

ABSTRACT

Title of Document: **SLEEP THROUGHOUT THE ALCOHOLISM RECOVERY PROCESS: A MIXED METHODS EXAMINATION OF INDIVIDUALS' EXPERIENCES TRANSITIONING FROM AN INPATIENT RESEARCH FACILITY PROVIDING REHABILITATION TREATMENT TO THE COMMUNITY**

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Despite research establishing the relationship between sleep disturbances and alcohol use, there is no clear understanding or model for what occurs once individuals who seek inpatient alcoholism treatment are discharged from rehabilitation facilities and attempt to integrate back into their homes and communities. This study used a mixed methods approach to assess individuals' perceptions of and experiences with sleep throughout the process of alcohol rehabilitation and to explore associations between sleep-related beliefs/behavior, sleep quality, and relapse. The Social Cognitive Theory (SCT), which posits that personal factors, the environment, and human behavior exert influence upon each other through *reciprocal determinism*, was used as the underlying theory for this study. Constructs from the SCT were measured directly in this study using both quantitative and qualitative approaches in a convergent parallel design to study the following aims: a) to assess perceptions of and experiences with sleep during alcohol rehabilitation, b) to describe sleep patterns, perceptions, and beliefs among individuals who are alcohol-dependent throughout the transition from a clinical research facility providing rehabilitation treatment back to the community, and c) to assess whether sleep-

related beliefs and/or behavior are associated with sleep quality or alcohol relapse. Data were collected from a cohort of clinical research participants enrolled on an inpatient alcohol treatment protocol (n=32). Sleep was assessed quantitatively and qualitatively within one week of discharge from the inpatient facility and again four to six weeks post-discharge. Results indicated a prevalence of sleep disturbances throughout the process of rehabilitation. Self-efficacy for sleep was associated with better sleep quality at both time points. Thematic analyses of interview transcripts yielded overarching themes of sleep-related beliefs/behavior, sleep environments, stress related to transitions, and self-medication. This study demonstrates a prevalence of sleep disturbances among individuals undergoing alcohol treatment and relationships between SCT constructs and sleep quality. The period of transition from inpatient to outpatient represents a time of change, thus future behavioral sleep intervention efforts in this population may benefit from addressing underlying sleep-related beliefs and behaviors to improve sleep quality and encourage healthy and sober living.

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METHODS EXAMINATION OF INDIVIDUALS' EXPERIENCES TRANSITIONING
FROM AN INPATIENT RESEARCH FACILITY PROVIDING REHABILITATION
TREATMENT TO THE COMMUNITY

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Dedication

*In loving memory of Virginia Todaro (10-7-14) and Helen Schauer (12-2-14), my
incredible grandmothers*

*“Anxiety in a man’s heart weighs it down, but an encouraging word makes it glad.”
– Proverbs 12:25*

This journey has been filled with people whose invaluable support and encouragement truly carried me through the past five years. This project is dedicated to each of them:

To my husband, Justin Nicholas Brooks – my inspiration and my universe - you make me want to be better. Your gentle but persistent encouragement – physically, emotionally, and spiritually – and your supportive presence in my life means more to me than anything. You are the most loyal, caring, and sincere person I know and I am so proud of the person you are. Thank you for intimately witnessing both the most exciting and the most vulnerable periods of my life and for holding my worst and best in your heart. *“I will always love you more than I did yesterday, but not as much as I know I shall tomorrow.”*

To my parents, David and April Todaro – for giving me an example to strive for every single day. Thank you for allowing me to make mistakes when necessary, for supporting me physically, emotionally, mentally, financially, spiritually, and *comprehensively*, on every journey even if you did not agree with it, for teaching me that love really *is* patient and kind (and did I mention *patient*?)...no matter how old I get, my goal always was and always will be to make you proud. I am truly and forever blessed to be your daughter and you will never understand the admiration and respect I have for you. You will never have to wonder whether or not you made a difference in this world. Thank you for being my truest friends, harshest critics, and biggest supporters.

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CHAPTER 1: Introduction

The misuse of alcohol is a global public health concern that compromises both individual and societal well-being, resulting in an estimated 2.5 million deaths annually (WHO, 2013a). In the United States, alcohol is the leading risk factor for premature mortality, disability, and overall loss of health (WHO, 2013b). Alcohol consumption is causally related to over 60 different medical conditions, including cancer and neuropsychiatric disorders (Rehm, Room, Graham, Monteiro, Gmel, & Sempos, 2003; Room, Babor, & Rehm, 2005). Harmful drinking is associated with many other chronic diseases spanning across multiple organ systems such as cardiovascular disease, cirrhosis of the liver, and certain infectious diseases (WHO, 2013b). "Excessive" alcohol use, which encompasses binge drinking, defined as five or more drinks on one occasion for men or four or more drinks on one occasion for women, leads to an increased risk of numerous health problems (CDC, 2013a). Most health researchers maintain that "almost no pattern of drinking is entirely risk-free" (Room, Babor, & Rehm, 2005, p. 522).

The effects of alcohol consumption have the potential to harm not only the physical and psychological health of the drinker, but also those around him or her. Albert Bandura, famous for his contributions in the field of health behavior theory, posits that "substance abuse in a nation is a social problem, not just a personal one" (Bandura, 1999, p. 216). Traffic accidents and violence are just two examples of the potentially far-reaching effects of excessive alcohol consumption. Much of the disease burden related to alcohol is from intentional and unintentional injuries due to accidents, violence, and suicide, particularly among younger age groups (WHO, 2013b).

Alcohol dependence

Although alcohol abuse and dependence were once classified as two separate disorders in the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV), with alcohol dependence being the more serious of the two, recently the two disorders were combined to better quantify individuals' levels of severity/acuity. *Substance use disorder* now quantifies alcohol use on a continuum from *mild* to *severe* (APA, 2013). Despite this change in classification, much of the scientific literature and realm of clinical practice still uses the phrase “alcohol dependency” to characterize individuals who are addicted to alcohol. The National Institute on Alcohol Abuse and Alcoholism (NIAAA) distinguishes alcoholism by craving (a strong need to drink), loss of control (not being able to stop drinking), physical dependence (withdrawal symptoms), and tolerance (the need to drink increasingly greater amounts of alcohol in order to feel the same effects; NIAAA, *Alcohol Use Disorders*).

Individuals who are alcohol-dependent spend much of their time either drinking, making sure they can obtain alcohol, or recovering from alcohol's effects at the expense of other activities and responsibilities (NIAAA, *Alcohol Use Disorders*). Because of both individual and societal consequences of the disease, the prognosis and treatment of alcoholism is increasingly of interest to patients, clinicians, policymakers, and researchers alike. *Healthy People 2020*, which outlines health objectives for the US, has a category dedicated to substance abuse and multiple alcohol-related objectives including SA-11: *reduce cirrhosis deaths*. Currently, a high prevalence of individuals with substance use problems are either unaware of their problem or have made unsuccessful efforts to obtain treatment (Healthy People 2020, 2013).

Alcohol and sleep disturbances

Like many other chronic diseases, alcoholism is often accompanied by various psychiatric and behavioral problems including but not limited to depression, anxiety, post-traumatic stress disorder (PTSD), violence, and significant sleep disturbances (Benca, 1996; Levola, Aalto, Holopainen, Cieza, & Pitkanen, 2014; WHO, 2013a; WHO, 2013b). Insomnia is defined at the most basic level as difficulty falling or staying asleep and is relatively common in the U.S. (NHLBI, 2011). The national Behavioral Risk Factor Surveillance System (BRFSS) survey of the general U.S. population indicated that 37.9% of responders had unintentionally fallen asleep during the day at least once in the past month (CDC, 2013b). Inadequate sleep can affect multiple aspects of a person's health and well-being, thus making it a major concern with regards to quality of life. Furthermore, poor sleep quality can precede sleep-related unhealthy behaviors such as drowsy driving, which have the potential to cause serious injury or death (CDC, 2013b).

The relationship between alcohol use and sleep disturbances is complex and bidirectional, but the two often occur simultaneously (Brower, 2003; Gillin & Drummond, 2000; Teplin, Raz, Daiter, Varenbut, & Tyrrel, 2006). Alcohol can negatively affect many aspects of sleep including the proportion of rapid eye movement (REM) sleep, nightmare frequency, and snoring (Ebrahim, Shapiro, Williams, & Fenwick, 2013; Landolt & Gillin, 2001). Recent research suggests that genetic differences can help explain variance in insomnia severity among individuals who are alcohol-dependent (Brower, 2012). Additionally, late preferences for the timing of sleep and wakefulness (e.g. identifying as a “night owl”) may be related to increased alcohol consumption. In general, common correlates of insomnia in individuals who are alcohol-

dependent are similar to those of non-dependent individuals and include depression, anxiety, smoking, and the use of sleep aids (Brower, 2003).

Clear temporality of the development of insomnia and alcohol use disorders has not been and may never be established. Insomnia can persist for weeks or months following abstinence, suggesting that issues with sleep may originate prior to the development of alcoholism (Brower, 2003). Ford & Kamerow (1989) demonstrated that individuals who met criteria for alcohol abuse and dependence were more likely to report *ever* experiencing a period of two or more weeks of insomnia when compared to non-dependent individuals. Additionally, Weissman and colleagues (1997) demonstrated that those with insomnia in the past year (and no other psychiatric condition) were more than twice as likely to *develop* alcohol abuse problems over the subsequent year compared to those without either condition. Sleep disturbances because of worrying may particularly increase the risk for alcohol-related problems (Crum, Storr, Chan, & Ford, 2004). Some evidence suggests that sleep problems as early as childhood may increase the risk for early-onset alcohol use (Wong, Brower, Fitzgerald, & Zucker, 2004).

Regardless of which precedes the other, sleep disturbances are common among those who are alcohol-dependent during phases of drinking, withdrawal, and abstinence (Gillin & Drummond, 2000) and abnormal sleep may persist for months or years during the process of recovery and abstinence (Landolt & Gillin, 2001). Sleep disturbances are particularly common among individuals who are alcohol-dependent in the early stages of recovery and are far more common among individuals who are alcohol-dependent with co-morbid depression (Gillin, Smith, Irwin, Kripke, & Schuckit, 1990). One recent study suggested that depression may mediate the effect of drinking on insomnia (Zhabenko,

Krentzman, Robinson, & Brower, 2013). Sub-groups of individuals who are alcohol-dependent may benefit from special consideration of psychosocial aspects of their lives, including high-risk groups such as veterans (Chakravorty, Grandner, Kranzler, Mavandadi, Kling, Perlis, & Oslin, 2013). Up to 91% of individuals who are alcohol-dependent continue to suffer with sleep disturbances after one week of abstinence (Cohn, Foster, & Peters, 2003), which can sometimes persist for five weeks or more (Alling, Balldin, Bokström, Gottfrieds, Karlsson, & Långström, 1982). Compared to heavy drinking, both abstinence and moderate drinking are associated with fewer insomnia symptoms among recovering individuals who are alcohol-dependent (Brower, Krentzman, & Robinson, 2011).

Sleep disturbances and relapse among individuals who are alcohol-dependent

Sleep disturbances during various stages of alcohol recovery are often associated with relapse to drinking (Brower, 2001; Brower, Aldrich, Robinson, Zucker, & Greden, 2001; Landolt & Gillin, 2001). Among individuals who are alcohol-dependent who seek treatment, *baseline* sleep problems upon entering treatment have demonstrably predicted subsequent relapse to drinking (Brower, 2001; Brower, Aldrich, Robinson, Zucker, & Greden, 2001). Smith and colleagues (2013) demonstrated that longer sleep onset latency during inpatient rehabilitation predicted relapse one month after discharge from the treatment facility. Those who report insomnia within six months prior to achieving abstinence are more likely to relapse after five months of abstinence (Brower, 2003). Interestingly, both objective and subjective measures of sleep disturbances may predict relapse (Landolt & Gillin, 2001; Brower, Aldrich, & Hall, 1998). Aside from the fact that sleep disturbances among individuals who are alcohol-dependent can predict relapse,

sleep insufficiency even in the general population is associated with a variety of adverse health behaviors and lower health-related quality of life (Stine & Chapman, 2005).

Self-medicating theory / hypothesis

There is no single theory that explains the complex motivations behind problematic alcohol use, but several hypotheses have emerged. One such hypothesis is the self-medication theory, wherein an individual attempts to "treat" underlying mental health conditions or other symptoms with alcohol consumption. A central concept in this theory is the fact that individuals may be unaware they have an underlying issue. Some literature suggests that the act of self-medicating mood symptoms with alcohol is associated with increased odds of alcohol dependence and the persistence of dependence (Crum, Mojtabai, Lazareck, et al., 2013; Crum, La Flair, Storr, et al., 2013), which could be an important potential target for prevention and early intervention efforts. Alcohol use may *temporarily* relieve an unpleasant symptom or experience, including the inability to fall asleep, but it is not a healthy long-term solution.

In 1998, Johnson and colleagues reported that more than 10% of individuals in the general population use alcohol to self-medicate sleep problems (Johnson, Roehrs, Roth, & Breslau, 1998). Specifically among individuals who are alcohol-dependent, re-initiation of drinking following achieving abstinence may be an attempt to self-medicate sleep problems (Vitiello, 1997). Mahfoud and colleagues reported that nearly half of a sample of individuals with active substance abuse used substances to self-medicate sleep problems (Mahfoud, Talih, Stroom, & Budur, 2009). One recent study suggested that a small portion of participants self-reported drinking alcohol to cope with sleep problems (Sobieraj, Fabin, Wilczynski, & Krysta, 2013). Those with sleep disturbances may

choose to drink alcohol specifically because of its depressive effects (Fetting, 2012). Heavy alcohol consumption can induce fatigue and speed up the process of falling asleep (Vitiello, 1997), which may be particularly tempting for those who are struggling with difficulty sleeping and are already accustomed to drinking heavily.

Lance Dodes, a self-medication theorist from Harvard University, emphasizes the fundamentally psychological nature of addiction and has even suggested that "physical addiction is surprisingly incidental to the real nature of addiction" (2002, p. 76). He suggests that people feeling trapped in a problem or dilemma results in their feeling helpless or powerless, much like what could occur in the cycle of insomnia: when an individual who is alcohol-dependent experiences the inability to sleep, he or she may feel that the only "solution" available is drinking. Teaching healthy sleep hygiene techniques may encourage an individual to feel that he or she is in *control* of the issue and has choices for how to respond. The self-medicating hypothesis has influence on both medical and lay culture surrounding addiction, yet it has received some criticism for being overly simplistic. While addiction cannot and should not be reduced to solely the process of self-medication, given the multitude of complex reasons why people use and abuse alcohol (i.e. environment or genetics), the use of alcohol to self-medicate sleep disturbances has not yet been explored in-depth. In order to explore the multifaceted relationship between alcohol and sleep, a dynamic, reciprocal theory may offer more utility than a unidimensional approach.

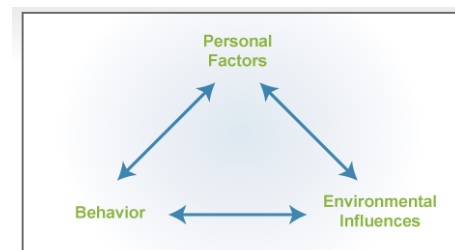
Theoretical framework: Social Cognitive Theory

In theories of addiction, enabling factors that give people skills, resilience, and environmental control are important to both understand and elucidate as methods for

overcoming dependence (Bandura, 1997). The Social Cognitive Theory (SCT), which posits that personal factors, the environment, and human behavior (Figure 1.1) exert influence upon each other through *reciprocal determinism* (Bandura, 1986), was used as the underlying theory the study described herein. In addition to individual behaviors and personal factors, a supportive environment can increase the likelihood of sustained behavior change. An individual's sleeping environment (and other environmental factors including facilitators and barriers to recovery), sleep-related cognitions, thoughts, and perceptions, as well as sleep-related behaviors should be carefully considered in maximizing the success of recovery efforts.

Figure 1.1: *Social Cognitive Theory*

Retrieved February 1, 2015 from
<http://www.esourceresearch.org/Default.aspx?TabId=734>.



Self-efficacy (personal factor) is a major construct in the SCT and refers to confidence in one's ability to take action and overcome barriers. Alcohol-related self-efficacy is predictive of lower likelihood of relapse for individuals in recovery (Adamson, Sellman, & Frampton, 2009). Self-efficacy has also been identified as a predictor and mediator of treatment success in various studies of alcoholism (Kadden & Litt, 2011). Perceived sense of community, which is an aspect of the *environment*, can predict abstinence-specific self-efficacy (Stevens, Jason, Ferrari, & Hunter, 2010). This

emphasizes the potentially important relationship between the environment and personal (cognitive) factors, as outlined in the theory.

Outcome expectancies (personal factor) and behavioral capability (behavioral factor) are also central concepts in the SCT and have been extensively explored in alcohol research. Outcome expectancies refer to the anticipated consequences of a behavior (i.e. sleep-related expectations). These might include sleep-related *cognitions*, such as dysfunctional beliefs about sleep, which are established contributors to poor sleep (Harvey, 2002; Yang, Spielman, & Golvinsky, 2006). Furthermore, cognitive arousal and inaccurate beliefs about sleep can lead to maladaptive sleep behaviors (Yang, Spielma, & Golvinsky, 2006). Behavioral capability encompasses knowledge and/or skills necessary to perform a behavior (one's ability to use non-alcoholic methods of initiating or sustaining sleep, such as relaxation techniques). On the contrary, unhealthy "safety" behaviors with regards to sleep, such as daytime napping and sleeping in on weekends to "make up" for lack of sleep can be harmful to overall sleep quality (Yang, Spielman, & Golvinsky, 2006). Some individuals may attempt to cope with sleep problems with such behaviors. Sleep-related expectations and behavior are both influenced by an individual's home sleeping *environment*: bedtime, lighting, temperature, pressure to attend to other obligations, bed-partner snoring, pets in the bedroom, and other environment-specific factors.

Albert Bandura posits that "if [alcoholics] are to be spared relapses, they must learn how to avoid troublesome situations, develop strategies for dealing effectively with situations that tax their self-regulatory capabilities, and learn how to recover from setbacks" (Bandura, 1999, p. 216). Self-efficacy is important in determining how much

effort people put behind an endeavor and their "staying power in the face of difficulties" (Bandura, 1997, p. 214). Regardless of what motivates an individual to drink (such as environmental triggers, the influence of another person, boredom, difficulty falling asleep, or stress), self-efficacy can determine whether the response is drinking or another, healthier adaptation (Bandura, 1999). The construct of self-efficacy is closely tied to the self-medicating theory: self-efficacy for healthy responses to unpleasant stimuli such as disturbed sleep could contribute to increased success in recovery (Bandura, 1999).

Constructs from the SCT were assessed in this study using both quantitative and qualitative methods. Qualitative interviews helped to characterize individuals' environment for recovery, which may be particularly relevant given that "major personal changes require an enabling subcommunity that promotes the diverse competencies needed to turn one's life around" (Bandura, 1999, p. 216). Additionally, one-on-one interviews aided in understanding individualized facilitators and barriers to sleep and expectations about transitioning back into the community. Quantitative measures assessed self-efficacy, beliefs, and behaviors related to sleep throughout recovery as well as general sleep quality. These measures were triangulated with qualitative data exploring parallel themes.

Study justification / purpose

Preliminary data were collected from adult participants (n=164) consented to participate in a study entitled *Assessment and Treatment of People with Alcohol Drinking Problems* (NCT00106093). This study is conducted through intramural program of the NIAAA and allows for evaluation and treatment of people with drinking problems at a clinical research facility providing rehabilitation treatment. Between September 2011 and

March of 2013 participants' sleep patterns during the inpatient phase of the study were characterized. From these data, we discovered that average sleep duration was relatively short (5.37 hours) and average sleep onset latency was 47.5 minutes during the first week of inpatient treatment. Over 90% of patients reported sleep disturbances at baseline (day 2 of inpatient treatment), which decreased to 50.5% at day 28 for those who were in treatment for 28 days or more. Despite slightly improved sleep during treatment, on average, individuals were still experiencing significant sleep disturbances at day 28 which made an outpatient data collection phase of interest to researchers and clinicians alike (Wallen, Brooks, Whiting, et al., 2014).

Despite research establishing the relationship between sleep disturbances and alcohol use, there is no clear understanding or model for what occurs once individuals who seek inpatient alcoholism treatment are discharged from rehabilitation facilities and attempt to integrate back into their homes and communities. The complexity of alcoholism and all of its associated co-morbidities may contribute to sleep disturbances in this population. Fears surrounding returning to the home environment following discharge from an inpatient rehabilitation facility have been documented qualitatively (Allen, Copella, & Orford, 2005), but questions from that study were not sleep-specific. Most studies of individuals who are alcohol-dependent do not include a qualitative component at all, which could limit a full understanding of the individual recovery process. Arnedt and colleagues (2007) recently called for more controlled studies characterizing the *phenomenology* of sleep during recovery.

The purpose of this study was to characterize sleep-related cognitions, behaviors, and patterns of sleep quality and duration among individuals who are alcohol-dependent

throughout the transition from a clinical research facility providing rehabilitation treatment back into the community. This study fills a gap in the literature by simultaneously characterizing sleep quantitatively and by qualitatively assessing individuals' sleep throughout the rehabilitation process and ongoing maintenance of abstinence. Sleep is a unique and individualized aspect of health, so a mixed methods approach provides unique insight into the recovery process and re-integration in communities. In 2009, William White wrote that "the greater the physical, psychological, and cultural distance between a treatment institution and the natural environments of its clients, the greater is the problem of transfer of learning from the institutional to the natural environment" (p. 151). Without exploring individual differences in patients' experiences with sleep throughout recovery, there is no way to understand this gradient and build science that is translational with potential to improve the prognosis of recovery.

Treating sleep problems will not cure an individual of his or her alcoholism, which is both a complex and multi-faceted biological addiction and a devastating chronic disease. However, treating insomnia and alcohol-dependency concurrently could increase recovery rates and ultimately improve quality of life throughout the recovery process. Addressing individuals' concerns surrounding sleep, particularly post-discharge, could be a step in the right direction toward tailored, holistic, and patient-centered care for individuals who are alcohol-dependent. Fetting posits that "an energized interest in self is a key ingredient for living a full life" (2012, p. 99). To date, the voices of people who are alcohol-dependent have not been heard in the development of interventions for sleep. Individuals who are alcohol-dependent have a unique set of needs and, for the purpose of sustainable behavior change, should be participating in the design and structuring of

interventions which begins by inviting them to participate in discussions surrounding their experience. Understanding the experiences of individuals who are alcohol-dependent with sleep throughout recovery, as well as their unique needs, provides useful preliminary data for informing the structure, timing, and delivery of a future behavioral sleep intervention.

Project aims

Study hypotheses in full narrative form and a conceptual framework are outlined in detail in Chapter 2 of this dissertation. Based on constructs from the SCT and previous literature, the following broad research aims were examined:

- Aim 1: To assess patients' perceptions of and experiences with sleep during alcohol rehabilitation;
- Aim 2: To describe sleep patterns, perceptions, and beliefs among individuals who are alcohol-dependent over the *transition* from a clinical research facility providing rehabilitation treatment back to the community; and
- Aim 3: To assess whether sleep-related beliefs and/or behavior of individuals are associated with sleep quality or alcohol relapse.

Definition of variables / terms

- **Alcohol-dependence (alcoholism):** Based on the DSM-IV criteria, which is currently used for screening, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) distinguishes alcoholism by craving (a strong need to drink), loss of control (not being able to stop drinking), physical dependence (withdrawal symptoms), and tolerance (the need to drink increasingly greater

amounts of alcohol in order to feel the same effects; NIAAA, *Alcohol Use Disorders*).

- **Codes:** In qualitative interviews, codes refer to a group of "references" to a certain topic. "Coding" refers to the process of collecting references centered around a specific topic. In NVivo 10.0 software, a group of references referring to a single topic is a "node" (Richards, 1999).
- **Insomnia:** Insomnia is a sleep disorder characterized by difficulty initiating or sustaining sleep. It is generally diagnosed by a physician after a medical/sleep history and physical exam. Although we were not diagnosing individuals with insomnia in this study, much of the existing literature has examined insomnia in relation to alcohol consumption.
- **Nodes:** In NVivo software, a node is a collection of references which refer to a specific theme. References are determined by "coding" segments of content from transcripts (Richards, 1999) which was done both manually and with NVivo.
- **Relapse:** Relapse to drinking was considered primarily as any level of self-reported drinking.
- **Sleep disturbances** (impaired sleep, disrupted or disturbed sleep): Sleep disorders are problems with sleeping, including trouble falling or staying asleep, falling asleep at the "wrong" times, too much sleep, or abnormal behaviors during sleep (National Library of Medicine, 2013). In this study we examined "trouble falling or staying asleep" in detail.
- **Sleep quality:** For the purposes of this study, "sleep quality" was assessed with a self-rated questionnaire the Pittsburgh Sleep Quality Index (PSQI). The Epworth

Sleepiness Scale (ESS) was used to characterize daytime sleepiness levels.

Detailed descriptions of each scale are outlined in Chapter 3 under "sleep-related measures." In general, sleep quality was assessed with the PSQI through a global score which indicates sleep disturbances (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). To further explore the concept of "daytime dysfunction," "excessive daytime sleepiness" was examined with the ESS (Johns, 1991).

- **Social Cognitive Theory (SCT):** The Social Cognitive Theory (SCT) posits that personal factors, the environment, and human behavior exert influence upon each other through *reciprocal determinism* (Bandura, 1986). Specific constructs include self-efficacy, behavioral capability, and outcome expectancies.

Study overview

Following the approval of the NIH Addictions Institutional Review Board (IRB), adult research participants admitted to the inpatient behavioral health unit and enrolled on to the NIAAA intramural study NCT 0010693: *Assessment and Treatment of People with Alcohol Drinking Problems* were recruited for participation in this descriptive, clinical study – NCT 021815698 (n = 32). Sleep quality and duration were quantitatively assessed approximately one week prior to discharge from the inpatient facility and again four to six weeks after discharge. In addition to quantitative measures and biomarkers (collected on a sub-set of participants), qualitative semi-structured interviews were conducted with participants within a week of the scheduled discharge date and again four to six weeks post-discharge to assess perceptions of sleep during recovery, as well as the acceptability of various proposed intervention formats.

This dissertation has yielded one publication and several presentations thus far. The first paper, a literature review, was entitled “Sleep disturbances in individuals with alcohol-related disorders: a review of cognitive-behavioral therapy for insomnia (CBT-I) and associated non-pharmacological therapies” (Brooks & Wallen, 2014) and was accepted into *Substance Abuse: Research and Treatment* in revised form on August 19th, 2014. Two additional manuscript drafts are included in this dissertation: the second paper is a mixed methods examination of sleep-related beliefs, experiences, and sleep quality over individuals’ transition from inpatient alcohol rehabilitation to the community and will be submitted to *Alcohol & Alcoholism*, and the third paper is a mixed methods examination of sleep throughout the alcoholism recovery process grounded in the Social Cognitive Theory and will be submitted to the *Journal of Health Psychology*.

Table of contents in paragraph form

Chapter 1 provided an overview of background literature, statement of the problem, and project aims. Chapter 2 highlights manuscript #1, a literature review, and introduces the conceptual model which guided the measures and analyses of this study. Chapter 3 provides an overview of study methods, including the participants, measures, analyses, and project timeline. Chapter 4 includes manuscript #2, an examination of sleep over the transition from an inpatient rehabilitation facility back to the community. Chapter 5 includes manuscript #3, an examination of sleep throughout the alcoholism recovery process grounded in Social Cognitive Theory constructs. Chapters 4 and 5 both contain all elements of a standard manuscript. Finally, Chapter 6 provides an overview of all findings, suggestions for future research directions, strengths and limitations, and conclusions / implications for the field.

CHAPTER 2: Literature review (manuscript #1) and conceptual model

The purpose of this chapter is to provide an overview of available treatments for individuals who are alcohol-dependent suffering with various sleep disturbances, highlight a gap in the literature and a need for patient-centered intervention efforts, and introduce a conceptual model for sleep disturbances among individuals who are alcohol-dependent based on the Social Cognitive Theory (SCT). The first paper, titled “Sleep disturbances in individuals with alcohol-related disorders: a review of cognitive-behavioral therapy for insomnia (CBT-I) and associated non-pharmacological therapies,” was published in *Substance Abuse: Research and Treatment*. The contents of the review article are typed below exactly as the article appears in the journal (Brooks & Wallen, 2014), with one exception: every attempt has been made to replace the term “alcoholic” with more sensitive, person-centered language based on a recommendation from a reviewer of another journal.

Abstract

Sleep disturbances are common among individuals who are alcohol-dependent and are often associated with relapse. The utility of behavioral therapies for sleep disturbances, including cognitive-behavioral therapy for insomnia (CBT-I), among those with alcohol-related disorders is not well understood. This review systematically evaluates the evidence of CBT-I and related behavioral therapies applied to those with alcohol-related disorders and accompanying sleep disturbances. A search of four research databases (PubMed, PsycINFO, Embase, and CINAHL Plus) yielded six studies that met selection criteria. Articles were reviewed using Cochrane’s Grades of Recommendation,

Assessment, Development, and Evaluation (GRADE) scoring system. A majority of the studies demonstrated significant improvements in sleep efficiency among behavioral therapy treatment group(s), including but not limited to CBT-I. While behavioral sleep interventions have been successful in varied populations, they may not be utilized to their full potential among those with alcohol-related disorders as evidenced by the low number of studies found. These findings suggest a need for mixed methods research on individuals' sleep experience to inform interventions that are acceptable to the target population.

Keywords: alcoholism, alcohol disorders, sleep disturbances, insomnia, cognitive-behavioral therapy for insomnia, CBT-I

Introduction

Insomnia is defined at the most basic level as difficulty falling or staying asleep (NHLBI, 2013). Estimates suggest that up to one-third of the U.S. population is currently sleep deprived (Colten & Altevogt, 2006). Nearly 40% of respondents of the national behavioral risk factor surveillance system (BRFSS) survey indicated that they had unintentionally fallen asleep during the day at least once in the past month. Inadequate sleep can affect multiple aspects of a person's health and well-being, thus making it a major "quality of life" concern. Furthermore, poor sleep quality can precede unhealthy behaviors such as drowsy driving, which have the potential to cause serious injury or death (CDC, 2013b).

Sleep disturbances and chronic disease. Individuals suffering with chronic diseases may be at an increased risk of sleep disturbances, which for the purposes of this

paper are interchangeable with the term *impaired sleep quality*. Cardiovascular disease and mental health problems are just two of many chronic diseases associated with sleep problems (Ayas, White, Al-Delaimy, et al., 2003; Stine & Chapman, 2005). Depression, heart disease, and chronic pain are associated with more prevalent symptoms of insomnia, while obesity, arthritis, and osteoporosis are associated with other sleep-related problems including snoring, restless legs, or daytime sleepiness. Individuals suffering with chronic diseases who have abnormalities of sleep duration (sleeping too much or too little), which is independent of but related to insomnia as a clinical diagnosis, are at increased risk of obesity, mental distress, coronary heart disease, stroke, and diabetes (Foley, Ancoli-Israel, Britz, & Walsh, 2004). Specifically, insomnia with short sleep duration has been associated with increased risk of hypertension (Vgontzas, Liao, Bixler, Chrousos, & Vela-Bueno, 2009), diabetes (Vgontzas, Liao, Pejovic, Calhoun, Karataraki, & Bixler, 2009), and for men, overall mortality (Vgontzas, Liao, Pejovic, et al., 2010). Chronic diseases are frequently accompanied by a range of complex comorbidities and health-related quality of life (HRQOL) issues; thus, sleep quality may be particularly important for clinicians and researchers to consider in these populations.

Sleep disturbances among individuals who are alcohol-dependent.

Alcoholism is a chronic and typically progressive disease (The Mayo Clinic, 2009), with the potential to severely compromise individual and societal well-being. The nature of alcoholism calls for a “sustained recovery management model” (White, Boyle, & Loveland, 2003) that is holistic in nature, taking into account associated comorbidities and overall quality of life. Alcohol misuse and sleep disturbances often occur simultaneously, but their relationship is not well understood (Benca, 1996). Among

individuals who are alcohol-dependent, sleep disturbances are common during phases of active drinking, withdrawal, and abstinence (Gillin & Drummond, 2000).

Sleep problems may originate prior to the development of clinical alcoholism, as evidenced by insomnia that persists for weeks or months following abstinence (Brower, 2003). However, whether or not one consistently precedes the other has yet to be established. Ford and Kamerow demonstrated that individuals who met the Diagnostic and Statistical Manual of Mental Disorders, 3rd edition (DSM-III) criteria for alcohol abuse and dependence were more likely to report ever experiencing a period of two or more weeks of insomnia compared to non-dependent individuals (Ford & Kamerow, 1989). Weissman and colleagues demonstrated that those with insomnia (and no other psychiatric condition) in the past year were more than twice as likely to *develop* alcohol abuse problems over the subsequent year compared to those without either condition (Weissman, Greenwald, Nino-Murcia, & Dement, 1997). Some evidence indicates that sleep problems originating in early childhood may increase the risk for early onset alcohol use (Wong, Brower, Fitzgerald, & Zucker, 2004).

Any level of drinking has the potential to negatively impact sleep. Sleep disturbances are particularly common among those who are alcohol dependent during the early stages of recovery and are even more common among those with comorbid depression (Gillin, Smith, Irwin, Kripke, & Schuckit, 1990). Insomnia can persist in patients despite abstinence. Alcohol use can negatively affect sleep composition and lead to increased nightmare frequency, snoring, and other sleep interruptions (Foster & Peters, 1999). Despite causal mechanisms remaining unclear, the association between poor sleep and alcohol consumption is supported by a growing body of evidence (Currie, Clark,

Rimac, & Malhotra, 2003; Ford & Kamerow, 1989; Smith, Hill, Marshall, Keaney, & Wanigaratne, 2013).

The role of quality sleep in preventing relapse. Getting quality sleep is not only an important component of a healthy lifestyle but may also prevent relapse in recovering individuals who are alcohol-dependent. Both objectively- and subjectively-measured sleep disturbances among individuals who are alcohol-dependent in various phases of recovery have the potential to increase the risk of relapse (Foster & Peters, 1999; Brower, Aldrich, Robinson, Zucker, & Greden, 2001). Among treatment-seeking individuals who are alcohol-dependent, baseline sleep problems upon entering treatment may predict subsequent relapse to drinking (Brower, Aldrich, Robinson, Zucker, & Greden, 2001). Sleep disturbances after detoxification are also common. Many individuals who are alcohol-dependent report sleep disturbances following abstinence, which may persist for up to five weeks of abstinence (Alling, Balldin, Bokstron, Gottfrieds, Karlsson, & Langstrom, 1982). Some research suggests that abnormal sleep may persist for months to years during the recovery and abstinence process (Adamson & Burdick, 1973; Drummond, Gillin, Smith, & DeModena, 1998). The role and implications of insomnia in various phases of alcoholism (drinking, withdrawal, early/prolonged abstinence) are not yet clear, but one clinical trial currently underway seeks to elucidate this concept (NCT02181569: Sleep Disturbance and Relapse in Individuals with Alcohol Dependence: An Exploratory Mixed Methods Study). Thus, improving sleep among individuals who are alcohol-dependent is increasingly of interest to researchers, clinicians, and patients alike.

Cognitive-behavioral therapy for insomnia (CBT-I). Behavioral sleep interventions addressing underlying beliefs and behaviors have been successful in varied populations and have fewer side effects than pharmacological treatments (Morin, 2006). However, when sleep restriction is included as part of the non-pharmacological regimen, providers should be vigilant for any untoward side effects (Kyle, Miller, Rogers, Siriwardena, Macmachon, & Espie, 2014). A review of the use of CBT for primary insomnia revealed that CBT is superior to any single-component treatment and can improve sleep efficiency, sleep-onset latency, and wake after sleep onset, in addition to reducing sleep medication use (Wang, Wang, & Tsai, 2005). CBT-I targets behaviors, cognitions, and associations that negatively affect sleep, and it is undoubtedly the most common and well-accepted non-pharmacological treatment for insomnia (Lund, Rybarczyk, Leszczyszyn, & Stepanski, 2012). CBT-I interventions can vary, but may include education on sleep information, sleep hygiene and relaxation techniques, sleep scheduling, developing strong sleep patterns, and cognitive techniques designed to change mental approaches to sleep (Morin & Espie, 2003). Sleep restriction (limiting time spent awake in bed), stimulus control, and addressing distorted beliefs about sleep can also be included (Fucito, Redeker, Ball, Toll, Ikomi, & Carroll, 2014; Morin & Espie, 2003). CBT-I has been utilized to improve sleep for individuals with various conditions, including moderate-to-severe chronic pain (Jungquist, Tra, Smith, et al., 2012). CBT-I has also reduced the extent to which pain interfered with daily functioning among chronic pain sufferers (Junquist, O'Brien, Matteson-Rusby, et al., 2010). A version of CBT-I combined with sleep hygiene education has demonstrably improved sleep and decreased cognitive arousal over time (Gellis, Arigo, & Elliott, 2013). Another study wherein

patients received progressively reduced 4-week pharmacotherapy or a combination of self-help and pharmacotherapy found that those utilizing self-help showed significantly more improvements in sleep quality and negative sleep-related cognitions. Regular appointments and sleep logs had a positive influence on sleep outcomes for these participants (Katofsky, Backhaus, Junghanns, et al., 2012). Although one review article concluded that CBT-I is a promising treatment for individuals with medical and psychiatric comorbidities (Friedmann, Herman, Freedman, Lemon, Ramsey, & Stein, 2003); evidence on the efficacy of these types of interventions specifically among patients with alcohol-related disorders is scarce.

Treatment options for individuals with alcohol-related disorders and comorbid sleep disturbances. Both pharmacological and behavioral treatment options exist for individuals with alcohol-related disorders suffering from sleep disturbances, although pharmacological interventions are used more often. A survey of members of the American Society of Addiction Medicine (ASAM) revealed that 64% of physicians have recommended some type of pharmacological treatment (prescription or over-the-counter) to an individual who is alcohol-dependent suffering from insomnia within 3 months of their detoxification, although a much smaller proportion do so consistently for the majority of their patients (Friedmann, Herman, Freedman, Lemon, Ramsey, & Stein, 2003). Despite the utilization of pharmacological treatment, non-pharmacological therapies may also be effective and should be given careful consideration in this population (Bracken, Penetar, Maclean, & Lukas, 2011). Non-drug treatments for insomnia, specifically CBT-I, may have long-term benefits as opposed to pharmacologic sleep aids, which often have side effects and are only recommended for short-term use

(Jacobs, Pace-Schott, Stickgold, & Otto, 2004; Sivertson, Omvik, Pallesen, et al., 2006).

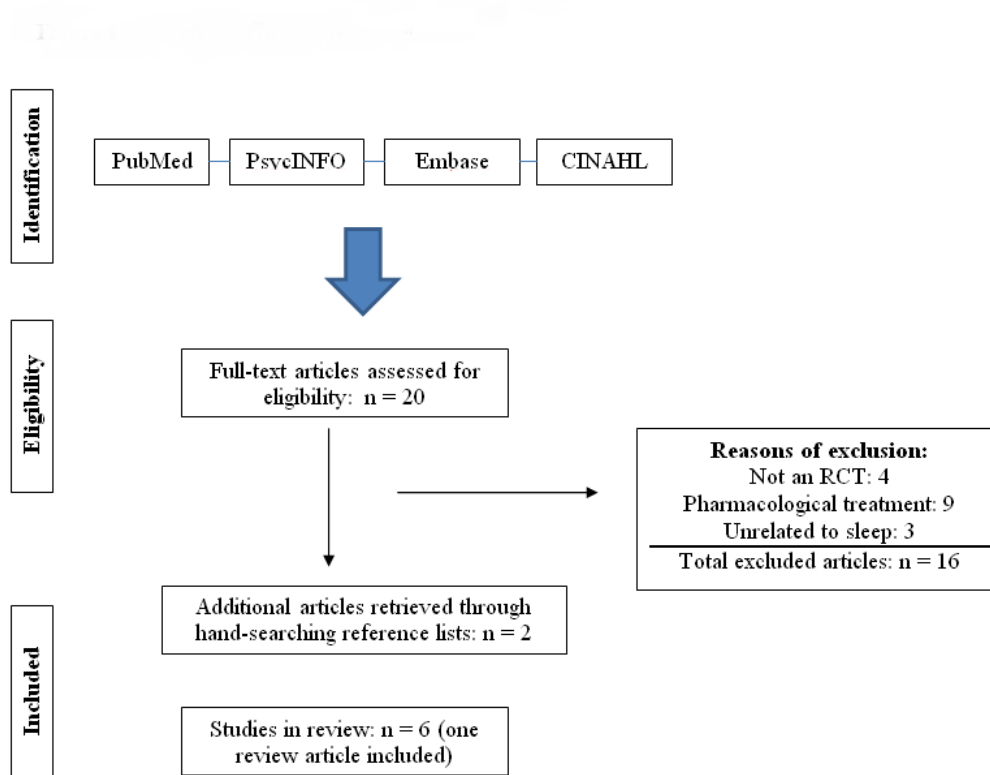
The benefits of CBT-I may extend beyond treatment of insomnia, providing benefits to non-sleep issues, such as overall well-being and depressive symptom severity (Manber, Bernert, Suh, Nowakowski, Siebern, & Ong, 2011). In general, mind–body interventions, including tai chi, music therapy, yoga, relaxation, and CBT, may improve sleep quality and reduce the need for hypnotic drugs (Kozasa, Hachul, Monson, et al., 2010). The purpose of this review is to describe the available behavioral treatments for individuals with alcohol-related disorders suffering with various sleep disturbances and to elucidate the gaps that exist in the literature and research knowledge-base related to behavioral sleep interventions.

Methods

The GRADE system, adopted by the World Health Organization (WHO) and Cochrane, was utilized for this review (The Cochrane Collaboration, 2011). We conducted a search in PubMed, PsycINFO, Embase, and CINAHL Plus between September 2013 and June 2014 for peer-reviewed journal articles written in English and published since January 1998. We sought to identify research studies that examined non-pharmacological interventions for sleep among individuals with alcohol-related disorders. After first searching for all sleep initiation and maintenance interventions, we discovered that fewer than half of all search results that included sleep interventions or therapies were non-pharmacological in nature. A considerable number of CBT-I articles were found in varying populations (not specific to alcoholism, $n = 365$). When we limited the search to interventions only in alcohol-related disorders, 20 articles were retrieved (PubMed search terms: (“sleep initiation and maintenance disorders/th OR sleep initiation

and maintenance disorders/dt) & alcohol-related disorders [mh]”). To further develop a comprehensive evidence base, reference lists of relevant articles were hand searched by the authors. Refer to Figure 2.1 for a flowchart of the process resulting in the articles reviewed herein. All behavioral sleep interventions, including CBT-I and/or progressive relaxation training, among individuals with alcohol-related disorders are included in Table 2.2, which illustrates pertinent study details including sample size, demographic characteristics of participants, and basic methodological approach for each study ($n = 6$).

Figure 2.1: *Flowchart of literature search*



Results

The GRADE system for review was utilized to assess each article's quality of evidence (see Table 2.1 for an explanation of each level). In our assessment, "high" ratings were reserved for well-conducted randomized trials or very strong observational studies, "moderate" ratings were reserved for randomized trials with some methodological weaknesses or strong observational studies, "low" ratings were reserved for very weak randomized trials or observational studies, and "very low" ratings were reserved for weak observational studies or case reports. No articles were ranked as "very low." In total, two articles were rated as "low," three articles were rated as "moderate," and only one article was rated as "high." One randomized controlled trial (RCT) assessed the effectiveness of CBT on improving sleep and reducing relapse in recovering alcohol-dependent patients. Diary-rated sleep efficiency, wake after sleep onset, and daytime ratings of general fatigue improved more in the treatment group compared to the control (Arnedt, Conroy, Rutt, et al., 2007). Another RCT assessed the effectiveness of progressive relaxation training, and the treatment group experienced improved sleep quality (Greeff & Conradie, 1998). Four of the five studies demonstrated significant improvements in sleep efficiency for the CBT-I treatment groups (Arnedt, Conroy, Rutt, et al., 2007; Arnedt, Conroy, Armitage, & Brower, 2011; Bootzin & Stevens, 2005; Currie, Clark, Hodgins, & El-Guebaly, 2004). When sleep was examined more comprehensively in 2005 by Bootzin and Stevens and in 2011 by Arnedt and colleagues and Britton and colleagues, sleep-onset latency, wake after sleep onset, and measures of general fatigue were significantly lower in treatment groups. Other outcomes achieved in

the studies included decreased depression, anxiety, and fatigue as well as higher subjective quality of life (Table 2.2)

Table 2.1: Levels of quality of a body of evidence in the GRADE approach

Underlying methodology	Quality rating
Randomized trials; or double-upgraded observational studies.	High
Downgraded randomized trials; or upgraded observational studies.	Moderate
Double-downgraded randomized trials; or observational studies.	Low
Triple-downgraded randomized trials; or downgraded observational studies; or case series/case reports.	Very low

Adapted from:

http://handbook.cochrane.org/chapter_12/table_12_2_a_levels_of_quality_of_a_body_of_evidence_in_the.htm

Table 2.2: Non-pharmacologic sleep interventions for individuals with alcohol-related disorders: selected articles and findings

Author/year	Sample	Intervention	Sleep measures	Method of delivery	Key findings	Limitations	Rating
Arnedt et al., 2007	n=7, 43% female, 38.6 years (\pm 10.8), 85.7% Caucasian, alcohol-dependent (based on DSM-IV)	8 individual CBT-I sessions	Daily sleep diaries, Insomnia Severity Index	In-person	Improvements in depression / anxiety, fatigue, sleep efficiency, QOL	No control group, no follow-up assessments	Low
Arnedt et al., 2011	n=17, 35% female, 46.2 years (\pm 10.1), 77.8% Caucasian, alcohol-dependent	9 individual CBT-I for AD treatments	Daily sleep diaries, Insomnia Severity Index	In-person	Sleep efficiency, WASO, general fatigue improved in treatment group	40% attrition, self-reported data	Moderate
Bootzin & Stevens, 2005 (and Britton et al., 2010) *	n=55, 38% female, 16.35 years (\pm 1.23), 2/3 Caucasian, recent completers	6 therapy sessions including MBSR, CBT-I components, bright light	Daily sleep diaries, actiwatches during baseline and posttreatment, dim light	In-person	Improved SE, SOL, WASO, total sleep time, and diary ratings on quality / soundness of	No control condition, conducted among adolescents only, bright light therapy's	Low

	of OP substance abuse treatment programs	therapy	melatonin onset (in lab)		sleep among those who completed 4+ sessions - mindfulness meditation practice frequency associated with improvements in sleep, emotional distress, reduced substance use	effect on <i>sleep-related</i> outcomes unclear	
Currie et al., 2004	n=60, 30% female, 43.3 years (\pm 10.9), diagnosed with alcohol dependence, variation in length of remission	3 treatment conditions which included a CBT-I arm (5 one-hour sessions of individual therapy)	Sleep diaries, PSQI, SII, actigraphy	In-person	Improved sleep quality, sleep efficiency, SOL, and WASO maintained for 6 months post-treatment; not corroborated by actigraphy	30% had 12 months or more of pre-treatment abstinence, improvements in sleep still put people in dysfunctional range even after 6 months	High
Greeff & Conradie, 1998	n=37, 0% female, 45.5 years (\pm 9.5), diagnosed with alcoholism (DSM-III-R)	10 sessions of progressive relaxation training offered by a psychologist	Questionnaire designed by Tworetzky (1975) - assessing history and treatment for sleep problems, sleep diary	In-person	Treatment group had significant difference in sleep quality pre- and post-treatment	Only men, no follow-up assessments, did not control for possible effects of other treatments	Moderate

*Given the paucity of literature on behavioral sleep interventions, we included this study in our review despite the fact that the sample was younger than that of the other studies, so interpretation of results may differ. Additionally, the participants in this study were in treatment for *general* substance abuse (many were multi-drug users, though virtually all reported *ever* using alcohol).

Methods of non-pharmacological sleep intervention delivery. To expand our search and examine the use of behavioral sleep interventions in other populations, we examined several other factors with regard to intervention delivery. As with any population suffering with a complex chronic disease, consideration of the feasibility and acceptability of an intervention among the individuals struggling with alcohol

dependence is imperative. In addition to a call for more behavioral sleep intervention research and resources comes a call for “alternative” and integrated delivery methods (brief protocols, self-help, Internet, etc.) to increase access to and acceptability of these highly effective treatments (Williams, Roth, Vathauer, & McCrae, 2013). See Table 2.3 for selected examples of methods of delivery for non-pharmacological sleep interventions (Arnedt, Cuddihy, Swansom, et al., 2013; Behar, Roebuck, Domingos, Geder, & Clifford, 2013; Cheng & Dizon, 2012; Espie, Kyle, Williams, et al., 2012; Lancee, van den Bout, van Straten, & Spoormaker, 2012; Riley, Mihm, Behar, & Morin, 2010; Ritterband, Thorndike, Gonder-Frederick, et al., 2009; Ritterband, Bailey, Thorndike, et al., 2012; Troxel, Germain, & Buysse, 2012; Vincent & Lewycky, 2009; Vincent & Walsh, 2013).

Table 2.3: *Methods of non-pharmacologic sleep intervention delivery*

Method	Authors / year	Results
<i>Telephone-delivered CBT-I</i>	Troxel, Germain, & Buysse, 2012	Developed briefer alternative to standard CBT-I intervention including two phone sessions to address barriers to widespread dissemination of the therapy
	Arnedt et al., 2013	CBT-I delivered by phone was more beneficial than information (pamphlet) control; more CBT-I phone participants showed improvements in unhelpful sleep-related cognitions and were classified as "in remission" from insomnia at follow-up
<i>Computerized therapy for insomnia</i>	Cheng & Dizon, 2012	Meta-analysis concluded that computerized CBT-I (cCBT-I) is a "mildly to moderately effective" self-help therapy for short-term treatment of insomnia; average number of sessions needed for treatment was 3.59; estimated that one in every four patients treated with computerized CBT-I will recover from chronic insomnia
	Ritterband et al., 2009	Internet intervention for insomnia group experienced significantly better sleep compared to control group; internet has potential for delivery of structured behavioral programs for insomnia

	Ritterband et al., 2012	Internet-based CBT-I program to improve insomnia symptoms (among cancer survivors) using components of CBT-I including sleep restriction, stimulus control, cognitive restructuring, sleep hygiene, and relapse prevention; intervention significantly improved insomnia severity, sleep efficiency, sleep onset latency, general fatigue
	Riley et al., 2010	Designed automated program delivering stimulus control and sleep restriction strategies; well-accepted and well-utilized by patients with primary insomnia
	Espie et al., 2012	Web-based CBT course delivered via virtual therapist with automated support & a community forum; effective in improving sleep and associated daytime functioning of adults with insomnia; improvements maintained over time
	Lancee et al., 2012	Assessed self-help for insomnia program and found that electronic and paper/pencil treatment conditions significantly better than control group on insomnia symptoms, daily sleep measures, depression, and anxiety; improvements maintained over 48-week follow-up
	Vincent & Lweycky, 2009	5-week online CBT-I course for adults with chronic insomnia consisting of psychoeducation, sleep hygiene, stimulus control, sleep restriction, relaxation training, cognitive therapy, and medication tapering assistance; online treatment group experienced significant improvements in sleep quality, insomnia severity, and daytime fatigue
	Vincent & Walsh, 2009	Hyperarousal and time awake in bed partially mediated impact of computerized CBT on sleep at follow-up; pre-sleep arousal more significant in explaining change associated with computerized CBT-I
<i>Smartphones for behavioral sleep interventions</i>	Behar et al., 2013	Smartphone "apps" offer digital versions of questionnaires about sleep, infer nighttime wakefulness from body movement measured through accelerometer, monitor sound of snoring, help with sleep apnea; "powerful tools that offer both computational and communication opportunities which can be leveraged for the benefit of healthcare"

Alternative delivery of health interventions. Psychosocial and health behavior therapies have been successfully implemented in populations with alcoholism and other conditions. Ecological momentary interventions (EMI), which are a real-time intervention delivery mechanism, have been effectively implemented and are acceptable to patients for a variety of health behaviors, and physical and psychological symptoms (Heron & Smyth, 2010). Behavior change interventions delivered via text message or the Internet have been successfully implemented in “hard-to-reach” populations including socially disadvantaged men (Irvine, Falconer, Jones, et al., 2012), those with comorbid alcohol use disorder and depression (Agyapong, McLoughlin, & Farren, 2013), and those in the criminal justice system (Walters, Ondersma, Ingersoll, et al., 2014). One smartphone application designed to support sustained recovery from alcoholism was successful in reducing risky drinking days among individuals recently discharged from residential treatment (Gustafson, McTavish, Chih, et al., 2014). These interventions can be based on existing health behavior theories or incorporated into evidence-based models of treatment.

With the exponential growth in communication technology, landline telephones, computers, and smartphones all have the potential to serve as vessels for the delivery of non-pharmacological sleep interventions and may be considered viable mechanisms for transitioning care from inpatient to outpatient among individuals who are alcohol-dependent in a patient-centered way. For example, telephone-delivered CBT-I intervention sessions may decrease the need for physical presence of a therapist which has the potential to increase patient access to this treatment. This finding could be particularly relevant for hard-to-reach populations, such as rural-dwelling individuals

(Holmgvist, Vincent, & Walsh, 2014). Some researchers and clinicians posit that the key feature that makes computerized (and other forms of) CBT-I promising is decreased reliance on a therapist, but further research is necessary. Individuals who are alcohol-dependent in recovery who are unable to attend outpatient meetings following inpatient treatment, as we have experienced in our own clinic, may be more amenable to interventions delivered via phone or Internet.

Discussion

The studies in this systematic review of the literature provide substantial evidence for non-pharmacological sleep interventions being effective and largely accepted when tailored appropriately. While CBT-I is undoubtedly the most common type of treatment both prescribed and investigated, its utilization among those with alcohol-related disorders is not extensive and therefore remains relatively inconclusive. Small sample sizes and methodological weaknesses of the behavioral sleep interventions reviewed limit conclusions regarding intervention efficacy and highlight the need for patient-centered, formative work. Larger sample sizes and following individuals through the transition from inpatient to outpatient could also benefit individuals who are alcohol-dependent with sleep disturbances and their varying needs post-discharge. Exploring this issue of improving sleep during treatment and sustaining improved sleep through discharge may have unique implications for relapse prevention. Emergent therapies should be evidence-based with established feasibility and acceptability to patients.

An area for future work to move closer to understanding feasibility and acceptability of sleep interventions may be conducting mixed methods research wherein patient perspectives are sought and explored in-depth. Peer-reviewed, published studies

using mixed methods to examine sleep are few in number, but contribute to our knowledge of disease-or population-specific sleep issues and patient preferences for interventions (Andrews, Coviello, Hurley, Rose, & Redeker, 2013; Barbour & Mead, 2012; Chen, Shiu, Yang, et al., 2013; Davy, Middlemass, & Siriwardena, 2013; Owens, Stahl, Patton, Reddy, & Crouch, 2006; Papp, Stoller, Sage, et al., 2004). Qualitative data provide a deeper understanding of the individual experience. In order to understand complex phenomena such as sleep disturbances and alcohol dependence from treatment into recovery, qualitative research that is naturalistic and subjective in nature combined with deductive quantitative techniques moves beyond traditional approaches and has the potential to increase our knowledge-base (Newman, Ridenour, Newman, & DeMarco, 2003). One study, which utilized qualitative methods, found some evidence that building trust and improving the program functionality can improve adherence to computerized CBT-I (Middlemass, Davy, Cavanagh, et al., 2012).

Patient preference for the use of technology in their treatment and recovery is arguably not well understood. Given the success of varying methods of delivery particularly for CBT-I, these could be particularly useful and relevant for individuals undergoing the transition from inpatient to outpatient status during alcohol rehabilitation, but thorough pilot work is required to assess the efficiency of these technologies and approaches. Future interventions should consider unique challenges associated with the delivery of these behavioral treatments among individuals with alcohol-related problems (social and economic barriers, issues related to access to care, legal implications such as incarceration), which might only be brought to light by in-depth, pilot, mixed method studies.

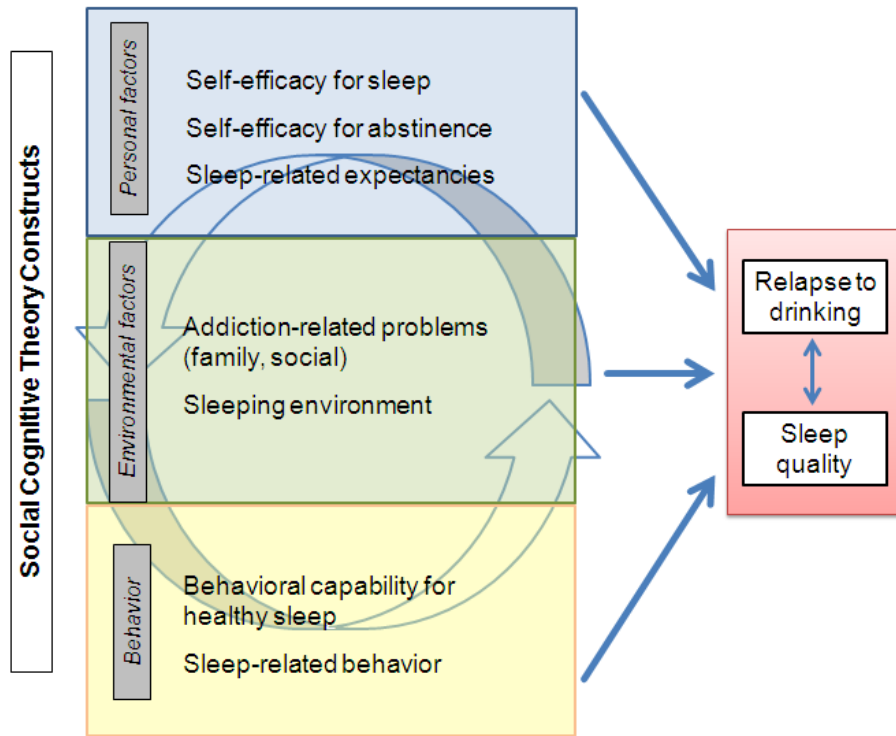
Conclusions and future research. The results of studies discussed in this paper provide the framework for a fundamentally homogenous message: evidence-based non-pharmacological sleep interventions can be effective and largely accepted when tailored appropriately. Despite considerable evidence for CBT-I efficacy with various methods of delivery, very few are specific to those with alcohol-related disorders and even fewer are specific to those with alcohol dependence. The potential importance of mind–body interventions and cognitive-behavioral strategies should not be overlooked among individuals with chronic diseases such as alcoholism given the comorbidities and disease burden that accompany this complex disease. Further studies of behavioral therapies with larger sample sizes and well-designed interventions are necessary, especially to elucidate the potential for these therapies to reduce relapse rates among individuals who are alcohol-dependent. Understanding the individual’s experience with sleep throughout recovery is important to explicate the acceptability of established, effective behavioral interventions that reflect sustainable and individualized care.

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Conceptual model based on the Social Cognitive Theory (SCT)

Given the success of CBT-I demonstrated by recent literature and the unique potential contributions of mixed methods approaches to examine sleep and alcohol use, assessing sleep-related *cognitions* and *behaviors* of individuals who are alcohol-dependent may be important in understanding sleep quality and subsequent relapse. For individuals with sleep problems, self-medicating with alcohol is one possibility, but sleep-related cognitions and behaviors could also play a role. Each broad construct of the Social Cognitive Theory (personal factors, environment, and behavior) was assessed with *both* qualitative and quantitative methods and analyzed concurrently. Associations between constructs were examined (particularly as demonstrated by the concept of reciprocal determinism between the person, the environment, and behavior). As outlined in the SCT (Figure 2.2), personal factors in this study included self-efficacy for sleep, sleep-related expectancies, and self-efficacy for abstinence (using alcohol craving as a proxy). Environmental factors included assessment of addiction-related problems (specifically family and social issues due to alcoholism) and participants' sleeping environments. Behavioral assessments included behavioral capability and assessments of sleep-related behaviors. Sleep quality was assessed with validated measures of sleep disturbance and daytime sleepiness. Relapse was assessed primarily via self-report.

Figure 2.2: *Conceptual model based on constructs from the Social Cognitive Theory*



Aims and hypotheses in full narrative form

Aim 1: To assess individuals' perceptions of and experiences with sleep during alcohol rehabilitation.

Aim 2: To describe sleep patterns, perceptions, and beliefs among alcohol-dependent patients during the transition from an inpatient rehabilitation facility to the community.

Aim 3: To assess whether sleep quality, beliefs, and/or behavior of individuals are associated with sleep quality or relapse.

- Hypothesis 1: Higher self-efficacy for sleep is associated with better sleep quality and lower relapse rates.
- Hypothesis 2: Fewer dysfunctional beliefs about sleep are associated with better sleep quality and lower relapse rates.
- Hypotheses 3: Higher endorsement of sleep-related safety behaviors is associated with poorer sleep quality and higher relapse rates.
- Hypothesis 4: Better sleep quality is associated with lower relapse rates.

CHAPTER 3: Study methods

Description of population to be studied / overview

The NIH Clinical Center is located in Bethesda, Maryland and is the largest research hospital in the nation, with 240 inpatient beds (NIH, 2015). The protocol from which participants were recruited for this study is implemented through the intramural program of the NIAAA within the Clinical Center, wherein individuals who are alcohol-dependent can receive treatment for their alcohol, psychosocial, and other medical problems (clinical trial number NCT0010693: *Assessment and Treatment of People with Alcohol Drinking Problems*). All participants enrolled in this study were first admitted under this parent study, which includes adults over 18 years of age seeking treatment for alcohol dependency. Research participants in this study could not have been court-mandated to receive alcohol treatment; all are admitted completely voluntarily and can leave treatment at any time. Individuals with complicated medical problems requiring intensive medical or diagnostic management are ineligible for participation in studies. All participants receive continued physical evaluations, inpatient treatment of alcohol withdrawal, psychosocial management, and an educational treatment program. Upon being admitted to the inpatient unit, participants are evaluated and recruited for more focused research efforts (including the study described herein). Patients may receive up to six or more weeks of inpatient treatment followed by 16 weeks of optional outpatient treatment for alcoholism, including weekly Alcoholics Anonymous (AA) meetings. Individuals were eligible to participate in this study whether or not they elected to receive outpatient treatment through the NIAAA following discharge, but were required to come back to the Clinical Center approximately four to six weeks post-discharge for a follow-

up visit to complete a semi-structured interview and surveys. If participants were unable to return to the Clinical Center for the follow-up visit, we attempted to complete the interviews and surveys by phone.

Recruitment

Participants were generally recruited to come to the NIH for research and rehabilitation through local media and professional avenues in the Washington, DC metropolitan area. Advertisements were placed in local newspapers for recruitment outreach. Following a telephone recruitment interview, participants came to the National Institute on Alcohol Abuse and Alcoholism (NIAAA) inpatient unit for admission. Following the NIH Addictions Institutional Review Board (IRB) approval, eligible participants admitted to the Clinical Center alcohol rehabilitation unit were approached for participation in the study (NCT #02181569). Recruitment continued until 25 completed cases were obtained. The sample did not constitute a representative group of individuals who are alcohol-dependent; it was limited to those who either lived in the vicinity of the treatment facility or provided their own travel from out-of-area and were willing to become inpatients at the NIH Clinical Center.

Screening and consent

Impaired consent was obtained prior to the completion of screening procedures in case of alcohol intoxication upon arrival, per the parent protocol. Then, treatment for alcohol withdrawal and other acute illnesses was provided. When a licensed independent practitioner (physician or nurse practitioner) and the nursing staff deemed appropriate, the participant signed an unimpaired consent form (usually on or around the fourth day of treatment). No patients who were simultaneously enrolled on studies investigating

pharmacologic interventions were eligible for this study. If participants relapsed within four to six weeks of being discharged from the hospital, they were still eligible to participate in this study.

Inclusion and exclusion criteria

Participants were eligible for this study if they were 1) 18 years of age or older, 2) enrolled on the screening, assessment and treatment protocol, 3) had been an inpatient for 21 days or more preceding discharge (to ensure that enough time had passed between administration of the measures), 4) not simultaneously enrolled onto a pharmacologic intervention study, 5) able to understand the study, and 6) willing to return to the Clinical Center four to six weeks after being discharged from inpatient treatment for a follow-up visit. Participants were ineligible for this study if they were 1) less than 18 years of age, 2) unable to understand the purpose of the study, 3) unable to provide informed consent, 4) unable to follow the study design, or 5) unable or unwilling to return to the Clinical Center four to six weeks after being discharged from inpatient treatment for a follow-up visit or complete the interview and questionnaires via phone.

Validity and reliability of measures

Sleep-related measures.

Pittsburgh Sleep Quality Index (PSQI). The Pittsburgh Sleep Quality Index (PSQI) is a 19-item, self-rated questionnaire used to measure sleep quality and disturbances over a one-month (30 days) time interval. Examples of these items include "During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes?" with four response options ranging from "not during the past month" to "three or more times a week." Nineteen individual items generate seven

“component” scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. For the purposes of this dissertation, only global scores were considered. A global summation score of five or higher is indicative of poor sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI has been validated in populations with insomnia and other sleep disorders, with psychiatric patients, and in normal populations (Backhaus, Junghanns, Brooks, Riemann, & Hohagen, 2002; Doi, Minowa, Uchiyama). There exists some early evidence of validity in alcohol-dependent populations (Brooks, Krumlauf, Whiting, Clark, & Wallen, 2012; Wallen, Brooks, Whiting, et al., 2014). The PSQI has internal consistency and a reliability coefficient ranging from 0.80 to 0.83 for its seven components (Buysee, Reynolds, Monk, Berman, & Kupfer, 1989; Carpenter & Andrykowski, 1998). It takes approximately five minutes to complete.

Epworth Sleepiness Scale (ESS). The Epworth Sleepiness Scale (ESS) is an eight-item self-administered questionnaire that provides a measure of an individual’s general level of excessive daytime sleepiness over a one week time period (Johns, 1991). Individuals are asked to rate their usual chances of dozing off or falling asleep on a four-point scale in eight distinct situations or activities that most people engage in during their daily lives (e.g. “lying down to rest in the afternoon when circumstances permit”). Higher scores are indicative of higher levels of daytime sleepiness. An alpha coefficient between 0.70 and 0.88 has been documented and numerous studies support high validity and reliability (Johns, 1992; Spira, Beaudreau, Stone, et al., 2012). A score higher than ten is indicative of “excessive” daytime sleepiness (Johns, 1993). Completing the ESS generally takes two to three minutes.

Dysfunctional Beliefs and Attitudes about Sleep (brief version; DBAS-16). The DBAS-16 is a 16-item questionnaire that assesses sleep-related cognitions including faulty beliefs and appraisals, unrealistic expectations, and perceptual and attention bias. The DBAS-16 has adequate internal consistency (Cronbach alpha = 0.77 for clinical and 0.79 for research samples) and temporal stability ($r = 0.83$). Factor structure is similar to the original 30-item version of the questionnaire and includes perceived consequences of insomnia, worry/helplessness about insomnia, sleep expectations, and medication. Participants are asked to indicate the extent to which they agree or disagree with statements such as “when I sleep poorly on one night, I know it will disturb my sleep schedule for the whole week.” Domains include expectations about sleep requirements and issues with being worried or feeling helpless about insomnia (Morin, Vallieres, & Ivers, 2007). The scoring of the DBAS-16 is the average score of all items.

Self-Efficacy for Sleep Scale (SE-S). The SE-S includes nine items used to measure the level of confidence a person has in performing behaviors that might be helpful in initiating sleep. Each item is scored on a five-point Likert scale from 1 representing “not confident” to 5 representing “very confident.” Items include statements such as “lying in bed with your thoughts ‘turned off’” and “feel refreshed upon waking in the morning.” The total score ranges from nine to 45, with higher scores indicative of greater confidence. Concurrent validity of the scale has been established by comparison with PSQI, sleep diaries, and objective measures of sleep (Edinger, Wohlgemuth, Radtke, Coffman, & Carney, 2007). The scale has excellent internal reliability (Cronbach's alpha of 0.71-0.86; Edinger, Wohlgemuth, Radtke, Coffman, & Carney, 2007; Rutledge, La

Guardia, & Bluestein, 2013). Test-retest reliability has also been established (Fichten, Libman, Creti, Amsel, Sabourin, Brender, & Bailes, 2001).

Sleep-Related Behaviours Questionnaire (SRBQ). The SRBQ assesses the use of safety behaviors that individuals may use to promote sleep and cope with tiredness. It is a 32-item scale with a possible score range of 0 to 128. Each item is scored on a five-point Likert scale ranging from 0 (almost never) to 4 (almost always). Items include safety behaviors such as “I figure out how I will catch up on my sleep later on,” “I work less hard to conserve energy,” and “I avoid sleeping away from home.” Higher scores are indicative of more “problematic” use of safety behaviors. The scale has discriminated between normal sleepers and those with insomnia in previous research and correlates with the PSQI ($r = 0.78, p < .01$). Each item on the questionnaire also positively correlates with the Insomnia Severity Index (ISI), indicating that implementation of the techniques in the scale are associated with insomnia severity (Ree & Harvey, 2004).

Validity of self-reported sleep data. Based on a preliminary analysis of inpatient data from 2012, patients' self-reported sleep efficiency converged significantly with actigraphy-recorded (objective) sleep efficiency, but patients slightly overestimated their sleep duration (Brooks, Krumlauf, Whiting, Clark, & Wallen, 2012). In a later study analyzing a larger sample ($n=164$), self-reported sleep duration was about 4.5 minutes longer than actigraphy-recorded sleep duration (Wallen, Brooks, Whiting, et al., 2014). Despite statistical significance, this difference is likely not clinically significant.

Alcohol-related measures.

Addiction Severity Index (ASI). The ASI is an instrument used extensively in the Addiction Medicine field to comprehensively identify problems in multiple dimensions

including medical, employment, drug and alcohol use, legal, family, social and psychiatric. It is a 200-item interview that takes approximately 60 minutes to complete. Average concordance for severity of treatment problems has been estimated at 0.89 and concurrent and discriminant validity has been demonstrated (McLellan, Luborsky, Cacciola, Griffith, Evans, Barr, & O'Brien, 1985). To gauge an individual's environment, we specifically examined the family/social sub-component of the scale, which ranges from 0 to 8 and indicates severity of problems in those particular domains. Scoring of the family/social sections includes detailed assessments of living arrangements, marital status, number of close relationships, problems getting along with friends and family, and abusive relationships.

Penn Alcohol Craving Scale (PACS). The PACS is a clinical tool for practitioners to measure alcohol cravings. It is a five-item self-administered instrument that measures frequency, intensity, and duration of thoughts about drinking along with ability to resist drinking (i.e the perceived difficulty of not drinking alcohol if it were immediately available for consumption). The final item asks the responder to provide an average rating of his or her craving over the course of the past week. The PACS has excellent internal consistency (Cronbach's $\alpha = 0.92$). Construct, predictive, and discriminant validity has been established. This assessment takes between two and five minutes to complete (Flannery, Volpicelli, & Pettinati, 1999).

Subjective measure of alcohol relapse: Timeline Follow-Back (TLFB). The TLFB collects drinking information using personal historical events recounted over a fixed time period (Sobell & Sobell, 1992). It is a standard assessment for measuring alcohol drinking patterns and quantification in treatment programs. The number of items

corresponds to the number of days of interest, typically 90, which usually takes about 30 minutes to complete. For this study, we used data from the 4-6 week time period following discharge from the inpatient rehabilitation facility. The TLFB has demonstrated high test-retest reliability across multiple populations of drinkers. Content, criterion, and construct validity have been demonstrated in both clinical and general population samples (Sobell & Sobell, 2000). It is extensively used in research and practice (Connors & Maisto, 2003; Del Boca & Darkers, 2003). Relapse was examined as *any* level of self-reported drinking since discharge.

Objective measures of alcohol relapse. Blood tests were conducted on a subsample of participants to explore correlations between several biomarkers and self-reported drinking data as a secondary analysis (refer to Appendix I for correspondence with the NIH Addictions IRB regarding the use of a blood draw solely for this study). Currently, there is no clear standard set of blood and body fluid tests that clearly indicate relapse to alcohol use. However, guidelines are emerging (Litten & Fertig, 2003) and include a hepatic blood panel which tests for liver damage, Gammaglutamyl-transpeptidase (GGT) which detects alcohol-induced liver disease and is indicative of heavy drinking, and carbohydrate-deficient transferrin (CDT) which is a biomarker for heavy alcohol consumption. Participants were asked to provide a blood sample at the follow-up visit as part of the treatment (parent) protocol, approximately four to six weeks post-discharge. These biomarkers were available to our analyses only if participants were returning as part of the screening protocol for an outpatient visit between four and six weeks following discharge and already providing a blood sample. For those subjects who did not have blood drawn as part of the screening protocol (including those who did not

physically return to the Clinical Center and instead completed the second interview and questionnaires via phone), we did not obtain blood samples.

While biomarkers are generally less sensitive than well-standardized and properly administered self-report measures, they provide a unique source of information on drinking status and are often used as “corroborators” to self-reported measures (Allen & Litten, 2003). Participants who returned for the outpatient follow-up visit four to six weeks after discharge were also asked to provide a breath sample to assess *current* level of intoxication via Breath Alcohol Content (BAC).

Mental health / diagnostic measures.

Childhood Trauma Questionnaire (CTQ). The CTQ questionnaire assesses adverse experiences, including stressful experiences like physical and emotional abuse, neglect, or other trauma experienced in childhood. It is a 28-item questionnaire that takes five to ten minutes to complete. Experiences represented on the questionnaire include being called names by family, feeling hated by family, or the presence of emotional/physical abuse. Factor analysis supports the use of the CTQ as a screening instrument for maltreatment in clinical groups. The scale demonstrates good evidence of criterion-related validity (Bernstein, Stein, Newcomb, et al., 2003).

Comprehensive Psychopathological Rating Scale (CPRS). The CPRS-S-A consists of 19 self-assessed variables that correspond to CPRS-based subscales for affective and anxiety syndromes (Åsberg, Montgomery, Perris, Schalling, & Sedvall, 1978). These subscales are the Montgomery Åsberg Depression Rating Scale (MADRS; Montgomery & Åsberg, 1979) and the Brief Scale for Anxiety (BSA; Tyrer, Owen, &

Cicchetti, 1984). This self-report measure takes 5-10 minutes to complete. Refer to Table 3.1 for an overview of study measures.

Table 3.1: *Overview of study measures at-a-glance*

<p>Pittsburgh Sleep Quality Index (PSQI)</p>	<ul style="list-style-type: none"> • 19-item, self-rated questionnaire used to measure sleep quality and disturbances over a one-month (30 days) time interval • Nineteen individual items generate seven “component” scores • Score of 5 or higher is indicative of poor sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) • Validated in populations with insomnia, other sleep disorders, psychiatric patients, and normal populations (Backhaus, Junghanns, Broocks, Riemann & Hohagen, 2002; Doi, Minowa, Uchiyama, et al., 2000)
<p>Epworth Sleepiness Scale (ESS)</p>	<ul style="list-style-type: none"> • 8-item questionnaire that provides a measure of an individual’s general level of excessive daytime sleepiness over a one week time period (Johns, 1991) • Individuals are asked to rate their usual chances of dozing off or falling asleep on a four-point scale in eight distinct situations or activities that most people engage in during their daily lives • A score higher than ten is indicative of <i>excessive</i> daytime sleepiness (Johns, 1993) • Numerous studies support high validity and reliability (Johns, 1992; Spira, Beaudreau, Stone, et al., 2012)
<p>Dysfunctional Beliefs and Attitudes about Sleep (brief version: DBAS-16)</p>	<ul style="list-style-type: none"> • 16-item questionnaire assessing sleep-related cognitions including faulty beliefs and appraisals, unrealistic expectations, and perceptual and attention bias • Includes perceived consequences of insomnia, worry/helplessness about insomnia, sleep expectations, and medication (Morin, Vallieres, & Ivers, 2007)
<p>Self-efficacy for Sleep Scale (SE-S)</p>	<ul style="list-style-type: none"> • 9-item questionnaire measuring confidence a person has in performing behaviors that might be helpful in initiating sleep • Higher scores are indicative of greater confidence • Concurrent validity (Edinger, Wohlgemuth, Radtke, Coffman, & Carney, 2007), internal reliability (Edinger, Wohlgemuth, Radtke, Coffman, & Carney, 2007; Rutledge, La Guardia, & Bluestein, 2013), and test-retest reliability (Fichten, Libman, Creti, et al., 2001) has been established

Sleep-Related Behaviours Questionnaire (SRBQ)	<ul style="list-style-type: none"> • 32-item scale assessing the use of safety behaviors that individuals may use to promote sleep and cope with tiredness • Implementation of the techniques in the scale are associated with insomnia severity (Ree & Harvey, 2004)
Addiction Severity Index (ASI)	<ul style="list-style-type: none"> • Instrument used to comprehensively identify problems in multiple dimensions including medical, employment, drug and alcohol use, legal, family, social and psychiatric (McLellan, Lester, John, et al., 1985) • 200-item interview that takes approximately 60 minutes to complete • We specifically examined the family and social sub-component of the scale, which indicates severity of problems in that domain • Scoring of the family/social section includes detailed assessments of living arrangements, marital status, number of close relationships, problems getting along with friends and family, and abusive relationships
Penn Alcohol Craving Scale (PACS)	<ul style="list-style-type: none"> • Clinical tool for practitioners to measure alcohol cravings • 5-item questionnaire that measures frequency, intensity, and duration of thoughts about drinking along with ability to resist drinking • Excellent internal consistency; construct, predictive, and discriminant validity has been established (Flannery, Volpicelli, & Pettinati, 1999)
Timeline Follow-Back (TLFB)	<ul style="list-style-type: none"> • Collects drinking information using personal historical events recounted over a fixed time period (Sobell & Sobell, 1992) • Standard assessment for measuring alcohol drinking patterns and quantification in treatment programs • Demonstrated high test-retest reliability across multiple populations of drinkers; content, criterion, and construct validity have been demonstrated in both clinical and general population samples (Sobell & Sobell, 2000) • Relapse will be examined first as <i>any</i> level of self-reported drinking and also as a categorical quantification of <i>level</i> of drinking based on the distribution of the data
Childhood Trauma Questionnaire (CTQ)	<ul style="list-style-type: none"> • 28-item scale assessing adverse experiences, including stressful experiences like physical and emotional abuse, neglect or other trauma experienced in childhood • Factor analysis supports the use of the CTQ as a screening instrument for maltreatment in clinical groups; demonstrates good evidence of criterion-related validity (Bernstein, Stein, Newcomb, et al., 2003)
Comprehensive	<ul style="list-style-type: none"> • 19 self-assessed variables that correspond to subscales for

Psychopathological Rating Scale (CPRS)	<p>affective and anxiety syndromes (Åsberg, Montgomery, Perris, Schalling, & Sedvall, 1978)</p> <ul style="list-style-type: none"> • Subscales include the Montgomery Åsberg Depression Rating Scale (MADRS) (Montgomery & Åsberg, 1979) and the Brief Scale for Anxiety (BSA; Tyrer, Owen, & Cicchetti, 1984)
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Table 3.2 outlines how each quantitative measure aligns with constructs from the conceptual model or are general assessments of sleep quality and relapse. With the exception of the semi-structured interviews and the SE-S, DBAS-16, and SRBQ, all proposed measures were either a) currently being collected as part of the existing parent protocol or b) had been pilot-tested in the population as part of a pilot study which examined the prevalence of sleep disturbances among inpatients on the unit between 2011 and 2013. As previously mentioned, the purpose of the sleep assessments including the PSQI and ESS was not to clinically diagnose someone with insomnia but to establish subjective sleep quality and determine the extent to which sleep disturbances exist.

Table 3.2: *Quantitative measures and conceptual model based on the Social Cognitive Theory*

Social Cognitive Theory Constructs	<i>Personal factors</i>	Self-efficacy for sleep	Self-efficacy for sleep scale (SE-S)
		Sleep-related outcome expectancies	Dysfunctional Beliefs About Sleep Scale (DBAS-16)
		Self-efficacy for abstinence	Penn Alcohol Craving Scale (PACS)
	<i>Environmental factors</i>	Addiction-related problems	Addiction Severity Index (ASI; family/social sub-component)
<i>Behavior</i>	Behavioral capability	Sleep-related behavior questionnaire (SRBQ)	
Sleep and alcohol-related measures		Sleep quality	Pittsburgh Sleep Quality Index (PSQI)
			Epworth Sleepiness Scale (ESS)
		Relapse to drinking	Timeline Follow-Back (TLFB)
			Physiological measures*
*BAC (blood alcohol content), hepatic panel, GGT (gamma-glutamyl transpeptidase), and CDT (carbohydrate-deficient transferrin), collected on a subset of patients (n=12; refer to Appendix H).			

Qualitative component. Sleep and sleep hygiene behaviors are unique and individualized aspects of health. Currently, we do not have a clear understanding of sleep trajectories for individuals who are alcohol-dependent in recovery and how sleep behaviors may affect relapse, but it is well established that insomnia and other sleep disturbances can increase risk of relapse among individuals who are alcohol-dependent (Brower, 2011; Drummond, Gillian, Smith, & DeModena, 1998; Roth, 2009). The qualitative component of this study allowed us to explore this pattern in-depth. The qualitative phase of this dissertation consisted of individual semi-structured interviews. The interviews were conducted within one week of participants’ scheduled discharge date and again four to six weeks post-discharge when they returned for a follow-up visit.

Questions were focused on sleep patterns prior to becoming an inpatient, during the inpatient stay, and in anticipation of becoming an outpatient. A secondary goal of the qualitative phase was to inform the development of a future sleep hygiene intervention.

Interviews contained three types of questions: main questions that initiated or guided the conversation, probes that clarified answers or requested further examples, and follow-up questions that pursued implications of answers to the main questions. Probes were utilized to guide the interviews and were either *standard probes* (asked of everyone) or *individually-developed probes* (spontaneous and unique to the individual; Willis, 1994). Participants were asked to "think out loud," which allowed for freedom from interviewer-imposed bias, provided an open format, and permitted "unanticipated" responses which contributed to the depth of the knowledge gained (Willis, 1994).

Interviews were phenomenological in nature: questions were designed to investigate the *lived experience* of individuals. Interview questions were reviewed by clinicians on the inpatient and outpatient units who have extensive expertise and experience working with individuals who are alcohol-dependent. Additionally, an intramural NIH researcher with expertise in qualitative question development reviewed the questions and worked with the student researcher to iteratively revise the questions to the final version that has been appended to this dissertation. Finally, the interview questions were pilot-tested with clinicians who interact directly with study participants on a daily basis. Refer to Appendix G for a copy of the interview scripts (including all planned standard probes). A second interviewer was present on all interviews and introduced to the participants with an explanation that he or she would observe, take notes, and probe additional questions

based on the participant's responses. This strategy was employed to decrease potential bias of only having one interviewer.

Interviews were audio recorded (with the interviewee's consent) and lasted between 10 and 30 minutes, depending on the participant's responses. The semi-structured interview format utilized a lucid structure, which allowed each participant to complete the interview at his or her own pace and delve deeper into subjects he or she felt were most important. Interviews were conducted prior to participants filling out the quantitative measures in order to optimize cognitive focus. Refer to Table 3.3 for sample interview prompts and how they fit in to the overarching conceptual model based on the SCT, and Appendix G for a list of the questions asked at each time point in order.

Table 3.3: *Sample interview prompts related to SCT constructs*

Environment	
	<i>Describe the process of how you adjusted to being an inpatient in the Clinical Center.</i>
	<i>Describe how it has been to adjust to sleeping in this hospital. What about it is the same or different from your home environment? (Probe: What barriers or facilitators to recovery do you expect?)</i>
	<i>It's been about a month since you left the Clinical Center. Talk me through what the transition has been like as you returned to your home environment. (Probe: Describe any barriers or facilitators to recovery you have experienced.)</i>
	<i>Compared to what it was like in the hospital, what has your sleep been like since leaving the NIH?</i>
Behavior	
	<i>Describe the process of how you adjusted to being an inpatient in the Clinical Center.</i>
Behavioral capability	<i>Describe what you will do if you have trouble sleeping when you get home.</i>
Personal (cognitive)	
	<i>When you feel like you have had a really "good night's sleep," what does that generally mean to you? Describe this in as much detail as you can.</i>
Self-efficacy	<i>Describe what you will do if you have trouble sleeping when you</i>

	<i>get home.</i>
Expectations	<i>Describe in as much detail as you can any expectations you have about transitioning back into your home environment. (Probe: What barriers or facilitators to recovery do you expect?)</i>
Expectations	<i>How do you think alcohol affects sleep?</i>

Study timeline overview

Refer to Table 3.4 for an overview of the study timeline. Certain measures already collected as part of the parent protocol during the inpatient phase were used to characterize patients who participated in this study. Within one week of patients' scheduled discharge date, a study team member approached patients to begin the first segment of data collection for the study. Participants were asked to complete subjective measures regarding daytime sleepiness, self-efficacy for sleep, and sleep-related beliefs and behaviors at that time in addition to a semi-structured face-to-face interview. Four to six weeks following discharge, participants returned to the Clinical Center to complete sleep measures similar to those administered when they were inpatients, as well as another semi-structured interview in the outpatient clinic. Alternatively, patients completed the second interview and questionnaires by phone.

Table 3.4: *Study timeline*

		Inpatient			Outpatient (follow-up)
		Baseline (Day 2)	Other	Within 7 days of discharge	(4-6 weeks following discharge)
Sleep measures	PSQI	x		x (day 28)*	x
	ESS			x	x
	DBAS-16			x	x
	SE-S			x	x
	SRBQ			x	x
Alcohol measures	ASI		Day 8		
	PACS				x
	Objective measures				x
	TLFB		Day 13		x
Other	CTQ	x			
	CPRS		Day 16		
	Demographics (gender, age, race, ethnicity)	x			
	Semi-structured interview			x	x

*The second PSQI will be administered on day 28, unless the patient is discharged prior to day 28 in which case the PSQI will be administered within one week of discharge. In order to be eligible for participation in this component of the study, patients must be inpatients for a minimum of 21 days. If a patient stays longer than five weeks, the PSQI will be repeated closer to discharge (instead of on day 28).

Data collection

The student researcher conducted all but one of the qualitative interviews and oversaw the completion of survey data, including being available to answer participants' questions. The interviews and surveys were conducted in private interview rooms for participant privacy. To minimize participant burden, short forms of scales were utilized where available and participants were able to take breaks. Once discharged, participants received up to three reminder phone calls before their follow-up return visit. Participants were asked to return to the Clinical Center between four and six weeks after they were discharged.

Analysis

The conceptual model based on the SCT outlined in Chapter 2 guided the analyses for this study. Quantitative and qualitative results were triangulated upon presentation.

Qualitative data analysis approach. Each audio-recorded interview was transcribed. An internal reliability check was performed on each transcript; a member of the research team listened to the audio files to make sure they were transcribed verbatim. As a preliminary step in the data analysis, the student researcher developed a codebook, or dictionary of concepts, based on the SCT. For example, some codes based on the theory included dysfunctional beliefs about sleep, information on the physical sleeping environment, and/or sleep-related behaviors and cognitions. Evidence of each code or theme was assessed using quotes from the interviews. Additional codes were added to the coding dictionary based upon a review of the interview transcripts. Each code was accompanied by an operational definition that allowed for clarity and consistency in the coding process. Once agreement on the codes and definitions was reached, a team of coders independently reviewed a subset of transcripts. NVivo (version 10.0) was utilized for further qualitative analysis. Using NVivo 10.0, inter-rater reliability percentages were calculated. Kappa coefficients, which take into account any agreement occurring by chance and are therefore a more conservative measure of agreement, were calculated as an indicator of inter-rater reliability. Kappa scores range between zero and one depending on the level of agreement or disagreement. The goal was to achieve an initial Kappa value of 0.80, although guidance from NVivo software suggests that 0.40 to 0.75 is “fair to good agreement” based on the algorithm used for calculation (

nv10.qsrinternational.com/desktop/procedures/run_a_coding_comparison_query.htm).

Low Kappa scores occur in NVivo specifically due to differences in the unit of measurement (text character length). Discordant coding was discussed until consensus between the student researcher and the second coder was achieved.

To ensure that the trustworthiness of qualitative data is preserved, three criteria assessing rigor were considered: creditability, auditability, and fittingness of the data (Table 3.5). Creditability refers to truth of the findings, often assessed by others in the discipline (Barroso, 2010). All themes were validated with a member of the clinical care team and an intramural mixed methods expert. Auditability refers to the “adequacy of the information leading the reader from the research question and raw data through various steps of analysis to the interpretation of findings” (Barroso, 2010, p. 119). Examples of data were presented alongside each theme in publications to illustrate how data led to each theme being identified (Streubert, 2010). Lastly, fittingness refers to the “faithfulness to everyday reality of participants” (Barroso, 2010, p. 119). Interviewing ample participants at two time points, until saturation was reached, provided a wealth of data from which to draw inferences to maximize the likelihood of the data's utility for informing practice (Streubert, 2010).

Table 3.5: *Criteria for judging scientific rigor in qualitative research*

Criteria	Criteria characteristics	Example methods for this study
Credibility	<ul style="list-style-type: none"> • Truth of findings (can be judged by others within the discipline) • E.g.: Share interpretation of findings and query accuracy from those living the experience 	Validation of themes by a member of the clinical care team and mixed methods expert who was present during a majority of the interviews
Auditability	<ul style="list-style-type: none"> • Adequacy of information leading the researcher from the research question / raw data through analysis and interpretation of findings • E.g.: Others being able to follow the reasoning of the researcher step-by-step through explicit examples of data 	Presenting examples of data alongside their corresponding themes; detailed description of the iterative process of coding and multiple coders coming to consensus (how many coders, initial percentage of inter-rater agreement, etc)
Fittingness	<ul style="list-style-type: none"> • Faithfulness to everyday reality of the participants (described in enough detail so that others can evaluate importance for their own research and practice) • E.g.: Human experience being reported is transparent and others can decide whether it has utility for guiding their practice 	Conducted adequate number of interviews to reach saturation, allowing for inferences to be drawn with implications for research and / or practice

Quoted and adapted from Barroso, J. (2010). Qualitative approaches to research. In G. LoBiondo-Wood and Haber, J. (Eds). *Nursing Research: Methods and Critical Appraisal for Evidence-Based Practice*. Elsevier: St. Louis, MO, USA.

Once the iterative process of consensus building was complete, a representative from the clinical team and an NIH intramural qualitative expert validated the themes and coding. Data were analyzed as it was made available. Average interview time and a thorough description of the interview setting were reported. Selected quotes which were illustrative of each designated theme were displayed in tables to highlight pertinent findings. “Quantifying” the qualitative data (e.g. tallying the number of times a theme was mentioned overall) supplemented the qualitative data but was not meant to take away from the richness of individuals’ verbatim experiences. Careful consideration was given to variation in themes between the two time points and implications for outcomes. For

instance, participants might have reported higher levels of self-efficacy for sleep prior to being discharged from the inpatient facility and lower levels once returning to their home environment. Qualitative responses were carefully reviewed for any differences in environment which could have been contributing to this type of change.

Quantitative data analysis approach. Statistical analyses of quantitative results were conducted with the Statistical Package for Social Sciences (SPSS) software, version 22.0. All quantitative data were double-data entered, cross-checked, and reconciled where necessary. The first step in quantitative data analysis was running baseline "diagnostics" to check for outliers and normal distribution of all continuous variables. Appropriate parametric or non-parametric tests were utilized based on the sample size and distribution of the data. For quantitative analyses, statistical significance was considered at $p < 0.05$. In a study with similar predictors with relapse as a dichotomous outcome (yes/no), the effect size was 0.203 (pseudo R-square - Nagelkerke's method; Smith, Hill, Marshall, Kearney, & Wanigaratne, 2013). Assuming a similar effect size of 0.2 utilizing a linear regression analysis (outcome: sleep quality) with alpha level set at 0.05, the sample size of 25 provided a power level of 0.18. For the logistic regression analysis (outcome: relapse vs. no relapse), a sample size of 25 and alpha level of 0.05 provided a power level of 0.13 (Buchner, Erdfelder, Faul, & Lang, 2009). Given these relatively low power levels, the quantitative analyses were strictly exploratory in nature and were meant to be hypothesis-generating in addition to complementing qualitative findings.

Descriptive data are summarized in the text and reported in tables, including frequencies for categorical variables as well as range, mean, and standard deviation for continuous variables. The ASI, PACS, CTQ, CPRS, and basic demographics (including

age, gender, race, and ethnicity) were used to characterize the sample. Patterns of missing data were examined thoroughly to assess whether any questions were systematically skipped by all participants or any sub-group of participants. Since no more than 5% of the quantitative data were missing at random, no imputation was employed.

Initial analyses were descriptive and exploratory in nature to assess the prevalence of sleep disturbances pre- and post-discharge. Due to a relatively small sample size, predictive regression models only included 1-2 covariates (those which were significantly associated with dependent variables of interest: sleep quality as measured by the PSQI). Table 3.6 outlines the potential predictor variables and dependent variables which were considered based on results of correlational analyses, and represents potential predictor and dependent variables to include for future analyses. Since the regression analyses were not included in papers 2 and 3 (chapters 4 and 5), the results and a brief summary are outlined in Appendix H.

Table 3.6: *Exploratory regression analyses*

Predictor variables	Dependent variables & corresponding type of regression model
<ul style="list-style-type: none"> • SE-S (Continuous) • PACS (Continuous) • ASI (Family/social subcomponent, continuous) • SRBQ (Continuous) • Age (Continuous) • Gender (Dichotomous) • Race (Categorical) • Ethnicity (Categorical) 	<ul style="list-style-type: none"> • Sleep quality (PSQI & ESS; both continuous) -- Linear regression (maximum of two predictors) • Relapse (TLFB; dichotomous) -- Logistic regression (maximum of two predictors)

Use of mixed methods

As previously described, the format for the use of mixed methods was a *convergent parallel design*, wherein both quantitative and qualitative data were collected simultaneously and each method of study was given equal priority (Creswell & Plano Clark, 2011). The concept of reciprocal determinism was assessed through correlations between personal, environmental, and behavioral quantitative assessments as well as qualitative responses associated with each construct. Finally, each construct of the SCT was triangulated with relevant qualitative responses. For example, participants' averages on the SRBQ were analyzed as well as themes from qualitative interviews which discussed sleep-related behaviors.

The purpose of this study was to examine three key aims: **Aim 1** - To assess individuals' perceptions of and experiences with sleep during alcohol rehabilitation; and **Aim 2** - To describe sleep patterns, perceptions, and beliefs among individuals who are alcohol-dependent over the transition from an inpatient rehabilitation facility back to the community. Aims 1 and 2 were assessed through concurrent triangulation of quantitative and qualitative data results. As described by Creswell and colleagues (2011), merging data, or presenting results simultaneously was the approach that was chosen to present findings. More specifically, qualitative responses which reflect sleep quality, perceptions, experiences, and beliefs were combined with quantitative measures of sleep quality (the PSQI and ESS) over time. For example, one way to combine methods is to report first the quantitative statistical results and then show qualitative quotes or themes which may support, refute, or help to explain the quantitative results. This method allows the merging of quantitative and qualitative results together, after analysis and during interpretation (Bishop & Holmes, 2013). The data is “merged” both in the presentation of

findings and in the discussion of results. Examples of what this mixed approach provides that either type of data by itself is unable to provide are discussed in conclusions. "By combining and increasing the number of *research strategies* used within a particular project, we are able to broaden the dimensions and hence the scope of our project. By using more than one *method* within a research program, we are able to obtain a more complete picture of human behavior and experience" (Morse, 2003, p. 189). Collecting both types of data concurrently and comparing emerging themes from qualitative data with quantitative analyses allowed for a more thorough understanding of the relationships between SCT constructs, sleep quality, and relapse. These findings can be used to guide future individualized CBT-I interventions in the population.

Aim 3: To assess whether sleep quality, beliefs, and/or behavior of individuals are associated with sleep quality or relapse. To examine Aim 3, the following hypotheses were formulated concerning sleep quality and relapse potential:

Hypothesis 1 - Higher self-efficacy for sleep is associated with better sleep quality and lower relapse rates. Correlations between the Self-Efficacy for Sleep Scale (SE-S) and the PSQI and ESS were assessed. Independent samples t-tests were used to assess differences in SE-S scores at baseline and follow-up between those who relapsed and those who did not relapse. Qualitative responses related to self-efficacy for sleep were compared between those with and without sleep disturbances (as measured by the PSQI and ESS) as well as those who relapsed and those who did not relapse.

Hypothesis 2 - Fewer dysfunctional beliefs about sleep are associated with better sleep quality and lower relapse rates: Correlations between the Dysfunctional Beliefs about Sleep Scale (DBAS-16) and the PSQI and ESS were assessed. Independent

samples t-tests were used to assess differences in DBAS-16 scores at baseline and follow-up between those who relapsed and those who did not relapse. Qualitative responses related to beliefs about sleep were compared between those with and without sleep disturbances (as measured by the PSQI and ESS) as well as those who relapsed and those who did not relapse.

Hypotheses 3 - Higher endorsement of sleep-related safety behaviors is associated with poorer sleep quality and higher relapse rates: Correlations between the Sleep-Related Behaviours Questionnaire (SRBQ) and the PSQI and ESS were assessed. Independent samples t-tests were used to assess differences in SRBQ scores at baseline and follow-up between those who relapsed and those who did not relapse. Qualitative responses related to sleep behaviors were compared between those with and without sleep disturbances (as measured by the PSQI and ESS) as well as those who relapsed and those who did not relapse.

Hypothesis 4 - Better sleep quality is associated with lower relapse rates: Independent samples t-tests were used to assess differences in PSQI and ESS scores at baseline and follow-up between those who relapsed and those who did not relapse. Qualitative responses related to general sleep quality were compared between those who relapsed and those who did not relapse.

Project timeline

As outlined in Figure 3.1, the dissertation proposal was successfully defended on January 31st, 2014. Revisions to the proposal were made in February and March of 2014 and the final intramural protocol was submitted to the NIH Addictions IRB in March of 2014. After one round of revisions, it was approved on May 29th, 2014. The University of

Human subject procedures

Storage of data and samples. Fully identifiable subject data were stored in three locations: a) the NIH Clinical Center CRIS (Clinical Research Information System), where clinical patient data are routinely stored and adequate privacy protections are implemented by design, b) on access-controlled NIH Clinical Center servers, located in secured space to prevent physical theft of storage, and c) for hard copies of surveys, in locked filing cabinets in a locked office. We utilized electronic backups and controlled (password-protected) access to files to ensure confidentiality of the data. Participants completed surveys and interviews behind closed doors for privacy. Data were de-identified where possible through the use of non-identifiable codes. Any personally-identifiable information that participants mentioned during the interview (names, hometowns, specific jobs, etc) was removed from transcripts and excluded from all data sets and any publications. The key to the code was kept securely and separate from data and samples. Subject information was maintained in secured databases and computers were stored in locked files within a locked office. Paper records were maintained in locked file cabinets within a locked office. Access to data was limited to authorized study personnel.

Compensation. Guidelines for payment of research participants were based on suggestions of the NIH Clinical Center (Dominguez, Jawara, Martino, Sinaii, & Grady, 2012). All payment amounts and scheduling were approved by the NIH Addictions IRB prior to the start of the study. "Inconvenience units" are determined by the fiscal structure of the protocol and the discomfort level of procedures and are generally assigned \$10 each. On average, structured clinical interviews are assigned 1.47, and "history and

physical" are assigned 2.02. Payment for a one-hour questionnaire has historically been \$30 on average (based on NIH data; Dominguez, Jawara, Martina, Sinaii, & Grady, 2012).

Payments were made in the form of a check or direct deposit at the end of the study (after the follow-up outpatient visit) through the NIH Clinical Center Research Volunteer System. Participants were paid for the portions of the study they completed (Table 3.7).

Table 3.7: *Participant compensation rates*

Tasks completed	Procedures	Payment
Inpatient	Qualitative interview and survey measures	\$30
Outpatient (4-6 post-discharge visit)	Qualitative interview and survey measures (\$30)	\$30
Total possible payment		\$60

Study and procedures were approved and monitored by the NIH Addictions Institutional Review Board (IRB) and the University of Maryland via an Authorization Agreement. All research team members affiliated with the University of Maryland completed the Collaborative IRB Training Initiative (CITI) training online, which is designed to address concerns surrounding human subject research protections. Investigators authorized to obtain informed consent also completed training coordinated by the National Institute of Mental Health (NIMH). Individuals were eligible to participate in the study if they are over 18 years of age and alcohol-dependent. The lead associate investigator (student researcher), principal investigator (PI), or another associate investigator approved by the IRB to obtain consent explained study objectives, time commitment, expectations, and processes for assessments to each eligible participant. Samples and data were stored using researcher-generated ID numbers, similar

to how data were collected during the preliminary phase establishing the prevalence of sleep disorders among inpatients. Data linking participants to their unique identifier were kept in password-protected computers in locked files. Reported results were not linked to identifiable info; when summarizing notes from interviews participants were not identified by name.

Evaluation of risks / discomforts and benefits ratio. This study falls under the minimal risk category. This study provided information on the quality of individuals' sleep upon returning to their home environment after inpatient alcoholism treatment. Understanding alcoholics' experience with sleep throughout recovery, as well as their unique needs, provides preliminary data for informing the structure, timing, and delivery of a future behavioral sleep intervention. There are no direct benefits to individuals who participated in this research study. There are no known risks to completing the survey assessments or interviews. Confidentiality and information technology standards are in place at the intramural programs of the NIH campus to protect electronic repositories of patient data. It is reasonably expected that these safeguards will protect participants' medical and personal health information, ensuring their privacy.

Recruitment and informed consent. Informed consent is a continuous process of participants learning about the study throughout the duration of the study implementation. A detailed informed consent document explained participant rights and study requirements. This was not meant to serve as a "contract," because participants could withdraw from the study at any time. Risks and benefits of the study were outlined in detail. The principal investigator (PI) or designee explained the study objectives, time commitment, expectations, and processes for assessments. Participants were continuously

reminded that their participation in this study was entirely voluntary and did not affect the treatment they received from the NIH. Before enrolling in the study, participants were given a “consent quiz” assessing their understanding of study procedures, expectations, risks, and the voluntary nature of their participation.

Inclusion of women, minorities, and children. This study included both males and females and was open to persons from all racial and ethnic categories. Children (under the age of 18) were *not* eligible for participation in this study.

CHAPTER 4: Manuscript #2 – *Embracing change*: a mixed methods examination of sleep over the transition from an inpatient alcohol rehabilitation program to the community

The manuscript below will be submitted to *Alcohol and Alcoholism*.

Title: *Embracing change*: a mixed methods examination of sleep over the transition from an inpatient alcohol rehabilitation program to the community

Authors: A. Brooks, M. Krumlauf, C. Fryer, K. Beck, L. Yang, V. Ramchandani, & G. Wallen

Keywords: alcohol, addiction, sleep, mixed methods, qualitative

Introduction

Alcoholism, a chronic and progressive disease, is often accompanied by co-morbid conditions such as sleep disturbances (Benca, 1996; WHO, 2013a; WHO, 2013b). Alcohol use can negatively affect sleep via increased nightmares, snoring, and other interruptions (Landolt & Gillin, 2001). Sleep disturbances are common during phases of drinking and recovery (Gillin & Drummond, 2000) but it is unclear whether sleep disturbances precede alcohol dependence or vice versa. More than likely, this varies by individual. Sleep disturbances can persist for months or years during the process of recovery (Landolt & Gillin, 2001) and are especially common among individuals who are alcohol-dependent with co-morbid depression (Gillin, Smith, Irwin, Kripke, & Schuckit, 1990). Sleep disturbances are related to a multitude of health problems and can greatly reduce an individual's quality of life (Ancoli-Israel, Britz, & Walsh, 2004; Ayas, White, Al-Delaimy, et al., 2003; Foley, Vgontzas, Liao, Bixler, Chrousos, & Vela-Bueno, 2009;

Stine & Chapman, 2005; Vgontzas, Liao, Pejovic, Calhoun, Karataraki, & Bixler, 2009; Vgontzas, Liao, Pejovic, et al., 2010). Both pharmacologic and non-pharmacologic treatment options exist for individuals who are alcohol-dependent suffering with sleep disturbances (Brooks & Wallen, 2014).

Relationship between sleep disturbances and relapse to drinking. Sleep disturbances measured both objectively and subjectively among individuals who are alcohol-dependent are associated with increased risk of relapse to drinking following detoxification and rehabilitation (Alling, Balldin, Bokstron, et al., 1982; Brower, Aldrich, & Hall, 1998; Foster & Peters, 1999; Landolt & Gillin, 2001). More specifically, baseline sleep problems upon entering inpatient treatment have predicted subsequent relapse to drinking (Brower, 2001; Brower, Aldrich, Robinson, Zucker, & Greden, 2001). For some individuals, re-initiation of drinking after achieving abstinence may be an attempt to medicate for sleep problems (Vitiello, 1997). The long-term consequences of sleep disturbances among individuals who are alcohol-dependent remain unclear.

Transition periods during the alcohol rehabilitation process. Both 1) the initial adjustment to inpatient treatment and 2) the transition from inpatient to outpatient status for an individual who is alcohol-dependent are time periods accompanied by many changes. The environment and structure of an inpatient facility warrant certain adjustments on the part of the individual. Upon discharge from an inpatient facility, continuing care (or “aftercare”) of varying structures and intensity levels have been utilized to help individuals maintain healthy lifestyle changes and maximize the likelihood of sustained sobriety (McKay, 2006). “Transition groups” have been used to assist with the process of patients’ discharge from inpatient facilities to outpatient care

(Hanson, Foreman, Tomlin, & Bright, 1994), but many of these programs are focused solely on preventing relapse. Beyond the intent to remain sober, access to transportation for continuing care appointments, success of inpatient treatment, and patient motivation levels are all factors which may influence sobriety (Schaefer, Harris, Cronkite, & Turrubiartes, 2008). Getting adequate, quality sleep is not only an important component of a healthy lifestyle but, as demonstrated by previous literature (Alling, Balldin, Bokstron, et al., 1982; Brower, Aldrich, & Hall, 1998; Foster & Peters, 1999; Landolt & Gillin, 2001), might also play a role in preventing relapse. Thus, sleep patterns should be assessed and changes in sleep throughout the rehabilitation process should be monitored.

Potential value of mixed methods research. Exploring individual perspectives and experiences could provide a better understanding of sleep throughout recovery (Brooks & Wallen, 2014). In order to understand complex phenomena such as sleep disturbances and alcoholism, qualitative research that is naturalistic and subjective in nature *combined* with deductive quantitative techniques moves beyond traditional approaches and could potentially increase our knowledgebase (Newman, Ridenour, Newman, & DeMarco, 2003). Collecting both types of data concurrently and comparing emerging themes from qualitative data with quantitative analyses may allow for a more thorough understanding of the complexity of sleep and any individual differences present.

Purpose of study. This analysis utilized a mixed methods approach to assess experiences with sleep among individuals who are alcohol-dependent undergoing rehabilitation treatment at a clinical research facility across the transition periods associated with the rehabilitation process: the initial adjustment to becoming an inpatient and the transition from inpatient to outpatient status. We examined sleep patterns,

perceptions and beliefs as participants adjusted to an inpatient program and eventually transitioned back to their communities. While certain measures, both quantitative and qualitative, were informed by the Social Cognitive Theory (SCT), a forthcoming publication will focus on those constructs and associated analyses; this analysis was focused on changes over time.

Methods

This study was approved by the NIH Addictions Institutional Review Board (IRB) at the National Institutes of Health (NIH; NCT # 02181659). All participants enrolled in this study were first admitted to a clinical research facility providing rehabilitation treatment under a screening and assessment protocol, which enrolls adults over 18 years of age seeking treatment for alcohol dependence. All participants received continued physical evaluations, inpatient treatment of alcohol withdrawal, psychosocial management, and an educational treatment program. Patients could receive up to six or more weeks of inpatient treatment followed by 16 weeks of optional outpatient treatment. After consenting to the screening protocol, participants were evaluated and, in some cases, recruited for more focused research efforts including the study described herein. Participants were paid for the study portions they completed based on guidelines from the NIH Bioethics Department (Dominguez, Jawara, Martino, Sinaii, & Grady, 2012) for a total possible payment of \$60. Enrollment in this protocol had no effect on other treatments or research at NIH.

Inclusion and exclusion criteria. Participants were eligible for this study if they were 18 years of age or older, enrolled on the screening and treatment protocol (parent study), an inpatient for 21 days or more preceding discharge (to ensure that enough time

had passed between administration of the measures), not simultaneously enrolled onto a pharmacologic intervention study, able to understand the study and provide informed consent, and willing to return to the Clinical Center four to six weeks after being discharged from inpatient treatment for a follow-up visit *or* complete the follow-up study visit by phone. All participants signed an informed consent document indicating their voluntary participation and understanding of study procedures and expectations.

Study timeline. Specific measures already collected upon inpatient admission as part of the screening and assessment protocol were used to characterize patients who participated in this study. Approximately one week prior to patients' scheduled discharge, a study team member approached patients to begin the first segment of data collection for the study. Interviews were conducted and questionnaires were administered within one week of participants' scheduled discharge date and again four to six weeks post-discharge when they returned for a follow-up visit (or via phone).

Qualitative measures. Sleep and sleep-related behaviors can vary greatly from one individual to another. The qualitative component of this study was based on individual semi-structured interviews, audio-recorded with the interviewees' consent. The interview questions were reviewed and pilot-tested by clinicians and investigators with extensive experience working with individuals who are alcohol-dependent. A second interviewer was present on all interviews and introduced to the participants with an explanation that he or she would observe, take notes, and probe additional questions based on the participant's responses. This strategy was employed to decrease potential bias of only having one interviewer. Questions were focused on sleep patterns prior to becoming an inpatient, during the inpatient stay, and in anticipation of becoming an

outpatient and were designed to complement quantitative data to allow for the eventual convergence of qualitative and quantitative data. Figure 4.1 presents interview prompts specifically related to *transitions* (both the initial adjustment to becoming an inpatient as well as leaving the inpatient facility and re-integrating into the community).

Figure 4.1: *Interview prompts related to transitions*

First interview (within one week of discharge from inpatient facility):

- *“Describe the process of how you adjusted to being an inpatient in the Clinical Center.”*
- *“Think about the first few days after you leave here and go home. Walk me through what you think it will be like.”*
- *“Describe in as much detail as you can any expectations you have about transitioning back into your home environment.”*
- *“Describe how it has been to adjust to sleeping in this hospital. What about it is the same or different from your home environment?”*
 - Probe: positives and negatives of both environments...
- *“Describe what you think your sleep will be like when you leave the NIH.”*

Second interview (4-6 weeks post-discharge from inpatient facility):

- *“It's been about a month since you left the Clinical Center. Talk me through what the transition has been like as you returned to your home environment.”*
 - Probe: Environment, support system...
 - Probe: Barriers / facilitators to sobriety...

Quantitative measures – baseline (collected during inpatient phase only).

Specific measures collected as part of the screening protocol were used to provide descriptive data on participants. First, the Addiction Severity Index (ASI) identifies addiction-related problems in multiple dimensions. We specifically examined the family/social subcomponent of the scale, which is indicative of severity of problems in that domain (assessments of living arrangements, marital status, number of close relationships, etc). The Childhood Trauma Questionnaire (CTQ) questionnaire assesses adverse experiences, including physical and emotional abuse, neglect, or other trauma

experienced in childhood. It is a 28-item questionnaire that takes five to ten minutes to complete. Factor analysis supports the use of the CTQ as a screening instrument for maltreatment in clinical groups. The scale demonstrates good evidence of criterion-related validity (Bernstein, Stein, Newcomb, et al., 2003). The Comprehensive Psychopathological Rating Scale (CPRS-S-A) consists of 19 self-assessed variables that correspond to CPRS-based subscales for affective and anxiety syndromes (Åsberg, Montgomery, Perris, Schalling, & Sedvall, 1978). These subscales are the Montgomery Åsberg Depression Rating Scale (MADRS; Montgomery & Åsberg, 1979) and the Brief Scale for Anxiety (BSA; Tyrer, Owen, & Cicchetti, 1984).

Sleep quality and daytime sleepiness (assessed approximately one week pre-discharge and 4-6 weeks post-discharge). The Pittsburgh Sleep Quality Index (PSQI) is a 19-item, self-rated questionnaire used to measure sleep quality and disturbances over a one-month (30 days) time interval. A global summation score of five or higher is indicative of poor sleep quality or “disturbed” sleep (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI has been validated in populations with insomnia and other sleep disorders, with psychiatric patients, and in normal populations (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002; Doi, Minowa, Uchiyama, Okawa, Kim, Shibui, & Kamei, 2000).

The Epworth Sleepiness Scale (ESS) is an eight-item self-administered questionnaire that provides a measure of an individual’s general level of excessive daytime sleepiness over a one week time period (Johns, 1991). Individuals are asked to rate their usual chances of dozing off or falling asleep on a four-point scale in eight distinct situations or activities that most people engage in during their daily lives. Higher

scores are indicative of higher levels of daytime sleepiness. A score higher than ten is indicative of “excessive” daytime sleepiness (Johns, 1993).

Sleep-related beliefs and behaviors (assessed approximately one week pre-discharge and 4-6 weeks post-discharge). The Dysfunctional Beliefs and Attitudes about Sleep Scale (brief version: DBAS-16) is a 16-item questionnaire that assesses sleep-related cognitions including faulty beliefs and appraisals, unrealistic expectations, and perceptual and attention bias. Domains include expectations about sleep requirements and issues with being worried or feeling helpless about insomnia (Morin, Vallieres, & Ivers, 2007). Higher scores are indicative of stronger endorsement of dysfunctional beliefs. The Self-Efficacy for Sleep Scale (SE-S) includes nine items used to measure the level of confidence a person has in performing behaviors that might be helpful in initiating sleep, with higher scores indicative of greater confidence. The Sleep-Related Behaviours Questionnaire (SRBQ) assesses the use of safety behaviors that individuals may use to promote sleep and cope with tiredness. Higher scores are indicative of higher frequency of engaging in safety behaviors in an effort to cope with sleeplessness or tiredness.

Alcohol-related measures – craving and relapse (collected 4-6 weeks post-discharge). The Penn Alcohol Craving Scale (PACS) is a clinical tool for practitioners to measure alcohol craving. It is a five-item self-administered instrument that measures frequency, intensity, and duration of thoughts about drinking along with ability to resist drinking. The Timeline Follow-Back (TLFB) collects drinking information using personal historical events recounted over a fixed time period (Sobell & Sobell, 1992). It is a standard assessment for measuring alcohol drinking patterns and quantification in

treatment programs and was the primary measures of relapse for this study. If the TLFB was missing or invalid, we used a positive Breath Alcohol level or participants' voluntarily self-reporting relapse during the second interview as proxy measures of relapse.

Analyses - qualitative data. Each audio-recorded interview was transcribed and quality checked prior to analysis. A codebook was developed based on emergent themes related to transitions and changes in sleep over time from the interviews. Each code was accompanied by an operational definition that allowed for clarity and consistency in the coding process. A team of two coders independently reviewed a sub-set of transcripts. After data were transcribed and cross-checked, NVivo (version 10.0) was utilized for further qualitative analyses. Using NVivo, inter-rater reliability percentages were calculated. Discordant coding was discussed until consensus among the coding team was achieved.

Once the iterative process of consensus building was complete, a representative from the clinical team and a mixed methods expert from the NIH Clinical Center validated the themes and codes presented herein. To ensure that the trustworthiness of qualitative data was preserved, three criteria assessing rigor were considered: creditability, auditability, and fittingness of the data (Barroso, 2010). Table 4.1 outlines the characteristics of each criterion and how we operationalized each for the analyses described herein.

Table 4.1: *Criteria for judging scientific rigor in qualitative research*

Criteria	Criteria characteristics	Example methods for this study
Credibility	<ul style="list-style-type: none"> • Truth of findings (can be judged by others within the discipline) • E.g.: Share interpretation of findings and query accuracy from those living the experience 	Validation of themes by a member of the clinical care team and mixed methods expert who was present during a majority of the interviews
Auditability	<ul style="list-style-type: none"> • Adequacy of information leading the researcher from the research question / raw data through analysis and interpretation of findings • E.g.: Others being able to follow the reasoning of the researcher step-by-step through explicit examples of data 	Presenting examples of data alongside their corresponding themes; detailed description of the iterative process of coding and multiple coders coming to consensus (how many coders, initial percentage of inter-rater agreement, etc)
Fittingness	<ul style="list-style-type: none"> • Faithfulness to everyday reality of the participants (described in enough detail so that others can evaluate importance for their own research and practice) • E.g.: Human experience being reported is transparent and others can decide whether it has utility for guiding their practice 	Conducted adequate number of interviews to reach saturation, allowing for inferences to be drawn with implications for research and / or practice

Quoted and adapted from Barroso, J. (2010). Qualitative approaches to research. In G. LoBiondo-Wood and Haber, J. (Eds). *Nursing Research: Methods and Critical Appraisal for Evidence-Based Practice*. Elsevier: St. Louis, MO, USA.

Analyses - quantitative data. Statistical analyses of quantitative results were conducted with the Statistical Package for Social Sciences (SPSS) software, version 22.0. All quantitative data were double-data entered, cross-checked, and reconciled where necessary. The Addiction Severity Index (ASI), Penn Alcohol Craving Scale (PACS), Childhood Trauma Questionnaire (CTQ), Comprehensive Psychopathological Rating Scale (CPRS), and basic demographics including age, gender, race, and ethnicity were used to characterize the sample. Initial analyses were descriptive and exploratory in nature to assess the prevalence of sleep disturbances pre- and post-discharge. Sleep quality (PSQI) and relapse status (TLFB and other sources) were the main outcomes of

interest. Correlations between variables were assessed by appropriate parametric or non-parametric tests.

Use of mixed methods – *convergent parallel design*. The format for the use of mixed methods was a *convergent parallel design*, wherein both quantitative and qualitative data were collected simultaneously and each method of examination was given equal priority (Creswell & Plano Clark, 2011). Quantitative and qualitative results were merged during analysis and interpretation (Bishop & Holmes, 2013). More specifically, qualitative responses which reflect sleep quality, perceptions, experiences, and beliefs were combined with quantitative measures of sleep quality and daytime sleepiness (the PSQI and ESS) and perceptions, beliefs, and behavior (DBAS, SE-S, and SRBQ) at each time point.

Results

Aside from the general demographics presented in Table 4.2, participants represented a wide range of occupations, hobbies, temperaments, familial statuses, co-morbid conditions (mental and physical), and histories of drinking patterns. On the second day of inpatient treatment, the average PSQI score was indicative of sleep disturbances (mean 12.0, s.d. 4.0). “Emotional abuse” and “emotional neglect” were the most commonly endorsed on the CTQ with a mean of 11.0 (s.d. 6.0) for both sub-scales.

Of the 32 participants who completed the pre-discharge study visit, 24 returned for the post-discharge visit. The eight participants who did not return did not differ significantly from those who did return based on age, gender, race, or sleep quality (measured by the PSQI).

Eight participants had valid TLFB data at follow-up (4-6 weeks post-discharge). Of those eight, only one had relapsed within the 4-6 week post-discharge time frame, reporting drinking four of the 34 days with an average of 7.13 drinks per drinking day. Of the remaining 24 patients, five were lost to follow-up, one had a positive breath alcohol content (BAC) at the time of the follow-up interview, five admitted to relapsing during their follow-up interview, and 10 did not mention drinking during their follow-up interview and were thus treated as “missing” since verification of sobriety was not possible (denoted in Table 4.2).

Table 4.2: *Participant demographics and clinical variables*

	Pre-discharge (n=32)*	Post-discharge (n=24)
	n (%)	n (%)
Gender		
Male	21 (65.6)	16 (66.7)
Female	11 (34.4)	8 (33.3)
Race/ethnicity		
Black/African-American	14 (43.8)	8 (33.3)
White	16 (50.0)	15 (62.5)
Other/multiracial	2 (6.2)	1 (4.2)
Relapse		
Relapse	N/A	7 (29.2)
No relapse		7 (29.2)
Missing		10 (41.7)
	Mean (s.d)	Mean (s.d)
Age (Range: 25-59 years)	44.16 (10.48)	46.33 (10.49)
Baseline depression (CPRS)** (Range: 2-37, n=31)	17.8 (7.8)	17.42 (7.09)
Baseline anxiety (CPRS)** (Range: 2-30, n=31)	12.9 (6.6)	12.75 (6.02)
ASI – Family/social composite score (Range: 0.00 to 0.75)	0.21 (0.24)	0.21 (0.25)
CTQ – (Sum of 5 components: emotional abuse, sexual abuse, physical abuse, emotional neglect, & physical neglect) (Range: 25-110)	46.78 (23.08)	N/A
PACS (Range: 0-28)	N/A	9.94 (8.79)

*If n ≠ 32 (data were missing), it is noted in the left column.

**In this table, “baseline” denotes day 2 of inpatient treatment.

Qualitative results. The goal of achieving an inter-rater agreement of over 80% was met, thus no second round of coding occurred. The interviews lasted between 10 and 30 minutes with an average length of 18.48 minutes (pre-discharge) and 17.95 minutes (post-discharge). Interestingly, many participants mentioned the severity, chronicity, or cyclic nature of their alcoholism when they were asked to describe themselves in general (pre-discharge):

“I know I’m going to die...from something related to alcohol – if I continue to drink. It’s very serious at this point.” -57 year old White female

“I’m definitely a full-fledged alcoholic.” -50 year old White female

“I’m an end-stage alcoholic – there is zero, zero, zero denial about that...I’ve been wrestling with alcohol since I was 21...it’s a lifelong struggle...I’ve been sober for long periods of time before...I came here specifically to...immerse myself in fixing my brain.” -49 year old White male

“...been dealing with...alcohol, for 22 years I’ve been trying to stay sober.” -47 year old African American male

“I didn’t have my first drink until I was 20...but it’s pretty much dominated my life for the past 23 years.” -51 year old male, multiple races

“I was in a really bad car accident in July with alcohol involved...my life’s a mess right now...I blacked out and...flipped my car...I hit rock bottom then. But...I continued to drink, like an idiot.” -32 year old White female

“I’ve been in treatments...many, many...for some reason, I’ll slack off...something else will fall by the wayside and eventually I get drunk.” -48 year old White female

Qualitative themes related to transitions and changes in sleep over time are presented, along the frequency of their endorsement at each time point, in Table 4.3. Important to note is that some themes did not “emerge” on their own but were actually prompted by the interviewer (e.g. a) sleep-related behavior: the strategies used to help oneself fall asleep or stay asleep and b) changes in sleep since leaving the inpatient facility), as depicted earlier in Figure 4.1.

Table 4.3: *Qualitative themes specific to transitions and sleep changes over time*

Pre-discharge		Post-discharge	
Themes	Frequency of endorsement; n(%), (n=32)	Themes	Frequency of endorsement; n(%), (n=24)
Fear / uncertainty related to transition to becoming an inpatient or returning home	24 (75.0)	Transition back home	23 (95.8)
Healthy lifestyle	6 (18.8)	Lifestyle changes	12 (50.0)
Anticipated barriers / facilitators to sobriety (family, social, other)	20 (62.5)	Perceived barriers / facilitators to sobriety (family, social, other)	8 (33.3)
Sleep-related behavior	27 (84.4)	Sleep-related behavior	22 (91.7)
Mind or thoughts racing	13 (40.6)	Changes in sleep (since leaving inpatient facility)	24 (100.0)

A majority of participants (24 of 32) discussed some type of fear or uncertainty surrounding either the adjustment to becoming an inpatient and/or returning back home during the pre-discharge interview. Similarly, a large majority of participants (23 of 24) discussed the level of difficulty or ease of their transition back home during their follow-up interviews. While only six participants discussed a healthy lifestyle in the context of their recovery process while they were inpatient, half of those who returned for the follow-up interview endorsed healthy lifestyle changes since returning home. Most participants (20 of 32) identified *anticipated* barriers and facilitators to sobriety before leaving the inpatient facility, but fewer participants (8 of 24) discussed the *actual* barriers and facilitators they had experienced during the follow-up interviews. Participants discussed sleep-related behaviors (i.e. bedtime routines and/or strategies for falling asleep or staying asleep) at both time points (27 of 32 at pre-discharge and 22 of 24 at post-discharge). A considerable proportion of participants (13 of 32) discussed “racing thoughts” while reflecting on their sleep or drinking patterns during the first interview.

Selected quotes. In addition to the broad themes presented in Table 4.3, certain quotes highlighted in this section captured the essence of *transitions*, whether it was the initial adjustment to becoming an inpatient or leaving the inpatient facility, and how sleep and other related factors changed throughout the process of recovery.

Pre-discharge: fear / uncertainty related to transition to becoming an inpatient or returning home. Some participants described an initial adjustment period upon arriving to the inpatient facility. These descriptions included physical, emotional, and social ramifications of the adjustment, appreciation of staff and structure of the inpatient treatment program, and learning tools to cope to replace drinking:

“I mean, the first couple days I was really sick, I mean – I was withdrawing, I was nauseous, I was – I just didn’t really wanna be around anybody at first...” -32 year old White female, pre-discharge

“I always had...my bags packed. That was my attitude. My bag was packed. And...then one day it got halfway packed...I think the next day I just said...let’s do this.” -53 year old African-American female, pre-discharge

“I’m so grateful that [the clinical staff] talked to me ‘cause my impulsivity...I said, ‘I’m gonna go home and drink. I’m going to drink.’ ‘Cause that’s all I knew – I felt uncomfortable, I’m gonna drink. But what I’ve learned here is...I don’t have to drink when I’m uncomfortable.” -57 year old White female, pre-discharge

When asked about their upcoming transition back home, participants largely associated concerns about their “success” post-discharge with whether or not they would be able to maintain sobriety. Finding purpose through work was also mentioned by several participants:

“My first concern [post-discharge from the inpatient facility] is to become employed. I mean, that’s...one of the great stressors there, is to become employed, preferably in my own field – that’s becoming more and more difficult...a job, for me, I’m old school...and my self-worth has everything to do with being able to support myself and not have to ask for or refer to other resources.” -60 year old White male, pre-discharge

“This is a bubble...real life is out there...stress is definitely gonna go up going out there, you know...I’m going out to the reality of...what I have to...catch up on.” -47 year old African American male

Pre-discharge: healthy lifestyle. Another emergent theme was incorporating components of a healthy lifestyle during the inpatient stay:

“I have more energy... I focus my energy on more positive things...now, because drinking is eliminated, I’m using that...extra energy for good things. I go to the gym, I play basketball out back, I got my bike here on campus, I go bike riding...” -37 year old White male, pre-discharge

“Definitely now at this point, I...feel that I am on the right path. And I just have a new outlook on life. So, that’s where I am now...I’m a different person that I walked in here...30 – uh, 28 days ago.” -53 year old African American female, pre-discharge

Pre-discharge: anticipated barriers / facilitators to sobriety (family, social, other). In considering the transition back home prior to discharge, many participants outlined a plan and their intention to use strategies they learned while they were in the inpatient facility to maintain sobriety post-discharge. For some, social support was a major part of their plan to sustain sobriety:

“...AA meetings and...get a sponsor, learn how to be open, and...be honest, and then – if I ever run into a problem, that I’m gonna drink, don’t act like the phone weighs 1000 pounds. You know what I mean? Learn how to reach out. Maybe – reach out before the problem reaches you. That’s what I say.” -43 year old African American male, pre-discharge

“I’m also excited about...going back to my AA group, and I’m gonna try to expand that as well...I have a very, very big support group.” -49 year old White female, pre-discharge

Pre-discharge: sleep-related behavior. Participants discussed sleep-related behaviors as components of their inpatient stay. One participant expressed joy surrounding sleep and wake cycles associated with sobriety and inpatient treatment:

“I go to sleep with...a little bit more contentment...I’ll put it that way...when I get up in the morning, I used to dance every morning in my bedroom. And I haven’t done that in the last three to four years. So, this morning I found myself dancing before I got dressed...that was cool.” -53 year old African American female, pre-discharge

Others outlined behavioral strategies they learned during their inpatient stay to promote sleep:

“I’m back into meditation now...and I’ve also got chamomile tea. But I’m looking forward to sleep now. And I’ve got tools to cope with now.” -53 year old African American female, pre-discharge

Pre-discharge: mind or thoughts racing. Many participants discussed “racing thoughts” being associated with poor sleep either prior to or during their inpatient stay:

“I couldn’t really go to sleep ‘cause my thinking was just...here come the thoughts again...a racket going on in my mind.” -55 year old African American male, pre-discharge

“Sleep’s terrible, you know, ‘cause your mind’s racing – with all the things that are really going on...” -47 year old African American male, pre-discharge

Post-discharge: transition back home. When participants were interviewed 4-6 weeks post-discharge, they reflected on their varying experiences over the transition back home, both positive and negative:

“The transition has been okay...things have been...okay, I would say... up to the day that I was ready to be discharged, I think I got a little nervous about things...but...[I’ve] been managing.” -52 year old African American female

“A lot of times, I think about drinking and things like that, and just – I knew it was wrong, but I still would just follow my impulses. Now, like – I still get cravings every now and then, but every time they go in my head I think about all the bad stuff that happened, and they’ll go away.” -27 year old African American male

“It was a little rough in the beginning...I mean, I kind of started feeling better, and I was like, you know, all right, I can probably start drinking again. It turned out to be ...a bad idea.” -26 year old White male, post-discharge

“[The] transition was a little rough. I got out...I went to stay with my cousin for a little bit...and then started drinking again, um...so that fell through...I have had one slip-up since I’ve been there...besides that...[I’m] just really trying to focus on sobriety.” -27 year old White male, post-discharge

Post-discharge: lifestyle changes. Participants described positive lifestyle changes since returning home:

“I’m not waking up looking for the vodka bottle. That’s...the blunt way to put it...I’ve filled my life with other things, and yes, you can still have fun without drinking.”

-53 year old African-American female, post-discharge

“[Cleaned] the kitchen, and stuff like that... just to keep me busy...and I’m doing yoga now.” -49 year old White female, post-discharge

“I’m eating much better...much healthier. And I’m still exercising almost every day, whether it’s – I mean, just taking a walk – and I think those two things are kind of important, um...at least, an overall balance, and I think – it definitely helps me.” -50 year old White male, post-discharge

Post-discharge: perceived barriers / facilitators to sobriety (family, social, other). Participants described aspects of their environment that served as barriers or facilitators to their sustained sobriety post-discharge.

“I’m kinda realizing...recovering alcoholic working in a bar might not be such a good combo.” -26 year old White male, post-discharge

“[I’ve] avoided a lot of the people in my neighborhood, which is a good thing...they don’t even know I’m home...the neighbors – that I used to drink and...do things with. They don’t even – they’ve seen me...but they don’t come over and I don’t know their phone numbers anymore.” -54 year old White male, post-discharge

One participant, who also admitted to relapsing, acknowledged that he viewed AA meetings differently as an outpatient:

“I’m finding the meetings...I’m finding them helpful...I don’t have a sponsor yet, I don’t have any of that, but...I don’t hate going to them, I don’t mind being there – I’m not sitting here looking at the clock, you know what I mean? I’m just...listening, I guess, and just hearing other peoples’ experiences. So that’s one thing that’s different – that’s changed.” -27 year old White male, post-discharge

Post-discharge: sleep-related behavior. Participants discussed behavioral strategies for sleep, whether the strategies they initiated as inpatients were still helpful post-discharge, and new sleep-related “routines” initiated post-discharge:

“I still do try to meditate before I go to bed... and sometimes that... just calms me down, sometimes it doesn’t. It really depends on, I think, what I went through [during] the day.” -49 year old White female, post-discharge

“And I actually went and bought one of the little tapes that they recommended...it’s just got a bunch of, like, sea sounds in it. Bird chirps...” -47 year old African American male, post-discharge

“I’ve...gotten my new routine down for bed... I take my medication ...8:00 o’ clock... and I still sit up and read or if there [are] sports on TV or a movie or something, I’ll watch it till, like, 10:00 or 10:30.” -54 year old White male, post-discharge

Post-discharge: changes in sleep (since leaving inpatient facility). Participants outlined both positive and negative changes in sleep post-discharge (often associated with a new environment). One participant commented on her perceptions of the effect of alcohol on sleep after relapsing:

“I will drink and then pass out – it’s not sleeping, it’s being passed out from alcohol being infused into my whole system. And it’s not a deep sleep, it’s more of a

knocked out sleep. And then, after a few hours – I mean, this is not eight, nine hours – after a few hours I wake up...I can also tell in my face...when I’m drinking and I don’t sleep well, which is – always happens...I notice bags under my eyes.” -57 year old White female, post-discharge

“These days it’s easy for me to sleep... it’s not like before...I would sleep mostly...after midnight. But now, I find myself, it’s around 10:00, I don’t know if it’s getting old or something. [Laughter] I feel sleepy, which is a good thing I guess.” -35 year old African American male, post-discharge

“I’ve been having a lot more nightmares...more of the irritating variety. A lot of drunk dreams.” -51 year old male, multiple races, post-discharge

Quantitative results. A McNemar test was used to assess differences in the distribution of “sleep disturbances vs. no sleep disturbances” (PSQI) and “excessive daytime sleepiness vs. no excessive daytime sleepiness” (ESS). Among those with valid data at both time points (n=22), no significant differences were found between pre- and post-discharge scores (Table 4.4).

Table 4.4: *Sleep-related variables pre- and post-discharge**

Pre-discharge (n=32)		4-6 weeks post-discharge (n=24)	
	n (%)		n (%)
Sleep disturbance (PSQI ≥ 5)	22 (68.8)	Sleep disturbance (PSQI ≥ 5)	11 (45.8)
No sleep disturbance (PSQI < 5)	9 (28.1)	No sleep disturbance (PSQI < 5)	11 (45.8)
Missing	1 (3.1)	Missing	2 (8.3)
No daytime sleepiness (ESS ≤ 10)	26 (81.3)	No daytime sleepiness (ESS ≤ 10)	21 (87.5)
Daytime sleepiness (ESS > 10)	6 (18.8)	Daytime sleepiness (ESS > 10)	3 (12.5)

*McNemar test performed only in the case of valid data at both time points (n=22).

The mean PSQI scores approximately one week pre-discharge and 4-6 weeks post-discharge remained above the cut-off for “disturbed sleep” (7.72 ± 3.94 and $6.81 \pm$

4.81, respectively; Table 4.5) although only 50% of participants who completed the post-discharge follow-up visit were categorized as “disturbed sleepers.” Of those participants with valid data at both time points (n=22 for PSQI and n=24 for all other sleep-related variables), there were no significant changes from pre- to post-discharge (Table 4.5). No differences were found between males and females when considering the change in PSQI scores from pre- to post-discharge. Interestingly, non-White participants were more likely to experience improvements in PSQI scores from pre- to post-discharge.

Table 4.5: Paired samples statistics (pre- and post-discharge)

	Pre-discharge, mean (s.d.)	Post-discharge, mean (s.d.)	n	95% CI for mean difference	t
PSQI (Sleep quality)	7.72 (3.94)	6.81 (4.81)	22	-0.91, 2.72	1.04
ESS (Daytime sleepiness)	7.33 (3.90)	5.96 (4.24)	24	-0.28, 3.04	1.71
SE-S (Self-efficacy for sleep)	28.88 (6.78)	30.21 (7.54)	24	-3.32, 0.66	-1.39
SRBQ (Sleep-related safety behaviors)	45.88 (15.55)	45.22 (15.47)	24	-3.95, 5.26	0.29
DBAS-16 (Dysfunctional beliefs about sleep)	4.17 (1.87)	4.24 (1.69)	24	-0.83, 0.69	-0.20

There were no *statistically* significant differences in demographic or sleep-related variables between those who relapsed, those who were sober, and those whose relapse data were missing, likely due to the small sample size. However, demographic and clinical variables are presented by relapse status (if known) and “trajectory” of sleep quality based on PSQI scores pre- and post-discharge in Table 4.6. In the table, “ongoing sleep disturbances” refers to individuals whose PSQI scores were above the cut-off for sleep disturbances at both time points. “Sleep disturbances resolved” refers to individuals

whose pre-discharge PSQI score was above the cut-off for sleep disturbances but their post-discharge PSQI score was below the cut-off. Finally, “no sleep disturbances at either time point” refers to individuals whose PSQI scores were below the cut-off for sleep disturbances at both time points. No participants went from having no sleep disturbances pre-discharge to *developing* sleep disturbances post-discharge based on PSQI scores, although some participants outlined negative changes in sleep from pre- to post-discharge qualitatively. Those who relapsed had higher craving scores (PACS) and those with no sleep disturbances at either time point had the lowest craving scores of any group. All of the participants whose sleep disturbances resolved were non-White.

Table 4.6: Participant demographics and clinical variables by relapse status and sleep quality

Relapse (n=7)		No relapse (n=7)			
	n (%)		n (%)		
Gender		Gender			
Male	5 (71.4)	Male	4 (57.1)		
Female	2 (28.6)	Female	3 (42.9)		
Race		Race			
White	5 (71.4)	White	4 (57.1)		
Non-white	2 (28.6)	Non-white	3 (42.9)		
	Mean (s.d.)		Mean (s.d.)		
Age Range: 25-59	43.29 (14.33)	Age Range: 27-57	47.29 (9.76)		
PACS Range: 5-27	18.14 (7.90)	PACS Range: 0-11	4.29 (3.77)		
Ongoing sleep disturbances (n=12)		Sleep disturbances resolved (n=5)		No sleep disturbances at either time point (n=5)	
	n (%)				n (%)
Gender		Gender		Gender	
Male	7 (58.3)	Male	4 (80.0)	Male	4 (80.0)
Female	5 (41.7)	Female	1 (20.0)	Female	1 (20.0)
Race –		Race		Race	
White	9 (75.0)	White	0 (0.0)	White	5 (100.0)
Non-white	3 (25.0)	Non-white	5 (100.0)	Non-white	0 (0.0)
	Mean (s.d.)				Mean (s.d.)
Age Range: 25-57	46.25 (11.81)	Age Range: 35-55	43.20 (11.84)	Age Range: 35-59	47.00 (8.34)
PACS Range: 0-18	8.80 (6.76)	PACS Range: 0-28	11.46 (9.59)	PACS Range: 0-10	3.80 (4.15)

Aside from the demographic and clinical variables presented in Table 4.6, preliminary qualitative findings suggested differences between those with ongoing sleep disturbances, those whose sleep disturbances had resolved, and those with no sleep disturbances at either time point. Only one of the five individuals whose sleep disturbances resolved and two of the 12 individuals with ongoing sleep disturbances mentioned healthy lifestyles during their pre-discharge interviews. Only one of the five individuals whose sleep disturbances had resolved mentioned “racing thoughts” during their pre-discharge interview.

Lastly, to complement the quantitative results and summarize the overarching emergent themes from the interviews, we present key qualitative findings by theme in Table 4.7. While some themes emerged on their own, others were coded as direct responses to interviewer questions/prompts (presented in Figure 4.1).

Table 4.7: *Summary of key qualitative findings by time point and theme*

Pre-discharge qualitative themes	Prevalent findings
Fear / uncertainty related to transition to becoming an inpatient or returning home	<ul style="list-style-type: none"> • Initial adjustment period upon arriving to inpatient facility (new environment, new “rules” -for some, this was while undergoing medically-assisted detoxification and treatment for withdrawal) • This was often followed by an “adjustment” period and developing a level of comfort with the inpatient rehabilitation program routine • Anxiety, excitement, or a mixture of both feelings regarding the transition back home • Particularly among those who had not attempted sobriety before, some degree of uncertainty surrounding not knowing “triggers” to relapse, whereas those who had been sober before often focused on what they would do differently • Regardless of prior experiences with rehabilitation, participants placed a lot of emphasis on maintaining sobriety / managing stress as primary determinants of their success post-discharge
Healthy lifestyle	<ul style="list-style-type: none"> • Appreciation of the structure associated with the inpatient facility (regular meal times, normalizing sleep schedules, making time for physical activity)

	<ul style="list-style-type: none"> • Those with concerns about their physical health appreciated the clinical / diagnostic tests and receiving information on their health
Anticipated barriers / facilitators to sobriety (family, social, other)	<ul style="list-style-type: none"> • Perceptions of the inpatient treatment facility as a safe space (“bubble”), some apprehension about the challenges awaiting them in the “real world” (post-discharge) • Concerns about re-integrating into non-sober social circles, finding work in a timely manner • Associating boredom with temptation to drink • Connecting facilitators to sobriety back to their original reason for seeking treatment (e.g. a life experience or a friend or family member’s suggestion) or perceiving the onus of staying sober to be entirely on themselves (e.g. maintaining self-awareness / self-control or being their “own best friend”)
Sleep-related behavior	<ul style="list-style-type: none"> • Initiation of bed-time routines or other sleep-related behaviors during the inpatient stay (use of relaxation techniques, herbal / pharmacological remedies, attempting to implement a regular sleep schedule, etc) • Anticipating the continuation of these behaviors post-discharge
Mind or thoughts racing	<ul style="list-style-type: none"> • Racing thoughts / inability to stop thinking, either when trying to go to sleep or as a precursor to drinking
Post-discharge themes	Prevalent findings
Transition back home	<ul style="list-style-type: none"> • Feeling overwhelmed with the stress of “normal” life - including job interviews, family stressors, and other aspects of their lives they had been away from for at least 3 weeks • In some cases, these stressors led to relapse • Finding a job or finding purpose / meaning in other activities (e.g. re-connecting with family or volunteering in the community) were motivators to stay sober • Those who had not relapsed at the time of the second interview were more likely to perceive other aspects of the transition back home more positively • Participants indicated there were both “ups” and “downs” (positives and negatives) related to this transition
Lifestyle changes	<ul style="list-style-type: none"> • Healthy lifestyle changes mentioned during the second interview included being sober, having non-alcohol methods of coping with stressful situations, losing weight, increased physical activity, drinking less coffee, re-organizing living spaces or finances
Perceived barriers / facilitators to sobriety (family, social, other)	<ul style="list-style-type: none"> • Several participants mentioned the physical environment being important to maintaining sustained sobriety (e.g. removing alcohol from their home) • For those working in industries where alcohol was present (bars / restaurants), presented unique challenge to sustained sobriety • Major post-discharge sources of support included sponsors and / or the AA community in general, family members, church communities, co-workers, friends, and structured programs (e.g. sober living houses) • Some participants indicated they had none or very little outside support; their sobriety was largely self-driven

Sleep-related behavior	<ul style="list-style-type: none"> • Some participants continued pre-bedtime rituals they initiated as inpatients, including drinking chamomile tea, meditation, calming music, guided imagery, reading, watching TV, and other methods of relaxation
Changes in sleep (since leaving inpatient facility)	<ul style="list-style-type: none"> • Drunk dreams, dreaming more frequently (sometimes attributed to a change in medication) • Improved sleep (less interruptions, comfortable environment) • Many who had maintained sobriety felt that sleep was more regular / routine • Stress of the transition back home and everyday life potentially led to increased sleep interruptions

Discussion

This analysis highlights individual variation in sleep throughout the process of alcohol rehabilitation. Collecting quantitative and qualitative data concurrently and combining emerging themes from qualitative data with quantitative analyses through triangulation allowed for a more thorough examination of this relatively novel area of research and provided information that can be utilized to inform future behavioral sleep interventions. As previously discussed, the rehabilitation process represents a time of transformation. Inpatient facilities may represent an environment conducive to initiating lifestyle changes, including those which could improve sleep.

As with previous studies (Benca, 1996; Brower, 2003; Levola, Aalto, Holopainen, Cieza, & Pitkanen, 2014), the individuals in this study had a wide range of co-morbid conditions. Our findings support the co-occurrence of alcohol use and sleep disturbances (Brower, 2003; Gillin & Drummond, 2000; Tiplin, Raz, Daiter, Varenbut, Tyrrel, 2006), particularly in the early stage of recovery (Gillin, Smith, Irwin, Kripke, & Schuckit, 1990; Wallen, Brooks, Whiting, et al., 2014). Individuals undergoing inpatient alcohol rehabilitation are in a new environment, away from their homes and communities, and may therefore become accustomed to a “schedule” for eating, sleeping, and recreation.

The first few days of the inpatient stay may not be the best time to introduce an intervention, as participants may be focused on adjusting to their surroundings. As evidenced by our results, the period of transition from inpatient to outpatient represents another transition period of uncertainty and change. Sustaining healthy behaviors which may have been initiated during inpatient treatment could help to maintain sobriety, a healthy lifestyle, and overall health-related quality of life.

Similar to our previous work establishing the prevalence of sleep disturbances throughout the inpatient stay, there was low variability in daytime sleepiness levels (ESS) and average scores on the measure were not indicative of “excessive” daytime sleepiness. Measures of self-efficacy for sleep (SE-S), sleep-related safety behaviors (SRBQ), and dysfunctional beliefs about sleep (DBAS-16) remained relatively stable at both time points, despite participants discussing many changes occurring throughout the transition from inpatient to outpatient during their interviews. This particular discrepancy between quantitative and qualitative findings could either suggest that these scales are insensitive to the changes over time or that not enough time passed between administration of the measures. Another possible explanation is that without focused treatment designed to increase self-efficacy for sleep or other constructs of the SCT, there is no change in these variables. More importantly, we believe that this highlights the importance of complementing the patient-reported outcomes with qualitative data to capture the essence of any and all changes over time.

The demographic and clinical variables presented in Table 4.6 did not differ significantly by relapse status or sleep quality, but one trend emerged that could have clinical implications and warrants further investigation: those who self-reported no sleep

disturbances at either time point had the lowest craving scores. Craving may be important to examine at various points throughout the recovery process, especially when considering the possibility of relapse. Furthermore, measures of sleep quality (PSQI) and daytime sleepiness (ESS) both trended toward reduction in the prevalence from pre- to post-discharge. Additionally, several interesting qualitative differences emerged by sleep quality status: 1) those who mentioned healthy lifestyles pre-discharge were less likely to self-report *no* sleep disturbances at either time point and 2) those whose sleep disturbances resolved by the post-discharge time point were less likely to endorse “racing thoughts” while inpatients. These findings offer preliminary support to the idea that “stabilizing” sleep during the inpatient phase may be especially important.

Strengths and limitations. The mixed methods nature of this study allowed for the collection of rich and diverse information. In particular, the wealth of qualitative data accrued and the rigorous process through which they were analyzed was useful in describing the complex phenomenon of sleep throughout recovery. It also provided unique insight on patient preferences and needs for future behavioral sleep interventions. Following patients across the transition from inpatient to outpatient status allowed for a more thorough examination of sleep across time.

However, this study is not without limitations. Given a small sample size and subsequently low power levels, the quantitative analyses were strictly exploratory in nature and were meant to complement qualitative findings, which were intended to be hypothesis-generating. Despite methods of ensuring rigor of the qualitative analyses, personal biases still existed and may have influenced the coding process. The sample was non-representative; findings should not be generalized to all individuals who are alcohol-

dependent and seeking treatment. Finally, much of the data used for this analysis were self-reported, which are subject to inherent biases.

Future directions. The second phase of the intramural NIH protocol from which these data were collected includes continuation of the quantitative patient-reported outcomes on a total sample of up to 215 participants. With this larger sample size, we will be able to power further quantitative analyses. Additional sub-analyses could include an examination of social support, participants' perceptions on *Alcoholics Anonymous*, dreams and nightmares, familial implications of alcoholism, and other constructs that remain to be explored in-depth. Examining subgroups of individuals in a larger sample, particularly a) those who relapse compared to those who do not and b) those who have ongoing sleep disturbances versus those who do not, could provide further support for tailored interventions. Future efforts should include following patients for a longer period of time post-discharge when possible to capture patients' experiences over time. The quotes reflected in this paper coalesce around the overarching theme of structure; the appreciation of re-developing routines during inpatient treatment may be conducive to changing sleep habits through a tailored behavioral sleep intervention. At a minimum, sleep should be monitored in alcohol rehabilitation programs in order to understand it both as a potential relapse trigger and an important component of a healthy lifestyle post-discharge. The most effective mechanism for assessing sleep (i.e. objectively, subjectively, or a combination of both) still needs to be explored.

Conclusion. This research confirms a high prevalence of sleep disturbances in a sample of individuals who are alcohol-dependent throughout various stages of recovery that had not yet been explored in detail using a mixed methods approach. Patient-reported

outcomes and in-depth interviews provided a clearer picture of individual experiences throughout recovery and the complexity of alcoholism and associated co-morbid conditions, compared to either data source individually. Capturing the essence of *transition* periods throughout the process of recovery highlights the important role they may play in sleep quality and eventually relapse. Of particular importance may be learning how to capitalize on positive lifestyle changes post-discharge from inpatient rehabilitation facilities that emerged qualitatively in this study, particularly those changes introduced during the inpatient phase of recovery and sustained. This study fills a gap in the literature by characterizing sleep throughout the rehabilitation process and ongoing maintenance of abstinence (or relapse).

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CHAPTER 5: Manuscript #3 – Sleep throughout the alcoholism recovery process: a mixed methods examination grounded in the Social Cognitive Theory

The manuscript below will be submitted to the *Journal of Health Psychology*.

Title: Sleep throughout the alcoholism recovery process: a mixed methods examination grounded in the Social Cognitive Theory

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Keywords: alcoholism, sleep disturbances, mixed methods, relapse, Social Cognitive Theory

Introduction

Alcohol dependence is a devastating global public health concern. The effects of this chronic disease are debilitating and far-reaching, affecting not only individuals, but also families, communities, and ultimately societies. Holistic, accessible, and patient-centered detoxification and rehabilitation facilities and programs for those who are alcohol-dependent are essential to alleviating the burden of this disease.

Alcohol, sleep disturbances, and relapse. Alcohol consumption and sleep disturbances often co-occur (Paquet, Kawinska, & Carrier, 2007). Sleep disturbances can accompany alcoholism at various phases of the disease (Brower, Aldrich, Robinson, Zucker, & Greden, 2001; Brower, Conroy, & Arnedt, 2007; Irshaad, Colin, Shapiro, & Fenwick; 2013). Researchers and clinicians are interested in understanding the prevalence and correlates of sleep disturbances among recovering individuals who are

alcohol-dependent because they are associated with increased risk of relapse to drinking (Paquet, Kawinska, & Carrier, 2007).

Theoretical framework: Social Cognitive Theory. In theories of addiction, enabling factors that give people skills, resilience, and environmental control are important to both understand and elucidate as methods for overcoming dependence (Bandura, 1997). The Social Cognitive Theory (SCT) posits that personal factors, the environment, and human behavior exert influence upon each other through *reciprocal determinism* (Bandura, 1986; Figure 5.1). In addition to individual behaviors and personal factors, a supportive environment can increase the likelihood of sustained behavior change. An individual's sleeping environment and sleep-related cognitions, thoughts, perceptions, and behaviors, as well as other environmental factors, including facilitators and barriers to recovery, should be carefully considered in maximizing the success of recovery efforts.

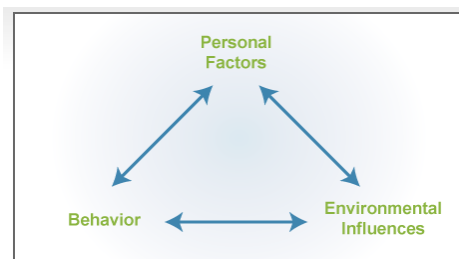


Figure 5.1: Social Cognitive Theory

Retrieved February 1, 2015 from <http://www.esourceresearch.org/Default.aspx?TabId=734>.

Self-efficacy (personal factor) is a major part of the SCT and refers to confidence in one's ability to take action and overcome barriers. Alcohol-related self-efficacy is predictive of lower likelihood of relapse for individuals in recovery (Adamson, Sellman, & Frampton, 2009). Self-efficacy has also been identified as a predictor and mediator of treatment success in various studies of alcoholism (Kadden & Litt, 2011). Perceived

sense of community, which is an aspect of the *environment*, can predict abstinence-specific self-efficacy (Stevens, Jason, Ferrari, & Hunter, 2010). This emphasizes the potentially important relationship between the environment and personal (cognitive) factors, as outlined in the theory.

Outcome expectancies (personal factor) and behavioral capability (behavioral factor) are also central concepts in the SCT and have been extensively explored in alcohol research. Outcome expectancies refer to the anticipated consequences of a behavior (i.e. sleep-related expectations). These might include sleep-related *cognitions*, such as dysfunctional beliefs about sleep, which are established contributors to poor sleep (Harvey, 2002; Yang, Spielman, & Golvinsky, 2006). Furthermore, cognitive arousal and inaccurate beliefs about sleep can lead to maladaptive sleep-related behaviors (Yang, Spielma, & Golvinsky, 2006). Behavioral capability encompasses knowledge and/or skills necessary to perform a behavior (one's ability to use non-alcoholic methods of initiating or sustaining sleep (e.g. relaxation techniques). On the contrary, unhealthy "safety" behaviors with regards to sleep, such as daytime napping and sleeping in on weekends to "make up" for lack of sleep can be harmful to overall sleep quality (Yang, Spielman, & Golvinsky, 2006). Some people may attempt to cope with sleep problems with such behaviors. Sleep-related expectations and behavior are both influenced by an individual's home sleeping *environment*: bedtime, lighting, temperature, pressure to attend to other obligations, bed-partner snoring, pets in the bedroom, and other factors.

Conceptual model based on the Social Cognitive Theory. Assessing sleep-related cognitions and behaviors of alcohol-dependent individuals may be important in understanding sleep quality and ultimately relapse to drinking. For individuals with sleep

problems, self-medicating with alcohol is one possibility, but sleep-related cognitions and behaviors could also play a role. Each broad construct of the Social Cognitive Theory (personal factors, environment, and behavior) were assessed with *both* qualitative and quantitative methods and analyzed concomitantly (Figure 5.2). Associations between constructs were examined, particularly as demonstrated by the concept of reciprocal determinism between personal factors, the environment, and behavior.

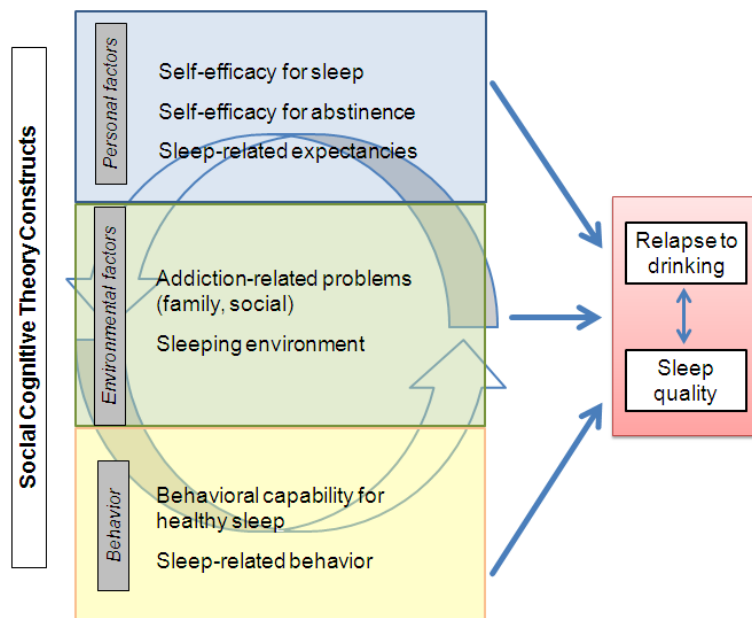


Figure 5.2: *Conceptual model based on constructs from the Social Cognitive Theory*

Purpose of study. This analysis utilizes a mixed methods approach to assess whether sleep quality, beliefs, and/or behavior of individuals who are alcohol-dependent are associated with sleep quality both pre- and post-discharge from a clinical research facility providing inpatient alcohol rehabilitation treatment. Our hypotheses, grounded in the Social Cognitive Theory and existing literature, are as follows: 1) higher self-efficacy

for sleep is associated with better sleep quality and lower relapse rates, 2) fewer dysfunctional beliefs about sleep are associated with better sleep quality and lower relapse rates, 3) higher endorsement of unhealthy sleep-related safety behaviors is associated with poorer sleep quality and higher relapse rates, and 4) better sleep quality is associated with lower relapse rates.

Methods

This study was approved by the NIH Addictions Institutional Review Board (IRB) at the National Institutes of Health (NIH; NCT # 02181659). All participants enrolled in this study were first admitted to a clinical research facility providing rehabilitation treatment under a screening and assessment protocol (Alcoholism Assessment and Treatment, NCT # 00106093), which enrolls adults over 18 years of age seeking treatment for alcohol dependency. Upon being admitted to the screening protocol, participants are evaluated and recruited for more focused research efforts, including the study described herein. All participants receive continued physical evaluations, inpatient treatment of alcohol withdrawal, psychosocial management, and an educational treatment program. Patients may receive six or more weeks of inpatient treatment followed by 16 weeks of optional outpatient treatment. Participants were paid for the study portions they completed based on guidelines from the NIH Bioethics Department (Dominguez, Jawara, Martino, Sinaii, & Grady, 2012) for a total possible payment of \$60. Enrollment in this protocol had no effect on treatment or research involvement at NIH.

Inclusion and exclusion criteria. Participants were eligible for this study if they were 18 years of age or older, enrolled on the screening protocol, an inpatient for 21 days

or more preceding discharge (to ensure that enough time had passed between administration of the measures), not simultaneously enrolled onto a pharmacologic intervention study, able to understand the study and provide informed consent, and willing to return to the Clinical Center four to six weeks after being discharged from inpatient treatment for a follow-up visit *or* complete the follow-up study visit by phone. All participants signed an informed consent document indicating their voluntary participation and understanding of study procedures and expectations.

Study timeline. Specific measures already collected as part of the screening and assessment protocol during the inpatient phase were used to characterize patients who participated in this study. Approximately one week prior to patients' scheduled discharge, a study team member approached patients to begin the first segment of data collection for the study. The interviews and questionnaires were conducted within one week of participants' scheduled discharge date and again four to six weeks post-discharge when they returned for a follow-up visit (or via phone).

Measures – mixed methods approach. Each construct in the SCT was assessed with both qualitative and quantitative data to explore the aforementioned research aims and provide both breadth and depth to our analyses. Collecting both types of data concurrently and comparing emerging themes from qualitative data with quantitative analyses will allow a more thorough understanding of the relationships between SCT constructs and sleep quality. This study incorporates *transformative* procedures in which the investigators use an overarching theoretical lens, the Social Cognitive Theory, to focus on constructs of interest and potential changes in primary outcomes. As outlined in the SCT, personal factors in this study will include self-efficacy for sleep, sleep-related

expectancies, and self-efficacy for abstinence (using alcohol craving as a proxy). Environmental factors will include assessment of addiction-related problems (specifically family and social issues related to alcoholism) and participants’ physical sleeping environments. Behavioral factors will include assessments of sleep-related behaviors. Sleep quality will be assessed with validated measures of sleep disturbance and relapse will be assessed primarily via self-report. Refer to Tables 5.1 and 5.2 for a list of all quantitative measures and an overview of how they fit in with SCT constructs, respectively.

Table 5.1: *Overview of quantitative study measures, validity and reliability, and point of collection*

Measure and possible range (if applicable)	Description of measure	Point(s) of collection
<p>Pittsburgh Sleep Quality Index (PSQI)</p> <p>Possible range: 0-21</p>	<ul style="list-style-type: none"> • 19-item, self-rated questionnaire used to measure sleep quality and disturbances over a one-month (30 days) time interval • Nineteen individual items generate seven “component” scores • Score of 5 or higher is indicative of poor sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) • Validated in populations with insomnia, other sleep disorders, psychiatric patients, and normal populations (Backhaus, Junghanns, Brooks, Riemann & Hohagen, 2002; Doi, Minowa, Uchiyama, et al., 2000) 	<p>Day 2 of inpatient treatment, approximately one week pre-discharge, and 4-6 weeks post discharge</p>
<p>Epworth Sleepiness Scale (ESS)</p> <p>Possible range: 0-24</p>	<ul style="list-style-type: none"> • 8-item questionnaire that provides a measure of an individual’s general level of excessive daytime sleepiness over a one week time period (Johns, 1991) • Individuals are asked to rate their usual chances of dozing off or falling asleep on a four-point scale in eight distinct situations or activities that most people engage in during their daily lives • A score higher than ten is indicative of <i>excessive</i> daytime sleepiness (Johns, 1993) • Numerous studies support high validity and 	<p>Approximately one week pre-discharge and 4-6 weeks post discharge</p>

	reliability (Johns, 1992; Spira, Beaudreau, Stone, et al., 2012)	
<p>Dysfunctional Beliefs and Attitudes about Sleep (brief version: DBAS-16)</p> <p>Possible range: 0-160</p>	<ul style="list-style-type: none"> • 16-item questionnaire assessing sleep-related cognitions including faulty beliefs and appraisals, unrealistic expectations, and perceptual and attention bias • Includes perceived consequences of insomnia, worry/helplessness about insomnia, sleep expectations, and medication (Morin, Vallieres, & Ivers, 2007) 	Approximately one week pre-discharge and 4-6 weeks post discharge
<p>Self-efficacy for Sleep Scale (SE-S)</p> <p>Possible range: 9-45</p>	<ul style="list-style-type: none"> • 9-item questionnaire measuring confidence a person has in performing behaviors that might be helpful in initiating sleep • Higher scores are indicative of greater confidence • Concurrent validity (Edinger, Wohlgemuth, Radtke, Coffman, & Carney, 2007), internal reliability (Edinger, Wohlgemuth, Radtke, Coffman, & Carney, 2007; Rutledge, La Guardia, & Bluestein, 2013), and test-retest reliability (Fichten, Libman, Creti, et al., 2001) has been established 	Approximately one week pre-discharge and 4-6 weeks post discharge
<p>Sleep-Related Behaviours Questionnaire (SRBQ)</p> <p>Possible range: 0-128</p>	<ul style="list-style-type: none"> • 32-item scale assessing the use of safety behaviors that individuals may use to promote sleep and cope with tiredness • Implementation of the techniques in the scale are associated with insomnia severity (Ree & Harvey, 2004) 	Approximately one week pre-discharge and 4-6 weeks post discharge
<p>Addiction Severity Index (ASI) – famle & social sub-scale</p> <p>Possible range: 0-8</p>	<ul style="list-style-type: none"> • Instrument used to comprehensively identify problems in multiple dimensions including medical, employment, drug and alcohol use, legal, family, social, and psychiatric (McLellan, Lester, John, et al., 1985) • 200-item interview that takes approximately 60 minutes to complete • We specifically examined the family and social sub-component of the scale, which indicates severity of problems in that domain • Scoring of the family/social section includes detailed assessments of living arrangements, marital status, number of close relationships, problems getting along with friends and family, and abusive relationships 	Day 8 of inpatient treatment
<p>Penn Alcohol Craving Scale (PACS)</p> <p>Possible range: 0-30</p>	<ul style="list-style-type: none"> • Clinical tool for practitioners to measure alcohol cravings • Five-item questionnaire that measures frequency, intensity, and duration of thoughts about drinking along with ability to resist drinking • Excellent internal consistency; construct, 	4-6 weeks post-discharge

	<p>predictive, and discriminant validity has been established (Flannery, Volpicelli, & Pettinati, 1999)</p>	
<p>Timeline Follow-Back (TLFB)</p>	<ul style="list-style-type: none"> • Collects drinking information using personal historical events recounted over a fixed time period (Sobell & Sobell, 1992) • Standard assessment for measuring alcohol drinking patterns and quantification in treatment programs • Demonstrated high test-retest reliability across multiple populations of drinkers; content, criterion, and construct validity have been demonstrated in both clinical and general population samples (Sobell & Sobell, 2000) 	<p>4-6 weeks post discharge</p>
<p>Childhood Trauma Questionnaire (CTQ)</p> <p>Possible range: 25-125 (5-25 for each of the 5 subscales)</p>	<ul style="list-style-type: none"> • 28-item scale assessing adverse experiences, including stressful experiences like physical and emotional abuse, neglect or other trauma experienced in childhood • Factor analysis supports the use of the CTQ as a screening instrument for maltreatment in clinical groups; demonstrates good evidence of criterion-related validity (Bernstein, Stein, Newcomb, et al., 2003) 	<p>Day 2 of inpatient treatment</p>
<p>Comprehensive Psychopathological Rating Scale (CPRS)</p> <p>Possible ranges: 0-60</p>	<ul style="list-style-type: none"> • 19 self-assessed variables that correspond to subscales for affective and anxiety syndromes (Åsberg, Montgomery, Perris, Schalling, & Sedvall, 1978) • Subscales include the Montgomery Åsberg Depression Rating Scale (MADRS) (Montgomery & Åsberg, 1979) and the Brief Scale for Anxiety (BSA); Tyrer, Owen, & Cicchetti, 1984) 	<p>Day 2 of inpatient treatment</p>

Table 5.2: *Quantitative measures and SCT constructs*

Social Cognitive Theory Constructs	<i>Personal factors</i>	Self-efficacy for sleep	Self-efficacy for sleep scale (SE-S)
		Sleep-related outcome expectancies	Dysfunctional Beliefs About Sleep Scale (DBAS-16)
		Self-efficacy for abstinence	Penn Alcohol Craving Scale (PACS)
	<i>Environmental factors</i>	Addiction-related problems	Addiction Severity Index (ASI; family/social sub-component)
	<i>Behavior</i>	Behavioral capability	Sleep-related behavior questionnaire (SRBQ)

Qualitative measures. Sleep and sleep-related behaviors can vary greatly from one individual to another. The qualitative component of this study was based on individual semi-structured interviews. A preliminary interview guide was developed and later revisions evolved after role-plays, group discussions, and final approval by the study’s principal investigator. The final questions were reviewed and pilot-tested by clinicians and investigators with extensive experience working with individuals who are alcohol-dependent. A second interviewer was present on all interviews and introduced to the participants with an explanation that he or she would observe, take notes, and probe additional questions based on the participant’s responses. This strategy was employed to decrease potential bias of only having one interviewer. During the pre-discharge interview, questions were focused on sleep patterns prior to becoming an inpatient, during the inpatient stay, and in anticipation of becoming an outpatient. During the post-discharge interview, questions were focused on changes in sleep over the transition from inpatient to outpatient status. Interviews were audio recorded with the interviewee’s consent. Questions were designed based on SCT constructs to complement quantitative

data and allow for the eventual convergence of qualitative and quantitative data. Refer to Table 5.3 for an overview of sample interview prompts related to SCT constructs.

Table 5.3: *Sample interview prompts related to SCT constructs*

Environment	
	<i>Describe the process of how you adjusted to being an inpatient in the Clinical Center.</i>
	<i>Describe how it has been to adjust to sleeping in this hospital. What about it is the same or different from your home environment? (Probe: What barriers or facilitators to recovery do you expect?)</i>
	<i>It's been about a month since you left the Clinical Center. Talk me through what the transition has been like as you returned to your home environment. (Probe: Describe any barriers or facilitators to recovery you have experienced.)</i>
	<i>Compared to what it was like in the hospital, what has your sleep been like since leaving the NIH?</i>
Behavior	
	<i>Describe the process of how you adjusted to being an inpatient in the Clinical Center.</i>
Behavioral capability	<i>Describe what you will do if you have trouble sleeping when you get home.</i>
Personal (cognitive)	
	<i>When you feel like you have had a really "good night's sleep," what does that generally mean to you? Describe this in as much detail as you can.</i>
Self-efficacy	<i>Describe what you will do if you have trouble sleeping when you get home.</i>
Expectations	<i>Describe in as much detail as you can any expectations you have about transitioning back into your home environment. (Probe: What barriers or facilitators to recovery do you expect?)</i>
Expectations	<i>How do you think alcohol affects sleep?</i>

Analyses - quantitative data. Statistical analyses of quantitative results were conducted with the Statistical Package for Social Sciences (SPSS) software, version 22.0. All quantitative data were double-data entered, cross-checked, and reconciled where necessary. The Addiction Severity Index (ASI), Penn Alcohol Craving Scale (PACS), Childhood Trauma Questionnaire (CTQ), Comprehensive Psychopathological Rating

Scale (CPRS), and basic demographics including age, gender, race, and ethnicity were used to characterize the sample. Initial analyses were descriptive and exploratory in nature to assess the prevalence of sleep disturbances pre- and post-discharge, based on a PSQI score of 5 or higher. Relationships between the PSQI, demographic variables, and sleep related beliefs and behavior were assessed by appropriate parametric or non-parametric tests.

Analyses - qualitative data. Each audio-recorded interview was transcribed and quality checked prior to analysis. For this analysis, a codebook was developed based on the Social Cognitive Theory (SCT). Each code was accompanied by an operational definition that allowed for clarity and consistency in the coding process. A team of coders independently reviewed all transcripts. After data were transcribed and cross-checked, NVivo (version 10.0) was utilized for further qualitative analysis. Using NVivo, inter-rater reliability percentages were calculated on a sub-sample of interview transcripts and a benchmark of 80% inter-rater agreement was met. Discordant coding was discussed until consensus among the coding team was achieved.

To ensure that the trustworthiness of qualitative data was preserved, three criteria assessing rigor were considered: credibility, auditability, and fittingness of the data (Barroso, 2010). Credibility refers to truth of the findings, often assessed by others in the discipline (Barroso, 2010). All themes were validated with a member of the clinical care team and a mixed methods expert at the NIH Clinical Center. Auditability refers to the “adequacy of the information leading the reader from the research question and raw data through various steps of analysis to the interpretation of findings” (Barroso, 2010, p. 119). Examples of data are presented alongside each theme to illustrate how data led to

each theme being identified (Streubert, 2010). Lastly, fittingness refers to the “faithfulness to everyday reality of participants” (Barroso, 2010, p. 119). Interviewing ample participants at two time points, until saturation was reached, provided a wealth of data from which to draw inferences to maximize the likelihood of the data's utility for informing practice (Streubert, 2010).

Use of mixed methods – *convergent parallel design*. The structure for the mixed methods analysis was a *convergent parallel design*, wherein both quantitative and qualitative data were collected simultaneously and each method of examination was given equal priority (Creswell & Plano Clark, 2011). More specifically, qualitative responses which reflect sleep quality, perceptions, experiences, and beliefs were combined with quantitative measures of sleep quality (PSQI) and perceptions, beliefs, and behavior (DBAS, SE-S, and SRBQ). The concept of reciprocal determinism was assessed through non-parametric correlations between personal, environmental, and behavioral quantitative assessments, as well as qualitative responses associated with each construct. Finally, each construct of the SCT was triangulated with relevant qualitative responses. For example, participants' averages on the SRBQ were analyzed as well as themes from qualitative interviews which discussed sleep-related behaviors and how they related to other theory constructs and outcomes of interest (sleep quality and/or relapse).

Results

Quantitative results. Participant demographics, baseline (inpatient) clinical variables, measures of craving, and relapse status at the post-discharge study visit are presented in Table 5.4 along with actual ranges for each variable. All study participants were non-Hispanic/Latino. The average length of inpatient stay was 31.23 days.

“Emotional abuse” and “emotional neglect” were the most commonly endorsed on the CTQ with a mean of 11.0 (s.d. 6.0) for both sub-scales. All participants self-reported “disturbed sleep” (PSQI \geq 5) upon being admitted to the inpatient facility (day 2; mean = 12.0, s.d. 4.0, range 5-20).

Eight participants had valid TLFB data at follow-up (4-6 weeks post-discharge). Of those eight, only one had relapsed within the 4-6 week post-discharge time frame, reporting drinking four of the 34 days with an average of 7.13 drinks per drinking day. Of the remaining 24 patients, five were lost to follow-up, one had a positive breath alcohol content (BAC) at the time of the follow-up interview, five admitted to relapsing during their follow-up interview, and 10 did not mention drinking during their follow-up interview and were thus treated as “missing” since verification of sobriety was not possible (denoted in Table 5.3). There were no significant differences in demographic variables, SCT-related sleep measures (DBAS, SRBQ or SE-S), or sleep quality (PSQI) scores between those who relapsed (n=7), those who were sober (n=7), and those whose relapse data were missing (n =10).

Table 5.4: *Participant demographics and clinical variables*

	Pre-discharge (n=32)*	Post-discharge (n=24)
	n (%)	n (%)
Gender		
Male	21 (65.6)	16 (66.7)
Female	11 (34.4)	8 (33.3)
Race/ethnicity		
Black/African-American	14 (43.8)	8 (33.3)
White	16 (50.0)	15 (62.5)
Other/multiracial	2 (6.2)	1 (4.2)
Relapse		
Relapse	N/A	7 (29.2)
No relapse		7 (29.2)
Missing		10 (41.7)
	Mean (s.d)	Mean (s.d)
Age (Range: 25-59 years)	44.16 (10.48)	46.33 (10.49)
Baseline depression (CPRS)** (Range: 2-37, n=31)	17.8 (7.8)	17.42 (7.09)
Baseline anxiety (CPRS)** (Range: 2-30, n=31)	12.9 (6.6)	12.75 (6.02)
ASI – Family/social composite score (Range: 0.00 to 0.75)	0.21 (0.24)	0.21 (0.25)
CTQ – (Sum of 5 components: emotional abuse, sexual abuse, physical abuse, emotional neglect, & physical neglect) (Range: 25-110)	46.78 (23.08)	N/A
PACS (Range: 0-28)	N/A	9.94 (8.79)

*If data are missing (n < 32), it is noted in the left column.

**In this table, “baseline” denotes day 2 of inpatient treatment.

Average PSQI scores both pre- and post-discharge indicated a prevalence of sleep disturbances at both time points. The average ESS scores both pre- and post-discharge indicated no prevalence of excessive daytime sleepiness at either time point. No significant differences were found in any of the sleep-related variables over time. However, both the PSQI and ESS scores decreased slightly and self-efficacy for sleep (SE-S) improved from pre- to post-discharge (Table 5.5).

Table 5.5: *Sleep-related variables pre- and post-discharge*

Within one week of discharge		4-6 weeks post-discharge	
	Mean (s.d.)		Mean (s.d.)
PSQI (Range: 2-17) n=31	7.52 (3.59)	PSQI (Range: 1-19) n=22	6.82 (4.81)
ESS (Range: 2-17) n=32	7.53 (3.73)	ESS (Range: 0-14) n=24	5.96 (4.24)
SE-S (Range: 16-40) n=32	28.94 (6.72)	SE-S (Range: 16-43) n=24	30.21 (7.54)
SRBQ (Range: 16-74) n=32	44.98 (14.96)	SRBQ (Range: 0-64) n=24	45.22 (15.47)
DBAS (Range: 0.25-7.38) n=32	4.19 (1.98)	DBAS (Range: 0.75-7.38) n=24	4.24 (1.69)

Associations between SCT constructs, sleep disturbances, and relapse. Table 5.5 displays significant associations between sleep-related SCT constructs (measured by the SE-S, DBAS, and SRBQ), sleep quality (measured by the PSQI), and relapse, assessed with Spearman's rho. Based on the four hypotheses, SCT constructs (self-efficacy for sleep, dysfunctional beliefs about sleep, and sleep-related safety behaviors) was tested with regards to a) sleep quality and b) relapse rates. No associations between relapse and any of the SCT constructs *or* sleep quality were found.

With regards to sleep quality, hypothesis #1 held true at both time points: those with higher self-efficacy for sleep reported better sleep quality. Interestingly, the opposite relationship than what was expected in hypothesis #2 was found: those with fewer dysfunctional beliefs about sleep (DBAS) had poorer sleep quality at the pre-discharge time point (no association existed at the post-discharge time point). Finally, hypothesis #3 held true only at the pre-discharge time point: those with higher unhealthy sleep-related safety behaviors (SRBQ) had poorer sleep quality (no association existed at the post-discharge time point).

Outside of the hypothesized relationships, several other significant relationships emerged (Table 5.6). Older participants were significantly more likely to endorse more unhealthy sleep-related safety behaviors (SRBQ) at both time points. Those with higher self-efficacy for sleep (SE-S) were significantly less likely to endorse unhealthy sleep-related safety behaviors (SRBQ) at both time points. Finally, those with higher addiction-related problems at baseline (ASI) and those who self-reported poorer sleep quality (PSQI) at the post-discharge time point both self-reported higher alcohol craving levels (PACS) at the post-discharge time point.

Table 5.6: Associations between SCT constructs and sleep quality (Spearman’s rho values)

Pre-discharge (n=32)					Post-discharge (n=22)					
	PSQI	Age	SRBQ	DBAS		PSQI	Age	SRBQ	ASI	PACS
SE-S	0.73**	0.13	-0.55**	-0.58**	SE-S	-0.92**	0.29	-0.51+	-0.16	-0.43+
DBAS	0.37+	-0.08	0.35	--	DBAS	0.20	0.23	0.36	0.38	0.28
SRBQ	0.48**	0.48**	--	0.35	SRBQ	0.39	0.58*	--	0.19	0.30
ESS	0.18	-0.01	0.33	0.55**	ESS	0.20	0.29	0.39	-0.32	-0.01
					PACS	0.49+	0.03	0.30	0.52*	--

+: p < .05
 *: p < .01
 **: p < .001

Regression modeling. Due to a relatively small sample size, linear regression models only included covariates which were significantly associated with dependent variable of interest (sleep quality) and were strictly exploratory in nature. Although the original intent was to also conduct a logistic regression model with an outcome of relapse (dichotomized), because only eight participants had valid TLFB data and only one of those eight participants had reported any drinking, the second model was not cogent. The predictor variables, which were all significantly associated with the outcome of interest (a change in PSQI scores from pre-discharge to 4-6 weeks post-discharge), included race (recoded as White vs. non-White), anxiety/depression scores from day 2 of

inpatient treatment, and the difference in SE-S scores from pre-discharge to 4-6 weeks post-discharge. In the final model, only the difference in SE-S scores from pre- to post-discharge ($\beta = -.472, p < 0.05$) significantly predicted the change in PSQI scores (Table 5.6). The overall model fit was $R^2 = 0.54$ and adjusted $R^2 = 0.43$. Thus, the pre- to post-discharge change was negatively correlated with the PSQI (those whose SE-S scores increased were more likely to experience a decrease on PSQI scores from pre- to post-discharge, indicating fewer sleep disturbances).

Table 5.7: Multiple linear regression modeling for prediction of difference in sleep quality by race, CPRS variables, and difference in SE-S scores

Independent variables	B	SE B	β	p
Race	2.761	1.472	.332	.078
Difference in SE-S score	-.421	.156	-.472	.015
Anxiety (Day 2)	.158	.154	.228	.318
Depression (Day 2)	.008	.133	.015	.950

Adjusted R^2 (denotes the adjusted proportion of the variance explained by the model) = .429.

B denotes the variable estimate.

SE B denotes the standard error of the variable estimate.

β denotes the standardized estimate.

Qualitative results. Inter-rater agreement percentages on coding were above the benchmark goal of 80%. The average length of interviews was 18.48 minutes (pre-discharge interviews) and 17.95 minutes (post-discharge interviews). Qualitative codes related to the SCT constructs included the following at both time points, with selected sub-codes listed in parentheses:

1. Personal factors

- a. Self-efficacy for sleep
- b. Self-efficacy for abstinence (barriers/facilitators to sobriety, responsibility for self / self-awareness)
- c. Sleep-related expectancies (perceived effects of poor sleep, sleep-related beliefs, definition of a good night’s sleep, dysfunctional beliefs about sleep, perceived importance of a good night’s sleep)
- d. Fear or uncertainty related to transition to becoming inpatient or returning home

- e. Alcohol's effects on sleep
- 2. Environmental factors**
 - a. Addiction-related problems (barriers and facilitators – family, social, or other, negative effects of alcohol on life)
 - b. Physical sleeping environment
 - c. Social support
- 3. Behavior**
 - a. Sleep-related behavior (routines or structure)
 - b. Healthy lifestyle
 - c. Mind-body remedies,
 - d. Use of pharmacological sleep aids
 - e. Self-medication

We first examined qualitative responses according to the four hypotheses which were also examined by quantitative associations. From Hypothesis #1, only one of the individuals who relapsed mentioned self-efficacy for sleep during their interviews. Conversely, virtually all of the individuals who did not relapse endorsed self-efficacy for abstinence during their interviews. None of the individuals with self-reported sleep disturbances at either time point (measured by the PSQI) qualitatively endorsed self-efficacy for sleep. From Hypothesis #3, five of the seven individuals who relapsed endorsed self-medicating sleep disturbances with alcohol during their interviews, compared to only two of the seven individuals who did not relapse. Only those who did not self-report sleep disturbances post-discharge (measured by the PSQI) discussed sleep-related behavior during their interviews. Qualitative findings offered less support for Hypotheses #2 and #4.

Outside of these hypothesized relationships but pertinent nonetheless, were the following qualitative associations: 1) all but one individual who did not relapse endorsed fear or uncertainty related to the transition to becoming an inpatient or returning back home, and 2) five of the seven individuals who did not relapse did not endorse lifestyle

changes since returning home during their follow-up interview. To further illustrate SCT themes endorsed during the qualitative interviews, Table 5.8 depicts themes related to the SCT along with selected quotations. The age, race, gender, and relapse status (if known) of the participant is presented alongside each quote.

Table 5.8: *Qualitative themes related to the SCT and selected quotes*

Sub-themes	Frequency of endorsement; n(%)*	Selected quotations
Personal factors		
Self-efficacy for sleep	Pre-discharge: 4 (12.5) Post-discharge: 1 (4.2)	<p>“I just did not wanna go to sleep...I...literally would stay up. And I would make sure I was very sleepy, or I would make sure I have a drink before I go to sleep...but now...I go to bed with no issue.” -53 year old African American female, pre-discharge, did not relapse</p> <p>“I can fall asleep pretty good – pretty quickly... I’ve gotten to the point where, if I want to, I can go back to sleep [after awakening].” -48 year old White female, pre-discharge, relapse status unknown</p> <p>“I was never able to sleep – until my mind was clear, you know, the reason why I don’t sleep is ‘cause I’m always thinking about what’s next for work... what I have to do here and there... and my mind was clear now, I was able to sleep very well.” -35 year old African American male, pre-discharge, relapse status unknown</p> <p>“I can see that if I put effort in, I can see changes... and I love sleep. I love it.” -57 year old White female, post-discharge, relapsed</p>
Self-efficacy for abstinence (barriers/facilitators to sobriety, responsibility for self / self-awareness)	Pre-discharge: 28 (87.5) Post-discharge: 11 (45.8)	<p>“...the expectations I look for are all on me. I mean, I’m looking at myself being a responsible person... just like I was responsible for drinking, I want to be responsible for my recovery.” -55 year old African American male, pre-discharge, did not relapse</p> <p>“‘Cause I feel like if I ever feel overwhelmed again, I probably will slip back down.” -27 year old African American male, pre-discharge, did not relapse</p> <p>“I think I have a great chance of getting the habit wrestled into some kind of shape, but I also know that I can lose it really easily.” -49 year old White male, pre-discharge, did not relapse</p> <p>“[I’ve]...been listening and thinking about all my past and drinking and situations and I know how to go about situations now.” -28 year old African American male, pre-discharge, relapse status unknown</p> <p>“I gotta be responsible enough to follow this program... and do what I have to do for myself because I expect me to maintain my living. Maintain the job.” -55 year old African American Male, pre-discharge, did not relapse</p> <p>“I know how to ask for help now.” -53 year old African American female, pre-discharge, did not relapse</p>

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		<p>“It’s about me changing how I’m going to deal with things when I’m out of here – you know, ‘cause I have to avoid any triggers and stuff like that, but, hey – you can’t control everything, at least you can try to control yourself.” -35 year old African American male, pre-discharge, relapsed</p> <p>“I just gotta help myself. That’s the first thing – first and foremost. Social things to do – people to talk to, meetings to go to...barriers have been the same. When I go back it’s not gonna be no different, so...it’s all about how...I decide to deal with it.” -27 year old African American male, pre-discharge, did not relapse</p> <p>“The knowledge and the support and the network is definitely there, so – that’s very good. I think it was me just needing to...take all the knowledge that I have and apply it.” -47 year old White female, post-discharge, did not relapse</p> <p>“I haven’t really been close to doing anything – I haven’t had any temptations that have made me uncomfortable...I do – I used to play professional pool – and I really am missing shooting pool. You can’t find any non-alcoholic or sober pool halls.” -37 year old White male, post-discharge, relapse status unknown</p>
<p>Sleep-related expectancies (perceived effects of poor sleep, sleep-related beliefs, definition of a good night’s sleep, dysfunctional beliefs about sleep, perceived importance of a good night’s sleep)</p>	<p>Pre-discharge: 27 (84.4) Post-discharge: 21 (87.5)</p>	<p>“I’m more optimistic when I sleep – sleep is so important to me...and not too much. If I have too much, then...I remain tired for longer than I should be. But six, six and a half hours is great.” -50 year old White male, pre-discharge, relapsed</p> <p>“A good night’s sleep is just a good, peaceful sleep...no nightmares...no dreams...just, good solid sleep where you just, your mind is just relaxed and blank. That’s a good night’s sleep to me.” -55 year old African American male, pre-discharge, did not relapse</p> <p>“I like eight – minimum eight hours of sleep. I like to sleep through the night. If I get up to go to the bathroom, go right back to sleep. So, it’s [an] uninterrupted eight hours of sleep...eight or nine hours – is optimal for me.” -57 year old White female, pre-discharge, relapsed</p> <p>“I define a good night’s sleep by how long it takes me till the next time I feel sleepy. Sometimes I go to sleep, and wake up, and an hour later I’m sleepy again. Sometimes I wake up...and then, I’m good for almost the whole day.” -27 year old African American male, pre-discharge, did not relapse</p> <p>“But – if you’re really here – the sleep is huge...it has such a mood factor. At least, for me...it makes a huge difference...in my attitude, productivity...”-50 year old White male, pre-discharge, relapsed</p> <p>“If I sleep for six hours...at a given time, then I hope to pick up the other two later. Somehow.” -60 year old White male, pre-discharge, relapsed</p> <p>“I feel... fresher, I feel lighter on my feet [the morning after a good night’s sleep].” 30 year old Asian female, pre-discharge, relapse status unknown</p> <p>“A good night’s sleep for me is...when I fall asleep...in a serene space, you know, in my head...and wake up usually – usually six hours...six to seven at the most is – is, like, a really good number for me. I wake up energetic, um...and ready to start the day.” -48 year old White female, pre-discharge, relapse status unknown</p>

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		<p>“When I don’t get sleep, it just feels like I have an annoying little...headache or something...it just makes me grouchy.” -51 year old African American male, pre-discharge, relapse status unknown</p> <p>“I really need eight hours of sleep...minimum. My body can’t go on, like, this five hours that some people do. I have to have my sleep.” -57 year old White female, pre-discharge, relapsed</p> <p>“Being continually...short on sleep is like having Alzheimer’s, I guess, you...don’t learn as easily, you don’t retain as much...you drift off – concentrating is hard, I know it’s – that’s much less of problem if I’ve been getting enough sleep. And I guess I’m not so depressed.” -51 year old male, multiple races, pre-discharge, relapse status unknown</p> <p>“What I envision as a good night’s sleep is...if I wake up and haven’t moved. I don’t know if that has anything to do with a true good night’s sleep, but I know if my covers have not been shuffled all over, thrown off the bed, and I have not moved much, plus didn’t wake up at night – maybe to go to the bathroom, but if I sleep the whole night through and don’t wake up...and don’t move around much, I know it’s a restful sleep.” -57 year old White female, post-discharge, relapsed</p> <p>“My personal definition of what a good night’s sleep would be...I guess if I woke up feeling good. If I woke up feeling like I was ready to go, and – and rested, that would be a good night’s sleep...a good night’s sleep has been four hours of sleep, a good night’s sleep has been eight hours of sleep.” -37 year old White male, post-discharge, relapse status unknown</p> <p>“It isn’t so much the duration as it is the intensity [of sleep] that matters to me...”-49 year old White male, post-discharge, relapsed</p>
<p>Fear or uncertainty related to transition to becoming inpatient or returning home (pre-discharge only)</p>	<p>Pre-discharge: 24 (75.0) Post-discharge: N/A</p>	<p>“It took me a couple of days...to get adjusted. Uh...I’m – I observe things when I’m around new things or people... just to see how comfortable I can get.” -34 year old African American female, pre-discharge, relapse status unknown</p> <p>“The first couple days I was really sick...I was withdrawing, I was nauseous...I just didn’t really wanna be around anybody at first.” -32 year old White female, pre-discharge, relapse status unknown</p> <p>“I always lived with somebody or roomed with somebody...just being responsible for myself now...it’s kind of – just a fear.” -55 year old African American male, pre-discharge, did not relapse</p> <p>“...nervous, excited...I feel like I’m going to college – I feel like I’m a freshman...I can’t wait to meet my roommate...just excited and nervous, but I know I’ll be fine.” -37 year old White male, pre-discharge, relapse status unknown</p> <p>“I would be disillusioned to tell you I got this thing figured out, or – anything like that...but...I can’t live here forever...I hope that I have enough incentives – with my son, who...he’s 10 years old. He’s always watching his dad.” -45 year old White male, pre-discharge, relapse status unknown</p>
<p>Alcohol’s effects on sleep</p>	<p>Pre-discharge: 28 (87.5) Post-discharge: 23 (95.8)</p>	<p>“It affects sleep...tremendously. Because I’ve stopped remembering my dreams. I don’t think I’m getting REM sleep.” -57 year old White female, pre-discharge, relapsed</p>

MIXED METHODS ALCOHOL AND SLEEP 121

		<p>“Still being tired, waking up and still half-drunk like you ain’t been asleep...and it...affect[s] your whole day.” -28 year old African American male, pre-discharge, relapse status unknown</p> <p>“I have to learn how to sleep again...I didn’t sleep, I fell out. I just passed out. It’s been going on for...five years.” -54 year old African American male, pre-discharge, relapse status unknown</p> <p>“That’s what’s so great about alcohol...is that – in and out – when you’re going to sleep, that feeling of, like...I love that feeling when you’re watching TV and you can’t keep your eyes open and you force yourself to watch a little bit more and then you fall asleep...that’s what alcohol does. It kinda gets you that, like, really mellow, in-between falling asleep thing.” -57 year old White female, pre-discharge, relapsed</p> <p>“Passing out isn’t sleeping, it’s loss of consciousness and there’s no real rest involved.” -49 year old White male, pre-discharge, did not relapse</p> <p>“It wasn’t sleep, it was just...how do I describe it? Um...aside from the fact that it looked like sleeping, it wasn’t sleeping – it was just checking out for a while and then waking up.” -30 year old Asian female, pre-discharge, relapse status unknown</p> <p>“As far as sleep...the sleep has been actually very good. Except, I think, the nights I drink. When I drink, I don’t sleep as well – you know – you pass out, you’re really not sleeping.” -57 year old White female, post-discharge, relapsed</p> <p>“I get up saying ‘wow, you had a good night’s sleep.’ And that’s due from not using the alcohol. Because when I was on the alcohol I did not wanna sleep, because when I’d wake up, I’d...have to deal with life.” -53 year old African American female, post-discharge, did not relapse</p> <p>“Going to sleep when you’re passed out, you don’t remember anything and you feel like you never went to sleep.” -47 year old African American male, post-discharge, relapse status unknown</p> <p>“I’d wake up...every couple hours, you know, like – ‘course...even going through withdrawals, you know what I mean, you’re sweating, and...then you’d have the chills, and nausea – oh, it was awful.” -32 year old White female, post-discharge, relapse status unknown</p>
Environmental factors		
<p>Addiction-related problems (barriers and facilitators to society – family, social, etc)</p>	<p>Pre-discharge: 25 (78.1) Post-discharge: 10 (41.7)</p>	<p>“I’ve been looking for a job for seven years...I’ve had four interviews and filled out hundreds of applications. This is enough to lead me to drink.” -60 year old White male, pre-discharge, relapsed</p> <p>“People that have relapsed, they can tell you what their triggers are. They can tell you what caused them to drink...I can’t. I have no...clue what’s gonna trigger me and what’s not gonna trigger me...getting my ID and putting it in my back pocket is a trigger. ‘Cause when do you put your ID in your pocket? When you’re going to a bar.” -37 year old White male, pre-discharge, relapse status known</p> <p>“I cleaned out my phone of about 15 contacts of people that – I don’t need to be...in contact with anymore... I got a list of changes, uh – as far as rerouting</p>

MIXED METHODS ALCOHOL AND SLEEP 122

		<p>when I'm coming home from work and staying away from certain things that are familiar to me, you know, 'cause – I could easily find myself right back in front of a liquor store, without even knowing – you know, just by habit, you know – what I was – used to do before.” -35 year old African American male, pre-discharge, relapse status unknown</p> <p>“This is a safe zone. I know there's no alcohol in here. But you know how many liquor stores and...street drugs they got out there – it's so many of them.” -55 year old African American male, pre-discharge, did not relapse</p> <p>“Well, I can honestly tell you that...I belong to a couple private clubs and I guarantee you that if I have 100 friends, 95 of them could be in here as well. So I need to make a conscious effort – a lot of people know that I came in – I came in on my own free will...but I...just need to keep a low-profile. So I'm going to...just...almost – I don't wanna say 'be a hermit,' but...I'm just gonna keep a low-profile...” -50 year old White male, pre-discharge, relapsed</p> <p>“It's the same job, same house and everything, it's...wasn't my doing, but [laughter]...my significant other...changed everything up. My bar went to sodas and Gatorade.” -47 year old African American male, pre-discharge, did not relapse</p> <p>“So I thought...a beer – a beer or two going out, I could handle it. And I could. And I stopped at that. And then I was like, 'oh, well'...the next day I'm not craving a beer, two days later I'm not craving a beer, so I can...go out a little bit and have, you know, three or four drinks. And then...it's probably in part because...I kinda just had freedom and isolation a little bit, and...had a girl over, and started drinking lots of whiskey, pretty heavily, and going out after that...I guess probably in part because...isolated myself from the individuals who would be telling me that I was drinking too much.” -26 year old White male, post-discharge, relapsed</p> <p>“Everybody around me...they're heavy drinkers, and it's funny, 'cause since I left, I've been around them...while they were drinking. And I look at them, like – nah, I'm good...I don't need it. And I thought that would be really hard for me.” -27 year old African American male, post-discharge, did not relapse</p>
Physical sleeping environment	Pre-discharge: 19 (59.4) Post-discharge: 6 (25.0)	<p>“I wasn't actually sleeping all the time before I got here, because I was...running the streets and...sometimes I wouldn't go to sleep for two or three days.” -55 year old African American male, pre-discharge, did not relapse</p> <p>“This is not home...it somehow gets affected...I – I don't know if it's just me, but when I move to – if I go...someplace that I'm not really – and I'm just trying to adjust, it's...sleep is kinda strange for...you know, to get used to the environment.” -35 year old African American male, pre-discharge, relapse status unknown</p> <p>“I would think that the difference between being here and being at home...your sleep patterns would be directly related to comfort.” -47 year old White female, post-discharge, did not relapse</p>
Social support	Pre-discharge: 27 (84.4) Post-discharge: 19 (79.2)	<p>“I'm very proud of my brother. He's been through the wringer. He's been married and divorced, he's got two kids...and just the difference in what I've seen from him. I wouldn't be here today if I hadn't seen him get sober.” -37 year old White male, pre-discharge, relapse status unknown</p>

MIXED METHODS ALCOHOL AND SLEEP 123

		<p>“...I really don’t have a lot [of support]. I don’t have that...the kids are all off to college. I don’t have a whole lot of family – like, my immediate family is no support...I have some very good friends...that’ll be there for me.” -50 year old White male, pre-discharge, relapsed</p> <p>“I heard a lot of peoples’ stories about how... alcohol ruined they life, and...I’ve been thinking about all my past and drinking and situations...and...I know how to go about situations now. If I need help, instead of picking up a bottle I can call my sponsor, or...go to a meeting.” -28 year old African American male, pre-discharge, did not relapse</p> <p>“Get a sponsor, learn how to be open, and...be honest, and then – if I ever run into a problem, that I’m gonna drink, don’t act like the phone weigh[s] 1000 pounds.” -43 year old African American male, pre-discharge, relapse status unknown</p> <p>“The meetings...I’ll build a network, once I...go there, a lot of it I can’t really say right now because I don’t have it, but what I plan on doing – well, I – what I do have is friends and my significant other which is very good...family members...but I also plan on going out and building a network, grabbing a sponsor, seeing how that works.” -47 year old African American male, pre-discharge, did not relapse</p> <p>“I kinda isolated myself from the individuals who would be telling me that I was drinking too much...” [Interviewer]: And who are those individuals? “...my parents.” -26 year old White male, post-discharge, relapsed</p> <p>“As far as support, I have really good support at work...I have eight people that work for me and they’re all substance abuse professionals, it’s...a very supportive environment. And my family’s very supportive – my daughter’s a substance abuse nurse.” -47 year old White female, post-discharge, did not relapse</p>
Behavior		
<p>Sleep-related behavior (routines or structure)</p>	<p>Pre-discharge: 27 (84.4) Post-discharge: 22 (91.7)</p>	<p>“...walking, meditating...a hot bath...music...talk to my sponsor...just things – the next right thing, that I know to keep me where I need to be, instead of running...I wanna try to stay away from the Tramadol as much as possible...I would much rather drink the chamomile tea...but if that doesn’t work then I would go to the Tramadol...only if I really needed to. So...exert myself more doing things – walking and all that.” -50 year old White female, pre-discharge, relapse status unknown</p> <p>“If I didn’t fall asleep, I would drink until I fell asleep, so...I didn’t go to bed when I needed a night’s sleep, I would go to bed with a bottle and just pass out.” -54 year old African American male, pre-discharge, relapse status unknown</p> <p>“I listen to music...play music. You know, I’m fortunate to have something like that...it’s a great...comfort for me.” -47 year old African American male, pre-discharge, relapse status unknown</p> <p>“That’s just – almost a lifetime pattern...I never use an alarm clock, and it’s...one of the things I’m proud of - that I can wake myself up” -49 year old White male, pre-discharge, relapsed</p> <p>“I’m kind of conditioned now to where I won’t get in bed until I know I’m</p>

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		<p>gonna sleep – I have to wear myself out.” -54 year old White male, pre-discharge, relapse status unknown</p> <p>“I would take deep ...those long, drawn-out ... get back on my back, cross my arms and take those and honestly, in no time, I’m sleeping. I would read...I would most likely read the bible and – or I’ll just pray.” -35 year old African American male, pre-discharge, relapse status unknown</p> <p>“I haven’t even been taking the [sleep medication prescribed to me]...’cause those will make me drag in the morning when I have to go to work.” -50 year old White female, post-discharge, relapse status unknown</p>
Mind-body remedies	<p>Pre-discharge: 5 (15.6) Post-discharge: 4 (16.7)</p>	<p>“I’m back into mediation now...and I’ve also got chamomile tea. But I’m looking forward to sleep now. And I’ve got tools to cope with now.” -53 year old African American female, pre-discharge, did not relapse</p> <p>“[I] do some deep breathing with [my]...stomach...some with just your chest – then you’re breathing with both your stomach and your chest, breathing in and out – you know, at different paces. It’s very relaxing.” -47 year old African American male, pre-discharge, did not relapse</p> <p>“I’ve been doing some...guided imagery and some self-soothing tapes to all work with my...upheavals. ‘Cause I get...a little bit stressed.” -57 year old White female, post-discharge, relapsed</p> <p>“Yoga...to get in shape...and mind-wise, [it’s] quiet time.” -49 year old White female, post-discharge, did not relapse</p> <p>“I still meditate every day in the shower...it works.” -54 year old African American male, post-discharge, relapse status unknown</p>
Self-medication	<p>Pre-discharge: 13 (40.6) Post-discharge: 7 (29.2)</p>	<p>“One of the reasons I continue to drink is avoiding...the sleepless nights.” -49 year old White male, pre-discharge, did not relapse</p> <p>“I’m really high anxiety...I would run to the liquor store and it was a relief...” -50 year old White female, pre-discharge, relapse status unknown</p> <p>“The relapses were from...chaotic thoughts in my mind. Just thoughts that I felt I could not control. And I felt...so much turmoil, I wanted to put them at peace...and sometimes, drinking to that point puts them out. I know it’s not a solution, but that’s what I’m thinking.” - 57 year old White female, post-discharge, relapsed</p> <p>“A lot of the times it’s difficult for me to fall asleep just because...you have racing thoughts and alcohol is a really easy way to kind of kill that.” -26 year old White male, post-discharge, relapsed</p> <p>“My idea to deal with the problems was to use alcohol to anesthetize myself versus finding any real-word solutions to – because I just – I felt like I had run to the end of the course” -60 year old White male, post-discharge, relapsed</p> <p>“I would drink to go to sleep. I couldn’t sleep. So, I drank to go to sleep every night...and then I’d get up and go to work...and then I found myself - on weekends, when I didn’t have to get up and do anything, when I woke up in the middle of the night, I would drink to go back to sleep.” -57 year old White female, post-discharge, relapsed</p> <p>“A lot of the times it’s difficult for me to fall asleep just because...you have</p>

		“racing thoughts and alcohol is a really easy way to kind of kill that.” -26 year old White male, post-discharge, relapsed
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*Total number of interviews for each time point: Pre-discharge (Time 1), n=32; Post-discharge (Time 2), n=24.

As demonstrated in Table 5.6, participants reported varying levels of self-efficacy for sleep at the pre- and post-discharge time points. Self-efficacy for abstinence was often discussed in terms of anticipated (pre-discharge) or actual (post-discharge) barriers and facilitators to sobriety. Participants expressed their perceptions of the implications of getting quality sleep at both time points. Those who relapsed could make actual comparisons between “sober” and “intoxicated” sleep post-discharge, but most participants reflected on their experiences before, during, and after their inpatient stay to summarize their perceptions of the effects of alcohol on sleep. Differences in the physical sleeping environment pre- and post-discharge were outlined. Social support included other individuals who are alcohol-dependent in recovery, family, friends, and *Alcoholics Anonymous* sponsors. Finally, participants highlighted changes in sleep-related behaviors between pre- and post-discharge time points.

Discussion

As with previous studies (Benca, 1996; Levola, Aalto, Holopainen, Cieza, & Pitkanen, 2014), the individuals in this study were facing a wide range of co-morbid conditions. As with previous studies establishing the prevalence of sleep disturbances on inpatient alcoholism treatment units (Gillin, Smith, Irwin, Kripke, & Schuckit, 1990; Smith et al., 2013; Wallen, Brooks, Whiting, et al., 2014), average PSQI scores in this study were above the cut-off for “disturbed sleep” at baseline (day 2 of inpatient treatment) and approximately one week prior to discharge. In addition, sleep disturbances 4-6 weeks post-discharge remained an issue during various stages of drinking, sobriety,

and in some cases, withdrawal (Table 5.4). Consistent with previous findings (Wallen, Brooks, Whiting, et al., 2014), the ESS proved to have low variability across time points, and participants did not experience excessive daytime sleepiness on average. Although the PSQI and ESS scores both improved slightly from pre- to post-discharge, neither change was statistically significant (likely due to a small sample size). However, participants did commonly report frustrations with sleep during their interviews, as evidenced by themes such as attempting to self-medicate sleep disturbances with alcohol (both pre- and post-discharge) and the use of sleep-related safety behaviors (SRBQ) – including pharmacological sleep aids. At the pre-discharge time point, those with higher unhealthy sleep-related safety behaviors (SRBQ) reported poorer sleep quality which is congruent with one previous study (Yang, Spielman, & Glovinsky, 2006). The correlation between age and the SRBQ at both time points was not an *a priori* hypothesized relationship, but may reflect that older participants had engaged in more sleep-related behaviors and employed more strategies than younger participants. Participants perceived the effects of alcohol on sleep to be largely negative, and many differentiated between intentionally initiating sleep while sober versus “passing out,” or falling asleep after drinking.

The exploratory regression analysis examining predictors of sleep quality demonstrated that race, baseline anxiety/depression, and change in self-efficacy for sleep scores explained over 40% of the variance in sleep quality improvement over time (adjusted $R^2 = 0.429$). This finding in a small sample has implications for informing future power analyses for examining the predictors and outcomes in a similar population.

Qualitative findings suggested positive associations between 1) not relapsing and fear or uncertainty related to the transition to becoming an inpatient or returning back home and 2) not relapsing and not endorsing lifestyle changes since returning home during the follow-up interview. The first finding could suggest that some degree of anxiety surrounding these transitions may actually serve a positive purpose (i.e. mobilize coping strategies). The second finding could be indicative that those who did not relapse already had positive behaviors in place prior to their inpatient admission and thus did not need to make major adjustments to their lifestyles.

Many of the sleep-related themes that emerged from the interview were virtually inseparable from constructs related to the *environment*. One specific example of this was a participant struggling to answer questions about social support and the general recovery process because she was preoccupied with post-discharge housing concerns. An individual's physical and emotional environment for recovery and sleep ultimately affects sleep quality and are important to consider in relation to relapse.

In most interviews, self-efficacy for sleep did not emerge as a theme in and of itself. Instead, participants conceptualized it as the strategies they learned while they were inpatients to quiet racing thoughts, "wind down," and prepare themselves for bed. However, participants reported varying degrees of self-efficacy for *abstinence* at both time points. Another study demonstrated that self-efficacy for abstinence was associated with lower risk of relapse for individuals in recovery (Adamson, Sellman, & Frampton, 2009), which should be explored in a larger sample with both quantitative and qualitative approaches. Much of the fear and/or uncertainty regarding re-integrating back into their homes and communities could be linked to social support.

Finally, those who reported self-medicating sleep disturbances with alcohol use and/or perceived the effects of alcohol on sleep to be all or mostly positive could be targets for future sleep interventions, particularly if they report high levels of craving post-discharge and low social support. Understanding sub-groups and eventually developing predictive models for sleep and relapse will be helpful in targeting treatments and ensuring that those patients who are potentially most at-risk for relapse receive the support they need. Both the quantitative correlations and the inter-relatedness of SCT qualitative themes supported the concept of reciprocal determinism among certain SCT constructs. References to behavior or personal factors were often discussed in tandem with the environment for recovery and vice versa.

Participants reported both a) self-medicating anxiety with alcohol and b) self-medicating the inability to fall asleep with alcohol. The use of alcohol to self-medicate sleep disturbances has not yet been explored in-depth, and this finding warrants further investigation. While self-efficacy for sleep was positively correlated with sleep quality and negatively correlated with the SRBQ, as previously mentioned, it was not frequently endorsed qualitatively. This may have been because individuals did not generally perceive “good sleep” as something they could have confidence in their ability to achieve; as demonstrated by qualitative findings, it is more likely that they associated sleep quality with their environment, their drinking, and/or their behavior.

Interestingly, relapse was not quantitatively correlated with sleep quality or any of the measures linked to constructs from the SCT. Although our measure of relapse was limited, this finding differs from the existing literature on sleep disturbances and relapse. However, several interesting correlations emerged from the alcohol craving measure

administered only at the post-discharge study visit: 1) those reporting higher levels of craving were more likely to have more disturbed sleep, 2) those reporting higher levels of craving reported lower self-efficacy for sleep, and 3) those reporting higher levels of craving also scored higher on the family/social sub-scale of the ASI. Since all of the participants who returned for the post-discharge study visit completed the PACS, these findings suggest that sub-groups of individuals who are alcohol-dependent who report higher craving levels, which are undoubtedly influenced by their recovery environment, may warrant targeted sleep interventions. Furthermore, the qualitative results supported the relationships between environment for recovery (specifically facilitators and barriers to sobriety), personal factors, and behavior.

Strengths and limitations. Despite the TLFB data being largely missing among outpatients (reflective of the difficulty of follow-up with individuals who are alcohol-dependent in recovery, both in our clinic and elsewhere), the mixed methods approach allowed us to explore relapse from multiple sources and standpoints. Although the sample size included in this analysis was inadequate to explore predictive modeling between SCT constructs and the outcomes of interest (sleep quality and relapse), the qualitative component provided a wealth of information from which to draw inferences and make recommendations for future research and interventions. We believe that by grounding our measures in the SCT, we were able to identify potentially modifiable cognitions and/or behaviors associated with sleep quality and craving measure. Whether the sleep-related cognitions, environmental factors, and behaviors included in this study are truly modifiable in the target population remains to be determined. Although self-reported relapse was largely missing in the sample, the craving measure provided unique

insight and a proxy measure to identify those who may be most at-risk for relapse, particularly in the short-term follow-up period (four to six weeks post-discharge).

While qualitative analysis is subject to inherent coder biases, to maximize the likelihood of our analysis being representative, multiple coders/validators developed the coding scheme to ensure that final versions represented the findings discussed herein. Many studies collect and analyze qualitative and quantitative data separately, as in the case of multi-phase research designs, but because of the lack of mixed methods research on this topic, this exploratory pilot sample provided unique and preliminary insight.

Given the success of behavioral sleep interventions in various populations demonstrated by recent literature and the unique potential contributions of mixed methods approaches to examine sleep and alcohol use, assessing sleep-related *cognitions* and *behaviors* of alcohol-dependent individuals may be important in understanding sleep quality and subsequent relapse. Because sleep is a personal aspect of health and individual variations were so great, as evidenced by the selected qualitative findings, the SCT elements provided a mechanism by which to ground our measures and begin to examine individual differences in a meaningful way. The use of the SCT highlights the unique and potentially important role that psychosocial theory constructs could play in understanding sleep and relapse, and ultimately contribute to the design of behavioral interventions that are population-specific or individually tailored based on beliefs, cognitions, and individual environment. Self-efficacy for sleep is a potentially modifiable construct, and these findings support including self-efficacy for sleep as a potential target of future behavioral sleep interventions in this population.

Conclusions. Even with pharmacological treatment mechanisms emerging for both sleep and relapse, it is important for practitioners to consider personal, environmental, and behavioral aspects surrounding sleep in relation to relapse. These study findings support that in order to bring about changes in behavior (e.g. healthy sleep hygiene), it may be important to address underlying beliefs. Future behavioral sleep interventions could include elements that can be mapped onto the SCT constructs and address all three overarching themes of personal, behavioral, and environmental influences on sleep quality.

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CHAPTER 6: Summary, conclusions and future directions

This chapter summarizes the findings of this project, describes potential implications for the field and for public health, outlines strengths and limitations, and suggests future research tracks. This project has yielded one peer-reviewed publication thus far (Brooks & Wallen, 2014), with one under review (a condensed version of the study protocol submitted to the *Journal of Mixed Methods Research* on February 6th, 2015) and two in preparation for submission, included herein. The intramural protocol will soon be amended to include objective measures of sleep, similar to what was collected during the preliminary phase establishing the prevalence of sleep disturbances on the inpatient unit from 2011 to 2013. Preliminary findings from this study were presented at an NIH Intramural Sleep & Chronobiology Special Interest Group (SIG) meeting in January of 2015. Findings will be presented to the NIAAA Laboratory of Clinical and Translational Studies (LCTS) in April of 2015. In addition, selected results will be presented as an oral presentation as part of an symposium on alcohol and sleep at the upcoming *Research Society on Alcoholism* meeting in San Antonio, Texas of June of 2015.

Summary of findings

Of the three publications in this dissertation, the first paper provided an overview of CBT-I and related behavioral therapies applied to those with alcohol-related disorders and accompanying sleep disturbances, highlighting the potential utility of mixed methods research in informing acceptable interventions. The second and third papers utilized a mixed methods approach to examine sleep throughout inpatient alcohol rehabilitation, across the transition from inpatient to outpatient, and beyond; the latter highlighting

constructs stemming from the SCT. Paper #2 highlighted individual variation in transitions throughout the recovery process (becoming an inpatient, adjusting to a new environment, and eventually transitioning back to the community), specifically related to sleep. Paper #3 began to elucidate the potential role of SCT constructs in affecting sleep quality and/or relapse.

The overarching goals of this study were to assess patients' perceptions of and experiences with sleep throughout the process of alcohol rehabilitation, specifically focusing on the transition from the facility providing inpatient rehabilitation treatment back to the community, and to conduct exploratory analyses of the associations between sleep-related beliefs and behavior with sleep quality and relapse. A mixed methods approach generated a unique database from which to examine these original aims. The conceptual model, grounded in the SCT, provided a framework for examining the issue of sleep disturbances situated in the context of environmental, personal, and behavioral factors throughout the process of alcohol rehabilitation. Instead of treating individual symptoms of co-morbid conditions accompanying alcohol dependence (often with pharmacological approaches), the conceptual framework suggests a way of examining the issues within the constructs of the SCT. Sleep disturbances are one of many co-morbid conditions common in the target population; multi-component health behavior theories may offer a unique method of conceptualizing both explanatory models and future intervention approaches. This study embodies a health behavior-oriented theory and methodological approach utilized in a clinical setting, spanning two separate but related disciplines and environments. However, alcoholism is a disease and not necessarily a health behavior in and of itself. The intramural and clinical environment is an ideal

setting to eventually explore behavioral approaches to addressing sleep disturbances among individuals with chronic diseases, including alcohol dependence.

The wealth of qualitative data accrued in this project lent itself to in-depth exploratory analyses. As anticipated, additional quantitative data (self-report and other) will be needed to power predictive models. Although participants were compensated minimally for participation (\$60 for completing both study visits), personal connections between the research team and patients were formed; patients expressed a willingness and desire to “finish what they started” with the study. Additionally, an undertone of altruism – wanting to participate in the research to help future patients – emerged clearly from the interview transcripts, particularly from the second time point when participants were probed about feasibility, acceptability, and suggestions for content and format of possible future intervention studies. Through collaboration with other intramural investigators, certain clinical co-variables have been incorporated in this study that would not have been possible in other environments.

Future research directions

This project is the first phase of what is envisioned as a comprehensive research portfolio focused on addressing sleep disturbance as a co-morbidity of alcohol dependence and other chronic diseases. The mixed methods component represents an underutilized technique in the field of alcohol research. Phase II of the intramural NIH protocol from which these data were collected will no longer include the semi-structured interviews with each patient, but includes continuation of the quantitative patient-reported outcomes on a total sample of up to 215 participants. With this larger sample size, we will be able to power further quantitative analyses, including but not limited to

validated sub-scales of the PSQI and any implications that they may have for outcomes of interest. Additionally, we will be able to provide further validation for the SRBQ, SE-S, and DBAS-16; examining distribution of the data and potentially contributing to the literature on validity and reliability of these relatively newer scales, or establishing preliminary cut-off scores with which to characterize samples. Additional sub-analyses could include an examination of types of social support, participants' perceptions on *Alcoholics Anonymous*, dreams and nightmares, familial implications of alcoholism, and other broad constructs that remain to be explored in-depth. Future efforts should include following patients for a longer period of time post-discharge to capture patients' experiences over time. Interestingly, 15 of the 16 White participants enrolled returned for the follow-up visit and only eight of the 14 Black/African-American participants. Although this was not a statistically significant difference, it may be an important area for exploration with a larger sample size.

An amendment is currently under way to add in objective measures of sleep using a newer Respironics© actiwatch model. With that data, we will be able to closely examine Circadian rhythms, sleep over the initial period of withdrawal and detoxification, as well as day-to-day variation in sleep outcomes and mood or clinical variables. Furthermore, objective measures of sleep which feature user-friendly, cutting-edge technology with the capacity to offer real-time feedback has the power of providing individuals with tools to track and manage their health behaviors, potentially increasing the chances that health behavior change is sustainable. It is anticipated that the original protocol will be amended in the future as new interdisciplinary collaborations emerge.

One of the main goals of this project was to contribute to the planning of a behavioral sleep intervention that is tailored and informed by both qualitative and quantitative data. Despite the literature review included in Chapter 2 and the findings herein, when considering behavioral interventions for sleep disturbances among individuals in alcohol recovery programs, we are not yet in the realm of evidence-based practice. In considering mechanisms by which to *tailor* future intervention efforts, we will pay special attention to self-efficacy for sleep given the important associations found in this study. Whether self-efficacy for sleep precedes healthy sleep hygiene or vice-versa may be particularly important to examine in a larger sample size. Variables which may moderate the relationships established in this study, particularly between self-efficacy for sleep and sleep quality, may be important to take into consideration for a future tailored intervention. Demographic and clinical variables which may be potential moderators will be explored in the larger sample. In the future, behavioral sleep intervention regimens can be initiated during the inpatient phase of treatment and sustained over time, taking into careful consideration the implications of the transition periods and personal, behavioral, and environmental factors experienced by each individual. Of particular importance may be the alternative methods of behavioral sleep intervention delivery explored in Chapter 2 (Table 2.3). Certain components of behavioral sleep interventions successful in other populations could be tailored to this group, ensuring acceptability and feasibility in the meantime. Participants provided useful insight on not only feasibility and acceptability of a behavioral sleep intervention, but also suggestions for timing and structure, which will be immensely useful preliminary data for the next phase of intervention design. This intervention will include both hospital-based and outpatient (community-based)

components with more extensive follow-up. A sub-concentration of piloting these interventions will be focused on comparing the effectiveness of various methods of delivery and format and ultimately working to determine a gold standard for sustaining outcomes. It is anticipated that the protocol for a randomized controlled trial examining the efficacy of a behavioral sleep intervention for this population will be written in the Fall of 2015. Findings from this study that are relevant to a future intervention will be presented as an in-service to staff of the inpatient unit and outpatient clinic, as the intervention will likely be a nursing-led effort.

Finally, the methodology and interventions used in this portfolio of sleep and alcohol research can ultimately be expanded to other vulnerable and diverse patient populations in order to promote self-management of chronic conditions, including the side effects of disturbed sleep, and ultimately improve health-related quality of life. This project serves as a launching pad for answering future complex and interdisciplinary health research questions through an innovative research program, the pillars of which will be continued interdisciplinary collaboration and research that is truly patient-centered in nature.

Strengths and limitations

The mixed methods design of this study allowed for the collection of rich and diverse information. The wealth of qualitative data accrued, in particular, was useful in describing the complex phenomenon of sleep and relapse from an emic perspective. It also has the potential to provide unique insight on patient preferences and needs for future behavioral sleep interventions. Mixed methods can shed light on *why* a phenomenon is occurring. Additionally, the study is grounded in a well-established health

behavior theory; the Social Cognitive Theory. Self-efficacy is one of the most well-known contributors to health behavior; applying it to sleep hygiene provides a way to elucidate underlying mechanisms of sleep and relapse. Following patients in this study across the transition from inpatient to outpatient status allowed for a thorough examination of sleep patterns across time.

This study is not without limitations. The sample was non-representative of individuals who are alcohol-dependent and thus findings cannot be generalized to all individuals who are alcohol-dependent and seeking treatment. Furthermore, participants in this study were *voluntarily* seeking treatment – many individuals who are alcohol-dependent may have been court-mandated to seek treatment or may not complete voluntary treatment due to financial, familial, and other barriers. Participants who were willing to participate in this study may be more willing to disclose information on these topics and not necessarily represent the true distribution of beliefs, perceptions, and experiences. This study did not include a measure of “social desirability” to assess the extent to which participants may have responded in a way they thought the researchers wanted them to respond. Future studies could include a short measure of social desirability such as the Marlowe-Crowne scale (Fischer & Fick, 1993). To maximize the rigor of qualitative data analysis, credibility, auditability, and fittingness of the data were used as criteria for appraisal (Barroso, 2010) and discussed when presenting results, but qualitative analyses remain subject to personal biases to a certain extent. The sample size of this study was sufficient to reach saturation from a qualitative analysis standpoint, but was not adequate for robust quantitative analyses. Additionally, this study did not utilize objective measures of sleep (actigraphy, polysomnography, etc) due to budgetary and

time constraints. Because of this limitation, there are no data on sleep *architecture* (REM vs. non-REM sleep, etc), which could have been associated with subjective sleep quality and daytime functioning, nor is there any objective validation of self-reported sleep data. The objective measures of relapse, which were secondary outcome measures, were largely missing and therefore not utilized to corroborate self-reported drinking levels. In the inpatient facility, the controlled environment could have played a role in increasing self-efficacy for abstinence that may not have been as relevant to the outpatient setting. Beyond self-efficacy, other components of the SCT could be relevant to the population; namely, observational learning and/or modeling (Bandura, 1986), particularly as both relate to self-efficacy for abstinence. Individuals in structured alcohol rehabilitation programs are often surrounded by other individuals in recovery (whether inpatient or outpatient) which could reinforce sober activities and interactions. In the future, these constructs could be explored (potentially with mixed methods approaches). Finally, although we attempted to make the interview feel comfortable and “safe” for the patient, the interview was still conducted in a hospital; the patient’s room (if no roommate) or a conference room for the inpatient visit and a conference / interview room for the outpatient visit. Going through rehabilitation is arguably a complex and emotionally trying process; the hospital itself may have served as a reminder of this issue.

Conclusions

This research begins to confirm a high prevalence of sleep disturbances in a sample of individuals who are alcohol-dependent throughout various stages of recovery that had not yet been explored in detail using a mixed methods approach. Patient-reported outcomes and in-depth interviews provided a clearer picture of individual experiences

throughout recovery, compared to either data source individually. This work demonstrates that underlying sleep-related beliefs and behaviors, which could potentially be addressed and modified by non-pharmacological intervention, may play a role in improving sleep quality in the population and potentially preventing relapse. Understanding subgroups of individuals and their experience with recovery provides useful information on tailoring future interventions. This study fills a gap in the literature by characterizing sleep throughout the rehabilitation process and the ongoing maintenance of abstinence (or relapse).

Translational science – from bench to bedside and ultimately into communities – is strengthened and accelerated when the strengths of various disciplines are integrated and when clinicians and researchers collaborate successfully, as has been the case with this project. This “team science” approach is particularly important in the realm of health behavior, which requires sustained multi-disciplinary, multi-level, and cooperative efforts. Through this process, the value and role of the clinical environment – particularly one which embodies innovation, collaboration, and compassion for individuals - for public health research is revealed.

Appendix A: Pittsburgh Sleep Quality Index (PSQI)

Subject's Initials ID# _____ Date _____ Time _____

PITTSBURGH SLEEP QUALITY INDEX

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?

BED TIME _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .

- a) Cannot get to sleep within 30 minutes

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a
week_____				

- b) Wake up in the middle of the night or early morning

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a
week_____				

- c) Have to get up to use the bathroom

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a
week_____				

d) Cannot breathe comfortably

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a

week_____

e) Cough or snore loudly

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a

week_____

f) Feel too cold

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a

week_____

g) Feel too hot

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a

week_____

h) Had bad dreams

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a

week_____

i) Have pain

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a

week_____

j) Other reason(s), please describe _____

How often during the past month have you had trouble sleeping because of this?

Not during the	Less than	Once or twice	Three or more	
past month_____	once a week_____	a week_____	times	a

week_____

6. During the past month, how would you rate your sleep quality overall?

Very good _____

Fairly good _____

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Fairly bad _____

Very bad _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during the	Less than	Once or twice	Three or more
past month_____	once a week_____	a week_____	times a

week_____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the	Less than	Once or twice	Three or more
past month_____	once a week_____	a week_____	times a

week_____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all _____

Only a very slight problem _____

Somewhat of a problem _____

A very big problem _____

10. Do you have a bed partner or roommate?

No bed partner or room mate _____

Partner/roommate in other room _____

Partner in same room, but not same bed _____

Partner in same bed _____

If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

a) Loud snoring

Not during the	Less than	Once or twice	Three or more
past month_____	once a week_____	a week_____	times a

week_____

b) Long pauses between breaths while asleep

Not during the	Less than	Once or twice	Three or more
past month_____	once a week_____	a week_____	times a

week_____

c) Legs twitching or jerking while you sleep

Not during the	Less than	Once or twice	Three or more
past month_____	once a week_____	a week_____	times a
week_____			

d) Episodes of disorientation or confusion during sleep

Not during the	Less than	Once or twice	Three or more
past month_____	once a week_____	a week_____	times a
week_____			

e) Other restlessness while you sleep; please describe_____

Not during the	Less than	Once or twice	Three or more
past month_____	once a week_____	a week_____	times a
week_____			

Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ: Psychiatry Research, 28:193-213, 1989.

Appendix B: Epworth Sleepiness Scale (ESS)

Epworth Sleepiness Scale

Name: _____

Today's date: _____

Your age (Yrs): _____

Your sex (Male = M, Female = F): _____

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

0 = would **never** doze

1 = **slight chance** of dozing

2 = **moderate chance** of dozing

3 = **high chance** of dozing

It is important that you answer each question as best you can.

Situation

Chance of Dozing (0-3)

Sitting and reading _____

Watching TV _____

Sitting, inactive in a public place (e.g. a theatre or a meeting) _____

As a passenger in a car for an hour without a break _____

Lying down to rest in the afternoon when circumstances permit _____

Sitting and talking to someone _____

Sitting quietly after a lunch without alcohol _____

In a car, while stopped for a few minutes in the traffic _____

THANK YOU FOR YOUR COOPERATION

_ M.W. Johns 1990-97

Appendix C: Sleep-related Behaviour Questionnaire (SRBQ)**Sleep-Related Behaviour Questionnaire**

Instructions	Almost never	Rarely	Sometimes	Often	Almost always
Please carefully read each of the statements below and circle the number that best describes how often you do the following things in order to cope with tiredness or improve your sleep (ie, 0 = almost never, 4 = almost always).					
<i>To cope with tiredness or improve sleep....</i>					
1. I spend time considering ways to improve sleep	0	1	2	3	4
2. I stay in the background in social situations	0	1	2	3	4
3. I try to stop all thinking when trying to get to sleep	0	1	2	3	4
4. I do something active close to bed-time to tire myself out	0	1	2	3	4
5. I miss or cancel appointments (daytime or evening)	0	1	2	3	4
6. During the day, I block thoughts about sleep out of my mind	0	1	2	3	4
7. I reduce my expectations of what I can achieve	0	1	2	3	4
8. I figure out how I will catch up my sleep later on	0	1	2	3	4
9. I work less hard to conserve energy	0	1	2	3	4
10. I try to keep all disturbing thoughts and images out of my mind while in bed	0	1	2	3	4
11. I avoid talking about my sleep	0	1	2	3	4
12. I look at the clock on waking to calculate how many hours of sleep I got	0	1	2	3	4
13. I plan to get an early night	0	1	2	3	4
14. I give up trying to work	0	1	2	3	4
15. I take a sleeping pill or pills	0	1	2	3	4
16. I catch up on sleep by napping	0	1	2	3	4
17. I wear earplugs to block out all sounds that might wake me up/prevent me falling asleep	0	1	2	3	4
18. I worry about the consequences of poor sleep while lying in bed	0	1	2	3	4

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19. I take on fewer social commitments	0	1	2	3	4
20. I put tasks off until tomorrow	0	1	2	3	4
21. I avoid difficult conversations with people	0	1	2	3	4
22. During the day, I conserve energy any way I can	0	1	2	3	4
23. I avoid sleeping away from home	0	1	2	3	4
24. I look at the clock to see how long it's taking to get to sleep	0	1	2	3	4
25. I am less active during the day	0	1	2	3	4
26. I keep busy to stop thinking about my sleep	0	1	2	3	4
27. I limit myself to mundane chores or tasks during the day/evening	0	1	2	3	4
28. I worry about other things (e.g. work) to distract from concerns about sleep	0	1	2	3	4
29. I take herbal remedies to aid sleep	0	1	2	3	4
30. While in bed, I try to block out thinking about any problems	0	1	2	3	4
31. I stick to a routine during the day so that I don't have to think as much	0	1	2	3	4
32. I give myself lots of time to fall asleep by going to bed early	0	1	2	3	4

Appendix D: Self-efficacy for Sleep Scale (SE-S)

Self-Efficacy for Sleep Scale

Name _____ Date _____

For the following 9 items, please rate (by circling a number from 1 to 5) your ability to carry out each behavior. If you feel able to accomplish a behavior some of the time but not always, you should indicate a lower level of confidence.

Indicate how confident you are that you can:

1. Lie in bed, feeling physically relaxed.

1	2	3	4	5
Not confident			Very confident	

2. Lie in bed, feeling mentally relaxed.

1	2	3	4	5
Not confident			Very confident	

3. Lie in bed with your thoughts "turned off."

1	2	3	4	5
Not confident			Very confident	

4. Fall asleep at night in under 30 minutes.

1	2	3	4	5
Not confident			Very confident	

5. Wake up at night fewer than 3 nights.

1	2	3	4	5
Not confident			Very confident	

6. Go back to sleep within 15 minutes of waking in the night.

1	2	3	4	5
Not confident			Very confident	

7. Feel refreshed upon waking in the morning.

1	2	3	4	5
Not confident			Very confident	

8. Wake after a poor night's sleep without feeling upset about it.

1 2 3 4 5

Not confident

Very confident

9. Not allow a poor night's sleep to interfere with daily activities.

1 2 3 4 5

Not confident

Very confident

Appendix E: Dysfunctional Beliefs and Attitudes about Sleep (DBAS)

Dysfunctional Beliefs and Attitudes about Sleep (DBAS)

Name: _____ **Date:** _____

Several statements reflecting people's beliefs and attitudes about sleep are listed below. Please indicate to what extent you personally agree or disagree with each statement. There is no right or wrong answer. For each statement, circle the number that corresponds to your own personal belief. Zero (0) indicates **disagreement** and ten (10) indicates **agreement**. Please respond to all items even though some may not apply directly to your own situation.

1. I need 8 hours of sleep to feel refreshed and function well during the day.

0 1 2 3 4 5 6 7 8 9 10

2. When I don't get the proper amount of sleep on a given night, I need to catch up on the next day by napping or on the next night by sleeping longer.

0 1 2 3 4 5 6 7 8 9 10

3. I am concerned that chronic insomnia may have serious consequences on my physical health.

0 1 2 3 4 5 6 7 8 9 10

4. I am worried that I may lose control over my abilities to sleep.

0 1 2 3 4 5 6 7 8 9 10

5. After a poor night's sleep, I know that it will interfere with my daily activities on the next day.

0 1 2 3 4 5 6 7 8 9 10

6. In order to be alert and function well during the day, I believe I would be better off taking a sleeping pill rather than having a poor night's sleep.

0 1 2 3 4 5 6 7 8 9 10

7. When I feel irritable, depressed, or anxious during the day, it is mostly because I did not sleep well the night before.

0 1 2 3 4 5 6 7 8 9 10

8. When I sleep poorly on one night, I know it will disturb my sleep schedule for the whole week.

0 1 2 3 4 5 6 7 8 9 10

9. Without an adequate night's sleep, I can hardly function the next day.

0 1 2 3 4 5 6 7 8 9 10

10. I can't ever predict whether I'll have a good or poor night's sleep.

0 1 2 3 4 5 6 7 8 9 10

11. I have little ability to manage the negative consequences of disturbed sleep.

0 1 2 3 4 5 6 7 8 9 10

12. When I feel tired, have no energy, or just seem not to function well during the day, it is generally because I did not sleep well the night before.

0 1 2 3 4 5 6 7 8 9 10

13. I believe insomnia is essentially the result of a chemical imbalance.

0 1 2 3 4 5 6 7 8 9 10

14. I feel insomnia is ruining my ability to enjoy life and prevents me from doing what I want.

0 1 2 3 4 5 6 7 8 9 10

15. Medication is probably the only solution to sleepiness.

0 1 2 3 4 5 6 7 8 9 10

16. I avoid or cancel obligations (social, family) after a poor night's sleep.

0 1 2 3 4 5 6 7 8 9 10

Appendix F: Penn Alcohol Craving Scale (PACS)**PENN ALCOHOL CRAVING SCALE**

Circle the most appropriate number for each item. If this is the first time you are filling out this form, the questions apply to the last week that you drank any alcohol. If you received serax or another medication for detoxification, exclude that time period. If you are currently participating in the medication trial, these questions cover the time period from the day of your last visit to the day before your current visit.

1. How often have you thought about drinking or about how good a drink would make you feel during this period?

Never, that is, 0 times during this period of time. = 0

Rarely, that is, 1 to 2 times during this period of time. = 1

Occasionally, that is, 3 to 4 during this period of time. = 2

Sometimes, that is, 5 to 10 times during this period or 1 to 2 times per day. = 3

Often, that is, 11 to 20 times during this period or 2 to 3 times a day. = 4

Most of the time, that is, 20 to 40 during this period or 3 to 6 times a day. = 5

Nearly all of the time, that is, more than 40 times during this period or more than 6 times a day. = 6

2. At its most severe point, how strong was your craving during this period?

None at all. = 0

Slight, that is a very mild urge. = 1

Mild urge. = 2

Moderate urge. = 3

Strong urge, but easily controlled. = 4

Strong urge and difficult to control. = 5

Strong urge and would have drunk alcohol if it were available. = 6

3. How much time have you spent thinking about drinking or about how good a drink would make you feel during this period?

None at all = 0

Less than 20 minutes = 1

21-45 minutes = 2

46-90 minutes = 3

90 minutes - 3 hours = 4

Between 3 to 6 hours = 5

More than 6 hours = 6

4. How difficult would it have been to resist taking a drink during this period of time if you had known a bottle were in your house?

Not difficult at all = 0

Very mildly difficult = 1

Mildly difficult = 2

Moderately difficult = 3

Very difficult = 4

Extremely difficult = 5

Would not be able to resist = 6

5. Keeping in mind your responses to the previous questions, please rate your *overall average* alcohol craving for the stated period of time.

Never thought about drinking and never had the urge to drink = 0

Rarely thought about drinking and rarely had the urge to drink = 1

Occasionally thought about drinking and occasionally had the urge to drink = 2

Sometimes thought about drinking and sometimes had the urge to drink = 3

Often thought about drinking and often had the urge to drink = 4

Thought about drinking most of the time and had the urge to drink most of the time = 5

Thought about drinking nearly all of the time and had the urge to drink nearly all of the time = 6

Appendix G: Interview scripts**Interview #1** (conducted within a week of scheduled discharge)

Thank you for participating in this study. My name is _____ and I'll be facilitating the interview today. _____ is with me to observe and take some notes. We are audio-recording this session because we don't want to miss any of your comments.

We're conducting these interviews because we're trying to understand more about your recovery, transition into the community, and sleep patterns. Some questions are very general and others are more specific to your transition. I want you to talk out what you are thinking more than what you might normally be used to - so basically, to "think out loud." I do have a set of questions written out, but mainly, I just want to hear what you have to say. There are no "right" or "wrong" answers. If you are uncomfortable with any question, we can skip it. However, the more information you are able to provide me with, the more I'll be able to understand your experience and how each person's recovery process differs. You can choose to end the interview at any time and this will not affect your treatment here at NIH.

- 1) *What should I know about you as a person?*
- 2) *Describe the process of how you adjusted to being an inpatient in the Clinical Center.*
- 3) *Talk me through what your experience has been throughout the process of rehabilitation here at NIH.*
- 4) *Think about the first few days after you leave here and go home. Walk me through what you think it will be like.*
- 5) *Describe in as much detail as you can any expectations you have about transitioning back into your home environment.*
 - a) Probe: What barriers or facilitators to recovery do you expect?
- 6) *How did you sleep last night? Describe in as much detail as you can.*
- 7) *Talk me through what your experience has been with sleep throughout the process of rehabilitation here at NIH.*
- 8) *Describe how it has been to adjust to sleeping in this hospital. What about it is the same or different from your home environment?*
 - a) Probe: positives and negatives of both environments...
- 9) *Describe what you think your sleep will be like when you leave the NIH.*
- 10) *Describe what you will do if you have trouble sleeping when you get home.*

- 11) *When you feel like you have had a really "good night's sleep," what does that generally mean to you? Describe this in as much detail as you can.*
a) Probe: how many hours, how you felt in the morning, ease of falling asleep...
- 12) *How do you think alcohol affects sleep?*
- 13) *Is there anything you'd like to add that we haven't discussed already?*

We appreciate your responses - thank you for time.

Interview #2 (conducted approximately one month post-discharge)

Thank you for participating in this study. My name is _____ and I'll be facilitating the interview today. _____ is with me to observe and take some notes. We are audio-recording this session because we don't want to miss any of your comments.

We're conducting these interviews because we're trying to understand more about your recovery, transition into the community, and sleep patterns. Some questions are very general and others are more specific to your transition. I want you to talk out what you are thinking more than what you might normally be used to - so basically, to "think out loud." I do have a set of questions written out, but mainly, I just want to hear what you have to say. There are no "right" or "wrong" answers. If you are uncomfortable with any question, we can skip it. However, the more information you are able to provide me with, the more I'll be able to understand your experience and how each person's recovery process differs. You can choose to end the interview at any time and this will not affect your treatment here at NIH.

- 1) *It's been about a month since you left the Clinical Center. Talk me through what the transition has been like as you returned to your home environment.*
a. Probe: Different environment, support system...
Probe: Describe any barriers or facilitators to recovery you have experienced.
- 2) *How did you sleep last night? Describe in as much detail as you can.*
- 3) *Compared to what it was like in the hospital, what has your sleep been like since leaving the NIH?*
Probe: More/less sleep, more/less tired, dreams...
- 4) *Describe what your process has been if you have experienced any trouble sleeping.*

Probe: television, reading, medication, alcohol...

5) *When you feel like you have had a really "good night's sleep," what does that generally mean to you? Describe this in as much detail as you can.*

a. Probe: how many hours, how you felt in the morning, ease of falling asleep...

6) *How do you think alcohol affects sleep?*

7) *Would you be open to an intervention to help you sleep? What would an ideal sleep intervention look like to you?*

Probe: Inpatient or outpatient, group-based or one-on-one, setting, timing...

8) *Is there anything you'd like to add that we haven't discussed already?*

We appreciate your responses - thank you for time.

Appendix H: Ancillary analyses / results

Objective measures of relapse. Twelve participants had blood draws that corresponded with their second study visit. Of those 12, one did not have a Breath Alcohol Content (BAC) reading; the other 11 participants had “0” readings. Six additional patients provided a breath sample and no blood sample. Of those six, one had a positive BAC reading (0.02) and five had “0” readings. Of the remaining participants on the study, five were lost to follow-up, three completed the follow-up visit by phone (and therefore were not able to provide a blood or breath sample), and six returned to the clinic but did not provide a breath sample.

Regression modeling. Due to a relatively small sample size, linear regression models only included covariates which were significantly associated with dependent variable of interest (sleep quality) and were strictly exploratory in nature. Although the original intent was to also conduct a logistic regression model with an outcome of relapse (dichotomized), because only eight participants had valid TLFB data and only one of those eight participants had reported any drinking, the second model was not cogent. The predictor variables, which were all significantly associated with the outcome of interest (a change in PSQI scores from pre-discharge to 4-6 weeks post-discharge), included race (recoded as White vs. non-White), anxiety/depression scores from day 2 of inpatient treatment, and the difference in SE-S scores from pre-discharge to 4-6 weeks post-discharge. In the final model, only the difference in SE-S scores from pre- to post-discharge ($\beta = -.472$, $p < 0.05$) significantly predicted the change in PSQI scores. The overall model fit was $R^2 = 0.54$ and adjusted $R^2 = 0.43$. Thus, the pre- to post-discharge change was negatively correlated with the PSQI (those whose SE-S scores increased were

more likely to experience a decrease on PSQI scores from pre- to post-discharge, indicating fewer sleep disturbances).

Table H.1: *Multiple linear regression modeling for prediction of difference in sleep quality by race, CPRS variables, and difference in SE-S scores*

Independent variables	B	SE B	β	p
Race	2.761	1.472	.332	.078
Difference in SE-S score	-.421	.156	-.472	.015
Anxiety (Day 2)	.158	.154	.228	.318
Depression (Day 2)	.008	.133	.015	.950

Adjusted R^2 (denotes the adjusted proportion of the variance explained by the model) = .429.

B denotes the variable estimate.

SE B denotes the standard error of the variable estimate.

β denotes the standardized estimate.

References

- Adamson, J. & Burdick, J.A. (1973). Sleep of dry alcoholics. *Archives of General Psychiatry*, 28(1), 146-149.
- Adamson, S.J., Sellman, J.D., & Frampton, C.M. (2009). Patient predictors of alcohol treatment outcome: a systematic review. *Journal of Substance Abuse Treatment*, 36(1), 75-86.
- Agyapong, V.I., McLoughlin, D.M., & Farren, C.K. (2013). Six-months outcomes of a randomised trial of supportive text messaging for depression and comorbid alcohol use disorder. *Journal of Affective Disorders*, 151(1), 100-104.
- Allen, J., Copella, A., & Orford, J. (2005). Fear during alcohol detoxification: views from the clients' perspective. *Journal of Health Psychology*, 10(4), 503-510.
- Allen, J.P. & Litten, R.Z. (2003). Recommendations on use of biomarkers in alcoholism treatment trials. *Alcoholism: Clinical and Experimental Research*, 27(10), 1667-1670.
- Alling, C., Balldin, J., Bokström, K., Gottfrieds, C.G., Karlsson, I., & Långström, G. (1982). Studies on duration of a late recovery period after chronic abuse of ethanol. A cross-sectional study of biochemical and psychiatric indicators. *Acta Psychiatrica Scandinavica*, 66(5), 384-397.
- American Psychiatric Association (APA). (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.) Retrieved from: <http://dx.doi.org/10.1176/appi.books.9780890425596.910646>.
- Andrews, L.K., Coviello, J., Hurley, E., Rose, L., & Redeker, N.S. (2013). "I'd eat a bucket of nails if you told me it would help me sleep:" perceptions of insomnia and its treatment in patients with stable heart failure. *Heart & Lung: The Journal of Critical Care*, 42(5), 339-345.
- Arnedt, J.T., Conroy, D.A., & Brower, K.J. (2007). Treatment options for sleep disturbances during alcohol recovery. *Journal of Addictive Disorders*, 26(4), 41-54.
- Arnedt, J. T., Conroy, D., Rutt, J., Aloia, M.S., Brower, K.J., & Armitage, R. (2007). An open trial of cognitive-behavioral treatment for insomnia comorbid with alcohol dependence. *Sleep Medicine*, 8(2), 176-180.
- Arnedt, J.T., Conroy, D.A., Armitage, R., & Brower, K.J. (2011). Cognitive-behavioral therapy for insomnia in alcohol dependent patients: a randomized controlled pilot trial. *Behaviour Research and Therapy*, 49(4), 227-233.

- Arnedt, J.T., Cuddihy, L., Swanson, L.M., Pickett, S., Aikens, J., and Chervin, RD. (2013). Randomized controlled trial of telephone-delivered cognitive behavioral therapy for chronic insomnia. *Sleep*, 36(3), 353-362.
- Åsberg, M., Montgomery, S.A., Perris, C., Schalling, D., & Sedvall, G. (1978). A comprehensive psychopathological rating scale. *Acta Psychiatrica Scandinavica, Supplementum*, 271, 5-27.
- Ayas, N.T., White, D.P., Al-Delaimy, W.K., Manson, J.E., Stampfer, M.J., Speizer, F.E., Patel, S., & Hu, F.B. (2003). A prospective study of self-reported sleep duration and incident diabetes in women. *Diabetes Care*, 26(2), 380-384.
- Backhaus, J., Junghanns, K., Broocks, A, Riemann, D., & Hohagen F. (2002). Test-retest reliability and validity of the Pittsburgh Sleep Quality Index in primary insomnia. *Journal of Psychosomatic Research*, 53(3), 737-740.
- Bandura, A. (1986). *Social foundations of thought and action: a social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Bandura, A. (1999). A sociocognitive analysis of substance abuse: an agentic perspective. *Psychological Science*, 10(3), 214-217.
- Barbour, V.L. & Mead, G.E. (2012). Fatigue after stroke: the patient's perspective. *Stroke Research and Treatment*, 2012, ePub, DOI: 10.1155/2012/863031.
- Barroso, J. (2010). Qualitative approaches to research. In G. LoBiondo-Wood and Haber, J. (Eds). *Nursing Research: Methods and Critical Appraisal for Evidence-Based Practice*. Elsevier: St. Louis, MO, USA.
- Benca, R.M. (1996). Sleep in psychiatric disorders. *Neurologic Clinics*, 14(4), 739-764.
- Behar, J., Roebuck, A., Domingos, J.S., Geder, E., & Clifford, G.D. (2013). A review of current sleep screening applications for smartphones. *Physiological Measurement*, 34(7), R29-46.
- Bernstein, D.P., Stein, J.A., Newcomb, M.D., Walker, E., Pogge, D., Ahluvalia, T., Stokes, J.,...Zule, W. (2003). Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse & Neglect*, 27(2), 169-190.
- Bishop, F.L. & Holmes, M.M. (2013). Mixed methods in CAM research: a systematic review of studies published in 2012. *Evidence-Based Complementary and Alternative Medicine*, 2013, ePub, DOI: 10.1155/2013/187365.

- Bootzin, R.R. & Stevens, S.J. (2005). Adolescents, substance abuse, and the treatment of insomnia and daytime sleepiness. *Clinical Psychology Review, 25*(5), 629-644.
- Bracken, B.K., Penetar, D.M., Maclean, R.R., & Lukas, S.E. (2011). Kudzu root extract does not perturb the sleep/wake cycle of moderate drinkers. *Journal of Alternative and Complementary Medicine, 17*(10), 961-966.
- Britton, W.B., Bootzin, R.R., Cousins, J.C., Hasler, B.P., Peck, T., & Shapiro, S.L. (2010). The contribution of mindfulness practice to a multicomponent behavioral sleep intervention following substance abuse treatment in adolescents: a treatment-development study. *Substance Abuse, 31*(2), 86-97.
- Brooks, A.T. & Wallen, G.R. (2014). Sleep disturbances in individuals with alcohol-related disorders: a review of cognitive-behavioral therapy for insomnia (CBT-I) and associated non-pharmacological therapies. *Substance Abuse: Research and Treatment, 16*(8), 55-62.
- Brooks, A.T., Krumlauf, M.C., Whiting, B.P., Clark, R.J., & Wallen, G.R. (2012). Are you sleeping? Pilot comparison of self-reported and objective measures of sleep quality and duration in an inpatient alcoholism treatment program. *Substance Abuse: Research and Treatment, 6*, 135-139.
- Brower, K.J., Aldrich, M.S., and Hall, J.M. (1998). Polysomnographic and subjective sleep predictors of alcoholic relapse. *Alcoholism: Clinical and Experimental Research, 22*(8), 1864-1871.
- Brower, K. J. (2001). Alcohol's effects on sleep in alcoholics. *Alcohol Research & Health, 25*(2), 110-125.
- Brower, K. J., Aldrich, M.S., Robinson, E.A., Zucker, R.A., and Greden, J.F. (2001). Insomnia, self-medication, and relapse to alcoholism. *American Journal of Psychiatry, 158*(3), 399-404.
- Brower, K. J. (2003). Insomnia, alcoholism and relapse. *Sleep Medicine Reviews, 7*(6), 523-539.
- Brower KJ, Conroy DA, Arnedt JT. (2007). Treatment Options for sleep disturbances during alcohol recovery. *Journal of Addictive Diseases, 26*(4), 41-50.
- Brower, K. J., Krentzman, A., & Robinson, E.A. (2011). Persistent insomnia, abstinence, and moderate drinking in alcohol-dependent individuals. *American Journal of Addiction, 20*(5), 435-440.
- Brower, K.R., Wojnar, M., Sliwerska, E., Armitage, R., & Burmeister, M. (2012). PER3 polymorphism and insomnia severity in alcohol dependence. *Sleep, 35*(4), 571-577.

- Buchner, A., Erdfelder, E., Faul, F., & Lang, A. (2009). *G*Power (Version 3.1.2) [Computer program]*. Retrieved from <http://www.gpower.hhu.de/en.html>
- Buysse, D.J., Reynolds, C.F., III, Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193-213.
- Carpenter, J.S. & Andrykowski, M.A. (1998). Psychometric evaluation of the Pittsburgh Sleep Quality Index. *Journal of Psychosomatic Research*, 45(1), 5-13.
- Centers for Disease Control and Prevention (CDC). (2015a, February 1). *Alcohol and Public Health*. Retrieved February 1, 2015 from <http://www.cdc.gov/alcohol/>.
- Centers for Disease Control and Prevention (CDC). (2015b, January 20). *Sleep*. Retrieved January 20, 2015 from <http://www.cdc.gov/features/dssleep/>.
- Chakravorty, S., Grandner, M.A., Kranzler, H.R., Mavandadi, S., Kling, M.A., Perlis, M.L., & Oslin, D.W. (2013). Insomnia in alcohol dependence: predictors of symptoms in a sample of veterans referred from primary care. *American Journal of Addiction*, 22(3), 266-270.
- Chen, W.T., Shiu, C.S., Yang, J.P., Lee, S.Y., Lee, T.S., Simoni, J.M., Bao, M.J., & Lu, H.Z. (2013). Fatigue and sleep disturbance related to perceived stress in Chinese HIV-positive individuals: a mixed-methods study. *Journal of AIDS & Clinical Research*, 4(6).
- Cheng, S.K. & Dizon, J. (2012). Computerised cognitive behavioural therapy for insomnia: a systematic review and meta-analysis. *Psychotherapy and Psychosomatics*, 81(4), 206-216.
- The Cochrane Collaboration. (2011). *Cochrane Handbook for Systematic Reviews of Interventions*. Retrieved from http://handbook.cochrane.org/front_page.htm.
- Cohn, T. J., Foster, J.H., & Peters, T.J. (2003). Sequential studies of sleep disturbance and quality of life in abstaining alcoholics. *Addiction Biology*, 8(4), 455-462.
- Colten, H.R. & Altevogt, B.M. (2006). Sleep disorders and sleep deprivation: an unmet public health problem. *Institute of Medicine (US) Committee on Sleep Medicine and Research*, Washington DC National Academic Press.
- Connor, J.P., George, S.M., Gullo, M.J., Kelly, A.B., & Young, R.M. (2011). A prospective study of alcohol expectancies and self-efficacy as predictors of young adolescent alcohol misuse. *Alcohol & Alcoholism*, 46(2), 161-169.

- Connors, G.J. & Maisto, S.A. (2003). Drinking reports from collateral individuals. *Addiction*, 98(S2), 21-29.
- Creswell, J.W. & Plano Clark, V.L. (2011). *Designing and Conducting Mixed Methods Research*. SAGE Publications, Inc: Thousand Oaks, CA, USA.
- Crum, R.M., Storr, C.L., Chan, Y., & Ford, D.E. (2004). Sleep disturbance and risk for alcohol-related problems. *American Journal of Psychiatry*, 161(7), 1197-1203.
- Crum, R.M., La Flair, L., Stor, C.L., Green, K.M., Stuart, E.A., Alvanzo, A.A., Lazareck, S.,...Mojtabai, R. (2013). Reports of drinking to self-medicate anxiety symptoms: longitudinal assessment for subgroups of individuals with alcohol dependence. *Depression & Anxiety*, 30(2), 174-183.
- Crum, R.M., Mojtabai, R., Lazareck, S., Bolton, J.M., Robinson, J., Sareen, J.,...Storr, C.L. (2013). Prospective assessment of reports of drinking to self-medicate mood symptoms with the incidence and persistence of alcohol dependence. *JAMA Psychiatry*, 70(7), 718-726.
- Currie, S.R., Clark, S., Hodgins, D.C., & El-Guebaly, N. (2004). Randomized controlled trial of brief cognitive-behavioural interventions for insomnia in recovering alcoholics. *Addiction*, 99(9), 1121-1132.
- Currie, S.R., Clark, S., Rimac, S., & Malhotra, S. (2003). Comprehensive assessment of insomnia in recovering alcoholics using daily sleep diaries and ambulatory monitoring. *Alcoholism: Clinical and Experimental Research*, 27(8), 1262-1269.
- Davy, Z., Middlemass, J., & Siriwardena, A.N. (2013). Patients' and clinicians' experiences and perceptions of the primary care management of insomnia: qualitative study. *Health Expectations*, Epub, doi: 10.1111/hex.12119.
- Del Boca, F.K. & Darkes, J. (2003). The validity of self-reports of alcohol consumption: state of the science and challenges for research. *Addiction*, 98(S2), 1-12.
- Demmel, R., Beck, B., & Lammers, A. (2003). Prediction of treatment outcome in a clinical sample of problem drinkers: self-efficacy, alcohol expectancies, and readiness to change. *German Medical Science: GMS E-Journal*, Epub.
- Dodes, L. (2002). *The heart of addiction: A new approach to understanding and managing alcoholism and other addictive behaviors*. New York, NY, USA: HarperCollins Publishers.
- Doi, Y., Minowa, M., Uchiyama, M., Okawa, M., Kim, K., Shibui, K., & Kamei, Y. (2000). Psychometric assessment of subjective sleep quality using the Japanese version of the Pittsburgh Sleep Quality Index (PSQI-J) in psychiatric disordered and control subjects. *Psychiatry Research*, 97(2-3), 165-172.

- Dominguez, D., Jawara, M., Martino, N., Sinaii, N., & Grady, C. (2012). Commonly performed procedures in clinical research: a benchmark for payment. *Contemporary Clinical Trials, 33*(5), 860-868.
- Drummond, S.P., Gillin, J.C., Smith, T.L., & DeModena, A. (1998). The sleep of abstinent pure primary alcoholic patients: natural course and relationship to relapse. *Alcoholism: Clinical and Experimental Research, 22*(8), 1796-1802.
- Ebrahim, I.O., Shapiro, C.M., Williams, A.J., & Fenwick, P.B. (2013). Alcohol and sleep I: effects on normal sleep. *Alcohol: Clinical and Experimental Research, 37*(4), 539-549.
- Edinger, J.D., Wohlgemuth, W.K., Radtke, R.A., Coffman, C.J., & Carney, C.E. (2007). Dose-response effects of cognitive behavioral insomnia therapy: a randomized clinical trial. *Sleep, 30*(2), 203-212.
- Espie, C.A., Kyle, S.D., Williams, C., Ong, J.C., Douglas, N.J., Hames, P., & Brown, J.S. (2012). A randomized, placebo-controlled trial of online cognitive behavioral therapy for chronic insomnia disorder delivered via an automated media-rich web application. *Sleep, 35*(6), 769-781.
- Fetting, M. (2012). *Perspectives on addiction: An integrative treatment model with clinical case studies*. University of Southern California, USA: Sage Publications, Inc.
- Fichten, C.S., Libman, E., Creti, L., Amsel, R., Sabourin, S., Brender, W., & Bailes, S. (2001). Role of thoughts during nocturnal awake times in the insomnia experience of older adults. *Cognitive Therapy and Research, 25*(6), 665-692.
- Fischer, D.G. & Fick, C. (1993). Measuring social desirability: short forms of the Marlowe-Crowne Social Desirability Scale. *Educational and Psychological Measurement, 53*(2), 417-424.
- Flannery, B.A., Volpicelli, J.R., & Pettinati, H.M. (1999). Psychometric properties of the Penn Alcohol Craving Scale. *Alcoholism: Clinical and Experimental Research, 23*(8), 1289-1295.
- Foley, D., Ancoli-Israel, S., Britz, P., & Walsh, J. (2004). Sleep disturbances and chronic disease in older adults: results of the 2003 National Sleep Foundation Sleep in America Survey. *Journal of Psychosomatic Research, 56*(5), 497-502.
- Ford, D.E. & Kamerow, D.B. (1989). Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? *JAMA, 262*(11), 1479-1484.

- Foster, J.H. & Peters, T.J. (1999). Impaired sleep in alcohol misusers and dependent alcoholics and the impact upon outcome. *Alcoholism: Clinical and Experimental Research*, 23(6), 1044-1051.
- Friedmann, P.D., Herman, D.S., Freedman, S., Lemon, S.C., Ramsey, S., & Stein, M.D. (2003). Treatment of sleep disturbance in alcohol recovery: a national survey of addiction medicine physicians. *Journal of Addictive Diseases*, 22(2), 91-103.
- Fucito, L.M., Redeker, N.S., Ball, S.A., Toll, B.A., Ikomi, J.T., & Carroll, K.M. (2014). Integrating a behavioral sleep intervention into smoking cessation treatment for smokers with insomnia: a randomized pilot study. *Journal of Smoking Cessation*, 9(1), 31-38.
- Gellis, L.A., Arigo, D., & Elliott, J.C. (2013). Cognitive refocusing treatment for insomnia: a randomized controlled trial in university students. *Behavior Therapy*, 44(1), 100-110.
- Gilles, D.M., Turk, C.L., & Fresco, D.M. (2006). Social anxiety, alcohol expectancies, and self-efficacy as predictors of heavy drinking in college students. *Addictive Behaviors*, 31(3), 388-398.
- Gillin, J.C., Smith, T.L., Irwin, M., Kripke, D.F., & Schuckit, M. (1990). EEG sleep studies in "pure" primary alcoholism during subacute withdrawal: relationships to normal controls, age, and other clinical variables. *Biological Psychiatry*, 27(5), 477-488.
- Gillin, J.C. and Drummond, S.P. (2000). Medication and substance abuse. In M.H. Kryger, Roth, T., and Dement, W.C. (eds), *Principles and Practice of Sleep Medicine*, 3rd edition. Philadelphia, PA: WB Saunders.
- Greeff, A.P. & Conradie, W.S. (1998). Use of progressive relaxation training for chronic alcoholics with insomnia. *Psychological Reports*, 82(2), 407-412.
- Gustafson, D.H., McTavish, F.M., Chih, M.Y., Atwood, A.K., Johnson, R.A., Boyle, M.G., ... & Shad, D. (2014). A smartphone application to support recovery from alcoholism: a randomized clinical trial. *JAMA Psychiatry*, 71(5), 566-572.
- Hanson, M., Foreman, L., Tomlin, W., Bright, Y. (1994). Facilitating problem drinking clients' transition from inpatient to outpatient care. *Health & Social Work*, 19(1), 23-28.
- Harvey, A.G. (2002). A cognitive model of insomnia. *Behaviour Research and Therapy*, 40(8), 869-893.
- Healthy People 2020. (2013). *Substance Abuse*. Retrieved from <http://healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=40>.

- Heron, K.E. & Smyth, J.M. (2010). Ecological momentary interventions: incorporating mobile technology into psychosocial and health behavior treatments. *British Journal of Health Psychology*, *15*(Pt 1), 1-39.
- Holmgvist, M., Vincent, N., & Walsh, K. (2014). Web-vs. telehealth-based cognitive behavioral therapy for insomnia: a randomized controlled trial. *Sleep Medicine*, *15*(2), 187-195.
- Irshaad E, Colin M, Shapiro A, Fenwick P. Alcohol and Sleep I: Effects on Normal Sleep. *Alcoholism: Clinical & Experimental Research*, *37*(4), 539-549.
- Irvine, L., Faconer, D.W., Jones, C., Ricketts, I.W., Williams, B., & Crombie, I.K. (2012). Can text messages reach the parts other process measures cannot reach: an evaluation of a behavior change intervention delivered by mobile phone? *PLoS One*, *7*(12), Epub, doi: 10.1371/journal.pone.0052621.
- Jacobs, G.D., Pace-Schott, E.F., Stickgold, R., & Otto, M.W. (2004). Cognitive behavior therapy and pharmacotherapy for insomnia: a randomized controlled trial and direct comparison. *Archives of Internal Medicine*, *164*(17), 1888-1896.
- Johns, M.W. (1991). A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep*, *14*(6), 540-545.
- Johns, M.W. (1992). Reliability and factor analysis of the Epworth Sleepiness Scale. *Sleep*, *15*(4), 376-381.
- Johns, M.W. (1993). Daytime sleepiness, snoring, and obstructive sleep apnea. The Epworth Sleepiness Scale. *Chest*, *103*(1), 30-36.
- Johnson, E.O., Roehrs, T., Roth, T., & Breslau, N. (1998). Epidemiology of alcohol and medication as aids to sleep in early adulthood. *Sleep*, *21*(2), 178-186.
- Jungquist, C.R., O'Brien, C., Matteson-Rusby, S., Smith, M.T., Pigeon, W.R., Xia, Y.,...Perlis, M.L. (2010). The efficacy of cognitive-behavioral therapy for insomnia in patients with chronic pain. *Sleep Medicine*, *11*(3), 302-309.
- Jungquist, C.R., Tra, Y., Smith, M.T., Pigeon, W.R., Matteson-Rusby, S., Xia, Y., & Perlis, M.L. (2012). The durability of cognitive behavioral therapy for insomnia in patients with chronic pain. *Sleep Disorders*, *2012*: Epub, doi: 10.1155/2012/679648.
- Kadden, R.M., & Litt, M.D. (2011). The role of self-efficacy in the treatment of substance use disorders. *Addictive Behaviors*, *36*(12), 1120-1126.

- Katofsky, I., Backhaus, J., Junghanns, K., Rumpf, H.J., Huppe, M., von Eitzen, U., & Hohagen, F. (2012). Effectiveness of a cognitive behavioral self-help program for patients with primary insomnia in general practice – a pilot study. *Sleep Medicine, 13*(5), 463-468.
- Kozasa, E.H., Hachul, H., Monson, C., Pinto Jr L., Garcia, M.C., Mello, L.E., & Tufik, S. (2010). Mind-body interventions for the treatment of insomnia: a review. *Revista Brasileira de Psiquiatria, 32*(4), 437-443.
- Kyle, S.D., Miller, C.B., Rogers, Z., Siriwardena, A.N., Macmahon, K.M., & Espie, C.A. (2014). Sleep restriction therapy for insomnia is associated with reduced objective total sleep time, increased daytime somnolence, and objectively impaired vigilance: implications for the clinical management of insomnia disorder. *Sleep, 37*(2), 229-237.
- Lancee, J., van den Bout, J., van Straten, A., & Spoormaker, V.I. (2012). Internet-delivered or mailed self-help treatment for insomnia?: a randomized waiting-list controlled trial. *Behavioral Research and Therapy, 50*(1), 22-29.
- Landolt, H.P. & Gillin, J.C. (2001). Sleep abnormalities during abstinence in alcohol-dependent patients. Aetiology and management. *CNS Drugs, 15*(5), 413-425.
- Levola, J., Aalto, M., Holopainen, A., Cieza, A., Pitkanen, T. (2014). Health-related quality of life in alcohol dependence: a systematic literature review with a specific focus on the role of depression and other psychopathology. *Nordic Journal of Psychiatry, 68*(6), 369-384.
- Litten, R.Z. & Fertig, J. (2003). Self-report and biochemical measures of alcohol consumption. *Addiction, 98*(S2), 31-43.
- Lund, H.G., Rybarczyk, B.D., Leszczyszyn, D., and Stepanski, E. (2012). The discrepancy between subjective and objective measures of sleep in older adults receiving CBT for comorbid insomnia. *Journal of Clinical Psychology, 69*(10), 1108-1120.
- Mahfoud, Y., Talih, F., Strem, D., & Budar, K. (2009). Sleep disorders in substance abusers: how common are they? *Psychiatry, 6*(9), 38-42.
- Manber, R., Bernert, R.A., Suh, S., Nowakowski, S., Siebern, A.T., & Ong, J.C. (2011). CBT for insomnia in patients with high and low depressive symptom severity: adherence and clinical outcomes. *Journal of Clinical Sleep Medicine, 7*(6), 645-652.
- The Mayo Clinic. (2009). *Alcoholism*. Retrieved from <http://www.mayoclinic.org/diseases-conditions/alcoholism/basics/definition/con-20020866>.

- McKay, J.R. (2006.) Continuing care in the treatment of addictive disorders. *Current Psychiatry Reports*, 8(5), 355-362.
- McLellan, A. T., Lester, L., John, C., Griffeth, J., Evans, F., Barr, H.L., & O'Brien, C.P. (1985). New data from the Addiction Severity Index: reliability and validity in three centers. *Journal of Nervous and Mental Disease*, 173(7), 412-413.
- Middlemass, J., Davy, Z., Cavanagh, K., Linehan, C., Morgan, K., Lawson, S., & Siriwardena, A.N. (2012). Integrating online communities and social networks with computerized treatment for insomnia: a qualitative study. *British Journal of General Practice*, 62(605), 840-850.
- Montgomery, S.A., & Åsberg, M. (1979). A new depression scale designed to be sensitive to change. *The British Journal of Psychiatry*, 134(134), 382-389.
- Morin, C.M. (2006). Combined therapeutics for insomnia: should our first approach be behavioral or pharmacological? *Sleep Medicine*, 7(S1), S15-S19.
- Morin, C.M. & Espie, C.A. (2003). *Insomnia: A clinical guide to assessment and treatment*. Kluwer Academic/Plenum Publishers: New York, NY.
- Morin, C.M., Vallieres, A., & Ivers, H. (2007). Dysfunctional beliefs and attitudes about sleep (DBAS): validation of a brief version (DBAS-16). *Sleep*, 30(11), 1547-1554.
- Morse, J.M. (2003). Principles of mixed methods and multimethod research design. In *Handbook of Mixed Methods in Social & Behavioral Research*, Tashakkori, A. and Teddlie, C (Eds), Sage Publications: Thousand Oaks, CA, USA.
- National Heart, Lung, and Blood Institute (NHLBI). (2011). *What Is Insomnia?* Retrieved from <http://www.nhlbi.nih.gov/health/health-topics/topics/inso/>.
- National Institute on Alcohol Abuse and Alcoholism (NIAAA). *Alcohol Use Disorders*. Retrieved from <http://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/alcohol-use-disorders>.
- National Institutes of Health (NIH). (2015). *NIH Clinical Center: Facts at a Glance*. Retrieved from <http://www.cc.nih.gov/about/welcome/fact.shtml>.
- National Library of Medicine. (2013). *Sleep disorders - overview*. Retrieved from www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001803/.
- Newman, I., Ridenour, C.S., Newman, C., & DeMarco, G.M.P. (2003). A typology of research purposes and its relationship to mixed methods. In *Handbook of Mixed*

Methods in Social & Behavioral Research, Tashakkori, A. and Teddlie, C (Eds), Sage Publications: Thousand Oaks, CA, USA.

- Oei, T.P. & Morawski, A. (2004). A cognitive model of binge drinking: the influence of alcohol expectancies and drinking refusal self-efficacy. *Addictive Behaviors*, 29(1), 159-179.
- Owens, J.A., Stahl, J., Patton, A., Reddy, U., & Crouch, M. (2006). Sleep practices, attitudes, and beliefs in inner city middle school children: a mixed-methods study. *Behavioral Sleep Medicine*, 4(2), 114-134.
- Papp, K.K., Stoller, E.P., Sage, P., Aikens, J.E., Owens, J., Avidan, A.,...& Strohl, K.P. (2004). The effects of sleep loss and fatigue on resident-physicians: a multi-institutional, mixed-method study. *Academic Medicine*, 79(5), 394-406.
- Paquet J, Kawinska A, Carrier J. (2007). Wake detection capacity of actigraphy during sleep. *Sleep*, 30(10), 1362-1369.
- Ree, M.J. & Harvey, A.G.(2004). Investigating safety behaviours in insomnia: the development of the sleep-related behaviours questionnaire (SRBQ). *Behaviour Change*, 21(1), 26-36.
- Rehm, J., Room, R., Graham, K., Monteiro, M., Gmel, G., & Sempos, C.T. (2003). The relationship of average volume of alcohol consumption and patterns of drinking to burden of disease - an overview. *Addiction*, 98(9), 1209-1228.
- Richards, L. (1999). *Using NVivo in qualitative research* (2nd ed.). Victoria, Australia: Qualitative solutions and Research Ltd.
- Riley, W.T., Mihm, P., Behar, A., & Morin, C.M. (2010). A computer device to deliver behavioral interventions for insomnia. *Behavioral Sleep Medicine*, 8(1), 2-15.
- Ritterband, L.M., Bailey, E.T., Thorndike, F.P., Lord, H.R., Farrell-Carnahan, L., & Baum, L.D. (2012). Initial evaluation of an Internet intervention to improve the sleep of cancer survivors with insomnia. *Psychooncology*, 21(7), 695-705.
- Ritterband, L.M., Thorndike, F.P., Gonder-Frederick, L.A., Magee, J.C., Bailey, E.T., Saylor, D.K., & Morin, C.M. (2009). Efficacy of an Internet-based behavioral intervention for adults with insomnia. *Archives of General Psychiatry*, 66(7), 692-698.
- Room, R., Babor, T., &Rehm, J. (2005). Alcohol and public health. *Lancet*, 365(9458), 519-530.
- Roth, T. (2009). Does effective management of sleep disorders reduce substance dependence? *Drugs*, 69(S2), 65-75.

- Rutledge, C.M., La Guardia, A.C., and Bluestein, D. (2013). Predictors of self-efficacy for sleep in primary care. *Journal of Clinical Nursing*, 22(9-10), 1254-1261.
- Schaefer, J.A., Harris, A.H., Cronkite, R.C., & Turrubiarres, P. (2008). Treatment staff's continuity of care practices, patients' engagement in continuing care, and abstinence following outpatient substance-use disorder treatment. *Journal of Studies on Alcohol and Drugs*, 69(5), 747-756.
- Sivertson, B., Omvik, S., Pallesen, S., Bjorvatn, B., Havik, O.E., Kvale, G., Nielsen, G.H., & Nordhus, I.H.(2006). Cognitive behavioral therapy vs zopiclone for treatment of chronic primary insomnia in older adults: a randomized controlled trial. *JAMA*, 295(24), 2851-2858.
- Smith, N., Hill, R., Marshall, J., Keaney, F., & Wanigaratne, S. (2013). Sleep related beliefs and their association with alcohol relapse following residential alcohol detoxification treatment. *Behavioral Cognitive Psychotherapy*, 42(5), 1-12.
- Sobell, L.C. & Sobell, M.B. (1992). Timeline follow-back: a technique for assessing self-reported ethanol consumption. In *Measuring Alcohol Consumption: Psychosocial and Biochemical Methods* (Eds. Allen, J. & Litten, R.), p. 42-72. Humana Press: Totowa, NJ.
- Sobell, L.C. & Sobell, M.B. (2000). Alcohol Timeline Followback (TFLB). In: American Psychiatric Association (ed.). *Handbook of Psychiatric Measures*. Washington DC: American Psychiatric Association, pp. 477-479.
- Sobieraj, A., Fabian, K., Wilczynski, K., & Krysta, K. (2013). Occurrence of sleep abnormalities among people with mental disorders – questionnaire study. *Psychiatria Danubina*, 25(S2), S203-S206.
- Spira, A.P., Beaudrea, S.A., Stone, K.L., Kezirian, E.J., Lui, L.Y., Redline, S., Ancoli-Israel, S., & Stewart, A. (2012). Reliability and validity of the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Scale in older men. *The Journals of Gerontology, Series A, Biological Sciences and Medical Sciences*, 67(4), 433-439.
- Stevens, E.B., Jason, L.A., Ferrari, J.R., & Hunter, B. (2010). Self-efficacy and sense of community among adults recovering from substance abuse. *North American Journal of Psychology*, 12(2), 255-264.
- Stine, T.W. & Chapman, D.P. (2005). Associations of frequent sleep insufficiency with health-related quality of life and health behaviors. *Sleep Medicine*, 6(1), 23-27.
- Streubert, H.J. (2010). Appraising qualitative research. In G. LoBiondo-Wood and Haber, J. (Eds). *Nursing Research: Methods and Critical Appraisal for Evidence-Based Practice*. Elsevier: St. Louis, MO, USA.

- Teplin, D., Raz, B., Daiter, J., Varenbut, M., & Tyrrel, M. (2006). Screening for substance use patterns among patients referred for a variety of sleep complaints. *American Journal of Drug and Alcohol Abuse, 32*(1), 111-120.
- Troxel, W.M., Germain, A., & Buysse, D.J. (2012). Clinical management of insomnia with brief behavioral treatment (BBTI). *Behavioral Sleep Medicine, 10*(4), 266-279.
- Tyrer, P., Owen, R.T., & Cicchetti, D.V. (1984). The brief scale for anxiety: a subdivision of the comprehensive psychopathological rating scale. *Journal of Neurology, Neurosurgery, & Psychiatry, 47*(9), 970-975.
- Vgontzas, A.N., Liao, D., Bixler, E.O., Chrousos, G.P., & Vela-Bueno, A. (2009). Insomnia with objective short sleep duration is associated with a high risk for hypertension. *Sleep, 32*(4), 491-497.
- Vgontzas, A.N., Liao, D., Pejovic, S., Calhoun, S., Karataraki, M., & Bixler, E.O. (2009). Insomnia with objective short sleep duration is associated with type 2 diabetes: a population-based study. *Diabetes Care, 32*(11), 1980-1985.
- Vgontzas, A.N., Liao, D., Pejovic, S., Calhoun, S., Karataraki, M., Basta, M., Fernandez-Mendoza, J., & Bixler, E.O. (2010). Insomnia with short sleep duration and mortality: the Penn State cohort. *Sleep, 33*(9), 1159-1164.
- Vincent, N. & Lewycky, S. (2009). Logging on for better sleep: RCT of the effectiveness of online treatment for insomnia. *Sleep, 32*(6), 807-815.
- Vincent, N. & Walsh, K. (2013). Hyperarousal, sleep scheduling, and time awake in bed as mediators of outcome in computerized cognitive-behavioral therapy (cCBT) for insomnia. *Behavior Research and Therapy, 51*(3), 161-166.
- Vitiello, M.V. (1997). Sleep, alcohol, and alcohol abuse. *Addiction Biology, 2*(2), 151-158.
- Wallen, G.R., Brooks, A.T., Whiting, B., Clark, R., Krumlauf, M.C., Yang, L., Schwandt, M.L., George, D.T., & Ramchandani, V.A. (2014). The prevalence of sleep disturbance in alcoholics admitted for treatment: a target for chronic disease management. *Family & Community Health, 37*(4), 288-297.
- Walters, S.T., Ondersma, S.J., Ingersoll, K.S., Rodriguez, M., Lerch, J., Rossheim, M.E., & Taxman, F.S. (2014). MAPIT: development of a web-based intervention targeting substance abuse treatment in the criminal justice system. *Journal of Substance Abuse Treatment, 46*(1), 60-65.

- Wang, M.Y., Wang, S.Y., & Tsai, P.S. (2005). Cognitive behavioural therapy for primary insomnia: a systematic review. *Journal of Advanced Nursing*, 50(5), 553-564.
- Weissman, M.M., Greenwald, S., Niño-Murcia, G., & Dement, W.C. (1997). The morbidity of insomnia uncomplicated by psychiatric disorders. *General Hospital Psychiatry*, 19(4), 245-250.
- White, W.L., Boyle, M., & Loveland, D. (2003). Alcoholism/addiction as a chronic disease: from rhetoric to clinical reality. *Alcoholism Treatment Quarterly*, 3/4, 107-130.
- White, W. (2009). A lost vision: The mobilization of community resources to support long-term addiction recovery. *Journal of Substance Abuse Treatment*, 36(2), 146-158.
- Williams, J., Roth, A., Vathauer, K., & McCrae, C.S. (2013). Cognitive behavioral treatment of insomnia. *Chest*, 143(2), 554-565.
- Willis, G.B. (1994). Cognitive interviewing and questionnaire design: a training manual. Cognitive Methods Staff working paper series. Publishers: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Wong, M, Brower, K., Fitzgerald, H., & Zucker, R. (2004). Sleep problems in early childhood and early onset of alcohol and other drug use in adolescence. *Alcoholism, Clinical and Experimental Research*, 28(4), 578-587.
- World Health Organization (WHO). (2013a). *Public health problems caused by harmful use of alcohol*. Retrieved from http://www.who.int/substance_abuse/activities/public_health_alcohol/en/index.html.
- World Health Organization (WHO). (2013b). *Alcohol*. Retrieved from http://www.who.int/substance_abuse/facts/alcohol/en/index.html.
- Yang, C.M., Spielman, A.J., Glovinsky, P. (2006). Nonpharmacologic strategies in the management of insomnia. *The Psychiatric Clinics of North America*, 29(4), 895-919.
- Zhabenko, O., Krentzman, A.R., Robinson, E.A., & Brower, K.J. (2013). A longitudinal study of drinking and depression as predictors of insomnia in alcohol-dependent individuals. *Substance Use & Misuse*, 48(7), 495-505.