

**DO BELIEFS ABOUT TREATMENT CREDIBILITY AND EXPECTANCY
INFLUENCE THE OUTCOMES OF COGNITIVE BEHAVIORAL THERAPY FOR
INSOMNIA AMONG CANCER SURVIVORS**

by

© Brianna George

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Abstract

Objectives: Cognitive Behavioral Therapy for Insomnia (CBT-I) effectively improves insomnia and perceived cognitive impairment (PCI) in cancer survivors. This prespecified secondary analysis assessed how credibility and expectancy beliefs influence insomnia and PCI outcomes, and explored what factors were associated with higher beliefs about credibility and expectancy.

Methods: As part of a randomized waitlist-controlled trial, cancer survivors (N = 132) who met the DSM-5 criteria for insomnia disorder and reported PCI received 7 weekly virtual CBT-I sessions. Credibility and expectancy beliefs were assessed separately for insomnia and PCI using the Credibility Expectancy Questionnaire. We also examined whether credibility and expectancy moderated change in symptoms of insomnia and PCI, controlling for age. Factors associated with greater credibility and expectancy beliefs were evaluated using linear regression and qualitative interviews were used to explore patient perceptions.

Results: Only younger age was associated with higher pre-treatment expectations for insomnia and PCI outcomes ($p = 0.009$; $p = 0.008$). Beliefs about credibility or expectancy did not moderate change in symptoms of insomnia ($p = 0.972$; $p = 0.502$) or PCI ($p = .143$; $p = 0.283$). Qualitative results suggest that skepticism and doubt, one's understanding of sleep, and optimism and open-mindedness influence expectation of outcome and perceptions of treatment credibility.

Conclusion/Implications: CBT-I has robust efficacy regardless of pre-existing beliefs and expectations. While these factors may play a role in the decision to pursue CBT-I, our results suggest that clients are likely to experience benefits if they sufficiently engage in the therapy. Treatment outcomes may be enhanced by: 1) providing psychoeducation about sleep; 2) setting appropriate pre-treatment beliefs that foster optimism; 3) promoting consistent engagement with treatment; and 4) fostering positive therapeutic relationships.

General Summary

This study investigated the impact of credibility and expectancy beliefs on the effectiveness of Cognitive Behavioral Therapy for Insomnia (CBT-I) among cancer survivors experiencing insomnia and perceived cognitive impairment (PCI). The analysis involved 132 cancer survivors who received virtual CBT-I sessions over seven weeks. Results showed that CBT-I resulted in significant and meaningful improvements in insomnia and PCI. Younger age was associated with higher pre-treatment expectations for treatment outcomes. Beliefs about credibility and expectancy did not significantly moderate changes in insomnia severity or PCI symptoms over time. The study suggests that while pre-existing beliefs may influence the decision to pursue CBT-I, engagement with the therapy is key to achieving benefits. Recommendations for optimizing treatment outcomes include providing psychoeducation, setting positive pre-treatment beliefs, promoting consistent engagement, and fostering positive therapeutic relationships. Overall, the study underscores the robust efficacy of CBT-I in cancer survivors, regardless of pre-existing beliefs.

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Table of Contents

Abstract.....ii

General Summary.....iii

Acknowledgements.....iv

Table of Contents.....v

List of Tables.....vii

List of Figures.....viii

List of Appendices.....ix

Introduction.....1

 Prevalence and Impact of Cancer in Canada.....1

 Insomnia among Cancer Survivors1

 Cognitive Impairment in Cancer Survivors9

 Insomnia and Cognitive Impairment Comorbidity.....18

 Cognitive Behavioral Therapy for Insomnia21

 Credibility Beliefs and Treatment Expectancy.....25

 Credibility Beliefs/Expectancy and Treatment Outcomes.....30

 Credibility Beliefs/Expectancy and CBT-I.....33

 Justification for Research.....36

Methods.....37

Results.....44

Discussion.....54

Conclusions.....65

References.....67

BELIEFS AND CBT-I

Appendices.....98

List of Tables

Table 1: Demographic and Clinical Factors.....93

Table 2: Linear Regression of Factors Associated with Credibility Beliefs for Insomnia.....95

Table 3: Linear Regression of Factors Associated with Credibility Beliefs for PCI.....95

Table 4: Linear Regression of Factors Associated with Expectancy for Insomnia.....95

Table 5: Linear Regression of Factors Associated with Expectancy for PCI.....96

List of Figures

Figure 1: Factors Influencing CBT-I Impact.....97

Figure 2: Factors Influencing Credibility and Expectancy Beliefs.....97

List of Appendixes

Appendix A: CEQ Therapy Evaluation Form.....98

Appendix B: Interview Guide.....100

Appendix C: Code Book.....101

Prevalence and Impact of Cancer in Canada

Cancer is the leading cause of death in Canada. Estimates suggest that 2 in 5 Canadians will develop cancer at some point in their lifetime and there is currently over 1.5 million people in Canada living with or beyond cancer (Canadian Cancer Society, 2022). As defined by the National Cancer Institute in the United States, cancer survivorship begins from the time of diagnosis through the balance of life (Denlinger et al., 2014). The predicted five-year net survival for all cancers is 64% and this varies significantly among type of cancer with prostate cancer (91%) and breast cancer (89%) demonstrating the highest rates of survival (Canadian Cancer Society, 2022). These statistics are of utmost importance as a large proportion of the Canadian population will be cancer survivors at some point in their lifetime and will require specific care.

A cancer diagnosis impacts many aspects of an individual's well-being. Although these impacts may depend on the individual, type of cancer, as well as type of cancer treatment, there are several highly reported negative impacts (Stein et al., 2008). Two of the most noteworthy, lasting impacts cancer survivors struggle with are sleep disturbances, primarily in the form of insomnia, and cognitive impairments. Each of these serve as a barrier for cancer survivors returning to normal functioning and can persist for years or even decades (Garland et al., 2019; Passarella & Duong, 2008; Janelins et al., 2014).

Insomnia among Cancer Survivors

Definition and Diagnosis of Insomnia

Insomnia disorder is defined as a predominant complaint of dissatisfaction with sleep quality or quantity characterized by one or more of the following symptoms: difficulty initiating sleep, difficulty maintaining sleep, or early-morning awakening with inability to return to sleep

BELIEFS AND CBT-I

as defined by specific criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM) (American Psychiatric Association, 2013). Insomnia disorder is distinguished from insomnia symptoms by severity, frequency, and impact on daytime functioning (American Psychiatric Association, 2013). Insomnia symptoms can meet the criteria for a disorder when they occur more than three nights a week for at least 3 months, despite adequate opportunity for sleep (American Psychiatric Association, 2013). The resulting consequences can include significant distress or impairment in areas of functioning, and the disturbances must not be better accounted for by another sleep disorder, the effects of a substance, or a co-existing mental disorder or medical condition.

Diagnosing insomnia involves a thorough evaluation of an individual's sleep patterns, symptoms, and their impact on daily functioning (Bragg et al., 2019). A comprehensive assessment is critical for diagnosing insomnia (Pallesen et al., 2001). This assessment includes a detailed patient history and clinical interview to explore the onset, duration, and frequency of sleep difficulties, along with associated symptoms such as fatigue and mood disturbances. It also involves examining the sleep environment, lifestyle factors, and daily routines. Clinicians use standardized diagnostic tools and criteria, such as those in the DSM, to distinguish chronic insomnia from transient sleep problems and to rule out other sleep disorders and comorbid conditions like depression, anxiety, or chronic pain.

Through questionnaires and sleep logs using the Consensus Sleep Diary (Carney et al., 2012), clinicians gather detailed information about sleep quality and patterns, ensuring an accurate diagnosis and effective treatment plan (Bragg et al., 2019; Pallesen et al., 2001). Self-report measures offer valuable insights into the measurement and evaluation of insomnia (Moul et al., 2004). A prominent tool in this regard is the Insomnia Severity Index (ISI; Bastien et al.,

BELIEFS AND CBT-I

2001). The ISI is a widely used self-report questionnaire designed to assess the severity of insomnia symptoms and their impact on daily functioning. The ISI has been empirically validated in cancer patients and provides a standardized and reliable method for quantifying insomnia severity, making it invaluable for both clinical assessment and research purposes (Savard et al., 2005). Consensus sleep diaries are another valuable tool for measuring insomnia and are often used alongside self-report measures to provide a detailed account of an individual's sleep patterns and habits over time (Mallinson et al., 2019). The consensus sleep diary is a standardized, prospective tool and findings support the validity, clinical utility, and usability of this measure (Carney et al., 2012; Maich et al., 2016).

Prevalence of Insomnia among Cancer Survivors

Insomnia is a prominent side effect among cancer patients and is one of the most troubling symptoms throughout all stages that continues into survivorship (Al Maqbali et al., 2022; Pachman et al., 2012). Prevalence of insomnia symptoms depends on the type of cancer diagnosis, with rates higher among individuals with breast cancer (42% to 69%) and gynecologic (33% to 68%), and lower among men with prostate cancer (25% to 39%) (Savard et al., 2011). Different types of cancer can impact the severity of insomnia due to factors such as the nature of the disease, treatment modalities, and psychological impact. Additionally, several cancer-related factors may trigger the onset of sleep disturbances, including surgery and hospitalization, adjuvant treatments, nocturnal hot flashes, fatigue, and pain (Huong et al., 2020; Savard & Savard, 2013).

Estimates of insomnia among cancer patients vary, with rates ranging from 30.9-54.3% in those newly diagnosed, and 23-44% in patients five years after initiation of adjuvant therapy (Harrold et al., 2020). Approximately 40-60% of cancer patients present with insomnia

BELIEFS AND CBT-I

symptoms and around 20% will meet the criteria for an insomnia disorder diagnosis (Harrold et al., 2020; Savard et al., 2011). An 18-month longitudinal study of cancer patients (n = 962) revealed high rates of insomnia symptoms at baseline (59%), with rates remaining pervasive (36%) after an 18-month period (Savard et al., 2011). Although symptoms of insomnia are more prevalent and severe during cancer treatment, insomnia can persist for years among cancer survivors in remission, with up to 60% experiencing insomnia at some point (Garland et al., 2019; Pachman et al., 2012).

Factors Contributing to the Development and Maintenance of Insomnia

Predisposing Factors

Predisposing factors explain susceptibility to developing insomnia (Garland et al., 2019; Howell et al., 2014), representing underlying vulnerabilities that encompass both biological factors and psychological traits (Spielman et al., 1987). Qualitative research among a sample of 63 patients highlighted familial predisposition, anxious temperaments, and an inability to relax as factors predisposing individuals to insomnia (Garland et al., 2019). Further predisposing factors include demographic variables such as female gender (Passarella & Duong, 2008) and younger age (Harrold et al., 2020). Hyperarousal as a trait has also been found to increase risk for insomnia among individuals with cancer (Graci, 2005). Additional predisposing factors of insomnia include personal or family history (Berger, 2009) and co-occurring psychiatric disorders such as mood or anxiety disorders (Bower et al., 2011).

Precipitating Factors

Precipitating factors trigger the onset of insomnia (Garland et al., 2019; Howell et al., 2014). Insomnia can be triggered at any time during the cancer process: from initial diagnosis, to treatment, to survivorship (Savard et al., 2001). A cancer diagnosis itself can precipitate

BELIEFS AND CBT-I

insomnia as it is a physical and psychological stressor that disrupts homeostasis (Garland et al., 2019; Savard et al., 2001). Among a sample of fifty hospitalized cancer patients, hospitalization itself triggered sleep disturbances due to environmental factors, as well as psychological and behavioral factors (Sheely, 1996). Cancer treatments may also contribute to the aggravation of insomnia symptoms due to emotional impacts, physiologic effects, or side effects (Beck et al., 2010; Savard et al., 2015). Radiotherapy and chemotherapy contribute to insomnia among patients with breast cancer; while, androgen deprivation therapy is related to increased insomnia among patients with prostate cancer (Savard et al., 2015). Chemotherapy is thought to be particularly harmful, and patients report more sleep disturbances during active chemotherapy compared to nontreatment periods (Beck et al., 2010). There is also evidence that cancer symptoms, such as pain, can trigger insomnia (Bastien et al., 2004; Palesh et al., 2007). In a longitudinal study of 93 breast cancer patients, higher levels of pain at baseline predicted more problems getting to sleep and increases in pain predicted greater sleep disturbances (Palesh et al., 2007). Thus, the multifaceted nature of cancer and its treatment can significantly contribute to the development of insomnia in cancer patients.

Perpetuating Factors

Perpetuating factors maintain insomnia once it is established (Garland et al., 2019; Howell et al., 2014). These factors encompass behaviors individuals adopt in their attempts to address sleep concerns (Garland et al., 2019). Maladaptive sleep habits, such as excessive amount of time spent in bed and irregular sleep-wake schedules, as well as dysfunctional cognitions about sleep, such as unrealistic sleep requirement expectations, are among the most notable factors perpetuating insomnia (Walker et al., 2022). Conditioned associations, where the bed and bedroom become linked with wakefulness and anxiety rather than sleep and relaxation,

BELIEFS AND CBT-I

also play a critical role in perpetuating insomnia (Howell et al., 2014). For instance, if a person frequently experiences frustration and worry in bed due to difficulty falling asleep, the bed can become a trigger for these negative emotions, further disrupting sleep.

Additional perpetuating factors include napping, using back-lit electronics before bed, poor sleep hygiene, and use of sleep medications (Garland et al., 2019). Furthermore, circadian rhythm disruptions due to cancer treatment can exacerbate insomnia. For instance, reductions in sleep quality and circadian activity rhythmicity have been shown to predict changes in both objective and subjective cognitive functioning in women treated for breast cancer, indicating a strong connection between disrupted circadian rhythms and insomnia (Ancoli-Israel et al., 2022).

Impact of Insomnia

Sleep is essential for regulating various functions such as mood, emotional regulation, impulse control, and stress adaptation (Palagini et al., 2019). Sleep disturbances and insomnia are acknowledged as significant risk factors for both mental and physical health concerns (Medic et al., 2017). The consequences of insomnia are particularly profound among cancer patients, affecting mood (Delgado-Guay et al., 2011; Palagini et al., 2019), physical functioning, and the ability to return to work. Additionally, insomnia can exacerbate symptoms of fatigue, cognitive impairment, and pain, further adding to the negative impact of insomnia among cancer patients.

Impact on Mood

A systematic meta-analysis of 94 studies demonstrates that some combination of mood disorders is present in roughly 30-40% of cancer patients (Mitchell et al., 2011). Insomnia and sleep disturbances have been found to significantly affect mood, contributing to heightened levels of depression, anxiety, and emotional distress among cancer patients (Delgado-Guay et al., 2011; Palagini et al., 2019). A cross-sectional study of 101 patients with cancer revealed a strong

BELIEFS AND CBT-I

association between sleep disturbances and increased levels of pain, depression, anxiety, and an overall poorer sense of well-being (Delgado-Guay et al., 2011). Additionally, a recent narrative review synthesizing existing literature from 22 studies further supports these observations, highlighting that insomnia is frequently linked with cancer-related comorbid conditions such as emotional distress and depressive symptoms (Palagini et al., 2019). This review suggests that the hyperactivation of stress and inflammatory systems, known to sustain insomnia, may also contribute to cancer-related depression, creating a feedback loop that exacerbates both conditions. These findings underscore the importance of addressing sleep disturbances in cancer care, not only to improve sleep quality but also to alleviate mood-related symptoms and enhance overall well-being for cancer patients.

Impact on Physical Functioning

Insomnia's impact on physical functioning is profound and multifaceted, posing significant challenges for cancer patients. Numerous studies have consistently highlighted the negative effects of insomnia on aspects of physical well-being (Savard et al., 2013; Garland et al., 2022). Poor sleep has been associated with decreased physical functioning and a negative impact on the body's ability to heal from medical treatments, such as surgeries, chemotherapy, or radiation treatment (Canadian Cancer Society, 2022). Additionally, insomnia adversely affects general daytime functioning (Savard et al., 2013) and impairs social and occupational function (Krystal, 2006).

Insomnia also makes it incredibly difficult for cancer patients to resume normal life and has an impact on returning to work (Porro et al., 2019; Reynolds-Cowie & Fleming, 2020). Among the general population, insomnia can lead to decreased productivity and work absenteeism (Daley et al., 2009). Furthermore, the fatigue and cognitive impairment often

BELIEFS AND CBT-I

associated with insomnia (Garland et al., 2022; Palagini et al., 2019) further exacerbate these challenges, making it harder for individuals to meet the demands of their jobs effectively. A longitudinal study of 68 patients demonstrated that quality of life, sleep disturbance, and fatigue impact return to work among women with breast cancer (Porro et al., 2019). Additionally, a qualitative analysis of 27 cancer survivors highlighted that participants decided to give up work due to the impact of insomnia on their daily functioning and perceived loss of control (Reynolds-Cowie & Fleming, 2020). Insomnia also hinders individuals' ability to resume work by disrupting their daily routines (Fleming et al., 2009), contributing to fatigue (Lee et al., 2017), productivity loss, and impairments in daily activities (Ng et al., 2024).

Impact on Biological Functioning

Chronic insomnia has also been associated with various immune alterations, such as reduced natural killer (NK) cell activity (Savard et al., 2003). An observational study comparing immune functioning between individuals with chronic insomnia and good sleepers found significant differences in immune responses, suggesting that chronic insomnia can weaken the body's immune defenses (Savard et al., 2003). These immune alterations may influence the body's ability to recover from cancer treatments and increase susceptibility to infections. Although immune and physical functioning are interconnected, it's essential to recognize the distinct biological processes that insomnia disrupts, emphasizing the importance of addressing sleep issues to support overall health.

Impact on Cognition

Initial research has also shown that insomnia has a strong bidirectional relationship with cognitive impairment, including decreased memory, concentration, and attention (Garland et al., 2022). While cognitive impairment can influence physical functioning, such as the ability to

BELIEFS AND CBT-I

perform daily tasks, it primarily falls under the domain of psychological functioning rather than physical functioning. Therefore, addressing cognitive issues related to insomnia may require separate interventions focused on mental and neurological health.

Cognitive Impairment in Cancer Survivors

Definition and Diagnosis of Cognitive Impairment

Cognitive impairment is characterised as a decline in areas of cognition, including memory, attention, concentration, and executive function (Janelins et al., 2014). Perceived cognitive impairment (PCI), on the other hand, refers to subjective cognitive difficulties experienced by individuals in their everyday life (Pullens et al., 2010). Cancer survivors primarily express concerns among six major domains of cognition including short-term memory, long-term memory, speed of processing, attention and concentration, language, and functioning (Boscher et al., 2020; Myers et al., 2015; Von Ah et al., 2013). The most common cognitive changes are forgetfulness, absentmindedness, and an inability to focus when performing daily tasks (Myers et al., 2015).

Measurement and diagnosis of PCI among cancer survivors and other clinical populations relies predominantly on subjective self-report tools that capture individuals' personal experiences and perceptions of their cognitive functioning (Lai et al., 2009). These tools are designed to assess various aspects of cognitive difficulties that patients feel impact their daily lives, such as memory lapses, attention deficits, and problems with executive functions. Although evaluating PCI is challenging due to a lack of standardized practices (Dyk et al., 2020), several self-report measures are available to assess cognitive impairment. Of note, research efforts are ongoing to standardize the measurement of PCI (Dyk et al., 2020).

BELIEFS AND CBT-I

One of the most extensively used and researched instruments is the Functional Assessment of Cancer Therapy-Cognitive Function (FACT-Cog; Wagner et al., 2004). The FACT-Cog is a comprehensive tool specifically developed to assess PCI among cancer patients and survivors. It consists of multiple subscales that evaluate different dimensions of cognitive function and its impact on quality of life. Using subjective measures is critical to understand the patient's perspective, which might not always be reflected in objective cognitive assessments (Hutchinson et al., 2012). While PCI may be more frequently reported than objectively measured cognitive impairment (Shilling & Jenkins, 2007), understanding patients' perceptions is crucial due to its significant impact on quality of life (Hutchinson et al., 2012). This highlights the importance of considering both subjective experiences and objective measures of cognitive function in clinical assessment.

Prevalence of Cognitive Impairment among Cancer Survivors

The prevalence of PCI among cancer survivors is notably high, with research suggesting that 30% of cancer patients exhibit cognitive impairment prior to treatment, 75% of patients report some form of cognitive impairment during treatment, and 35% of cancer survivors will continue to exhibit cognitive difficulties in the months to years that follow treatment (Janelins et al., 2014). Past studies report PCI prevalence rates ranging from 12 to 63% in oncology samples (Mehnert et al., 2007), with some studies reporting rates as high as 75% (Asher & Myers, 2015). Long-term cognitive delays have been documented as late as 20 years following completion of cancer treatment (Myers et al., 2015).

While PCI is one of the most prevalent symptoms of a cancer diagnosis, objectively measured cognitive impairment is more difficult to quantify (Shilling & Jenkins, 2007). This discrepancy may arise due to several factors, including the subjective nature of self-reported

BELIEFS AND CBT-I

cognitive difficulties, which can be easily influenced by psychological stress, fatigue, and mood disturbances. Additionally, individual perceptions and personal thresholds for noticing cognitive changes can vary widely, contributing to the differences in reported prevalence rates between PCI and objective cognitive impairment.

While it has been suggested that PCI could be an indicator of psychological distress rather than cognitive impairment, patients' perceptions of impairment are still important (Hutchinson et al., 2012). These perceptions significantly impact quality of life and overall well-being. Moreover, there is a high correlation between subjectively measured perceived cognitive ability and objective neuropsychological performance, indicating that PCI can sometimes reflect actual cognitive deficits (Von Ah & Tallman, 2015). Ultimately, understanding PCI is a fundamental aspect as it often correlates with other measures of psychological health and provides a comprehensive picture of a patient's overall condition.

Factors Contributing to the Development and Maintenance of Cognitive Impairment

Risk Factors for PCI

Various risk factors contribute to the development and persistence of PCI among cancer survivors. Risk factors of PCIs include sleep difficulties, post-traumatic stress symptoms, and psychotropic medications (Boscher et al., 2020). Sleep disturbances are prevalent among cancer survivors and can significantly impact cognitive function (Savard et al., 2013). Disrupted sleep patterns interfere with memory consolidation and cognitive processing, exacerbating perceived cognitive difficulties (Pace-Schott & Spencer, 2014). Moreover, sleep disturbances often co-occur with other symptoms such as pain and psychological distress, further compounding their impact on cognitive function.

BELIEFS AND CBT-I

A cancer diagnosis and treatment can also lead to the development of post-traumatic stress disorder (PTSD) symptoms among some survivors, as cancer is highly stressful and potentially traumatic (Cordova et al., 2017; Hermelink et al., 2015)). Characterized by intrusive thoughts, hyperarousal and avoidance behaviors, PTSD is associated with cognitive impairments and reduced cognitive flexibility (Cordova et al., 2017). Individuals with PTSD may experience difficulties with concentration, memory retrieval, and decision-making, contributing to an overall decline in cognitive abilities. Additionally, the chronic stress associated with PTSD can dysregulate neuroendocrine pathways, leading to alterations in brain structure and function, further exacerbating cognitive deficits.

Use of psychotropic medications to manage psychological symptoms, such as depression and anxiety, is common among cancer survivors (Braun et al., 2014; Puneekar et al., 2011). For example, in a cross-sectional observational study, long-term cancer survivors demonstrated rates of psychotropic medication use around 28.8% (Braun et al., 2014). While this study did not find a significant difference between long-term cancer survivors and cancer-naïve controls, the use of these medications highlights the ongoing psychological challenges faced by survivors. Although alleviating distressing symptoms, these medications may have adverse effects on cognitive function (Boscher et al., 2020). Certain psychotropic medications, (e.g., benzodiazepines, antidepressants and antipsychotics) are known to impair cognitive performance, as identified in a recent systematic review of 27 articles (Chandramouleeshwaran et al., 2023). Moreover, long-term use of psychotropic medications may lead to cognitive decline and exacerbate existing cognitive difficulties in susceptible individuals (Boscher et al., 2020; Chandramouleeshwaran et al., 2023).

BELIEFS AND CBT-I

Additional risk factors that can contribute to PCI include higher body mass index, low levels of exercise, fatigue, and stress (Myers et al., 2015). Anxiety is significantly associated with an increased risk of perceived attention and memory impairment, in a cross-sectional analysis of lung cancer survivors (Takemura et al., 2022). There is also evidence suggesting potential genetic risk factors for cognitive impairment (Buskbjerg et al., 2019) and a variety of mechanisms have been proposed. Mechanisms that have been proposed involve cytokine profiles (Toh et al., 2020), deficits in DNA-repair, genetic predispositions (Ahles & Saykin, 2007), chemotherapy-induced anemia, chemotherapy-induced menopause (Jansen et al., 2005), and injury to important neural progenitor cells (Dietrich et al., 2006).

Effects of Cancer and Treatment

While various risk factors contribute to the development of PCIs, cognitive impairment can be due to any number of things, including, direct effects of cancer itself and/or the adverse impact of cancer treatment (Moore, 2014; Pendergrass et al., 2018). The direct effects of cancer on cognition are multifaceted and arise from various biological and psychological mechanisms. Cancer itself can also cause metabolic changes, leading to severe weight loss, muscle wasting, and nutritional deficiencies, all of which can detrimentally affect brain health (Argiles, 2005). The psychological burden of a cancer diagnosis also contributes to cognitive impairment (Janelins et al., 2014). The stress, anxiety, and depression associated with facing a life-threatening illness can lead to elevated cortisol levels and altered brain chemistry, which impair cognitive function.

Treatment for cancer, while crucial for combating the disease, can also lead to significant cognitive impairments (Kovalchuk & Kolb, 2017). Chemotherapy, a cornerstone of cancer treatment, is often associated with cognitive deficits due to its neurotoxic effects on healthy brain

BELIEFS AND CBT-I

cells. Chemotherapy itself is more toxic to healthy brain cells than to the cancer cells they were designed to treat (Moore, 2014). These cognitive impairments can manifest across various domains, including memory, attention, processing speed, and executive function, persisting for months to several years following treatment. Both subjective and objective changes in cognition have been linked to chemotherapy, with patients commonly describing their experience as "chemo brain" or "brain fog" (Mitchell & Turton, 2011).

The term "chemo brain" underscores the significant impact of chemotherapy-related cognitive impairment on cancer survivors. Many patients are unaware, however of the potential cognitive side effects before undergoing treatment, highlighting a lack of communication and understanding between patients and healthcare professionals (Mitchell & Turton, 2011). This gap in awareness further disempowers patients, exacerbating the challenges faced by patients as they navigate the cognitive consequences of cancer treatment.

Impact of Cognitive Impairment

The impact of cognitive impairment among cancer survivors extends far beyond the realms of memory lapses and attention deficits; it significantly affects various facets of life, including emotional well-being (Li et al., 2013; Yang & Hendrix, 2018; Von Ah & Tallman, 2015), social interactions (Haywood et al., 2023; Reid-Arndt et al., 2009), occupational functioning (Garland et al., 2021; Von Ah et al., 2018), and overall quality of life (Boykoff et al., 2009; Dhillon et al., 2018). PCI represents a profound disruption to the sense of self and identity among many cancer survivors who struggle to reconcile their pre-cancer cognitive abilities with the challenges they face post-treatment. For example, an in-depth qualitative study of 74 breast cancer survivors detailed that many patients view cognitive impairment as the most problematic post-treatment symptom (Boykoff et al., 2009).

BELIEFS AND CBT-I

Emotional Well-Being

Cognitive impairment can profoundly impact the emotional well-being of cancer survivors (Li et al., 2013; Yang & Hendrix, 2018). The challenges posed by PCI often lead to feelings of frustration and anxiety, and hopelessness (Yang & Hendrix, 2018). Cross-sectional research confirms this association (Von Ah & Tallman, 2015). Tasks that were once effortless may now require immense concentration and effort, leading to a sense of inadequacy or incompetence. For instance, routine activities such as remembering appointments, managing daily tasks, or even engaging in conversations may become daunting challenges. This can create a persistent sense of self-doubt and diminish self-esteem, as survivors struggle to adapt to their cognitive limitations. Moreover, the fear of cognitive decline may linger, casting a shadow of uncertainty over survivors' futures and impacting their ability to fully engage in life post-treatment (Yang & Hendrix, 2018). This fear can be pervasive, affecting not only their personal and social lives but also their professional identities and career aspirations. The anticipation of further cognitive deterioration can exacerbate anxiety, leading to a vicious cycle where stress further impairs cognitive function, compounding the emotional burden.

Social Interactions

PCI can strain relationships and hinder meaningful connections with others (Haywood et al., 2023; Reid-Arndt et al., 2009). Survivors may withdraw from social activities or avoid social gatherings altogether due to embarrassment or fear of judgment regarding their cognitive struggles (Haywood et al., 2023). This social isolation can exacerbate feelings of loneliness and further contribute to psychological distress. Moreover, the challenges of PCI can affect an individual's ability to participate in conversations, remember important details, or engage in activities they once enjoyed, further impacting their social interactions and relationships. Cross

BELIEFS AND CBT-I

sectional research of breast cancer survivors also demonstrates that cognitive deficits in executive functioning are associated with decreased community involvement and social role functioning (Reid-Arndt et al., 2009). These challenges can directly impact an individual's self-efficacy and ability to manage and coordinate doctors' visits, follow-up appointments, prescriptions and medications, financial and insurance-based demands, as well as ability to engage in physical and social activities (Moyo et al., 2021).

The inability to fully participate in social interactions due to cognitive impairment can also lead to feelings of inadequacy and frustration, further eroding one's self-confidence and sense of belonging in social settings (Boykoff et al., 2009). Studies have shown that social isolation and loneliness are associated with poorer health outcomes and reduced quality of life in cancer survivors (Oppegaard, 2023). This systematic literature review of 130 articles highlighted how survivors experiencing cognitive challenges tend to withdraw from social interactions, which intensifies their feelings of loneliness and isolation, creating a detrimental cycle that affects both their mental and physical health. Ultimately, cognitive impairment substantially impacts an individual and can be detrimental to an individual's self-confidence and social relationships (Dhillon et al., 2018).

Occupational Functioning

PCI can also negatively affect an individual's ability to return to work, impair overall performance, and can result in prolonged leaves of absence or early retirement (Garland et al., 2021; Von Ah et al., 2018). Many survivors find it challenging to return to work following treatment due to the cognitive difficulties they experience (Von et al., 2018). Tasks that require memory, concentration, and decision-making may become increasingly difficult, leading to impaired job performance and potential career setbacks. Furthermore, the cognitive challenges

BELIEFS AND CBT-I

posed by PCI may necessitate accommodations in the workplace to support survivors in maintaining their employment and achieving their professional goals. In addition to the direct impact on job performance, cognitive impairment may lead to feelings of frustration and inadequacy in the workplace, further impacting an individual's self-esteem and confidence (Wells et al., 2013). Wells et al. (2013) conducted a systematic review and meta-analysis of 25 publications examining the impact of cognitive impairment on work-related outcomes among cancer survivors. The study found that cognitive impairment is significantly associated with reduced work ability, increased absenteeism, and early retirement. The results indicated that survivors with cognitive impairment were more likely to report difficulties in performing work tasks, decreased productivity, and a higher likelihood of job loss or the need to change jobs. These findings underscore the critical need for workplace interventions and support systems to help cancer survivors manage cognitive challenges and maintain their occupational functioning.

A literature review of 25 articles examined return to work outcomes for breast cancer survivors, focusing on return-to-work timeframe, work ability, and work performance (Sun et al., 2016). Quantitative studies consistently showed a decrease in employment among breast cancer survivors compared to cancer-free individuals. Timeframes for returning to work varied, with many women returning within a year post-treatment, although some studies reported longer delays (Balak et al., 2011; Petersson et al., 2009; Johnsson et al., 2011). In terms of work ability, survey research found more work limitations in a sample of 100 breast cancer survivors, compared to a group of women without a cancer diagnosis (Hansen et al., 2008). Work ability was also frequently impaired, with significant limitations reported due to symptoms like cognitive impairment, irrespective of age (Carlsen et al., 2013; Hansen et al., 2008). Work

BELIEFS AND CBT-I

performance, or work productivity, was consistently found to be reduced in survivors compared to healthy controls (Calvio et al., 2009; Lavigne et al., 2008; Quinlan et al., 2011).

Quality of Life

Beyond the emotional, social, and occupational challenges, PCI can significantly diminish overall well-being and quality of life (Boykoff et al., 2009; Dhillon et al., 2018). The constant struggle to manage cognitive difficulties can erode self-confidence and undermine one's sense of identity. Survivors often report that "chemo brain" leads to a notable decline in daily functioning and overall satisfaction with life (Boykoff et al., 2009). The limitations imposed by PCI can prevent individuals from engaging in activities that bring joy and fulfillment, further impacting their overall satisfaction with daily life (Moyo et al., 2021). Even slight cognitive deteriorations can have devastating effects on quality of life, emphasizing the importance of recognizing and addressing these issues (Grober, 2002).

Insomnia and Cognitive Impairment Comorbidity

Role of Sleep in Cognitive Function

Past research highlights the comorbid relationship that exists between sleep and cognition. Findings from a comprehensive review of observational studies provide robust evidence supporting the link between sleep disturbances and cognitive impairment among older adults in the general population (Yaffe et al., 2014). This research encompassed a wide array of sleep-related issues, including insomnia, sleep quality, sleep duration, excessive daytime sleepiness, sleep-disordered breathing, and circadian rhythm disturbances. The results demonstrated that participants suffering from insomnia exhibited a significantly higher risk of developing dementia compared to those without sleep disturbances, underscoring the critical role that adequate sleep plays in maintaining cognitive health. Specifically, chronic insomnia was

BELIEFS AND CBT-I

linked to an elevated risk of cognitive decline, with the impact varying by sex and the presence of depression. Men, regardless of their depressive status, showed greater cognitive decline if they suffered from chronic insomnia. For women, the combination of chronic insomnia and depression was particularly detrimental, leading to more pronounced cognitive deterioration. These findings collectively suggest that the sleep-wake cycle plays an integral part in brain aging and overall cognitive function. Disruptions in sleep patterns can accelerate cognitive decline, highlighting the importance of addressing sleep disorders as a preventive measure against cognitive impairment.

Individuals with insomnia also report cognitive difficulties such as memory and attention (Fortier-Brochu et al., 2012). In a meta-analysis of 24 studies, including 639 participants with insomnia and 558 controls, individuals with insomnia displayed performance impairments among several areas of cognition including: working memory (tasks involving retaining material in short term memory); episodic memory (tasks involving learning material and recalling it after either a short or long delay), and some aspects of executive functioning (problem solving tasks). Sleep not only plays an important role in memory consolidation and contributes to insightful, inferential thinking, but lack of sleep negatively impacts overall cognitive function and prolonged wakefulness results in subjective and objective cognitive impairment (Deak & Stickgold, 2010; Hao et al., 2021).

Role of Sleep in Cognitive Function among Cancer Patients

Relative to the general population, there is similar evidence for the association between sleep and cognition among cancer patients/survivors with insomnia. This research highlights the significant overlap between sleep disturbances and insomnia with cognitive decline among cancer populations (Caplette-Gingras et al., 2013; Garland et al., 2021; Garland et al., 2021;

BELIEFS AND CBT-I

Garland et al., 2022; Liou et al., 2019; Rodriguez et al., 2020; Von Ah & Tallman, 2015).

Comorbid insomnia and cognitive impairment are experienced by about 1 in 5 cancer patients (Garland et al., 2021). This comorbid association is more likely among patients that are younger, female, not currently working or receiving chemotherapy, with clinical levels of depression and anxiety, and taking medications such as antidepressants or anxiolytics (Garland et al., 2021).

Research analyzing cross-sectional data demonstrated that, among 1072 women with breast cancer, 556 (51.9%) reported insomnia and 847 (79.0%) reported cognitive difficulties (Liou et al., 2019). Importantly, as insomnia severity increased, so did the proportion of women reporting concerns related to cognitive impairment. This finding suggests a dose-response relationship between insomnia severity and cognitive difficulties among cancer patients, highlighting the progressive impact of sleep disturbances on cognitive function in this population.

Similar results highlight that one in five cancer patients suffer from comorbid insomnia and PCIs (Garland et al., 2022). In a secondary analysis, 962 cancer patients completed survey measures to assess insomnia and PCI at 6 time points: baseline (T1), 2 months later (T2), 6 months later (T3), 10 months later (T4), 14 months later (T5), and 18 months later (T6). The results revealed significant bidirectional relationships between insomnia and PCI at all time points and across the duration of the study. The prevalence of comorbid insomnia and cognitive impairments ranged from 18.73% to 25.84%, with the highest proportions observed at T1 and T2, which were significantly greater than at T4, T5, and T6. Comorbid insomnia and PCI are also more common in the beginning stages of a cancer diagnosis and appears to be bidirectional (Garland et al., 2022; Von Ah & Tallman, 2015). Symptoms of insomnia and cognitive impairment also seem to persist; research highlighting that these symptoms endure over a 12-

BELIEFS AND CBT-I

month study duration (Rodriguez et al., 2020) as well as persisting from 6 months to 20 years into remission (Koppelmans et al., 2012).

Cognitive Behavioral Therapy for Insomnia (CBT-I)

Cognitive Behavioral Therapy for Insomnia (CBT-I) is a multimodal intervention that combines several interrelated cognitive and behavioral treatment elements, such as sleep restriction, stimulus control, sleep hygiene, cognitive restructuring, and relaxation training (Garland et al., 2014). Sleep restriction, also known as sleep consolidation, helps to address the common problem individuals with insomnia have of spending hours in bed struggling to sleep. It does so by building homeostatic sleep drive to reduce sleep-onset latency (SOL) and wake after sleep onset (WASO), which promotes time spent in slow wave sleep and improves overall sleep quality (Garland et al., 2014). Consequently, by staying awake longer, the patient is able to fall asleep more easily when they do get into bed (Rossman, 2019). Next, stimulus control ensures individuals with insomnia do not associate their bed with anxiety and wakefulness by instructing the patient to only use their bed for sleeping (Rossman, 2019). This is achieved by reconditioning the bed to be associated with sleep, thereby breaking the conditioned association that has been developed in insomnia. Next, cognitive restructuring involves changing maladaptive thinking and negative thoughts surrounding sleep into more constructive thoughts (Rossman, 2019). For example, negative thoughts surrounding sleep such as “I dread getting into bed because I won’t be able to get to sleep” are changed into more constructive thoughts, such as “I can let go and trust in my body’s natural ability to sleep”. By identifying and addressing thoughts and beliefs that may reinforce poor sleep behaviors, this decreases anxiety and increases positive thoughts surrounding sleep. Lastly, relaxation training includes techniques that quiet the mind and relax the body, such as deep breathing exercises and mindfulness

BELIEFS AND CBT-I

(Rossman, 2019). In terms of sleep hygiene, this is a set of guidelines given to patients that promote healthy sleep. Guidelines include making sure the room is cool, dark, comfortable, and quiet, refraining from eating 2 to 3 hours before bedtime, etc. (Rossman, 2019).

Although each component of CBT-I has demonstrated effectiveness, their utility as standalone interventions vary. Research suggests that while individual elements like sleep restriction and stimulus control can be beneficial on their own, they tend to be more effective when combined with other components of CBT-I. For instance, Maurer and Kyle (2022) highlight that the efficacy of single CBT-I components is generally enhanced when used as part of a comprehensive treatment approach, rather than in isolation. Sleep restriction and stimulus control, for example, address different aspects of insomnia and are more impactful when integrated with cognitive restructuring and relaxation training. Similarly, while relaxation techniques and sleep hygiene are valuable, their effects are often modest when applied alone and are most effective when combined with other therapeutic strategies. Therefore, a multimodal approach incorporating all these components typically provides the most robust results for treating insomnia.

Efficacy of CBT-I in General and in Cancer Populations

CBT-I has demonstrated efficacy and is recommended by major health organizations. According to the American Association of Sleep Medicine, CBT-I is highly effective and considered a first-line treatment for insomnia disorder (Morgenthaler et al., 2006). Similarly, the American College of Physicians endorses CBT-I as the preferred treatment for managing insomnia (Qaseem, 2019). In general populations, CBT-I has been shown to improve sleep quality, reduce the time it takes to fall asleep, decrease nighttime awakenings, and enhance overall sleep efficiency (Bennett, 2020). These improvements contribute to better daytime

BELIEFS AND CBT-I

functioning and quality of life for individuals suffering from insomnia. CBT-I provides results that are equivalent to sleep medication, with only temporary side effects (daytime sleepiness, mood dysregulation, and daytime dysfunction), fewer episodes of relapse, and a tendency for sleep to continue improving, even after treatment (Rossman, 2019).

CBT-I is also a robust treatment for cancer-related insomnia. In a meta-analysis of 22 studies, with a sample size of 1461 participants, CBT-I significantly improved insomnia severity among cancer survivors with benefits lasting at 3- and 6-month follow-up (Squires et al., 2022). CBT-I positively impacted self-reported sleep efficiency, wake after sleep onset, total sleep time, sleep onset latency, sleep quality, anxiety, depression, fatigue, and overall quality of life. An additional meta-analysis of randomized controlled trials of CBT-I among cancer survivors (n = 752) further highlights its beneficial outcome (Johnson et al., 2016). Specifically, analysis of 8 included studies indicated that CBT-I resulted in a 15.5% improvement in sleep efficiency from pre- to post-intervention when compared to a control group. The results also demonstrate that sleep latency was reduced by 22 minutes, relative to a reduction of 8 minutes in the control group. CBT-I not only improves sleep-related outcomes but has also been demonstrated to impact anxiety and depression related to cancer treatment (Fleming et al., 2014).

While face-to-face CBT-I may be the gold standard, there is also evidence that video-delivered CBT-I is effective in treating insomnia symptoms among cancer patients (Amidi et al., 2022; Garland, Savard, et al., 2021; Savard et al., 2021). Video-delivered CBT-I offers increased accessibility relative to traditional in-person CBT-I, serving as a viable alternative for patients who lack access to in-person sessions. Thus, independent of delivery format, CBT-I has been repeatedly highlighted in the literature as a first line treatment for chronic insomnia among cancer patients.

BELIEFS AND CBT-I

Using CBT-I to Improve Cognition

Due to the significant overlap between sleep and cognition, CBT-I may prove to be an effective treatment for PCIs as well as insomnia. Moreover, the proposed biological mechanisms for the relation between sleep disturbances and cognitive decline highlight the significant overlap between sleep and cognitive pathways (Deak & Stickgold, 2010; Garland et al., 2022). These specific findings suggest that an intervention designed to treat insomnia, may also positively impact cognitive function.

There is growing support for the use of CBT-I in treating PCIs among cancer patients (Garland et al., 2024; Herbert et al., 2018; Quesnel et al., 2003). Early research suggested that CBT-I was associated with significant improvements in mood, general and physical fatigue, and global and cognitive dimensions of quality of life (Quesnel et al., 2003). A systematic review and narrative synthesis further support this (Herbert et al., 2018). Although not conducted among patients with cancer, 18 studies involving 923 participants with insomnia symptoms reported small to moderate effects of CBT-I on subjective measures of cognitive functioning. These findings suggest that CBT-I may present a promising avenue for addressing cognitive impairments among cancer patients, as it has shown efficacy in treating insomnia and has been associated with improvements in cognitive function.

A randomized controlled trial of virtually delivered CBT-I further supports these results and provides empirical evidence into the effectiveness of CBT-I in treating cognitive impairment among cancer survivors (Garland et al., 2024). This research included 132 Canadian cancer survivors who underwent assessments conducted at multiple time points and were assigned to one of two groups: CBT-I or waitlist control. Results indicated significant reductions in insomnia severity and substantial improvements in perceived cognitive impairment, cognitive abilities, and

BELIEFS AND CBT-I

quality of life among those receiving CBT-I, with these benefits maintained at 6-month follow-up. Moreover, change in insomnia symptoms fully mediated the effect of CBT-I on subjective cognitive outcomes. These findings suggest that CBT-I holds promise as an effective intervention for managing PCI in cancer survivors, emphasizing the importance of integrating evidence-based insomnia treatment into cancer care settings.

Credibility Beliefs and Treatment Expectancy

Definition and Measurement

Beliefs about treatment credibility and expectation of benefit are important to consider in determining the overall effectiveness of a psychological intervention. Credibility beliefs encompass a client's belief about a treatment's personal logicity, suitability, and efficaciousness (Constantino et al., 2018). Personal logicity refers to the client's belief that the treatment makes sense to them on a personal level, aligning with their understanding of their condition and how it can be addressed (Constantino et al., 2018). Suitability pertains to the client's belief that the treatment is appropriate for their specific situation, considering the fit between the treatment approach and the individual's unique characteristics, needs, and preferences (Constantino et al., 2018). Efficaciousness involves the client's belief in the treatment's ability to produce the desired results, encompassing their confidence that the treatment can effectively address their issues and lead to improvement (Constantino et al., 2018). Credibility beliefs are not constant and can shift and develop over the course of treatment based on further exposure to the intervention (Mooney et al., 2014; Schulte, 2008).

Similarly, treatment expectancy is an individual's beliefs about how likely they are to benefit from a treatment (Thompson-Hollands et al., 2014). That is, the degree to which an individual believes a treatment will impact them, prior to beginning the treatment. Outcome

BELIEFS AND CBT-I

expectancy, then, reflects an individual's expected symptom improvement by receiving a specific intervention. This construct is crucial because it significantly influences a person's decision to commence treatment (Constantino, 2012; Vogel et al., 2005). Individuals with high outcome expectancy are more likely to start and persist with a treatment, as they believe it will lead to meaningful improvements in their symptoms.

In other words, credibility represents “what an individual *thinks* will happen” and expectancy represents “what an individual *feels* will happen”. Although credibility and expectancy are fundamentally related, research highlights important distinctions between the two (Deville & Borkovec, 2000; Greenberg et al., 2006). Some disagreements do exist, however, regarding the extent to which credibility and expectancy overlap (Constantino, 2012). Although theoretically distinct, these two factors are often used interchangeably in the literature. A randomized controlled trial of 37 individuals with anxiety-related disorders undergoing treatment with the unified protocol highlighted a correlation between patients' credibility rating and outcome expectancies with some shared variance (13%) (Thompson-Hollands et al., 2014). Utilizing the Credibility Expectancy Questionnaire (CEQ), these constructs will be measured both combined as well as separately, due to the scale possessing a unique ability to capture both credibility beliefs and outcome expectancy individually.

Development of Credibility and Expectancy Beliefs

Understanding how individuals develop credibility and expectancy beliefs is essential because these beliefs can significantly influence how clients engage with and respond to psychological treatments (Constantino et al., 2018; Greenberg et al., 2006). Credibility beliefs, which involve a logical evaluation of a treatment's personal suitability and efficacy, are developed through a more cognitive process (Deville & Borkovec, 2000). In contrast,

BELIEFS AND CBT-I

expectancy beliefs, which pertain to the anticipated benefits of the treatment, arise from more affective or emotional processes. Dating back over 50 years, it was postulated that effective treatment requires an individual to develop or reacquire a belief that change is possible and that a given treatment makes sense to effect such change (Frank, 1961). Additionally, drawing on social influence theory (Strong & Claiborn, 1982), psychotherapy can be likened to an interpersonal influence process whereby therapists gain influence through establishing credibility with clients and subsequently use that influence to bring about desired change in client behavior and ways of thinking (Constantino et al., 2018).

In this regard, credibility serves as a foundation for thoroughly understanding and incorporating CBT-I, which might directly relate to the outcomes of this intervention. As expectancy relates to the extent to which an individual engages with therapy (Vogel et al., 2005), it could determine the depth of exploring the possibilities of CBT-I. Expectancy also impacts how effective the psychological treatment is perceived to be. Based on the perceptual processes underlying credibility and expectancy, credibility may be more strongly related to outcomes involving cognitive interpretations, such as general thoughts about the self and others, while expectancy may be more strongly related to affective outcomes, such as reductions in depression and anxiety (Boelen et al., 2003; Newman & Fisher, 2010).

As a result, beliefs about credibility and expectancy can impact an individual's overall perception of a treatment's efficacy and, in turn, can impact how they accept and react to a treatment (Deville & Borkovec, 2000; Vogel et al., 2005). This is particularly important for subjective outcomes, as subjective outcomes are directly influenced by beliefs. Additionally, this is also important in the context of a psychological intervention, as evidence suggests that the outcome of any treatment approach is based less on its respective techniques, and more on non-

BELIEFS AND CBT-I

specific factors, such as the therapeutic alliance, empathy, and the client's expectations and belief for improvement, which are shared by all forms of psychotherapy (Asnaani & Foa, 2014; Laska et al., 2014). Survey research suggests that psychological factors and attitudes towards treatment predict 62% of variance in intent to seek psychological help in a sample of college students at a large Midwestern University (Vogel et al., 2005). This research also highlights that attitude toward counselling mediated most of the relationships between the different psychological factors and help-seeking intent. Although an individual who decides to begin an intervention is assumed to expect positive change, numerous factors impact this including clinical characteristics (e.g., symptom severity, psychological mindedness), as well as how credible the treatment seems (Constantino et al., 2014; Tsai et al., 2014).

Importance of Credibility and Expectancy Beliefs

Therapeutic Alliance

The therapeutic relationship is a professional relationship involving a good working alliance, trust, honesty, and the promise of confidentiality (Hill & Knox, 2009). This relationship is pivotal for the success of counseling, often exerting a greater influence on client change than the individual techniques employed. Therapeutic alliance is a widely accepted predictor of psychotherapy outcomes (Ardito & Rabellino, 2011) and is thus an important factor to consider. Some non-specific factors are well studied in the context of CBT. For example, research highlights the importance of the therapeutic alliance, as well as several clinical (e.g., symptom severity), demographic (e.g., gender), and personal (e.g., religiosity) characteristics in terms of CBT effectiveness (Bowen et al., 2006; Olatunji et al., 2013; Spek et al., 2008; Thompson-Hollands et al., 2014).

BELIEFS AND CBT-I

Credibility and expectancy beliefs are integral to the therapeutic alliance (Cohen et al., 2015). Clients are more likely to develop a strong therapeutic alliance when they perceive a treatment as logical and suitable (credibility), and believe they are likely to benefit from it (expectancy). Research has consistently demonstrated that these beliefs significantly influence the development and strength of the therapeutic alliance (Constantino et al., 2020; Constantino, Vîslă et al., 2018; Vîslă et al., 2018). For example, a meta-analysis of 81 independent samples, encompassing 12,722 patients, found that more positive pre-treatment beliefs were associated with more robust therapeutic alliances (Constantino, Vîslă et al., 2018). This strong alliance, in turn, predicted better treatment outcomes, underscoring the importance of these beliefs in forming a positive therapeutic relationship. Additionally, a study involving 91 patients who completed 10 weeks of group CBT indicated that the relationship between baseline outcome expectation and post-treatment anxiety and depression was mediated by the quality of the therapeutic alliance (Vîslă et al., 2018). Further, research using a longitudinal independence model has shown that both patient and therapeutic outcome expectations influence the quality of the therapeutic alliance on a session-by-session basis, which in turn translates into better patient outcomes (Constantino et al., 2020). This study found that when patients had greater outcome expectations at one session, their therapist reported better next-session alliances, demonstrating the dynamic and dyadic nature of these constructs. Collectively, these findings underscore the importance of fostering positive credibility and expectancy beliefs to enhance the therapeutic alliance and, consequently, improve treatment outcomes.

Willingness to Accept and Engage with Treatment

Research also suggests that common therapeutic factors such as treatment engagement are associated with credibility and expectancy (Thompson-Hollands et al., 2014). A recent

BELIEFS AND CBT-I

randomized controlled trial of a yoga intervention versus a health education control group for the treatment of depression underscores this relationship (Uebelacker et al., 2018). In this study, treatment engagement was examined in relation to participants' (n = 122) beliefs about the efficacy of the treatment and their expectations of its benefits. The results demonstrated that participants who held positive beliefs about the treatment's effectiveness and had high expectations for improvement were more likely to engage fully with the intervention. This suggests that enhancing a client's credibility and expectancy beliefs can lead to better engagement, which is critical for the success of any therapeutic approach. Similarly, in a study of virtually delivered CBT, higher pre-treatment credibility beliefs were associated with higher rates of adherence (El Alaoui et al., 2015), further emphasizing the importance of fostering positive credibility and expectancy beliefs to improve treatment adherence and outcomes.

Credibility Beliefs/Expectancy and Treatment Outcomes

Treatment Effectiveness

A recent meta-analysis examined the perception of treatment credibility and posttreatment outcomes across a range of therapeutic approaches and presenting concerns (Constantino, Coyne et al., 2018). Included in the meta-analysis were 24 independent samples with a total of 15,404 patients. To be included, articles published through August 2017 had to meet specific criteria: (a) include a clinical sample, (b) include a therapist-delivered treatment of at least three sessions, (c) include a measure of patients' own early treatment credibility perception, (d) include at least one posttreatment mental health outcome not explicitly referenced as a follow-up occasion, and (e) report a statistical test of the credibility–outcome association. The treatment types/modalities included individual CBT, group CBT, problem-solving CBT, physical therapy, family-based treatment, and supportive therapy. The outcome variables

BELIEFS AND CBT-I

measured included pain and impairment, quality of life, social anxiety, anxiety severity, depression, PTSD, obsessive-compulsive disorder (OCD) symptoms, and binge and purge frequency, among others. Most of these studies utilized the Credibility/Expectancy Questionnaire (CEQ; Devilly & Borkovec, 2000) to assess baseline beliefs, with outcome measures varying from study to study.

The results of this meta-analysis provided an overall significant association between treatment credibility and treatment outcomes. Specifically, higher credibility and expectancy scores at baseline were correlated with better outcomes across the different therapeutic modalities and presenting concerns. For instance, patients who believed more strongly in the effectiveness of the treatment they were receiving were more likely to experience reductions in symptoms of depression, anxiety, and PTSD. Additionally, positive credibility beliefs were associated with improvements in quality of life and reductions in OCD symptoms and binge/purge behaviors. This highlights that patients' treatment credibility beliefs and outcome expectancy are empirically supported correlates of treatment outcomes. Therefore, therapists should assess and potentially enhance these beliefs throughout the course of treatment to improve engagement and therapeutic success. By fostering a sense of credibility and expectancy, therapists can help patients to remain committed to the treatment process, thereby maximizing the likelihood of positive therapeutic outcomes.

Research also highlights the direct link between beliefs regarding credibility and expectancy, and therapeutic outcomes (Greenberg et al., 2006). This has been demonstrated across both physical illnesses such as chronic low back pain (Smeets et al., 2008), as well as psychological concerns (Cohen et al., 2015). In terms of therapeutic approaches, this has been demonstrated across a range of psychotherapies, including CBT (Safren et al., 1997; Smeets et

BELIEFS AND CBT-I

al., 2008), cognitive behavioral group therapy (Safren et al., 1997), exposure based CBT (Lewin et al., 2011), and medication (Rutherford et al., 2013). The association between credibility beliefs and outcomes has also been established across a wide range of psychological issues. This includes social anxiety disorder (Safren et al., 1997), depression (Rutherford et al., 2013), substance abuse (Kuusisto et al., 2011), OCD (Lewin et al., 2011), and personality disorders (Wenzel et al., 2008).

Treatment Retention and Adherence

Research in the domain of credibility beliefs and outcome expectancies illustrates a strong relationship between pre-treatment beliefs, and treatment retention and overall adherence to interventions. Several key studies provide empirical support for this connection. First, a randomized controlled trial involving outpatients with substance abuse (n = 327) found that baseline expectancy ratings were positively associated with treatment retention and effectiveness (Kuusisto et al., 2011). This indicates that patients who had higher expectations about the benefits of their treatment were more likely to stay engaged and achieve better outcomes. Thus, empirical evidence supports the notion that pre-treatment beliefs are crucial for overall treatment effectiveness and treatment retention.

Next, a randomized controlled trial with participants suffering from OCD (n = 71) undergoing exposure-based CBT found that higher treatment expectations were associated with better treatment response and reduced impairment (Lewin et al., 2011). Moreover, these higher expectations were linked to lower attrition rates and better adherence to homework assignments. The study also identified several factors contributing to lower pre-treatment expectations, including baseline depressive symptoms, child/parent-related functional impairment, externalizing behavior problems, the number of comorbid psychiatric disorders, and a lower

BELIEFS AND CBT-I

perception of control. These findings highlight the multifaceted nature of treatment expectations and their significant impact on both treatment adherence and outcomes.

Additionally, research utilizing a randomized controlled trial design with 162 participants demonstrated that greater treatment credibility beliefs predicted higher treatment adherence. Conversely, lower credibility beliefs were associated with higher dropout rates in an internet-based CBT program (Alfonsson et al., 2016). This underscores the importance of fostering strong credibility beliefs, particularly in digital and remote treatment settings, to enhance adherence and reduce dropout rates. Overall, the evidence supports the critical role of pre-treatment credibility beliefs and outcome expectancy in enhancing treatment retention and adherence. Clinicians should assess and foster these beliefs early in the therapeutic process to improve patient engagement and outcomes.

Credibility Beliefs/Expectancy and CBT-I

Despite the growing literature on this topic, limited research exists in terms of credibility beliefs and treatment expectancy in relation to CBT-I. The extant research provides empirical evidence into the role that pre-treatment beliefs play in CBT-I treatment outcomes (Cho et al., 2021; Constantino et al., 2007; Jansson-Fröjmark & Jacobson, 2021; Norell-Clarke et al., 2015). In a randomized controlled trial of 64 participants diagnosed with insomnia, no significant differences were found between the two groups (CBT-I vs relaxation training) on the credibility subscale. On the expectancy subscale, the CBT-I group reported higher expectancy, relative to the relaxation training group. Greater attrition and lower attendance were observed among participants assigned to the relaxation training group, which may be explained by lower expectancies compared to the CBT-I group. Another study by Jansson-Fröjmark & Jacobson (2021) examined the efficacy of CBT-I among patients with insomnia disorder co-morbid with

BELIEFS AND CBT-I

generalized anxiety disorder (GAD) in an open trial design. They administered CBT-I to 24 patients over 10 weeks and assessed outcomes including insomnia severity, anxiety, depression, functional impairment, and quality of life. The study reported moderate to large effect sizes for CBT-I on insomnia symptoms, with approximately 61% of patients responding to treatment and significant improvements in GAD symptoms, depression, functional impairment, and quality of life. The findings also highlighted positive treatment perceptions, including high credibility and expectancy among participants. While not directly comparing credibility beliefs and treatment expectancy to insomnia outcomes, this study reported high credibility and expectancy among participants, suggesting a positive influence on treatment outcomes.

A recent review by Cho et al. (2021) delves into patient characteristics associated with favorable response and adherence to CBT-I, emphasizing the significant role of motivation and treatment expectancies in predicting better subjective improvements, and highlighting the need to address and enhance these factors for effective treatment outcomes. Therapeutic factors may also play a role. Drawing on interpersonal theory and the broader psychotherapy literature, Constantino et al. (2007) investigated patient expectations and outcome in group CBT-I using a case series study. Using a sample of 86 participants, the research demonstrated a significant negative interaction between expectations and therapist affiliations, where therapist affiliation refers to the perceived warmth, empathy, and supportive connection between therapist and patient. That is, for individuals with high expectations for change, perceived therapist affiliation made little difference to treatment outcome; while individuals with low expectations for change had better outcomes if they perceived their therapist as more affiliative. This finding suggests that a specific aspect of therapeutic alliance, perceived therapist affiliation, is particularly relevant for those individuals who doubt the credibility and expectancy of CBT-I.

BELIEFS AND CBT-I

In summary, research into credibility beliefs and outcome expectancy in the context of CBT-I suggests that pre-treatment beliefs may play a role in treatment outcomes (Cho et al., 2021; Constantino et al., 2007; Jansson-Fröjmark & Jacobson, 2021; Norell-Clarke et al., 2015). Research demonstrates that higher treatment expectancies are associated with better subjective improvements following CBT-I (Cho et al., 2021), while perceived therapist affiliation, may mitigate the impact of low expectancy beliefs (Constantino et al., 2007). Moreover, the comparison between CBT-I and relaxation training highlights the importance of addressing and enhancing patient motivation and expectations to mitigate attrition rates and optimize treatment adherence (Norell-Clarke et al., 2015). Overall, these findings emphasize the need for clinicians to assess and address patients' pre-treatment beliefs to optimize the effectiveness of CBT-I interventions.

CBT-I Credibility and Expectancy among Cancer Survivors

In terms of credibility beliefs and expectancy for CBT-I treatment outcomes within cancer populations, even less research exists, and the results are inconsistent. In a randomized waitlist-controlled trial of CBT-I among individuals with breast cancer (n = 57) (Tremblay et al., 2009), improvements in subjective sleep at posttreatment was associated with the initial level of expectations and perceived credibility of treatment. there was no significant relationship between baseline expectancy and CBT-I treatment outcome in a more recent randomized comparative effectiveness trial of CBT-I versus acupuncture in a heterogeneous sample of 160 cancer survivors with insomnia (Li et al., 2022); however, a significant association was demonstrated between pre-treatment expectancy and insomnia severity in the acupuncture group. This might suggest that CBT-I is not as impacted by beliefs when compared to other non-pharmacological, but less behaviorally based interventions. Additional research is well warranted to further

BELIEFS AND CBT-I

investigate whether the pre-treatment credibility and outcome expectancy effect can be seen in relation to CBT-I.

Justification for the Proposed Research

Understanding how beliefs regarding credibility and expectancy influence CBT-I is essential, especially considering limited research in this area. When patients have positive beliefs about the credibility and effectiveness of CBT-I, they are more likely to engage in treatment, adhere to therapy recommendations, and experience better outcomes. On the other hand, negative beliefs may lead to skepticism, reluctance to participate, and poorer treatment adherence, ultimately affecting the effectiveness of the intervention. By gaining insights into these factors, clinicians can tailor treatment approaches, address patient concerns, and enhance the overall success of CBT-I in managing insomnia and PCI, ultimately improving the quality of life for patients. Therefore, understanding the role of beliefs in treatment outcomes is imperative for optimizing therapeutic interventions and promoting positive patient experiences.

The proposed research seeks to extend the past literature to investigate how beliefs about treatment credibility and expectancy influence the outcomes of CBT-I among cancer survivors with insomnia and cognitive impairment. The current study is a secondary analysis of a completed trial of CBT-I, in which we demonstrated that CBT-I significantly improves insomnia as well as subjective and objective parameters among cancer survivors (Garland et al., 2024). The prespecified aims were to: 1) examine what factors were associated with higher treatment credibility and expectancy; 2) investigate whether pre-treatment credibility and expectancy moderate change in treatment outcomes for insomnia and PCI; and 3) explore post-treatment perceptions of expectancy and credibility with a subsample of participants using qualitative interviews.

Methods

Study Design

The details of the original trial have been published elsewhere (Garland et al., 2024; Garland et al., 2021) and are summarized here. This study was a randomized waitlist-controlled trial of CBT-I among cancer survivors with insomnia disorder and comorbid cognitive complaints. Participants were recruited from October 2019 to July 2022 and included a total sample size of 132. Canadian cancer survivors were randomly assigned to receive seven weekly virtual CBT-I sessions (n = 63) or placed in a waitlist control group (n = 69). Assessments were completed at baseline, 1 month (mid-treatment), and 2 months (post-treatment), with additional follow-up at 3 and 6 months. The study was approved by the Newfoundland and Labrador Health Research Ethics Board and was registered at clinicaltrials.gov (NCT04026048).

Participants

Participants were recruited from one of the four Canadian Atlantic Provinces (Newfoundland and Labrador, Prince Edward Island, New Brunswick, and Nova Scotia). Inclusion criteria were: (1) age 18 years or older; (2) ability to easily understand and read English; (3) no current evidence of cancer or clinically stable/inactive disease; (3) received and completed all treatments at least 6 months prior to study entry; (4) report PCI as indicated by a score of “quite a lot” or “always” on at least one of the two items that assesses concentration and memory on the European Organization for Research and Treatment of Cancer (EORTC); (5) meet the DSM-5 criteria for insomnia disorder and have a score of 8 or greater on the Insomnia Severity Index; (6) have good performance status as indicated by an Eastern Cooperative Oncology Group (ECOG) score of 0-2; and (7) have high-speed internet, webcam, and are fluent using the internet. Patients receiving continued hormone treatment or maintenance targeted

BELIEFS AND CBT-I

therapies, or those taking psychotropic medication, hypnotics, or sedatives, remained eligible, provided that the dose had been stable for the past 6 weeks.

Exclusion criteria included: (1) a sleep disorder besides insomnia, that was not adequately treated; (2) the presence of another psychological disorder that was not stable; (3) a major sensory deficit; (3) a neurologic or major medical condition known to affect cognitive function; (4) a history of cranial radiation; (5) a history of any other condition that may impact cognitive functioning; and (6) previous experience with CBT-I.

Participants were mainly recruited via self-referral. Creative strategies were also employed including posting announcements and having pamphlets in the main areas of medical centres, notifying treating physicians, nurses, and health professionals, as well as notifying community supports, posting information on websites, local newspapers and television programs media releases, and paid advertising in print media, on the radio, television, and/or social media.

Procedure

Eligible individuals provided informed consent and then completed sleep, symptom, and cognitive assessments. Pre-treatment credibility and expectancy was measured separately for the effect that CBT-I would have on insomnia and cognitive impairment. Participants were sequentially randomized to: (1) immediate CBT-I treatment; or (2) waitlist control. Participants in the immediate treatment group received the CBT-I intervention immediately, while participants in the wait-list control group received CBT-I following a two-month waiting period to match the length of the CBT-I therapy.

To encourage retention and adherence to the study, participants were provided with a compensation of \$20 per assessment in the form of a gift card to a vendor of their choice. All participants were invited to participate in a qualitative interview with the researcher upon

BELIEFS AND CBT-I

completion of treatment sessions. The interview was semi-structured and participants were asked a series of open-ended questions regarding their beliefs going into the study, how they felt about the overall treatment, their relationship with the study's therapist, and how they felt the treatment did or did not help them. A total of 21 participants accepted the invitation to the qualitative interviews, and all 21 were interviewed. The decision to stop recruiting was based on the determination of data saturation, where no new themes or insights were emerging from additional interviews. As a result, the sample size of 21 was deemed sufficient to capture a comprehensive range of perspectives. There was no specific method used to obtain a representative subsample, as saturation was reached with the participants who were already involved. The interviews were conducted over a secure video conference system, according to participant and researcher preferences and availability. Each interview lasted approximately 30 minutes. Participants who completed the qualitative interview were compensated with an additional \$30 gift card for their time.

Intervention

Over the course of the seven weekly, one-hour sessions, each participant received individualized CBT-I delivered via an online video conferencing platform. The intervention was conducted by trained doctoral students under the supervision of a PhD level registered Clinical Psychologist who has experience conducting CBT-I for more than ten years. Throughout the course of the study, all therapists received training in the manualized CBT-I protocol and attended weekly case supervision sessions with video review. During weekly supervision, a checklist of the key lessons to be covered in each therapy session were reviewed, and compliance with the CBT-I protocol were assessed. Any adverse events that happened during or after CBT-I

BELIEFS AND CBT-I

(e.g., mood disturbance, sleepiness, or other changes in symptoms) were monitored for and documented, in accordance with CONSORT recommendations.

Measures

Credibility Expectancy Questionnaire

The Credibility/Expectancy Questionnaire (CEQ) was used at the baseline assessment to quantify credibility or expectancy beliefs (Devilley & Borkovec, 2000). The CEQ is currently the most widely used measure of treatment credibility and expectancy (Constantino et al., 2018). This is a 6-item questionnaire that captures both credibility beliefs and outcome expectancy. Questions on this scale are rated on a 1-to-9 point or 0-100% Likert scale, depending on the exact question. The original scale was adapted to separately assess: (1) credibility beliefs for insomnia; (2) credibility beliefs for PCI; (3) expectancy beliefs for insomnia; and (4) expectancy beliefs for PCI. Scores from the items in each subscale were summed, yielding total scores where higher values indicate stronger credibility and expectancy beliefs, aligning with recommendations by Devilly and Borkovec (2000). Credibility beliefs scores ranged from 0 to 23 and expectancy beliefs scores ranged from 0 to 27. Previous research has supported the validity, high internal consistency within each factor, and good test-retest reliability of this measure (Constantino et al., 2018). A copy of the adapted CEQ evaluation form is included in Appendix A. Internal consistency reliability of CEQ total scores was high, with a Cronbach's Alpha of .78 for credibility beliefs for insomnia, .81 for credibility beliefs for PCI, .78 for expectancy beliefs for insomnia, and .84 for expectancy beliefs for PCI.

The Functional Assessment of Cancer Therapy – Cognitive Function, Version 3

The Functional Assessment of Cancer Therapy – Cognitive Function (FACT-Cog) version 3 was used to examine perceived cognitive impairment at each time point (Wagner et al.,

BELIEFS AND CBT-I

2004). The FACT-COG is a 37-item questionnaire with responses ranging from 0, “never”, to 4, “several times a day”, in the previous 7 days. Scores on this scale can range from 0 to 72 points, with higher points indicating better self-reported cognitive functioning. The scale includes four cognitive subscales: perceived cognitive impairments, impact on quality of life, comments from others, and perceived cognitive abilities. For the purposes of this study, the perceived cognitive impairment (PCI) subscale score was used to measure subjective cognitive impairment. Previous research has demonstrated the FACT-Cog to be reliable and valid, and a change of 5.9-points has been established as a clinically meaningful change on the PCI subscale (Bell et al., 2018). This scale is frequently and regularly employed in both observational and treatment studies (Garland et al., 2021). The measure had good internal consistency reliability, with a Cronbach’s Alpha value of .79 on the PCI subscale.

The Insomnia Severity Index

The Insomnia Severity Index (ISI) was used to assess the severity of insomnia symptoms, the impact on daytime functioning, and the amount of associated distress at each time point (Bastien et al., 2001). The ISI is a 7-item scale with responses ranging from 0, “none”, to 4, “very severe”, in the last 2 weeks. Scores on this scale can range from 0-28, with higher values indicating more severe insomnia symptoms. The ISI has been empirically validated in cancer patients and has been shown to be a reliable and valid instrument (Savard et al., 2005). The ISI has established a minimally important change value of 8.4, which ensures that the change is not only statistically significant, but also clinically meaningful to patients (Morin et al., 2011). The internal consistency reliability of the ISI was strong, with a Cronbach’s Alpha value of .85.

BELIEFS AND CBT-I

Interviews

Interviews were used to better understand participants' subjective account of the overall outcomes of the study. The interviews asked a series of open-ended questions about the participant's beliefs going into the study, how they felt about the treatment, their relationship with the study therapist, and how they subjectively felt the treatment did or did not help them. While the interviews were not based on any previously validated or widely used interview protocols, the list of questions was carefully created and refined by various members of the research team. This process ensured that the questions were relevant, comprehensive, and tailored to the specific goals of the study. A copy of the semi-structured interview guide is included in Appendix B.

Statistical Analyses

Descriptive statistics were conducted to characterize the sample in terms of demographic and clinical variables. This included summarizing the frequencies and percentages of participants based on relevant characteristics, such as age, gender, years of education, and type of cancer diagnosis, among others.

Multiple linear regression analyses were utilized to examine whether demographic and clinical factors are related to credibility and expectancy ratings for insomnia and PCI using the baseline data with the full sample. Our specific goal was to pinpoint which demographic and clinical variables, if any, were associated with higher ratings in these areas. Understanding the factors that contribute to higher credibility and expectancy ratings can provide valuable insights into how individuals perceive and respond to information, services, or interventions. To conduct this analysis, separate models were used for each of the four dependent variables (credibility beliefs for insomnia, credibility beliefs for PCI, expectancy beliefs for insomnia, and expectancy

BELIEFS AND CBT-I

beliefs for PCI). The variables included in the regression models were determined based on previous research and clinical judgment (Cohen et al., 2015). These independent variables were age, gender, treatment group, years of education, duration of insomnia, baseline PCI, and baseline symptoms of depression. The seven independent variables were entered simultaneously in each model to see how they might collectively contribute to the criterion variable. This approach allowed us to gain a comprehensive understanding of how these different factors work together to shape people's perceptions and expectations regarding treatment effectiveness. Assumptions of linearity, independence of errors, homoscedasticity, and normality of residuals were assessed for each regression model.

Moderation analyses were employed to investigate whether the observed change in post-treatment outcome variables of insomnia and PCI was moderated by pre-treatment credibility or expectancy beliefs. In this analysis, the treatment outcome was operationalized as pre-post difference scores, the independent variables were not centered, and individual models were used for each of the four independent variables. Assumptions of linearity, independence of residuals, and absence of multicollinearity were tested for each moderation model.

Interviews were analyzed using a reflexive thematic analysis approach (Byrne, 2022). This process involves systematically identifying patterns, themes, and meaning within the data. The primary researcher, a master's student, conducted the entire thematic analysis process in consultation with the study supervisor. This involved several stages: initially, raw data were systematically reviewed and coded using semantic coding techniques, capturing the essence of participants' responses. This initial coding phase involved breaking down the data into meaningful segments and assigning descriptive labels to each segment to represent its content. Subsequently, a comprehensive analysis of the coded data was conducted to identify emerging

BELIEFS AND CBT-I

themes and patterns. This involved organizing and synthesizing the coded segments to discern overarching themes that encapsulated the essence of participants' experiences and perspectives. Through an iterative process of data immersion and reflection, potential themes were refined, clarified, and defined, ensuring a comprehensive understanding of the data. Once potential themes were identified, they were critically reviewed and analyzed to ensure accuracy and consistency. Main themes were outlined, representing the broader concepts and ideas that emerged from the data, while sub-themes were identified to capture more specific nuances and variations within each main themes. To maintain inter-rater reliability, clear criteria and guidelines were established and a second rater reviewed and refined themes. The codebook, which served as the foundation for the qualitative analysis, was created by the primary researcher, with consultation and guidance from the study supervisor. While no independent raters were used, the supervisor provided feedback during the development process to ensure the codebook's accuracy and comprehensiveness. To ensure transparency, quotes from participants are provided throughout the qualitative results and a complete copy of the code book is included in Appendix C.

Results

Sociodemographic and clinical characteristics for the participants (N = 132) are reported in Table 1. The mean age of participants was 60.31 years (SD = 11.24), and 77.4% (n = 103) identified as female. Most participants identified their race as white (92.5%), and participants had an average of 16.10 years (SD = 3.47) of education. The most common cancer diagnoses were breast (46.2%), prostate (6.8%), and colon/rectal (3.8%) cancer. The distribution across various cancer stages was as follows: Stage 0 (3%), Stage I (20.3%), Stage II (17.3%), Stage III (21.8%), Stage IV (5.3%), and unknown (35, 26.3%). Regarding cancer treatment, most

BELIEFS AND CBT-I

participants underwent surgery (88.7%), chemotherapy (60.9%), radiation (57.9%), and hormonal therapy (32.3%). Descriptive statistics for credibility and expectancy beliefs across each unique identifier show mean credibility beliefs of 15.92 (SD = 4.19; range = 6.60-23.00) for insomnia, and 16.05 (SD = 4.60; range = 4.00-23.80) for PCI. Expectancy beliefs averaged 19.99 (SD = 4.32; range = 19.00-27.00) for insomnia and 19.78 (SD = 4.55; range = 5.00-27.00) for PCI. These results indicate moderately high levels of credibility and expectancy beliefs across each identifier.

Objective 1: Factors Associated with Credibility and Expectancy Beliefs

None of the seven baseline variables were significantly associated with beliefs about the credibility of CBT-I as a treatment for insomnia ($p > 0.05$; See Table 2) or PCI ($p > 0.05$; See Table 3) when entered simultaneously. In the analysis examining factors associated with higher expectancy, only younger age was significantly associated with higher expectancy for insomnia ($b = -0.101$, 95% CI [-0.176, -0.026], $p = 0.009$; $\beta = -0.258$; See Table 4) and PCI treatment outcomes ($b = -0.110$, 95% CI [-0.191, -0.030], $p = 0.008$; $\beta = -0.264$; see Table 5).

Objective 2: Credibility and Expectancy Beliefs and CBT-I Treatment Outcomes

The moderation analysis aimed to examine whether credibility or expectancy beliefs were statistically significant moderators on the change (as quantified by difference scores) in insomnia severity and PCI from baseline to post-treatment. Age was also included as a covariate in the moderation analyses given its association with expectancy in regression models; however, age did not emerge as a significant predictor ($p > 0.05$). Neither beliefs about credibility nor expectancy for insomnia outcomes significantly moderated the effect of CBT-I on post-treatment insomnia ($p = 0.975$; $p = 0.498$). Beliefs about credibility and expectancy for PCI outcomes also did not significantly moderate change in post-treatment PCI ($p = 0.106$; $p = 0.145$). For the

BELIEFS AND CBT-I

moderation analyses, the effect of condition 1 was non-significant and the effect of condition 2 was also non-significant; consequently, the results are null.

Objective 3: Qualitative Analysis of Post-Treatment Perceptions

The mean age of the interview subsample (N=21) was 64.6 years (SD = 8.28). The interview sample was predominately female (95.2%), white (95.2%), and highly educated (17.43 years; SD = 3.10). In this subsample, the most common cancer diagnoses were breast (52.4%), uterine (9.5%), melanoma (9.5%), and skin (9.5%) cancer. The distribution across various cancer stages was as follows: Stage 0 (4.8%), Stage I (19.0%), Stage II (19.0%), Stage III (23.9%), and unknown (33.3%). Most participants underwent surgery (100%), chemotherapy (62.0%), radiation (62.0%), and hormonal therapy (33.3%).

We approached data saturation by conducting interviews until thematic saturation was achieved. Saturation was considered reached when no new themes or insights emerged from successive interviews, indicating that additional interviews were unlikely to yield substantially new information (Fusch & Ness, 2015). This approach ensured that the qualitative data collection adequately represented the range and depth of participants' experiences and perceptions related to post-treatment outcomes.

CBT-I Impact

Most participants (71%) reported improvements in their sleep and overall cognitive abilities after CBT-I. Participants noted the connection between sleep and cognition: “My concentration definitely gets better when I started getting more sleep and started having a better routine. My brain was less foggy when I had a better night’s sleep.” (53, female, thyroid cancer). Another participant commented, “Um, I guess they were positively impacted because I was

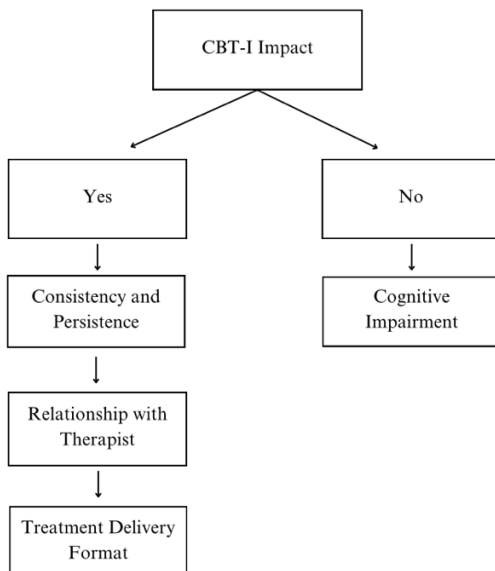
BELIEFS AND CBT-I

sleeping better and so I felt rested and could focus a little better. Not every single day, but an overall improvement.” (64, female, breast cancer).

The remaining participants acknowledged that while improvements in sleep patterns were evident, the extent of cognitive enhancement after CBT-I remained uncertain. One participant said, “Let's put it this way. I know when I have a good sleep, I feel better, and I do better overall. I'm not sure if there was a huge change in my abilities and memory concentration, but there is no question that sleep itself was improved.” (74, female, breast cancer). Another participant reported, “I was able to change my sleep pattern, but I don't know how much it impacted me cognitively.” (70, female, cervical cancer).

For those individuals who did report improvements in sleep and cognition after CBT-I, this was attributed to several key factors: consistence and persistence, relationship with therapist, and treatment delivery format. Themes and subthemes regarding CBT-I impact are presented visually in Figure 1.

Figure 1. CBT-I Impact



Consistency and Persistence

Participants attributed their improvement in large part to a commitment to maintaining recommended practices and persistence, despite challenges. Participants who consistently adhered to the treatment reported a notable improvement in their sleep quality and cognitive abilities. The commitment to incorporating new sleep habits into their routines appeared to be an important factor in achieving positive outcomes. Seeing improvements early in treatment also motivated participants to be persistent. “I noticed the difference after a week of doing it and that's what kept me going to finish the program” (53, female, thyroid cancer). Another participant said:

“Yes, I would say probably on about the 2-week point, because it takes a while to get into the habit of establishing that buffer zone before you go to bed and turning off all your electronics and not crowding your mind with too much. So yeah, it takes a while to get into that routine so, yeah, I'd say about 2 weeks.” (63, female, breast cancer)

Some participants highlighted the transformative nature of this commitment, emphasizing that it was not merely a matter of adopting new practices but also of consistently integrating them into their daily lives. Moreover, the challenges encountered during the process were acknowledged, reflecting the realistic nature of implementing change in sleep habits.

“The one thing I would say is it wasn't an easy thing to do. It took a lot of concentration and patience to change my sleep habits. I did notice an improvement about halfway through though. Things got easier then too.” (73, female, breast cancer).

BELIEFS AND CBT-I

Relationship with Therapist

The participants expressed satisfaction with their therapists' friendly, empathetic, and professional approach, underlining the ease of communication and the comfort they experienced during their sessions. The participants frequently (67%) attributed the positive outcomes of their treatment to the guidance and support provided by their therapists. They highlighted the importance of personal connections, accountability, and motivation, as well as the therapists' professional competence and knowledge.

“Well, like I said, he was very helpful. If I wasn't looking forward to talking to him or meeting with him, I would have had a negative feeling about the whole process, and I probably would have ended up quitting.” (59, female, skin cancer).

In detailing their experiences, participants also emphasized the patience and adaptability exhibited by their therapists. These qualities were particularly relevant when participants felt reluctant or hesitant to embrace certain aspects of the intervention. Therapists were able to be flexible and collaborative in working towards ideal outcomes.

“Well, she was very patient. She kept trying to come at my reluctance from different angles. She didn't just say, well, this is what you must do, period. We discussed things and she offered different strategies.” (70, female, cervical cancer).

Additionally, participants highlighted that having accountability in their relationship with the therapist was a key component of their success with CBT-I. This accountability was not only in terms of their commitment to the treatment process but also in their engagement with the therapist. Knowing that they were accountable to someone, that they had scheduled sessions and someone to report progress to, played a pivotal role in maintaining their focus and dedication to treatment.

BELIEFS AND CBT-I

“I wouldn't have done anything if the therapist hadn't given me the steps and the protocol and then I had never spoken to him again. I don't know that I would have benefited because I really valued having that accountability to fill out the consensus sleep diary every day. And then speaking at the end of the week” (63, female, breast cancer).

Treatment Delivery Format

Participants expressed a high level of satisfaction with the virtual delivery format of CBT-I. Notably, all participants reported that the video format did not negatively impact their relationship with their therapist. One participant said:

“No, I don't feel like doing it in-person would improve my overall cognitive results any differently. The fact that I received the therapy, whether it was online or in-person, is what helped me.” (53, female, breast cancer)

Participants appreciated the convenience and comfort of receiving the treatment in their own environment. Many participants preferred the video format, citing the elimination of the need to travel and the enhanced comfort of receiving treatment from their homes.

“If anything, it was better virtually because I could still interact with the therapist, but I didn't have to leave my home.” (60, female, breast cancer);

“At first, I thought I wouldn't want to do it by Zoom, but in the end, it was for me. At times that I was uncomfortable, I was quite glad it was over Zoom because I was in the comfort of my own living room versus sitting across from someone.” (70, female, uterine cancer).

Participants also indicated that the format did not compromise the overall effectiveness of the treatment.

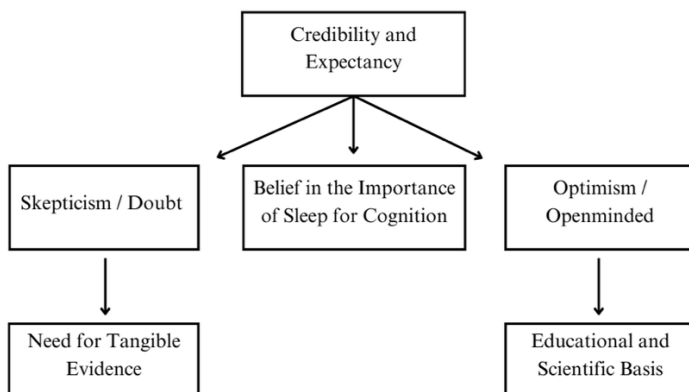
BELIEFS AND CBT-I

“I don't know if there would have been a difference doing it in person. I think that perhaps maybe we're getting used to this as a society, so it doesn't feel any different. The quality of the intervention was great, and I think that's all that matters.” (65, female, breast cancer)

Credibility and Expectancy Beliefs

Several factors contributed to the credibility and expectancy beliefs held by the participants regarding CBT-I. Within this domain, three prominent subthemes emerged: skepticism and doubt, where some participants approached the program with reservations and wanted more tangible evidence; believing in the importance of sleep for cognition, reflecting those participants understood the connection between these functions; and optimism and open-mindedness, whereby participants reported embracing treatment with a positive and open attitude. Themes and subthemes regarding the factors influencing pre-treatment beliefs and expectancy are presented visually in Figure 2.

Figure 2. Factors Influencing Credibility and Expectancy Beliefs



Skepticism and Doubt

Initial skepticism and doubt were common among the participants, with some expressing reservations and uncertainties regarding the efficacy of CBT-I.

BELIEFS AND CBT-I

“Prior to doing it, I didn't really think it was going to help at all. I thought I don't know if this going to work for me and felt like this going to be waste of time, but I was willing to give it a try because I was willing to give anything a try if I thought it would help my sleep and memory. But I was pleasantly surprised that it was making things better for me in respect to sleep.” (60, female, breast cancer)

Participants voiced concerns about the feasibility of achieving meaningful improvements in their sleep and cognitive abilities through the intervention. “I questioned whether it would have much impact. I would say I was fairly skeptical about the right amount of improvement.” (64, female, breast cancer). For some participants, skepticism was rooted in a lack of familiarity with CBT-I and the need for tangible evidence. “Well, they didn't do anything, you know right. They didn't give you any medicine or anything like that. So, you think how is just talking about it going to do anything?” (77, male, colon cancer).

Belief in the Importance of Sleep for Cognition

Many participants highlighted what they felt to be a logical connection between improved sleep and enhanced concentration, memory, and overall cognitive performance. Their expectations were rooted in the belief that addressing sleep issues would lead to improvements in other cognitive domains.

“I believed it would be helpful on the basis that without good sleep, your mind doesn't work 100% and you need to have your sleep in order to be able to function well.” (74, female, breast cancer)

Participants described a belief that a well-functioning mind relies on adequate sleep which supported their rationale for engaging in CBT-I. “Because I wasn't getting very good sleep, I was hoping if I improved my sleep, my memory and concentration would improve too.”

BELIEFS AND CBT-I

(59, female, skin cancer). Such beliefs highlight the participants' expectations and offers insight into the motivation behind their participation in the program.

Optimism and Open-mindedness

Participants reported an open-minded and optimistic attitude towards treatment and a willingness to give CBT-I a chance.

“Well, I tried to go into it relatively blind. I purposely did not want to look it up on Google, I thought, okay, if I'm going to participate in this and I felt I needed to go in relatively blind, so I didn't really have any preconceived notions. I suppose I thought, gosh, you know, I've tried everything. Nothing seems to work, but I wanted to be relatively open minded.” (67, female, ovarian)

“Well, I went into it very open minded. I mean, if I didn't believe that it was going to help me, I wouldn't have done it.” (64, female, breast cancer).

A significant factor contributing to participants' open-mindedness was the solid educational and scientific basis of CBT-I.

“I know that people doing these kinds of studies are doing them with a basis of hoping that it could help. So, I'm a strong believer in educated people offering beneficial opportunities.” (72, female, breast cancer).

For some, understanding the intervention's basis in empirical research and educational expertise played an important role in shaping participants' attitudes towards the program. This foundation instilled a sense of confidence in the legitimacy of the intervention. Knowing that the program was designed and implemented by knowledgeable professionals added a layer of credibility, assuring participants of the intervention's potential efficacy.

Discussion

Factors Associated with Credibility and Expectancy Beliefs

This study explored the factors associated with credibility and expectancy beliefs for CBT-I and their impact on treatment outcomes. Only younger age was associated with higher ratings of credibility and expectation of benefit. This finding is consistent with a meta-analysis conducted by Constantino, Vîslă et al. (2018), which synthesized data from 81 independent samples to investigate predictors of treatment outcomes in cognitive-behavioral therapies. Their meta-analysis revealed that younger age was consistently linked to stronger outcome expectancy beliefs, indicating a more positive perception of treatment efficacy. Specifically, their findings suggested that for every unit increase in age, there was a slight decrease ($\beta = -0.006$) in the association between outcome expectancy and treatment effectiveness. Further results confirmed in a secondary analysis using pooled data from multiple observational studies (Mooney et al., 2014) revealed the association between age and credibility scores in the context of CBT-I. Results indicate that age was significantly associated with higher credibility scores, suggesting that younger individuals tend to perceive treatment rationales as more credible compared to older individuals. One possible explanation is that younger individuals may have greater exposure to information about CBT-I through digital platforms and demonstrate a greater openness to novel treatments, though further research is needed to confirm these hypotheses. Considering that our study primarily involved participants with an average age of 60, with limited representation outside of this age range, caution must be exercised in extrapolating these findings to younger populations.

Other studies have identified additional demographic factors associated with pre-treatment beliefs (Cho et al., 2021; Cohen et al., 2015; Constantino et al., 2014). For instance,

BELIEFS AND CBT-I

sex has been shown to influence treatment expectancy and outcomes, with women often reporting higher treatment expectations and better outcomes in some psychotherapy studies (Constantino et al., 2018), while others demonstrate that being male has more positive effects (Heron-Speirs et al., 2012). Education level is another demographic factor that has been associated with higher credibility and expectancy beliefs, likely due to greater health literacy and understanding of therapeutic principles (Cho et al., 2021; Cohen et al., 2015). Our results also differ from other studies due to the specific characteristics of our sample including sex and education levels. For instance, our sample is characterized by a high proportion of females and individuals with high levels of education. This demographic profile may explain why we did not observe significant effects of sex or education on credibility and expectancy beliefs in our results. The predominance of highly educated females in our sample can be both a strength and a limitation. It allows us to gain insights into how these specific groups perceive and respond to treatment, which can be valuable for understanding their unique perspectives. However, the lack of diversity in our sample may limit the generalizability of our findings to other demographic groups. Future research with a more diverse sample could help determine whether our results are consistent across different populations.

Moreover, methodological differences across studies, such as variations in sample size, geographic location, or specific measures used to assess credibility and expectancy, could lead to discrepancies in findings. For instance, larger sample sizes might provide more robust statistical power, while different geographic locations could influence cultural perceptions and responses. Additionally, variations in assessment measures might capture different aspects of credibility and expectancy beliefs, affecting comparability between studies. Understanding these nuances is crucial for interpreting how demographic factors interact with treatment beliefs and outcomes

across different studies and populations. Additionally, our study did not assess other potentially relevant demographic factors such as socioeconomic status, ethnicity, or previous experience with other psychological therapies, which could also impact credibility and expectancy beliefs (Cohen et al., 2015; Constantino et al., 2014).

Credibility and Expectancy Beliefs and Treatment Outcomes

Our study did not find associations between credibility and expectancy beliefs and treatment outcomes. Several other studies also did not find a significant link between pre-treatment beliefs and treatment outcomes. For instance, Constantino et al. (2007) conducted a study examining the role of initial expectations in cognitive-behavioral interventions across diverse psychotherapy contexts. Constantino and colleagues observed that expectancy beliefs might influence initial engagement with therapy but did not reliably predict final treatment success. This suggests that factors beyond initial expectations may play a more significant role in determining treatment outcomes. In another relevant study, Safran et al. (1997) investigated the impact of expectancy of benefit on treatment outcomes in CBT. Their findings indicated that while therapeutic alliance and patient engagement were crucial for treatment success, the expectancy of benefit did not significantly predict overall treatment outcomes. Collectively, these findings emphasize the complexity of treatment outcomes in psychotherapy and highlight the need for further investigation into the mechanisms through which credibility and expectancy beliefs may or may not impact treatment effectiveness.

These findings also suggest a complex interplay between psychological factors and treatment effectiveness that might not be fully captured by measuring credibility and expectancy alone. It is possible that other mediating factors, such as the quality of the therapeutic alliance, patient adherence to treatment protocols, and individual differences in cognitive and emotional

BELIEFS AND CBT-I

processing, play more pivotal roles in determining outcomes. Given the mixed evidence in the literature, then, it is important to consider that credibility and expectancy beliefs may still play an indirect role by influencing patient engagement and adherence. As highlighted in the meta-analysis by Thompson-Hollands et al. (2014), the therapeutic alliance and engagement in therapy are critical components that can be affected by initial beliefs about treatment credibility and expectancy. Thompson-Hollands et al. (2014) synthesized findings from multiple studies, demonstrating that while credibility and expectancy beliefs may not directly predict treatment outcomes, they can influence patient motivation and adherence, which are crucial for therapeutic success. Additionally, in a study of virtually delivered CBT, higher pre-treatment credibility beliefs were associated with higher rates of adherence (El Alaoui et al., 2015) among 764 individuals during a 4-year period.

Our results suggest the need for further research into shaping pre-treatment beliefs among older adults, especially through targeted educational campaigns or interventions aimed at increasing awareness of non-pharmacological treatments for insomnia, particularly given evidence of CBT-I's effectiveness in later life (Huang et al., 2022). Additionally, exploring how these beliefs relate to engagement processes, such as patient participation in therapy sessions, adherence to treatment protocols, and interactions with healthcare providers could provide valuable insights into the mechanisms through which credibility and expectancy influence treatment outcomes. Future research should delve into potential indirect effects of credibility and expectancy beliefs on outcomes through engagement markers, such as patient adherence to treatment plans, participation in therapy sessions, and rapport with healthcare providers. Additionally, exploring how pre-treatment beliefs interact with other variables, such as patient demographics, psychological factors, and treatment modalities, could provide insights into their

BELIEFS AND CBT-I

combined influence on therapy engagement and overall treatment outcomes. Collectively, this will contribute to a deeper understanding of the mechanisms underlying treatment efficacy in CBT-I.

Effectiveness and Delivery of CBT-I

Our findings underscore the robustness of CBT-I, indicating its effectiveness in treating symptoms of insomnia and PCI, regardless of individuals' pre-treatment beliefs. While credibility and expectancy beliefs may impact a patient's perception of treatment, our findings suggest those perceptions did not significantly predict the treatment outcomes. This aligns with previous studies that have also found the efficacy of CBT-I not significantly influenced by initial credibility and expectancy beliefs (Li et al., 2023). This study specifically found that the CBT-I group did not demonstrate significant differences in treatment outcomes based on participants' initial beliefs about the therapy in comparison to the acupuncture group. These findings highlight the consistent effectiveness of CBT-I in improving insomnia symptoms among cancer survivors, supporting its role as a preferred treatment option in clinical practice.

High levels of satisfaction with the virtual delivery format of the CBT-I intervention were also reported. Participants cited convenience and comfort as advantages of virtual sessions, which did not compromise treatment effectiveness. This supports the feasibility and acceptability of virtual interventions, further contributing to the growing literature on virtual CBT-I (Arnedt et al., 2021; Garland et al., 2021; Garland et al., 2024; Savard et al., 2021). Insights from these studies highlight that virtual CBT-I can effectively overcome barriers related to access, such as geographical or logistical challenges, thereby enhancing treatment accessibility for diverse populations. Given the advantages of virtual delivery, ongoing exploration of this format is

BELIEFS AND CBT-I

crucial to optimize its integration into mental health care practices, especially for populations with geographical or logistical barriers.

Expanding on this, the virtual delivery of CBT-I can significantly enhance accessibility by allowing individuals in remote or underserved areas to receive treatment without the need for travel (Arnedt et al., 2021; Cheng et al., 2023). This means that people living in rural communities or areas lacking specialized healthcare services can now access evidence-based treatment for insomnia without having to travel long distances. For individuals with mobility limitations or those who find it challenging to attend in-person appointments due to health reasons, virtual CBT-I offers a convenient solution. Moreover, it reduces barriers related to geographical distance and transportation costs, thereby increasing access to effective mental health care interventions. This is particularly crucial in regions where there are limited numbers of healthcare providers trained in delivering CBT-I, ensuring that more people can benefit from treatment regardless of their location (Cheng et al., 2023; Garland et al., 2021; Savard et al., 2021; Zachariae et al., 2018). As suggested by Cheng et al. (2023), utilizing generalist providers (e.g., nurses, physician assistants) with basic CBT-I training could help minimize the bottleneck created by the limited availability of specialists and offer necessary support. By addressing these potential challenges, the benefits of virtual CBT-I can be maximized, making effective treatment more widely accessible.

Potential barriers, or downsides of virtual CBT-I, include technological barriers, such as lack of access to reliable internet or devices, which could limit participation for some individuals (Cheng et al., 2023). Additionally, virtual formats may not be suitable for all patients, particularly those with technological aversion or those who benefit more from in-person interactions due to the nature of their conditions or personal preferences. To mitigate these

BELIEFS AND CBT-I

downsides, it is essential to provide technological support and training for participants who may be unfamiliar with digital platforms. Providing as-needed patient support should also be an area of priority. Additional barriers such as informational, structural, and geographical limitations may hinder individuals from engaging fully with virtual CBT-I delivery, despite its potential advantages. These challenges underscore the importance of addressing various barriers to optimize patient experiences and enhance cancer care outcomes. Future research and interventions should focus on identifying and mitigating these barriers to ensure equitable access to effective treatment options and continue to enhance cancer care outcomes.

Factors Influencing Improvement

Regardless of expectancy and beliefs about credibility, participants described several factors that they felt impacted their improvement in sleep and cognition following CBT-I, such as consistency and persistence. These findings highlight the significance of individual commitment and active engagement in the intervention process, while also highlighting the realistic nature of behavior change and the need for ongoing support. This finding aligns with previous research indicating that individuals undergoing CBT-I may initially feel worse, because part of treatment relies on the removal of factors that help them cope with insomnia in the short term, but that maintain insomnia in the long term (e.g., napping or sleeping in) (Rossman, 2019). This initial discomfort resolves in 4-6 weeks once their body adjusts to a consistent sleep schedule.

These findings are consistent with the broader literature on the importance of therapeutic factors and the association that exists between therapeutic alliance and beliefs about credibility and expectancy (Thompson-Hollands et al., 2014). Therapeutic factors encompass various elements of the therapeutic process that contribute to treatment outcomes, including the

BELIEFS AND CBT-I

therapeutic alliance, therapist credibility, and patient expectations (Constantino et al., 2020). The therapeutic alliance, characterized by trust, collaboration, and a positive bond between the therapist and the patient, has consistently been identified as a key predictor of treatment success across psychotherapy modalities (Ardito & Rabellino, 2011). Patients who perceive their therapist as credible and trustworthy are more likely to engage actively in treatment and adhere to therapeutic recommendations (Constantino, Vişlă et al., 2018). Furthermore, patients' expectations about treatment efficacy, often shaped by their interactions with the therapist and their beliefs about the credibility of the treatment rationale, play a significant role in determining treatment outcomes (Constantino et al., 2020; Kumpasoğlu et al., 2024).

In the context of this study on CBT-I, these factors elucidate crucial mechanisms underlying therapeutic engagement and patient-centered variables that contribute to significant improvements in sleep quality and cognitive function. The findings emphasize the pivotal role of consistency and persistence in treatment adherence, emphasizing the necessity for sustained effort in behavior change processes. Participants' descriptions of initial discomfort resonate with previous research, highlighting the temporary challenges associated with the removal of short-term coping mechanisms that perpetuate insomnia, which typically resolve with continued adherence to a structured sleep schedule (Rossman, 2019).

This study aligns with established literature on therapeutic factors, such as the therapeutic alliance and patient expectations, reaffirming their significant role in treatment outcomes across various psychotherapeutic interventions (Ardito & Rabellino, 2011; Constantino, Vişlă et al., 2018). The therapeutic alliance, characterized by trust and collaboration between therapist and patient, not only fosters a positive treatment environment but also enhances treatment adherence and engagement. Patients who perceive their therapist as credible and trustworthy are more likely

BELIEFS AND CBT-I

to actively participate in treatment sessions, implement recommended strategies, and sustain behavioral changes over time (Constantino et al., 2020).

Moreover, patient expectations regarding treatment efficacy, shaped by their interactions with therapists and their understanding of treatment rationale, significantly influence treatment outcomes (Kumpasoğlu et al., 2024). By addressing these patient-centered variables within the therapeutic process, clinicians can tailor CBT-I interventions to individual needs, thereby optimizing treatment strategies and enhancing overall effectiveness in managing insomnia and associated cognitive impairments.

In practical terms, these insights suggest that enhancing therapeutic engagement through fostering a strong therapeutic alliance and addressing patient expectations can lead to more robust treatment outcomes in CBT-I. Clinicians should consider integrating strategies that promote trust and collaboration while effectively communicating treatment goals and rationale to align with patient expectations. By doing so, clinicians can maximize treatment adherence, improve sleep hygiene practices, and ultimately facilitate long-term improvements in sleep quality and cognitive functioning among individuals with insomnia.

While our investigation primarily focused on participants' perceptions of treatment credibility and expectancy using the credibility and expectancy questionnaire (CEQ), it's important to recognize the broader implications of therapeutic factors in CBT-I outcomes. Recent research, including a meta-analysis by Kumpasoğlu et al. (2024), has emphasized the significant impact of therapist credibility on treatment outcomes. A range of treatment modalities were included with CBT being the most frequently used, followed by other approaches such as psychodynamic therapy and interpersonal therapy, among others. This study aimed to examine the relationship between perceived treatment and therapist credibility and treatment outcomes.

BELIEFS AND CBT-I

The analysis of 27 studies revealed a positive association (i.e., $r = 0.15$) between perceived treatment credibility and treatment outcome, suggesting that clients' perceptions of higher credibility – whether concerning the treatment or the therapist – are associated with better therapeutic outcomes. Moreover, nine studies reported a significant association between perceived therapist credibility and outcome, further highlighting the importance of therapist credibility in treatment effectiveness. These findings underscore the need for future research to explore the multifaceted nature of therapeutic factors, including therapist credibility, to enhance our understanding of the mechanisms underlying treatment outcomes in CBT-I.

Shaping Credibility and Expectancy Beliefs

In considering the factors shaping credibility and expectancy beliefs, tangible evidence and an educational/scientific basis prior to the intervention is crucial. Initial skepticism was common, yet participants were willing to engage despite doubt. Understanding factors contributing to skepticism, such as unfamiliarity with CBT-I, can inform interventions aimed at addressing concerns and enhancing engagement. Participants' receptiveness was bolstered by the solid educational and scientific foundation of CBT-I, instilling confidence in its legitimacy. This emphasizes the importance of transparently communicating the empirical basis of interventions to reinforce credibility and foster participant trust. Clinicians can optimize CBT-I effectiveness among cancer survivors by: 1) providing psychoeducation to promote an understanding of sleep; 2) setting appropriate pre-treatment beliefs that foster optimism and mitigate skepticism; 3) promote consistent engagement with treatment; and 4) foster positive therapeutic relationships.

Strengths and Limitations

One of the key strengths of the study was its mixed methods approach that combined quantitative and qualitative analyses to provide a more comprehensive understanding of the

BELIEFS AND CBT-I

patient motivation and experience. The inclusion of a participant sample encompassing different cancer types and stages for the quantitative analyses enhances the generalizability of the findings. Additionally, the study's focus on post-treatment perceptions provided valuable insights into the participants' satisfaction, commitment, and expectations related to the CBT-I program. Another notable strength was the evaluation of expectancy and credibility of CBT-I not only as a treatment for insomnia, but also PCI. This broader evaluation adds depth to the study's understanding of participants' attitudes towards CBT-I and enhances its overall comprehensiveness.

Despite these strengths, several potential limitations should be acknowledged. First, an important limitation is the underrepresentation of diverse and male participants in the qualitative interviews, with only one male participant included in this sub-sample. Consequently, to ensure a comprehensive understanding of beliefs, experiences, and treatment expectations related to CBT-I among diverse and male cancer survivors, future research should aim for a more equitable representation of participants. The current findings may not fully capture the nuances and challenges specific to these groups, thus limiting the broader applicability of the results. To enhance the recruitment of male and diverse samples for research among cancer survivors, effective strategies could include targeted outreach through community organizations and healthcare providers, utilizing culturally competent recruitment materials, offering culturally relevant incentives, providing flexible participation options, and prioritizing trust-building measures such as transparent communication and community engagement (Lankveld et al., 2018; Wenger et al., 2014). These approaches aim to address barriers and ensure equitable representation, thereby enriching the inclusivity and relevance of study findings within diverse populations.

BELIEFS AND CBT-I

It's important to note that in the context of this trial, we may not have captured the full range of beliefs about credibility and expectancy. Participants who believed CBT-I to be ineffective might not have been willing to participate in the first place, which may have introduced a self-selection bias. Another limitation is related to the use of the CEQ. While the CEQ is a validated and widely used measure, it does not capture potentially relevant aspects of credibility and expectancy, such as the credibility of the therapist, which has been associated with treatment outcomes (Constantino et al., 2020; Constantino, Višlă et al., 2018; Višlă et al., 2018). To capture this specific nuance, an additional measure that could be incorporated is the Working Alliance Inventory (WAI; Horvath & Greenberg, 1989).

Credibility and expectancy beliefs also may operate through processes of change, such as engagement (Thompson-Hollands et al., 2014), which were not directly measured or evaluated in the present study. Additionally, future studies should consider incorporating measures to evaluate engagement to elucidate the mechanisms underlying the effects of credibility and expectancy on treatment outcomes, such as treatment engagement, utilizing the Treatment Engagement Rating Scale (TER; Drieschner, 2009) and treatment adherence, incorporating a measure such as the Treatment Adherence Rating Scale (TARS; Quittner et al., 1998). These limitations suggest a need for future research to employ measures that encompass a broader range of credibility and expectancy factors to provide a more comprehensive assessment of patient perceptions.

Conclusions

This study makes significant contributions to the growing body of literature concerning the efficacy of CBT-I in mitigating symptoms of insomnia and cognitive impairment among cancer survivors. By simultaneously targeting both insomnia and cognitive impairment, CBT-I

BELIEFS AND CBT-I

offers an approach that acknowledges and addresses the interconnected nature of these symptoms, ultimately enhancing the overall well-being and quality of life for survivors. Despite the recognized influence of credibility and expectancy beliefs on patient adherence and engagement with interventions, the study demonstrates that they did not significantly impact the actual treatment outcomes of CBT-I. This observation reaffirms the robustness and efficacy of CBT-I in producing tangible improvements in insomnia and PCI, irrespective of patients' initial beliefs or expectations. Factors such as skepticism and doubt or misconceptions about psychological interventions can pose significant obstacles to treatment uptake and adherence. By acknowledging and mitigating these barriers, healthcare providers can create more supportive environments that facilitate survivors' access to and engagement with evidence-based interventions like CBT-I. By incorporating these findings into clinical practice and future research endeavors, healthcare professionals can optimize survivorship care and improve long-term outcomes for individuals transitioning beyond cancer treatment.

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BELIEFS AND CBT-I

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Table 1. Demographic and Clinical Variables

	Full Sample N (%)	Interview Sub-Sample N (%)
	133	21
Age (M±SD)	60.31±11.24	64.6±8.28
Sex		
Female	103 (77.4)	20 (95.2)
Male	30 (22.6)	1 (4.8)
Race		
White	123 (92.5)	20 (95.2)
BIPOC*	6 (4.5)	
Other	4 (3)	1 (4.8)
Years of Education (M±SD)	16.10±3.47	17.43±3.10
Relationship Status		
In a relationship/married	103 (77.4)	14 (66.7)
Single/widowed/divorced	27 (20.3)	7 (33.3)
Other	3 (2.3)	
Type of Cancer Diagnosis		
Breast	61 (45.9)	11 (52.4)
Prostate	9 (6.8)	
Colon/Rectal	5 (3.8)	1 (4.8)
Head/Neck	9 (6.8)	
Melanoma	6 (4.5)	2 (9.5)
Lymphoma	12 (9)	
Leukemia	5 (3.8)	
Uterine	8 (6)	2 (9.5)
Skin	4 (3)	2 (9.5)
Other	14 (10.5)	3 (14.3)
Cancer Stage		
Stage 0	4 (3)	1 (4.8)
Stage I	27 (20.3)	4 (19.0)
Stage II	23 (17.3)	4 (19.0)
Stage III	29 (21.8)	5 (23.9)
Stage IV	7 (5.3)	
Unknown	35 (26.3)	7 (33.3)
Cancer Treatment**		

BELIEFS AND CBT-I

Surgery	118 (88.7)	21 (100)
Chemotherapy	81 (60.9)	13 (62.0)
Radiation	77 (57.9)	13 (62.0)
Hormonal therapy	43 (32.3)	7 (33.3)

*Abbreviations: BIPOC=Black, indigenous, or a person of colour; **Participants may have received multiple types of treatment. Total number of treatments may equal more than 100% of the sample.

Table 2. Linear Regression of Factors Associated with Credibility Beliefs for Insomnia

	<i>b</i>	SE	β	95% CI	<i>p</i>	<i>r</i>	Γ_{part}
Age	-0.062	0.037	-0.162	(-0.135, 0.011)	0.097	-0.169	-0.149
Sex	-0.653	0.913	-0.065	(-2.461, 1.155)	0.476	-0.087	-0.064
Treatment Group	1.403	0.765	0.168	(-0.113, 2.918)	0.069	0.166	0.164
Years of Education	-0.057	0.112	-0.047	(-0.278, 0.164)	0.611	-0.018	-0.046
Time since Insomnia	-0.006	0.005	-0.101	(-0.016, 0.005)	0.287	-0.160	-0.095
Baseline PCI	-0.012	0.030	-0.039	(-0.071, 0.046)	0.675	-0.066	-0.038
Baseline Depression	-0.290	0.522	-0.052	(-1.324, 0.745)	0.580	-0.026	-0.050

Table 3. Linear Regression of Factors Associated with Credibility Beliefs for PCI

	<i>b</i>	SE	β	95% CI	<i>p</i>	<i>r</i>	Γ_{part}
Age	-0.050	0.041	-0.119	(-0.131, 0.032)	0.233	-0.140	-0.109
Sex	-0.134	1.017	-0.012	(-2.149, 1.881)	0.895	-0.035	-0.012
Treatment Group	0.492	0.852	0.054	(-1.197, 2.180)	0.565	0.047	0.053
Years of Education	-0.121	0.125	-0.092	(-0.368, 0.126)	0.334	-0.053	-0.088
Time since Insomnia	-0.003	0.006	-0.045	(-0.014, 0.009)	0.642	-0.085	-0.044
Baseline PCI	-0.052	0.034	-0.146	(-0.121, 0.016)	0.132	-0.152	-0.141
Baseline Depression	-0.432	0.585	-0.071	(-1.590, 0.727)	0.462	-0.012	-0.067

Table 4. Linear Regression of Factors Associated with Expectancy for Insomnia

	<i>b</i>	SE	β	95% CI	<i>p</i>	<i>r</i>	Γ_{part}
Age	-0.101	0.038	-0.258	(-0.176, -0.026)	0.009	-0.247	-0.237
Sex	-0.772	0.934	-0.075	(-2.623, 1.079)	0.410	-0.083	-0.074
Treatment Group	1.003	0.783	0.117	(-0.548, 2.554)	0.203	0.099	0.114
Years of Education	0.007	0.114	0.006	(-0.220, 0.234)	0.951	-0.041	0.005
Time since Insomnia	9.39E-5	0.005	0.002	(-0.011, 0.011)	0.986	-0.084	0.002
Baseline PCI	-0.014	0.030	-0.044	(-0.075, 0.046)	0.637	-0.085	-0.044
Baseline Depression	-0.346	0.535	-0.061	(-1.405, 0.713)	0.519	-0.030	-0.058

Bold font indicates statistically significant results.

Table 5. Linear Regression of Factors Associated with Expectancy for PCI

	<i>b</i>	SE	β	95% CI	<i>p</i>	<i>r</i>	r_{part}
Age	-0.110	0.041	-0.264	(-0.191, 0.030)	0.008	-0.261	-0.243
Sex	-0.495	1.002	-0.045	(-2.480, 1.490)	0.622	-0.046	-0.044
Treatment Group	0.721	0.840	0.079	(-0.942, 2.385)	0.392	0.042	0.077
Years of Education	0.033	0.123	0.025	(-0.210, 0.276)	0.789	0.048	0.024
Time since Insomnia	0.002	0.006	0.032	(-0.010, 0.013)	0.740	-0.062	0.030
Baseline PCI	-0.008	0.033	-0.024	(-0.073, 0.056)	0.801	-0.152	-0.141
Baseline Depression	0.249	0.573	0.041	(-0.886, 1.385)	0.664	0.067	0.039

Bold font indicates statistically significant results.

Figure 1. CBT-I Impact

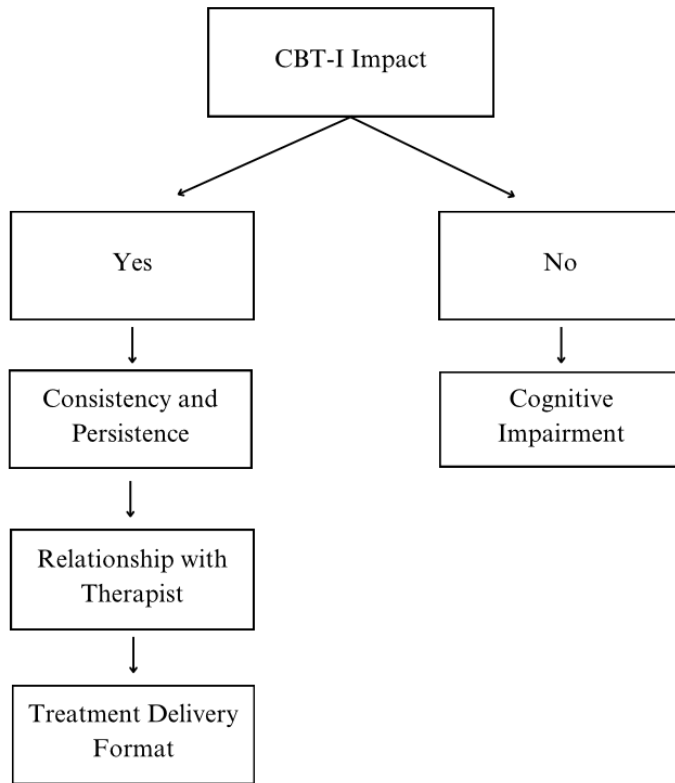
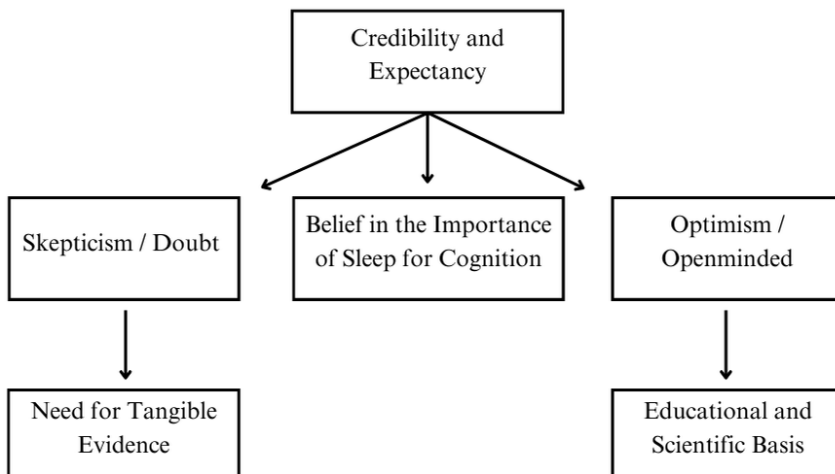


Figure 2. Factors Influencing Credibility and Expectancy Beliefs



Appendix A – CEQ Therapy Evaluation Form

We would like you to indicate below how much you believe, right now, that the therapy you are receiving will help you improve your lifestyle/functioning. Belief usually has two aspects to it: (1) what one thinks will happen and (2) what one feels will happen. Sometimes these are similar; sometimes they are different. Please answer the questions below. In the first set, answer in terms of what you think. In the second set answer in terms of what you really and truly feel. We do not want the research assistant to ever see these ratings, so please keep this to yourself.

Set I

1. At this point, how logical does the therapy offered to you seem?

1 Not at all logical	2	3	4	5 Somewhat logical	6	7	8	9 Very logical
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2. At this point, how successfully do you think this treatment will be in reducing your insomnia symptoms?

1 Not at all useful	2	3	4	5 Somewhat useful	6	7	8	9 Very useful
------------------------------	---	---	---	-------------------------	---	---	---	---------------------

3. How confident would you be in recommending this treatment to a friend who experiences similar problems?

1 Not at all confident	2	3	4	5 Somewhat confident	6	7	8	9 Very confident
------------------------------	---	---	---	----------------------------	---	---	---	------------------------

4. By the end of the therapy period, how much improvement in your insomnia symptoms do you think will occur?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

5. At this point, how successfully do you think this treatment will be in reducing your cognitive impairment symptoms (i.e. issues with memory, concentration, and attention)?

1 Not at all useful	2	3	4	5 Somewhat useful	6	7	8	9 Very useful
------------------------------	---	---	---	-------------------------	---	---	---	---------------------

6. How confident would you be in recommending this treatment to a friend who experiences similar problems (i.e. issues with memory, concentration, and attention)?

1	2	3	4	5	6	7	8	9
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BELIEFS AND CBT-I

Not at all confident				Somewhat confident				Very confident
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7. By the end of the therapy period, how much improvement in your cognitive impairment symptoms (i.e. issues with memory, concentration, and attention) do you think will occur?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Set II

For this set, close your eyes for a few moments, and try to identify what you really feel about the therapy and its likely success. Then answer the following questions.

1. At this point, how much do you really feel that therapy will help you to reduce your insomnia symptoms?

1 Not at all	2	3	4	5 Somewhat	6	7	8	9 Very much
--------------------	---	---	---	---------------	---	---	---	-------------------

2. By the end of the therapy period, how much improvement in your insomnia symptoms do you really feel will occur?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

3. At this point, how much do really feel that therapy will help you to reduce your cognitive impairment symptoms (i.e. issues with memory, concentration, and attention)?

1 Not at all	2	3	4	5 Somewhat	6	7	8	9 Very much
--------------------	---	---	---	---------------	---	---	---	-------------------

4. By the end of the therapy period, how much improvement in your cognitive impairment symptoms (i.e. issues with memory, concentration, and attention) do you really feel will occur?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Appendix B – Interview Guide:

1. What was your overall experience with the treatment (i.e., Cognitive Behavioral Therapy for Insomnia or CBT-I) you received during the ACTION study?
2. At any point during the treatment program, did you feel like stopping treatment? If so, when and why?
3. How do you feel your cognitive impairment symptoms (i.e., memory, concentration, and attention issues) were impacted by the CBT-I intervention?
4. If you noticed improvement, at what point during treatment (i.e., at which session) did you start experiencing improvements in your memory concentration and attention?
5. Prior to beginning the CBT-I intervention, how believable, convincing, and logical did you think the treatment would be for reducing your cognitive impairment symptoms (i.e., memory, concentration, and attention issues)? What contributed to these beliefs?
6. Prior to beginning the CBT-I intervention, how much did you expect your cognitive impairment symptoms (i.e., memory, concentration, and attention issues) to improve? What contributed to this expectation?
7. Why do you think treatment did (or did not) impact your memory, concentration, or attention?
8. How would you describe your relationship with the therapist who provided you the CBT-I intervention?
9. How do you feel that receiving treatment over video did or did not impact your relationship with your therapist?
10. How do you feel that receiving treatment over video did or did not impact your changes in memory, concentration, and attention?
11. How do you feel your treatment outcome was or was not related to the therapist who provided you the CBT-I intervention?
12. Do you feel there was anything missing from the CBT-I intervention that would have further benefited your cognitive function?
13. Would you recommend this treatment program to someone else experiencing similar symptoms to you (e.g., trouble sleeping or concentrating) after cancer treatment? Why or why not?
14. Do you have any other comments or concerns regarding the CBT-I intervention, the pre-treatment beliefs you had, or the therapist who completed the intervention with you?

Appendix C – Code Book:

MAIN THEME: CBT-I Impact

Subtheme = Impact

Definition: If participants indicated that the CBT-I intervention had an impact

“I mean, it's hard to interpret cognitively yourself how you're feeling but, I mean, I think I am good.” (67, female, ovarian cancer)

“Oh, they were definitely helped. I mean, they're okay.” (66, female, ovarian cancer)

“During the study, I certainly felt that I was gaining better memory and better ability to do things through the day.” (72, female, breast cancer)

“Positively, because, I mean, getting sleep makes all the difference in the world, you know.” (59, female, skin cancer)

“Let's put it this way. I know when I have a good sleep, I feel better, and I do better overall. I'm not sure if there was a huge change in my abilities and memory concentration, but there is no question that sleep itself was improved.” (74, female, breast cancer)

“Oh, definitely for the positive. I'm not sure I had tremendous problems with those, but certainly there was some and I think I feel better about it now.” (65, female, breast cancer)

“There's definitely been improvement.” (72, female, breast cancer)

“I feel like it was positively impacted.” (53, female, breast cancer)

“I don't know, I might have been slight. I still use sticky notes for everything.” (60, female, breast cancer)

“It's hard to know. It definitely did not get any worse and I think at times I'm a little better, but it's hard to measure something like that. I think the whole thing helped a little bit.” (77, male, colon cancer)

“Um, I guess they were positively impacted because I was sleeping better and so I felt rested and could focus a little better. Not every single day, but an overall improvement.” (64, female, breast cancer)

“Most of the time after the treatment, and after using the tools that they gave me, I did wake up being more attentive and more refreshed.” (50, female, cervical cancer)

“My concentration definitely gets better when I started getting more sleep and started having a better routine. My brain was less foggy when I had a better night's sleep.” (53, female, thyroid cancer)

BELIEFS AND CBT-I

Subtheme = Consistency and Persistence

Definition: If participants indicated that impact was due to consistency and persistence

“Hmm. I would say that they were all impacted positively. When I followed the sleep protocol, I definitely woke up feeling fresher and that I was able to concentrate better.” (63, female, breast cancer)

“I think that if I consistently have good sleep, then I would definitely say that it did improve.” (70, female, uterine cancer)

“I can't specifically say there was 1 certain time. Just probably gradually over the course of the treatment.” (66, female, ovarian cancer)

“Once I was given the different tools and incorporated them. Probably about halfway through.” (59, female, skin cancer)

“The 1 thing I would say, is it, it wasn't an easy thing to do. I mean, it took a lot of concentration and patience to change my sleep habits. I did notice an improvement about halfway through though. Things got easier than too.” (73, female, breast cancer)

“Yes, I would say probably on about the 2-week point, because it takes a while to get into the habit of establishing that buffer zone before you go to bed and turning off all your electronics and not crowding your mind with too much. So yeah, it takes a while to get into that routine so, yeah, I'd say about 2 weeks.” (63, female, breast cancer)

“I think it was after a couple of weeks of getting into that routine of really making sure I've only gone to bed when I'm really tired and realizing that if I've been in bed and couldn't get to sleep to get up, get out of bed, reset, things like that.” (53, female, breast cancer)

“It took it took a few weeks for sure. It didn't happen overnight.” (70, female, cervical cancer)

“After a few weeks. I noticed the difference after a week of doing it and that's what kept me going to finish the program.” (53, female, thyroid cancer)

“Within 2 sessions maybe 3 of us looking at while the contributing factors what time I was going to bed, what time I was getting up, um you know, finding my rhythm and everything, I did see improvements.” (50, female, cervical cancer)

“Well, it was a slow start. For me, I didn't see a big difference suddenly, but it was effective. I've also fallen off a bit now, but I do know how to get back on track.” (70, female, uterine cancer)

Subtheme = Relationship with Therapist

Definition: If participants highlighted that treatment impact was positively related to the therapist who provided them the intervention

“I think it played a big part of it. Just because of her way of presenting it and, you know, walking me through it. She had all kinds of tips and tricks.” (66, female, ovarian cancer)

“They certainly had an influence. Like I say, because I felt the connection, if I hadn't felt the connection, I may not have been motivated to continue the whole thing in some ways.” (67, female, uterine cancer)

“Well, like I said, he was very helpful. If I wasn't looking forward to talking to him or meeting with him, I would have had a negative feeling about the whole process, and I probably would have ended up quitting.” (59, female, skin cancer)

“I think it was positive. It's hard to say, because I've never had that kind of thing with another person. I felt very comfortable with her. I think that if somebody, I didn't feel as comfortable with, I'm not sure it would've gone quite as well.” (65, female, breast cancer)

“I think it was a positive thing. If she had been somebody who I didn't feel relaxed with, I'm not sure I would have felt as good about the outcomes.” (70, female, skin cancer)

“Well, she was very patient. She kept trying to come at my reluctance from different angles. She didn't just say, well, this is what you must do, period. We discussed things and she offered different strategies.” (70, female, cervical cancer)

“Very much so, uh, because we had the ability to not only just look at the data, but 1st discuss it and pick it apart to find out what works for me and what didn't, and we had a comfortable conversation and relationship.” (50, female, cervical cancer)

“100% because of her whole process.” (53, female, thyroid cancer)

“So, I feel like that's a loaded question. And I say that, because I think the therapist is part of it, but I think the 2nd part of it is my own personal ability and willingness to participate fully in the program. So, I feel like that's a 2-part answer. I think having somebody be able to give the directions as well as she did is important, but I also think that my self-motivation helped a lot as well.” (53, female, breast cancer).

“Um. I think it was a factor. I mean, I found him very knowledgeable and very patient. So, from that perspective, I, don't know what another therapist would be like, but it was it was a good match for me.” (73, female, breast cancer)

“Um, I would say probably, it was, positively impacted because they were so understanding and accommodating.” (70, female, uterine cancer)

BELIEFS AND CBT-I

“I wouldn't have done anything if the therapist hadn't given me the steps and the protocol and then I had never spoken to him again. I don't know that I would have benefited because I really valued having that accountability to fill out the consensus sleep diary every day. And then speaking at the end of the week” (63, female, breast cancer)

“Well, it was definitely related to her giving me the suggestions and putting me on track.” (72, female, breast cancer)

Subtheme = Delivery Format

Definition: If participants highlighted that treatment impact was related to virtual delivery format

“Doing it over video actually made it easier because then I didn't have to worry about getting somewhere and having to go different places.” (53, female, thyroid cancer)

“I don't know if it being over video would have made a difference. To me, there were a lot of benefits by having it on video other than like, at the beginning.” (70, female, uterine cancer)

My experience was positive and I'm not sure my outcomes would have changed if I were to have done the intervention in-person.” (63, female, breast cancer)

“Well, I guess it wouldn't have mattered whether it was in person or on video. It was the treatment itself that helped.” (72, female, breast cancer)

“No, I don't feel like doing it in-person would improve my overall cognitive results any differently. The fact that I received the therapy, whether it was online or in-person, is what helped me.” (53, female, breast cancer)

“The video yeah, I mean, normally I'm not a big fan of video, but it's more convenient to be home. So, I do feel that the video was okay, and it didn't negatively impact my relationship with the therapist.” (47, female, breast cancer)

“I don't think it really made any difference positive or negative, it was just fine. It was more convenient. So that was useful.” (67, female, uterine cancer)

“I don't know if there would have been a difference doing it in person. I think that perhaps maybe we're getting used to this as a society, so it doesn't feel any different. The quality of the intervention was great, and I think that's all that matters.” (65, female, breast cancer)

“I don't know if anything would have been gained by doing it 1 on 1 in person. I feel this is one of those times where I think that I'm happy to have done it online through the computer.” (53, female, breast cancer)

“I was surprised with how easy the video connection was. I'm quite comfortable with it and so yeah, the video call was not a problem for me. Also, I'm in my own environment and I'm comfortable in my own environment so there are advantages to the somewhat impersonal nature of these kind of video chats.” (67, female, ovarian cancer)

“To me, this was easier. I was much more satisfied to do it this way. I don't even think I would have participated if it had been in-person.” (72, female, breast cancer)

“It was more convenient. So that was useful.” (67, female, uterine cancer)

BELIEFS AND CBT-I

“If anything, it was better because I could still interact with the therapist, but I didn't have to leave my home.” (60, female, breast cancer)

“At first, I thought I wouldn't want to do it by zoom, but in the end, it was for me. At times that I was uncomfortable, I was quite glad it was over zoom because I was in the comfort of my own living room versus sitting across from someone.” (70, female, uterine cancer)

“I thought it was better on video because I had more chances to ask questions.” (77, male, colon cancer)

“I mean, I think I was better doing it over video, simply because knowing what was going on in the world at the time. It probably would not have been positive or comfortable at all to do this in person.” (50, female, cervical cancer)

Subtheme = No Impact on Cognitive Impairment

Definition: If participants noted no impact when asked “Do you feel your cognitive symptoms were impacted by the intervention”

“I don't think I saw a dramatic change in any way.” (64, female, breast cancer)

“Um, I don't know if they were. They were always a part of me so it's hard to say whether they were improved.” (47, female, breast cancer)

“There are still low compared to what I used to be able to function. I don't think they've either improved, nor, gotten worse.” (67, female, uterine cancer)

“I was able to change my sleep pattern, but I don't know how much it impacted me cognitively.” (70, female, cervical cancer)

“Um, I'm not sure they were. I know the tests were done before and after and all of that and it did have a lot of impact on sleep, but I don't know whether I had a significant impact on the cognitive areas. I didn't have a noticeable change that I could see.” (73, female, breast cancer)

“I'm not sure that they were as I'm not sure I was having too many difficulties like that in the 1st place.” (70, female, skin cancer)

MAIN THEME: Credibility and Expectancy Beliefs

Subtheme = Skepticism and Doubt

Definition: If participants noted that their credibility/expectancy beliefs were impacted by their skepticism and doubt

“I questioned whether it would have much impact. I would say I would I was fairly skeptical about the right amount of improvement.” (64, female, breast cancer)

“I guess I was a little skeptical after having many years of having these issues.” (72, female, breast cancer)

“Prior to doing it, I didn't really think it was going to help at all. I thought I don't know if this going to work for me and felt like this going to be waste of time, but I was willing to give it a try because I was willing to give anything a try if I thought it would help my sleep and memory. But I was pleasantly surprised that it was making things better for me in respect to sleep.” (60, female, breast cancer)

“I don't know if I ever tried to look into it before. I always have a little bit of skepticism that's there, so I felt skeptical.” (53, female, breast cancer)

“I might've had some reluctance.” (70, female, cervical cancer)

“I always have a little bit of skepticism that's there, so I felt skeptical.” (53, female, breast cancer)

“I'm a bit of a pessimist to be honest. I never think things are going to work out.” (70, female, cervical cancer)

“I was skeptical.” (60, female, breast cancer)

“Um, I wasn't a true believer. I was willing to give it a try, but I guess I wasn't 100% sold on it.” (66, female, ovarian)

“Um, I was skeptical. But while I was skeptical, I was also thinking that it would prove me wrong. That this was it was going to work. Plus, knowing from working in health care for years as well I, I knew that this was an opportunity. Yeah, well, so I was thinking that while I'm having a bit of skepticism, I also knew that this wasn't this was not going to be some wishy-washy thing that didn't work. It had some real sound science. So, yeah, that that part of it kind of outweighed the skepticism quickly.” (50, female, cervical cancer)

“Well, of course, probably had a little bit of doubts, but it wasn't long till I could see that it was going to help.” (77, male, colon cancer)

BELIEFS AND CBT-I

Subtheme = Need for tangible evidence

Definition: If participants noted that their credibility/expectancy beliefs were influenced by their need for more tangible evidence

“I really hadn't focused on potential impacts of insomnia over the long term.” (67, female, uterine cancer)

“I thought maybe those concerns were tied to aging so I don't know whether I really thought this would help that.” (65, female, breast cancer)

“I don't know if I ever tried to look into it before.” (53, female, breast cancer)

“Just lack of information.” (53, female, thyroid cancer)

“Well, they didn't do anything, you know right. They didn't give you any medicine or anything like that. So, you think how is just talking about it going to do anything?” (77, male, colon cancer)

“I was somewhat skeptical, because I really didn't understand the sleep cycle, and I hadn't really even though I've been dealing with insomnia, I really hadn't focused on potential impacts of insomnia over the long term.” (67, female, uterine cancer)

Subtheme = Belief in the Importance of Sleep for Cognition

Definition: If participants noted that their credibility/expectancy beliefs were impacted by their a belief in the logical connection between sleep and cognition

“Knowing that better sleep was going to help some of those other things.” (66, female, ovarian cancer)

“I recognize that when you're well rested you function better, but I never really made the connection between good sleep and ability to concentrate before.” (63, female, breast cancer)

“Without good sleep, your mind doesn't work 100% and you need to have your sleep in order to be able to function well.” (74, female, breast cancer)

“Well, I think it seems logical that if you, if you get more sleep or more real rest, then your cognition would improve, and your energy would improve as well.” (67, female, ovarian cancer)

“I think my belief was once I was getting longer times asleep; it would positively impact my memory.” (72, female, breast cancer)

“Because I wasn't getting very good sleep, I was hoping if I improved my sleep, my memory and concentration would improve too.” (59, female, skin cancer)

“I was thinking it would improve sleep and then I knew that it would improve other areas as well.” (74, female, breast cancer)

“I find when I'm getting better sleep, it allows me to just function better overall.” (65, female, breast cancer)

“I felt it would improve my sleep so therefore I was rested, which would improve my cognitive function.” (53, female, breast cancer)

“I just do believe that if you're rested you can focus and do better. I know for myself that if I'm tired, I can't focus.” (64, female, breast cancer)

“Um, I don't know if my cognitive was what drove me to do this. It's definitely a nice little side bonus. I figured if my sleep improved, in turn, my cognitive issues would kind of straighten away and I, I would feel better. That was my hope.” (50, female, cervical cancer)

“I believed it would be helpful on the basis that without good sleep, your mind doesn't work 100% and you need to have your sleep-in order to be able to function well.” (74, female, breast cancer)

Subtheme = Optimism / Open minded

Definition: If participants noted that their credibility/expectancy beliefs were influenced by their optimism / having an open mind going into the intervention

“Well, I tried to go into it relatively blind. I purposely did not want to look it up on Google, I thought, okay, if I'm going to participate in this and I felt I needed to go in relatively blind, so I didn't really have any preconceived notions. I suppose I thought, gosh, you know, I've tried everything. Nothing seems to work, but I wanted to be relatively open minded.” (67, female, ovarian)

“I was open to it. I wanted to believe it was going to work.” (47, female, breast cancer)

“Well, I went into it very open minded. I mean, if I didn't believe that it was going to help me, I wouldn't have done it, right?” (64, female, breast cancer)

“I had a positive outlook towards it.” (72, female, breast cancer)

“I probably would have thought it would have been beneficial.” (70, female, skin cancer)

“Oh, to me, like, I have terrible sleep. Um, and a lot of it is bad sleep habit. So, I went into it knowing that if anything helped, it would be beneficial. Right? Regardless of the circumstances, whether they felt I qualified, or I felt I qualified.” (70, female, uterine cancer)

“Having experienced a similar intervention in the past, this made me think this intervention could be beneficial as well.” (53, female, thyroid cancer)

“Well, I'd hoped that they would be improved. I'm a positive person so I remained optimistic and positive about that.” (72, female, breast cancer)

“I was kind of hoping for a positive outcome but didn't really know for sure.” (72, female, breast cancer)

“I was open to it. I wanted to believe it was going to work” (47, female, breast cancer)

“Well, I was hopeful that it would, right? I, I went into it open minded.” (77, male, colon cancer)

Subtheme = Educational and Scientific Basis

Definition: If participants noted that their openness to the intervention was influenced by the educational and scientific basis of the intervention

“I know that people doing these kinds of studies are doing them with a basis of hoping that it could help. So, I'm a strong believer in educated people offering beneficial opportunities.” (72, female, breast cancer)

“Well, I just kind of feel like you wouldn't be doing it if there wasn't something behind it, right?” (64, female, breast cancer)

“The intervention seemed logical, and the staff seemed logical.” (47, female, breast cancer)