

Mindful of sleep: A scoping review on the intersection of mindfulness and sleep among marginalized populations

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This review article synthesizes existing research in response to the guiding research question: How do psychosocial and cultural factors influence sleep and circadian health disparities?

Abstract

Background: Mindfulness is a nonjudgmental awareness of moment-to-moment experience that is linked with numerous mental and physical health benefits. Emerging research suggests mindfulness may influence sleep quality by reducing stress, improving emotional regulation, and altering sleep-related cognitive processes. As marginalized populations experience disproportionate rates of poor sleep and related health disparities, a comprehensive understanding of the relationship between mindfulness and sleep in these populations is necessary.

Objective: This review explores associations of trait mindfulness and mindfulness-based interventions with sleep health among marginalized populations. We highlight gaps in existing research and discuss the need for culturally responsive interventions tailored to diverse racial and ethnic groups.

Design: A scoping review of peer-reviewed literature (2015–2024) was conducted. Keywords related to mindfulness, sleep and marginalized populations identified relevant studies. Articles were screened and categorized based on subjective sleep parameters and objective sleep parameters including actigraphy and polysomnography.

Results: This review highlights the intersection of mindfulness and sleep health among marginalized populations. Evidence suggests that higher trait mindfulness is associated with improved sleep quality and reduced sleep disturbances, particularly in individuals experiencing psychosocial stressors. MBIs have demonstrated efficacy in reducing insomnia, improving sleep quality and reducing distress-related sleep disturbances. In actigraphy studies, MBIs demonstrate improvements in sleep efficiency and duration. However, most research has predominantly focused on White/Caucasian populations, limiting the generalizability of findings. Studies on racial and ethnic minorities indicate that mindfulness may buffer the negative effects of discrimination on sleep, but gaps remain in understanding cultural variations in mindfulness practice and sleep perception. Further research is needed to determine the mechanisms underlying mindfulness-based improvements in sleep and to develop tailored interventions addressing sleep health disparities in minority populations.

Conclusions: We underscore critical research gaps in the study of mindfulness and sleep health among marginalized populations. Future research should examine biases in self-reported sleep measures, improve accuracy and applicability of objective sleep metrics, and investigate the intersection of mindfulness, sleep and social determinants of health. Addressing these disparities through culturally tailored mindfulness interventions may offer a pathway for improving sleep health across diverse communities.

Introduction

Sleep is a fundamental biological process essential for cognitive function, physical health and overall well-being (Cao *et al.*, 2020). It is a universal behavior across species, emphasizing its evolutionary significance. Research demonstrates that inadequate sleep can negatively impact brain development, maturation and the functioning of various physiological systems (Gorgoni *et al.*, 2020). Sleep disorders are now recognized as having pathobiological effects on nearly all human tissues, affecting cardiovascular, immune and metabolic health (Bar *et al.*, 2021). Poor sleep quality has been linked to increased risk for chronic diseases such as cardiovascular disease, obesity, and diabetes, as well as impaired cognitive function including memory and attention (Chen *et al.*, 2022; Dutil *et al.*, 2018; Leong and Chee, 2023; Ling *et al.*, 2020). Sleep health is a multidimensional construct characterized by sleep duration, continuity, efficiency, and timing. Healthy sleep is defined as adequate sleep quantity and quality, appropriate timing, regularity and the absence of disturbances (Chung *et al.*, 2021).

Sleep can be measured both subjectively via self-reports, and objectively using either wearable technology at home or polysomnography conducted overnight in a sleep laboratory. The current scoping review of literature features self-reported sleep parameters (SSPs) and

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objective sleep parameters (OSPs). SSPs consist of self-report surveys such as the Pittsburgh Sleep Quality Index (PSQI) which investigates the subjects' perception of their sleep quality (Smyth, 1999). Unfortunately, there are biases, including social desirability, which can affect self-reported data and may skew the validity of results. SSP research sheds light on the challenges of subjective sleep measurement, revealing that non-reactivity significantly moderates the association between perceived sleep and sleep health (Xie *et al.*, 2023). Interestingly, the perception of poor sleep is identified as a key characteristic of insomnia, contributing to a negative cycle that exacerbates sleep complaints and reduces sleep quality. These data highlight a well-known gap between subjective and objective sleep measures (Akram, 2018; Glidewell and Okun, 2022; Harris *et al.*, 2020).

The OSPs actigraphy and polysomnography (PSG) are not vulnerable to the self-report bias of SSPs. Most actigraphy devices are worn like a watch, providing a noninvasive data collection technique that yields accurate estimates of 24-hour sleep and wakefulness based on highly sensitive measures of body movement aggregated over one-second epochs. PSG requires subjects to sleep in a lab with multiple sensors taped to the body to analyze brain waves linked to different sleep stages, eye movements, body movement and blood oxygen levels. Expanding OSP research is illuminating sleep disparities among minority populations. Compared with nonminority subjects, minority participants with inflammatory bowel disease (IBD) were shown to have poorer objectively measured sleep. This study illuminates the need for further research on cultural responsiveness in the care of minority IBD patients, specifically a need to focus on psychosocial issues in managing sleep disparities (Qazi *et al.*, 2021).

Sleep disparities and marginalized populations

Disparities in sleep health disproportionately affect racial and ethnic minorities, who consistently experience shorter sleep duration, lower sleep efficiency and greater night-to-night variability compared to White populations (Billings *et al.*, 2021). These disparities likely stem from systemic inequities including socioeconomic (SES) disadvantages, environmental stressors, and healthcare barriers (Grandner, 2016).

A marginalized population refers to any group that is systematically excluded from full participation in society based on race, gender, sexual orientation, age, disability, immigration status, SES status or other intersecting factors. This exclusion often results in multiple adverse sleep health outcomes (Stansbury *et al.*, 2022). Individuals of lower SES are 1.62 times more likely to experience insufficient sleep compared to higher-income groups (Batoool-Anwar and Quan, 2024). Similarly, racial and ethnic minorities face a disproportionate burden of sleep disturbance due to discrimination, chronic stress, adverse living conditions and occupational demands (Majeno *et al.*, 2023).

Evidence highlights significant racial disparities in sleep health among Black and Latino adults compared to White adults in the U.S., with multiple studies confirming differences in sleep duration and quality across diverse groups (Cunningham *et al.*, 2016; Sheehan *et al.*, 2018). These disparities have serious health implications, including increased risk for obesity, type 2 diabetes, hypertension and cardiovascular disease (Caraballo *et al.*, 2022; Papadopoulos *et al.*, 2022).

Beyond physiological consequences, sociocultural factors further compound sleep disparities. Cultural sleep attitudes, economic stress, high unemployment, precarious work conditions

and limited healthcare access all contribute to unequal sleep health outcomes (Zarhin *et al.*, 2023). Sleep has been described as a "luxury" rather than a biological necessity in high-stress, low-resource environments, where individuals may prioritize work and caregiving responsibilities over rest (Saelee *et al.*, 2021; Sexton *et al.*, 2020; Rojanapairat, 2023).

Additionally, subjective sleep measures may not accurately capture sleep attitudes across different cultural groups. For example, a study on Black and African American adults at risk for sleep apnea found they endorsed dysfunctional beliefs and attitudes about sleep at rates higher than their White counterparts, possibly leading to poorer sleep hygiene practices (Grandner *et al.*, 2016). These findings underscore the limitations of current sleep assessment tools in capturing the unique sleep challenges faced by minority populations. There is a need for culturally inclusive research methodologies to better address sleep health disparities.

Mindfulness as a potential intervention for sleep disparities

Prior research has documented the intersection of sociocultural identities with sleep health, emphasizing the necessity of a nuanced socioecological approach to understanding within-group variability in sleep disparities (Zarhin *et al.*, 2023). There is a need for tailored sleep interventions that account for sociocultural contexts.

Mindfulness can be described as a trait—an individual's natural tendency to be attentive to and aware of present-moment experiences in daily life (Baer *et al.*, 2006). Trait mindfulness is theorized to involve key mental practices that may include observing internal and external experiences such as thoughts, feelings, and sensations; describing those experiences with words; acting with awareness (i.e., rather than on 'autopilot'); an approach of nonjudgement toward one's own thoughts, emotions, and sensations; and nonreactivity to inner experiences (i.e., letting thoughts come and go without reacting to them; Baer *et al.*, 2006). Mindfulness is also understood as a state—of maintaining nonjudgmental awareness of one's thoughts, emotions and experiences in the present moment. Gaining increasing recognition in Western clinical and psychological research, mindfulness training programs have been widely studied as interventions for reducing stress and improving mental health. Rooted in Buddhist tradition, mindfulness in the West commonly includes meditation, 'body scans' that bring attention to proprioceptive stimuli, and a focus on the breath as a starting point for new practitioners. These practices have been shown to enhance psychological flexibility, emotion regulation and resilience to stress (Marais *et al.*, 2020). Both trait mindfulness and state mindfulness are understudied among marginalized populations. Mindfulness-based interventions (MBIs) can promote self-regulation, cognitive control, and relaxation, making them a promising approach to improving sleep (Sala *et al.*, 2020).

In clinical applications, MBIs have demonstrated effectiveness in reducing sleep disorders including insomnia and Post traumatic Stress Disorder (PTSD)-related sleep disturbances (Garcia *et al.*, 2018; Smith *et al.*, 2020). A meta-analysis found that higher trait mindfulness was associated with improved health behaviors, including better sleep quality and duration (Fabbro *et al.*, 2020). Additionally, MBIs have been linked to reductions in stress, anxiety and negative affect, all of which are associated with poor sleep outcomes (Black *et al.*, 2015; Jones *et al.*, 2020; Neher *et al.*, 2021).

Despite these promising findings, the mechanisms through which mindfulness influences sleep remain unclear. It is uncertain

whether mindfulness primarily affects stress as a mediator, indirectly improving sleep quality, or if it has a direct impact on the biological mechanisms of sleep regulation. Additionally, there is limited research on the role of mindfulness in addressing sleep disparities in marginalized populations. Further studies are needed to explore how mindfulness-based interventions can be tailored to effectively address sleep health disparities among racial and ethnic minority groups.

Mindfulness and sleep: Subjective vs. objective measures

A key challenge in sleep research is distinguishing between subjective perceptions of sleep and objective sleep metrics, yet limited research has comprehensively examined this distinction. Subjective sleep measures (SSPs) – such as self-reported sleep quality questionnaires – are widely used due to their accessibility and ease of administration. However, these measures are prone to biases, including recall errors, cultural influences and social desirability effects. In contrast, objective sleep measures (OSPs) – such as actigraphy and polysomnography (PSG) – provide physiological data on sleep stages, duration and efficiency, but may not fully capture the perceived sleep experience, particularly in marginalized populations who experience unique sociocultural influences on sleep health.

Understanding the alignment between subjective and objective sleep measures is particularly crucial for populations disproportionately affected by sleep disparities. Along with advances in technologies for measuring sleep, research continues to show racial and ethnic minorities experience significantly poorer sleep health outcomes (Haghighyegh *et al.*, 2019). Addressing these disparities requires more accurate and culturally relevant sleep assessments that integrate subjective experiences with objective sleep data.

Studies indicate that individuals who engage in mindfulness practices frequently report improved sleep quality (Greeson *et al.*, 2018; Kennett *et al.*, 2021). However, mindfulness intervention studies utilizing actigraphy and polysomnography have produced inconsistent findings (Alder *et al.*, 2017). Subjective sleep improvements associated with mindfulness interventions may not always be reflected in objective sleep metrics.

The effectiveness of mindfulness-based interventions (MBIs) in improving sleep outcomes may depend on factors such as program duration, intensity, and participant adherence. For example, Alder *et al.* (2017) found no significant differences in sleep outcomes between the MBI and control groups in a mindfulness-based weight loss intervention. However, within the MBI group, higher engagement in meditation was associated with improved sleep quality after six months. Individual differences in mindfulness practice engagement may affect sleep. There is a need for further research on long-term adherence, dose-response effects, and the interaction between mindfulness practice and sleep metrics in diverse populations.

Future studies should focus on bridging the gap between subjective and objective sleep assessments, particularly in racial and ethnic minority populations, to better understand how mindfulness interventions influence both subjective and objective sleep outcomes.

Purpose of this review

Despite growing evidence supporting a role of mindfulness in sleep health, few studies explicitly examine effects among marginalized populations (Gentry, 2020). Given the psychosocial and cultural factors influencing sleep health disparities, this

scoping review aims to synthesize existing research on mindfulness and sleep health among marginalized populations. Here we provide background information to inform hypothesis regarding effects of mindfulness on sleep. The review will explore:

1. How psychosocial and cultural factors contribute to sleep health disparities
2. The role of trait mindfulness in sleep health outcomes
3. The efficacy of MBIs in improving sleep among diverse populations

This review follows the PRISMA 2020 guidelines for scoping reviews to ensure systematic identification, synthesis and presentation of findings (Page *et al.*, 2021). By examining the intersection of mindfulness, sleep measurement methods and marginalized populations, we seek to provide an overview of current evidence and identify areas for future research.

Methods

A scoping review of the sleep literature was conducted by collaborating researchers who utilized multiple online academic databases. Independent searches were conducted across six databases, PubMed, MEDLINE, PsycINFO, EBSCO, Google Scholar, Consensus AI and SciSpace. The research excluded studies published outside the specified ten-year search range of 2015–2024. Titles, abstracts and keywords were used to screen possible key terms. Concerning the topic of mindfulness and sleep across minority populations, a set of key terms were used by researchers, and included “mindfulness,” “trait mindfulness OR dispositional mindfulness,” “mindfulness intervention OR mindfulness-based intervention,” “sleep,” “insomnia,” “objective sleep,” “subjective sleep OR self-reported sleep,” “sleep quality,” “actigraphy-measured sleep” and “polysomnography.” To inform future research that may be conducted among the most common racial/ethnic minority groups in the United States, the sets of keywords included “African American,” “Asian-American,” “racial and ethnic minority,” “Mexican or Hispanic or Latino,” “racial discrimination OR ethnic discrimination” and finally “sexual or gender minority.” The results are categorized into two main sections: SSPs and OSPs. Each section is further divided into two subsections: trait mindfulness and MBIs.

Results

A total of 81 peer-reviewed articles were identified. Findings generally indicate that higher trait mindfulness is associated with improved SSPs including shorter sleep onset latency, fewer nighttime awakenings, and higher overall sleep satisfaction. MBIs were effective for improving these outcomes across diverse populations: particularly in reducing insomnia, stress-related sleep disturbance, and sleep discrepancies linked to racial and SES disparities. Among studies that measured OSPs (actigraphy and PSG), results were mixed, with some research demonstrating that MBIs improved in sleep efficiency and lengthened total sleep time. However, other studies reported no significant intervention effects on OSPs.

We found that sleep metrics were lacking among studies specific to marginalized populations. Thus, findings from studies that were not focused on minority subjects were also synthesized to inform future hypothesis generation regarding effects of mindfulness on sleep among minoritized groups. In general, the data point

to a need for future research to investigate psychosocial factors, cultural influences, and social determinants of health in relation to sleep disparities among racial and ethnic minority groups. Expanding research in these areas will be essential for developing targeted, culturally responsive interventions that promote equitable health outcomes in marginalized populations.

Subjective sleep parameters research

Trait mindfulness and SSPs

Sleep disparities among minority populations may be partially explained by social determinants of health such as historical/generational trauma, immigration or acculturation stressors, natural and manmade disasters, discrimination, racial residential segregation, or family and community violence (Pumariega *et al.*, 2022). Higher levels of trait mindfulness have been linked to good sleep, specifically, reduced sleep onset latency, lower subjective-objective sleep discrepancy, and a perception of better sleep quality (Shaif *et al.*, 2022). Specific facets of mindfulness that may be linked with sleep-promoting behavior include the “what” skills of mindfulness such as observing and describing, and the “how” skills of mindfulness such as nonjudgment and acting with awareness (Iani *et al.*, 2018). Sala *et al.* (2020) discovered that of all trait mindfulness facets, acting with awareness and describing were the most important for sleep-promoting behavior. In contrast, that ‘observing’ aspect of trait mindfulness was not associated with sleep-promoting behaviors. Thus people with high ‘observing’ skills alone may not experience sleep benefits. Across diverse populations, there seems to be a relatively consistent pattern of positive sleep perception associated with trait mindfulness (Luo *et al.*, 2023). Studies including African Americans, trauma-exposed individuals, and college-aged young adults each indicated that individuals with dispositional mindfulness reported better SSPs (Ilori *et al.*, 2022; Ma, 2022). Of interest, the impact of observing without other mindfulness skills had disproportionate effects and was smaller among ethnic minorities compared to European Americans (Sala *et al.*, 2020). It is necessary for further research to explore how the various aspects of individual trait mindfulness relate to SSPs among racial/ethnic minority groups.

Trait mindfulness is associated with positive subjective perceptions of sleep. Individuals with greater dispositional mindfulness report enhanced sleep quality represented by lower frequency of PTSD-related sleep disturbances (Nagy *et al.*, 2022) and lower anxiety and depressive symptoms (Bogusch *et al.*, 2016). Among racial/ethnic minority adults, trait mindfulness moderates the association between perceived discrimination and depressive symptoms, underscoring a possible role of trait mindfulness in mitigating mental health challenges related to sleep quality (Shallcross and Spruill, 2018). Among African Americans living in the southeastern US, Watson-Singleton *et al.* (2019) found those with high trait mindfulness were better protected against the emotional toll of race-related stress, reporting fewer depressive symptoms and less race-related anxiety. Likewise, Nell (2016) showed that mindfulness was linked to less negative emotion when facing racial stressors. Ilori *et al.* (2022) found that middle-aged and older African American adults who reported higher levels of trait mindfulness also tended to experience better sleep, greater well-being, and fewer depressive symptoms. Their findings suggest that sleep quality may be one way mindfulness supports mental health in this population. In sum, trait-mindfulness in African Americans has been linked with decreased race-related anxious

arousal (Zapolski *et al.*, 2019), decreased depressive symptoms and race-related stressors (Watson-Singleton *et al.*, 2019) and reduced negative affect (Nell, 2016). Thus, it is vital for future research to explore associations among these factors, and their relation to sleep health among racial/ethnic minorities.

Extending beyond racial/ethnic minorities, the benefits of trait mindfulness are evident among members of sexual and gender minority groups. Transgender individuals often face discrimination in the workplace, which can lead to emotional exhaustion, partly through heightened feelings of mistrust or paranoid thinking. Thoroughgood *et al.* (2020) found that individuals with higher levels of trait mindfulness were less likely to engage in such thinking and felt less emotionally drained after experiencing discrimination. These findings suggest that mindfulness may serve as a helpful psychological buffer against the stress of identity-based workplace mistreatment. In two studies conducted with gay and bisexual men and women, the nonjudging facet of trait mindfulness was associated with lower levels of internalized sexual stigma (Salvati *et al.*, 2019; Salvati and Chiorri, 2023). While trait mindfulness may support better sleep quality among gender minorities through mechanisms such as reduced emotional exhaustion, lower paranoid cognition, and decreased internalized stigma, no current research has directly examined the relationship between trait mindfulness and sleep in sexual and gender minority populations. Further investigation is warranted to explore this potential connection.

Mindfulness-based interventions and SSPs

Several studies suggest that MBIs improve SSPs (Black *et al.*, 2015; Greeson *et al.*, 2018; Jones *et al.*, 2020; Neher *et al.*, 2021). Interventions tailored for adolescents with insomnia show promise in improving sleep duration (de Bruin *et al.*, 2020). Mechanisms contributing to these improvements may include reduced perseverative cognition and improved emotion regulation (Greeson *et al.*, 2018), as well as greater present-moment awareness and increased psychological detachment (Kennett *et al.*, 2021). In specific groups such as postmenopausal women and male patients with alcohol use disorder, mindfulness training is significantly associated with enhanced sleep quality (Wang *et al.*, 2023). MBIs among elderly adults produce better sleep quality, decreased insomnia symptoms, and diminished sleep onset discrepancy (Shaif *et al.*, 2022). A systematic review and meta-analysis by Yang *et al.* (2022) points to benefits of MBIs as measured by effects on SSPs, particularly in healthy populations and older adults.

MBIs show promise for addressing sleep disparities among racial and ethnic minorities. A pilot 30-day app-based mindfulness intervention among a diverse sample of Asian, Black, Hispanic, and White young adults led to decreased stress levels and improved sleep quality, with positive implications for physical health outcomes (Johnson and Aiello *et al.*, 2023). Tailoring mindfulness interventions to the possible racial preferences of particular groups, such as incorporating Black instructors and providing additional sleep education for Black participants, has been shown to enhance effectiveness; particularly when mindfulness group meetings are conducted in the evening (Johnson *et al.*, 2022). However, as Incollingo *et al.* (2024) point out, Black patients with chronic pain were less likely to respond to an MBI compared to their White counterparts. More comprehensive research is needed to determine the feasibility and acceptability of MBIs among marginalized populations with chronic pain and other severe symptoms

(Incollingo *et al.*, 2024). Because improvements in SSPs have consistently been observed across different aspects of sleep quality with MBIs, research suggest that MBIs are a viable option for minorities who are experiencing sleep difficulties (Kennett *et al.*, 2021).

Objective sleep parameters research

Trait mindfulness and OSPs: Actigraphy

Despite increasing evidence supporting the relationship between mindfulness and sleep, actigraphy has not often been used as an outcome variable in mindfulness research among racial and ethnic minorities. However, available studies suggest that racial and ethnic minorities experience unique sleep disturbances influenced by systemic inequities, discrimination, and psychosocial stressors (Clark *et al.*, 2024). Actigraphy-measured sleep studies show that adolescents from minoritized backgrounds experience shorter sleep duration compared to their White counterparts (Gillis *et al.*, 2021; Guglielmo *et al.*, 2018; James *et al.*, 2020; Yip *et al.*, 2020). Additionally, research in adult minority participants found that actigraphy-measured sleep partially explained racial disparities in cardiometabolic disease risk, emphasizing the long-term health consequences of sleep disparities in minority populations (Curtis *et al.*, 2017).

Growing evidence links trait mindfulness to improved psychological well-being in racially diverse populations, though much of this research has yet to integrate actigraphy-based sleep measures. In a college sample ($n = 118$) of predominantly Hispanic ($n = 58$) and Black ($n = 25$) students, the “Observing” facet of the Five-Facet Mindfulness Questionnaire was inversely related to suicidal ideation, whereas the other mindfulness facets (Describing, Non-judging, Non-reactivity, and Acting with Awareness) showed no significant associations (Chesin and Jelic, 2016). Similarly, in a racially diverse community sample ($n = 97$; Hispanic = 37, Black = 44, Asian = 11), researchers found that higher trait mindfulness buffered the impact of perceived discrimination on depressive symptoms, highlighting the potential role of mindfulness in reducing stress-related sleep disturbances (Shallcross and Spruill, 2018).

While these studies suggest that trait mindfulness may mitigate stress-related sleep disruptions in minority populations, a significant gap remains in actigraphy-based research on this topic.

These studies underscore the urgent need to expand actigraphy-based research on mindfulness and sleep within diverse populations. Although evidence suggests that trait mindfulness is associated with better sleep quality and reduced stress-related sleep disturbances, existing research overwhelmingly focuses on White populations, leaving critical questions unanswered regarding its impact on minority and marginalized groups. Moving forward, it is essential to design culturally inclusive studies that investigate how trait mindfulness interacts with systemic stressors, discrimination, and sleep health disparities. Expanding research in this area could inform the development of targeted mindfulness interventions to address the unique sleep challenges faced by racial and ethnic minorities.

Mindfulness-based interventions and OSPs: Actigraphy.

Actigraphy research on MBIs and sleep among minority populations remains limited but is steadily emerging. Existing studies suggest that MBIs may offer sleep benefits, but findings indicate inconsistencies in how these improvements manifest across subjective and objective sleep measures, particularly in racial

and ethnic minority groups. A study by Sieverdes *et al.* (2020) examined the effects of a mindfulness-based smartphone intervention on actigraphy-measured sleep among African Americans with prehypertension. While results showed modest improvements in sleep efficiency, the study emphasized the persistent barriers affecting sleep disparities in this population. Social determinants of health including chronic stress, occupational demands, and neighborhood environments contributed to ongoing sleep disturbances despite intervention benefits.

In contrast, a recent MBI study on Black women with insomnia found clinically significant improvements in subjective sleep parameters, yet actigraphy measures did not show statistically significant changes (Nam *et al.*, 2024). This discrepancy between subjective and objective sleep improvements highlights a key challenge in measuring sleep outcomes among marginalized populations. Cultural influences, chronic stress and SES barriers may shape how mindfulness interventions translate into measurable sleep improvements.

Emerging research underscores the importance of culturally adapting mindfulness interventions to enhance engagement and effectiveness for racial and ethnic minority populations. Johnson *et al.* (2023) found that an app-based mindfulness intervention significantly improved sleep quality in a racially diverse sample, with greater effectiveness when incorporating cultural adaptations, such as Black mindfulness instructors and community-based sleep education. However, research by Incollingo *et al.* (2024) found that Black patients with chronic pain were less responsive to an MBI compared to White participants, suggesting that additional culturally tailored approaches are needed to optimize engagement and efficacy.

The mixed findings in actigraphy studies underscore the necessity for further research into how MBIs influence sleep across diverse populations. While MBIs show promise for mitigating sleep disparities, future studies should expand sample sizes to include larger and more representative racial and ethnic minority groups. They should also investigate the role of cultural, SES, and environmental factors in shaping the effectiveness of MBIs in moderating objective sleep outcomes. Further, new studies should refine mindfulness interventions to better align with culturally specific sleep behaviors and challenges faced by marginalized communities. A deeper understanding of the mechanisms underlying MBI effectiveness in racially and ethnically diverse groups will be essential for developing equitable, evidence-based interventions that effectively address sleep health disparities.

Trait mindfulness and OSPs: Polysomnography

Polysomnography is considered the gold standard in sleep research due to its advanced capability to monitor physiological markers of sleep including brain activity, cardiac function, respiratory patterns and nervous system responses (Rundo and Downey, 2019). By capturing detailed sleep architecture, PSG provides highly accurate assessments of sleep staging and pathology, making it an essential tool for understanding the biological mechanisms of sleep regulation.

Despite these advantages, PSG data collection methods do not lend themselves to home-based environments. Thus, research exploring the relationship between trait mindfulness and sleep using PSG remains extremely limited, particularly among racial and ethnic minority populations. Few studies have examined how trait mindfulness influences sleep architecture, and even fewer have specifically investigated such effects in marginalized subject groups. The lack of research in this area highlights a critical gap in

the literature, as PSG could provide valuable insights into the physiological impact of mindfulness on sleep health (Gómez-Odrizola and Calvete, 2021; Hazlett-Stevens *et al.*, 2019; Lucas-Thompson *et al.*, 2020).

The scarcity of PSG-based mindfulness research may be due to logistical and methodological challenges: PSG studies require participants to sleep in a laboratory setting while connected to multiple sensors for an extended period, which can be intrusive, expensive and difficult to conduct on a large scale. These barriers may disproportionately limit participation among racial and ethnic minority populations, who already face systemic obstacles in accessing healthcare

and sleep research participation.

Given these challenges, future research should prioritize investigating the relationship between trait mindfulness and PSG-measured sleep health in diverse populations (Chung *et al.*, 2024). Expanding PSG studies to include racially and ethnically diverse participants will be essential to understanding how mindfulness-based practices influence sleep physiology across different sociocultural and environmental contexts. By addressing these research gaps, PSG-based studies can provide crucial evidence to inform the development of culturally responsive interventions aimed at improving sleep health equity.

Mindfulness-based interventions and OSPs: Polysomnography

Similar to the issues with research on trait mindfulness and PSG, data on the impact of MBIs on sleep assessed through PSG is limited. The extant data presents mixed findings, reflecting both promising results and methodological inconsistencies. Some studies have demonstrated improvements in PSG-measured sleep efficiency, including reductions in wake time and sleep onset latency discrepancies (Shaif *et al.*, 2022).

For example, Goldstein *et al.* (2019) found some interesting effects of MBI on non-rapid eye movement (NREM) sleep, which is typically associated with restorative processes. After MBI, NREM brain wave activity in the beta frequency band was positively associated with mindfulness and negatively associated with insomnia, suggesting a potential neurophysiological mechanism linking mindfulness to improved sleep. Additionally, a school-based mindfulness curriculum conducted with children of lower SES and matched controls showed significant changes in PSG-measured total sleep time and rapid eye movement (REM) sleep over two years. However, contrary to expectations, the lower SES group with improved sleep also reported increased perceived social stress (Chick *et al.*, 2022). This paradox suggests that mindfulness training may enhance awareness of environmental stressors, while also equipping individuals with tools to mitigate stress vulnerability.

Despite these promising outcomes, the limited body of PSG-based MBI research has yielded inconsistent results. Several studies have shown no significant improvements in PSG-measured sleep following mindfulness interventions (Garcia *et al.*, 2018; Kanen *et al.*, 2015; Zhang *et al.*, 2019). Additionally, in some cases, MBIs have been associated with worsened PSG-measured sleep outcomes compared to baseline conditions (Wong *et al.*, 2022).

The discrepancy between subjective sleep improvements and PSG-measured sleep outcomes suggests the need for further investigation into the mechanisms through which mindfulness influences sleep physiology. Future research should examine long-term effects of MBIs on PSG-measured sleep to determine whether improvements emerge over extended periods. Studies should investigate individual differences in MBI responsiveness,

particularly among racially and SES diverse populations, and explore how mindfulness impacts sleep-related neurophysiological processes (e.g., REM versus NREM sleep regulation) in different demographic groups. Given the growing interest in MBIs as a non-pharmacological intervention for sleep health, expanding PSG-based research will be critical for understanding the physiological effects of mindfulness on sleep and identifying potential disparities in its effectiveness across diverse populations.

Discussion

This scoping review highlights the complex relationship between mindfulness and sleep health among marginalized populations, providing an overview of both SSPs and OSPs in evaluating sleep outcomes. The findings underscore significant disparities in sleep health among racial and ethnic minority groups, emphasizing the importance of culturally informed mindfulness interventions as a potential tool for reducing these inequities.

A key finding from this review is the discrepancy between SSP and OSP-measured sleep outcomes. Studies indicate that racial and ethnic minorities often self-report poorer sleep in SSPs, yet self-reports do not always align with OSP data (Jackson *et al.*, 2020). This discrepancy may be influenced by sociocultural sleep attitudes, or chronic stress and environmental factors that disproportionately affect minority populations. Research suggests that mindfulness may improve self-reported sleep quality, but PSG and actigraphy studies have produced mixed findings, making it unclear whether mindfulness impacts actual sleep physiology or primarily modulates sleep perception (Goldstein *et al.*, 2019; Sala *et al.*, 2020). These inconsistencies raise important methodological considerations for future research, particularly in refining culturally responsive sleep assessments that accurately reflect the experiences of marginalized communities. Given that subjective experiences of sleep impact overall well-being, it is crucial to balance both self-report and objective measures when evaluating the effectiveness of MBIs.

The findings suggest that trait mindfulness and MBIs have potential for improving sleep health outcomes, particularly for individuals facing discrimination, chronic stress and socioeconomic adversity (Blake *et al.*, 2018; Nagy *et al.*, 2022). Studies demonstrate that mindfulness interventions may mitigate sleep disparities by reducing stress reactivity, enhancing emotional regulation, and improving overall sleep-related behaviors (Smith *et al.*, 2020). However, the effectiveness of MBIs varies across populations, and research indicates stronger outcomes in self-reported sleep improvement compared to objective sleep metrics (Alder *et al.*, 2017). This discrepancy highlights the need for further exploration into the mechanisms underlying mindfulness-related sleep benefits, including whether mindfulness directly influences sleep architecture or primarily enhances relaxation and stress reduction.

Another key takeaway from this review is the importance of cultural adaptations in mindfulness interventions. Studies show that racial and ethnic minorities may respond differently to MBIs, with some groups demonstrating greater engagement and sleep improvements when interventions are culturally tailored (Johnson and Smith-Ireland *et al.*, 2023). For example, mindfulness interventions led by Black mindfulness instructors and incorporating community-based sleep education were found to be more effective in improving sleep outcomes among racially diverse participants (Incollingo *et al.*, 2024). Despite these promising findings, existing mindfulness research remains predominantly

focused on White/Caucasian populations, limiting its generalizability to marginalized communities. Future studies should focus on integrating mindfulness practices into culturally relevant frameworks that consider historical trauma, socioeconomic stressors and environmental barriers to sleep health.

This review highlights several key directions for future research. First, there is a need to bridge the gap between subjective and objective measures of sleep by refining methodologies that better account for cultural differences in how sleep is perceived and reported. Second, the long-term effects of mindfulness practice on sleep remain underexplored, particularly using physiological measures like polysomnography (PSG) and actigraphy in racially and ethnically diverse populations. Third, developing mindfulness-based interventions that are tailored to the needs and lived experiences of marginalized communities may help address persistent disparities in sleep health. Community-driven approaches may offer an effective path forward in reducing these disparities. Mindfulness shows promise as a scalable and accessible intervention to improve sleep, especially for those disproportionately affected by poor sleep. However, further research is needed to better understand its physiological pathways, enhance intervention design, and ensure cultural relevance. Advancing this work will be critical to using mindfulness as an equitable strategy for improving sleep and long-term health across diverse populations.

Limitations

While this review highlights the multifaceted nature of SSP and OSP research in understanding the interplay between mindfulness and sleep, several limitations should be acknowledged. A significant portion of the existing evidence is derived from studies conducted primarily with White/Caucasian populations, limiting the generalizability of findings to marginalized groups. Additionally, the variability in mindfulness interventions, measurement methods, and study designs may contribute to inconsistencies in results, emphasizing the need for more standardized approaches. Finally, as this was a scoping review, the focus was on mapping recent evidence rather than critically appraising the quality or validity of individual studies, leaving room for future systematic reviews to provide a deeper evaluation of the findings.

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Data availability statement. The research that supports the findings of this review is reported in the reference section.

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Connections references

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