Waking up to the problem of sleep: can mindfulness help?
A review of theory and evidence for the effects of mindfulness
for sleep
Amanda J Shallcross1, Pallavi D Visvanathan2, Sarah H Sperber1 and
Zoe T Duberstein1

The high incidence of poor sleep and associated negative
health consequences substantiates the need for effective
behavioral sleep interventions. We offer an integrative model of
sleep disturbance whereby key risk factors for compromised
sleep quality and quantity are targeted through mindfulness
practice—namely, experiential awareness, attentional control,
and acceptance. Theoretical considerations and burgeoning
evidence suggest that mindfulness-based interventions (MBIs)
may be promising treatments for improving sleep outcomes.
However, evidence is mixed due to heterogeneity in design and
methods across studies. More rigorous RCTs are needed to
determine the efficacy and underlying mechanisms of MBIs for
sleep. MBIs that are affordable, accessible, and scalable are
needed to improve sleep outcomes at the population level.

Addresses
1 New York University School of Medicine, United States
2 Manhattan Mindfulness-Based Cognitive Behavioral Therapy, United States

Corresponding author:
Shallcross, Amanda J (amanda.shallcross@nyumc.org)

Chronic sleep disturbance is a global pandemic with two-
thirds of individuals failing to obtain the recommended
7–9 h of sleep each night [1]. Further, up to 10% of people
meet criteria for clinical insomnia [2]. Unlike sleep depri-
vation (shortened sleep due to external restriction of the
opportunity to sleep—e.g. staying up late to meet a
deadline), clinical insomnia is the difficulty initiating or
maintaining sleep or the experience of non-restorative
sleep that is present despite the effort to sleep. These
difficulties are accompanied by daytime impairment for at
least 3 days per week for 3 months [3]. Given the
heterogeneity of the diagnostic criteria for insomnia [4]
and its varied operationalizations (e.g. insomnia as a
symptom versus a diagnosis) [5], for the purpose of this
paper, the term sleep disturbance will be used to describe
both the clinical and subclinical experience of insufficient
and/or poor sleep despite attempts to sleep.

The average adult spends 25–30 years of one’s life asleep.
As such, this time-consuming activity unlikely serves a
single and unimportant function for wellbeing. Indeed,
inadequate sleep is linked to increased risk of cancer [6],
Alzheimer’s disease [7], diabetes [8], cardiovascular dis-
ease [9], psychological disorders (e.g. depression, anxiety)
[10], and lower life span via motor vehicle accidents [11]
and suicide [12]. Despite the incidence and grave conse-
quences of sleep disturbance, the majority of people
who report insufficient and/or poor sleep remain
unhelped by the most commonly used treatments, namely
prescription and over-the-counter sleep aids (e.
g. sedative hypnotics such as sleeping pills). Meta-anal-
yses indicate that pharmacological treatments for insom-
nia confer no objective benefit (measured via polysom-
nography) compared to placebo [13]. Sedative hypnotics
are also associated with daytime residual effects, with
increases in the risks for falls, fractures, and traumatic
brain injury, particularly in older adults [14].

Results from pharmacological studies may be unsurpris-
ing given that the underlying factors that contribute to
sleep disturbance are not targeted by this treatment
approach. Psychobehavioral factors such as poor sleep
hygiene (e.g. irregular bed and wake times, excessive
caffeine and/or alcohol consumption) and cognitive pro-
cesses (e.g. ruminating) that maintain psychophysologi-
cal arousal are primary risk factors for sleep disturbance
[15]. Thus, the most effective treatments for insomnia are
psychological and behavioral interventions that incorpo-
rate varied treatment components including stimulus
control, sleep restriction, relaxation, and cognitive ther-
apy [16,17].

Cognitive behavioral therapy for insomnia (CBT-I) is one
of the most effective treatments for insomnia and is
recommended as first-line treatment [18]. However, addi-
tional treatment approaches are needed for the up to 25%
of individuals who do not respond to CBT-I or who
experience only partial symptomatic relief [19]. Also,
CBT-I and similar clinical interventions are not readily
available to patients because they require treatment from therapists with specialized training and involve time-intensive sessions that may not be covered by insurance [20]. They are also intended for patients with clinical insomnia. Collectively, these considerations support the need for additional or complementary treatments that are accessible, affordable, and effective for the treatment of insomnia and subclinical sleep disturbance, with a focus on prevention of insomnia and associated consequences.

**Etiological model of sleep disturbance**

Sleep disturbance is thought to be initiated and perpetuated by the following sequential cognitive and behavioral processes: first, excessive daytime and nighttime rumination [21], second, primary arousal (i.e. initial negative appraisal about daytime consequences of poor sleep that results in distress and physiological activation)—‘If I don’t sleep tonight, I’m going to fail at my job tomorrow and be fired.’ [22]; third, secondary arousal (i.e. the negative secondary or metacognitive evaluation or judgment of initial (primary) arousal, which leads to continuing distress and physiological activation)—‘I hate how I’m feeling and shouldn’t be feeling this way.’ [23]; fourth, excessive monitoring of and selective attention to internal (e.g. bodily sensations) and/or external (e.g. clock) sleep cues that are either consistent or inconsistent with falling asleep [22]. Hand in hand with selective attention is a dysfunctional perceived need for control and engagement in sleep effort (e.g. actively trying to sleep or increasing sleep opportunity) [24]; and fifth, distorted perceptions about sleep impairment (i.e. regularly overestimating sleep loss) [25]. Misperceptions of sleep deficit frequently lead to excessive negative cognitions about sleep thus fortifying a vicious cycle of sleep disturbance.

**Theoretical framework for mindfulness and sleep disturbance**

In Figure 1, we present an integrative etiological model of sleep disturbance from several cognitive and behavioral frameworks and demonstrate how processes that are core to the practice of mindfulness may target key risk factors for sleep disturbance [26]. The practice of mindfulness involves three core processes (experiential awareness, attentional control, and acceptance) that have the potential to target each of the risk factors for sleep disturbance. For example, mindfulness-based practices (e.g. breath-focused meditation, body scanning, sensory meditations) promote experiential awareness of a range of experiences including internal (e.g. thoughts, emotions, physiological sensations) and external stimuli (e.g. sights, sounds) (4). During these exercises, participants acquire skills in attentional control by focusing attention on the breath (sustained attention) and redirecting attention to this anchor whenever one’s thoughts wander (attention inhibition) [27,28]. Finally, participants learn to change their relationship to their experiences by learning to accept, rather than avoid or control negatively perceived thoughts, emotions, and physical sensations. Skills in acceptance are learned by non-judgmentally observing one’s thoughts, feelings, and physical sensations and by viewing such experiences as passing events, rather than facts [29].

Collectively, mindfulness practices target each of the cognitive and behavioral vulnerabilities associated with poor sleep (see Figure 1). Increased awareness of internal and external experiences (e.g. thoughts and behaviors) should target each of the processes that contribute to the maintenance of sleep disturbance: (1) Rumination; (2) Primary arousal; (3) Secondary arousal; (4) Sleep monitoring/selective attention and effort; and (5) Distorted perceptions. Attentional control should enable individuals to disengage from negative thoughts and/or beliefs about sleeplessness by disrupting selective attention toward internal/external sleep-related threat cues. Thus, skills in attentional control should target processes (1)–(4) above. Finally, skills in acceptance should foster a less contentious and more flexible relationship to one’s thoughts, emotions, and sensations by promoting the ability to approach, rather than avoid, and to engage with such experiences with equanimity instead of with judgment. Therefore, acceptance should target the following processes: (3) Secondary arousal; (4) Sleep monitoring/selective attention and effort; and (5) Distorted perceptions.
Mindfulness-based interventions and sleep

The literature on the effects of mindfulness for sleep is comprised primarily of investigations that have tested mindfulness-based stress reduction (MBSR) or mindfulness-based therapy for insomnia (MBTI), a tailored derivative of MBSR and CBT-I (for reviews see Refs. [30*,31]). The most compelling evidence for the effects of MBIs for insomnia come from randomized controlled trials that have compared MBIs to rigorous comparison conditions. For example, in one study, MBSR demonstrated greater improvements in self-reported sleep quality and quantity compared to a pharmacotherapy (PCT) (Cohen’s d = −1.68; large within group effect) and showed comparable improvements on sleep efficiency, measured using sleep diary and actigraphy at post-intervention [32]. In another RCT, a three-arm trial comparing MBTI to MBSR and a self-monitoring condition, MBTI showed greater improvements in insomnia severity index scores (ISI) (d = 2.56 at 6-month follow-up; large within group effect); MBTI also showed higher treatment remission and response rates at 6-month follow-up [33]. Also in individuals with insomnia, Wong et al. demonstrated short-term benefits of an MBI to a comparable psychoeducation control condition on post-intervention ISI scores (d = 0.36; small between group effect; p = 0.02). However, significant group differences were not found for remission rates and ISI scores did not differ between groups beyond a 5-month follow-up [34*].

In addition to studies conducted in people with insomnia, several studies have examined MBIs in patients with chronic diseases and psychiatric conditions who also suffer from comorbid sleep disturbance (for reviews see Refs. [31,35]). Two recent meta-analyses indicate that MBIs show promise for improving sleep outcomes across a range of patient populations [36**]. Overall, evidence across randomized and non-randomized trials supports that MBIs are associated with significant improvements in self-reported total sleep time (TST) and sleep efficiency (SE) and decreased sleep onset latency (SOL) and waking after sleep onset (WASO) assessed with sleep diaries [36**]. Among only RCTs that have compared MBIs to waitlist control or attention control groups, pooled results measured using standardized weight mean differences (SMD) did not support significant effect sizes for TST (SMD = 0.28; p > .30). Pooled results for effects of MBIs versus controls were significant for improved sleep quality using standardized sleep inventories (SMD = 0.85; medium effect size), and also reduced SOL (SMD = −0.53; small effect size) and SE assessed with sleep diaries (SMD = 1.09; large effect size) [37*]. Effects of MBIs on sleep parameters (e.g. SOL, SE, TST, WASO) using actigraphy or polysomnography were not significant across eight studies [36**]. Collectively, conclusions from these meta-analyses are difficult to draw, however, due to high variability in: first, sleep parameters assessed; second, methodology (e.g. actigraphy, sleep diaries, standardized sleep inventories); third, treatment protocol (e.g. MBSR, MBTI, MBCT, # of sessions, etc.); fourth, single-arm versus RCT design; fifth, type of comparison condition in RCT (e.g. waitlist, attention control, alternative active treatment); sixth, study sample (e.g. type and severity of chronic illness); and seventh baseline levels of sleep disturbance. Further, the majority of extant research comprises predominantly uncontrolled studies [36**].

Despite the heterogeneity among studies and the limited number of RCTs, theoretical considerations and burgeoning evidence support that MBIs (e.g. MBSR) or the combination of mindfulness with existing treatments for insomnia (e.g. MBTI) are promising treatments for sleep disturbance. One advantage to adding a mindfulness component to existing treatments such as CBT-I may be that it presents an additional treatment option for patients who relate more to acceptance-based approaches than to cognitive restructuring. Also, the benefits of mindfulness may generalize across greater domains of healthy functioning (e.g. reductions in somatic and/or mood symptoms associated with other comorbid conditions) that may directly or indirectly improve sleep. In sum, mindfulness appears to involve basic cognitive, affective, and behavioral processes that undergird sleep and a range of other psychological disorders and chronic diseases that are co-morbid with sleep dysfunction. Thus, mindfulness is a promising transdiagnostic approach for the treatment and prevention of sleep disturbance.

Future directions

A prevalent criticism of evidence-based psychological treatments for sleep disturbance (e.g. CBT-I) and also of MBIs is that they are not readily accessible, scalable, or affordable [26*]. Although recent reviews suggest that alternative delivery (e.g. online versus in-person) [38*] or minimal facilitator involvement [39] could be encouraging intervention directions, we are unaware of any published results from studies that have tested alternatives to in-person delivery of MBIs for sleep disturbance. Nonetheless, some researchers are working towards ensuring greater accessibility and scalability of MBIs. For example, Black et al.’s 6-week mindfulness awareness practices (MAPs) program, which outperformed a rigorous active control condition for sleep outcomes [40**], is available to communities at low cost via either online or in-person delivery. Other studies are beginning to test alternative delivery (e.g. telephone-based) of MBIs for sleep outcomes [41].

Another area worthy of investigation is characterizing the mechanisms underlying the effects of MBIs for sleep outcomes. As an initial step, it is important to understand the specificity of the effects of MBIs for sleep disturbance (i.e. whether observed benefits are due to mindfulness rather than non-specific therapeutic elements such as...
alliance with instructor or group members). The Black et al. investigation offers some evidence that MBIs confer unique benefits above and beyond non-specific therapeutic components such as time, attention, group support, and expectancy [40**]. Also, this study demonstrated that changes in sleep outcomes were correlated with changes in the non-reactivity scale of the five facet of mindfulness questionnaire in the MAPs group but not the active control group. This finding, along with converging evidence from other studies, support that cognitive (e.g., rumination, selective attention), emotional (e.g., affective symptoms, physiological arousal), and behavioral processes (e.g., clock monitoring, effortful attempts to control sleep) may underlie effects of MBIs on sleep outcomes [33,42,43]. Still, a definitive test of the mechanisms of MBIs for sleep would require several assessments of the hypothesized mediator (i.e., pre-intervention, during, and post-intervention) in order to detect the time course of intervention-related changes, and a demonstration that the mechanisms of MBIs differ from the mechanisms underlying the effects of attention control conditions [29]. Before this, however, additional work may be required to develop a clear conceptual model to guide the testing of treatment mechanisms. We and others have started to lay the necessary initial groundwork by integrating extant theory from cognitive and behavioral models with mindfulness-based concepts and processes (e.g., metacognition and secondary arousal) that are associated with sleep disturbance and that are targeted by MBIs [23,26*].

**Conflict of interest statement**
Nothing declared.

**Acknowledgements**
This work was supported by the National Institutes of Health [grant number K23AT009208]. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

**References and recommended reading**
Papers of particular interest, published within the period of review, have been highlighted as:

- of special interest
- of outstanding interest

Mindfulness and sleep Shallcross et al.


Presents a theoretical model and summarizes evidence for the use of mindfulness-based cognitive therapy (MBCT) as a treatment for insomnia. Evidence indicates that MBCT is a promising intervention for improving sleep outcomes, especially in those with a history of recurrent major depression and/or individuals with elevated depressive symptoms.


Summarizes theory behind mindfulness meditation as an intervention for sleep disturbance and reviews the body of literature exploring this relationship. The authors find a significant impact of mindfulness interventions on sleep quality, particularly in studies that target sleep as a primary outcome.


A randomized controlled trial evaluating the effects of mindfulness-based cognitive therapy compared to a sleep psycho-education with exercise control group for insomnia. MBCT was more beneficial in the short-term with no significant benefit compared to control at an 8-month follow-up.


A meta-analysis of the effects of mindfulness-based interventions (MBIs) for sleep disturbance. MBIs are efficacious for sleep outcomes measured using questionnaires and sleep diaries. Minimal evidence exists for effects on outcomes measured using polysomnography or actigraphy. Conclusions are based on a minimal number of randomized controlled trials and are limited by heterogeneity of samples, design, and methods across studies.


A meta-analysis of randomized controlled trials that investigate the effects of mindfulness meditation (MM) for insomnia. MM may mildly improve total wake time, sleep onset latency, sleep quality, and sleep efficiency. MM can serve as an auxiliary treatment to medication for sleep complaints.


Reviews evidence for web-based mindfulness-based interventions (MBIs) in individuals with physical health conditions. Evidence supports that web-based MBIs may be helpful in alleviating symptom burden, particularly when interventions are tailored for specific symptoms. There was no evidence of differences between synchronous versus asynchronos or facilitated versus self-directed web-based MBIs.


A randomized controlled trial investigating the efficacy of a community-accessible mindfulness-based intervention (MBI) on sleep disturbance in older adults, as compared to a sleep hygiene education control. The MBI demonstrated superior benefits for sleep quality immediately following the intervention.

