Third-Wave Therapies for Insomnia

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Abstract The development of psychological and behavioral therapies over the past several decades has led to what is termed the third wave of psychotherapy, a collection of treatments that adopt a new approach to maladaptive cognitions and target broad, contextualistic goals. Within the field of behavioral sleep medicine, treatments for insomnia have followed a similar evolution, and several emerging therapies, including mindfulness and acceptance-based therapies, have begun to accumulate evidence as effective treatments for this sleep disorder over the past several decades. This paper discusses the historical background of the third wave of psychotherapy, introduces each of the third-wave therapies that have been applied to the treatment of insomnia, and reviews the recent literature to critique the effectiveness of these treatments. Relevant controversies with the third-wave therapies are discussed to inform future directions in insomnia research.

Keywords Third-wave therapies · Insomnia · Behavioral treatments · Mindfulness-based therapies

Introduction

Behavioral Sleep Medicine (BSM) is a rising specialty that applies scientific knowledge about behavioral, psychological, and physiological factors that underlie normal and disordered sleep to the prevention and treatment of sleep disorders [1]. The cornerstone of BSM has been the conceptualization and behavioral treatment of insomnia, which is currently the non-pharmacological treatment of choice for chronic insomnia [2]. The rise of psychological and behavioral treatments for insomnia over the past several decades has followed a similar path to the broader evolution of behavioral psychotherapy. Hayes [3] proposed the concept of “waves” to describe how each new phase of psychotherapy evolved out of that which preceded it, resulting in treatments that possess overarching similarities but also exhibit notable differences reflecting new trends within the field.

In this paper, we provide an overview of the third-wave therapies for insomnia, a varied collection of treatment approaches developed over the past two decades. First, we provide a historical context for the movement of first wave behavior therapies to the current third-wave behavior therapies. This serves as a backdrop for the parallel evolution in the waves of behavior therapy for insomnia. Next, we review the specific third-wave therapies for insomnia, providing a description of the treatments, the theoretical underpinnings, and the evidence of these treatment packages. Finally, we discuss controversies with the third-wave therapies that could serve as future directions to guide research of these therapies.

This article is part of the Topical Collection on *Insomnia - Behavioral Therapy*

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Historical Context: From Behavior Therapies to Third-Wave Therapies

The third wave of psychotherapy developed out of two previous waves (see Fig. 1), beginning with the first wave of behavior therapy in the 1950s. Most commonly associated with BF Skinner and Ogden Lindsley in the USA (operant conditioning), Joseph Wolpe in South Africa (systematic desensitization), and Hans Eysenck (outspoken opponent to pre-existing psychotherapies) in England, behavior therapy took a step away from psychoanalytic psychotherapy to focus on making direct changes to observable behaviors. With an emphasis on empirical research in psychotherapy, behavior therapy is often considered the first scientifically based psychological approach [4].

As research studies began to examine the relationship between maladaptive cognitions and patterns of behavior, the second wave of psychotherapy emerged. Led by the work of Aaron Beck [5] and others, such as Donald Meichenbaum [6] and Michael Mahoney [7], in the 1970s, cognitive therapy adjusted its focus from behaviors alone to target the thoughts that precede and occur in response to human behavior. The therapies of this second wave require patients to recognize errors in their cognitions and to engage in the process of refuting these errors to make changes to distorted patterns of thinking. Although some tension was initially present between the first and second waves, this gave way to a more collective approach to psychotherapy in the 1980s, and the efforts to target behavior and cognition were merged into “cognitive behavioral therapy” (CBT). With a shared focus on making changes to thinking and behavior patterns, this psychological approach has accumulated a large evidence base over the last 40 years for a range of specific diagnoses (see [8] for a review).

The third wave of psychotherapy began as questions arose about the necessity of cognitive change when considering clinical improvement. As studies emerged suggesting cognitive therapy may provide no added benefit in clinical treatment [9, 10], philosophical changes within the field of psychotherapy set the stage for new approaches to existing models of psychotherapy. Over the last 20 years, a collection of new therapies have been developed that continue the tradition of behavior therapy but adopt a different approach to internal experiences and cognitions compared to the therapies

of the second wave. Specifically, the concept of cognition was expanded beyond the traditional notion of the content of thought to include values and metacognitions.

There is some debate about which therapies comprise the third wave of psychotherapy; however, typically included in this category are acceptance and commitment therapy (ACT) [3], dialectical behavior therapy (DBT) [11], and mindfulness-based therapies such as mindfulness-based cognitive therapy (MBCT) [12]. Metacognitive therapy (MCT) [13] is also sometimes grouped with the third-wave therapies. Although some of these therapies incorporate meditation as a primary activity (e.g., MBCT), other forms of meditation (e.g., transcendental meditation), or hypnosis are not normally considered part of the third-wave of psychotherapy, since these techniques have different tenets.

ACT [14] is a third-wave therapy that has garnered much attention in the psychotherapy literature over the past 15 years. Based on Relational Frame Theory (RFT) [15], a psychological theory of human language and cognition, ACT involves a focus on behavioral change strategies while pulling from the themes of acceptance and mindfulness of the present moment. Individuals are guided to identify their values and take action in their lives in line with these values and learn to “defuse” from their thoughts in the process of doing so rather than engaging with them or trying to change them.

DBT is a comprehensive behavioral treatment for individuals with borderline personality disorder who are chronically “parasuicidal” or who engage in repeated suicidal gestures or attempts. Based on biosocial theory, which views suicidal behaviors as problem-solving behaviors or attempts at coping with psychological distress, the treatment targets an individual’s low distress tolerance, inadequate resources for coping, and beliefs about the value and likely outcomes of suicidal behavior [16]. Patients learn tools to improve distress tolerance, emotion regulation, and interpersonal effectiveness. Although there are significant overlaps between DBT and traditional CBT, DBT’s focus on tolerance of internal experiences and inclusion of mindfulness skills commonly places it within the third-wave.

Mindfulness-based approaches are grounded in the Buddhist tradition and use the principles of Buddhist philosophy related to distress and suffering with the practice of mindfulness meditation as a means to relieve distress. Mindfulness is commonly defined as the act of bringing one’s attention to the

Fig. 1 The evolution of psychological and behavior therapies through the three waves

present moment, without judgment or attachment to outcomes [17]. These principles of present moment awareness are cultivated through the practice of meditation. By practicing mindfulness meditation, an awareness of impermanence and constant change in nature allows one to let go of the attachment to outcomes, thereby, relieving emotional distress. This process of mindfulness and acceptance has been associated with reduced emotional distress and an increase in positive emotions [18]. Rather than targeting the thoughts or behaviors directly, mindfulness-based approaches operate by changing the relationship with thoughts and behaviors, and for this reason, have been incorporated into third-wave psychological interventions.

Although diverse and based on different underlying theoretical models, the third-wave therapies have several commonalities that tie them together. One of these is the reduction in focus on content-oriented cognitive interventions and a new concentration on metacognitive processes. Whereas cognitive therapies guided patients to engage with their thoughts by identifying, appraising, and refuting maladaptive cognitions, the third-wave therapies target patients' awareness of and relationship to their thoughts. Rather than working to directly change the content of their thinking, patients may be encouraged to bring their attention to the process of thinking through simply noticing or observing their thoughts. Other commonalities between third-wave therapies have been identified by Hayes [3] as the adoption of more "contextualistic assumptions" with a "broader focus of change" ([3], p. 6) and the use of more experiential change strategies as opposed to the direct change strategies characteristic of treatments from the previous waves. Most third-wave therapies also adopt a focus on broader life goals or generally applicable skills rather than specific symptoms.

Accumulating evidence provides empirical support for the effectiveness of third-wave therapies across a range of psychological disorders, such as depression [19–21], anxiety disorders [22–24], and substance use disorders [25, 26]. Other studies have shown support for third-wave therapies in the treatment of chronic pain conditions [27, 28]. A recent review on meditation-based interventions for stress and well-being concluded that the effects of these interventions might not be optimized until participants maintain long-term practice [29•]. The overall empirical evidence appears to support the theoretical models of third-wave therapies emphasizing broader, value-oriented shifts and life-long practices.

Third-Wave Therapies in the Treatment of Insomnia

A similar evolution to that of general psychotherapy can be seen in the development of psychotherapies for insomnia. The first wave of psychotherapy for insomnia included single-

component treatments that took a strictly behavioral focus. These treatments, which ranged from paradoxical intention [30–32] to stimulus control [33] to sleep restriction [34] among others, were administered as stand-alone interventions in clinical trials and were the first to gather empirical support as non-pharmacological treatments for insomnia. As the field of psychotherapy moved towards a focus on patterns of thinking during the second wave, insomnia treatments followed, with cognitive therapy for insomnia [35] emerging as a treatment specifically targeting the maladaptive beliefs about sleep and cognitive arousal commonly associated with the disorder. Shortly after, multicomponent therapies began to be tested [36], with cognitive and behavioral approaches merged in various combinations under the collective label of cognitive behavioral therapy for insomnia (CBTI). CBTI has since garnered extensive support from the literature and is considered by many to be the gold standard treatment for insomnia.

As third-wave therapies have gained increasing attention in the psychotherapy literature, a growing number of studies have applied these therapies to specific problem areas or diagnoses, including insomnia. Several third-wave therapies have been tested in insomnia samples or in some cases samples of patients with psychiatric disorders who are experiencing insomnia symptoms. These findings contribute to a growing literature of non-pharmacological treatments for this sleep disorder.

Mindfulness- and Acceptance-Based Approaches

Over the last decade, an increasing number of studies have been carried out in insomnia samples testing therapies involving mindfulness-based approaches. See [Appendix](#).

MBSR

The first mindfulness-based treatment approach to be formally developed was an eight-session group format treatment known as Mindfulness-Based Stress Reduction (MBSR). Created in 1979 by Jon Kabat-Zinn and his colleagues at the University of Massachusetts Medical Center, this program includes mindfulness practices such as body scan and yoga combined with group discussions. Several studies utilizing MBSR to target insomnia and sleep symptoms have been published, including a number targeting disturbed sleep in individuals with medical issues such as cancer [37–41], fibromyalgia [42], and organ transplant [42–45]. Collectively, the results of these studies suggest that MBSR may have positive effects on sleep quality and quantity, although these effects are generally modest. Other studies have tested MBSR, or multicomponent treatments that include MBSR, for sleep in patients with psychiatric diagnoses [46], adolescents with substance abuse [47], healthy adults [48], and women undergoing menopause [49].

Of the two studies that have tested MBSR specifically in individuals with a diagnosed insomnia disorder [50•, 51], one was a randomized controlled trial comparing MBSR to pharmacotherapy (3 mg of eszopiclone). Eight weeks of MBSR treatment plus a weekend meditation retreat resulted in comparable sleep improvements to pharmacotherapy, with significant changes in sleep onset latency as measured by actigraphy and sleep efficiency and total sleep time as measured by sleep diary. Significant improvements in global insomnia severity (as measured by the Insomnia Severity Index (ISI) [52] and score on the Pittsburgh Sleep Quality Index (PSQI) [53]) were also reported. A qualitative study examining patient response to MBSR through focus groups with 18 adults with chronic insomnia [54] discussed findings consistent with these quantitative studies. Participants reported that MBSR led to improved sleep, reduced distress about insomnia, and improved skills for coping with bouts of poor sleep. In the second study, a randomized, partially-blinded non-inferiority trial compared MBSR to CBTI in 111 patients with insomnia comorbid with cancer [50•]. MBSR produced clinically significant change in sleep, evidenced by a reduction in sleep diary-measured sleep onset latency and wake time after sleep onset and improvement in total sleep time. Scores on the PSQI also significantly improved; however, CBTI was shown to be associated with more rapid and durable change [50•].

MBCT

MBCT is an intervention using mindfulness meditation and elements of cognitive therapy that was developed to prevent relapse in patients with major depression. MBCT aims to reduce symptoms of depression by teaching mindful awareness of negative thinking patterns and making changes to the way that one relates to such thoughts [55, 56]. Given that insomnia and sleep disturbances often occur in the context of depression and anxiety, the effect of MBCT on sleep variables has been examined in several studies, including in patients with depression [57, 58], anxiety disorders [59], and HIV [60]. In the first study to examine whether mindfulness meditation was associated with objective changes in sleep as measured by polysomnography, Britton and colleagues [57] randomized 26 individuals with partially remitted depression to either MBCT or a wait list control. Following 8 weeks of treatment, MBCT was associated with subjective improvement in sleep but not beyond what was reported by controls. Interestingly, MBCT was also associated with objectively increased cortical arousal and a higher number of nighttime awakenings, suggesting that objective measures of sleep did not corroborate the subjective improvement in sleep reported by individuals receiving the treatment. A subsequent study of similar design [58] found more comparable improvements between objective and subjective measures of sleep in 23 individuals experiencing residual depressive symptoms. Individuals receiving

MBCT showed decreased wake time and increased sleep efficiency compared to controls. An additional pilot study [61] specifically targeted insomnia by testing MBCT in 14 patients diagnosed with refractory primary insomnia. Cognitive elements were specifically tailored to insomnia in this adaptation of the treatment. Although results are limited by this study's small sample size, sleep diaries completed before and after MBCT showed significant improvement in total sleep time and sleep onset latency between the two time points (5.5 versus 6.5 h; 30 versus 26 min, respectively). Participants also reported reductions in worry and focus on sleep-related content.

MBTI

Developed to specifically target insomnia while taking a mindfulness-based approach, Mindfulness-based Behavioral Therapy for Insomnia (MBTI) [62] combines mindfulness meditation with CBTI. MBTI includes the behavioral strategies typically contained within CBTI but takes a different approach to sleep-related cognitions, targeting the hyperarousal commonly experienced by individuals with insomnia through mindfulness meditation and the shifting of metacognitions. Two studies to date provide evidence to suggest that MBTI is a viable treatment option for patients with chronic insomnia. In a treatment-development study conducted in 30 adults with primary insomnia, Ong et al. [62] found that MBTI led to significant improvements in diary-reported total wake time and sleep efficiency, as well as sleep-related arousal as measured by the pre-sleep arousal scale (PSAS) [63]. A subsequent randomized controlled trial [64•] was conducted, through which 54 adults with chronic insomnia were randomized to receive MBSR, MBTI, or 8 weeks of self-monitoring. Results showed comparable improvements in total wake time and pre-sleep arousal between MBSR and MBTI, with both showing superior effects to the self-monitoring control condition. MBTI showed greater reductions in insomnia severity compared to MBSR at follow-up.

Other Mindfulness-Based Approaches

Mindful Awareness Practices (MAPs for Daily Living) is a group-based mindfulness course that takes places over six 2-h weekly sessions [65•]. Certified mindfulness instructors with over 20 years of experience with mindfulness practice teach various mindfulness exercises (e.g., mindful sitting meditation, mindful eating, mindful walking) through didactic material, in-class experiential practice, group discussion, and homework. In a randomized clinical trial involving 49 older adults with moderate sleep disturbances, Black et al. [65•] tested 6 weeks of MAPs versus a 6-week sleep hygiene education intervention. Results showed that those who received MAPs reported significantly improved sleep quality and symptoms of insomnia

compared to the other treatment group. Improvement in secondary outcomes was also observed, including depression symptoms and fatigue interference/severity.

Acceptance and Commitment Therapy

One preliminary study to date has applied ACT to insomnia [66], testing a 6-session group intervention in 10 adults with chronic primary insomnia who were non- or partial-responders to CBTI. Diary-measured sleep parameters did not change across treatment; however, quality of life and sleep-related avoidance behavior were significantly improved after ACT, leading authors to suggest that ACT may have promise as an adjunctive treatment for insomnia. In a case study by Dalrymple, et al. [67], the authors illustrate how ACT may be applied to the treatment of insomnia through the example of a 40-year-old male with a history of depression, anxiety, and sleep problems. Three initial sessions of traditional CBTI were followed by six sessions of therapy guided by principles of ACT, including acceptance, thought defusion, mindfulness, values, and committed action. Maladaptive sleep-related cognitions were addressed using an acceptance-based approach. The authors discuss how a combined approach to insomnia treatment resulted in reduced distress about sleep in this case example. To our knowledge, no randomized controlled trials have been conducted using ACT for insomnia.

Controversies or Hypotheses of Interest

The emergence of the third-wave of behavior therapy for insomnia builds upon the work of previous generations of insomnia treatments. As reviewed in this paper, several randomized controlled trials have demonstrated efficacy and effectiveness of these approaches, particularly for mindfulness-based approaches. Moving forward, there are three areas that might be fruitful to address in future research.

First, the mechanisms underlying the third-wave therapies for insomnia have yet to be elucidated. Hypotheses have been proposed for how mindfulness-based approaches relate to theoretical models of insomnia [68, 69], but thus far, empirical evidence to support these models are not yet available. The use of acceptance-based therapies as a second-line intervention in non-responders to CBTI has been proposed [70]; however, future studies may consider comparing these treatments to CBTI across subtypes of insomnia. The measurement of metacognitions in the context of insomnia could be useful, and preliminary work has been conducted in this area [71–74], but it has not yet been applied in a third-wave treatment study. Also, efforts to examine the different patterns of self-report measures (e.g., sleep diaries) and objective measures (e.g., polysomnography) might provide greater insight to physiological changes. Thus far, the effect sizes are

generally larger in self-report measures compared to polysomnography and wrist actigraphy [57, 58, 64]. Similar findings are also observed in CBTI and pharmacological treatments for insomnia (e.g., [75]); thus, it is not yet clear if these findings are due to measurement issues or the phenomenology of sleep perception among people with insomnia.

A second area relates to the timing of outcome measures. Given that the theoretical models of third-wave therapies are broader in scope, more contextual, and generally involve lifestyle changes, it might be argued that evaluation of effectiveness should focus on long-term outcomes rather than acute outcomes. As noted earlier, a recommendation in a recent systematic review on meditation-based therapies indicated that the effects of teaching meditation might be better captured using long-term measurements beyond acute treatment effects [29]. Therefore, careful consideration should be given to the timing of outcome measures when testing third-wave therapies for insomnia and should include long-term assessments whenever possible.

A third area relates to the necessity of third-wave therapies above and beyond current “second wave” therapies for insomnia (i.e., CBTI), which serves as the current gold standard non-pharmacological treatment for insomnia. The evidence to support CBTI is compelling, yet remission from insomnia is achieved in only about 35–40 % of patients. Preliminary findings indicate that third-wave therapies can yield similar effects, but some of these therapies, such as MBSR or MBTI, require significant time for the patient to practice meditation. Therefore, cost-effectiveness studies examining patient costs, in terms of time and money, relative to the clinical benefits, could be used to compare second-wave and third-wave therapies. In general, third-wave therapies should not be viewed as competitors to replace CBTI, but rather, therapies that could complement CBTI for individuals with specific characteristics (e.g., elevated arousal) or for those who do not respond to CBTI.

Conclusions

Similar to how decisions for pharmacological treatments are based on patient characteristics, counterindications, and safety, the hope is that a wider range of behavioral therapies for insomnia can provide clinicians with more options to tailor treatments to patient characteristics and preferences as is recommended in patient-centered care models.

Compliance with Ethics Guidelines

Conflict of Interest The authors declare that they have no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Appendix

Table 1 Summary of third-wave therapies for improving sleep

Ref. #	Date	First author	Population sample	Third wave intervention	Intervention details	Sleep/insomnia outcome measures	Sleep/insomnia findings
Mindfulness-based therapies							
[37]	2003	Shapiro	63 cancer-free women with previous diagnosis of stage II breast cancer	MBSR	Randomized to MBSR or free choice (FC) control condition	Sleep efficiency and sleep quality measured by sleep diary	Both groups reported significant improvement in self-reported sleep quality at post-treatment; no significant change in sleep efficiency. MBSR participants reporting greater mindfulness practice showed largest improvement in sleep quality
[38]	2013	Andersen	336 women undergoing surgery for stage I-III breast cancer within past 3–18 months	MBSR	Randomized to MBSR or treatment as usual control condition	Medical outcomes study sleep scale	Mean sleep problem scores were significantly lower in MBSR group immediately after the intervention but no lower than controls at 12-month follow-up
[39]	2012	Lengacher	84 women who had completed breast cancer treatment within the last 18 months	MBSR	Randomized to 6-week MBSR (BC) intervention or treatment as usual control condition	MD Anderson Symptom Inventory (MDASI) core symptom severity items: sleep disturbance, fatigue	MBSR group showed significant decrease in fatigue and sleep disturbance severity items at post-treatment compared to control group
[40]	2003	Carlson	49 breast cancer and 10 prostate cancer patients	MBSR	Participants completed 8-week MBSR program	Self-reported sleep quality (poor, adequate, or good)	Significant improvement in sleep quality reported at post-treatment
[41]	2005	Carlson	63 cancer patients	MBSR	Participants completed 8-week MBSR program	Pittsburgh Sleep Quality Index (PSQI)	Significant improvement in PSQI total score and all PSQI subscales at post-treatment
[42]	2011	Schmidt	177 women with fibromyalgia	MBSR	Randomized to MBSR, active control, or wait list control	Pittsburgh Sleep Quality Index (PSQI)	No significant main effect for group; however, positive change rates on PSQI were highest for MBSR
[43]	2004	Gross	20 solid organ transplant recipients	MBSR	Participants completed 8-week MBSR program	Pittsburgh Sleep Quality Index (PSQI)	Significant improvement in sleep dysfunction at post-treatment and 3-month follow-up
[44]	2010	Gross	138 recipients of kidney, kidney/pancreas, liver, heart, or lung transplant	MBSR	Randomized to MBSR or 8-week health education intervention, either initially or after wait list	Pittsburgh Sleep Quality Index (PSQI)	MBSR group reported significant improvement in sleep symptoms compared to Health Education; benefits were retained at 1-year follow-up
[45]	2005	Kreitler	20 solid organ transplant recipients	MBSR	Participants completed 8-week MBSR program	Self-reported sleep quality and duration	Significant improvements in sleep quality and duration sustained 6 months later
[47]	2005	Bootzin	55 adolescents with substance abuse, insomnia, and daytime sleepiness	MBSR	Six-session group treatment for sleep disturbance combining MBSR, sleep hygiene education, and cognitive therapy	Sleep diary parameters (sleep efficiency, sleep onset latency, number of awakenings), Epworth Sleepiness Scale (ESS), actigraphy	Participants in MBSR group completing 4 or more treatment sessions reported significant improvement in sleep diary parameters; actigraphy showed a trend for improvement in total sleep. All participants reported significant reduction in sleepiness
[48]	2009	Klatt	48 healthy university faculty and staff working full-time	Low-dose MBSR (MBSR-ld)	Randomized to 6-week MBSR-ld intervention or wait list control	Pittsburgh Sleep Quality Index (PSQI)	Both MBSR-ld group and control group reported significant improvement in sleep quality at post-treatment

Table 1 (continued)

Ref. #	Date	First author	Population sample	Third wave intervention	Intervention details	Sleep/insomnia outcome measures	Sleep/insomnia findings
[49]	2011	Carmody	110 late perimenopausal and early postmenopausal women	MBSR	Randomized to MBSR or wait list control	Women's Health Initiative Insomnia Rating Scale (WHIIRS)	MBSR group reported significantly greater improvements in subjective sleep quality compared to control group
[50••]	2014	Garland	111 cancer patients with insomnia	MBSR	Randomized to MBSR or 8 sessions of CBTI	Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI), Dysfunctional Attitudes and Beliefs about Sleep Scale (DBAS), sleep diary parameters (sleep onset latency, wake time after sleep onset, total sleep time), actigraphy	MBSR was inferior to CBTI for improving insomnia severity immediately post-intervention but demonstrated non-inferiority at 3-month follow-up. Both interventions showed improvement in sleep diary parameters. CBTI group reported significant improvement in sleep quality and dysfunctional sleep beliefs
[51]	2011	Gross	30 adults with primary chronic insomnia	MBSR	Randomized to MBSR or 8 weeks of pharmacotherapy (3 mg of eszopiclone)	Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI), sleep diary parameters (total sleep time, sleep onset latency, sleep efficiency), actigraphy	MBSR group reported significant improvements in insomnia severity, sleep quality, and sleep diary parameters at 5-month follow-up; comparable changes were seen in pharmacotherapy group. Actigraphy showed significant reductions in sleep onset latency for MBSR group
[54]	2014	Hubbling	18 adults with chronic insomnia	MBSR	Randomized to MBSR	Qualitative data collected via post-treatment focus groups	Participants receiving MBSR reported improved sleep quality and reduced insomnia-related distress
[57]	2010	Britton	26 adults with partially remitted depression	MBCT	Randomized to MBCT or wait list control	Polysomnographic sleep profiles, sleep diary parameters (sleep onset latency, number of awakenings, wake time after sleep onset, sleep efficiency)	Polysomnography showed increased arousal at post-treatment in MBCT group (increased awakenings, stage 1 sleep, suppressed slow-wave sleep). MBCT group reported significant within-group decreases in sleep diary parameters
[58]	2012	Britton	23 antidepressant users with sleep complaints	MBCT	Randomized to MBCT or wait list control	Polysomnography (stage 1 sleep, slow-wave sleep), sleep diary parameters (total wake time, sleep efficiency)	MBCT group showed a significant reduction in PSG total wake time and significant improvement in sleep diary parameters
[59]	2008	Yook	19 patients with anxiety disorders	MBCT	Participants completed 8 weeks of MBCT	Pittsburgh Sleep Quality Index (PSQI)	Participants showed significant improvement in sleep quality at post-treatment
[60]	2014	Gonzalez-Garcia	40 adults diagnosed with HIV	MBCT	Randomized to MBCT intervention or routine follow-up control	Nottingham Health Profile (NHP) - sleep dimension score	MBCT group showed significant improvement in sleep-related quality of life at week 8 and week 20
[61]	2006	Heidenreich	14 adults with persistent primary insomnia	MBCT	Participants completed MBCT	Sleep diary parameters (sleep latency, total sleep time), Questionnaire to Assess Central Personality Variables in Insomnia (FEPS-ID), Thoughts Control Questionnaire for insomnia (TCQ-I)	Participants showed significant pre- to post-treatment improvements in sleep diary parameters; fewer participants were taking sleep medications at end of treatment. Significant changes were seen across treatment in 4 of 6 subscales of the TCQ; patients reported significantly less worry about sleep
[62]	2008	Ong	30 adults with psychophysiological insomnia	Mindfulness meditation	6 week multi-component intervention incorporating mindfulness meditation and CBTI	Sleep diary parameters (total wake time, time in bed, number of awakenings), Insomnia Severity Index (ISI), Hyperarousal Scale,	Participants reported significant post-treatment improvements in sleep diary parameters, insomnia

Table 1 (continued)

Ref. #	Date	First author	Population sample	Third wave intervention	Intervention details	Sleep/insomnia outcome measures	Sleep/insomnia findings
[64•]	2014	Ong	54 adults with chronic insomnia	MBSR, MBTI	Randomized to MBSR, MBTI, or 8-week self-monitoring condition	Dysfunctional Beliefs and Attitudes About Sleep Scale (DBAS), Glasgow Sleep Effort Scale (GSES), Pre-sleep Arousal Scale (PSAS) Total wake time measured by sleep diary, Insomnia Severity Index (ISI), Pre-Sleep Arousal Scale (PSAS), polysomnography, actigraphy	severely, pre-sleep arousal, sleep effort, and dysfunctional sleep-related cognitions MBTI and MBSR were associated with significantly greater reductions in total wake time, pre-sleep arousal, and insomnia severity compared to controls. MBTI group had greater reductions in ISI scores compared to MBSR
[65•]	2015	Black	49 older adults with moderate sleep disturbances	Mindful Awareness Practices (MAPs)	Randomized to 6-week MAPs or Sleep Hygiene Education (SHE) intervention	Pittsburgh Sleep Quality Index (PSQI), Athens Insomnia Scale (AIS), Fatigue Symptom Inventory (FSI)	Compared to SHE, MAPs group showed greater post-treatment improvements in PSQI scores, insomnia symptoms, and fatigue severity and interference
Acceptance and commitment therapy							
[66•]	2014	Hertenstein	11 non-responders to CBTI with chronic primary insomnia	ACT	Participants completed 6 group ACT sessions	Insomnia Severity Index (ISI), subjective sleep quality measured by sleep diary ratings, Sleep-Related Behaviors Questionnaire, Glasgow Sleep Impact Index (GSI), Pittsburgh Sleep Quality Index (PSQI)	Participants reported significant improvement in sleep-related quality of life and diary-measured subjective sleep quality at post-treatment and 3-month follow-up. No changes were seen across treatment in insomnia severity or PSQI scores
[67]	2010	Dalrymple	Case study: 40-year-old male w/ history of insomnia, anxiety, and depression	ACT	9 sessions; first 3 focusing on CBTI, second 6 focusing on ACT	Sleep diary parameters (wake time after sleep onset, total sleep time, time in bed, sleep efficiency)	After 11 sessions of ACT, case subject showed improvements in sleep efficiency and reported reduced focus on sleep symptoms

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- Of importance
- Of major importance

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