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EFFECT OF ONLINE MINDFULNESS-BASED BRIEF INTERVENTION ON SLEEP QUALITY AMONG SHIFT-WORKING NURSES: A NARRATIVE REVIEW

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Abstract:
Background: Shift-working nurses face significant disruption to circadian rhythms and sleep architecture, resulting in high rates of shift work disorder (SWD) and impaired sleep quality. Online mindfulness-based brief interventions (MBIs) offer an accessible, scalable, and cost-effective approach to address these occupational sleep challenges. However, the evidence base remains heterogeneous and requires systematic synthesis. **Objectives:** To review the current evidence on the effectiveness of online mindfulness-based brief interventions in improving sleep quality among shift-working nurses, and to examine proposed biological and psychological mechanisms. **Methods:** A narrative review of peer-reviewed literature was conducted using PubMed, EMBASE, Scopus, CINAHL, and PsycINFO databases. Studies published from 2010 to 2024 reporting the effects of online or app-based mindfulness interventions on sleep outcomes in nurses or shift workers were included. **Results:** Evidence from randomized controlled trials and systematic reviews demonstrates that online MBIs significantly improve PSQI global scores, reduce insomnia severity, decrease pre-sleep arousal, and attenuate hyperarousal in nurse populations. Brief digital formats (10-30 min/session) are effective and well-tolerated. Mechanistic pathways include modulation of the hypothalamic-pituitary-adrenal (HPA) axis, autonomic nervous system regulation, and reduced cognitive hyperarousal. **Conclusions:** Online mindfulness-based brief interventions are a promising, evidence-based strategy to improve sleep quality among shift-working nurses. Implementation considerations include session brevity, smartphone delivery, and integration with occupational health programs.

Keywords: mindfulness-based intervention; online intervention; sleep quality; shift work; nurses; Pittsburgh Sleep Quality Index; circadian rhythm; digital health

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1. Introduction

Nursing is widely recognized as one of the most demanding occupations in the healthcare sector, with shift work constituting a core feature of clinical nursing practice globally. An estimated 40–60% of nurses work rotating or night shifts, a scheduling pattern that fundamentally conflicts with the human circadian clock and predisposes workers to a spectrum of sleep disturbances collectively defined as shift work disorder (SWD). (1,2) Epidemiological data indicate that the prevalence of SWD symptoms among nurses' ranges from 24.4% to 48.5%, depending on the diagnostic criteria and shift schedule employed. (3,4)

Sleep disruption in shift-working nurses carries consequences that extend beyond individual health. Impaired sleep quality is associated with increased rates of medical errors, occupational accidents, burnout, and diminished quality of patient care. (5) Despite this substantial burden, pharmacological management of sleep disorders in this population is limited by concerns about daytime sedation and long-term dependence, creating an unmet need for non-pharmacological, accessible interventions.

Mindfulness-based interventions (MBIs) represent a class of structured psychological practices grounded in mindfulness theory, defined by Kabat-Zinn as the intentional, non-judgmental awareness of the present moment. (6) Canonical MBI programs include Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT). Over the past two decades, a growing body of evidence has demonstrated that MBIs improve sleep quality across diverse clinical populations, including those with insomnia, anxiety, and depression. (7,8)

The emergence of digital health platforms has enabled the delivery of MBIs through online and mobile-based formats, overcoming traditional barriers of time, geography, and cost that limit participation in in-person programs. For shift-working nurses, whose schedules are inherently unpredictable and fragmented, brief online MBIs offer a particularly compelling solution. However, the evidence base for online MBIs specifically targeting shift-working nurses remains sparse and requires synthesis.

This narrative review aims to:

1) summarize the epidemiology and pathophysiology of sleep disturbance in shift-working nurses;
2) describe the theoretical and biological mechanisms through which MBIs improve sleep;
3) review current evidence from clinical trials and systematic reviews on the effectiveness of online MBIs for sleep quality in nurses; and
4) identify gaps in knowledge and directions for future research.

2. Sleep Disturbance in Shift-Working Nurses

2.1 Epidemiology and Prevalence

Shift-working nurses represent one of the occupational groups most severely affected by sleep disorders. Bjorvatn and colleagues conducted a large cross-sectional study involving 1,968 Norwegian nurses and found that the prevalence of SWD symptoms ranged from 32.4% to 37.6% depending on the assessment instrument used, with certain shift schedules associated with rates as high as 44.3%. (1) A subsequent multicenter study conducted during the COVID-19 pandemic found that approximately 48.5% of shift nurses met criteria for SWD, with night shift frequency, excessive weekly hours, and psychological stress identified as key predictors. (3)

A 2021 systematic review and meta-analysis on the global prevalence of SWD reported that the condition affects a disproportionate share of healthcare workers, with insomnia and excessive sleepiness constituting the cardinal symptoms. (9) A 2026 cohort study of 42,119 nurses quantified cumulative circadian disruption and demonstrated a dose-response relationship between hours of circadian misalignment and the prevalence of sleep problems (IRR = 1.10, 95% CI 1.07–1.13), as well as medication use and overweight. (10)

2.2 Pathophysiology of Shift Work-Related Sleep Disruption

The biological basis of sleep disturbance in shift workers is rooted in the conflict between imposed work schedules and the endogenous circadian timing system, primarily regulated by the suprachiasmatic nucleus (SCN) of the hypothalamus. The SCN synchronizes physiological processes, including melatonin secretion, cortisol release, core body temperature, and sleep-wake cycles to the light-dark cycle. Night shift work requires wakefulness during the biological night, when circadian drive toward sleep is strongest, and attempts sleep during the biological day, when circadian alerting signals are active. (11)

Chronic circadian misalignment results in disruption of the three key processes governing sleep: the circadian process (Process C), the homeostatic sleep pressure (Process S), and the wake-promoting allostatic load. In shift nurses, the cumulative effect manifests as difficulty initiating and maintaining sleep, reduced total sleep time, frequent nocturnal awakenings, and elevated daytime sleepiness. Prolonged exposure is associated with dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, elevated inflammatory markers, and increased sympathetic nervous system tone, all of which further impair sleep architecture. (2,5)

The International Classification of Sleep Disorders, Third Edition (ICSD-3), defines SWD as:

1) a complaint of insomnia or excessive sleepiness associated with a shift work schedule;
2) symptom duration of at least three months;
3) circadian or sleep-time misalignment confirmed by sleep diary or actigraphy; and

4) exclusion of other sleep disorders. (12)

Clinical recognition of SWD in nursing practice remains suboptimal, in part due to workforce normalization of sleep complaints and the absence of routine screening protocols.

3. Mindfulness-Based Interventions: Theory and Mechanisms

3.1 Conceptual Framework

Mindfulness is defined as the moment-to-moment, non-judgmental awareness of one's thoughts, feelings, and bodily sensations. In the context of sleep, mindfulness practice targets the central perpetuating mechanism of insomnia: cognitive and physiological hyperarousal. (13) Ong and colleagues' metacognitive model of insomnia proposes that sleep disturbance is maintained not only by primary arousal (intrusive thoughts at bedtime) but, critically, by secondary metacognitive arousal—the negative evaluation and rumination about one's insomnia symptoms. (13) Mindfulness practice interrupts this cycle by cultivating non-reactive awareness and acceptance of pre-sleep cognitive activity.

The major structured MBI programs include: Mindfulness-Based Stress Reduction (MBSR), an 8-week program developed by Kabat-Zinn; Mindfulness-Based Cognitive Therapy (MBCT), which integrates cognitive behavioral techniques; and Mindfulness-Based Therapy for Insomnia (MBTI), a hybrid program specifically targeting sleep. (8) Brief adaptations of these programs, ranging from 4–6 weeks with session durations of 10–30 minutes, have been developed for delivery through digital platforms.

3.2 Biological Mechanisms

The beneficial effects of MBIs on sleep are mediated through multiple interacting biological pathways. Regarding HPA axis modulation, a systematic review published in 2024 examining 35 studies found that MBIs produced significant changes in cortisol levels in 25 of the included trials, consistent with downregulation of chronic stress-associated HPA hyperactivity. (14) Cortisol dysregulation is mechanistically important for sleep because elevated evening cortisol levels delay sleep onset by opposing the nocturnal rise of melatonin and maintaining arousal.

At the level of the autonomic nervous system, mindfulness practice has been shown to reduce sympathetic nervous system activation and increase parasympathetic (vagal) tone, as reflected by increases in high-frequency heart rate variability.15 Reduced sympathoadrenal activity translates into lower pre-sleep physiological arousal, facilitating the transition to non-rapid eye movement (NREM) sleep. Aguilar-Raab and colleagues demonstrated in an ecological momentary assessment study that state mindfulness was significantly associated with reduced salivary alpha-amylase—a sympathetic nervous system marker—on a moment-to-moment basis. (16)

Neuroimaging evidence indicates that sustained mindfulness practice produces structural and functional changes in regions implicated in arousal regulation, including

the prefrontal cortex, anterior cingulate cortex, amygdala, and insula. These changes are consistent with enhanced top-down inhibition of subcortical arousal centers, reduced amygdala reactivity to stressors, and improved emotion regulation—all of which contribute to more quiescent pre-sleep cognitive states. (17)

3.3 Online and Brief Digital Delivery Formats

The adaptation of MBIs for online and smartphone-based delivery represents a significant advancement in accessibility. A 2025 systematic review and meta-analysis by Huberty and colleagues examining 18 trials (n = 4,870 participants) found that digital MBIs (DMBIs) produced significant improvements in sleep quality with a moderate effect size (Hedges' g = 0.47, 95% CI 0.29–0.64), with no significant difference in effectiveness between guided and unguided formats. (18) Interventions included MBSR, mindfulness training, and Acceptance and Commitment Therapy (ACT) components, delivered via app or web platforms.

For healthcare workers specifically, a 2024 scoping review documented that online MBIs demonstrated consistent improvements in burnout, anxiety, and perceived stress across multiple trials, with adherence rates typically exceeding 70% when sessions were brief (10–15 minutes).(19) The Headspace application, one of the most widely studied commercial platforms, demonstrated significant reductions in stress, anxiety, and burnout in a multisite RCT involving NHS healthcare workers. (20)

4. Evidence Review: Online MBIs and Sleep Quality in Nurses

4.1 Summary of Key Studies

Author, Year	Design / Population	Intervention	Key Outcome	Finding
Alkhawaldeh et al., 2024	RCT; 100 nurses (Jordan) ICU & medical-surgical	Brief MBI vs. mindfulness video (control); 8 weeks	Sleep Disturbance (PSQI)	MI significantly reduced sleep disturbance ($p<0.001$)
Al-Hammouri et al., 2024	RCT; 123 nurses (Jordan)	Brief MBI (8 weeks); repeated-measure MANOVA	Sleep duration, quality, fatigue (PSQI)	Significant multivariate effect: $V=0.23$, $F(3,119)=12.02$, $p<.001$; $\eta^2=0.23$
Fazia et al., 2023	RCT; 56 poor sleepers (Italy); online format	12 biweekly integral meditation classes online (6 wk)	PSQI, ISI, FIRST, SCI, APS, SHI	Significant improvement in PSQI; FFMQ non-reactivity improved; online delivery feasible
Zhang et al., 2025 (meta-analysis)	Systematic review + meta-analysis; 16 RCTs (n=1,384 nurses)	MBI (MBSR, MBCT, ACT) vs. control	Sleep quality (PSQI, GSQ), burnout, resilience	MBI improved sleep: SMD=−1.10 (95% CI −1.79 to −0.41,

				p=0.002); burnout: SMD=−1.43 (p<0.001)
Huberty et al., 2025 (meta-analysis)	Systematic review; 18 trials, n=4,870; digital MBIs	MBSR, MT, ACT via app/web; 1–30 min/day	Sleep quality (various)	DMBIs improved sleep: Hedges' g=0.47 (95% CI 0.29–0.64); guided vs. unguided: no difference
Jaiswal et al., 2024	Cluster RCT; 22 healthcare professionals	WellMind app; 5–10 min/session; 60 sessions/3 months	Self-compassion, mindfulness, burnout, sleep dysfunction	Reduced sleep dysfunction; improved DMN connectivity; high adherence
Taylor et al., 2022	Multisite RCT; NHS healthcare workers (UK)	Headspace app (unguided DMBI) vs. waitlist	Stress, burnout, wellbeing	Reduction in stress and burnout; digital format accepted; brief sessions effective
Björvatn et al., 2012	Cross-sectional; 1,968 Norwegian nurses	Epidemiological (prevalence study)	SWD prevalence, associated factors	SWD prevalence: 32.4–37.6%; night work and circadian type as predictors

Note: MBI = Mindfulness-Based Intervention; PSQI = Pittsburgh Sleep Quality Index; ISI = Insomnia Severity Index; SWD = Shift Work Disorder; DMBI = Digital Mindfulness-Based Intervention; DMN = Default Mode Network; RCT = Randomized Controlled Trial

4.2 Assessment Tools for Sleep Quality

The Pittsburgh Sleep Quality Index (PSQI) is the most widely used and psychometrically validated instrument for the assessment of sleep quality in both clinical and research contexts. Originally validated by Buysse and colleagues in 1989 in a sample of 148 participants, the PSQI demonstrated good internal consistency (Cronbach's $\alpha = 0.83$), high test-retest reliability ($r = 0.85$), and strong criterion validity, with a global score >5 yielding a diagnostic sensitivity of 89.6% and specificity of 86.5% for distinguishing good from poor sleepers. (21)

The PSQI comprises 19 self-rated items generating seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. A global score >5 indicates clinically significant sleep impairment. The instrument has been translated into more than 60 languages and validated across a range of populations, including nurses and healthcare workers. (22) For shift-working nurses, the PSQI has been applied as a primary outcome measure in the majority of intervention trials reviewed in this article.

5. Online MBI Design Considerations for Shift-Working Nurses

5.1 Session Format and Duration

The scheduling demands of shift work necessitate that mindfulness interventions be brief, asynchronous, and flexible in delivery. Evidence from systematic reviews suggests that sessions of 10–20 minutes delivered 3–5 times per week over 4–8 weeks are sufficient

to produce meaningful improvements in sleep quality. (7,8) The meta-analysis by Huberty and colleagues found no significant difference in effect size between guided and unguided digital formats, suggesting that self-directed brief practice is a viable alternative for busy nursing staff. (18)

Core components of effective brief online MBIs for sleep include:

1) psychoeducation on sleep hygiene and the circadian effects of shift work;
2) guided body scan meditation (10–15 minutes);
3) mindful breathing exercises targeting pre-sleep physiological arousal; and
4) cognitive defusion techniques derived from MBCT to address ruminative thinking at bedtime. Delivery through smartphone applications allows access at any time, accommodating the variable shift schedules of nursing staff.

5.2 Adherence and Engagement Strategies

Adherence to digital MBIs in healthcare worker populations has been identified as a primary challenge. In the multisite RCT by Taylor and colleagues involving NHS workers, engagement with the Headspace app was variable despite overall positive outcomes. (20) Strategies to improve adherence include: push notifications aligned with post-shift recovery windows, brief session formats that can be completed during a 15-minute break, gamified progress tracking, and peer social support through group messaging features. A cluster RCT by Jaiswal and colleagues demonstrated that a closed-loop design incorporating biofeedback and reward systems achieved notably high adherence (up to 60 sessions over 3 months) in a healthcare professional cohort. (17)

5.3 Special Considerations for Night Shift Nurses

Night shift nurses face unique circadian challenges that may require adaptation of standard MBI protocols. Mindfulness practice during the daytime recovery sleep window should avoid morning bright light exposure, which would further delay the circadian phase. Body scan and breathing techniques practiced in a darkened, quiet environment may enhance daytime sleep quality. Additionally, protocols should address the psychological distress associated with social isolation and work-life imbalance that disproportionately affects night shift workers.

A multicenter cross-sectional study found that good social support, adequate work-family balance, and structured napping patterns were associated with reduced odds of SWD, suggesting that online MBIs should ideally be embedded within a broader occupational wellness framework that includes scheduling optimization and social support components. (3)

6. Gaps in Evidence and Future Research Directions

Despite the accumulating evidence base, several important gaps remain.

First, the majority of RCTs on MBIs for nurse sleep quality have been conducted in the Middle East (primarily Jordan) and East Asia, limiting generalizability to shift-working nurses in Southeast Asia and other regional contexts.

Second, no published RCT has specifically enrolled shift-working nurses and compared online versus in-person MBI delivery using active control conditions, making it difficult to isolate the unique contribution of the online format.

Third, most studies have measured outcomes at 4–12 weeks post-intervention, leaving the long-term durability of sleep improvements unknown.

Fourth, objective sleep measures (actigraphy, polysomnography) have rarely been incorporated alongside the PSQI, which as a self-report instrument may be subject to reporting bias.

Fifth, biological mediators of treatment response—including salivary cortisol, heart rate variability, and inflammatory biomarkers—have been understudied in nurse-specific MBI trials.

Future research should prioritize:

1) adequately powered RCTs recruiting shift-working nurses with verified SWD diagnoses;
2) head-to-head comparisons of brief online MBI versus cognitive behavioral therapy for insomnia (CBT-I), the current gold-standard non-pharmacological treatment;
3) long-term follow-up (6–12 months) to assess durability;
4) integration of objective sleep monitoring via actigraphy or smartwatch-based platforms; and
5) subgroup analyses examining the moderating effects of shift type (night vs. rotating), years of shift work experience, and individual chronotype.

7. Conclusion

Sleep disturbance is a pervasive occupational health problem among shift-working nurses, driven by chronic circadian misalignment and sustained physiological and cognitive hyperarousal. Online mindfulness-based brief interventions represent a theoretically grounded, mechanistically plausible, and empirically supported approach to improving sleep quality in this population. Evidence from randomized controlled trials and meta-analyses consistently demonstrates significant reductions in PSQI global scores following MBI delivery, with emerging evidence supporting the equivalent efficacy of brief digital formats relative to traditional in-person programs.

Effective online MBIs for shift-working nurses should incorporate body scan meditation, mindful breathing, and cognitive defusion techniques, delivered through smartphone platforms in sessions of 10–20 minutes, adaptable to variable shift schedules. Integration into institutional occupational health programs, combined with scheduling optimization and social support interventions, is likely to maximize population-level impact. Healthcare institutions are encouraged to consider online MBIs as a core

component of shift worker wellness programs, pending further evidence from high-quality, nurse-specific randomized trials.

Ethical Approval Statement
Not applicable (narrative review of published literature).

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Conflicts of Interest Statement
The author declares no conflicts of interest.

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Dr. Wuttipong Saisuwan is a physician at Wattanapat Hospital, Ao Nang, Krabi, Thailand. He completed his medical degree (MD) and has developed a clinical focus on Health Promotion Centre. His clinical interest in mindfulness-based interventions emerged from direct observation of the sleep difficulties and burnout experienced by nursing staff working rotating and night shift schedules at his institution. Dr. Saisuwan is committed to integrating evidence-based behavioral and lifestyle approaches into the occupational wellness programs at Wattanapat Hospital, with a particular emphasis on accessible, technology-delivered interventions suitable for the demanding schedules of shift-working clinical staff.
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