ABSTRACT

• **Objective:** To review treatment principles of cognitive behavioral therapy for insomnia (CBT-I).
• **Method:** Review of the literature and case presentation.
• **Results:** Insomnia complaints are common, rise to a clinically significant level among approximately 10% of the population, and seldom remit without direct intervention. CBT-I has demonstrated efficacy as an intervention for insomnia and its effects are comparable, and in some cases superior, to those of medication. Treatment effects for CBT-I are maintained following discontinuation of provider contact and are also observed when CBT-I is delivered to patients with a variety of psychiatric and medical conditions that commonly present with insomnia. CBT-I is a multicomponent therapy typically delivered over 6 to 8 weeks that includes both behavioral strategies and cognitive interventions aimed at addressing the key etiological factors of insomnia (e.g., hyperarousal, circadian dysregulation, and a disrupted homeostatic drive coupled with maladaptive behaviors and dysfunctional cognitions about sleep). A discussion of how a sleep-focused assessment informs a cognitive-behavioral case conceptualization is followed by a case-based illustration of the core treatment components of CBT-I.
• **Conclusion:** CBT-I is an empirically supported treatment for insomnia. Future efforts should focus on dissemination of this evidence-based therapy.

Nearly one-third to one-fourth of individuals in industrialized countries report disrupted sleep, with approximately 10% of the U.S. population experiencing persistent or chronic insomnia [1]. While insomnia can be classified as a distinct nosological entity, primary insomnia accounts for only 10% to 20% of all insomnia presentations. Thus, the majority of insomnia complaints occur within the context of medical conditions and psychiatric disorders. Difficulties initiating and/or maintaining sleep commonly co-occur with other psychiatric and medical conditions and typically do not remit with general psychotherapy [2]. If not addressed, insomnia complaints among patients with comorbid psychiatric and medical conditions may actually hinder responses to treatment [3] and even contribute to illness severity [4]. Without intervention, insomnia is associated with impaired work performance, poor quality of life, higher health care costs, and may pose an increased risk for additional morbidity and even mortality [5]. Given the scope and significance of this problem, the identification and implementation of efficacious and effective forms of treatment are necessary.

There is strong evidence to support the efficacy of cognitive behavioral therapy for insomnia (CBT-I) [6] based on the delivery of weekly structured CBT-I sessions for a 6- to 8-week time period [7,8]. There is some evidence to suggest that a briefer course of treatment may also be appropriate [9]. Direct evidence in comparison to hypnotic medications demonstrates that CBT-I produces comparable improvements in sleep with lasting benefit well after contact with a care provider has ended [10,11]. Moreover, current evidence indicates that CBT-I is effective for patients with a variety of conditions including depression [12,13], post-traumatic stress disorder (PTSD) [14] and chronic pain [15–17].

CASE STUDY

**Initial Presentation**

A 38-year-old married Caucasian male, Tim, presents to his primary care physician (PCP) with complaints of fatigue, problems with memory/concentration, and difficulties with falling and staying asleep.

**History**

The current episode of insomnia began about 6 months ago. His primary sleep complaint is characterized by dif-

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Difficulty falling asleep, which occurs every night. Within the past 3 months, in addition to his problems with sleep initiation, he began experiencing difficulties returning to sleep that are associated with a nighttime arousal that occurs 3 nights per week.

His current medications include zolpidem 10 mg at bedtime and 25 mg hydrochlorothiazide daily for hypertension. Initially the zolpidem prescription “worked like a charm,” but now Tim is not sure that he feels more refreshed in the morning. Tim has no prior history of psychological disorders or treatment.

Tim is married and has 2 children. He works in IT services at a local university and was promoted to assistant director of networking 6 months ago. He worries about new demands and often has to work late nights or from home in the evenings. He volunteers as a ski patroller 2 weekends a month during the winter. However, this winter Tim has felt less motivated to get up on weekend mornings and eventually stopped going to ski patrol. He also stopped going to the gym and coaching his son’s basketball team.

He is referred for insomnia treatment because he declined another prescription to address his sleep complaint from his PCP.

What are the diagnostic criteria for insomnia?

Insomnia complaints include significant subjective distress related to difficulties falling asleep, staying asleep, or nonrestorative sleep that occurs despite the opportunity for adequate sleep. Current diagnostic criteria for insomnia are somewhat minimal and do not include uniform benchmarks related to the frequency of insomnia complaints or for how little sleep or how much wakefulness is considered indicative of insomnia, although this may be remedied as the field awaits the publication of the 5th edition of the American Psychiatric Association’s Diagnostic and Statistical Manual (DSM-V) and adoption of proposals from the DSM-V Sleep-Wake Disorders work group [18]. Most importantly, the clear distinction between primary insomnia and insomnia due to other medical or mental health issues may be eliminated. Instead, the proposal is to include only 1 insomnia disorder; comorbid conditions, if present, would be listed without reference to causality between the condition and insomnia.

Nonetheless, the pathophysiology of insomnia is fairly complex and multifactorial [19]. Common etiological factors contributing to insomnia include hyperarousal, circadian dysregulation, and a disrupted homeostatic drive coupled with maladaptive behaviors and dysfunctional cognitions about sleep. The clinical manifestation of insomnia may differ based on the relative contribution of these factors.

What are aspects of the patient assessment?

The assessment of insomnia includes a detailed sleep, mental health, and medical history via a sleep-oriented clinical interview [20] with particular attention to factors contributing to the initiation and/or maintenance of insomnia. The evaluation of insomnia is enhanced by an understanding of sleep science and theoretical models that explain how insomnia develops and is maintained. One influential model, known as the “3P model” [21], posits that acute insomnia develops when Predisposing factors (eg, individual variants) and Precipitating factors (eg, stressors) interact, and that Perpetuating factors (eg, negative thoughts and maladaptive coping behaviors) lead to conditioned arousal that, when repeated over time, maintain insomnia. The 3P model provides clinicians with a structured way to organize and present information to patients. A sleep-oriented clinical interview should be supplemented by well-validated self-report instruments for the assessment of sleep disturbance, such as the Pittsburgh Sleep Quality Index [22], a global assessment of sleep, and the Insomnia Severity Index [23], an insomnia specific outcome measure.

At the conclusion of the sleep-oriented assessment, the patient is provided a sleep diary, a measure that allows the clinician to evaluate the severity of insomnia complaints on a daily basis, to identify behaviors that maintain insomnia, to determine the relative influence of circadian dysregulation, and to gather the data needed to guide treatment [24]. Assessment with sleep diaries requires that patients keep a daily log for a 1- to 2-week time interval so that enough behavior can be sampled. By obtaining values for time in bed and time out of bed, along with minutes to fall asleep and minutes awake during the time in bed, weekly averages of several variables can be calculated. These variables include latency to sleep,
wake time, average time in bed, total sleep time, and sleep efficiency (total sleep time/time in bed × 100). An overnight sleep study (a polysomnographic recording) is not indicated as part of a standardized assessment for insomnia [20].

Further History of Patient’s Sleep Complaint

When Tim was in college he worked the night-shift during his first 2 years loading delivery trucks for a parcel service in order to help with tuition and books. Tim has had difficulties falling asleep in the past, especially when under stress, but these seemed to resolve after a few weeks or with over-the-counter (OTC) sleep aids.

Currently, Tim approximates his total sleep time as 5 to 6 hours. His bedtime is variable and often occurs between 11:00 PM and 1:00 AM, with initial sleep onset latencies ranging from 60 to 90 minutes. He notes that his difficulties with sleep initiation are “better” on the weekend because he is more likely to fall asleep within 60 minutes. Tim typically awakens within 1 to 2 hours of falling asleep and will often awaken his wife as he “tosses and turns.” He typically gets up at 7:00 AM to get to work during the week and will sleep until 9:00 AM on the weekends. His score on the Insomnia Severity Index [23] is 20, which corresponds to moderate severity of insomnia.

Clinician’s Formulation of Case

Tim meets diagnostic criteria for insomnia. His chronic insomnia may be understood broadly within the 3P model of insomnia [21]. Tim exhibits a variety of predisposing factors, including a tendency to worry and ruminate, hyperreactivity, and a history of shift-work. Each of these factors is likely to make Tim vulnerable to developing insomnia, particularly during times of stress. Tim’s insomnia complaints seemed to have worsened around the time he received a promotion at work, a clear precipitating factor. His insomnia is likely maintained by a variety of behaviors (eg, sleeping later on the weekends and spending excessive amounts of time awake in bed in an effort to obtain more sleep) that may be classified as perpetuating factors. These maladaptive behaviors serve to disrupt the homeostatic and circadian regulation of his sleep, increase the opportunity for his bed and bedroom to become associated with wakefulness, and contribute to the development of conditioned hyperarousal characteristic of chronic insomnia.

CBT-I is a multicomponent therapy developed from (1) both operant and classical conditioning principles that are directly applied in stimulus control instructions [25]; (2) changing behaviors and environmental factors that interfere with sleep using sleep hygiene [26]; (3) reducing the hyperarousal features of insomnia [27]; (4) improving circadian and sleep homeostasis regulation of sleep with sleep scheduling and limited partial sleep deprivation [21]; and (5) the adaptation of cognitive therapy to insomnia [28]. CBT-I may be delivered in group and individual formats. The standard delivery of CBT-I is typically structured to allow for weekly individual therapy sessions over a 6- to 8-week time period.

The components of CBT-I include psychoeducation, behavioral strategies, cognitive therapies, and relaxation training. The order in which treatments are delivered may vary, but it is fairly standard to begin with psychoeducation about sleep and treatment rationale, followed by stimulus control therapy and sleep restriction therapy. It should be noted that many clinicians prefer to include a discussion of sleep hygiene practices during an initial session of CBT-I when providing psychoeducation about insomnia. Primarily, because sleep hygiene is easy to implement and addressing aspects of sleep hygiene early in treatment could increase patient compliance with other components of CBT-I (ie, sleep restriction may be difficult to implement if the bedroom is too hot).

Moreover, some conditions warrant targeted intervention prior to treating the presenting insomnia with CBT-I. These may include untreated or unstable gastroesophageal reflux disease, cardiovascular disease, bipolar disorder, alcohol or substance dependence, and other sleep disorders such as sleep apnea, restless legs syndrome, or circadian rhythm disorders. Nonetheless, depending on the condition, insomnia may still be treated in conjunction with such conditions.

PSYCHOEDUCATION

Clinicians should demonstrate an understanding of core sleep science principles including the two-process model of sleep (circadian process and homeostatic sleep drive) and how these processes interact to maintain wakefulness during the day and sleep throughout the night;
how hyperarousal interacts with the two-process model and contributes to the experience of insomnia; and the basics of sleep architecture and how it relates to sleep quality.

Providing rationale for treatment strategies is also useful. This involves educating the patient about (1) the difference between sleep ability and sleep opportunity, noting that the mismatch disrupts sleep homeostasis and regulation of sleep and (2) the importance of a good stimulus environment for sleep. As with most therapies, CBT-I practitioners find it important to both educate and work collaboratively with the client throughout the treatment process. Providing psychoeducation about sleep along with intervention rationale enhances treatment compliance [29].

**BEHAVIORAL STRATEGIES**

**Stimulus Control**

Stimulus control is an intervention that rests on behavioral principles designed to extinguish learned associations between the bed and negative states such as worry, wakefulness, or frustration [25]. Wakefulness and its associated negative emotions are conditioned by frequent and prolonged periods of time spent awake in bed. The goal of stimulus control therapy is to establish a regular sleep-wake schedule and for the patient to maintain a positive association between the bed and sleep. Conceptually, stimulus control rests on the idea that one stimulus may elicit many responses, depending on a learning history. When applied to insomnia, cues that are typically associated with sleep (e.g., the bedroom, the bed, bedtime) are paired with responses other than sleep. For example, patients often attempt to cope with wakefulness by remaining in bed and trying (unsuccessfully) to fall asleep. While this behavior may seem rational and may be successful at times, this behavior lowers the probability that sleep related stimuli (the bed, the bedroom, etc) will be associated with sleep initiation.

In practice, the goal of stimulus control is to re-associate the bed/bedroom with sleep. This includes telling patients to get into bed when they feel sleepy, to maintain a consistent wake time, to avoid naps, to use the bed only for sleep and intimacy. If patients are unable to fall asleep (or fall back to sleep following awakenings) within 20 minutes, they are instructed to get out of bed and engage in a relaxing activity until drowsy, and to then return to bed. Patients should not use actual clock time, but instead estimate when 20 minutes have passed. These instructions are designed to limit the amount of time in bed awake, thereby breaking the counterproductive associations between the bed and sleep.

**Sleep Restriction Therapy**

Sleep restriction therapy [30] attempts to align the time in bed and total sleep time based on data from at home sleep diaries. This intervention is designed to improve sleep consolidation by restricting total sleep time to enhance sleep drive by prolonging wakefulness. As the drive for sleep increases and the opportunity for sleep remains restricted, sleep becomes consolidated (patients fall asleep more quickly and remain asleep with fewer interruptions). Sleep restriction instructions include using an at home sleep log or sleep diary to determine average total sleep time for a baseline period of 1 to 2 weeks. Next, bedtimes are delayed and wake times are set at a consistent time so that time in bed approximates mean total sleep time. As an intervention, this controlled form of mild to moderate sleep deprivation usually decreases the amount of time it takes to fall asleep or return to sleep. Initially, patients get less sleep, but tend to produce sleep that consolidated. As sleep efficiency (total sleep time divided by time in bed × 100%) increases, weekly adjustments to the sleep schedule may be made. With sustained sleep efficiencies (7 days or more) above 85%, time in bed can be increased by 15 to 20 minutes. This adjustment provides the opportunity for increased total sleep time while maintaining consolidated sleep. Adjustments increasing total time in bed may be made if sleep efficiencies remain at or above 85%. If sleep efficiencies fall below 80%, time in bed may need to be decreased by 15 to 20 minutes.

It is important to note that when practicing sleep restriction therapy advancing wake times (having patients get up earlier) is not recommended because it does not take advantage of the effect that delaying bedtime has on facilitating sleep, and promotes early morning wake times which may lead patients to get into bed earlier. Sleep restriction therapy is effective because it prevents patients from coping with their insomnia by extending the opportunity for sleep. However, this treatment may be contraindicated for patients with comorbid histories of mania, seizure disorder, or patients with fall risks. In a slight modification of sleep restriction therapy, called sleep compression, clinicians essentially titrate sleep restriction by gradually compressing time in bed until a criterion level of total sleep time is achieved.
Treatment Initiation

Following sleep education and treatment rationale, Tim agrees to begin sleep restriction and stimulus control. His sleep window was set for 6.5 hours and anchored to his desired wake time of 7:00 AM, making his prescribed bed time 12:30 AM. He is instructed to keep this schedule on weekends and is given a blank sleep diary.

When Tim returned with a sleep diary 1 week later, several observations were made:

- Overall there was good compliance with sleep restriction with the exception of the weekend. Going to bed later than the prescribed sleep time is “allowable,” but that extending sleep opportunity by going to bed earlier or sleeping in later than prescribed times is counterproductive.
- Tim appears to have applied the stimulus control instruction of getting out of bed while awake on every night during the week but not on Sunday night.
- Initial sleep latency remains long, but waking during the middle of the night has decreased significantly. Overall total sleep time is still right around 6 hours, and sleep efficiency was close to our 85% target.
- The only significant adherence problem occurred on Sunday night when Tim went to bed 1 hour early and stayed in bed 1 hour later than prescribed, did not fall asleep until 1:00 AM, and did not get out of bed despite a 60-minute nighttime arousal around 3:00 AM.

After some discussion of these aspects of the diary and his ability to adhere to the plan most nights, the following exchange took place:

Therapist: Why don’t you tell me what happened on Sunday?
Patient: Oh, I was just worried about staying up late and still getting up on time for work, so I just went up to bed, which seemed fine but then I woke up around 3:00 AM and couldn’t fall back asleep for what seemed like forever.

Therapist: …but unlike other times in the week, you didn’t get out of bed when you remained awake?
Patient: I thought about it, but I was just too tired, so I just turned the light on and read for awhile.

Therapist: [Smiling] Do you recall how I said applying these rules can be really difficult? I understand that getting out of bed at 3 AM is not fun.

Patient: Yeah, a little harder than it sounded at the time... and I thought, even though I’m awake at least I’m resting and might fall back asleep because I have a big day tomorrow in the office.

Therapist: Let’s look at the positive side by looking closely at the sleep diary. You followed the plan and had some decent sleep a few nights. Then Sunday night came. Do you see how things went astray?
Patient: I guess so. I went to bed too early and even got a good 4 to 5 hours, but then I was in trouble.

Therapist: And next time…?
Patient: Right, next time I just get up because really, I just kept reading rather than falling asleep anyway.

What issues may come up with adherence to stimulus control? What other behavioral strategies are recommended?

This patient-therapist interaction included a very common issue that can arise with patients that bears some additional discussion. Namely, following stimulus control instructions to get out of bed when awake can be thwarted when patients report some variation of the rationale used by Tim (“at least I’m resting”). When presented with any such variant, an appropriate response can be some matching variation of “You may rest, you just need to do it somewhere other than the bedroom.”

After the sleep diary is reviewed and any problems implementing stimulus control or sleep restriction instructions are addressed, the focus may move to sleep hygiene. Sleep hygiene involves educating the patient about health practices (eg, avoiding tobacco, alcohol, large meals and vigorous exercise for several hours prior to bed) and environmental factors (eg, light, noise, temperature) that are either conducive or detrimental to sleep. Sleep hygiene is usually not effective when delivered as a monotherapy, but may be useful in combination with cognitive therapy or other behavioral strategies (eg, sleep restriction, stimulus control therapy) aimed at improving sleep.

For Tim, removing reading activity from the bedroom is an appropriate target for sleep hygiene (and one that also fits with stimulus control), as is providing him with other sleep hygiene targets that address promoting a comfortable sleep environment. For instance, maintain-
ing a comfortable temperature in the bedroom may be needed.

Also included in sleep hygiene is a discussion about how exercise can enhance sleep and that exercise close to bed time may be activating. Recall that Tim had stopped going to the gym and stopped volunteering for ski patrol. Even if this were not the case, a compelling rationale for activity/exercise is easy to come by: regular exercise can improve sleep [31]. Exercise was added to the CBT-I treatment goals at the end of this session.

- What is the role of cognitive therapy in CBT-I?

Cognitive therapy for insomnia [28] addresses the preoccupations and potential consequences of the patient’s sleep disruption. While specific cognitive interventions differ in their approach, all rest on the notion that insomniacs have negative beliefs and attitudes about their sleep. Directly addressing negative cognitions about poor sleep is believed to reduce the anxiety and arousal associated with nighttime worry and daytime concerns. Opportunities to utilize cognitive therapy may arise throughout treatment as a means to help patients challenge the usefulness and validity of their negative beliefs and thoughts. An example of a cognitive intervention from an individual session is outlined below.

Later in the session, Tim was provided a more formal introduction to cognitive therapy. The main focus of cognitive therapy is on dysfunctional thoughts and beliefs about sleep. As with other facets of the therapy, it may prove useful to begin with some instruction in how an event can elicit automatic thoughts and emotions that are counterproductive to sleep. After a brief didactic exercise, one way to elicit negative thoughts about sleep (and how to address them) is demonstrated by the following:

**Therapist:** So, let’s say you’re lying in bed awake at 2 AM and sleep is not coming. What is going through your mind?

**Patient:** Well, I would think I’d better get to sleep soon or else.

**Therapist:** Or else what?

**Patient:** Or else, I’ll have a rough day tomorrow.

**Therapist:** OK, give me the worst case scenario

**Patient:** I don’t know. I’ll really mess up big time at work.

**Therapist:** OK. Now, I know this may not happen a lot, but let’s use this as an example [gets up and starts writing on the white board]. So the event is “I’m awake” and the thought is “if I don’t fall asleep soon, I’ll make a big mistake at work tomorrow” and the emotion is what, anxiety?

**Patient:** Yea, I feel stressed and worried.

**Therapist:** And on a scale of 0–100 how worried are you?

**Patient:** Oh, pretty worried, like 90.

**Therapist:** Alright, and when you’re this worried, how certain are you that you will mess up something with the network at work.

**Patient:** [laughs] Well, in the moment, pretty certain.

**Therapist:** 100% certain? 75%?

**Patient:** Oh, 90% or so.

**Therapist:** OK. And how many major mistakes have you had at work?

**Patient:** I see where you’re going, but none. But I have had some close calls.

**Therapist:** OK. How many? Let’s say in the last 6 months since your sleep has been particularly bad.

**Patient:** I don’t know, one or two off-hand.

**Therapist:** Let’s work this out [turns again to the whiteboard]. Say you’ve worked 25 weeks and say 4 nights per week you’ve had poor sleep. That’s 100 nights with 90% certainly, so by that logic you should have had about 90 close calls. But you’ve only had one or two.

**Patient:** I see.

Why spend time addressing these cognitions? Often, one of the unstated beliefs here can be some version of “since my sleep is not going to improve, I can’t be the best I can be at work.” Clinically, we want to do two things: normalize the awakenings to some extent and focus work on what happens after the awakenings. Specifically, attention to what the patient’s mind and body are doing during those awakenings is useful in determining their contribution to extended awakenings. In such cases, standard cognitive therapy and stimulus control can be applied. With Tim, it may also be appropriate to address the troublesome cognitions about his sleep (and subsequent work performance) he might be having while attempting to fall asleep or return to sleep.


**Case-based Review**

- **What relaxation techniques can be used in CBT-I?**

Relaxation training targets cognitive and physiological hyperarousal that interferes with sleep and is often utilized with CBT-I. Relaxation techniques should be considered either after stimulus control and sleep restriction are not effective or when patients continue to exhibit hyperarousal that may be blunting a more robust treatment response. A variety of relaxation techniques may be utilized (eg, progressive muscle relaxation, diaphragmatic breathing, autogenics, mindfulness meditation), but the optimal method is the one that is most suitable or easiest for the patient to learn. The goal of relaxation training is not to induce sleep but rather to reduce basal hyperarousal. Learning relaxation skills requires consistent practice. When introducing these techniques, it is appropriate to encourage the patient to practice relaxation strategies throughout the day and prior to bedtime with the goal of reducing conditioned hyperarousal. It should be noted that specific relaxation techniques may be contraindicated for certain medical or psychiatric conditions.

**Case Resolution**

Tim completed 6 sessions of CBT-I with notable improvements in his sleep. He was able to taper his zolpidem prescription with assistance from his PCP. His sleep window re-expanded to 7 hours and 30 minutes (11:30 PM to 7:00 AM). His score on the Insomnia Severity Index decreased to 7 (mild insomnia) from 20 (moderate insomnia). His final sleep diary average values (vs. intake values) were sleep latency 15 minutes (vs. 60 minutes), number of awakenings 1.2 (vs. 2.0), wake after sleep onset 15 minutes (vs. 60 minutes), time in bed 450 minutes (vs. 500 minutes), total sleep time 420 minutes (vs. 380 minutes), and sleep efficiency 93% (vs. 75%). In addition, Tim continued to exercise almost daily, felt he had more energy, and returned to volunteering for ski patrol. Importantly, Tim learned that to regain some control over his sleep and that some nighttime variability in his sleep does not equate to disastrous work performance.

**CONCLUSION**

Overall, Tim was a hard-working and motivated patient. When provided with behavioral skills and cognitive strategies to address his insomnia, Tim was able to manage his sleep complaint effectively. Systematically addressing Tim’s insomnia using CBT-I resulted in increased total sleep time and improved sleep efficiency that resulted in less fatigue during the day. Barriers to future adherence may include his ability to consistently maintain the prescribed sleep schedule, especially on the weekend and managing work-related stress.

Strong evidence supports the efficacy of cognitive behavioral therapy for insomnia. This case presentation highlights the clinical utility of treating insomnia with a cognitive behavioral approach that is individualized and tailored to the specific background, experiences, and concerns of a patient. Future research should focus on the dissemination of CBT-I, while evaluating patient outcomes, long-term sustainability, and maintenance of treatment fidelity over time [32].

Note: Dr. Pigeon is also an employee of the Center of Excellence for Suicide Prevention of the Department of Veterans Affairs (VA). The views and opinions expressed herein do not reflect those of the VA or the United States government.

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