THESIS

PROMOTING ADHERENCE TO COGNITIVE-BEHAVIORAL THERAPY FOR INSOMNIA IN THE MEDICALLY COMPLEX CASE

Submitted by

Emily R. Lovell

Department of Occupational Therapy

In partial fulfilment of the requirements

For the Degree of Master of Science

Colorado State University

Fort Collins, Colorado

Summer 2023

Master's Committee:

Advisor: Aaron Eakman

Jennifer Weaver
Josiane Broussard

ABSTRACT

PROMOTING ADHERENCE TO COGNITIVE-BEHAVIORAL THERAPY FOR INSOMNIA IN THE MEDICALLY COMPLEX CASE

Objective. The purpose of this study is to explore how a medically complex case responded to cognitive-behavioral therapy for insomnia (CBT-I) in a community-based setting based on adherence to treatment recommendations. **Method.** A mixed-methods retrospective case study design was used to explore answers to two research questions: 1) How effective is CBT-I for an individual with insomnia comorbid with bipolar disorder? 2) How is CBT-I tailored for an individual with insomnia comorbid with bipolar disorder in a real-world setting? 3) How do we assess adherence to CBT-I delivered by an occupational therapist? Data sources included sleep diaries, service logs, pre-/post-treatment assessments, and interviews with the client and therapist. **Results.** Improvements in sleep latency, wake after sleep onset, early morning awakening, total sleep time, and sleep efficiency were observed. The most noteworthy improvements were a gain of almost two hours of total sleep time and a post-treatment SE of 95%. Likewise, scores on the Insomnia Severity Index, Epworth Sleepiness Scale, Sleep Disorders Symptoms Checklist-25, Dysfunctional Beliefs and Attitudes about Sleep scale, Sleep Hygiene Index, Quick Inventory of Depressive Symptomatology, and Patient Health Questionnaire-9 all improved to the extent that the client no longer met criteria for chronic insomnia. Overall adherence to the behavior components of CBT-I was very high. *High motivation* and *scheduling and engaging in activities* emerged as factors that promote adherence from the interview conducted with the client. A *therapeutic relationship* emerged as a factor that

promotes adherence from the interview conducted with the therapist. **Conclusion.** CBT-I can be safely delivered by occupational therapists to individuals with bipolar disorder. Large improvements in sleep were observed and the client had high adherence to treatment protocols.

TABLE OF CONTENTS

Introduction

Sleep deprivation is associated with a variety of negative consequences. Common daytime consequences of insufficient sleep include impaired cognition, memory issues, psychomotor dysfunction, decreased alertness, and difficulties concentrating (Szentrikirályi et al., 2009). Burton et al. (2017) studied the implications of insufficient sleep in the workplace and on employee health. Employees who reported sleeping seven or eight hours per night had significantly fewer absent days, lower on-the-job productivity loss, and better health. Employees who reported sleeping six or less hours per night were more likely to be at risk for obesity, life dissatisfaction, alcohol usage, high stress, arthritis, and lower back pain. Sleep deprivation has also been linked to the development of chronic diseases—including obesity, diabetes, cardiovascular disease, hypertension, etc.—and mood disorders (Perry et al., 2013).

Approximately 10-15% of the U.S. population is affected by chronic insomnia (Kraus & Rabin, 2012). Chronic insomnia is dissatisfaction with sleep quality or quantity that persists for three or more months. According to DSM-V criteria, chronic insomnia is characterized by one or more of the following for at least three nights per week: difficulty falling asleep, difficulty staying asleep due to frequent or prolonged awakenings, and early morning awakening with an incapacity to return to sleep (American Psychiatric Association, 2013).

Although insomnia is associated with a failure to get sufficient sleep, it should not be confused with insufficient sleep. Insufficient sleep can be defined as "occur[ring] when sleep does not support adequate alertness, performance and health" (Chaput et al., 2023, p. 85). The two disorders are different in that people with insomnia have difficulty sleeping even when given the opportunity to, whereas people with sleep insufficiency do not have enough time allotted for sleep (Chattu et al., 2019).

Application of CBT to Insomnia

Cognitive-behavioral therapy for insomnia (CBT-I) is an effective, well-established treatment for insomnia and includes strategies such as cognitive therapy for addressing dysfunctional sleep beliefs, stimulus control therapy, sleep restriction therapy, and sleep hygiene education (Smith et al., 2005). CBT-I can also be paired with complementary techniques such as sleep education, light therapy, and relaxation techniques (Leland et al., 2014).

The components of CBT-I are based on existing knowledge of sleep regulation systems and factors that lead to the development of chronic insomnia. Borbély (1982) described two processes that regulate sleep: the S system and the C system. The S system, or homeostatic sleep driver system, balances time awake with time asleep so that the pressure to sleep increases as more time spent awake and active passes. The C system, or circadian system, controls the timing of sleep and is strongly influenced by light. CBT-I helps regulate these systems as it has recipients avoid taking naps—which deplete sleep drive—and set consistent bed and rise times compatible with the individual's chronotype to promote entrainment of the circadian system (Manber et al., 2012).

Spielman et al. (1987) devised a behavioral model of chronic insomnia development based on predisposing, precipitating, and perpetuating risk factors. Genetics, temperament, and nighttime shiftwork are examples of predisposing factors. Precipitating factors include illness onset, the loss of a loved one, divorce, and having a baby. Spending excessive time in bed, conditioned arousal, and avoidance behaviors (e.g., cancelling planned social events in anticipation of poor sleep) are perpetuating factors (Spielman et al., 1987). CBT-I targets these perpetuating factors to promote effective sleep regulation.

CBT-I successfully treats chronic insomnia, and positive effects were maintained for twelve months post-treatment (Okajima et al., 2011; van der Zweerde et al., 2016). Evidence suggests that CBT-I can effectively reduce symptoms of insomnia in individuals with comorbid health conditions including generalized anxiety disorder, post-traumatic stress disorder (PTSD), Parkinson's disease, chronic pain, cancer, and other medical and psychiatric disorders (Smith et al., 2005; Wu et al., 2015). Evidence also demonstrates that CBT-I treatment is effective across treatment modalities. In addition to individual, in-person sessions, CBT-I has yielded positive treatment outcomes in group formats (Koffel, Koffel, & Gehrman, 2015), through telemedicine (Arnedt et al., 2021; Seyffert et al., 2016; Zachariae et al., 2016), and in online self-help formats (Ho et al., 2015; Ritterband et al., 2009). Due to the empirical support for CBT-I, the American College of Physicians (Qaseem et al., 2016) and the American Academy of Sleep Medicine (Edinger et al., 2021) strongly recommend CBT-I as the initial treatment for adults with chronic insomnia before pharmacological treatments.

CBT-I for Insomnia Comorbid with Other Disorders

Numerous randomized controlled trials have shown CBT-I to be safe and effective when delivered to people with insomnia comorbid with a wide variety of mental and physical health conditions including depression (Carney et al., 2017), alcoholism (Chakravorty et al., 2019), fibromyalgia (McCrae et al., 2019), multiple sclerosis (Siengsukon et al., 2020), and obstructive sleep apnea (Ong et al., 2020). CBT-I is advantageous over pharmacological interventions for insomnia comorbid with other conditions because it has very few contraindications. The most hazardous contraindications, specifically with regard to the use of sleep restriction therapy, are epilepsy and bipolar disorder (Smith et al., 2005).

CBT-I Adapted for Bipolar Disorder

Bipolar disorder is linked to impaired sleep. Individuals experience a reduced need for sleep during manic episodes, and insomnia or hypersomnia may present during depressive episodes (APA, 2013). In one study, 70% of people with bipolar disorder experienced clinically significant sleep disturbances and 55% met criteria for insomnia during the euthymic phase (Harvey et al., 2005). People with bipolar disorder have longer sleep latencies, linger longer in bed after awakening, take longer and more frequent daytime naps, display more delayed sleep phase trends, and spend more time in bed than people without the disorder (Ritter et al., 2012).

Although bipolar disorder presents with a myriad of sleep problems, it is considered a contraindication for CBT-I based on research indicating that decreased sleep duration predicts mania or hypomania the following day (Barbini et al., 1996; Leibenluft et al., 1996) suggesting that sleep restriction therapy is risky for individuals with bipolar disorder. These findings are corroborated by Gruber et al. (2009) who found that short sleepers (i.e., weekly average of less than six hours of sleep per night) exhibited more severe manic and depressive symptoms compared to normal sleepers. Bauer et al. (2006) found sleep pattern changes greater than three hours resulted in large mood changes (depression or mania) in most but not all of their participants suggesting vulnerability to sleep loss with mood changes varies between individuals.

Although there are risks associated with sleep restriction therapy, Kaplan & Harvey (2013) did not find any adverse effects in euthymic participants with bipolar disorder who received CBT-I with sleep restriction therapy and setting regular bed and rise times resulted in marked improvements in sleep efficiency for most participants. Jernelöv et al. (2022) entirely replaced sleep restriction therapy with scheduled sleep and emphasized using zeitgebers (e.g., light, meals, social interaction) to stabilize the circadian system in CBT-I modified for bipolar disorder. Small improvements in mood symptoms were observed during treatment along with

significant improvements in insomnia (Jernelöv et al., 2022). Harvey et al. (2015) also emphasized entraining the circadian system by integrating elements from interpersonal and social rhythm therapy (e.g., regularizing daytime rhythms such as meal and exercise times) and chronotherapy. Participation in CBT-I was linked to significantly lower hypomania/mania relapse rates and days spent in an episode at a six-month follow-up (Harvey et al., 2015).

Kaplan, Talavera, & Harvey (2018) added morning routine to CBT-I for bipolar disorder to target sleep inertia, defined as "decreased performance or disorientation upon waking that lasts several hours and impairs functioning" (p. 106). Treatment resulted in reduced sleep inertia and increased activity levels in the first hour after awakening (Kaplan et al., 2018). These findings are of interest because 42% of people with bipolar disorder experience sleep inertia (Ohayon et al., 2014) and those with bipolar disorder have lower daytime activity levels than people with insomnia or controls (Harvey et al., 2005). Even so, a systematic review conducted by Bisdounis et al., (2022) signified a need for more research on the use of CBT-I in individuals with bipolar disorder.

Research Gaps

Although much is known about CBT-I, much is still unknown. For instance, adherence has not been well studied. It is important to study the relationship between adherence and treatment response because the level of adherence may increase the effect of treatment outcome, affect how quickly one reaches treatment outcomes, and determine how long outcomes last after treatment ends. However, there is a lack of consensus on how to define adherence, measure adherence, and when to collect adherence data (Agnew et al., 2021; Mellor et al., 2022; Muench et al., 2022).

In addition to measuring adherence, we do not know what degree of adherence is necessary to benefit from CBT-I, whether there is a specific time point in treatment at which adherence is most critical, what factors lead to adherent behavior, and what factors lead to non-adherent behavior (Matthews et al., 2013; Mellor et al., 2022). Also, strategies that may improve adherence—such as setting alarms, sending alerts via text or email, wearing devices that track sleep, and using different terminology (e.g., saying "sleep efficiency training" instead of "sleep restriction")—have not been empirically studied (Muench et al., 2022).

In one study, adherence rates to behavioral CBT-I components are as low as 32-35% for stimulus control therapy, 45-50% for sleep restriction therapy, and 58-70% for relaxation techniques (McChargue et al., 2010). Potential barriers to adherence to behavioral therapies include the counterintuitive idea of limiting sleep to improve sleep, boredom/lack of activities due to delayed bedtime, resistance to getting up early on weekends, increased daytime sleepiness, and fear of disturbing others (McChargue et al., 2010; Vincent et al., 2008). Helping participants develop self-efficacy by providing support and encouragement, having participants self-monitor their experiences with treatment, focusing on improvements, creating action plans, and planning how to cope with anticipated barriers may help clinicians promote adherence to CBT-I (Fetz, 2023).

Another area of CBT-I not well researched is its delivery by clinicians such as nurse practitioners, physician assistants, social workers, and occupational therapists to whom behavioral sleep medicine training and certification has recently been extended (Muench et al., 2022). CBT-I traditionally has been provided by psychologists with clinical degrees and advanced training in behavioral sleep medicine (Perlis, Jungquist, Smith, & Posner, 2008). Although CBT-I has been recognized as a first-line treatment for insomnia, a scarce number of

professionals are qualified to deliver CBT-I in a variety of clinical settings (Manber et al., 2012). Occupational therapists are among those who can be trained to deliver CBT-I and fill the need for sleep services. Leland et al., (2014) argued that multicomponent CBT-I, physical activity interventions, and bright light therapy are within occupational therapy's scope of practice.

Occupational therapists analyze the person, environment, and occupation (e.g., sleep) and consider how variables such as work schedules (e.g., variable shift work), bed partners, daily routines, and premorbid napping affect adherence to CBT-I. Furthermore, because occupations have habitual components and modifying habits can improve health and wellness, Fritz et al. (2020) argued that occupational therapists ought to explicitly integrate habit formation interventions (e.g., goal setting) into practice. They coded occupational therapy interventions using the behavior change taxonomy (Michie et al., 2013) in their scoping review to demonstrate how occupational therapists are already utilizing habit formation. Occupational therapists may also offer unique insights into how engaging in meaningful activities can be used to promote adherence to CBT-I.

In one of the only studies assessing occupational therapist-delivered CBT-I, Eakman et al. (2017) found that multicomponent CBT-I delivered in a community-based setting was found to effectively improve sleep performance and satisfaction in United States veterans. A follow-up waitlist-controlled study demonstrated reductions in sleep latency, nighttime awakening, nightmares, dysfunctional sleep beliefs, stress, depression, and anxiety as well as improvements in sleep efficiency, mindfulness, and participation in meaningful activities (Eakman et al., 2022).

Method

Study Design

The purpose of this study is to explore how a medically complex case responded to CBT-I in a real-world clinic setting based on adherence to treatment recommendations. The current study's design is a mixed-methods case study. Crowe et al. (2011) define a case study as "a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context" (p. 1). Case studies have high external validity since the researchers do not control the intervention the research participant receives, so this design was chosen due to its applicability to clinical practice (Kooistra et al., 2009). The case study design also enables us to include data from multiple sources to gain a multidimensional view of the intervention and client (Baxter & Jack, 2008).

This paper seeks to address the following research questions: How effective is CBT-I for an individual with insomnia comorbid with bipolar disorder? How is CBT-I tailored for an individual with insomnia comorbid with bipolar disorder in a real-world setting? How do we assess adherence to CBT-I delivered by an occupational therapist?

Procedure

The Colorado State University Institutional Review Board approved the study. The client selected for a chart review was recruited for this study through purposive sampling (Portney, 2020). Specifically, we identified a client who had completed CBT-I, had insomnia comorbid with at least two other mental or physical health conditions when seeking treatment for insomnia, and whose records were complete. Informed consent was obtained from the client who received CBT-I to access the client's medical records. Treatment was delivered in a real-world setting at a sleep clinic affiliated with an academic institution in the western United States. Patient-reported outcome measures assessing sleep and mental health-related concerns were completed by the client during treatment (see Figure 1).

Variable	*Construct*	*Number of items; possible score range*	*Interpretation*
Insomnia Severity Index (ISI)	Insomnia severity	7; 0-4	Higher scores indicate more severe insomnia (Bastien et al., 2001).
Epworth Sleepiness Scale (ESS)	Level of daytime sleepiness	8; 0-24	A score of ≥ 16 denotes a high level of daytime sleepiness (Johns, 1991).
Sleep Disorders Symptom Checklist-25 (SDS-CL-25)	Sleep disorders	25; 0-100	Higher scores signal greater likelihood of the presence of a sleep disorder (Klingman et al., 2017).
Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS)	Dysfunctional beliefs and attitudes about sleep	30; 0-300	Higher scores indicate higher levels of dysfunctional beliefs and attitudes about sleep (Morin et al., 1993).
Sleep Hygiene Index (SHI)	Sleep hygiene	13; 0-52	Higher scores point to the presence of more maladaptive sleep hygiene behaviors (Mastin, Bryson, & Corwyn, 2006).
Quick Inventory of Depressive Symptomatology (QIDS)	Depression	16; 0-27	Higher scores imply greater depressive symptom severity (Rush et al., 2003).
Patient Health Questionnaire (PHQ-9)	Depression	9; 0-27	Higher scores indicate increased depression severity (Kroenke, Spitzer, & Williams, 2001).

Figure 1. Patient-Reported Outcome Assessments

The client's case was developed from documents generated by the occupational therapist and client during evaluation and treatment, as well as through interviews conducted with the therapist and client. Data used included service logs which recorded client assessments, the

therapist's intervention, and the client's response to the intervention. The client's consensus sleep diary data were used to evaluate adherence. Specifically, we looked at the following behaviors: 1) Prescribed time to bed (e.g., delaying bedtime until the prescribed time), 2) Prescribed time out of bed (e.g., ending the sleep period at the prescribed rise time), 3) stimulus control at bedtime (e.g., leaving the bed/bedroom if not sleeping), 4) stimulus control at rise time (e.g., leaving the bed-bedroom if not sleeping), and 5) napping. The degree of adherence was measured using the following values: a) ≤ 15 minutes = 2, b) > 15 minutes = 1, and c) > 30 minutes = 0. Higher scores indicate greater adherence to prescribed time to bed, prescribed time out of bed, and stimulus control. Scores were assigned to each of the five behaviors each day. The scores between CBT-I sessions were totaled and divided by the highest scores possible during that time frame to produce a percentage.

In-depth, semi-structured interviews were conducted with the occupational therapist (OT) who provided CBT-I and the client who received CBT-I seven months after treatment cessation. Questions were generated by two of the authors: (EL), who was a graduate student, and (AE) who has advanced research and practice experience in CBT-I. A verbal script was read aloud to the participants to obtain consent to participate in the interviews. The interviews were conducted over Microsoft Teams, recorded, and then transcribed verbatim. The recordings were deleted when transcription was finished. The interview with the OT lasted 45 minutes and the interview with the client lasted 30 minutes.

One researcher (EL) coded the interview transcripts independently generating in vivo, process, and descriptive first-level codes ("The Essential Guide") while AE reviewed the transcripts. The two researchers who reviewed the transcripts then met to discuss the most salient codes and created a list of categories, or common threads running through the codes (Graneheim

& Lundman, 2004). The categories are reported in this manuscript as factors that influence adherence to CBT-I. The accuracy of the categories was then confirmed by the participants.

Case Introduction

Zane (pseudonym) is an African American male who was 28 years old at the time of treatment. When he sought treatment for insomnia, Zane lived alone and attended college.

The OT, Ursula (pseudonym), has been an OT for 17 years and has been providing CBT-I for three years. Ursula received basic training in CBT-I through the Department of Occupational Therapy at Colorado State University. She had treated approximately 15 clients using CBT-I with consultation from an advanced CBT-I practitioner who was also an OT.

Presenting Insomnia Concerns

Zane sought out treatment for insomnia himself. On average, Zane reported sleeping six hours per night. Zane identified non-refreshing sleep as his primary concern. Additionally, Zane reported difficulties with falling asleep and waking too early in the morning. He shared that his goal for treatment was to have a steady schedule so he could plan exercise into his day with work and other activities. Zane said that he had received no prior treatment for insomnia or sleep-related problems. He described having a strong social support network.

History

Zane had been discharged from the military about ten months prior to the time when he sought treatment for insomnia. During his seven-year service in the military, Zane worked as a crew chief doing rotating shift work around the clock and had two-three windows of sleep for three or four hours each. Zane said he had struggled with insomnia since childhood, although he was not aware of a family history of insomnia.

Assessment

During the first session, Ursula determined Zane had chronic insomnia by conducting a clinical interview and administering the Insomnia Severity Index (ISI), the Sleep Disorders Symptoms Checklist-25 (SDS-CL-25), and the Epworth Sleepiness Scale (ESS).

Sleep Diary

A sleep diary was used to assess sleep problems and monitor response to treatment (Carney et al., 2012). Sleep diary variables included: total time in bed (TIB), sleep latency (SL), number of nighttime awakenings (NWAK), wake after sleep onset (WASO), early morning awakenings (EMA), lingering, total sleep time (TST), and sleep efficiency (SE). Zane's baseline sleep diary data showed that it took him ≥ 30 minutes to fall asleep on ≥ three nights per week affirming that he met the criteria for insomnia.

Case Conceptualization

The OT completed a case conceptualization (Manber & Carney, 2015) to assist with treatment planning. Sleep drive concerns included extended time in bed, e.g., lingering in bed in the morning for an average of 46 minutes after his final awakening and daily naps in the afternoon lasting one or more hours. Zane displayed inconsistent time to bed ranging from 10:20pm to 7:45am and time out of bed ranging from 7:45am to 12:15pm. Zane identified himself as a "night owl 100%" and said he stayed awake until feeling sleepy. This was associated with inconsistent alarm use, as he set his alarm clock only three days a week to wake in time for classes. General arousal concerns included worrying and ruminating about his future as well as experiences of feeling "revved up" and having more concentration power. Maladaptive sleep behaviors included playing video games, cell phone use, meditating, and researching interests (i.e., magic and Wicca religious beliefs and practices) until bedtime on top of consuming caffeine (i.e., tea, chocolate) and other substances (i.e., alcohol, cannabis, hookah,

and recreational psychedelics). Medications included 100mg of Lamotrigine daily for mood disorder which could contribute to insomnia (Sadler, 1999). Comorbidities included bipolar disorder (controlled with medication), pain in left hip and side, history of mild traumatic brain injury, bruxism, and possible PTSD. Sleep environment concerns included excess light, a messy/cluttered studio apartment, and use of a sofa for the activities noted above along with sleeping. Of benefit to sleep, Zane reported walking most places and doing light calisthenics in the morning upon waking.

Course of Treatment and Assessment of Progress

Treatment consisted of ten individual sessions of multicomponent CBT-I conducted virtually through Microsoft Teams over a period of 15 weeks. The client completed an electronic sleep diary throughout treatment. Zane had been educated on completing the sleep diary and this as well as sleep/mental health assessments were sent to the OT via encrypted emails. At the time of session one, Zane's ISI = 15, ESS = 12, SDS-CL-25 = 36, SHI = 24, DBAS = 82, and PHQ-9 = 5. The OT adapted and utilized the Manber & Carney (2015) and Perlis et al. (2008) treatment protocols for CBT-I. Behavior change techniques (BCTs) were identified from the service logs and reported for each session, please see Appendix C for definitions.

Session 1

Ursula completed a clinical history for Zane, determined that he met criteria for chronic insomnia, and decided that multicomponent CBT-I was warranted. Zane's baseline sleep diary data yielded an average SE of 81% and a TST of 382 minutes. Zane completed the Sleep Environment Questionnaire and the Motivation for Change Index during the first session. Psychoeducation was provided on CBT-I, contraindications for CBT-I, likely treatment outcomes, the treatment timeline, and filling out the sleep diary correctly. Cognitive therapy

involved gathering information about interests and meaningful activities that could be used to overcome anticipated obstacles such as difficulty staying awake to PTTB.

Session 2

Zane's ESS = 12. His average SE was 82% and his TST was 347 minutes. CBT-I components included in session two were goal setting, sleep scheduling, stimulus control, psychoeducation, and sleep hygiene. Ursula collaborated with Zane to set the following treatment goals: 1) Get up at 10:00am daily and get out of bed right when the alarm sounds (keep alarm across the room so have to get up to shut it off), 2) Go to bed at 2:00am each night, 3) Stay active and engaged all day long, 4) Use the bed for sleep and sex only, 5) If in bed for more than 15 minutes trying to fall asleep or awoken in the middle of the night and awake longer than 15 minutes, get out of bed and do something enjoyable in a different room until sleepy, and 6) Only safety naps/naps as a bank. Goals 1-3 correspond to sleep scheduling and goals 4-6 correspond to stimulus control. Ursula decided sleep restriction therapy—whereby sleep opportunity is limited to average total sleep time—was too risky given Zane's bipolar diagnosis after consulting with a more experienced CBT-I provider, looking at research articles, and talking with Zane's psychiatric nurse. Sleep scheduling was determined to be the safest approach. PTTB and PTOB times were based on Zane's average TTB and his eveningness chronotype. Psychoeducation was provided on sleep stages, Borbély's (1982) Two Process Model of Sleep Regulation, Spielman et al.'s (1987) behavioral model of chronic insomnia development, and bipolar disorder. Sleep hygiene education involved creating a buffer zone and using a sleep mask. BCTs identified were goal setting, self-monitoring, and habit formation.

Session 3

Zane's ESS = 10 and QIDS = 4. His average SE was 94% and TST was 444 minutes. Due the increases in SE and TST, 15 minutes was added to Zane's sleep window for a total of 8.25 hours. PTTB = 1:45am and PTOB = 10:00am. Goals 3-6 remained unchanged. Sleep hygiene education was provided on how substance use impacts sleep. BCTs identified were self-monitoring, review behavior goals, habit formation, feedback on behaviors, and feedback on outcomes of behavior.

Session 4

Zane's ESS = 11 and QIDS = 7. His average SE was 67% and TST was 348 minutes. Due to low SE and TST and changes to Zane's diet/routine caused by a week-long shamanic retreat, Zane's sleep window stayed the same. PTTB = 1:45am and PTOB = 10:00am. Goals 3-6 remained unchanged. Cognitive therapy involved challenging Zane's beliefs about his optimal sleep need. Stimulus control consisted of coming up with mundane activities to do during WASOs and EMAs since goal-oriented behavior is characteristic of bipolar disorder. BCTs identified were self-monitoring, review behavior goals, habit formation, feedback on behaviors, feedback on outcomes of behavior, behavioral experiments, and problem solving.

Session 5

Zane's ESS = 8 and QIDS = 4. His average SE was 91% and TST was 452 minutes. Due to the increases in SE and TST, 15 minutes were added to Zane's sleep window for a total of 8.5 hours. PTTB = 1:30am and PTOB = 10:00am. Goals 3-6 remained unchanged. Cognitive therapy consisted of introducing a constructive worrying worksheet. Stimulus control involved instructing Zane to place his phone, which he used as an alarm, across the room to address lingering concerns. BCTs identified were self-monitoring, review behavior goals, habit formation, feedback on behaviors, feedback on outcomes of behavior, and problem solving.

Session 6

Zane's ESS = 7 QIDS = 4. His average SE was 92% and TST was 474 minutes. Due to increases in SE and TST, 15 minutes were added to Zane's sleep window for a total of 8.75 hours. PTTB = 1:15am and PTOB = 10:00am. Goals 3-6 remained unchanged. Sleep hygiene education was provided on the benefits of keeping a consistent routine given his bipolar diagnosis to entrain his circadian system. BCTs identified were self-monitoring, review behavior goals, habit formation, feedback on behaviors, and feedback on outcomes of behavior.

Session 7

Zane's ESS = 2 and QIDS = 4. His average SE was 91% and TST was 473 minutes. Although Zane's SE and TST remained high, Zane's sleep window stayed the same per his request and because his body did not seem to be using the extra 15 minutes added in the previous session. PTTB = 1:15am and PTOB = 10:00am. Goals 3-6 remained unchanged. Stimulus control instructions were individualized for Zane to enable him to use his bed for breathwork 15 minutes prior to trying to fall asleep since he lived in a studio apartment and the bed was the most comfortable place to meditate with his hip pain. BCTs identified were self-monitoring, review behavior goals, habit formation, feedback on behaviors, feedback on outcomes of behavior, and behavioral experiments.

Session 8

Zane's ESS = 3 and QIDS = 2. His average SE was 89% and TST was 466 minutes. After consulting with a more experienced CBT-I provider, Zane, and the research on sleep in people with bipolar disorder, Ursula removed 15 minutes from Zane's sleep window leaving him with 8.5 hours. PTTB = 1:30am and PTOB = 10:00am. Goals 3-6 remained unchanged. BCTs identified were self-monitoring, review behavior goals, habit formation, feedback on behaviors, and feedback on outcomes of behavior.

Session 9

Zane's ESS = 2 and QIDS = 2. His average SE was 95% and TST was 483 minutes. Although SE and TST improved, Zane requested to return to an 8-hour sleep window to prepare for discharge and for a transition to employment from being a student. PTTB = 2:00am and PTOB = 10:00am. Goals 3-6 remained unchanged. Ursula reviewed Zane's many achievements with him during session nine. BCTs identified were self-monitoring, review behavior goals, feedback on behaviors, and feedback on outcomes of behavior.

Session 10

Zane's ESS = 2 and QIDS = 1. His average SE was 94% and TST was 453 minutes. Zane reported feeling like he had met his sleep goals, so his sleep window stayed the same. PTTB = 1:30am and PTOB = 9:30am. Relapse prevention involved quizzes on CBT-I protocols, education on how to conduct behavioral experiments with one independent variable to explore factors that may impact sleep, training on how to calculate sleep efficiency by hand, and a reminder to expect occasional poor nights of sleep but to restart CBT-I protocols if poor sleep persists for more than two weeks. BCTs identified were self-monitoring, review behavior goals, feedback on behaviors, feedback on outcomes of behavior, and problem solving.

Post-Treatment

Zane's ISI = 1, SDS-CL-25 = 3, SHI = 3, DBAS = 57, and PHQ-9 = 0.

Results

Quantitative Data

Pre-Treatment*					Post-Treatment*				
Variable	**Mean**	**SD**	**Median**	**Range**	**Variable**	**Mean**	**SD**	**Median**	**Range**
SL	35	30	27.5	115	**SL**	17	5.4	15	15
NWAK	1.4	1.9	0.5	7	**NWAK**	0.6	0.8	0	2
WASO	6	7.6	2.5	25	**WASO**	4	5	0	15
EMA	18	34.6	0	60	**EMA**	3	8.7	0	30
TIB	465	116.5	485	443	**TIB**	488	18.3	485	60
TST	354	101.1	367.5	385	**TST**	466	21.7	465	70
SE	80%	12.1	84.9	43.3	**SE**	95%	3	96	8.6

Figure 2. Pre-/Post-Treatment Comparison of Sleep Variables Derived from Sleep Diaries
Note. Means for SL, WASO, EMA, TIB, and TST are expressed in minutes.
(*14-day average)

Figure 2 presents a pre- to post-treatment comparison of sleep variables assessed by the sleep diaries. The numbers are based on a 14-day average. SL decreased by 51% and was well below clinical criteria for early insomnia post-treatment (See Figure 3). NWAK stayed the same. WASO improved slightly but was minimal to begin with. EMA decreased by 83% although 18 minutes at baseline was not a concern to begin with as it is well below the 30-minutes clinical criteria for late insomnia. TIB increased by 105% (23 minutes). TST increased by 132% (112 minutes) (See Figure 4). Although the client spent an additional hour in bed by the end of treatment, he gained almost two additional hours of sleep. SE improved by 119% (See Figure 5). Graphs 1, 2, and 3 display the daily data for SL, TST, and SE respectively. The baseline period consists of the dates 5/25 through 6/22 and the treatment period includes 6/23 through 9/6. Each graph includes a trend line represented by the dotted line.

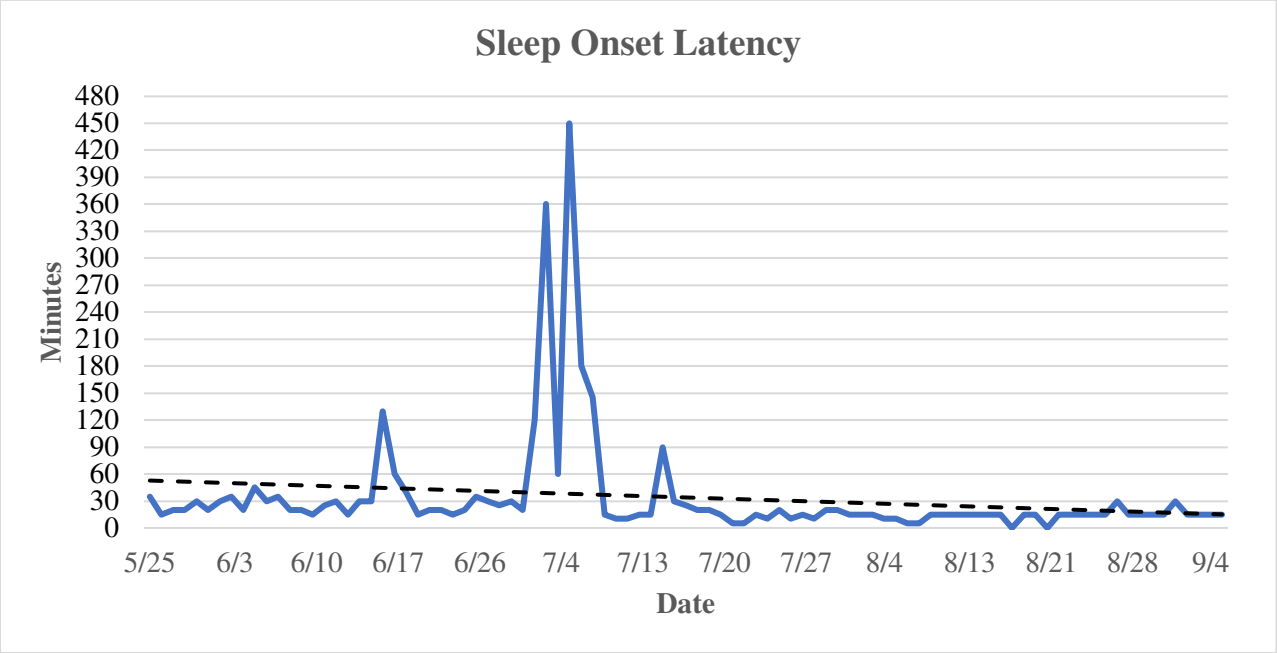

Figure 3. Daily sleep onset latency expressed in minutes.

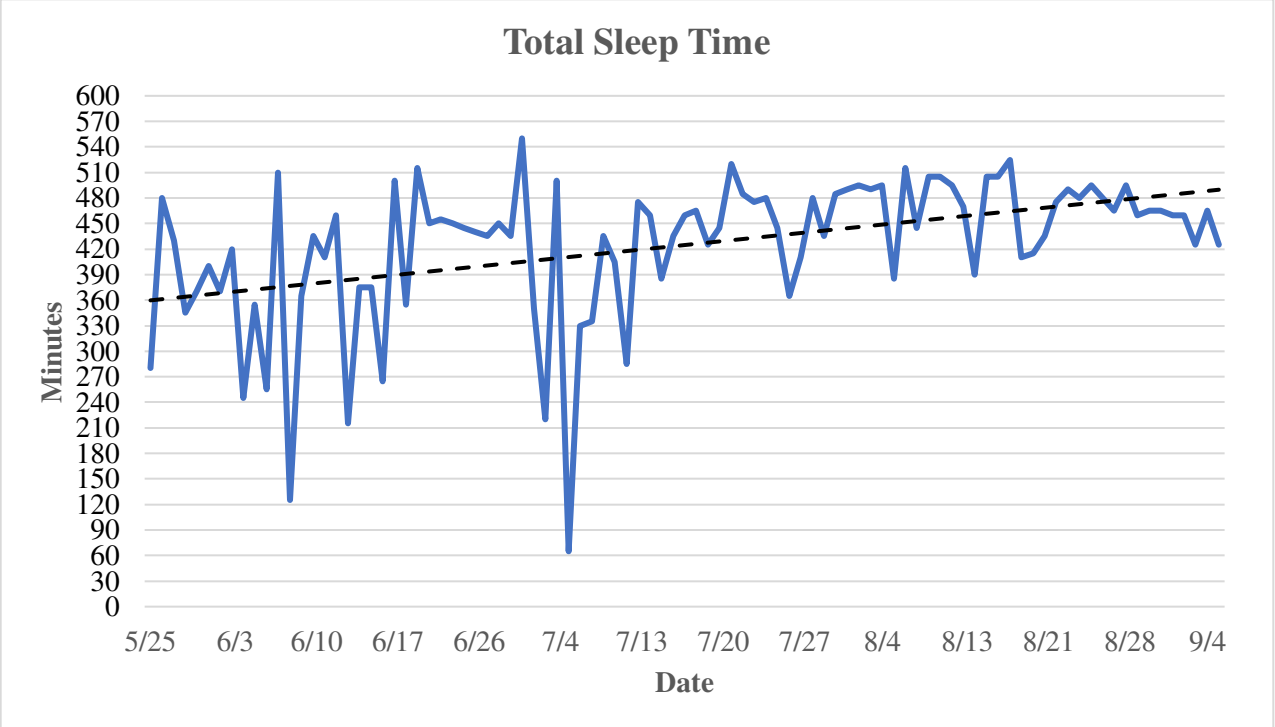

Figure 4. Daily total sleep time expressed in minutes.

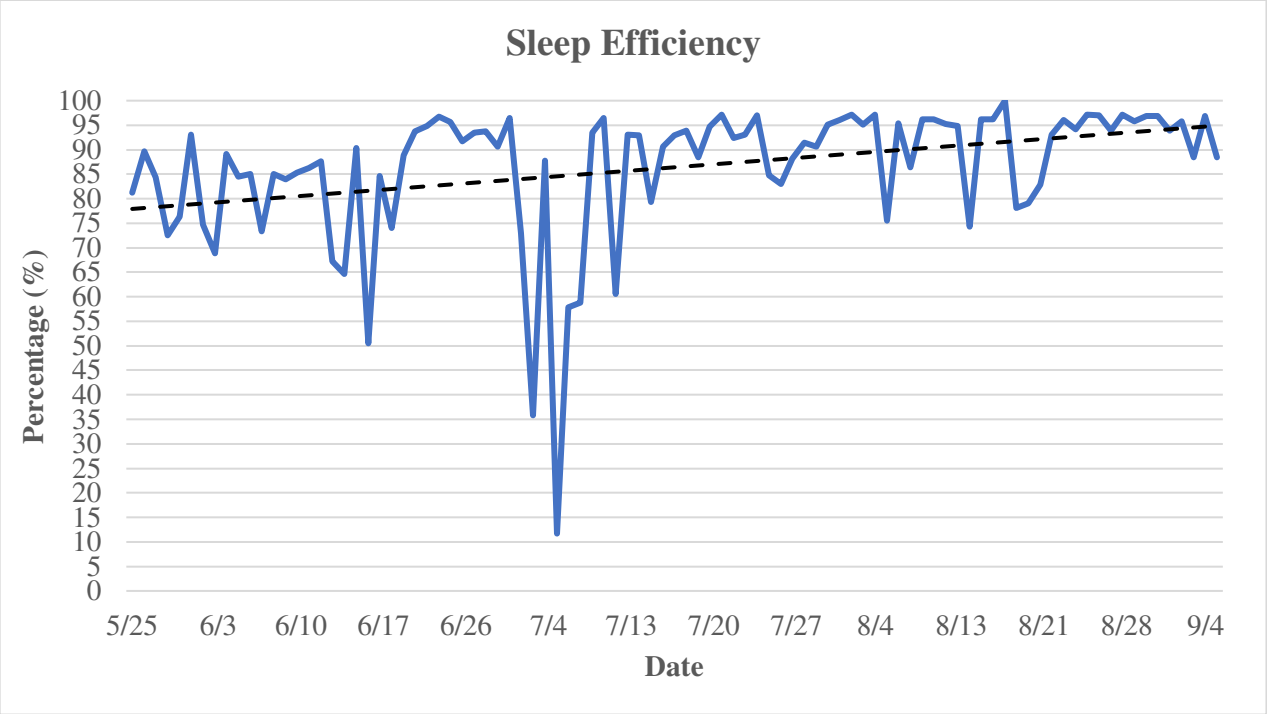

Figure 5. Daily sleep efficiency scores expressed as percentages.

Assessment	Pre-Treatment	Post-Treatment
Insomnia Severity Index	15	1
Epworth Sleepiness Scale	12	2
Sleep Disorders Symptoms Checklist-25	36	3
Dysfunctional Beliefs and Attitudes about Sleep	82	57
Sleep Hygiene Index	24	3
Quick Inventory of Depressive Symptomatology	4	1
Patient Health Questionnaire-9	5	0

Figure 6. Pre/Post-Treatment Scores on Self-Reported Outcome Assessments

Improvements were observed on all self-reported sleep and depression outcome assessments pre- to post-treatment (see Figure 6). Zane's ISI score decreased by 14 points or by 93%. ESS scores improved by ten points representing an 83% decrease. Zane's SDS-CL-25 scores as presented in Table 3 reflect cumulative morbidity for the thirteen sleep disorders the instrument assesses. His cumulative morbidity for sleep disorders decreased by 33 points or by 92%. DBAS scores decreased by 25 representing about a 30% decrease from Zane's baseline score. Zane's SHI score decreased by 21 points or by 88% pre- to post-treatment.

Measures of Adherence

Figures 7-11 represent adherence scores for the five indices included in our measure of adherence: PTTB, PTOB, SCT Bed, SCT Rise, and Napping. Each graph includes a trend line represented by the dotted line. Sleep diary variables during the assessment (baseline) period included three data points to show evidence of a trend (i.e., B1= 7 days, B2 = 9 days, and B3 = 9 days). Treatment sleep diary data variables were determined using the number of days between each respective session (i.e., T1 = 7 days, T2 = 11 days, T3 = 18 days, T4 = 7 days, T5 = 5 days, T6 = 6 days, T7 = 7 days, and T8 = 8 days). Zane filled out his sleep diaries for 93% of the days that spanned treatment.

Zane's average adherence score during the baseline period were as follows: SCT Bed = 44%, SCT Rise = 38%, and Napping = 80%. During the treatment period, SCT Bed = 78%, SCT Rise = 85%, and Napping = 92%. Adherence scores increased by 177% for SCT Bed, 224% for SCT Rise, and 115% for napping between the baseline and treatment periods. As PTTB and PTOB were not set until the second session, we did not have baseline averages to compare treatment averages to. Zane's average adherence to PTTB = 79% and his average adherence to PTOB = 77%. Overall, Zane's average adherence to CBT-I recommendations during the treatment period was 83%.

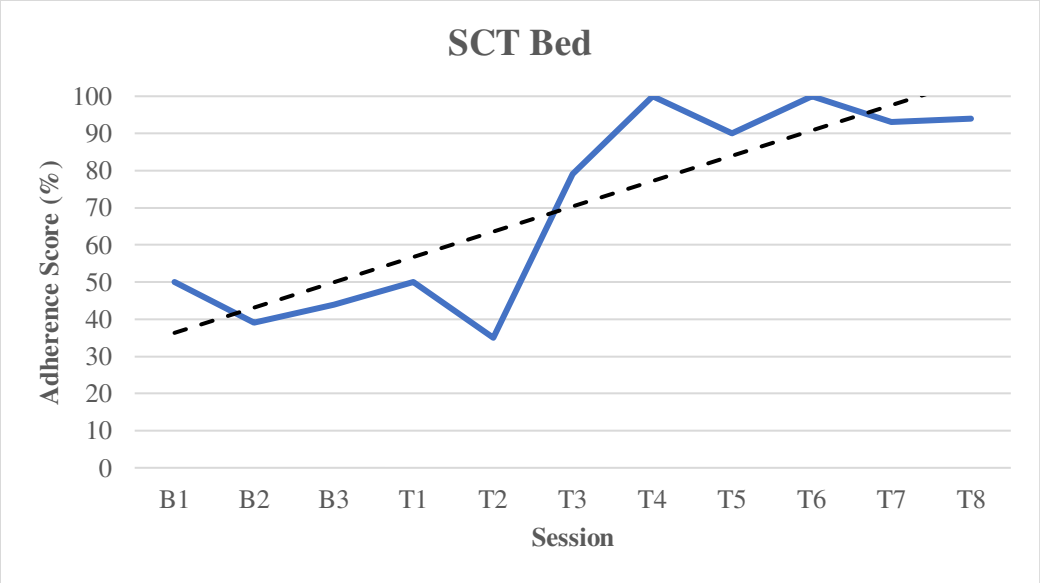

Figure 7. Adherence scores for baseline and treatment data expressed as percentages stimulus control at bedtime (SCT Bed).

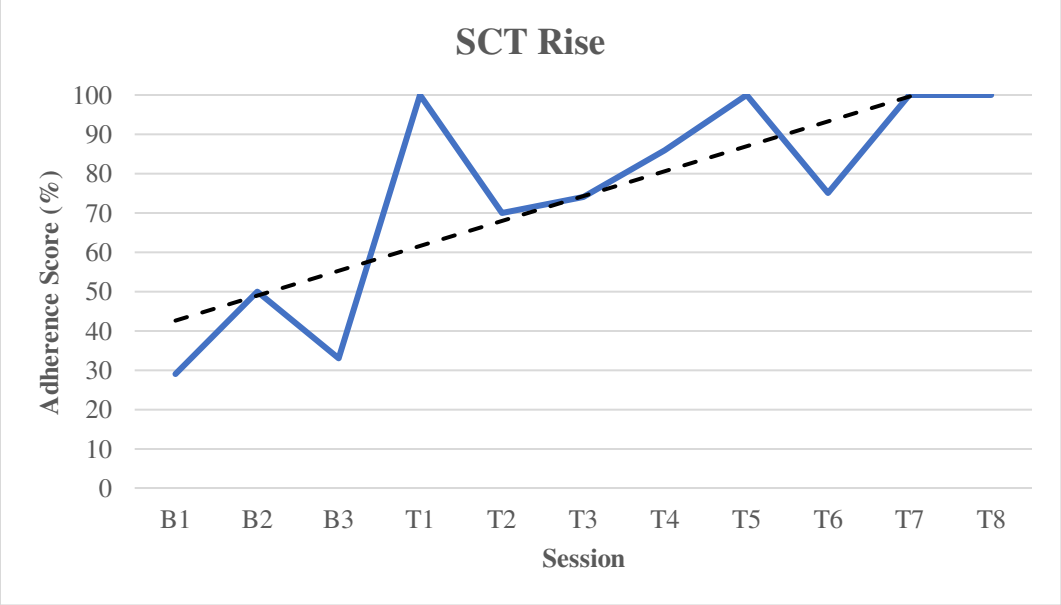

Figure 8. Adherence scores for baseline and treatment data expressed as percentages for stimulus control at rise time (SCT Rise).

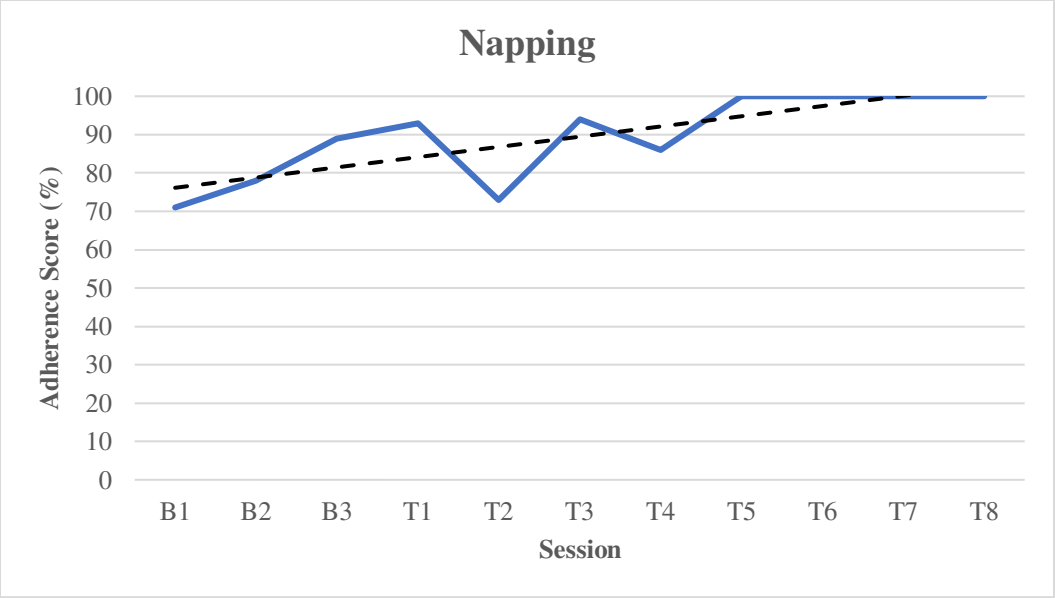

Figure 9. Adherence scores for baseline and treatment data expressed as percentages for napping.

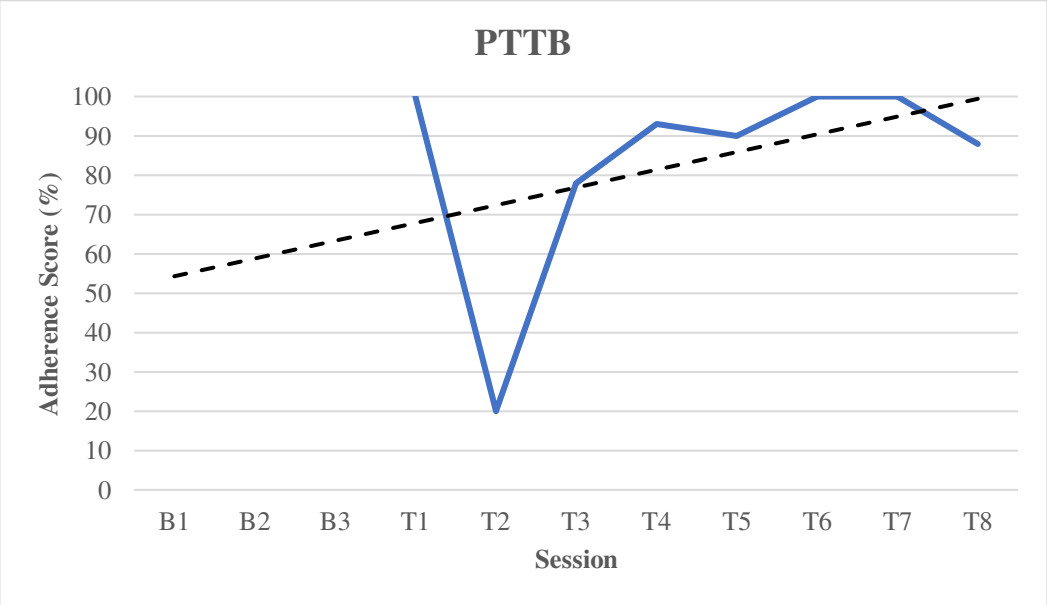

Figure 10. Adherence scores for baseline and treatment data expressed as percentages for prescribed time to bed (PTTB).

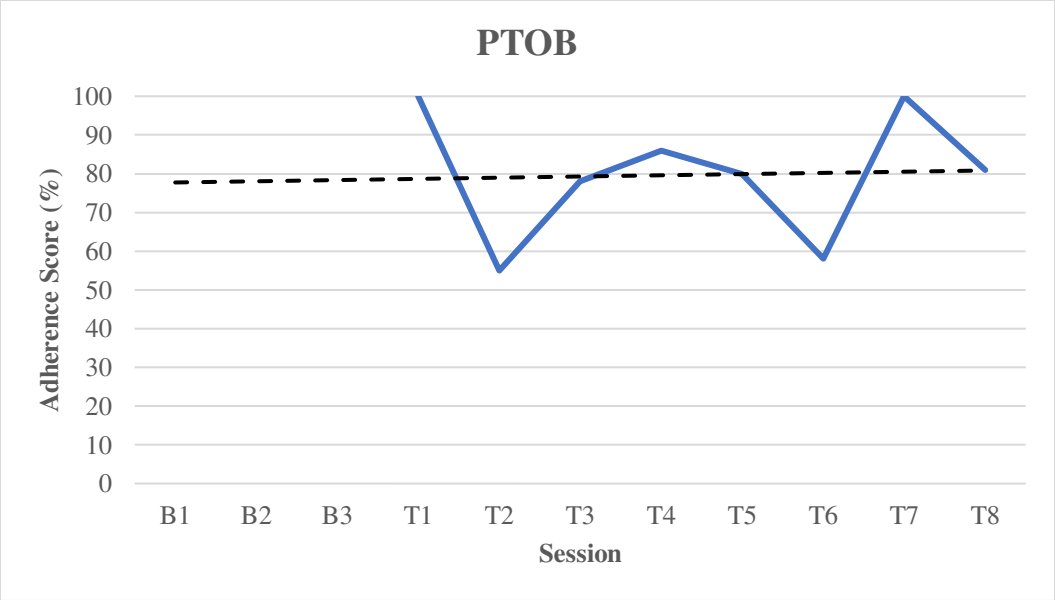

Figure 11. Adherence scores for baseline and treatment data expressed as percentages for prescribed time out of bed (PTOB).

Qualitative Data

Client's Reflections on Treatment

Two factors that contributed to adherence emerged from the interview with the client: 1) high motivation and 2) scheduling and engaging in activities. "High motivation" was conceptualized as having a strong desire to improve sleep and being willing to change habits, whereas the factor "scheduling and engaging in activities" was conceptualized as activities done at specific times to promote sleep.

High Motivation.

Zane was highly motivated. On the Motivation for Change Index administered during session one, Zane said that he would be willing to invest up to ten hours per week in the treatment process, to wait up to ten weeks for the treatment to fix his insomnia, and to get 100% worse before he got better demonstrating high motivation to do CBT-I. Zane's responses during the interview reiterated his willingness and desire to follow through with the treatment process.

First, he was taking actions toward improving his sleep, health, and well-being: "I was doing a whole bunch of stuff to heal myself of any ailments." In addition to undergoing CBT-I, Zane was also seeking help from his psychiatric nurse at the VA, a chiropractor, a shaman, and an occupational therapist specializing in improving cognitive performance. His readiness for change likely helped him adhere to treatment recommendations.

Zane's motivation is also evident based on how he invested time in reflecting on his experience receiving CBT-I:

> I had a marker for planning my day even when I didn't have classes, so that was actually helpful…I figured it out because I was taking notes personally myself on how I felt while I was doing the CBT-I and stuff. Just a mental [exercise], but I shared most of this stuff with the therapist anyway, most of my personal findings.

By reflecting on how CBT-I made him feel, Zane was able to come up with strategies to help him reach his goals (i.e., planning his day). He also seems to have realized that sharing his findings with the therapist would give her a better understanding of how to help him sleep better which likely contributed to his adherence as well.

Finally, Zane's willingness to make lifestyle/behavioral changes speaks to his motivation: "[The therapist] was like '[Zane], you're a rockstar!' because I was following her directions to the letter." This quote demonstrates that Ursula had earned Zane's buy-in. Once he believed that CBT-I would work, and started experiencing results, Zane likely became more motivated to complete treatment as evidenced by his close adherence to CBT-I protocols.

Scheduling and Engaging in Activities.

Activities were used to bookend Zane's PTTB and PTOB as well as support building of sleep drive during the day. One of Zane's presenting concerns was difficulty with initiating sleep, so as part of CBT-I, he was instructed to create a buffer zone. Zane listed washing dishes, chilling on his balcony, going for a walk, reading a book, and listening to music as buffer zone

activities that helped him unwind. Previously, he had spent the time leading up to bed playing video games and using his cell phone. Yet once he created a buffer zone, he became aware of how his body was responding to CBT-I in positive ways:

> Around midnight, my body would start to get tired, and then it became by around 11, because my body was gonna go to sleep in like a couple hours. So, it just started, the gears of slowing down around like [at] 11 or 12. I knew I'd be able to fall asleep soon.

In addition to improvements in his body's ability to produce sleep, Zane also noticed improvements in energy and cognition as evidenced by Ursula quoting Zane as saying that he feels "More alert as of late, really good, actually better than good! More driven, clearer thoughts and decision-making" during the ninth session. Positive feedback from his body showed Zane that CBT-I was working, likely increasing his desire to adhere.

Although Zane noticed improvements, he still had difficulty adhering to certain CBT-I components. For example, Zane said one of his major challenges with adherence to CBT-I was getting up in the morning. To help him adhere to his prescribed rise time, he engaged in activities:

> Doing something after getting up was helpful. I would like take a shower. That's the first thing I always do is like take a shower and do some self-care stuff. Take my shower, wash my face, brush my teeth. You know, stuff like that. Make a lunch if I wanna make a lunch or anything. Fill my water bottle up. And then get ready for class usually.

Another challenge was being tired enough to go to sleep at his PTTB because he occasionally becomes very stimulated before bed. To overcome this challenge, he said, "So [I] just expend more energy and stuff, so a lot more thinking stuff, a lot more writing. Uh, creative exercises or working out a little bit more than normal. Spending more time outside in the sun." Here Zane demonstrates an understanding of how he can apply knowledge about the circadian

system (e.g., exposure to sunlight) and the sleep driver system (e.g., increased physical activity) to promote better sleep through engagement in activities.

Establishing a consistent daily routine is key to improving sleep, but also to managing bipolar disorder (Frank et al., 2005). The emphasis on creating routines helped Zane gain control of his sleep as well as his day:

> CBT-I was absolutely fantastic too, because it helped me regulate my day…I wanted to regulate my day because I was pretty much sleeping through most of my day because I didn't have a very clear schedule. Like I have my classes and stuff, but I didn't know how to regulate time…So when I got a decent sleep schedule, it became a lot easier to adjust my day and like, schedule my day.

With his classes being the only structured part of his day prior to CBT-I, Zane said that his prescribed sleep schedule was "super doable." Once he established a consistent sleep schedule, Zane was able to schedule other activities as well, such as eating meals. In the Motivation for Change Index, Zane reported that his insomnia was preventing him from "keeping a decent eating schedule" among other things. During CBT-I, he developed a schedule for his meals and noticed how keeping consistent mealtimes benefited his sleep:

> At 2:00pm and like, between 7:00 or 8:00pm is when I'd have my two meals. And my lunches would be heavier than my dinners. So my dinner would be pretty light for the most part, so it made it super easy to digest and then fall asleep and stuff.

As an added bonus, scheduling his meals seems to have helped with his acid reflux issues too.

Therapist's Reflections on Treatment

A therapeutic relationship between client and therapist emerged as a factor that positively influenced adherence to CBT-I from the interview with the therapist. Cole & McLean (2003) linked therapeutic relationships to positive treatment outcomes. We borrow their definition of a therapeutic relationship as "a *trusting* connection and *rapport* established between therapist and client through *collaboration*, *communication*, therapist empathy, and mutual understanding and

respect" (Cole & McLean, 2003, p. 44). Many of these features surfaced in the interview with the OT.

Ursula said that she and Zane "clicked pretty immediately," but she discussed using humor to build rapport:

> I used the whiteboard [as one of my teaching modalities]. I am not an artist, so that generated some laughter…I also would employ occasional mini quizzes during the education sessions to see if he was paying attention, used with humor of course.

Ursula collaborated with Zane as part of her decision-making process. During the initial treatment session, Ursula combined her own clinical reasoning with Zane's input when deciding whether to pursue CBT-I as demonstrated by the following quote: "He fit the decision tree first off…and he fit the criteria of the 30 30 30…he wanted to proceed with treatment, so we moved ahead." By "30 30 30," Ursula is referring the commonly used threshold of 30 or more minutes to fall asleep and/or wakefulness after sleep onset to determine abnormal sleep (Perlis et al., 2008). And towards the end of treatment, Ursula's collaboration with Zane factored into the clinical reasoning behind her decision first to reduce his time in bed and then to discharge him:

> He was making significant strides and improvements. And working with him near the end, he was dictating well. Like, "I would like to try…" at the very end. I think he wanted to try going back down to 8 hours because he had gone up to like 8 ¾… he was also trying to figure out, am I going to shift from being a student to being employed? If I'm going to be employed, then I need to be thinking about maybe more of an 8-hour sleep schedule versus 8 ¾.

Ursula was conscientious about how she communicated with Zane and ensured that she provided rationale for her decisions:

> I tried not to just, 'You must do this,' but explain why it's important, why it helps his circadian system, how building routines help with other aspects of his life. And I think he was so willing to buy in that he was able to get that positive feedback quickly and then he understood.

By 'positive feedback,' we believe Ursula is referring to improvements in SE, TST, and SL.

Discussion

We set out to explore how a medically complex case responded to CBT-I in a community-based setting based on adherence to treatment recommendations. To determine whether our study fulfilled this purpose, we will first consider how effective CBT-I was in terms of Zane's sleep improvements. Then, we will describe how CBT-I was tailored for a client with bipolar disorder in a real-world setting. Finally, we will discuss how adherence to CBT-I delivered by an occupational therapist can be assessed.

Effectiveness of CBT-I for Insomnia Comorbid with Bipolar Disorder

We turn to our quantitative data to answer our first research question: How effective is CBT-I for an individual with insomnia comorbid with bipolar disorder? The most notable improvements in sleep variables derived from sleep diary data were in SE, TST, and SL. Zane's SE improved from 80% to 95%. A post-treatment SE of 95% is within the ideal SE range of ≥ 90 identified by Spielman, Yang, & Glovinsky (2011). Zane's TST improved by almost two hours. These findings are important because Zane reported sleeping an average of six hours per night, but after receiving CBT-I, he slept an average of 7 ¾ hours per night which meets his body's sleep need based on his sleep efficiency scores. Additionally, Zane presented with difficulties falling asleep, taking about 35 minutes to do so. By the end of treatment, his average SL was 17 minutes which is under the clinical threshold for early insomnia.

Zane's pre-treatment score on the ISI of 15 signifies clinical insomnia of moderate severity whereas his post-treatment score of 1 indicates no clinically significant insomnia (Bastien et al., 2001). A greater than or equal to decrease in 9 points on the ISI indicates marked improvement (Morin et al., 2011) and Zane's ISI score decreased by 14 points demonstrating greater than marked improvement.

Patel et al., (2018) estimated the minimum clinically important difference of the ESS is a decrease in score by two or three points. Zane's ESS score improved by ten points signifying a substantial improvement in daytime sleepiness. Daytime sleepiness can lead to the impairments in social, occupational, and academic functioning that characterize insomnia disorder (APA, 2013), but Zane's improvements indicate that he no longer meets this criterion for insomnia.

Zane's SDS-CL-25 cumulative morbidity score for sleep disorders decreased by 33 points pre- to post-treatment. Breaking it down by individual sleep disorders, Zane's pre-treatment scores were clinically relevant (e.g., items assessing these disorders averaged in the "3-5 times per week" and "> 5 times per week" frequencies) for insomnia disorder, fatigue, delayed sleep phase syndrome, shiftwork sleep disorder, and sleep insufficiency disorder (Klingman et al., 2017). His post-treatment scores were negative for all sleep disorders.

Although Zane's DBAS score decreased by 25 points, his post-treatment score of 57 is well above the cutoff score of 34.9 identified by Smith & Trinder (2001) as differentiating those with insomnia from those without insomnia. The DBAS gives clinicians insight on how to approach cognitive therapy with clients. Cognitive therapy is premised on Morin's (1993) microanalytic model of chronic insomnia. The model posits that sleep-related cognitions feed into a vicious cycle of emotional distress, insomnia, and maladaptive habits (Morin & Bélanger, 2011). Cvengros et al. (2015) found an association between fewer dysfunctional beliefs and better adherence to PTTB and PTOB. These findings are interesting then, when dysfunctional sleep beliefs are related to the perpetuation of insomnia and poorer adherence. Perhaps in this case, a score of 57 was still sufficient to result in improvements in sleep.

Zane's SHI score decreased by 21 points pre- to post-treatment. Seun-Fadipe et al. (2018) identified 16 as a suitable cutoff score for categorizing students who experienced good or poor

sleep quality using the SHI. Using this metric, Zane's pre-treatment score of 24 fits in the poor sleep quality category and post-treatment score of 3 fits in the good sleep quality category.

CBT-I Tailored for Bipolar Disorder in a Real-World Setting

Our case study yielded several answers to our second research question: How is CBT-I tailored for an individual with insomnia comorbid with bipolar disorder in a real-world setting?

First, participants in experimental research studies receive CBT-I that has been standardized in terms of number of sessions, frequency of sessions (e.g., weekly), content, provider, etc. which is not always representative of real-world practice. CBT-I typically consists of four to eight sessions in randomized clinical trials, but factors such as presence of comorbidities and adherence may increase or decrease the number of sessions needed in a natural context (Manber & Carney, 2015). In this case, the client received ten individual sessions of CBT-I conducted over Microsoft Teams. Treatment spanned a period of 15 weeks due to client and therapist availability and there was one session where a different therapist had to substitute for the main one. Furthermore, the client presented with a variety of comorbidities (e.g., bipolar disorder, mild traumatic brain injury, bruxism, etc.).

Second, the multicomponent CBT-I package was individualized for the client based on a case conceptualization (Manber & Carney, 2015). For instance, rather than sleep restriction therapy or sleep compression, the occupational therapist opted to use sleep scheduling. Sleep scheduling, where consistent bed and rise times were set based on average time in bed, was deemed safer than sleep restriction therapy due to research demonstrating associations between sleep deprivation and manic/depressive symptoms (Barbini et al., 1996; Bauer et al., 2006; Gruber et al., 2009; Leibenluft et al., 1996) and consultation with a more experienced CBT-I provider. Consistent with prior research (Jernelöv et al., 2022; Kaplan & Harvey, 2013),

scheduled sleep combined with other components of CBT-I (e.g., stimulus control) proved to be sufficient for treating insomnia comorbid with bipolar disorder.

Other components of CBT-I were used in addition to sleep scheduling. Cognitive therapy in the form of worry management was used to address rumination before bed. Sleep hygiene was included to introduce creating a buffer zone because Zane reported experiencing feeling "revved up" before bedtime which would increase his sleep latency. Stimulus control was utilized to address excessive time spent in bed using electronics and lingering after awakening. Psychoeducation on the two-process model of sleep regulation and insomnia perpetuating factors as well as relapse prevention were also included as treatment elements.

Third, Zane's initial PTTB (i.e., 2:00am) and PTOB (i.e., 10:00am) were set with his chronotype in mind which likely contributed to his adherence. Early on, Zane identified himself as a night owl and his scores on the SDS-CL-25 indicated some symptoms of delayed sleep phase disorder were present. For example, Zane indicated item 8 (i.e., "I sleep better if I go to bed late (after 1am) and wake up late (after 9am)") occurs 3-5 times per week. This is not surprising given literature examining associations between bipolar disorder and delayed sleep phase tendencies and a preference for the eveningness chronotype (Ritter et al., 2012; Giglio et al., 2010).

Fourth, depressive symptom severity was monitored throughout treatment given depression is a factor that may limit adherence. Depressive disorder was associated with attrition during an online treatment program for insomnia (Hebert, Vincent, Lewycky, & Walsh, 2010). Manber et al. (2011) found that patients with high depressive symptom severity have poorer adherence to the behavioral components of CBT-I—especially to a fixed rise time and to decreasing the amount of time spent in bed—than those with low depressive symptoms.

Moreover, greater adherence was associated with greater reductions in post-treatment ISI scores (Manber et al., 2011). Zane's depression was monitored by the QIDS and PHQ-9. Rush et al. (2003) determined a remission cutoff score of ≤ 6 for the QIDS. Zane's baseline score of 4 indicated that he was already in remission. Nonetheless, minimal improvements in his QIDS score were observed post-treatment. A baseline score of 5 signals mild depression severity on the PHQ-9, but a post-treatment score of 0 is in the minimal severity range (Kroenke et al., 2001). It is uncertain if such modest improvements had any effect on adherence, especially given depression symptoms were relatively low at the start of treatment.

Assessing Adherence to CBT-I delivered by an Occupational Therapist

Our third research question was: How do we assess adherence to CBT-I delivered by an occupational therapist? As was previously stated, adherence may influence treatment outcome intensity, speed with which treatment outcomes are reached, and how long treatment outcomes are maintained. Since there is no standardized way to measure adherence to CBT-I (Mellor et al., 2022), it is first necessary to discuss our approach.

Zane's post-treatment adherence scores were as follows: SCT Bed = 78%, SCT Rise = 85%, Napping = 92%, PTTB = 79%, and PTOB = 77%. His global post-treatment adherence score was 83%. Our findings were consistent with prior research (Bouchard, Bastien, & Morin, 2003; Perlis et al., 2004) in that adherence seems to follow a linear trend with improvement and was associated with improved outcomes. For example, improvements in adherence to prescribed time out of bed were associated with lower rates of insomnia.

Although clients have not been instructed follow stimulus control principles during the baseline period, including baseline data in our measure of adherence gives clinicians an idea of which maladaptive behaviors need to be targeted by CBT-I (e.g., spending excessive time in bed

before trying to fall asleep). Including baseline data also enables us to make pre- and post-treatment comparisons. For instance, SCT Bed and SCT Rise are low during the baseline period when Zane engaged in electronics use and rumination in bed prior to his bedtime and lingering upon awakening. Zane finished treatment with 100% adherence to Napping and SCT Rise indicating that Zane had replaced his maladaptive sleep behaviors and that he was receiving higher quality sleep no longer needing to nap and linger in bed to catch up on lost sleep.

Our approach permits us to examine relationships between sleep diary-derived sleep variables (e.g., SE) and adherence. For example, when Zane received his initial PTTB and PTOB at T1, he was 100% adherent to PTTB, PTOB, and SCT Rise during the week leading up to his next session which led to a large improvement in SE.

Additionally, we can examine the relationship between adherence and titration of the client's sleep window. For instance, during T2—when Zane attended a shamanic retreat causing changes in his diet and routine—decreases in adherence to all five indices were observed and the therapist kept Zane's sleep window the same instead of adding or subtracting 15 minutes. Therefore, our adherence indicator reflects seems to have captured aspects of adherence integral to timing of opportunities for sleep.

The cutoff times used in our measure of adherence of 15 and 30-minute intervals are based on clinical judgment. While these times have not been standardized, other studies have utilized similar cutoff times (Dong et al., 2017; Matthews et al., 2012; Perlis et al., 2004). In addition, 15- and 30-minute time intervals are common in CBT-I components. For example, clients are usually asked to follow the quarter-hour rule (i.e., leaving the bed if it takes more than 15 minutes to fall asleep) for stimulus control (Bootzin & Perlis, 2011) and time in bed is

typically increased by 15 or 30 minutes in sleep restriction therapy protocols (Spielman, Yang, & Glovinsky, 2011).

Our approach to measuring adherence has a couple advantages over existing approaches. First, many clinical studies use proportions of participants adherent in a given week and do not account for within person adherence (Bouchard, Bastien, & Morin, 2003; Cvengros et al., 2015; Matthews et al., 2012; Perlis et al., 2004). Accounting for within person adherence affords us the opportunity to investigate individual variations in adherence over time. Second, many clinical studies use a categorical measure of adherence (i.e., adherent vs. non adherent; Bouchard, Bastien, & Morin, 2003; Cvengros et al., 2015; Matthews et al., 2012; Perlis et al., 2004) but ours is a continuous measure enabling us to address questions related to "fractionating doses" of CBT-I (Muench et al., 2022) since differences in levels of adherence may be meaningful in terms of outcomes. Reporting adherence in percentages allows us to use the continuous variable we developed (i.e., 0, 1, 2) and weekly percentages permit more detail related to the degree of adherence exhibited by the individual. A range of percentages could represent a certain level of adherence. For example, 0-19 = very low adherence, 20-39 = low adherence, 40-59 = moderate adherence, 60-79 = high adherence, and 80-100 = very high adherence. Using this metric, Zane's overall adherence to CBT-I falls within the very high adherence range.

We will now transition to the second half of the research question concerning occupational therapist-delivered CBT-I. Occupational therapists use occupations therapeutically "to promote health, well-being, and participation in life" (American Occupational Therapy Association, 2020, p. 17). Occupations are everyday activities that occupy time and give life meaning. Occupational therapists can use occupations to support engagement in other occupations as demonstrated in this case study. Activity routines were implemented to bookend

Zane's prescribed sleep window and helped him adhere to PTTB and PTOB. To help him prepare to sleep, Zane engaged in relaxing activities to unwind (e.g., listening to music). To help him get out of bed in the morning, he did self-care activities (e.g., taking a shower). He also engaged in activities during the day to build his sleep drive by staying active and engaged (e.g., working out, spending time outside, etc.). These daytime activities likely helped entrain Zane's circadian and sleep driver systems.

Developing and upholding therapeutic relationships with clients by taking a client-centered approach to service delivery is essential to the occupational therapy process (AOTA, 2020) due to positive relationships between client-centered care and clinical outcomes, client satisfaction, and client well-being (Rathert, Wyrwich, & Boren, 2013). Adherence may serve as a mediator in the relationship between client-centered care and outcomes (Zandbelt et al., 2007). Our interview with the OT who delivered CBT-I revealed that a therapeutic relationship supports adherence. The collaborative aspect of the therapeutic relationship may be particularly important. As Cvengros et al. (2015) suggest, clients may engage in non-adherence to reassert personal control over sleep if they feel a lack of control due to dysfunctional beliefs (e.g., "I can't ever predict whether I will have a good or poor night's sleep.") and/or due to the therapist prescribing bed and rise times. Therefore, collaboration may promote adherence by affording clients some control.

Zane adhered closely to CBT-I protocols and came into treatment highly motivated based on his Motivation for Change Index responses as well as what he said during the interview. Studies have found a correlation between motivation to change sleep behaviors and adherence to sleep restriction (Matthews et al., 2012) and sleep hygiene recommendations (Hebert et al., 2010). Another study included motivational interviewing as a component of CBT-I

(Harvey et al., 2015). Motivating clients to change their sleep behaviors is one piece of the adherence puzzle and forming sleep-promoting habits is another.

Through the process of qualitative data analysis, behavioral change techniques (BCTs) emerged as a central aspect of CBT-I utilized by the OT. CBT-I is a habit formation intervention since it involves creating sleep-promoting habits such as setting a consistent sleep schedule. BCTs can be used to help people form habits (Fritz et al., 2020). Michie et al. (2013) created a taxonomy of 93 BCTs organized into groups. Using this taxonomy, a variety of BCTs were identified from the service logs generated by the OT in this study: goal setting, self-monitoring, habit formation, review behavior goals, feedback on behaviors, feedback on outcomes of behavior, behavioral experiments, and problem solving. Goals and planning (which includes goal setting, problem solving, and reviewing behavior goals) and feedback and monitoring (which includes feedback on behavior, self-monitoring of behavior, and feedback on outcomes of behavior) emerged as the two most prominently featured groups of BCTs featured in CBT-I. Six goals were set in terms of behaviors to be achieved (e.g., Get up at 10:00am daily) during session two. Filling out sleep diaries to record bed and rise times was a form of self-monitoring that enabled Zane to see if he was achieving his goals. Habit formation came into play as Zane followed treatment recommendations in the same context (i.e., his studio apartment) night after night. Ursula reviewed Zane's behavior goals during each ensuing session and modified his PTTB based on his SE. The therapist gave Zane feedback on his behavior (e.g., 'You stayed in bed for more than 30 minutes after your final awakening four days last week.') and feedback on outcomes of behavior (e.g., 'Your sleep efficiency improved from 80% to 94% this week! Building more consistency into your routine seems to have really helped.'). Behavioral experiments were conducted to determine Zane's body's sleep need by testing different sleep

windows and collecting data from the sleep diaries on how his body utilized that time. Zane was prompted to problem solve mundane activities (e.g., stretching) he could do to facilitate a return to sleep after a long WASO or EMA (See Appendix C for BCT definitions.).

Strengths and Limitations

This study has several strengths. First, we introduce a continuous measure of adherence that clinicians can use to assess degree of adherence to CBT-I protocols. Second, the reliability and validity of our results are improved by data triangulation as we cross-referenced data from multiple sources (i.e., sleep diaries, service logs, pre-/post-treatment assessments, and interviews). Third, we asked study participants to confirm the accuracy of our findings.

Nonetheless, our study has some limitations. First, objective measures of sleep quality—such as polysomnography and actigraphy—were not used to measure sleep outcomes. Second, our measure of adherence assessed adherence only to the behavioral components of CBT-I. Others have recommended assessing adherence to the cognitive components of CBT-I as well (Manber et al., 2011). Future research should also evaluate adherence to behaviors that promote sleep onset like meditation (Cvengros et al., 2015) or sleep routines (Bouchard, Bastien, & Morin, 2003). Third, our measure of adherence does not account for stimulus control during WASO. To address this issue, the sleep diary should be updated with sections labeled WASO-In and WASO-Out for clients to record time awake in the middle of the night in and out of bed (Muench et al., 2022). Fourth, we asked the therapist and the client to recall events that happened seven months ago lowering the quality of our interview data due to potential memory errors. Fifth, some of the interview questions we asked were leading questions and were influenced by our bias toward the power of engaging in activities to influence health and well-being (Wilcock, 2006). Sixth, no follow-up data was collected after treatment ended to determine if the effects of

CBT-I were maintained. Seventh, the client engaged in other health/wellness services during treatment that may have contributed to improvements in sleep.

Conclusion

The purpose of this study was to explore how a medically complex case responded to CBT-I in a community-based setting based on adherence to treatment recommendations. We also added to the literature on CBT-I delivered to individuals with bipolar disorder, occupational therapist-delivered CBT-I, and the relationship between adherence and treatment response. Although there are risks associated with sleep restriction therapy in individuals with bipolar disorder, CBT-I can be safely and effectively delivered when sleep restriction therapy is replaced with scheduled sleep. Occupational therapists can help meet a need for more CBT-I providers and can contribute the use of activities and habit formation strategies to CBT-I interventions. Our client was highly adherent to CBT-I protocols and major improvements in his sleep were observed.

References

Agnew, S., Vallières, A., Hamilton, A., McCrory, S., Nikolic, M., Kyle, S., Fleming, L., & Crawford, M. R. (2021). Adherence to cognitive behaviour therapy for insomnia: An updated systematic review. *Sleep Medicine Clinics, 16*(1), 155-202. https://doi.org/10.1016/j.jsmc.2020.11.002

American Occupational Therapy Association. (2020). Occupational therapy practice framework: Domain and process (4th ed.). *American Journal of Occupational Therapy*, *74* (Suppl. 2), 7412410010. http://doi.org/10.5014/ajot.2020.7452001

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). http://doi.org/10.1176/appi.books.9780890425596

Arnedt, J. T., Conroy, D. A., Mooney, A., Furgal, A., Sen, A., & Eisenberg, D. (2021). Telemedicine versus face-to-face delivery of cognitive behavioral therapy for insomnia: A randomized controlled noninferiority trial. *Sleep Research Society, 44*(1), 1-11. Doi:10.1093/sleep/zsaa136

Barbini, B., Bertelli, S., Colombo, C., & Smeraldi, E. (1996). Sleep loss, a possible factor in augmenting manic episode. *Psychiatry Research, 65*(2), 121-125. https://doi.org/10.1016/S0165-1781(96)02909-5

Bastien, C. H., Vallières, A., & Morin, C. M. (2001). Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Medicine, 2*(4), 297-307. https://doi.org/10.1016/S1389-9457(00)00065-4

Bauer, M., Grof, P., Rasgon, N., Bschor, T., Glenn, T., & Whybrow, P. C. (2006). Temporal relation between sleep and mood in patients with bipolar disorder. *Bipolar Disorders, 8* (2), 160-167. https://doi.org/10.1111/j.1399-5618.2006.00294.x

Baxter, P. & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13*(4), 544-550. http://doi.org/10.46743/2160-3715/

Bisdounis, L., Saunders, K. E. A., Farley, H. J., Lee, C. K., McGowan, N. M., Espie, C. A., & Kyle, S. D. (2022). Psychological and behavioural interventions in bipolar disorder that target sleep and circadian rhythms: A systematic review of randomized controlled trials. *Neuroscience and Biobehavioral Reviews, 132*, 378-390. http://doi.org/10/1016/j.neubiorev.2021.12.002

Bootzin, R. R. & Perlis, M. L. (2011). Stimulus control therapy. In M. Perlis, M. Aloia, & B. Kuhn (Eds.), *Behavioral Treatments for Sleep Disorders: A Comprehensive Primer of Behavioral Sleep Medicine Interventions* (1st ed., pp. 21-30). San Diego, CA: Elsevier.

Borbély, A. (1982). A two-process model of sleep regulation. *Human Neurobiology, 1*, 195-204.

Bouchard, S., Bastien, C., & Morin, C. M. (2003). Self-efficacy and adherence to cognitive-behavioral treatment of insomnia. *Behavioral Sleep Medicine, 1*(4), 187-199. https://doi.org/10.1207/S15402010BSM0104_2

Burton, W. N., Chen, C.-Y., Schultz, A. B., & Li, X. (2017). Association between employee sleep with workplace health and economic outcomes. *Journal of Occupational and Environmental Medicine, 59*(2), 177-183. Doi: 10.1097/JOM.0000000000000934

Carney, C. E., Buysse, D. J., Ancoli-Israel, S., Edinger, J. D., Krystal, A. D., Lichstein, K. L., & Morin, C. M. (2012). The consensus sleep diary: Standardizing prospective sleep self-monitoring. *Sleep, 35*(2), 287–302. https://doi.org/10.5665/sleep.1642

Carney, C. E., Edinger, J. D., Kuchibhatla, M., Lachowski, A. M., Bogouslavsky, O., Krystal, A. D., & Shapiro, C. M. (2017). Cognitive behavioral insomnia therapy for those with

insomnia and depression: A randomized controlled clinical trial. *SLEEP, 40*(4), 1-13. http://dx.doi.org/10.1093/sleep/zsx019

Chakravorty, S., Morales, K. H., Arendt, J. T., Perlis, M. L., Oslin, D. W., Findley, J. C., & Kranzler, H. R. (2019). Cognitive behavioral therapy for insomnia in alcohol-dependent veterans: A randomized, controlled pilot study. *Alcoholism: Clinical and Experimental Research, 43*(6), 1244-1253. Doi: 10.1111/acer.14030

Chaput, J. P., McHill, A. W., Cox, R. C., Broussard, J. L., Dutil, C., da Costa, B. G. G., Sampasa-Kanyinga, H., & Wright, K. P. (2023). The role of insufficient sleep and circadian misalignment in obesity. *Nature Reviews Endocrinology, 19*, 82-97. https://doi.org/10.1038/s41574-022-00747-7

Chattu, V. K., Manzar, D., Kumary, S., Burman, D., Spence, D. W., & Pandi-Perumal, S. R. (2019). The global problem of insufficient sleep and its serious public health implications. *Healthcare, 7*(1), doi:10.3390/healthcare7010001

Cole, M. B. & McLean, V. (2003). Therapeutic relationships re-defined. *Occupational Therapy in Mental Health, 19*(2), 33-56. https://doi.org/10.1300/J004v19n02_03

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BioMed Central Medical Research Methodology, 11*(100). https://doi.org/10.1186/1471-2288-11-100

Cvengros, J. A., Crawford, M. R., Manber, R., & Ong, J. C. (2015). The relationship between beliefs about sleep and adherence to behavioral treatment combined with meditation for insomnia. *Behavioral Sleep Medicine, 13*(1), 52-63. https://doi.org/10.1080/15402002.2013.838767

Dong, L., Soehner, A. M., Bélanger, L., Morin, C. M., & Harvey, A. G. (2017). Treatment agreement, adherence, and outcome in cognitive behavioral treatments for insomnia. *Journal of Consulting and Clinical Psychology, 86*(3), 294-299. https://doi.org/10.1037/ccp0000269

Eakman, A. M., Schmid, A. A., Henry, K. L., Rolle, N. R., Schelly, C., Pott, C. E., & Burns, J. E. (2017). Restoring effective sleep tranquility (REST): A feasibility and pilot study. *British Journal of Occupational Therapy*, *76*, pp. 1-11. Doi: 10.1177/03080226176911538

Eakman, A. M., Schmid, A. A., Rolle, N. R., Kinney, A. R., & Henry, K. L. (2022). Follow-up analyses from a wait-list controlled trial of occupational therapist-delivered cognitive-behavioral therapy for insomnia among veterans with chronic insomnia. *American Journal of Occupational Therapy, 76*, 7602205110. http://doi.org/10.5014/ajot.2022.045682

Edinger, J. D., Arendt, J. T., Bertisch, S. M., Carney, C. E., Harrington, J. J., Lichstein, K. L., & Martin, J. L. (2021). Behavioral and psychological treatments for chronic insomnia disorder in adults: An American Academy of Sleep Medicine clinical practice guideline. *Journal of Clinical Sleep Medicine, 17*, 255-262. https://doi.org/10.5664/jcsm.8986

Frank, E., Kupfer, D. J., Thase, M. E., Mallinger, A. G., Swartz, H. A., Fagiolini, A. M., Grochocinski, V., Houck, P., Scott, J., Thompson, W., & Monk, T. (2005). Two-year outcomes for interpersonal and social rhythm therapy in individuals with bipolar I disorder. *Archives of General Psychiatry, 62*(9), 996-1004. doi:10.1001/archpsyc.62.9.996

Fretz, K. M. (2023). Recommendations to bolster adherence in cognitive behavioral therapy for insomnia: A self-efficacy approach. *Translational Behavioral Medicine.* https://doi.org/10.1093/tbm/ibac104

Fritz, H., Hu, Y., Gahman, K., Almacen, C., & Ottolini, J. (2020). Intervention to modify habits: A scoping review. *Occupational Therapy Journal of Research: Occupation, Participation, and Health, 40*(2), 99-112. https://doi.org/10.1177/1539449219876877

Giglio, L. M. F., Magalhães, P. V. S., Andersen, M. L., Walz, J. C., Jakobson, L., & Kapezinski, F. (2010). Circadian preference in bipolar disorder. *Sleep Breath, 14*, 153-155. https://doi.org/10.1007/s11325-009-0301-3

Graneheim, U. H. & Lundman, B. (2004). Qualitative content analysis in nursing research: Concepts, procedures and measures to achieve trustworthiness. Nurse Education Today, 24, pp. 105-112. http://doi.org/10.1016/j.nedt.2003.10.001

Gruber, J., Harvey, A. G., Wang, P. W., Brooks III, J. O., Thase, M. E., Sachs, G. S., & Ketter, T. A. (2009). Sleep functioning in relation to mood, function, and quality of life at entry to the Systematic Treatment Enhancement Program for Bipolar Disorder (STEP-BD). *Journal of Affective Disorders, 114*(1), 41-49. https://doi.org/10.1016/j.jad.2008.06.028

Harvey, A. G., Schmidt, D. A., Scarnà, A., Semler, C. N., & Goodwin, G. M. (2005). Sleep-related functioning in euthymic patients with bipolar disorder, patients with insomnia, and subjects without sleep problems. *The American Journal of Psychiatry, 162*(1), 50-57. Doi: 10.1176/appi.ajp.162.1.50

Harvey, A. G., Soehner, A. M., Kaplan, K. A., Hein, K., Lee, J., Kanady, J., Li, D., Rabe-Hesketh, S., Ketter, T. A., Neylan, T. C., & Buysse, D. J. (2015). Treating insomnia improves mood state, sleep, and functioning in bipolar disorder: A pilot randomized

controlled trial. *Journal of Consulting and Clinical Psychology, 83*(3), 564-577. http://dx.doi.org/10.1037/a0038655

Hebert, E. A., Vincent, N., Lewycky, S., & Walsh, K. (2010). Attrition and adherence in the online treatment of chronic insomnia. *Behavioral Sleep Medicine, 8*(3), 141-150. https://doi.org/10.1080/15402002.2010.487457

Ho, F. Y. Y., Chung, K. F., Yeung, W. F., Ng, T. H., Kwan, K. S., Yung, K. P., & Cheng, S. K. (2015). Self-help cognitive-behavioral therapy for insomnia: A meta-analysis of randomized controlled trials. *Sleep Medicine Reviews, 19,* 17-28. Doi: 10.1016/j.smrv.2014.06.010.

Jernelöv, S., Killgren, J., Ledin, L., & Kaldo, V. (2022). Treatment feasibility and preliminary evaluation of group-delivered cognitive behavioral therapy for insomnia adapted for patients with bipolar and related disorders: A pragmatic within-group study. *Journal of Affective Disorders Reports, 7*, 1-10. https://doi.org/10.1016/j.jadr.2021.100293

Johns, M. W. (1991). A new method for measuring daytime sleepiness: The Epworth Sleepiness Scale. *Sleep, 14*(6), 540-545. https://doi.org/10.1093/sleep/14.6.540

Kaplan, K. A. & Harvey, A. G. (2013). Behavioral treatment of insomnia in bipolar disorder. *The American Journal of Psychiatry, 170*(7), 716-720. https://doi.org/10.1176/appi.ajp.2013.12050708

Kaplan, K. A., Talvera, D. C., & Harvey, A. G. (2018). Rise and shine: A treatment experiment testing a morning routine to decrease subjective sleep inertia in insomnia and bipolar disorder. *Behaviour Research and Therapy, 111,* 106-112. https://doi.org/10.1016/j.brat.2018.10.009

Klingman, K. J., Jungquist, C. R., & Perlis, M. L. (2017). Introducing the Sleep Disorders Symptom Checklist-25: A primary care friendly and comprehensive screener for sleep disorders. *Sleep Medicine Research, 8*(1), 17-25. https://doi.org/10.17241/smr.2017.00010

Koffel, E. A., Koffel, J. B., & Gehrmen, P. R. (2015). A meta-analysis of group cognitive behavioral therapy for insomnia. *Sleep Medicine Reviews, 19*, 6-16. http://doi.org/10.1016/j.smrv.2014.05.001

Kooistra, B., Dijkman, B., Einhorn, T. A., & Bhandari, M. (2009). How to design a good case series. *The Journal of Bone and Joint Surgery, 91* (Suppl. 3), 21-26. Doi: 10.2106/JBS.H.01573

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606-613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Leibenluft, E., Albert, P. S., Rosenthal, N. E., & Wehr, T. A. (1996). Relationship between sleep and mood in patients with rapid-cycling bipolar disorder. *Psychiatry Research, 63*(2), 161-168. https://doi.org/10.1016/0165-1781(96)02854-5

Leland, N. E., Marcione, N., Schepens Niemiec, S. L., Kelkar, K, & Fogelberg, D. (2014). What is occupational therapy's role in addressing sleep problems among older adults? *OTJR: Occupation, Participation and Health, 34*(3), 141-149.

Manber, R. Bemert, R. A., Suh, S., Nowakowski, S., Siebem, A. T., & Ong, J. C. (2011). CBT for insomnia in patients with high and low depressive symptom severity: Adherence and clinical outcomes. *Journal of Clinical Sleep Medicine, 7*(6), 645-652. http://dx.doi.org/10.5664/jcsm.1472

Manber, R. & Carney, C. E. (2015). *Treatment Plans and Interventions for Insomnia: A Case Formulation Approach*. New York, NY: The Guilford Press.

Manber, R., Camey, C., Edinger, J., Epstein, D., Friedman, L., Haynes, P. L., Karlin, B. E., Pigeon, W., Siebern, A. T., & Trockel, M. (2012). Dissemination of CBTI to the non-sleep specialist: Protocol development and training issues. *Journal of Clinical Sleep Medicine, 8*(2), 209-218. http://dx.doi.org/10.5664/jcsm.1786

Mastin, D. F., Bryson, J., & Corwyn, R. (2006). Assessment of sleep hygiene using the Sleep Hygiene Index. *Journal of Behavioral Medicine, 29*(3), 223-227. https://doi.org/10.1007/s10865-006-9047-6

Matthews, E. E., Arendt, J. T., McCarthy, M. S., Cuddihy, L. J., & Aloia, M. S. (2013). Adherence to cognitive behavioral therapy for insomnia: A systematic review. *Sleep Medicine Reviews, 17(6)*, pp. 453-464. http://dx.doi.org/10.1016/j.smrv.2013.01.001

Matthews, E. E., Schmiege, S. J., Cook, P. F., Berger, A. M., Aloia, M. S. (2012). Adherence to cognitive behavioral therapy for insomnia (CBTI) among women following primary breast cancer treatment: A pilot study. *Behavioral Sleep Medicine, 10*(3), 217-229. https://doi.org/10.1080/15402002.2012.666220

McChargue, D. E., Sankaranarayanan, J., Visovsky, C. G., Matthews, E. E., Highland, K. B., & Berger, A. M. (2012). Predictors of adherence to a behavioral therapy sleep intervention during breast cancer chemotherapy. *Support Care in Cancer, 20*(2), 245-252. https://doi.org/10.1007/s00520-010-1060-1

McCrae, C. S., Williams, J., Roditi, D., Anderson, R., Mundt, J. M., Miller, M. B., Curtis, A. F., Waxenberg, L. B., Staud, R., Berry, R. B., & Robinson, M. E. (2019). *SLEEP, 42*(3), 1-15. Doi: 10.1093/sleep/zsy234

Mellor, A., Kavaliotis, E., Mascaro, L., & Drummond, S. P. A. (2022). Approaches to the assessment of adherence to CBT-I, predictors of adherence, and the association of adherence to outcomes: A systematic review. *Sleep Medicine Reviews, 63*, 1-14. https://doi.org/10.1016/j.smrv.2022.101620

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., Eccles, M. P., Cane, J., & Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine, 46*(1), 81-95. https://doi.org/10.1007/s12160-013-9486-6

Morin, C. M. (1993). *Insomnia: Psychological assessment and management*. New York: Guilford Press.

Morin, C. M., & Bélanger, L. (2011). Cognitive therapy for dysfunctional beliefs about sleep and insomnia. In M. L. Perlis, M. Aloia, & B. Kuhn (Eds.), *Behavioral Treatments for Sleep Disorders: A Comprehensive Primer of Behavioral Sleep Medicine Interventions* (1st ed., pp. 107 - 118). San Diego, CA: Elsevier.

Morin, C. M., Belleville, G., Belanger, L., & Ivers, H. (2011). The insomnia severity index: Psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep, 34*(5), 601-608. https://doi.org/10.1093/sleep/34.5.601

Morin, C. M., Stone, J., Trinkle, D., Mercer, J., & Remsberg, S. (1993). Dysfunctional beliefs and attitudes about sleep among older adults with and without insomnia complaints. *Psychology and Aging, 8*(3), 463-467. https://doi.org/10.1037/0882-7974.8.3.463

Muench, A., Vargas, I., Grandner, M. A., Ellis, J. G., Posner, D., Bastien, C. H., Drummond, S. P. A., & Perlis, M. L. (2022). We know CBT-I works, now what? *Faculty Reviews, 11*(4), http://doi.org/10.12703/r/11-4

Ohayon, M. M., Mahowald, M. W., & Leger, D. (2014). Are confusional arousals pathological? *Neurology, 83*(9), 834-841. https://doi.org/10.1212/WNL.0000000000000727

Okajima, I., Komada, Y., & Inoue, Y. (2011). A meta-analysis on the treatment effectiveness of cognitive behavioral therapy for insomnia. *Sleep and Biological Rhythm, 9*, 24-34. Doi:10.1111/j.1479-8425.2010.00481.x

Ong, J. C., Crawford, M. R., Dawson, S. C., Fogg, L. F., Turner, A. D., Wyatt, J. K., Crisostomo, M. I., Chhangani, B. S., Kushida, C. A., Edinger, J. D., Abbott, S. M., Malkani, R. G., Attarian, H. P., & Zee, P. C. (2020). A randomized controlled trial of CBT-I and PAP for obstructive sleep apnea and comorbid insomnia: Main outcomes from the MATRICS study. *SLEEP, 43*(9), 1-10. Doi: 10.1093/sleep/zsaa041

Patel, S., Kon, S. S. C., Nolan, C. M., Barker, R. E., & Simonds, A. K. (2018). The Epworth Sleepiness Scale: Minimum clinically important difference in obstructive sleep apnea. *American Journal of Respiratory and Critical Care Medicine, 197*(7), 961-963. https://doi.org/10.1164/rccm.201704-0672LE

Perlis, M. L., Jungquist, C., Smith, M. T., & Posner, D. (2008). *Cognitive Behavioral Treatment of Insomnia: A Session-By-Session Guide*. New York, NY: Springer Science + Business Media, LLC.

Perlis, M. L., Smith, M. T., Orff, H., Enright, T., Nowakowski, S., Jungquist, C., & Plotkin, K. (2004). The effects of modafinil and cognitive behavior therapy on sleep continuity in

patients with primary insomnia. *Sleep, 27*(4), 715-725. https://doi.org/10.1093/sleep/27.4.715

Perry, G. S., Patil, S. P., & Presley-Cantrell, L. R. (2013). Raising awareness of sleep as a healthy behavior. *Preventing Chronic Disease, 10*, http://dx.doi.org.10.5888/pcd10.130081

Portney, L. G. (2020). Choosing a sample. In J. Pine (Ed.), *Foundations of Clinical Research: Applications to Evidence-Based Practice* (4th ed., pp. 180-191). Philadelphia, PA: F. A. David Company.

Qaseem, A., Kansagara, D., Forciea, M. A., Cooke, M., & Denberg, T. D.; Clinical Guidelines Committee of the American College of Physicians. (2016). Management of chronic insomnia disorder in adults: A clinical practice guideline from the American College of Physicians. *Annals of Internal Medicine, 165*, 125-133. https://doi.org/10.7326/M15-2175

Rathert, C., Wyrwich, M. D., & Boren, S. A. (2013). Patient-centered care and outcomes: A systematic review of the literature. *Medical Care Research and Review*, *70*(4), 351–379. https://doi.org/10.1177/1077558712465774

Riedel, B. W. & Lichstein, K. L. (2001). Strategies for evaluating adherence to sleep restriction treatment for insomnia. *Behaviour Research and Therapy, 39*(2), 201-212. https://doi.org/10.1016/S0005-7967(00)00002-4

Ritter, P. S., Marx, C., Lewtschenko, N., Pfeiffer, S., Leopold, K., Bauer, M., & Pfennig, A. (2012). The characteristics of sleep in patients with manifest bipolar disorder, subjects at high risk of developing the disease and health controls. *Journal of Neural Transmission, 119*, 1173-1184. Doi: 10.1007/s00702-012-0883-y

Ritterband, L. N., Thorndike, F. P., Gonder-Frederick, L., Magee, J. C., Bailey, E., Saylor, D. K., & Morin, C. M. (2009). Efficacy of an internet-based behavioral intervention for adults with insomnia. *Arch Gen Psychiatry, 66*(7), 692-698. Doi:10.1001/archgenpsychiatry.2009.66.

Rush, A. J., Trivedi, M. H., Ibrahim, H. M., Carmody, T. J., Arnow, B., Klein, D. N., Markowitz, J. C., Ninan, P. T., Kornstein, S., Manber, R., Thase, M. E., Kocis, J. H., & Keller, M. B. (2003). The 16-item Quick Inventory of Depressive Symptomatology (QIDS): A psychometric evaluation in patients with chronic major depression. *Biological Psychiatry, 54*(5), 573-583. https://doi.org/10.1016/S0006-3223(02)01866-8

Sadler, M. (1999). Lamotrigine associated with insomnia. *Epilepsia, 40*(30), 322-325. Doi: 10.1111/j.1528-1157.1999.tb00712.x

Seun-Fadipe, C. T., Aloba, O. O., Oginni, O. A., Mosaku, K. S. (2018). Sleep Hygiene Index: Psychometric characteristics and usefulness as a screening tool in a sample of Nigerian undergraduate students. *Journal of Clinical Sleep Medicine, 14*(8), 1285-1292. https://doi.org/10.5664/jcsm.7256

Seyffert, M., Lagisetty, P., Landgraf, J., Chopra, V., Pfeiffer, P. N., Conte, M. L., & Rogers, M. A. M. (2016). Internet-delivered cognitive behavioral therapy to treat insomnia: A systematic review and meta-analysis. *Public Library of Science One, 11*(2), http://doi.org/10.1371/journal.pone.0149139

Siengsukon, C. F., Aishehri, M., Williams, C., Drerup, M., & Lynch, S. (2020). Feasibility and treatment efficacy of cognitive behavioral therapy for insomnia ain individuals with multiple sclerosis: A pilot randomized controlled trial. *Multiple Sclerosis and Related Disorders, 40,* doi:10.1016/j.msard.2020.101958.

Smith, M. T., Huang, M. I., & Manber, R. (2005). Cognitive behavioral therapy for chronic insomnia occurring within the context of medical and psychiatric disorders. *Clinical Psychology Review, 23*, 559-592. Doi: 10.1016/j.cpr.2005.04.004

Smith, S. & Trinder, J. (2001). Detecting insomnia: Comparison of four self-report measures of sleep in a young adult population. *Journal of Sleep Research, 10*(3), 229-235. https://doi.org/10.1046/j.1365-2869.2001.00262.x

Spielman, A. J., Caruso, L. S., Glovinsky, P. B. (1987). A behavioral perspective on insomnia treatment. *Psychiatric Clinics of North America, 10*(4), 541-553.

Spielman, A. J., Yang, C. M., & Glovinsky, P. B. (2011). Sleep restriction therapy. In M. Perlis, M. Aloia, & B. Kuhn (Eds.), *Behavioral Treatments for Sleep Disorders: A Comprehensive Primer of Behavioral Sleep Medicine Interventions* (1st ed., pp. 9-19). San Diego, CA: Elsevier.

Szentkirályi, A., Madarász, C. Z., & Novák, M. (2009). Sleep disorders: impact on daytime functioning and quality of life. *Expert Review of Pharmacoeconomics & Outcomes Research, 9*(1), 49-64.

The essential guide to coding qualitative data. (n.d.). Delve. Retrieved June 28, 2023, from https://delvetool.com/guide

Van der Zweerde, T., Bisdounis, L., Kyle, S. D., Lanceee, J., & van Straten, A. (2019). Cognitive behavioral therapy for insomnia: A meta-analysis of long-term effects in controlled studies. *Sleep Medicine Reviews, 48*, 101208. http://doi.org/10.1016/j.smrv.2019.08.002

Vincent, N., Lewycky, S., & Finnegan, H. (2008). Barriers to engagement in sleep restriction and stimulus control in chronic insomnia. *Journal of Consulting and Clinical Psychology, 76*(5), 820-828. https://doi.org/10.1037/0022-006X.76.5.820

Wilcock, A. A. (2006). *An Occupational Perspective of Health* (2nd ed.). Thorofare, NJ: Slack.

Wu, J. Q., Appleman, E. R., Salazar, R. D., & Ong, J. C. (2015). Cognitive behavioral therapy for insomnia comorbid with psychiatric and medical conditions: A meta-analysis. *Journal of the American Medical Association Internal Medicine, 175*(9), 1461-1472. Doi: 10.1001/jamainternalmed.2015.3006

Zachariae, R., Lyby, M. S., Ritterband, L. M., & O'Toole, M. S. (2016). Efficacy of internet-delivered cognitive-behavioral therapy for insomnia: A systematic review and meta-analysis of randomized controlled trials. *Sleep Medicine Reviews, 30*, 1-10. http://dx.doi.org/10.1016/j.smrv.2015.10.004

Zandbelt, L. C., Smets, E. M. A., Oort, F. J., Godfried, M. H., & de Haes, H. C. J. M. (2007). Medical specialists' patient-centered communication and patient-reported outcomes. *Medical Care*, *45*(4), 330–339. https://doi.org/10.1097/01.mlr.0000250482.07970.5f

Appendix A

Interview Questions for the Occupational Therapist

Questions to Understand the Therapist's Background

- How long have you been an OT?
- Where did you receive your CBT-I training?
- What CBT-I training did you receive?
- How long have you been practicing CBT-I?
- How many clients have you treated?
- Is there a protocol you follow as a session-by-session guide for delivering CBT-I?

Questions to Understand CBT-I Delivery and Treatment Adherence

- Why did you find this case interesting?
- Why did you recommend this case for review?
- How did you determine that this individual was a good candidate for CBT-I?

- How did you earn the client's buy-in?
- How did you know you had earned the client's buy-in?

- What components of CBT-I did you use?
- What informed your choice of which components to implement and emphasize?
- Was your delivery approach informed by any of the models of CBT-I/insomnia (e.g., Spielman's 3P or 4P model, 2 process model of sleep regulation, stimulus control model, microanalytic model, etc.)? How?

- How did you take comorbid health conditions into account as you delivered CBT-I?
- Were there certain conditions that seemed more important to consider than others? Why?

- What teaching modalities did you use when educating this client?

- Some sleep diaries ask questions about caffeine/alcohol intake, medications, pain, etc. Do you why this consensus sleep diary doesn't include those questions? Do think including only the essential questions makes patients more likely to fill it out?
- Did you send any reminders (e.g., email, text) to fill the sleep diary out?
- How did you promote patient adherence to CBT-I (e.g., changing the language, reminders via text or email, etc.)?
- How did you address adherence to CBT-I goals (e.g., prescribed bedtime, prescribed time out of bed, stimulus control, napping, etc.)?

- Could you please help me understand how you are determining SOL & SE calculations?
- Are you including the time in bed the client is using to meditate/do breathwork?

- What indicated to you that the client was ready for discharge?

- Is there anything else you'd like to say about this case?

Appendix B

Interview Questions for the Client

- Why did you seek support at the Community Center for Partnerships?
- What kinds of sleep challenges were you having?
- How did the therapist collect your assessments, sleep diaries, etc.? Email exchange? An online portal?

- Can you please tell me about how your initial goals were set during the second session?
    - Why was 10:00 a.m. chosen as your designated rise time?
    - Why was 2:00 a.m. your designated bedtime?
    - Why were you asked to stay active and engaged all day long? What activities did your daily routine already consist of? How did the activities in your daily routine change?

- The therapist provided you education on using a buffer zone. How did you create one? What was your buffer zone like?

- Why do you think it was important to go to bed at the same time every day?
- Why do you think it was important to get up at the same time every day?
- Why do you think it was important to get out of bed if you aren't sleeping?
- Why do you think it was important to limit the bed/bedroom to sleep and intimacy?
- Why do you think it was important to stay active and engaged all day?
- Why do you think it was important to limit naps?

- Which of these changes do you think contributed the most to your sleep improvements? Why do you think so?

- How did you stick with treatment?
- How did the therapist help you stick with treatment?
- What challenges did you face with treatment? How did you overcome them?

- Do you still use what you learned in therapy to help you sleep well? Can you tell me more?

- Based on the documentation, you participated in a variety of health services (e.g., silent retreat, shamanic retreat, chiropractor, Braintrust services, diet changes, supplements, etc.) during treatment. Did you seek out any of these to help you specifically with sleep?

- Is there anything else you'd like to tell me about your experience receiving CBT-I?

Appendix C

BCT	Definition
Goal setting (behavior)	Set or agree on a goal defined in terms of the behavior to be achieved
Problem solving	Analyze, or prompt the person to analyze, factors influencing the behavior and generate or select strategies that include overcoming barriers and/or increasing facilitators
Review behavior goal(s)	Review behavior goal(s) jointly with the person and consider modifying goal(s) for behavior change strategy in light of achievement. This may lead to re-setting the same goal, a small change in that goal or setting a new goal instead of (or in addition to) the first, or no change
Feedback on behavior	Monitor and provide informative or evaluative feedback on performance of the behavior *(e.g., form, frequency, duration, intensity)*
Self-monitoring of behavior	Establish a method for the person to monitor and record their behavior(s) as part of a behavior change strategy
Feedback on outcome(s) of behavior	Monitor and provide feedback on the outcome of performance of the behavior
Behavior experiments	Advise on how to identify and test hypotheses about the behavior, its causes and consequences, by collecting and interpreting data
Habit formation	Prompt rehearsal and repetition of the behavior in the same context repeatedly so that the context elicits the behavior

Figure 12. Definitions of Behavior Change Strategies
Note. BCTs as defined by Michie et al. (2013). BCT = behavior change technique

List of Abbreviations

Abbreviation	Meaning
APA	American Psychiatric Association
AOTA	American Occupational Therapy Association
BCT	Behavior Change Technique
CBT-I	Cognitive-behavioral therapy for insomnia
DBAS	Dysfunctional Beliefs and Attitudes about Sleep
DSM-V	Diagnostic and Statistical Manual of Mental Disorders 5th Edition
EMA	Early morning awakening
ESS	Epworth Sleepiness Scale
ISI	Insomnia Severity Index
NWAK	Number of nighttime awakenings
OT	Occupational therapist
PHQ-9	Patient Health Questionnaire 9 items
PTOB	Prescribed time out of bed
PTSD	Post-traumatic stress disorder
PTTB	Prescribed time to bed
QIDS	Quick Inventory of Depressive Symptomatology
SCT	Stimulus control therapy
SCT Bed	Stimulus control therapy at bedtime
SCT Rise	Stimulus control therapy at rise time
SDS-CL-25	Sleep Disorders Symptom Checklist 25 items
SD	Standard deviation
SE	Sleep efficiency
SHI	Sleep Hygiene Index
SL	Sleep latency
SRT	Sleep restriction therapy
TIB	Time in bed
TST	Total sleep time
WASO	Wake after sleep onset
WASO In	Wake after sleep onset spent in bed
WASO Out	Wake after sleep onset spent out of bed