



# Translational Sleep Science in Behavioral Medicine: Introduction to this Special Issue

Natasha Williams<sup>1</sup> · Tracy Trevorrow<sup>2</sup>

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## Abstract

The consideration of sleep and circadian rhythms in the context of health is a relatively recent development in the history of the field of behavioral medicine. This special issue of the *International Journal of Behavioral Medicine* recognizes that sleep and circadian rhythms are fundamental to appreciating physiological, psychological, social, and environmental factors in the health and well-being of the population. The articles included in this issue draw attention to the breadth and saliency of sleep as a marker of health status and as a target of behavioral intervention to promote health. Such research highlights the diversity of participants, research methods, and clinical significance of translational sleep science allowing us to recognize the role of sleep in the context of health in new ways. These studies also illustrate progress in integrating theory, employing prospective and longitudinal designs and multimodal and integrative assessments. This introduction to the special issue concludes by discussing challenges and opportunities in the field of behavioral sleep medicine, including those posed by the coronavirus disease 2019 (COVID-19) pandemic and the need to more effectively provide sleep disorder treatment among underserved populations.

**Keywords** Sleep · Circadian rhythms · Behavioral medicine · Coronavirus

## Introduction

Over the past two decades, the number of published research studies that focus on sleep has increased seven-fold [1]; sleep has become a consistent topic of interest for behavioral medicine researchers and practitioners. The *International Journal of Behavioral Medicine* has included articles focused on sleep for each of the past 15 years. In 2016 the *Society of Behavioral Medicine* established a Special Interest Group dedicated to Sleep, which is serving as a co-sponsor of this special issue. The importance of sleep is well-established internationally in the behavioral medicine landscape, and this special issue serves to recognize this development, as well as to advance translational sleep science.

The arguments for appreciating the role of sleep in behavioral medicine are clear. Sleep is influenced by behavioral, psychological, educational, and environmental factors, as well as community and organizational policies [2]. At the same time, sleep has mediating and moderating influences on health. Sleep has been extensively studied regarding its relationship to disorders that have been the focus of behavioral medicine, such as physical activity [3], pain [4], obesity [5], substance use [6], and chronic illness [7]. As such, behavioral sleep science spans a broad range of disciplines, as the nature of sleep and circadian rhythms requires an appreciation from biological, psychological, social, and environmental perspectives.

Accompanying our increased understanding of the importance of sleep is the realization that so many of us do not sleep well. Across the spectrum of sleep disorders, the most common sleep problem is insomnia [8]. A 2019 poll of US adults reported 84% complained of inadequate sleep at least once per week, and about half of adults surveyed reported excessive daytime fatigue 3 to 7 days per week [9]. Approximately 10 to 20% of patients in primary care centers complain of insomnia symptoms [8]. Obstructive apnea is also frequently observed in older populations and becoming

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✉ Natasha Williams  
Natasha.williams2@nyulangone.org

<sup>1</sup> NYU Grossman School of Medicine Division of Health and Behavior Center for Healthful Behavior Change, NYU, Langone Health, New York, NY, USA

<sup>2</sup> Center for Medical Psychology, Chaminade University Honolulu, Honolulu, HI 96816, USA

increasingly prevalent in the general population due to rising rates of obesity. Prevalence rates for obstructive apnea are estimated at 17% for men and 9% for women over the age of 50 [10]. Inadequate sleep is not the sole providence of adults. School-aged children, particularly in the USA, have been systematically sleep deprived by inappropriately early school start times [11]. The US Center's for Disease Control and Prevention estimated that 60% of US middle school students and 70% of high school students do not get adequate sleep [12]. Currently, the coronavirus disease 2019 (COVID-19) pandemic has worsened sleep across the globe. Multiple pandemic-related factors including psychological distress, social isolation, poor sleep hygiene, and decreased physical activity appear to have resulted in disordered sleep [13–15]. Pandemic-related sleep disruption has been reported to be greater in health care workers, youth, women, and those with low levels of social capital [14–17]. As such, there is great potential in promoting community health through sleep health education, policy changes (such as establishing later school start times) and identifying and providing therapies to communities at high risk for inadequate sleep.

## About This Issue

It is a privilege to publish this special issue in the *International Journal of Behavioral Medicine*. We received an overwhelming response to the initial call for manuscripts. The editorial challenge of reducing over 50 submissions to a single issue was daunting! We could not include many worthy submissions in this issue, so we are delighted to report that a second special sister-issue, dedicated to sleep, is planned and forthcoming.

The purpose of this special issue is to showcase the breadth of sleep-related topics, the range of methodologies for appreciating the role of sleep in behavioral health, and the potential for significant health gains from sleep interventions. The selected papers for this special issue have clear theoretical frameworks, are grounded in existing literature, and employ strong designs. We were mindful to select studies that allow us to see the interrelationships between sleep and health in new ways. Consistent with the field of behavioral medicine, there is an applied focus of the selected articles. These papers increase the scientific and public understanding of the role of sleep in health and have implications for clinical and policy interventions to improve the health and wellbeing of individuals, families, communities, and populations. Participants in these studies span the developmental spectrum from children to older adults, include minority and underserved populations, and include studies conducted outside the continental USA. Sleep is not a unitary construct and researchers employ a broad range of approaches to assess sleep duration,

efficiency, quality, and timing. Technologies are also employed to assess sleep behavior (e.g., movement monitors, such as actigraphs) and physiological processes associated with sleep. The assessment approaches in this special issue include self-report measures (surveys, self-monitoring diaries), actigraphs, and structured interviews.

## The Articles

Papers in this issue fall into four general areas. Most studies focused on the effects of stress on sleep. Several papers examined the consequences of a stressful life role on sleep. Such roles included being a family member or other informal caregiver for those with cancer. Panjwani and colleagues ([18]; this issue) surveyed parents of teens and young adult children with cancer, focusing on parents' abilities to tolerate uncertainty. Being a graduate student is putatively understood to be stressful, yet, there are few published accounts of the sleep (or lack of sleep) of this population. Allen and colleagues ([19]; this issue) assessed 2683 graduate students to help fill this void and explored the phenomena of graduate school burnout. Bunjo and colleagues ([20]; this issue) considered the extent to which sleep duration moderated the relationship between work-life interference and time strain, work-to-community interactions, satisfaction with overall work-life balance, and depressive symptoms. Other papers in this group investigated the consequence to sleep after discrete stressful life events, such as job loss. Haynes and colleagues ([21]; this issue) evaluated recently unemployed individuals, finding connections between the type of work stress prior to job loss and long-term sleep problems once unemployed. Another study looked at the stress of pregnancy and the role of sleep in predicting newborn health status. Okun and colleagues ([22]; this issue) sought to determine whether sleep disruption early in pregnancy was implicated in inflammatory processes (cytokine levels) or newborn health outcomes.

A second group of studies investigated the moderating and mediating roles of sleep on disease and psychological maladies. Griffin and colleagues ([23]; this issue) examined the role of sleep as a mediator of the relationship between loneliness and self-reported health, controlling for demographics, isolation, and depression. Brooks and colleagues ([24]; this issue) explored self-efficacy for sleep, sleep quality, and relapse rates for participants with alcohol dependency. The investigators analyzed multiple data points and actigraphy data.

Two studies focused on clinical applications of sleep promotion interventions. In a randomized treatment outcome study, Fox and colleagues ([25]; this issue) examined relative rates of nighttime awakenings (per actigraph), self-report sleep quality, and depression between bright light

therapy and a dim light treatment. In another study, Irish and colleagues ([26]; this issue) evaluated whether participants' adherence to a self-help sleep promotion intervention related to an increase in sleep duration and other improvements in sleep health.

Three studies focused on underserved populations. April-Saunders and colleagues ([27]; this issue) studied cohorts of adolescents from Puerto Rico and from the South Bronx, New York. These researchers examined childhood adversities and sleep disturbance across three time points among 10 to 16-year-olds. Gatson and colleagues ([28]; this issue) investigated childhood experiences and sleep experience among Hispanic, Non-Hispanic White, and Black women. A focus of this article is the relationship of childhood trauma with sleep health across ethnic backgrounds. Characteristics of strength and resilience among Black women framed the third study in this group by McLaurin-Jones and colleagues ([29]; this issue). This study adds to the growing literature on stress and sleep disturbance in that there are unique stressors faced by Black women.

Two studies looked at sleep and immune response. Tucker and colleagues ([30]; this issue) considered the role of self-reported and actigraphically assessed sleep in cancer survivors and found an increase in sleep time corresponded with a reduction in emotional distress and attenuation of pro-inflammatory biomarkers. In a timely paper, given the current pandemic, Prather and colleagues ([31]; this issue) investigated the role of sleep in promoting antibody production in response to flu immunizations. The implications of this study are provocative in the context of a world-wide process of immunization.

## Future Developments

Although these articles represent a breadth of topics, problems, and methodologies, there are gaps in our selection worth noting. Although our initial response to a call for papers included studies from eight countries, only two studies in this issue were from outside the USA (i.e., Australia and Canada). In a related limitation, only three studies focused on underserved populations, resulting in a lack of representation of non-Black minorities, and no study focused on other marginalized groups such as sexual minorities. Unfortunately, none of the articles in this issue included a focus on sleep related breathing disorders or on circadian rhythms. The advantage of planning a second special issue on sleep is the opportunity to fill such gaps.

It is gratifying to showcase these articles that demonstrate the contribution of behavioral medicine in understanding and promoting sleep and wellbeing. Special issues provide an opportunity to reflect on accomplishments in the field,

and they are also an appropriate venue for considering new directions and approaches.

Technological developments make it possible, and increasingly cost-effective, to collect enormous amounts of information, be that through online surveys, actigraphs, or physiological assessments, such as heart-rate. The development of home-based EEG assessment that is reliable, cost effective, and patient friendly cannot be far away. Advancing technologies in sleep assessment that are portable, less intrusive, and easy to use, such as increasingly reliable and valid smart watches, will promote ecological validity, encourage researchers to consider the influence of circadian rhythms, and generate a more comprehensive and detailed understanding of sleep and sleep-health relationships. Our field will advance as we emphasize sleep assessments that are multimodal, integrative, and prospective and when we are less satisfied with conducting single administration, cross-sectional surveys.

With an increasing ability to generate large data sets, it will perhaps be even more tempting to look inductively for associations that describe but not explain relationships (so-called dustbowl empiricism) [32]. As many of the articles in this issue illustrate, the stronger contributions to the field of sleep research are studies that progress beyond description to theory-based investigation. We anticipate that future contributions to the field will increasingly use experimental and quasi-experimental designs to evaluate sleep mechanisms and the efficacy of interventions.

Clearly, one new area of investigation is the need to study pandemic-related sleep changes, as people across the world have been forced to accommodate decreased mobility, increased social isolation, and changes to routines, roles, and social structures [33]. Also of consideration is the need to retool in order to conduct behavioral sleep science and to provide clinical services in a pandemic environment [34]. (Articles included in this review predate the COVID-19 pandemic.) How the pandemic has changed sleep and the long-term consequence of such changes will likely be a topic for behavioral medicine research for many years. Prather and colleagues' article in this issue may be prescient with immediate relevance to individual's response to vaccines for the COVID-19 virus.

As the pandemic experience has made clear, underserved groups are the least likely to receive adequate health care [35]. We are challenged with the need to tailor sleep promotion interventions to minority populations and to promote accessibility to health providers, most notably through internet access and the technologies to engage it. The development of evidence-based and telehealth sleep programs is likely to be increasingly in demand during and after the COVID-19 pandemic. Fortunately, such interventions have been in development for several years. For example, Williams and colleagues describe a telehealth

intervention to improve sleep health among Black men and women at-risk for obstructive sleep apnea [36]. Further research is needed to understand how to deliver and sustain this intervention over time among underserved populations.

In closing, we hope that this special issue increases your appreciation of the novel and diverse ways sleep is understood by our field and that future research and interventions build on the lessons learned from studies included in this issue. We want to express our heartfelt appreciation to editors Michael Hoyt and Tracey Revenson for their guidance and the Society for Behavioral Medicine Sleep Special Interest Group for their support of this special issue. We look forward to a second such issue.

### Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

**Ethical Approval** For this type of paper, formal ethical review is not required.

**Informed Consent** This article does not report any new research data and therefore no consent was necessary.

**Research Involving Human and Animal Participants** This study does not present new data regarding studies with human participants.

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