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EDITORIAL

Sleep and sleep disorders: much more than how long you sleep, what truly matters is *How* you sleep

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Since the discovery of electroencephalography to measure brain activity in 1924, sleep research has rapidly advanced. Contemporary sleep research no longer focuses on the length of sleep and the consequences of sleep loss. Instead, a multitude of sleep parameters, such as sleep duration, quality, irregularity, health, and disordered sleep, now inform the sleep science community about the importance of sleep in relation to health, performance, cognitive, cultural, and clinical outcomes through diverse study designs, equipment, and across a range of populations. This special issue on sleep and its disorders has shown us how diverse and widespread the study of sleep has become today. Geographically, it is remarkable that we received manuscripts from various continents and from dozens of countries. The themes and approaches were equally diverse, ranging from population-based studies to laboratory investigations, and including discussions of public policies related to sleep.

The study of sleep health has not only expanded worldwide but also become increasingly diverse. Today, sleep is understood as a multifaceted phenomenon: encompassing not just characteristics such as quality, regularity, and timing, but also its intricate relationship with wakefulness. Consequently, cultural, social, and economic dimensions have become inseparable from sleep health, revealing that sleeping well reflects overall health and a good quality of life. In this editorial, we will touch upon many of these aspects featured in this collection, which is a rich tapestry of diverse topics and interests.

In one study addressing the impact of public policies on sleep, Yuan Fang and Shih-Ting Huang examined the behavioral health repercussions of China's 2016 universal two-child policy by analyzing sleep pattern data from the China Family Panel Studies[1]. Their analysis revealed a gender discrepancy in response to the policy: specifically, women exhibited a discernible reduction in both the likelihood and duration of daytime napping, as well as in overall daily sleep. Beyond napping, irregular sleep patterns have increasingly drawn attention in sleep research. In this issue, we highlight the study by Arora et al., which explored the relationship between sleep regularity and factors such as lifestyle behaviors, subjective sleep, clinical outcomes, and academic performance in a sample of 176 female university students in the United Arab Emirates[2]. Although no significant associations emerged between sleep regularity and psychological or physical health, or academic performance, the results suggested that daily irregular sleep patterns are associated with more frequent daytime napping, stronger dysfunctional sleep beliefs, and poorer subjective sleep quality. Conversely, weekly irregular sleep patterns were linked to greater dysfunctional sleep beliefs and increased nighttime technology use.

Physical activity also appears to be important not only for improving sleep quality but also for interrupting sedentary work, that is, prolonged sitting. In this regard, Gupta et al. investigated the effects of breaking up prolonged sitting with physical activity during the day or night, compared to not breaking up sitting, on sleep architecture during a 9-h or 5-h sleep opportunity[3]. Participants completed five simulated shifts in the sleep laboratory. Better sleep quality was observed in the 9-h condition compared to the 5-h condition, and breaking up sitting did not affect sleep. Given the overall health benefits of interrupting sedentary behavior, these findings suggest that interventions encouraging individuals to break up sitting can be promoted without detrimental impacts on sleep.

It is also important to highlight studies related to mental health, such as the original work by Thorne et al., which examined gambling under extended wakefulness[4]. In a laboratory setting, 19 participants remained awake for 18.75 h to simulate late-night gambling sessions. Compared to performance earlier in the evening, participants showed cognitive slowing, lapses, increased tiredness, and negative affect at 0300h, though gambling intensity itself did not change. These findings suggest that, unlike other cognitive domains, gambling behavior may be less sensitive to the impairing effects of extended wakefulness. Yamada et al., investigated the association

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between nonrestorative sleep (NRS) and suicidal ideation in the general population[5]. A total of 2,559 participants were asked about insomnia symptoms, sleep duration, and the presence of suicidal ideation. In the multivariate analysis, adjusting for the confounding effects of other sleep-related factors, NRS showed a positive association with suicidal ideation. These findings suggest the importance of focusing on NRS in suicide prevention strategies for the general population. Whilst the evidence surrounding sleep and mental health has been mounting for decades, adolescents are a group of particular interest given that they are vulnerable to forming suboptimal sleep habits as well as mental ill-health. Liu et al. share cross-sectional findings from a large sample (n = 18,516) of adolescents across rural areas of Northwestern China[6]. The Strengths and Difficulties Questionnaire (SDQ) was employed to capture information surrounding emotional symptoms, hyperactivity, conduct problems, peer issues, and prosocial behavior. Their findings revealed U-shaped associations between sleep duration (calculated by determining the time difference between get-up time and bedtime) and overall difficulties as well as prosocial behavior. The authors concluded by calling for interventional programs to promote and educate those in rural areas about sleep hygiene, as well as enhance access to mental health services.

In terms of sleep disorders, an interesting study is presented by Kraiwattanapong et al., which focused on personalising treatment preferences for patients[7]. A total of 377 patients underwent sleep screening and were divided into three groups based on their chief complaint: 1) sleepiness; 2) sleep disruption; 3) asymptomatic with comorbidities. The study aimed to identify comorbidities, polysomnography factors, phenotypical features, and treatment preferences amongst patients with obstructive sleep apnea (OSA). Body mass index (BMI), comorbidities, oxygen saturation, as well as sleep disturbances all influenced OSA patients' treatment preferences. Patients with high levels of daytime sleepiness reported a preference for continuous positive airway pressure (CPAP), as did those with comorbid cardiovascular conditions, those with high BMI, and patients with severe OSA. A small number of patients reported a desire for bariatric surgery or upper airway surgery as a means of addressing OSA. The study underscores the significance of potentially tailoring different treatment approaches for OSA patients to enhance outcomes, whilst maintaining clinical effectiveness.

Li et al., report their findings from a double-blind, randomized controlled trial (RCT) for patients with chronic insomnia[8]. The RCT involved 55 patients. The experimental group was exposed to ten days of high-definition transcranial direct current stimulation in the dorsal medial prefrontal cortex. The control group received ten days of sham stimulation. Participants underwent polysomnography, as well as subjective sleep evaluations, before and after the ten-day intervention. When comparing baseline to post-intervention, the experimental group reported decreased scores on the Pittsburgh Sleep Quality Index (PSQI). No notable changes were observed for sleep staging ratio, but two proxies for sleep quality were, namely, sleep onset latency (SOL) and sleep efficiency (SE), which were shorter and higher, respectively. The authors concluded that this intervention could complement first-line treatment approaches for insomnia, such as cognitive behavioural therapy for insomnia (CBT-I) and/or prescription medications. We also highlight a study presented by Pape et al., which reported on the findings from an open pilot study involving a five-week digitally guided self-help intervention amongst university students with self-reported insomnia symptoms[9]. Whilst the intervention was based on CBT-I, this was adapted to incorporate emphasis on the biological clock, which is often shifted in this population. Whilst there were a total of 101 student participants, only 13 completed the intervention, with a post-test response of 39%. The findings of this pilot study were, however, promising, with good improvements to the insomnia severity index (ISI) and moderate improvements to depression, anxiety, and functioning scores. Future efforts should focus on strategies to engage university students with self-reported insomnia in interventions that are likely to have positive outcomes for their mental health, daily functionality, and reductions in their insomnia symptoms.

In conclusion, this special collection houses a range of study designs and presents data from the general population as well as sleep-disordered patient populations. Our aim is to educate the scientific community with the latest findings in the area of sleep and sleep disorders.

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Declarations

Competing interests
The authors declare no competing interests.

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