temperature conditions.

Materials and methods: We conducted a literature search on Web of Science using the keywords “bedroom” AND “temperature” AND “sleep.” Only peer-reviewed journal articles in English of laboratory experimental studies on the effects of room temperature on sleep were included. We excluded observational or lab studies involving personal comfort devices or dynamic temperature changes, as their focus extended beyond steady-state room conditions. We also reviewed dominant international standards and guidelines related to indoor thermal environments, with a specific focus on recommendations for sleeping environments.

Results: Eleven peer-reviewed studies met the inclusion criteria. Of these, three were conducted in the cooling season, four in the heating season, one in both seasons, and two did not specify the season. One study reported no significant changes in both objectively monitored and subjectively reported sleep quality across a broad temperature range (10–32.2 °C). In the remaining ten studies that found significant impacts of room temperatures on both objectively measured and subjectively rated sleep quality, the optimal temperature for sleep appeared to depend on the need to have heating or cooling. In cooling, the highest sleep quality was observed at temperatures between 24–29 °C across experimental ranges of 21–37 °C. In heating, sleep quality was highest at temperatures between 16–23 °C across experimental ranges of 10–23 °C. Variations in optimal temperature between the reviewed studies are mainly attributed to differences in the insulation of bedding and clothing (0.8 to 4.66 clo). A review of international standards and guidelines found general recommendations for residential indoor temperatures but no specific guidance for bedrooms. For instance, the WHO Housing and Health Guidelines (2018) suggests an indoor temperature range of 18–24 °C. CIBSE Guide A (2021) recommends 23–25 °C in summer and 17–19 °C in winter, while EN 16798 (2019) suggests 25.5–28 °C for summer and 16–21 °C for winter. ASHRAE standard 55 (2017) does not specify temperature ranges for sleeping people. Overall, recommended temperatures generally align with experimental optima, though WHO and CIBSE advise cooler-than-evidenced levels for the cooling season.

Conclusions: The optimal bedroom temperatures for sleep appear to be 24–29 °C in the cooling season and 16–23 °C in the heating season. While current standards on temperature requirements are broadly consistent with experimental findings, revisions may be needed to address sleep comfort amid energy goals and warming nights.

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Multi-Night At-Home Evaluation of Oura Ring Against Dreem Headband in Free-Living Older Adults

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Introduction: Although sleep-tracking wearables are widely used, few validation studies have assessed their accuracy and night-to-night stability in older adults under free-living conditions. This study evaluated the Oura Ring against the Dreem headband across multiple nights, focusing on both measurement bias and intra-individual variability.

Materials and methods: Forty-five older adults [mean age $\pm$ SD: 74.4 $\pm$ 2.4 years; 23 females] concurrently wore the Oura Ring and Dreem headband at home. The Dreem headband served as a research-grade EEG reference to evaluate the performance of the Oura Ring in free-living older adults. We analysed 215 nights of paired data to compare nightly estimates of total sleep time (TST), sleep efficiency (SE), wake after sleep onset (WASO), sleep onset latency (SOL), and time spent in each sleep stage. Bias (Oura – Dreem) and the standard deviation (SD) of nightly bias were calculated for each subject to evaluate measurement stability. We also report epoch-by-epoch agreement metrics including accuracy, sensitivity, specificity, Cohen’s kappa and prevalence-adjusted bias-adjusted kappa (PABAK).

Results: On average, Oura underestimated TST by 17.5 $\pm$ 42.3 minutes, SE by 3.5 $\pm$ 8.4%, and REM by 23.2 $\pm$ 36.9 minutes, and overestimated SOL by 11.5 $\pm$ 27.3 minutes, WASO by 6.0 $\pm$ 38.9 minutes, and light sleep by 7.8 $\pm$ 46.5 minutes. Deep sleep was slightly underestimated (–2.1 $\pm$ 32.2 minutes). Mixed models showed no significant effect of night on bias across any variable, supporting stability over time. The night-to-night variability (SD) of these biases was significantly lower in participants with higher SE; indicating greater measurement stability in more

efficient sleepers. Accuracy, sensitivity, and specificity for sleep-wake classification were 85.6% ($\pm 6.7\%$), 88.4% ($\pm 7.5\%$), and 75.7% ($\pm 15.4\%$), respectively, with a Cohen's kappa of 0.58 ($\pm 15\%$) and PABAK of 0.71 ($\pm 13\%$).

Conclusions: In this multi-night validation study under free-living conditions in older adults, Oura Ring demonstrated reasonably accurate and stable multi-night sleep estimates when compared to the Dreem headband, with systematic but consistent biases across nights. Notably, higher sleep efficiency was associated with reduced night-to-night variability in Oura's measurement bias, suggesting a link between sleep fragmentation and device reliability. These findings support the use of Oura for longitudinal sleep monitoring under naturalistic conditions in older adults, with appropriate consideration of its limitations in subjects with lower sleep efficiency.

Can the alpha power of the electroencephalogram (EEG) signal during the eyes-closed calibration of the Multiple Sleep Latency Test (MSLT) first nap predict daytime hypersomnolence?

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Introduction: Hypersomnolence poses significant medical risks, including driving risks. A sleep latency of 8 minutes or less, as measured by the Multiple Sleep Latency Test (MSLT), indicates clinical sleepiness. However, MSLT is time-consuming and resource intensive. An alternative, simple method would be valuable.

This study evaluates whether EEG total alpha power (TAP) from the 20-second eyes closed calibration exercise conducted before the start of nap 1 of the MSLT can predict sleep latency (MSL) as a measure of daytime hypersomnolence

Materials and methods: We retrospectively collected data from 400 consecutive polysomnography (PSG) and MSLT sleep studies conducted between January 2022 and February 2025 at an Australian tertiary hospital. Participants were prohibited from alcohol and caffeine during the tests as per the laboratory standard procedure. Exclusions included PSG reports with an Apnea-Hypopnea Index (AHI) ≥ 15 , Total Sleep Time (TST) < 6 hours, or Sleep Efficiency (SE) $< 75\%$ ($n=156$), and MSLT data with poor EEG quality and different montages ($n=37$).

We extracted alpha frequency components of EEG from the occipital (O1 & O2) and frontal (F3 & F4) lobes using digital filtering (filter settings of 8 Hz for the low pass and 12 Hz for the high pass).

To calculate total alpha power (TAP), alpha waves were transformed using a Fast Fourier Transformation algorithm (LabChart8, ADInstruments) before generating TAP values from each of the 4 signals using the 20-second segment of the eyes-closed manoeuvre at the start of nap 1. We averaged, then categorized TAP values from the frontal channels (F-TAP) and occipital channels (O-TAP) into 3 groups of low TAP ($< 20 \mu V^2$), medium TAP ($20-40 \mu V^2$), and high TAP ($> 40 \mu V^2$). Mean sleep latency was compared to the 3 groups using a one-way ANOVA and post hoc tests ($p < 0.05$). Analyses were conducted using IBM SPSS Version 30.

Results: After exclusion, PSG/MSLT data were analyzed for 207 participants, age range 16-68 years, 65% were female ($n=134$).

The MSL mean values increased by F-TAP groups: low F-TAP ($n=92$) 8.35 ± 4.62 , medium F-TAP ($n=66$) 8.62 ± 5.09 , and high F-TAP ($n=49$) 9.76 ± 5.13 .

Similarly, the MSL mean values increased by O-TAP groups: low O-TAP ($n=55$) 8.21 ± 4.64 , medium O-TAP ($n=43$) 8.94 ± 5.03 , and high O-TAP ($n=109$) 8.99 ± 5.00 .

However, the one-way ANOVA analyses showed no significant difference in the mean of MSL between the 3 groups of F-TAP ($p = 0.26$) or O-TAP ($p = 0.616$), nor were significant differences found in post-hoc pairwise comparisons.

A correlation was observed between MSL and F3_TAP ($p=0.015$), but not with the other channels (F4_TAP $p=0.186$; O1_TAP $p=0.855$; O2_TAP $p=0.588$).

Conclusions: We observed some evidence that higher alpha power from the frontal lobe may be associated with increased sleep latency, though this finding requires more data and further examination of the impact of various medications and incorporating an arousal index threshold into the exclusion criteria.

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Snoring Sound Detection: An Explorative Study on Use of TensorFlow.js for Sleep Quality Monitoring

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Introduction:

This study presents the development and evaluation of a browser-based snoring detection application leveraging TensorFlow.js. The application was designed to perform real-time monitoring and analysis of snoring patterns as a non-invasive method for assessing sleep quality and conducting preliminary screening for potential sleep apnea.

Materials and methods:

The model was trained on a dataset comprising 500 seconds of snoring audio (300 seconds from publicly available sources and 200 seconds of researcher-generated samples) and 500 seconds of background noise recordings. Testing was conducted over a cumulative duration of 200 seconds in various acoustic environments. All audio files were processed using Google's Teachable Machine platform, which segments input into 1-second intervals. No manual preprocessing or noise reduction techniques were applied. Model training was conducted using the Teachable Machine's built-in binary classification system powered by the TensorFlow framework, for 100 epochs using default hyperparameters. Model performance was evaluated based on sensitivity and specificity using a separate test split of the dataset.

Results:

Performance evaluation revealed a high overall accuracy of 94.12%, supported by a sensitivity of 95.00%, specificity of 93.22%, precision of 93.44%, and an F1-score of 94.71%. These findings indicate the system's strong ability to reliably detect snoring events while minimizing false positives from ambient background noise. The model maintained consistent performance across varying acoustic environments without requiring manual preprocessing or noise filtering, underscoring the robustness of the browser-based approach. Additionally, the application was able to generate session-level statistics, such as snoring duration, frequency, and proportion, which enhance its utility for practical sleep quality monitoring.

Conclusions:

The solution offers several advantages, including requiring no specialized hardware beyond a standard microphone, functioning entirely within a web browser without installation, ensuring privacy by processing all audio data locally, and providing detailed session statistics such as snoring duration, count, and percentage. This work demonstrates the potential of leveraging modern web technologies for accessible sleep monitoring solutions. It shows a high level of accuracy in distinguishing snoring sounds from ambient noise and provides relevant statistical information for sleep quality assessment. This approach opens new opportunities for creating user-friendly and widely accessible

sleep monitoring technologies. Future research involving larger-scale studies with diverse user characteristics and environmental conditions is recommended to validate the system's external applicability and robustness in real-world settings. Furthermore, its web-based design enables potential integration with other health platforms or wearable devices for broader sleep monitoring applications.

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Sleep Stage Classification Using Cardiorespiratory Features from Smart Mattress Signals: A Case-Based Validation Study

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Introduction: Non-contact physiological signal-based sleep staging has recently gained attention as a potential alternative to polysomnography (PSG). High-resolution smart mattress systems with a sampling rate of 200 Hz can detect subtle vibrations associated with cardiac and respiratory activity. This study investigates the feasibility of predicting sleep stages by separating heartbeat and respiration signals through two case-based analyses. To evaluate the capability of a high-frequency smart mattress system to separate cardiac and respiratory components from raw pressure signals, and to classify sleep stages based on cardiorespiratory features.

Materials and methods: Raw data were sampled at 200 Hz with the smart mattress system (Huijia Health Life Corporation) for approximately 25,000 seconds, totaling about 5 million data points. Each 30-second segment (epoch), containing 6,000 samples, underwent signal processing: a band-pass filter was used to detect respiratory peaks, while a band-pass filter extracted R-peaks for calculating heart rate (HR) and root mean square of successive differences (RMSSD). Features extracted per epoch included HR, RMSSD, respiratory rate, and respiratory variability. These features were input into a personalized classification function to estimate sleep stage labels (Wake, N1, N2, N3, REM) in accordance with AASM 30-second epoch standards.

Results: Both case studies demonstrated the feasibility of sleep stage classification using the extracted features. Case A exhibited physiological transitions consistent with expected patterns across Wake, non-REM (N1–N3), and REM stages. In Case B, 66.4% of total sleep time was identified as N2 stage, with detectable transitions in heart rate variability and respiratory dynamics across different stages. The proposed method yielded stable staging performance without requiring BCG or EEG signals.

Conclusions: This study demonstrates the potential of high-frequency smart mattress signals for non-invasive, epoch-based sleep stage classification. By using basic signal processing and classification methods to identify heart rate and breathing patterns, we can accurately determine sleep stages, which sets the stage for future large-scale, contactless sleep monitoring.

Acknowledgments: We sincerely thank the Kaohsiung Armed Forces General Hospital for providing clinical resources and institutional support. We also acknowledge Huijia Health Life Corporation for supplying the smart mattress system used in this study. Special thanks to Bo-Sheng Chen for his technical expertise in AI model development and implementation.

AI-Based Contactless Sleep Monitoring for Early Detection of Mood Dysregulation in Hospitalized Patients

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Introduction: Sleep disturbances are both a symptom and an early warning sign for mood disorders, including depression and bipolar disorders. Poor sleep quality not only impairs recovery but is also associated with increased risks of emotional instability, aggression, and suicide. These sleep-related issues are often underrecognized in psychiatric wards. Early and continuous monitoring of sleep may provide crucial opportunities for proactive intervention in vulnerable patients. This study aims to develop a contactless, AI-driven sleep monitoring system based on smart mattress technology to detect physiological changes associated with mood disorder exacerbation. The goal is to enhance early detection of emotional dysregulation and support timely psychiatric intervention.

Materials and methods: This study consists of two phases. In the first phase, the smart mattress system (Huijia Health Life Corporation) will be calibrated against gold-standard polysomnography (PSG) in healthy individuals to evaluate its validity and sensitivity for sleep stage detection and physiological signal reliability. In the second phase, psychiatric inpatients diagnosed with depression or bipolar disorder will undergo continuous overnight monitoring using the smart mattress, which captures heart rate, respiration, and body movement. Supervised machine learning algorithms will be used to model the association between sleep dynamics and clinical indicators of mood instability. SHAP will be applied to interpret model outputs and determine key contributing features.

Results: We anticipate developing a validated supervised learning model capable of detecting early changes in sleep patterns that indicate deterioration of mood disorders. The system is expected to provide real-time insights to assist clinical teams in decision-making and intervention planning.

Conclusions: Integrating AI-assisted, contactless sleep monitoring into psychiatric care may significantly improve early detection and clinical management of mood disorders. This approach has the potential to enhance patient safety, support timely treatment, and improve the overall quality of psychiatric care.

Acknowledgments: We sincerely thank the Kaohsiung Armed Forces General Hospital for providing clinical resources and institutional support. We also acknowledge Huijia Health Life Corporation for supplying the smart mattress system used in this study. Special thanks to Bo-Sheng Chen for his technical expertise in AI model development and implementation.

Clinical Application of a Polysomnography Report with an AI-Assisted Summary

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Introduction: The interpretation of polysomnography (PSG) reports in clinical practice traditionally focuses on the Apnea-Hypopnea Index (AHI), often overlooking the complex interplay of underlying pathophysiological traits that define a patient's Obstructive Sleep Apnea (OSA). The Phenotyping Using Polysomnography (PUP) approach allows for the non-invasive estimation of these traits—including Loop Gain (LG), Arousal Threshold (AT), Anatomical Collapsibility (Pcrit), and Pharyngeal Compensation. However, manual calculation and interpretation of these traits are complex and not widely integrated into routine clinical workflows. We aimed to develop a novel tool to bridge this gap.

Materials and methods: We developed a web-based application utilizing a multimodal AI model (Google's Gemini) to automate the analysis of PSG reports during the study period of 2025/May/1 to 2025/Jun/26. The tool's workflow involves: (1) user upload of a standard PSG report image; (2) AI-powered extraction of key parameters (AHI, respiratory event counts, SaO₂, arousal index, sleep architecture); (3) execution of a rule-based algorithm, informed by recent literature, to score and rank the four primary PUP traits based on the extracted data; and (4) dynamic generation of a structured, downloadable PDF report that presents the data and a prioritized analysis of the likely pathophysiological drivers for the specific case. It is important to note that all figures and data transferred to the Large Language Model (LLM) for calculation are anonymous and free from any personal information to ensure patient privacy.

Results: The AI-assisted tool successfully automates the translation of a static PSG report image into a dynamic, interpretable summary. It generates an instantaneous analysis that prioritizes the patient's likely OSA endotypes. The final report provides clinicians with a clear, ranked list of the contributing physiological traits (e.g., "I. High

Loop Gain," "2. Low Arousal Threshold"), along with data-driven justifications for the ranking. This output facilitates a more nuanced understanding of the individual patient's disease beyond a single AHI value.

Conclusions: This AI-assisted application demonstrates a practical and rapid method for integrating advanced PUP-based phenotyping into routine clinical practice. By automating the data extraction and analysis process, this tool has the potential to enhance clinical decision-making, facilitate the development of personalized treatment strategies for OSA, and ultimately improve patient outcomes by connecting complex sleep physiology research with day-to-day clinical care.

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A Smartphone-based Intervention to Improve Light Exposure in Young Adults

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Introduction: Light exposure patterns play a critical role in regulating circadian rhythms and promoting optimal sleep quality. Modern lifestyles often involve insufficient daytime sunlight exposure and excessive artificial light at night, disrupting sleep-wake cycles and impairing alertness and cognitive performance. Smartphone-based behavioural interventions offer a promising scalable approach to optimize individual light exposure and health. In this study, we introduce a novel, digital, smartphone-based intervention that tunes behaviour to optimize light exposure—enhancing daytime light intake while reducing nighttime exposure—with the goal of improving sleep quality and daytime functioning in young adults.

Materials and methods: Seventeen healthy young male adults (average age $\pm$ SD = 28.1 $\pm$ 4.5 years) participated in this study comprising a baseline and an intervention phase (10–14 days each). Light exposure was measured using wearable sensors with a 1-min sampling rate, for the continuous quantification of illuminance, spectral composition of light, and melanopic Equivalent Daylight Illuminance (mEDI). Daytime outdoor time (7AM–7PM) was estimated using a machine learning model trained to classify light data as indoor or outdoor. Sleep quality and duration were monitored using the same devices and sleep diaries. Baseline sleep quality and daytime sleepiness were assessed using the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS), respectively. During the intervention phase, participants received personalized WhatsApp nudges encouraging greater daytime exposure and reduced evening exposure to light. Evening nudges were sent three hours before baseline average bedtime. Outcome measures included time spent outdoors and above the recommended 250 mEDI (in minutes and as a percentage of wear time), average mEDI levels during daytime, as well as sleep metrics (e.g. Bed time, Get up time, Time in bed, Sleep efficiency, number of awakenings, etc.).

Results: At baseline, participants reported a mean PSQI score of 5.6 $\pm$ 3.3 and an ESS score of 7.2 $\pm$ 3.3. The digital intervention successfully enhanced outdoor time in 14 out of 18 participants (77.8%). That increment ranged between 4 to 78 minutes of outdoor time per day with improvements being more pronounced on weekdays compared to weekends. On average, on weekdays, daily outdoor time was increased from 84.6 $\pm$ 48.9 (at baseline) to 100.5 $\pm$ 51.7 minutes (p = 0.03). Accounting for the sensor's wear time, this translated to an increase from 12.6 $\pm$ 7.2% to 15.6 $\pm$ 7.1% (p = 0.01) of outdoor time during daytime. Time spent above 250 mEDI was also increased from 15.0 $\pm$ 8.9% to 18.7 $\pm$ 9.2% (p = 0.008). Additionally, mEDI levels increased marginally from 350.6 $\pm$ 280.2 lx to 470 $\pm$ 272.7 lx (p =0.07) during waketime. These outcome measures were not different between baseline and intervention on weekends. Nighttime mEDI levels and most sleep metrics were comparable between conditions, with fewer maximum awakenings during the intervention (p =0.04).

Conclusions: Our findings demonstrate the potential of a scalable smartphone-based intervention to enhance weekday light diets in young adults living busy, modern lifestyles. By significantly increasing daytime light exposure and mEDI, our approach holds promise for enhancing circadian alignment, reducing daytime sleepiness and performance, and improving nighttime sleep.

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Manual Versus Automated Polysomnography Scoring: Inter-rater Accuracy in a Single-Center Thai Cohort

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Introduction: The demand for trained sleep study personnel is rising, but the relative accuracy of advanced sleep technicians (ASTs), sleep disorder specialists (SDSs), and commercial autoscoring software (AUTO) has not been quantified in Thailand. We evaluated inter-rater agreement, scorer bias, and clinical comparability among these three methods.

Materials and methods: A retrospective analysis was performed on 250 consecutive diagnostic polysomnography (PSG) studies recorded between September 2022 and February 2023 (102 women, 148 men; mean age 48.5 ± 17.5 y; BMI 29.1 ± 6.6 kg/m²). Each record was independently scored by a randomly assigned certified AST (n = 10), a blinded SDS and AUTO (default settings). Sleep stages, respiratory events and derived indices were extracted. Categorical agreement was assessed with Cohen's κ ; continuous agreement with intraclass-correlation coefficients (ICC, two-way random, absolute agreement). Bias and limits of agreement were evaluated using Bland–Altman analysis. Apnoea–hypopnoea index (AHI), arousal index (ARI) and sleep efficiency (SE) were compared across raters with repeated-measures ANOVA and Tukey post-hoc tests ($\alpha = 0.05$).

Results: AST–SDS staging agreement was almost perfect ($\kappa = 0.832$ – 0.980). In contrast, AST–AUTO agreement ranged from slight for NREM1 ($\kappa = 0.081$) to moderate for wake ($\kappa = 0.599$), producing stage-specific differences between AST–SDS and AST–AUTO for every stage except NREM2 (overall $p < 0.0001$; NREM2 $p = 0.099$). For respiratory events, AST–SDS reliability was substantial to perfect (ICC = 0.684 for central apnoea; 0.945–0.998 otherwise), whereas AST–AUTO reliability spanned poor (central apnoea, ICC = 0.023) to strong (mixed apnoea, ICC = 0.869). The same pattern emerged for derived indices: AST–SDS ICCs were excellent for AHI (0.982), ARI (0.982) and periodic limb movements (PLMs, 0.965); AST–AUTO ICCs were moderate for AHI (0.564) and ARI (0.496) and poor for PLMs (0.149). Bland–Altman plots showed significant bias across all variables ($p \leq 0.0487$). Repeated-measures ANOVA revealed significant rater effects for AHI ($p = 0.042$) and ARI ($p = 0.028$); SE differed for seven of ten ASTs ($p < 0.006$). Post-hoc tests confirmed AST differed from AUTO for AHI ($p = 0.013$) and ARI ($p = 0.030$) but not from SDS.

Conclusions: Manual scoring conducted by ASTs and SDSs, following the AASM 2020 guidelines, shows a strong level of agreement and minimal bias. In contrast, the commercial AUTO algorithm demonstrates lower reliability and clinically significant discrepancies, particularly regarding NREM1 sleep, central apneas, and periodic limb movement detection. Therefore, expert review remains crucial until the performance of these algorithms is improved. This data serves as a foundation for national training standards and identifies specific areas for improvement, including NREM1, PLMs, and CA discrimination, to guide the development of future AI-enhanced autoscoring tools.

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Neurological Disorders Affecting Sleep

Motor Sleep Inertia and Activity-Based Prospective Memory in Early Multiple Sclerosis: An Actigraphic Study

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Introduction: Multiple sclerosis (MS) is a chronic autoimmune disease of the central nervous system, marked by significant clinical heterogeneity. The most common form at onset is relapsing-remitting MS (RRMS). Patients with

early-stage RRMS (diagnosed within 24 months) may show increased motor activity around 5:00 a.m., possibly due to hyperactivity of the hypothalamic–pituitary–adrenal (HPA) axis. While sleep disturbances have been increasingly studied in MS, transitional sleep-wake dynamics—such as sleep inertia (SI)—remain underexplored. Although actigraphy has been used to study SI in healthy individuals, it has not been widely applied to MS populations. Given MS-related motor and cognitive changes, characterizing SI could offer insight into real-life functioning.

Cognitive symptoms are also common in MS. Among these, prospective memory (PM)—the ability to remember to perform intended actions in the future—is particularly relevant, as it plays a key role in daily life, such as remembering to take medications. In this study, PM was assessed through an activity-based task: participants wore an actigraph and were asked to press the event marker upon the last morning awakening. We measured the PM efficiency (in percentage) and the latency between get-up time and button press and its association with motor SI.

Aims:

1. To investigate differences between MS patients and healthy controls (HC) in terms of motor sleep inertia;
2. To assess whether the percentage of accuracy in the PM task differs between HC and individuals with early-stage RRMS;
3. To explore the relationship between motor sleep inertia and performance on the activity-based PM task in both groups.

Materials and methods: We enrolled 35 patients with RRMS (24 females; mean age 31.4 ± 7.74) and 30 HC (21 females; mean age 29 ± 7.07). Participants wore Micro MotionloggerWatch devices on non-dominant wrist for seven consecutive days, pressing the event marker to signal bedtime and wake-up. Data were analyzed using the Action W-2® software, version 2.7.1.

Results: A functional linear model comparing post-wake motor activity in the first 60 minutes (1) revealed a similar pattern across groups, though MS participants showed reduced motor sleep inertia in the first ~10 minutes after morning awakening, suggesting faster motor reactivation. In the PM task (2), both groups showed high compliance, with HC showing slightly higher accuracy (91.4%) than MS (87.7%), though the difference was not statistically significant. FLM analysis showed a broader time window of association between early motor activity and task latency in MS (3), suggesting that reduced inertia correlates with better performance.

Conclusions: Our results indicate (1) reduced motor sleep inertia in individuals with MS, possibly reflecting a heightened adrenal response characteristic of early stages of the disease. This reduced motor inertia appears to (2) be accompanied by a preserved activity-based prospective memory, as MS participants were able to perform the cognitive task at a level comparable to HC. Furthermore, (3) FLM analysis showed that higher early motor activation was associated with faster task initiation in both groups. Notably, the MS group once again exhibited lower sleep inertia compared to HC, and as sleep inertia decreased, task performance improved, resulting in prospective-memory task shorter latency.

Association Between Long Sleep Duration and Dementia Risk Among Elderly Farmers: A Cross-Sectional Analysis

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Introduction: Dementia represents a significant public health concern among older adults worldwide. Growing evidence suggests that sleep duration may serve as an important modifiable risk factor for cognitive decline, warranting investigation in vulnerable populations. The agricultural workforce is experiencing rapid demographic aging, heightening the need for dementia prevention and early detection strategies in farming communities. Elderly farmers face unique challenges including physically demanding work, higher prevalence of chronic diseases, and limited healthcare access, making them particularly susceptible to cognitive impairment. This study examined the relationship between sleep duration and cognitive function in elderly Korean farmers.

Materials and methods: We performed a cross-sectional analysis of 710 Korean farmers aged 60 years and older. Cognitive impairment was assessed using the Mini-Mental State Examination for Dementia Screening (MMSE-DS) with age-, sex-, and education-adjusted cutoff scores. Participants reported their typical daily sleep duration, which was categorized as short (<6 hours), normal (6-8 hours, reference group), or long (>8 hours). Multivariable

logistic regression models were constructed to examine associations while controlling for demographic characteristics, medical comorbidities, depression, lifestyle factors, pesticide exposure, agricultural work type, and physical activity levels.

Results: Compared to farmers sleeping 6-8 hours nightly, those with prolonged sleep duration (>8 hours) demonstrated nearly three-fold increased odds of cognitive impairment (OR = 2.96, $p = 0.007$). Conversely, short sleep duration (<6 hours) was not significantly associated with dementia risk (OR = 0.71, $p = 0.302$).

Conclusions: Our findings align with international research demonstrating associations between extended sleep duration and cognitive decline. The results suggest that prolonged sleep among elderly farmers may serve as an early indicator of dementia risk. Given the occupational hazards and healthcare barriers faced by agricultural workers, integrating sleep assessment into rural health surveillance programs could enhance early detection of cognitive impairment. Future longitudinal research is needed to determine whether extended sleep duration precedes cognitive decline or represents a consequence of underlying neurodegenerative processes.

Sleep EEG Characteristics in People with Parkinson's Disease Dementia: A Retrospective Polysomnographic Analysis

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Introduction:

Dementia prevalence is rising worldwide, with one new case every three seconds and projected global costs of USD 2 trillion by 2030. In Taiwan, 7.54% of adults ≥ 65 years (about 319,000 cases) are affected. About 26% of community-dwelling patients experience sleep disturbances, which increase agitation, caregiver burden, and cognitive decline. Insomnia and sleep apnea elevate Alzheimer's and vascular dementia risk (RR 1.49 and 1.47), likely through neuroinflammation, impaired glymphatic clearance, and disrupted sleep-wake cycles. EEG studies show accelerated background slowing in dementia, with increased 8 Hz power and reduced entropy in Alzheimer's disease. Sleep EEG features—architecture, spindles, slow oscillations, coherence—differentiate dementia or MCI from controls, though subtyping remains limited.

This retrospective study (2020–2023) analyzed polysomnographic data from dementia patients at our Sleep Medicine Center to (1) characterize demographics and sleep physiology, (2) strengthen clinical practice, (3) identify research opportunities, and (4) promote cross-disciplinary collaboration.

Materials and methods: This exploratory study included patients with dementia or cognitive impairment confirmed by neurologists/psychiatrists at our hospital. Diagnoses were cross-referenced with ICD-10 codes, and all cases verified in electronic records. Two subprojects were undertaken:

1. Basic Sleep Physiology: Extracted demographics (sex, age, education, dementia type) and polysomnographic measures—total sleep time, latency, stage distribution (NI-REM), sleep events, oxygen saturation, mean heart rate, and periodic limb movement index. Data were de-identified and analyzed descriptively and by ANOVA across subgroups.

2. Sleep EEG Analysis: EEG signals from frontal, central, and occipital regions were processed with computer science support, involving pre-processing, feature extraction, classification, and post-processing. Patterns were compared across dementia subtypes.

Results: Of 46 identified cases, 33 unique remained after excluding duplicates. Records showed 24 cognitively normal individuals, 4 with subjective cognitive decline, 3 with Parkinson's disease (PD), and 2 with epilepsy. The three PD cases were included for further analysis. Preliminary spectral mapping revealed EEG differences across groups, suggesting sleep EEG may serve as a biomarker of dementia-related changes.

Conclusions: Spectral EEG analysis showed group-level differences between PD and controls. PD patients demonstrated altered delta activity and more pronounced theta power changes. Within-group analysis revealed that controls had no significant alpha–beta differences, whereas PD patients showed marked beta reduction relative to alpha. This alpha–beta imbalance may reflect impaired transitions between wakefulness and light sleep, linked to basal ganglia and cortical degeneration. Elevated Theta abnormalities are consistent with prior studies connecting Theta oscillations to cognition and memory, possibly underlying decline and disease progression in PD. These findings reinforce the value of sleep EEG for distinguishing PD dementia from normal aging and for monitoring progression.

This exploratory study highlights spectral EEG features as potential biomarkers for PD dementia. Future directions include predictive modeling of dementia progression, integrating subjective sleep measures with physiological data for risk scores, and applying machine learning to automate dementia subtyping. Despite limitations, the study demonstrates the value of institutional datasets in advancing early diagnostic tools and stratification strategies for dementia care.

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Rest-activity rhythm and risk of cognitive impairment: A systematic review and meta-analysis

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Introduction: Although rest-activity rhythm (RAR) disruption is widely recognized as a risk factor for cognition, its influence on cognitive impairment remains unclear. The study is to evaluate the association of RAR with cognitive impairment, including cognitive decline, mild cognitive impairment (MCI) and dementia.

Materials and methods: Two reviewers systematically searched PubMed, Embase, and PsycInfo for studies published from inception to February 2025, which were observational studies published as full-length articles in peer-reviewed journals related to the association of RAR and cognitive decline, MCI and dementia, and this review followed the Meta-analysis of Observational Studies in Epidemiology (MOOSE) reporting guidelines.

Results: A total of 11 longitudinal studies comprising 97,963 participants were included, with an average follow-up time of 4.95 years. It showed that individuals with lower amplitude (effect size, -0.062; 95% CI, -0.119 to -0.006), higher least active 5-hour period (effect size, 0.060; 95% CI, 0.014 to 0.105), higher intradaily variability (effect size, 0.015; 95% CI, 0.003 to 0.027), and phase-advanced (effect size, 0.114; 95% CI, 0.037 to 0.190) exhibited a higher risk of cognitive impairment. Lower amplitude (effect size, -0.092; 95% CI, -0.155 to -0.029), lower relative amplitude (effect size, -0.078; 95% CI, -0.116 to -0.039), and higher least active 5-hour period (effect size, 0.059; 95% CI, 0.025 to 0.093) were associated with mild cognitive impairment (MCI) and dementia. Lower amplitude (effect size, -0.006; 95% CI, -0.010 to -0.002) was associated with cognitive decline. But no association was found between either the most active 10-hour period or the midline estimating statistic of rhythm and cognitive impairment.

Conclusions: This meta-analysis found that RAR was associated with cognitive impairment. Higher amplitude and regular acrophase were protective factors for cognitive impairment, but higher least active 5-hour period increased the risk of cognitive impairment. The results suggested that a regular circadian rhythm pattern such as high-intensity exercise during daytime and a deep resting state during night could be useful in early-stage cognitive impairment management.

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Sleep Microarchitecture Disruptions in Ischemic Stroke: Insights from Polysomnography

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Introduction: Sleep microarchitecture, including spindles, K-complexes, and slow waves, plays a critical role in neuroplasticity and recovery. However, alterations in these features following stroke remain underexplored. This study aimed to compare sleep microarchitecture features in ischemic stroke patients versus healthy controls and to identify lesion locations associated with disrupted sleep parameter using voxel-based lesion-symptom mapping (VLSM).

Materials and methods: Ischemic stroke patients (within one month of onset) and healthy controls underwent overnight polysomnography (PSG). Sleep EEG was manually scored using AASM manual 2023 and microarchitecture was analyzed using the YASA toolbox. Spindle features (count, density, amplitude, duration, frequency) and K-complexes were extracted during Stage N2. Slow-wave features (amplitude, slope, duration) were analyzed during Stage N3. REM parameters were also assessed. VLSM analysis was performed in 25 stroke patients using manually segmented lesion masks co-registered to MNI space. Non-parametric mapping with FDR correction ($p < 0.05$) was applied.

Results: Thirty ischemic stroke patients (mean age: 51.4 ± 10.2 years; 20 males, 10 females) within one month of onset and thirty age- and gender-matched healthy controls (mean age: 50.8 ± 9.6 years; 20 males, 10 females) underwent overnight polysomnography (PSG). Stroke patients had significantly lower spindle density (mean: 0.49/min vs. 0.83/min, $p < 0.01$) and amplitude (mean: 11.2 μ V vs. 15.4 μ V, $p = 0.02$) compared to controls, particularly over fronto-central channels. Spindle count was also reduced (mean: 147.3 vs. 235.7, $p = 0.01$), with decreased average duration (mean: 0.75 s vs. 0.89 s, $p = 0.03$). During N3 sleep, stroke patients exhibited lower slow wave amplitude (mean: 59.2 μ V vs. 78.5 μ V, $p = 0.01$) and slope (mean: -1.47 μ V/ms vs. -2.18 μ V/ms, $p = 0.01$). REM density showed a trend toward reduction (mean: 1.9/min vs. 2.6/min, $p = 0.07$). VLSM analysis revealed that reduced sleep efficiency correlated with lesions in the right dorsolateral prefrontal cortex ($Z = 4.85$, 672 voxels), right superior frontal gyrus ($Z = 4.32$), right anterior cingulate cortex ($Z = 4.10$), left inferior parietal lobule ($Z = 3.95$), and right insular cortex ($Z = 3.82$).

Conclusions: Stroke survivors demonstrate disruptions in sleep microarchitecture, particularly in spindles and slow waves. Alterations in sleep efficiency are linked to lesions in frontal and parietal regions regulating attention and arousal. Disruptions of microarchitecture could be a potential biomarker for sleep alterations post stroke.

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Sleep Efficiency and Short-Term Topographic Memory in Stroke Survivors: Preliminary Results

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Introduction: Sleep plays a critical role in memory and learning tasks. About 90% of stroke patients have sleep disturbances. We have previously demonstrated differential effects of sleep efficiency based on the territory of stroke. This study aimed to assess short term topographical memory consolidation using the Four Mountain Task (4MT) in stroke patients compared to age-matched controls, pre- and post-sleep.

Materials and methods: Ischemic stroke patients (3 months old, chronic phase) and healthy volunteers, underwent the 4MT before and after an overnight polysomnography. The 4MT evaluates short term topographic memory by asking participants to recognize previously seen landscapes with four mountains. Reaction times and accuracy were recorded. Correlation between sleep efficiency and post-sleep task performance was analyzed.

Results: A total of 14 stroke patients and 14 controls were included in the study. The mean age of stroke patients was 47.3 years (SD: 8.4), while controls had a mean age of 44 years (SD: 9.39). Males comprised 50% of the stroke group and 57.1% of the controls. Reaction times improved after sleep in both groups (Patients: 4305 ms to 3920 ms; Controls: 3720 ms to 3345 ms), suggesting sleep-dependent memory improvement. Accuracy remained stable in patients and improved slightly in controls. No significant group differences were noted in overnight change scores. A significant negative correlation ($\rho = -0.48$, $p = 0.01$) was observed between sleep efficiency and post-sleep reaction time across all participants, suggesting that sleep dependent memory improvement.

Conclusions: Short term topographical memory benefit from sleep in stroke survivors, with reaction time improvements linked to better sleep efficiency. These findings suggest that preserving sleep quality may support cognitive recovery post-stroke.

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Prevalence of obstructive sleep apnea and screening questionnaire performance in highly drug-resistant epilepsy

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Introduction: Obstructive sleep apnea (OSA) is common among patients with drug-resistant epilepsy (DRE); however, data are limited for those with highly drug-resistant epilepsy (HDRE), defined as requiring three or more antiepileptic drugs. This study aimed to determine the prevalence of OSA in patients with HDRE and to evaluate the performance of existing screening questionnaires to identify the most suitable tool for assessing OSA risk.

Materials and methods: We conducted a cross-sectional study in 41 adults with HDRE. All participants underwent overnight polysomnography (PSG) and completed five screening questionnaires: STOP-BANG, SA-SDQ, Berlin Questionnaire, NoSAS, and NH-OSA. The discriminatory performance of each tool was assessed using receiver operating characteristic (ROC) curve analysis. A novel scoring model BANGS was developed using logistic regression.

Results: The prevalence of OSA was 75.6%, with severity classified as mild (26.8%), moderate (29.3%), and severe (19.5%). For an apnea-hypopnea index (AHI) ≥ 5 , the STOP-BANG questionnaire demonstrated the highest area under the curve (AUC) at 0.771 (95% CI: 0.62–0.92), with 74.2% sensitivity and 80% specificity. The newly developed BANGS score, based on BMI ≥ 23 , age ≥ 40 , neck circumference ≥ 40 cm, male gender, and snoring, achieved 71.4% sensitivity and 100% specificity for predicting moderate-to-severe OSA.

Conclusions: This is the first study to report OSA prevalence in patients with HDRE, revealing a notably high rate. Nearly half of the patients had moderate-to-severe OSA. STOP-BANG demonstrated acceptable diagnostic performance, while the BANGS score showed strong specificity and may serve as a useful screening tool. Routine OSA screening should be considered in patients with HDRE.

Investigation of Factors that Impact the Accuracy of Auto-detected REM Sleep with Atonia

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Introduction: Accurate, automated detection of rapid-eye-movement (REM) sleep without atonia (RSWA), a prodromal biomarker for alpha-synuclein-related neurodegeneration derived from chin and arm electromyograph (EMG) signal, would enable population-based studies to be conducted inexpensively and conveniently on large samples of REM sleep behavior disorder and Parkinson disease patients compared with healthy controls. This study investigates two factors that could impact the auto-detected RSWA accuracy acquired in the home, i.e., the auto-staging of REM sleep from the frontalis region, and rejection of RSWA during periods with artifact.

Materials and methods: Twenty-three women and 12 men (ages 71.5 ± 8.5 years, 30 diagnosed with mild cognitive impairment and 5 with Alzheimer's dementia) completed two-night in-home Sleep Profiler™ recordings with chin and arm EMG, while 10 participants repeated the procedure one-year later, for a total of 45 "MCI/AD" recordings. A second cohort of 3 women and 11 men with isolated REM sleep behavior disorder (iRBD) were studied for one (n=8) or two-nights (n=6), with chin EMG missing in one case.

Recordings were auto-scored for REM sleep and RSWA using previously described procedures ("auto"), and then visually edited for accuracy ("edited"). The edited studies were processed a third time to reject chin RSWA that overlapped with snoring ≥ 60 dB and/or head movement ("clean").

The total number of 3-second REM mini-epochs (ME) and those with RSWA were tallied across nights when available, and RSWA densities computed by condition. Bland-Altman plots identified biases resulting from edits to the auto-scoring. Abnormal RSWA densities were based on the previously validated thresholds for the chin ($\geq 15\%$), arm (≥ 12.5) and either chin or arm ("any" $\geq 25\%$).

Results: Editing of auto-staged REM reduced total REM Chin-MEs by 90 ± 596 , Arm-MEs by 138 ± 572 , and Any-MEs by 37 ± 149 in MCI/AD cohort, contributing to a Chin-RSWA bias of $0.2 \pm 1.6\%$, Arm-RSWA bias of $0.6 \pm 2.5\%$, and Any-RSWA bias of $0.9 \pm 2.7\%$.

In the iRBD group editing of REM sleep increased total Chin-ME by 170 ± 335 , Arm-ME by 330 ± 633 , and Any-MEs by 117 ± 182 , resulting in a Chin-RSWA bias of $-3.2 \pm 9.4\%$, Arm-RSWA bias of -1.1 ± 5.0 , and Any-RSWA bias of $-1.6 \pm 7.9\%$.

Across three conditions, the proportion of MCI/AD cases with abnormal Chin-RSWA was auto=31%, edited=29% and clean=16%, Arm-RSWA was auto=9% and edited/clean=4%, and Any-RSWA was auto=16% and edited=18% and clean=16%. Only one of the 7 cases with abnormal clean chin-RSWA had concurrent abnormal Arm-RSWA.

In the iRBD group, the proportions with abnormal chin-RSWA were auto=69%, edited=77% and clean=77%, while Arm-RSWA was auto=77% and edited/clean=86%, and Any-RSWA was auto=71%, edited=79% and clean=79%. In one case, a normal Chin-RSWA density classification likely resulted from only 89 total Chin-MEs.

Conclusions: Despite over-reporting auto-staged REM sleep in the MCI/AD group and under-reporting REM in the iRBD group, the distribution of cases with abnormal RSWA densities were similar before and after editing. Rules that rejected Chin-RSWA during periods with snoring or movement had the greatest impact on abnormal RSWA density distributions, reducing the number of presumed false-positive RSWA cases in the MCI/AD group while having no impact on abnormal Chin-RSWA or Amy-RSWA distributions in the iRBD group.

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Diagnostic Potential of Sleep Spindles in drug-naïve Schizophrenia Using Standard PSG Data: A Retrospective Pilot Study

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Introduction: In 2007, Ferrarelli et al. reported significant reductions in the number, amplitude, and duration of sleep spindles during non-REM stage 2 sleep in patients with schizophrenia. These abnormalities were not observed in non-schizophrenic populations. Further studies have found similar spindle abnormalities in early-onset, drug-naïve patients and even in first-degree relatives.

Based on these findings, abnormalities in sleep spindles among drug-naïve patients with schizophrenia have drawn attention as potential diagnostic markers.

In this study, we conducted a pilot analysis using polysomnography (PSG) data obtained with a standard clinical montage from previously recorded drug-naïve Japanese patients with schizophrenia at Kurume University Hospital, aiming to evaluate the diagnostic utility of sleep spindle activity in schizophrenia.

Materials and methods: We analyzed PSG data collected at Kurume University Hospital between January 2001 and December 2025 from seven drug-naïve schizophrenia patients (diagnosed according to DSM-IV and never previously treated with antipsychotic medication) and seven healthy controls.

Various spindle parameters—frequency, detection time, duration, and amplitude—were analyzed using spindle detection software and compared across four electrode sites (C3, C4, O1, and O2). Additionally, the effects of an initial administration of 2 mg of risperidone were evaluated.

Results: As a result, the drug-naïve schizophrenia group exhibited significantly lower spindle frequency and detection time, particularly at the C3 electrode site, compared to healthy controls. In particular, the frequency and detection time of fast spindles (12–15 Hz) were markedly reduced in drug-naïve schizophrenia patients (Frequency: $Sc = 35.69$, $HC = 98.25$, $p < 0.01$; Detection time: $Sc = 242.5$, $HC = 708.9$, $p < 0.01$).

Only slight decreases in these values were observed after risperidone administration.

In drug-naïve patients, ROC curve analyses revealed high diagnostic accuracy, with an AUC of 0.94 for both frequency and detection time of fast spindles. Both specificity values were 1.000. Similarly, the AUC for detection time of total spindles (9–15 Hz) was also 0.94, with a sensitivity of 1.000.

In patients administered risperidone, the AUCs for detection time of total and fast spindles still exceeded 0.7.

Conclusions: This study demonstrated that drug-naïve Japanese patients with schizophrenia exhibit reduced sleep spindle activity, particularly at the C3 electrode site, based on standard PSG data. Fast spindle frequency and detection time demonstrated excellent diagnostic performance, while total spindle detection time contributed to disease exclusion, suggesting their complementary diagnostic utility. The minimal changes observed after risperidone administration support the potential role of sleep spindles as trait markers.

These findings highlight the feasibility of using standard PSG data as a non-invasive tool for the early detection of schizophrenia. To further validate these results, prospective studies with larger sample sizes using PSG data obtained with standard electrode montages are warranted.

Optimising Positive Airway Pressure (PAP) Therapy in a Patient with Cervical Spinal Cord Injury and Untreated Severe Obstructive Sleep Apnoea (OSA): A Case Report

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Introduction: Sleep disordered breathing is common in individuals with spinal cord injuries (SCI). This often contributing to impaired rehabilitation outcomes. We present a case of a patient with previously diagnosed but untreated severe OSA, who sustained a cervical SCI. He subsequently underwent intensive rehabilitation in the Ventilatory Rehabilitation Unit, was successfully initiated on PAP therapy and had with improvement in functional outcomes.

Materials and methods: A case report of a patient with untreated severe OSA managed in a ventilatory rehabilitation unit following cervical spinal injury.

Results: A 52-year-old male with known severe OSA which was confirmed by polysomnography: Apnoea-Hypopnoea Index [AHI] 91.8, Oxygen Desaturation Index [ODI] 87.9, nadir SpO_2 58%. He had had previously declined Positive Airway Pressure (PAP) therapy due to the great discomfort he experienced with PAP therapy.

He presented to the hospital after sustaining from a fall from a chair, with resultant tetraparesis. Magnetic Resonance Imaging of the cervical spine showed cervical spondylosis and degenerative disc disease, worse at C3-4 to C5-C6 with moderate spinal canal and moderate to severe bilateral foraminal stenosis. He then underwent surgical decompression and instrumentation of his cervical spine before he was transferred to a rehabilitation centre for intensive tertiary rehabilitation.

On admission to the rehabilitation centre, his demonstrated improvement in his strength and had residual mild weakness in his limbs.

During his stay in the rehabilitation centre, he was noted to have daytime somnolence which significantly impaired his engagement in therapy. History revealed that he fell from the chair as he dozed off while sitting on the chair. Examination revealed a body mass index (BMI) of 40 kg/m², neck circumference of 38.5 cm, Epworth sleepiness scale (ESS) of 19 and STOP-BANG Score 7.

He was re-counselled and agreed for initiation of PAP therapy. Initial autoCPAP (10–12 cmH₂O) was poorly tolerated due to discomfort. He could only tolerate PAP therapy for up to 2 hours a night. This prompted reduction to CPAP 5 cmH₂O. Concurrent troubling symptoms of allergic rhinitis were managed with intranasal corticosteroids and oral antihistamines. As nasal symptoms improved, a structured PAP acclimatisation protocol was implemented. This included adjustment of ramp settings, progressive increase in pressure settings and duration of PAP therapy.

Gradually, the patient achieved improved tolerance, with nightly use extending to 8 hours. Compliance data showed that AHI had reduced to 21. ESS had also improved to 10. He reported marked reduction in daytime somnolence, enabling full participation in physiotherapy. On discharge, he achieved significant improvement in his functional status and required only minimal assistance for ambulation and activities of daily living.

Conclusions: Effective initiation and acclimatisation to PAP therapy in the inpatient setting in this patient not only led to significant improvement in sleep-related symptoms and functional rehabilitation outcomes. This could also reduce his risk of falls which could prevent further injuries.

Structured, individualised PAP therapy acclimatisation with close multidisciplinary support facilitated better adherence, especially in this patient who was previously non-compliant.

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BETWEEN SLEEP AND SORROWS: CASE REPORT ON NARCOLEPSY

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Introduction: Narcolepsy is a chronic neurological sleep disorder that often manifests during adolescence or early adulthood, but its subtle and overlapping symptoms can lead to delayed or missed diagnoses—particularly in patients also presenting with psychiatric symptoms. In clinical practice, excessive daytime sleepiness, cataplexy, vivid dreams, and sleep-related hallucinations are frequently misattributed to mood disorders, especially depression. This diagnostic overlap poses a significant challenge for clinicians and may result in inadequate treatment. In this case report, we present the complex clinical trajectory of Mikan, a 20-year-old Filipino college student, whose longstanding depressive symptoms masked an underlying diagnosis of narcolepsy.

Objectives: To explore the clinical presentation, diagnosis, and treatment of a 20-year-old female with overlapping depressive symptoms and excessive daytime sleepiness, cataplexy, fragmented sleep, vivid dreams and sleep-related hallucinations.

Materials and methods: This case study follows Mikan, a Filipino first-year college student, who first sought consultation in June 2023 at the Adult Outpatient Section. Detailed history taking was conducted. Polysomnography (PSG), test of wakefulness and mean sleep latency tests (MSLT) were done revealing Narcolepsy due to the presence of sleep onset REM periods (SOREMP) and short mean sleep latency of about 5 minutes². Other tests include the HLA-DQB1*06:02 genetic marker testing and the cerebrospinal fluid levels of Hypocretin which are not available in the country². She was started on Methylphenidate 10 mg/tablet 1 tablet and Fluoxetine 20 mg/capsule 1 capsule in the morning. Her repeat post-treatment sleep studies showed resolution of SOREMP but still with MSLT of about 5 minutes showing improvement. She was taught sleep hygiene and sleep diary.

Results: The patient's depressive symptoms such as persistent sadness, poor concentration and appetite, anhedonia, fatigue and suicidal ideations, began at age 11. Social withdrawal and academic decline were evident. By age 13, excessive daytime sleepiness became prominent, with involuntary sleep episodes, cataplexy, vivid dreams, hypnagogic and hypnopompic hallucinations, and fragmented nighttime sleep. Despite extended sleep durations and

frequent naps, fatigue persisted. Depressive symptoms remitted partially over time, but the unresolved sleep issues significantly impaired functioning. Two sleep studies were done to confirm the diagnosis of Narcolepsy. With the medications prescribed, she was able to resume functioning and experience relief of symptoms. Sleep diary showed improvement in quality of sleep and mood.

Conclusions: Conclusion: Mikan's case underscores the interplay between psychiatric and sleep disorders, demonstrating how untreated sleep conditions can exacerbate or mimic mental health issues. **Psychiatric disorders are commonly overlapping with symptoms of narcolepsy including the timeline of symptoms which makes diagnosis challenging. Analysis of other studies regarding Narcolepsy revealed association with psychiatric illnesses¹.** Early multidisciplinary evaluation, including sleep studies and psychiatric assessment, is essential for accurate diagnosis and treatment. This case emphasizes the need for increased education about sleep disorders to prevent long-term psychosocial and functional impairment.

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Clinical evidence of Traditional Chinese Medicine for post-stroke sleep disorders

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Introduction: Sleep disorders are prevalent complications among stroke survivors. Current clinical guidelines and expert consensus indicated a limited repertoire of effective interventions, underscoring the urgent need for further research to advance clinical practice. Previous studies have reviewed the literature on Traditional Chinese Medicine (TCM) interventions, specifically Chinese herbal medicine (CHM) and acupuncture, for post-stroke sleep disorders, demonstrating a substantial volume of research and suggesting several potentially beneficial therapeutic approaches. However, a comprehensive review of the overall clinical evidence remains lacking. This study employs an evidence-based approach to systematically collate and appraise modern clinical research on TCM interventions for post-stroke sleep disorders, aiming to establish a robust clinical evidence framework. The findings are intended to inform clinical decision-making and guide future research priorities.

Materials and methods: A comprehensive computerized search was conducted across multiple databases including PubMed, Embase, the Cochrane Library, and Chinese databases (CNKI, Wanfang, VIP, and CBM) , to identify clinical studies investigating TCM for post-stroke sleep disorders. Two independent researchers performed literature screening and data extraction. Quantitative analysis (meta-analysis) was applied to randomized controlled trials (RCTs), while qualitative analysis was used for non-randomized studies. The methodological quality of included systematic reviews was assessed using A Measurement Tool to Assess Systematic Reviews 2 (AMSTAR 2), reporting quality was evaluated using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020, and the risk of bias for RCTs was analyzed using the Cochrane Risk of Bias tool (RoB 1.0).

Results: The final analysis included 13 systematic reviews, 137 RCTs, 13 non-randomized controlled trials, 9 case series, 1 case-control study, and 1 case report. For systematic reviews, AMSTAR 2.0 and PRISMA assessments revealed low overall methodological and reporting quality. The results suggested that TCM showed efficacy in improving subjective sleep quality. Among the RCTs, for post-stroke insomnia, high-quality evidence suggested that acupuncture was superior to sham acupuncture in improving subjective sleep quality. Moderate-to-low quality evidence supported the advantages of CHM and acupuncture, either used alone or in combination with hypnotic, in improving subjective sleep outcomes. Additionally, low-quality evidence suggested that combining CHM with cognitive behavioral therapy for insomnia (CBT-i) yielded better subjective sleep improvements compared to CBT-i alone. For post-stroke sleep apnea, moderate-to-low quality evidence demonstrated that combining CHM or acupuncture with continuous positive airway pressure (CPAP) therapy was more effective than CPAP alone in improving the AHI and blood oxygen saturation. Regarding other post-stroke sleep disorders, low-quality evidence highlighted the potential benefits of acupuncture in improvement of subjective sleep quality and daytime sleepiness.

Conclusions: The review of clinical evidence suggested that TCM interventions (CHM and acupuncture) may improve subjective sleep quality, objective sleep parameters, and reduce daytime sleepiness in patients with post-stroke sleep disorders. However, the overall quality of the available evidence was limited. Future research should prioritize large-scale, high-quality RCTs to strengthen the clinical recommendations of TCM for post-stroke sleep disorders.

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Neuroimaging findings for poor sleepers after acquired brain injury

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Introduction: Stroke and trauma are the top causes of acquired brain injury (ABI) and more than half of this population suffer from some form of sleep disturbance, which causes caregiver distress and is a treatment challenge. Poor sleep after ABI also hinders participation in rehabilitation activities and therefore, may have an adverse impact on outcomes both directly and indirectly. There is emerging literature on neuroimaging findings of healthy individuals with poor sleep, and studies linking neuroimaging with poor sleep and cognition. However, little is known about neuroimaging findings of poor sleep in people with known structural brain damage after an ABI. The primary aim of the present study is to examine differences in structural and functional Magnetic Resonance Imaging (MRI) findings between ABI patients with poor sleep and those with normal sleep. The secondary aim is to correlate the neuroimaging findings with clinical outcomes of ABI patients.

Materials and methods: 25 patients with ABI were recruited within 3 months of index event concurrently with 49 age and gender-matched healthy controls and underwent baseline assessment involving mood and sleep questionnaires and cognitive tests. 11 ABI patients and 17 controls underwent objective sleep testing because they scored >5 on the Pittsburgh Sleep Quality Index (PSQI). 14 ABI and 40 controls were eligible and completed MRI brain that included structural and resting state functional sequences. Data analysis involved comparing ABI poor sleepers with ABI normal sleepers and comparing ABI poor sleepers with healthy control poor sleepers. Resting state functional MRI data was analyzed using FSL MELODIC to identify important networks common to both ABI poor sleepers and ABI normal sleepers, before being further analyzed with the dual regression to reveal differences in those networks between the two groups.

Results: Preliminary analysis shows differences in the sensorimotor network, default mode network, and cerebellar regions when comparing ABI poor sleepers with ABI normal sleepers. Further analysis ongoing.

Conclusions: Poor sleep after ABI may have a direct impact on brain structure and function, which may correlate with poorer clinical outcomes such as poorer cognitive function. Further work is required to examine if these neuroimaging changes are reversible after successful sleep treatment and whether outcomes can be improved after reversal of these changes.