Insomnia Overview: Epidemiology, Pathophysiology, Diagnosis and Monitoring, and Nonpharmacologic Therapy

Julie A. Dopheide, PharmD, BCPP, FASHP

ABSTRACT

Insomnia, whether short-term or chronic, is a common condition. It has a negative impact on vulnerable patient groups, including active military personnel and veterans, patients with coexisting psychiatric and medical disorders, those in life transitions such as menopause, and elderly persons. Although cognitive behavioral therapy for insomnia (CBTI) is first-line treatment for insomnia, its high cost and a lack of trained providers has prevented widespread uptake. Now, digital CBTI (dCBTI) is emerging as a scalable option with the potential to overcome these barriers in managed care. The first part of this article reviews the epidemiology and pathophysiology of insomnia with a focus on vulnerable patient groups. The second part explores the rapidly evolving landscape of nondrug therapy for insomnia. The underlying concepts and supporting evidence for CBTI and dCBTI are presented, including their utility in vulnerable patient groups.

Introduction

Insomnia, the most common sleep disorder, is a substantial burden for the US healthcare system and vulnerable patient groups. Combined direct and indirect costs for insomnia in the United States exceed $100 billion annually. Because it is so common, the annual loss of quality-adjusted life-years from insomnia appears to be greater than the loss from other medical and psychiatric conditions, including arthritis, depression, and hypertension. Between 1993 and 2015, the diagnosis of insomnia during office visits in the United States increased 11-fold, from 800,000 to 9.4 million. Further, insomnia is linked to higher healthcare utilization and costs, especially in patients with coexisting medical or psychiatric disorders, illustrating why it is an important managed care issue. In a recent study of a managed care population, an 80% increase in healthcare costs after a diagnosis of insomnia was attributed to management of insomnia and coexisting conditions.

Insomnia: Classification, Diagnosis, and Monitoring

In 2014, the third edition of the International Classification of Sleep Disorders (ICSD-3), the most widely used classification system for sleep disorders, revised how insomnia is defined. It now subclassifies insomnia as short-term, chronic, or other. The previous subclassification of chronic insomnia as primary or comorbid was eliminated because it did not improve diagnostic accuracy or differentiate treatment options. The underlying rationale for removal was that calling insomnia comorbid may misleadingly imply that it is a secondary concern that will resolve with adequate treatment of the comorbid condition. To the contrary, the maladaptive cognitions and behaviors that perpetuate insomnia must be addressed regardless of coexisting medical or psychiatric disorders.

Diagnostic criteria for insomnia include difficulty getting to sleep or staying asleep and results in daytime dysfunction in a patient who has an adequate opportunity to sleep. It is short-term if symptoms occur for less than 3 months and chronic if symptoms occur 3 or more times per week for 3 months or longer. Insomnia is often precipitated by a significant life stressor (eg, acute pain, traumatic event). It may end when the stressor resolves or the patient learns

To view the Patient Perspective interview accompanying this supplement, please visit www.pharmacytimes.org/go/insomnia-suppl.
to cope, or it may evolve into chronic insomnia. Short-term and chronic insomnia may be inferred from a patient’s language. No longer mentioning a precipitating life stressor and talking about insomnia as “the problem” may mark the transition from short-term to chronic insomnia.

Chronic insomnia is a clinical diagnosis that relies heavily on patient history about sleep, medical and psychiatric conditions, and substance use. The sleep history should characterize how sleep is disturbed and document the daytime consequences of insomnia. Descriptors that measure and characterize sleep disturbances are shown in Table 1.11-16 When patients report complaints of excessive daytime sleepiness, a diagnosis of a hypersomnolence disorder, narcolepsy, or a sleep-related breathing disorder should be considered. A general questionnaire can be used to differentiate between fatigue and significant daytime sleepiness that indicates the potential for another sleep disorder.16 Questionnaires, such as the Insomnia Severity Index (ISI) and Dysfunctional Beliefs and Attitudes About Sleep scale, and sleep diaries, such as the Consensus Sleep Diary, are useful to identify behaviors that perpetuate insomnia and to monitor treatment effects (see Table 1). A general questionnaire can identify comorbidities that contribute to insomnia or affect its management. A medication and substance use history, including over-the-counter drugs and dietary supplements, identifies drugs and substances that interfere with sleep.

Insomnia can occur as a primary sleep disorder, a symptom of another sleep disorder (eg, obstructive sleep apnea [OSA], restless legs syndrome [RLS]), periodic leg movements during sleep [PLMS]), or a comorbid sleep disorder.5,15,16 An estimated 39% to 55% of patients already diagnosed with OSA or sleep disordered breathing have reported symptoms of insomnia. Conversely, approximately 30% of elderly patients already diagnosed with insomnia have been found to have moderate OSA based on an apnea-hypopnea index of 15 or greater. In a large cross-sectional survey, almost 30% of participants with insomnia reported having RLS symptoms 3 or more nights per week, and 85% to 95% of patients with RLS also have PLMS.

The sleep history may suggest the presence of another sleep disorder. For example, snoring or breathing pauses suggest OSA, whereas a sleeping partner getting kicked during the night suggests RLS and/or PLMS. Concerns about OSA should be heightened in patients with obesity or a thick neck. Because symptoms of RLS can be difficult for patients to describe, it may help to ask about symptoms that involuntarily make them want to move their legs, improve by moving, and worsen at night. Polysomnography is not necessary for the diagnosis of chronic insomnia, but it is indicated if another sleep disorder is suspected. As part of the Choose Wisely initiative, the American Academy of Sleep Medicine (AASM) recommends against polysomnography in patients with chronic insomnia unless symptoms suggest a comorbid sleep disorder (eg, OSA, RLS, PLMS).

### Table 1. Common Terms and Definitions Used in Diagnosis and Monitoring of Insomnia

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Consensus Sleep Diary (CSD)</td>
<td>A standardized sleep diary with patient-collected sleep data including 10 morning and 5 nighttime items</td>
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<tr>
<td>Dysfunctional Beliefs and Attitudes about Sleep (DBAS) scale</td>
<td>28-item screening tool that provides detailed information about cognitive components that contribute to disturbed sleep; a shorter 16-item tool scores items on a 10-point Likert scale</td>
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<tr>
<td>Epworth Sleepiness Scale (ESS)</td>
<td>8-item self-report questionnaire that assesses subjective sleepiness (score range of 0-24; normal &lt;10)</td>
</tr>
<tr>
<td>Insomnia Severity Index (ISI)</td>
<td>7-item screening tool for insomnia that is used as an outcome assessment tool for insomnia treatment; score range of 0-28 with a decrease of &gt;7 points indicating a response to therapy</td>
</tr>
<tr>
<td>Pittsburgh Sleep Quality Index (PSQI)</td>
<td>19-item questionnaire about sleep quality with 7 component scores: (1) subjective sleep quality, (2) sleep latency, (3) sleep duration, (4) habitual sleep efficiency, (5) sleep disturbances, (6) hypnotic use, and (7) daytime dysfunction (poor sleep: global score &gt;5)</td>
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#### Sleep Descriptors

| Nonrestorative sleep | Sleep that is restless, light, or of poor quality, although the duration may appear normal |
| Sleep efficiency (SE) | Percentage of time in bed when sleep actually takes place |
| Sleep-onset latency (SOL) | Amount of time it takes to transition from being awake to the beginnings of non-REM sleep (ie, sleep onset) |
| Sleep quality | Definitions vary, but self-measured indicators of sleep quality may include sleep latency, number of awakenings >5 minutes, wake after sleep onset, and SE |
| Wake time after sleep onset (WASO) | Amount of time spent awake after initial sleep onset; measures the level of sleep fragmentation |

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### Pathophysiology of Insomnia

Insomnia is a complex interaction of psychological cognitive arousal and altered circadian and homeostatic mechanisms. Decreased function of the sleep-wake switch may also contribute to insomnia. During sleep, there is a slow transition through stages of non-rapid-eye
movement (non-REM) sleep to cycles of rapid-eye movement (REM) sleep.23 The AASM classifies sleep into 5 progressive stages23:

1. Stage W (wakefulness)
2. Stage N1 (relaxed wakefulness)
3. Stage N2 (light sleep)
4. Stage N3 (deep or slow-wave sleep)
5. Stage R (REM sleep or dreaming)

Stages N1-N3 are phases of non-REM sleep in which cortical activity is low, whereas the brain is highly active during REM sleep.23 Multiple brain centers work in concert to promote sleep or wakefulness. The sleep-wake cycle is a complex process in which wakefulness and sleep are switched on and off by reciprocal systems in a feedback loop.23,24 Wakefulness results from ascending activity in a number of brainstem and posterior hypothalamic nuclei in what is referred to as the ascending reticular activation system (ARAS). This system projects widely into the cerebral cortex. Hypocretin/orexin-containing neurons in the lateral hypothalamus (orexin) project into the brainstem and postero-rior arousal centers and functionally reinforce their activity during wakefulness.

This model of the sleep-wake cycle is often called the flip-flop switch because it permits one to either be awake or asleep, but not both, at the same time. Via the switching mechanism, the active state suppresses the other state until circadian rhythms induce a switch to the reciprocal state. The cerebral cortex and the limbic system further modify wakefulness. Sleep-promoting centers in the anterior hypothalamus project into the brainstem and posterior arousal centers and function with the lateral hypothalamus as a sleep-wake switch.

Circadian factors promote wakefulness on a roughly 24-hour biological clock, whereas homeostatic factors respond to accumulated wakefulness with the drive for sleep.23 In the brain, the ARAS promotes wakefulness and the ventrolateral preoptic region (VLPR) promotes sleep. During wakefulness, the ARAS inhibits the VLPR via activation of cholinergic neurons, monoaminergic cell bundles, and orexin nuclei in the lateral hypothalamus. The orexin system promotes wakefulness and alertness and works to balance sleep and wakefulness. Orexin system activation maintains the fully awake state for longer periods of time; conversely, deactivation of the orexin system allows for consolidated sleep during the night. Orexinergic signaling by 2 distinct forms, orexin A and orexin B, maintains wakefulness via continuous depolarization in wake-promoting brain nuclei. Sleep is cued by a homeostatic sleep drive inhibition of orexins. During sleep, the ventrolateral preoptic nucleus inhibits the ARAS via 2 inhibitory neurotransmitters, γ-aminobutyric acid (GABA) and galanin.23,24 GABA is the neurotransmitter that most widely promotes sleep, whereas norepinephrine and dopamine promote wakefulness; serotonin is necessary for both optimal sleep and wakefulness.23,24 Flip-flop switching also regulates the transition from non-REM to REM sleep.23 Within regions of the brainstem, REM-off and REM-on areas inhibit each other.23

The 3P behavioral model of insomnia helps to explain how acute insomnia becomes chronic and lays the groundwork for assessing insomnia in individual patients.26 The 3Ps, which occur in temporal order, are factors that:

- Predispose an individual to insomnia
- Precipitate an acute episode of insomnia
- Perpetuate insomnia from acute to chronic

Predisposing factors, which are generally not modifiable, include genetics and personality traits (eg, being a worrier; family history of poor sleep) that lead to physiologic and cognitive hyperarousal. As shown in Table 2,27–33 precipitating factors that trigger insomnia are typically stressful life events. Patients usually identify problems related to health, family, work, or school as precipitating factors for insomnia.34 Perpetuating factors are the maladaptive behaviors, thoughts, and coping strategies that allow insomnia to continue after original triggers have resolved.35 Physical examples of maladaptive behaviors include daytime napping or spending too much time in bed. Less quantifiable perpetuators include dysfunctional beliefs, expectations, and attributions about sleep as well as an intense desire to solve the sleep problem.

### Table 2. Selected Factors That Contribute to Insomnia27-33

<table>
<thead>
<tr>
<th>Life Events and Social/Societal Factors</th>
<th>Medical and Psychiatric Disorders and Symptoms</th>
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</thead>
<tbody>
<tr>
<td>Displacement due to traumatic events</td>
<td>Anxiety</td>
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<tr>
<td>Traffic noise</td>
<td>Depression</td>
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<tr>
<td>Owing money</td>
<td>Posttraumatic stress disorder</td>
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<tr>
<td>Unemployment</td>
<td>Substance abuse</td>
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<td>Racial discrimination</td>
<td>Pain</td>
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<td>Homelessness</td>
<td>Nocturia</td>
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<td>Traumatic childhood experiences</td>
<td>Dyspnea</td>
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<td>Divorce</td>
<td>Irritable bowel syndrome</td>
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<tr>
<td>Military deployment</td>
<td>Traumatic brain injury</td>
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<td></td>
<td>Other sleep disorders</td>
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### Insomnia Burden: Epidemiology and Vulnerable Patient Groups

The burden of insomnia in the United States was extensively characterized in 2008-2009 by the American Insomnia Survey, a nationwide survey of more than 10,000 members in a national health plan.36-38 More than one-half of adults had difficulty sleeping, and 22.1% met Diagnostic and Statistical Manual of Mental Disorders, 4th Edition diagnostic criteria for insomnia. The prevalence of insomnia based on other diagnostic criteria in place at the time was 14.7% for...
ICSD-2 and 3.9% for International Statistical Classification of Diseases and Related Health Problems, 10th Revision. The most prevalent symptom was difficulty maintaining sleep (61%), followed by early morning awakening (2.2%), difficulty initiating sleep (7.7%), and nonrestorative sleep (25.2%). Although the overall prevalence of insomnia in working people was 23.2%, it was significantly higher in women than men (27.1% vs 19.7%; P = .001). The higher prevalence of insomnia in women begins in adolescence, and it is especially high during menopause. In addition to women, insomnia has higher prevalence in the elderly population, individuals with low socioeconomic status, and those with poor health or low quality of life (QOL). As shown in Table 2, many social or societal stressors are associated with insomnia. For example, results of a recent study showed the incidence of insomnia in homeless people was twice that of the general population (41% vs 19%).

Approximately 30% to 40% of adults in the United States report symptoms of insomnia at some point in a given year. Short-term insomnia has an estimated prevalence of 9.5% in the United States, but about 1 in 5 cases of short-term insomnia transitions to chronic insomnia, which can persist for years. In longitudinal studies, insomnia continued in 40% to 70% of patients for as long as 4 years. Although symptoms persist in some patients, insomnia may have a waxing and waning course in others.

The incidence of insomnia appears to be increasing in the United States. Based on National Health Interview Survey data, the unadjusted prevalence of insomnia or trouble sleeping increased by 8% over a decade, from 17.5% (37.5 million adults) in 2002 to 19.2% (46.2 million adults) in 2012. National Ambulatory Medical Care Survey data showed that the number of office visits for insomnia increased by 13% over 10 years, from 4.9 million visits in 1999 to 5.5 million visits in 2010. Based on Medicare data, physician-diagnosed insomnia increased from 3.9% in 2006 to 6.2% in 2013. An increase in insomnia has also been noted in Canada, where data collected with similar methodology showed an increase in adults with insomnia symptoms from 13.4% in 2002 to 23.8% in 2015.

Insufficient sleep has been linked to poor outcomes across many disease states, including cardiovascular and cerebrovascular disease, cancer, hypertension, and diabetes. Epidemiologic studies have linked insomnia symptoms to the development of other diseases, including type 2 diabetes (hazard ratio [HR], 1.28; 95% CI, 1.24-1.33), dementia (relative risk, 1.53; 95% CI, 1.07-2.18), stroke (HR, 1.54; 95% CI, 1.38-1.72), and chronic kidney disease (HR, 1.39; 95% CI, 1.34-1.44). Specific symptoms of insomnia have been linked to an increase in total cardiovascular disease (CVD) incidence. Respective HRs for increased risk of total CVD incidence for difficulty initiating or maintaining sleep, early morning awakening, and daytime dysfunction were 1.09 (95% CI, 1.07-1.11), 1.07 (95% CI, 1.05-1.09), and 1.13 (95% CI, 1.09-1.18). The most recent evidence does not indicate a link between insomnia and mortality, although insomnia is also linked to higher rates of workplace injuries and traffic accidents.

**Vulnerable Patient Groups**

Insomnia has bidirectional effects with coexisting medical and mental disorders, especially depression. Insomnia is a significant predictor for subsequent onset of psychiatric disorders, including depression (odds ratio [OR], 2.83; 95% CI, 1.55-5.17), anxiety (OR, 3.23; 95% CI, 1.52-6.85), and alcohol abuse (OR, 1.35; 95% CI, 1.08-1.67).

**Military Personnel and Veterans**

Active military personnel and veterans are extremely vulnerable to insomnia. Most veterans report sleep disturbances and about half meet the diagnosis of insomnia. Since 2001, when the longest overseas conflict in US history began, insomnia in military service members has skyrocketed and has been linked to deployment and combat exposure. In a retrospective cohort study of more than 1.3 million active duty US Army soldiers, the incidence of insomnia increased by 652% between 2003 and 2011. Comorbid conditions with a 2- or 3-fold higher risk of insomnia included sleep-related movement disorders, posttraumatic stress disorder (PTSD), anxiety, adjustment reaction, and acute reaction to stress. The incidence of OSA also increased by 600% over this period. Medical conditions linked to more than a 2-fold risk of OSA included hypertension, gastroesophageal reflux, diabetes, PTSD, and being overweight or obese. More than 90% of veterans with PTSD report sleep disturbances, primarily insomnia and nightmares. The current thinking is that insomnia helps drive the suicide epidemic in veterans by exacerbating depression and PTSD. Suicide prevention is part of the rationale for a Veterans Affairs public health campaign that offers CBTI.

**Traumatic Brain Injury**

Almost 2.9 million traumatic brain injury (TBI)-related emergency department visits, hospitalizations, and deaths occurred in the United States in 2014. Insomnia occurs in 30% to 65% of patients with chronic TBI symptoms. In patients with mild TBI, insomnia appears to have a relationship with other TBI complications, including PTSD, depression, and chronic pain. A recent longitudinal study correlated the impact of sleep disturbances on functional impairment in adults with mild TBI. Functional impairment was highest among those with both insomnia and short sleep (43%-79%), followed by insomnia alone (33%-64%), those with short sleep of less than 6 hours (29%-33%), and good sleepers (15%-25%). The relationship between sleep quality and global functioning was also bidirectional, with greater sleep disturbance predicting greater functional impairment months later and vice versa. This raises the possibility that early detection and management of sleep disturbances may both identify patients with a poor prognosis and improve recovery from TBI.
**Depression and Anxiety Disorders**
A key concern for clinicians is that insomnia strongly predicts the occurrence of depression. About 90% of patients with major depressive disorder (MDD) report difficulty sleeping.\(^7\) Although sleep disturbances are part of the diagnostic criteria for MDD and generalized anxiety disorder, insomnia also occurs as a coexisting disorder that worsens the mood disorder prognosis.\(^7\) In one of the earliest studies to investigate the relationship between insomnia and psychiatric disorders, 40% of patients with insomnia had a psychiatric disorder, most commonly an anxiety disorder (24%) or depression (14%).\(^\text{48}\) In this study, people with insomnia had a substantial risk of developing depression over the following year (OR, 39.8; 95% CI, 19.8-80.0). The risk of developing an anxiety disorder was also increased (OR, 6.3; 95% CI, 3.6-10.9).\(^\text{48}\) Results of a meta-analysis of 34 prospective cohort studies found that insomnia more than doubled the risk of developing depression.\(^\text{49}\) This is supported by new evidence from the Sequenced Treatment Alternatives to Relieve Depression trial in which improvements in sleep may be followed by tolerance.\(^\text{73}\) Daily cannabis users report high rates of sleep disturbances, given that a tolerance often develops to the sleep-inducing effects of cannabis. Further, cannabis withdrawal can cause severe insomnia characterized by trouble falling asleep and staying asleep, as well as vivid dreams, all of which make it difficult to quit.\(^\text{71}\)

**Menopause and Aging**
Vasomotor symptoms are an important precipitating factor for chronic insomnia in peri- and postmenopausal women. In a cross-sectional study, the prevalence of chronic insomnia symptoms increased with the severity of vasomotor symptoms, reaching greater than 80% in women with severe vasomotor symptoms.\(^\text{24}\) Similar to other scenarios, insomnia and depression appear to have a bidirectional relationship in perimenopausal women, with insomnia contributing to depressive symptoms and vice versa.\(^\text{75}\)

In a longitudinal study of community-living persons aged in their mid-80s with a burden of medical conditions and taking multiple medications, the prevalence of insomnia was 43%\(^\text{77}\); however, the mean ISI score was 12.3, suggesting mild severity. Insomnia was associated with depressive symptoms (OR, 8.34; 95% CI, 4.49-15.47) and RLS (OR, 2.49; 95% CI, 1.48-4.21). Biological factors related to aging that are thought to predispose elderly persons to insomnia include circadian rhythm changes that lead to less deep sleep, more sleep fragmentation, and early morning awakening.\(^\text{77}\) Precipitating factors may include an increasing burden of health problems with sleep-disruptive symptoms (eg, nocturia, dyspnea, pain), lifestyle changes after retirement, poor physical function, and polypharmacy, whereas perpetuating factors may include social isolation, caregiving, and bereavement.\(^\text{76,78}\)

**Nonpharmacologic Therapy of Insomnia**
Since the mid-1970s when sleep hygiene education was conceived, nondrug therapy has evolved to target both physiologic and cognitive hyperarousal factors that contribute to insomnia.\(^\text{79}\) CBTI, the most effective and comprehensive nondrug approach to treating insomnia, combines cognitive therapy, behavioral interventions, and sleep hygiene education.\(^\text{10,16}\) The most recent iteration of CBTI is fully automated digital CBTI (dCBTI) and does not require clinician involvement. dCBTI has the scalability to address insomnia as a public health issue.\(^\text{1}\) Other nondrug approaches that may have benefit for some patients include relaxation techniques and mindfulness interventions.\(^\text{10,16}\)

**Sleep Hygiene Education**
Teaching patients about behavioral and environmental factors that improve sleep (see Table 3)\(^\text{10,16,80,81}\) can improve sleep over baseline. Practice guidelines recommend against sleep hygiene education (SHE) as a stand-alone intervention because it is less effective than CBTI or mindfulness training.\(^\text{86}\); however, sleep hygiene education is still commonly used in primary care.\(^\text{79,82}\) The newest aspect of sleep hygiene education is limiting bedtime screen use, because bright light from devices stimulates wakefulness.\(^\text{89}\) Short-wavelength blue

### Table 3. Elements of Sleep Hygiene Education\(^\text{10,16,80,81}\)

- Ensure the sleep environment is quiet, pleasant, and at the best temperature for sleeping (15.5°C-19.4°C [60°F-67°F])
- Establish a bedtime routine
- Ensure adequate exposure to sunlight
- Exercise during the day
- Avoid exercise, excessive fluids, alcohol, or nicotine close to bedtime
- Avoid caffeine in the afternoon and evening
- Avoid or limit naps to 30 minutes
- Limit screen time or interactive technology in the 1 or 2 hours before bed
light from electronics interferes with natural melatonin secretion. Study results show children and adolescents are particularly sensitive to insomnia worsened by light from electronics, with almost twice the magnitude of melatonin suppression compared with adults.83

Behavioral Treatment of Insomnia
The goal of behavioral treatment is to break the maladaptive connection between going to sleep and hyperarousal using 2 retraining strategies: (1) sleep restriction and (2) stimulus control.84 Sleep restriction aims to increase sleep drive by reducing the time spent awake in bed. Time in bed is limited to align with the patient’s sleep duration and requires monitoring of daily sleep and wake times. Stimulus control aims to break the association between being in bed and negative aspects of insomnia, such as wakefulness, frustration, and worry. The underlying rationale is that eliminating these activities allows the bed to be re-associated with sleep rather than arousal. Both strategies may increase daytime sleepiness in the short term. Sleep specialists recommend against sleep restriction in patients with coexisting conditions that sleep deprivation can exacerbate, such as untreated sleep apnea or seizure disorders.84 Sleep restriction in a person with bipolar disorder may risk triggering mania.84

Brief Behavioral Treatment for Insomnia
This streamlined 4-session approach, which focuses on stimulus control and sleep restriction, can be delivered by healthcare providers without specialized training.85 In a clinical trial of older adults, brief behavioral treatment for insomnia was more effective than sleep hygiene education at improving sleep onset latency (SOL), wake time after sleep onset (WASO), sleep efficiency, and sleep quality.86

Cognitive Treatment of Insomnia
The goal of cognitive therapy for insomnia is to identify and challenge myths and negative beliefs about sleep that perpetuate insomnia, and then replace them with rational thoughts and facts.16 Cognitive treatment of insomnia includes setting realistic expectations about the amount and quality of sleep any person should expect.87

Cognitive Behavioral Therapy for Insomnia
Based on robust evidence from many clinical trials, practice guidelines recommend cognitive behavioral therapy for insomnia (CBTI) as first-line treatment of chronic insomnia.10,16,88,89 The rationale is that CBTI has more durable benefit and fewer adverse effects than drug therapy. In comparative studies, the efficacy of CBTI was comparable with benzodiazepines or benzodiazepine receptor agonists during acute use; however, sedative hypnotics did not have continued benefit after discontinuation.10 CBTI has demonstrated efficacy for insomnia in patients with coexisting medical conditions, including chronic pain, fibromyalgia, and breast cancer, as well as in perimenopausal women with vasomotor symptoms.90,91 Efficacy has also been demonstrated for patients with coexisting psychiatric conditions, such as alcohol dependence, PTSD, and MDD.91

An important CBTI side benefit is improvement in symptoms of coexisting psychiatric conditions, particularly depression.92 The benefit for depression symptoms appears to be moderated by improvements in sleep quality. Longitudinal data from the Veterans Affairs CBTI program suggest that it reduces suicidal ideation.93 The proportion of patients endorsing suicidal ideation dropped from 32% at baseline to 21% after CBTI (P < .001). Each 7-point decrease in ISI score achieved with CBTI was linked to a 65% reduction in the odds of suicidal ideation (OR, 0.33; 95% CI, 0.24-0.52).

Despite guideline recommendations and robust evidence of benefit, few patients receive CBTI. The key access barrier is the lack of trained clinicians. A recent international survey identified 752 CBTI specialists, with almost 90% located in the United States and almost 60% of them concentrated in 12 states.94

dCBTI
dCBTI products make up the consumer sleep technology (CST) landscape and have the potential to resolve some of the barriers that have prevented widespread uptake of CBTI. Over the last decade, CST (eg, Fitbit) has become ubiquitous. There are more than 10,000 behavioral health apps, most of which focus on relaxation, mindfulness, and meditation.95 About 10% of adults in the United States may use sleep tracking devices.87 Analogue to dietary supplements, a software application that makes a wellness claim (eg, better sleep) does not require FDA approval, whereas one that makes a medical claim (eg, treating insomnia) does. The AASM position is that CST must be FDA approved and rigorously tested before adoption into clinical practice.96 Among the dCBTI products studied most extensively in clinical trials, Sleepio and CBT-i Coach have not sought FDA approval, whereas Somryst (formerly Shut) is currently being considered for FDA approval.97-102

How dCBTI compares with in-person CBTI is an important question. In a small randomized controlled trial (n = 90), dCBTI and in-person CBTI had significantly larger treatment effects on the ISI than a waitlist group.203 However, in-person CBTI outperformed dCBTI on ISI scores and posttreatment depression and anxiety symptoms. In a clinical trial of active military personnel with insomnia, in-person CBTI outperformed online delivery for self-reported sleep quality (d = 0.80), dysfunctional beliefs and attitudes about sleep (d = −0.58), and total sleep time (d = −0.55 to −0.60).104

Nonprescription dCBTI
As part of a wider initiative to provide digital therapeutics as a health plan benefit, CVS Health is encouraging employers to offer Sleepio as an employee benefit.39 It is already offered to 10.3 million patients in the United Kingdom’s National Health Service and at
least 2 million Americans through their employers. Sleepio has
the format of a single-player video game in six 20-minute sessions.
In the Digital Insomnia Therapy to Assist Your Life as Well as
Your Sleep (DIALS) trial, more than 1700 people with self-reported
insomnia were asked to rate adverse effects. Patients who received Sleepio
had a large improvement in sleep-related QOL with respective adjusted differences of 1.76 (95% CI, 1.22-2.30) and 2.95 (95% CI, 2.13-3.76). Almost 20% of participants randomized
to dCBTI did not attend the first session, and fewer than 50% completed all sessions.

The DIALS trial is one of the few large-scale clinical trials to
evaluate potential adverse effects of dCBTI. At week 8 posttreatment, participants randomized to Sleepio or sleep education were asked to rate adverse effects. Patients who received Sleepio had higher rates of fatigue and/or exhaustion (46.3% vs 27.0%; P < .0001); extreme sleepiness (30.8% vs 14.2%; P < .0001); headache or migraine (18.8% vs 12.6%; P = .0084); difficulty with concentration or focus (33.2% vs 19.1%; P < .0001); reduced motivation and/or energy (32.8% vs 24.1%; P = .0032); and irritability (28.2% vs 17.9%; P = .0002) compared with the sleep education group.

Prescription dCBTI

The FDA is considering approval of Somryst (formerly Shuiti) as the first prescription dCBTI to treat adults with chronic insomnia and depression. It is also the first product submitted for FDA approval through the Software Pre-certification Pilot Program. Somryst is a software application that provides CBTI and sleep restriction in 6 sessions.

Clinicians should not assume all dCBTI programs are equal. Programs with a longer duration and more personal clinical support may have greater benefit. Recent data suggest that specific traits of affect and personality influence whether a person responds to dCBTI. These observations highlight how much we need to learn about adherence, predictors of response, drop-out rates, and the clinical infrastructure needed to deliver dCBTI in managed care.

Conclusions

Insomnia is a heterogenous and almost ubiquitous disorder with unique predisposing and precipitating factors in vulnerable patient groups. Successful management requires that managed care clinicians understand the factors that drive insomnia in these groups. CBTI effectively treats chronic insomnia in most patients with coexisting medical and psychiatric conditions, in the elderly population, and in those in life transitions, such as menopause. A decade ago, understanding the subtleties of CBTI was a moot point because access barriers, primarily high cost and a lack of trained providers, prevented widespread adoption. Today, managed care clinicians face a vastly different challenge—the relatively unexplored landscape of digital therapeutics. However, dCBTI is here to stay, and it is a scalable option that is being launched in managed care. Now, the issues are which dCBTI product to provide, how to deliver it, how to manage nonresponders and adherence issues, and overall, what role dCBTI will play in the step-care of chronic insomnia.

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