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Evaluating the Effects of a Group Cognitive Behavioral Therapy for Veterans with Posttraumatic Stress Disorder and Insomnia: A Pilot Study.

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EVALUATING THE EFFECTS OF A GROUP COGNITIVE BEHAVIORAL THERAPY FOR VETERANS WITH POSTTRAUMATIC STRESS DISORDER AND INSOMNIA: A PILOT STUDY

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth

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Abstract

EVALUATING THE EFFECTS OF A GROUP COGNITIVE BEHAVIORAL THERAPY FOR VETERANS WITH POSTTRAUMATIC STRESS DISORDER AND INSOMNIA: A PILOT STUDY

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Combat and war zone veterans are particularly vulnerable to developing Posttraumatic Stress Disorder (PTSD) due to the increased risk of experiencing trauma inherent in military service. Insomnia and nightmares are core symptoms of PTSD and can be factors in the development, maintenance, and exacerbation of PTSD. However, sleep disturbance has received relatively little attention from a treatment point of view until recently. Recent research has demonstrated that cognitive behavioral therapy for insomnia (CBT-I) and imagery rehearsal therapy (IRT) for nightmares are effective stand alone and combination treatments for sleep disturbance in civilian and veteran populations. Although group interventions are lower in cost and more efficient to deliver in a VA setting, studies have yet to test the feasibility and efficacy

of group CBT-I/IRT combination treatment for veterans with PTSD. The current pilot study investigated the feasibility and efficacy of a combined CBT-I and IRT protocol intervention for insomnia and nightmares delivered in a group format to a sample of mixed theater veterans with PTSD. Participants (n = 34) were randomly assigned to either a treatment (n = 17) or waitlist control condition (n = 17). After baseline assessment, participants assigned to the treatment condition participated in six ninety-minute weekly group sessions of combined CBT-I and IRT and completed posttreatment and two month follow-up assessments. Those in the waitlist condition completed a six week waiting period. After completing post-waitlist assessment, they were given the opportunity to receive the treatment and 12 participants elected to cross over.

The authors hypothesized that those in the treatment condition would experience significant improvement on self-report measures of sleep, nightmare frequency, PTSD-related sleep disturbance, beliefs about sleep, and overall PTSD and depression severity compared to the waitlist condition at posttreatment and two-month follow-up. These hypotheses were largely supported by the study results with some notable exceptions. Significant condition by time interactions were found on measures of sleep and nightmares, beliefs about sleep, and depression at posttreatment. Treatment gains were maintained at two month follow-up for sleep variables but not nightmare frequency or depression. There were no condition by time interactions for measures of PTSD or PTSD-related sleep disturbance at posttreatment. In sum, the findings of this study indicate that a combined CBT-I and IRT delivered in a group format was effective in reducing insomnia symptoms, nightmare frequency, and depression in a sample of mixed theater veterans with PTSD. The study also demonstrated the feasibility of this treatment approach with this population suggesting that a larger randomized controlled study is warranted.

Evaluating the Effects of a Group Cognitive Behavioral Therapy for Veterans with Posttraumatic Stress Disorder and Insomnia: A Pilot Study

Combat and war zone veterans are particularly susceptible to developing Posttraumatic Stress Disorder (PTSD) because of the increased risk of experiencing trauma inherent in military service (Hoge et al., 2004). It has been estimated that 12% to 15% of male Vietnam veterans suffer from current PTSD with lifetime prevalence rates as high as 31% (Thompson, Gottesman, & Zalewski, 2006; Kulka et al., 1990) and approximately 20% of Operation Enduring Freedom and Operation Iraqi Freedom (OEF/OIF) veterans will develop PTSD post deployment (Hoge et al., 2004; Seal et al., 2009). Combat-related PTSD often co-occurs with substance abuse, major depression, other anxiety disorders (Helzer, Robins, & McEvoy, 1987), social dysfunction (Frueh**,** Turner, Beidel, & Cahill, 2001) and increased risk for suicide (Bullman & Kang, 1994).

Insomnia and chronic nightmares are core characteristics of PTSD (Ohayon & Shapiro, 2000; Neylan et al., 1998; Ross, Ball, Sullivan & Caroff, 1989; American Psychological Association, 2000) and can maintain or exacerbate PTSD symptoms (Spoormaker & Montgomery, 2008). However, sleep disturbance has received relatively little attention from a treatment point of view (Harvey, Jones, & Schmidt, 2003). Accumulating empirical support shows that psychological treatments such as trauma-focused cognitive behavioral therapy (CBT), prolonged exposed (PE) and eye movement desensitization and reprocessing (EMDR) reduce symptoms of PTSD (Ponniah & Hollon, 2009). However, insomnia and nightmares seem to be largely resistant to such treatments (Spoormaker & Montgomery, 2008; Forbes, Phelps, & McHugh, 2001). Available research suggests that sleep disturbances may persist for individuals whose PTSD has been successfully treated (Devida, Zayfert, Pigeon, & Mellman, 2005).

Accumulating research provides evidence that sleep-focused interventions such as cognitive behavioral therapy for insomnia (CBT-I) and imagery rehearsal therapy (IRT) can reduce insomnia and nightmares in civilian and veteran samples that have been exposed to trauma (Krakow et al., 2001; Forbes, Phelps & McHugh, 2001; Ulmer, Edinger, & Calhoun, 2011). However, studies of both civilian and veteran populations have research methodology limitations such as no control condition, small sample size, and no follow-up measures, which make it difficult to draw conclusions about the efficacy of treatment on symptom improvement.

The proposed study will build on the existing literature by testing the effectiveness of a six session group combined CBT-I and IRT intervention for insomnia and nightmares in a sample of Vietnam, Persian Gulf and OEF/OIF veterans with PTSD. To our knowledge, there has not been a randomized controlled study that employs a group combined CBT-I plus IRT intervention using a sample of mixed theater veterans. The purpose of this study is to address the following research questions which are fundamental not only to PTSD research but will also have relevance for insomnia and behavioral intervention research in general: 1) What is the impact of cognitive behavioral treatment for insomnia and nightmares for combat veterans with PTSD on measures of self-reported sleep and nightmares? 2) Do improvements in sleep lead to improvements in veterans' depression and PTSD symptom severity? 3) Is group treatment a viable alternative to individual treatment for insomnia and nightmares in a sample of veterans with PTSD? In the following section, a review of the literature of chronic insomnia and nightmares, and their relationship with PTSD is presented. Included in this review is a description of the primary cognitive behavioral treatments for chronic insomnia and nightmares followed by a discussion of past research that has investigated the effect of such treatments in samples of civilians and veterans with PTSD.

Review of the Literature

Chronic Insomnia

Insomnia is a general clinical term that refers to difficulty initiating or maintaining sleep which causes significant daytime distress. The term primary insomnia is used when insomnia is the only presenting symptom. Insomnia that co-occurred with another primary medical or psychiatric disorder was traditionally categorized as 'secondary insomnia' (Stepanski & Rybarczyk, 2006). However, due to difficulty determining whether coexisting conditions precede and/or exacerbate insomnia, a 2005 State-of-the-Science Conference (NIH State-of-the-Science-Conference Statement, 2005) recommended that 'comorbid insomnia' replace 'secondary insomnia' in the clinical lexicon. Both primary and comorbid insomnia can be acute or chronic. Chronic insomnia is defined as difficulty falling or staying asleep for at least one month which causes significant distress and/or has a negative impact on functioning (American Psychiatric Association, 2000).

Insomnia is a widespread disorder that affects people of all ages. Studies show that 6-10 percent of the general population meet diagnostic criteria for chronic insomnia (Ohayon, 2002; Ohayon, & Reynolds, 2009; Morin, LeBlanc, Daley, Gregoire, & Merette, 2006). Insomnia is more prevalent among women, individuals with psychiatric and medical disorders, and older adults (Ohayon, 2002; Pearson, Johnson, & Nahin, 2006).

Older adults and insomnia. Insomnia is especially common among adults over the age of 55 (Ohayon, 2002; Morin et al., 2006). While younger adults more commonly report difficulty falling sleep, older adults primarily report difficulty maintaining sleep. This could be a result of developmental changes in sleep structure characterized by increases in stage one sleep (shallow sleep) and decreases in delta wave sleep (deep sleep) (Morin & Kowatch, 1993). Sleep efficiency

(percentage of time asleep while in bed) also decreases with age as older adults stay in bed longer (Dement, Miles, & Carskadon, 1982; Reynolds et al., 1985) because of changing life styles, reduced job demands, and absence of regular routine. Older adults are also more likely to engage in unhealthy sleep practices like daytime napping, irregular sleep schedules, unrealistic sleep expectations or worry over the effect of compromised sleep on daytime functioning (Morin, Kowatch, Barry, & Walton, 1993). In addition, older adults may be especially vulnerable to sleep problems because of increased health problems, medication use and other sleep disorders associated with aging such as sleep apnea and restless leg syndrome (Ancoli-Israel, 2005). Among older adults, comorbid insomnia may account for as much as 70% of insomnia (Lichstein, 2000).

Development of chronic insomnia. A diathesis stress model known as the three factor model is the predominant theoretic framework for the development and treatment of chronic insomnia (Drake, Roehrs, & Roth, 2003; Spielman, Caruso, & Glovinsky, 1987). This model posits that predisposing factors such as trait hyperarousal in combination with precipitating factors such as a stressful event (losing a job, giving birth) can lead to episodes of sleep disruption. Chronic insomnia develops when this sleep disturbance is maintained by perpetuating behavioral and cognitive factors such as daytime napping, decreased daytime activity, and increased worry about loss of sleep. Such perpetuating factors often arise out of an individual's attempts to remedy episodes of disturbed sleep (Spielman et al., 1987). Therefore, cognitive behavioral treatments for insomnia target dysfunctional attitudes and beliefs about sleep (Edinger, Wohlgemuth, Radtke, Marsh, & Quillian, 2001) and maladaptive behaviors that maintain abnormal sleep patterns and nighttime arousal (Perlis, Giles, Mendelson, Bootzin, & Wyatt, 1997).

Impact of insomnia. Insomnia has a negative impact on the psychological and physical health of those who suffer from it. It is associated with depression (Katz & Mcorney, 1998; Ford & Kamerow, 1989; Breslau, Roth, Rosenthal & Andreski, 1996; Chang, Ford, Mead, Cooper-Patrick, & Klag, 1997), fatigue (Simon & VonKorff, 1997), decreased overall quality of life (Katz & McHorney, 2002; Zammit, Weiner, Damato, Sillup, & McMillan, 1999), pain (Haack & Mullington, 2005; Hakkio-nen, Alloui, Gross, Eschallier, & Dubray, 2001) and cardiac disease (Bonnet, 2010). Chronic insomnia has also been associated with impaired cognitive function, accident risk, and absenteeism (Walsh, 2004; Ancoli-Israel, 2005).

Chronic insomnia has significant negative financial implications for the individual and society. People who have sleep problems are more likely to use the healthcare system (Ford & Kamerow, 1989; Simon & VonKorff, 1997). In fact, a conservative estimate of the total direct cost of insomnia in 1995 was $13.9 billion due to insomnia treatment and higher healthcare utilization (Walsh & Engelhardt, 1999). Combined direct (total health care costs) and indirect costs (lost productivity costs) to the individual with moderate to severe insomnia have been estimated at $3,062 per year, which is roughly $1,300 more than costs incurred by individuals without insomnia (Sarsour, Kalsekar, Swindle, Foley, Foley, & Walsh, 2011).

Insomnia treatment. Most people who seek treatment for acute or chronic insomnia discuss it with their primary care providers (Edinger, Wohlgemuth, Radke, Coffman, & Carney, 2007) who usually prescribe hypnotic drugs due to lack of familiarity with viable behavioral alternatives (Baillargeon, Demers, Grégoire, & Pépin, 1996). In addition, hypnotic drugs are perceived as a less expensive and an easier treatment method than behavioral treatments (Bastien**,** Morin, & Ouellet, 2004).

Pharmacological treatments for insomnia. Hypnotic medications can be effective treatments for acute insomnia (McClusky, Milby, Switzer, Williams, & Wooten, 1991), and are the most commonly used insomnia treatment in the U.S. (Kripke, 2000; Morin & Azrin, 1988). Medications that are commonly prescribed to treat insomnia include benzodiazepines (Triazolam), non-benzodiazepines (Zolpidem), antihistamines (Benadryl) or anti-depressants (Trazodone). Although usually prescribed as a first-line treatment, sleep medications are not recommended as a treatment for chronic insomnia, especially for older adults (Sivertsen, Omvik, & Palleson, 2006) due to the possibilities of dependence as well as a number of potential side effects such as disrupted transitioning through sleep stages, tolerance, sedation, amnesia, psychomotor and cognitive impairments, and depression (Kripke, 2000; Morin & Wooten, 1996).

Non-pharmacological treatments for insomnia. Evidence-based non-pharmacological interventions for insomnia include behavioral interventions such as stimulus control, sleep restriction, relaxation training, and sleep hygiene (Morin et al., 2006). Stimulus control (Bootzin & Nicassio, 1978) reconditions patients to associate bed with sleep. The bed is reserved for sleep and sex only. According to the guidelines of stimulus control, when patients cannot fall asleep within 15 minutes, they are required to get out of bed and engage in a non-stimulating task. They are allowed to return to the bed only when sleepy. Sleep restriction (Spielman et al., 1987) is an attempt to build fatigue before attempting sleep. It entails adhering to a strict schedule of bedtimes and rise times to decrease time spent awake in bed (with no daytime napping). Cognitive restructuring, first introduced by Morin (1993), is an attempt to challenge and modify unrealistic beliefs and irrational fears about one's sleep patterns. It involves educating patients about normal and abnormal sleep, identifying maladaptive beliefs, addressing them, and then

replacing them with more adaptive beliefs (Petit, Azad, Byszewski, Sarazan, & Power, 2003). Relaxation training is an attempt to decrease anxiety and reduce cognitive and physiological arousal at bedtime through exercises such as pleasant imagery, progressive muscle relaxation, and diaphragmatic breathing. Sleep hygiene education is an attempt to inform patients about optimal sleep conditions such as appropriate bedroom temperature, reducing ambient noise in the bedroom, and avoiding caffeine, alcohol, and nicotine in the evening.

Cognitive behavioral therapy for insomnia. CBT-I is a multi-component treatment that is comprised of stimulus control, sleep restriction, cognitive restructuring, relaxation, and sleep hygiene (Smith, Huang, & Manber, 2005), with less emphasis on the last two components. CBT-I is usually delivered by a therapist in four to eight, 50-90 minute weekly sessions (Edinger et al., 2007; Morin, Kowatch, Barry, & Walton, 1993). CBT-I can lead to clear improvements in sleep outcome variables, with between 70% and 80% of insomnia patients reportedly benefitting from treatment (Morin, et al., 1999; Espie, Inglis & Harvey, 2001). A meta-analysis indicated that CBT-I is a highly effective treatment for primary insomnia in middle-aged and older adults (Irwin, Cole, & Nicassio, 2006). Additionally, a review by Smith, Huang, and Manber (2005) concluded that CBT-I is an effective treatment for those with chronic insomnia who suffer from a wide range of comorbid psychiatric and medical conditions. Thus, CBT-I has proven to be both an efficacious and effective treatment for chronic insomnia.

Research has indicated that CBT-I is a preferable alternative to sleep medication in the treatment of chronic insomnia (Morin et al., 1999; McClusky et al., 1991; Espie, 1999; National Institutes of Health State of the Science Conference Statement, 2005), especially for older adults (Sivertsen et al., 2006). Not only does CBT-I demonstrate equal or superior effects on sleep outcome measures when compared to pharmacology (Jacobs, Pace-Schott, Stickgold, & Otto et

al., 2004) but the therapeutic benefits of CBT-I continue after treatment is terminated (Morin et al., 1999) and does not involve the risks inherent in long term hypnotic drug use (Kriple, 2000). Unfortunately, there is a shortage of clinicians trained in the delivery of behavioral sleep medicine (Perlis & Smith, 2008). There is a critical need to make CBT-I more accessible and affordable to the general public.

Group cognitive behavioral treatment for insomnia. One way to address the shortage of trained CBT-I providers relative to the number of patients needing treatment is group therapy, a common alternative delivery format to individual CBT-I (Edinger & Carney, 2008). A meta-analysis by Morin, Culbert, and Swartz (1994) indicated that CBT-I is modestly more effective when it is delivered by a trained therapist in an individual versus a group setting. However, a study by Bastien and colleagues (2004) compared CBT-I delivered individually, in a group, or over the phone. According to the results of the study, all conditions were associated with significant improvement in sleep parameters with no difference between conditions and improvements were maintained at six month follow-up. These findings were supported by a more recent study (Verbeek, Konings, Aldenkamp, Declerk, & Klip, 2006) which compared patients with primary insomnia (n = 32) treated with individual CBT-I to patients (n = 74) with either primary or comorbid insomnia treated with group CBT-I. There were no significant differences in treatment outcomes between group and individual CBT-I conditions. In addition to conserving resources, one of the benefits of a group format for CBT-I is that it allows patients to obtain valuable social support from fellow group members (Bastien, et al., 2004; Verbeek et al., 2006) and to share strategies for adhering to challenging changes in sleep habits and beliefs.

Self-help cognitive behavioral therapy for insomnia. In addition to group therapy, self-help has been investigated as a treatment delivery method for CBT-I in an effort to reduce cost

and increase accessibility to treatment. Research studies have investigated the efficacy of self-help CBT-I delivered via manual (Alperson & Biglan, 1979; Mimeault & Morin, 1999; Morin, Beaulieu-Bonneau, LeBlanc, & Savard, 2005) audiotape (Morawetz**,** 1989), videotape (Riedel, Lichstein, & Dwyer, 1995; Rybarczyk, Lopez, Schelble, & Stepanski, 2005), and internet (Ström, Pettersson, & Anderson, 2004; Ritterband et al., 2009)**.** The results of a meta-analysis on the efficacy of self-help CBT-I demonstrated that patients with insomnia benefit from self-help CBT-I but the effects sizes of self-help treatments are small to moderate. Therefore, self-help treatments for insomnia are not intended to replace therapist-led interventions (Van Straten & Cuijpers, 2009).

Chronic Nightmares

Nightmare disorder is defined by the occurrence of repeated, vivid, frightening and easily recalled dreams that cause awakenings and result in daytime dysfunction or distress. Nightmares usually take place in the REM phase of sleep and result in lingering intense emotions which can inhibit returning to sleep. Nightmares often occur after traumatic events and can replicate the trauma (replay nightmares) or be symbolic of the traumatic event. Nightmare disorder is diagnosed only when the nightmares occur outside of the context of another mental health disorder. Otherwise, nightmares are considered a symptom of the primary mental health disorder (American Psychiatric Association, 2000).

An estimated 2-6 percent of the general population reports at least one nightmare per week (Hublin, Kaprio, Partinen, & Koskenvuo, 1999; Stepansky, et al., 1998) and rates are higher in clinical populations (Krakow & Zadra, 2006). Chronic nightmares are a major component of the posttraumatic response. In fact, 60% of individuals diagnosed with PTSD experience nightmares (Kilpatrick et al., 1998). Nightmares are associated with psychological

distress and sleep impairment (Berquier & Ashton, 1992; Krakow, Tandberg, Scriggins, & Barey, 1995) because they make people afraid to fall asleep and interrupt sleep once sleep onset has occurred.

Treatment of chronic nightmares. A variety of pharmacological and cognitive behavioral interventions for chronic nightmares exist. However, these treatments generally lack sufficient research support. There remains a need for further randomized controlled studies of these interventions as well as large scale pharmaco- versus cognitive behavioral comparison studies for the treatment of nightmares (Nappi, Dummund, & Hall, 2012).

Pharmacological treatments for chronic nightmares. The American Academy of Sleep Medicine's Standards of Practice Committee assessed the existing research on the treatment of nightmare disorder and found that few studies meet accepted standards for methodological rigor (Aurora et al., 2010). The investigation determined that only prazosin, an alpha-1 antagonist used to treat high blood pressure, could be considered a *Level A* treatment for PTSD related nightmares meaning it has been evaluated by a substantial amount of high quality research studies or clinical consensus. Indeed, prazosin has garnered research support as an effective treatment for nightmares with benefits for sleep disturbance, insomnia, and even PTSD symptoms, in samples of civilians (Boynton, Bentley, Strachan, Barbato & Raskind, 2009) and veterans with PTSD (Raskind et al., 2007; Germain et al., 2011). Other medications have been used to treat PTSD related nightmares but have not been sufficiently studied (Aurora et al., 2010; van Liempt, Vermetten, Geuze, & Westenberg, 2006).

Cognitive behavioral treatments for chronic nightmares. There are a number cognitive behavioral therapies that have been used to treat chronic nightmares such as IRT, exposure, relaxation, and rescripting therapy (ERRT), hypnosis, EMDR, lucid dreaming therapy,

systematic desensitization, and progressive deep muscle relaxation training (Aurora et al., 2010). Of these, only IRT is recommended as a *Level A* treatment by the American Academy of Sleep Medicine's Standards of Practice Committee based on the amount and quality of existing studies that have examined the efficacy of IRT on nightmares (Aurora et al., 2010).

IRT is a cognitive behavioral therapy in which imagery retraining rather than exposure is the active mechanism for nightmare change. The basic IRT protocol requires patients to select a reoccurring nightmare and rescript the dream starting from the first "hot spot" or when the dream's traumatic content begins. The participant then rehearses the rescripted dream for 5-20 minutes daily (Krakow & Zadra, 2006). Since direct exposure to the original nightmare is not part of the treatment protocol, IRT may be a more acceptable treatment for nightmare sufferers who have replay nightmares of past traumatic experiences (Krakow & Zadra, 2006). IRT can be effectively administered in a group (Krakow et al., 2001; Forbes, Phelps, & McHugh, 2001) or individual format (Rhudy et al., 2010), and benefits have been reported from a single session (Germain & Nielsen, 2003) to as many as eight sessions (Thunker & Pietrowsky, 2011). One concerning limitation of IRT could be dropout rates which have been estimated between 25 and 40 percent (Spoormaker & Montgomery, 2008). These rates could be due to some participants' unwillingness to tolerate the distress caused by discussing traumatic memories/nightmares even without direct exposure.

Davis and Wright (2007) introduced an adaptation of IRT called ERRT which has garnered some research attention (Davis & Wright, 2007; Rhudy et al., 2010; Swanson, Favorite, Horin, & Arnedt, 2009). ERRT is usually delivered in three sessions and the protocol involves psychoeducation about sleep and nightmares, relaxation, sleep hygiene, exposure, and nightmare rescripting. While similar to IRT, with ERRT exposure to the original dream is emphasized

whereas IRT focuses on changing the nightmares by building imagery skills. The exposure element of the EERT protocol requires individuals to write down their target nightmare, read it aloud, and identify trauma themes. Then, the nightmare is rescripted in a manner that challenges the trauma content of the dream (Davis & Wright, 2007; Nappi et al., 2012). To date, the only randomized control study that has compared IRT to ERRT did not detect a significant difference between these two treatment approaches (Kellner, Neidhardt, Krakow, & Pathak, 1991). However, IRT has received more attention in the treatment literature than ERRT (Aurora et al., 2010).

Posttraumatic Stress Disorder and Sleep Disturbance

PTSD is an anxiety disorder that develops after an individual is exposed to a life-threatening traumatic event (i.e. combat, rape, or natural disaster) which causes intense fear or helplessness. PTSD symptoms are categorized into three symptom clusters: re-experiencing, avoidance, and hyperarousal (American Psychiatric Association, 2000). PTSD develops in 10-20% of individuals who are exposed to severe trauma (Brunello et al., 2001), with a lifetime prevalence rate of 8% of the general population (American Psychiatric Association, 2000). PTSD often occurs with a number of negative physical and mental health comorbidities. An estimated 60-80 percent of individuals with PTSD also suffer from secondary depression (Ballenger et al., 2000). There is a greater risk for individuals with PTSD to experience poorer health status (Schnurr, Friedman, Sengupta, Jankowski, & Homes, 2000). PTSD is also associated with increased utilization of the health care system (Friedman**,** Schnurr, & McDonagh-Coyle, 1994) and subsequent increased healthcare costs (Walter et al., 2003).

Sleep disturbance is a key characteristic of PTSD (Harvey, Jones, & Schmidt, 2003). Insomnia is considered a symptom in the hyperarousal symptom cluster and nightmares are

considered a symptom of the re-experiencing symptom cluster (American Psychological Association, 2000). Estimates show that sleep disturbance affects over 70% of individuals suffering from PTSD in the general public (Ohayon & Shapiro, 2000). Emerging evidence indicates that sleep disturbance is a factor in the development, maintenance, and exacerbation of PTSD (Germain, Buysse, & Nofzinger, 2008; Nappi, Drummund & Hall, 2011; Krakow et al., 2007). Several hypothesis have been proposed to explain the relationship between sleep disturbance and PTSD which include neurobiological changes in the amygdala and medial frontal cortex (Germain, 2008), the role of sleep in memory consolidation and generalization of fear extinction (Pace-Schott, 2009), sleep-dependent emotion regulation and processing (Walker & van Der Helm, 2009), and resensitization to past trauma via replay nightmares (Rothbaum & Mellman, 2001).

Polysomnographic studies have been conducted in an effort to better understand potential differences in sleep architecture of individuals with PTSD and sleep disturbance (Maher, Rego & Anis, 2006; Kobayashi, Boarts, & Delahanty, 2007). Polysomnography (PSG) objectively assesses sleep using a variety of physiological measurement techniques and is considered the gold standard of sleep assessment techniques. Electrodes are placed on the head, face and legs to measure electrical brain activity, eye movement, muscle tone, and leg movement. PSG monitoring also includes measurement of airflow to monitor sleep-disordered breathing (Harvey, Jones, & Schmidt, 2003). Such studies could provide important information about potential abnormalities in the sleep cycle, thus allowing researchers to draw meaningful conclusions about the mechanism by which PTSD and sleep disturbance are related. Unfortunately, so far existing research involving PSG has produced inconsistent findings (Kobayashi, Boarts, & Delahanty, 2007). This may in part be due to the novel setting of a sleep laboratory which does not elicit the

same conditioned arousal and behaviors as the home environment thus allowing for better sleep (Germain, Hall, Shear, Nofzinger & Buysse, 2006). Despite these inconsistencies in PSG findings, a meta-analysis of studies comparing the sleep of those with and without PTSD was able to identify some similarities across PSG studies. Compared to those without PTSD, individuals with PTSD experience more "shallow sleep" or stage one sleep, less "deep sleep" or slow way sleep, and greater REM density duration (Kobayashi et al., 2007).

Negative behavioral and medical outcomes have also been linked to PTSD-related sleep disturbance (Devida, Zayfert, & Mellman, 2004). For example, the results of a study of 74 female rape victims indicated that sleep disturbance was significantly related to motives for drinking when controlling for depression and PTSD (Nishith, Resick, & Mueser, 2001). In a study of 167 female rape victims, trauma-related sleep disturbance was an independent predictor of self-reported physical symptoms (i.e. headache and upset stomach) after controlling for PTSD and depressive symptoms (Clum, Nishith, & Resick, 2001).

Although accumulating empirical evidence shows that psychological treatments such as trauma-focused CBT and EMDR have reduced symptoms of PTSD (Ponniah & Hollon, 2009), some evidence suggests that insomnia and nightmares are resistant to such treatments (Spoormaker & Mongomery, 2008; Forbes, Phelps, & McHugh, 2001), and persist even after PTSD has remitted (Zayfert & Deviva, 2004). Other evidence indicates evidence-based treatments for PTSD (exposure therapy and cognitive processing therapy) may improve sleep quality but do not resolve insomnia symptoms (Galovski, Monson, Bruce, & Resick, 2009; Belleville, Guay, & Marchand, 2011). Despite the mixed evidence regarding the effect of PTSD treatment on sleep disturbance, one common theme emerges from the existing literature. Sleep impairment is one of the most treatment resistant symptoms of PTSD (Galovski, et al., 2009;

DeViva et al., 2005) and despite being a core feature of PTSD, PTSD-related sleep disturbances have received relatively little clinical and research attention (Krakow et al., 2007).

Etiology of PTSD-related insomnia and nightmares. The theory that has garnered the most support regarding the development of insomnia in individuals with PTSD is that difficulty sleeping results from the increased arousal and hypervigilance inherent in individuals with PTSD (Mellman, Kulick-Bell, Ashlock, & Nolan, 1995; Harvey, Jones, & Schmidt, 2003). Hypervigilance could be the cause of delayed sleep onset, interrupted sleep, and difficult returning to sleep once awakened (Devida et al., 2004).

Other research suggested a classical conditioning explanation for PTSD-related insomnia. For individuals with PTSD, sleep can become associated with trauma related nightmares characteristic of PTSD (Mellman et al., 1995; Krakow et al., 2000). Individuals with severe chronic PTSD symptoms commonly experience replay nightmares, or nightmares that replicate the traumatic event they endured. This kind of nightmare is particularly distressing (Davis, Byrd, Rhudy, & Wright, 2007) and often accompanied by violent movements during sleep which can result in harm to the individual or their bed partner (Neylan et al., 1998). In an effort to avoid re-experiencing trauma in the form of nightmares, sleep is avoided altogether, leading individuals to develop unhealthy sleep habits (Devida et al., 2004). In this manner, staying awake is negatively reinforced by the reduction of anxiety caused by traumatic memories or nightmares. Neylan (1998) conceptualizes this phenomenon as "sleep phobia." Conditioning can also occur if the individual associates bed, bedroom, or darkness with danger. This association is especially strong if the trauma associated with PTSD happened at night (Devida, et al., 2004) which is often the case for veterans since most enemy engagement happens under the cover of darkness. Based on this theory, it stands to reason that if nightmares play a role in the development of PTSD

related insomnia, treating these nightmares could result in improved sleep (Zayfert & Devidia, 2004). It should be noted that some argue that insomnia is not related to PTSD at all but instead is associated with disorders that frequently co-occur with PTSD such as major depression, anxiety disorders, and substance use disorders (Helzer, Robins, & McEvoy, 1987).

PTSD and sleep disturbance in combat veterans. The increased risk of experiencing trauma inherent in military service renders combat and war zone veterans particularly susceptible to developing PTSD (Hoge et al., 2004). The notion that combat trauma leads to specific posttraumatic symptoms is not a new one. In fact, these symptoms were traditionally referred to as 'shell shock,' 'soldier's heart,' and 'combat neurosis' before PTSD was given official status as a DSM disorder in 1980 (Brunello et al., 2001). This designation facilitated the systematic collection of prevalence rates and the development of evidence-based treatments for PTSD. Results from the National Vietnam Veterans Readjustment Study estimated the lifetime prevalence of PTSD to be 30.9% among male Vietnam theater veterans (26% among females). Additional findings from this study indicated that almost 50 percent of the 1.7 million veterans who experienced significant symptoms of PTSD after the Vietnam War continue to experience clinically significant impairment and disability due to PTSD (Weiss et al., 1992). OEF/OIF veterans may be at even greater risk for PTSD due to multiple deployments and increased combat frequency compared to past wars (Nayback**,** 2008). In fact, 31 percent of OEF and 71-86 percent of OIF military service people reported exposure to several combat experiences (Hoge et al., 2004). For those who served in the OEF/OIF wars, it is estimated that approximately 20% of veterans will develop PTSD post-deployment (Hoge et al., 2004). Of those who develop PTSD, 70-91% will report trouble falling and staying asleep (Maher, Rego, & Asnis, 2006).

Combat-related PTSD has associated features not found in the DSM symptom criteria. A main feature of combat related PTSD is social dysfunction, which can include anger (Chemtob, Hamada, Roitblat, & Muraoka, 1994), social anxiety (Crowson, Frueh, Beidel, & Turner, 1998), interpersonal violence, family conflict and employment problems (Jordan et al., 1992; Kulka et al., 1990; Frueh, Turner, Beidel & Cahill, 2001). Veterans with PTSD are also at increased risk for suicide. In study of 100 Vietnam veterans with combat related PTSD, 19 percent reported a previous suicide attempt and an additional 15 percent had been preoccupied with suicidal ideation since the war (Hendin & Haas, 1991). In a recent study of 407 treatment seeking OEF/OIF veterans, after controlling for age, depression, and substance abuse, those who were diagnosed with PTSD were four times as likely to endorse suicidal ideation than veterans not diagnosed with PTSD (Jakupcak et al., 2009).

Evidence-based treatments for PTSD such as cognitive processing therapy and prolonged exposure are available to veterans in the VA health system (Karlin et al., 2010). However, due to increasing treatment demands and reluctance of some veterans to engage in trauma-focused treatments (Ouimette et al., 2011) the development of additional treatments for PTSD and related symptoms is warranted.

Veterans with PTSD commonly experience sleep disturbance (McLay, Klam, & Volkert, 2010), which typically consists of trouble falling and staying asleep, and reoccurring nightmares. In fact, 91% of Vietnam veterans with PTSD reported sleep disturbance (Neylan et al, 1998; Roszell, McFall, & Malas, 1991) with 45% reporting difficulty falling asleep, 91% reported difficulty staying asleep, and 55% reported experiencing nightmares (Neylan et al., 1998). Additional sleep disorders, including sleep disordered breathing and periodic limb movement disorder, are also frequently reported in veteran populations (Yesavage et al., 2012; Maher,

Rego, & Asnis, 2006). A retrospective study showed that individuals with PTSD and obstructive sleep apnea showed significant improvement in nightmares and PTSD symptoms after continuous positive airway pressure (CPAP) treatment (Krakow et al., 2000). A discussion of these disorders and their relationship to PTSD, however, is beyond the scope of this study.

The Veterans Health Administration (VHA) established a CBT-I training program for mental health providers as part of a national dissemination initiative to make evidence-based psychotherapies more accessible to veterans. The aim of this CBT-I "roll out" is to increase the number of clinicians trained in CBT-I in the VA system to increase access to CBT-I for the large number of veterans suffering from primary insomnia and insomnia that is comorbid with disorders such as PTSD (Karlin et al., 2013). According to a recent outcome study by Karlin and colleagues (2013) which included 102 clinicians and 182 veterans with insomnia, the CBT-I training program demonstrated favorable therapist competency outcomes as well as significant patient improvement in insomnia severity, depression, and quality of life.

Cognitive Behavioral Interventions for Insomnia and Chronic Nightmares in the Context of PTSD

Until recently, insomnia and nightmares were considered to be a consequence of PTSD and would therefore remit with successful treatment of the primary disorder (Spoormaker & Montgomery, 2008). Few studies have examined the sleep outcomes of participants who have completed treatment for PTSD (Zayfert & Deviva, 2004; Belleville et al. 2011; Galovski et al. 2005), Zayfert and Deviva (2004) conducted a retrospective analysis to investigate the persistence of insomnia in patients who had completed CBT for PTSD. In this study, of the 27 patients who no longer met PTSD diagnosis after undergoing PTSD treatment, 48% reported residual insomnia. Of those with persistent insomnia, nightmares, and hypervigilance were not

present. This study lends credence to the concept that insomnia, initially caused by PTSD symptoms of hyperarousal and reexperiencing in the form of nightmares, can develop into an independent disorder that is maintained despite that fact that the initial cause has been successfully treated (Krakow, et al., 2001; Rybarczyk, Lund, Mack, & Stepanski, 2009). Therefore, it is necessary to identify specific interventions that focus on the treatment of PTSD-related insomnia and nightmares (Krakow, et al, 2001; Zayfert, & DeViva, 2004).

A growing body of treatment research addresses sleep disorders in the context of PTSD. In the following section, studies that have evaluated cognitive behavioral interventions for insomnia, nightmares, or both in the context of PTSD for civilian and veteran populations will be discussed. See Tables 1-3 for a summary of all studies covered in the following section.

Cognitive behavioral treatment for insomnia the context of civilians with PTSD. To our knowledge, only one study has examined the effects of behavioral treatment for insomnia among in a population of civilians with PTSD. A case series study examined the effects of a CBT-I treatment that was tailored specifically to trauma survivors who reported persistent insomnia after positively responding to individually administered CBT for PTSD. Five Caucasian female participants completed a five-session individually administered CBT-I treatment protocol. In four of the five participants, CBT-I was associated with improvements on subjective sleep measures and sleep diary variables. Despite these improvements in self-reported measures of sleep, participants' scores did not fall below clinically significant cutoffs at posttreatment (DeViva et al., 2005).

Cognitive behavioral treatment for nightmares in the context of civilians with PTSD. There are a substantial number of studies which have investigated the efficacy of cognitive behavioral treatments for nightmares in civilian populations with PTSD. In one of the

few randomized controlled studies of IRT, investigators studied the effects of IRT on nightmare frequency, sleep quality, and PTSD symptoms in a sample of 168 female survivors of sexual assault (63% Caucasian), 95% of whom had moderate to severe PTSD. The treatment consisted of a brief three session group IRT treatment protocol (initial two sessions were three hours long, followed by a one hour session three weeks later). Assessment administered at three months posttreatment indicated the treatment condition experienced significantly decreased chronic nightmares, improved sleep quality, and decreased PTSD symptom severity compared to controls. These results were maintained at six month follow-up (Krakow et al., 2001).

Germain and Nielson (2003) conducted a pilot study to test the effectiveness of IRT on nightmare frequency, sleep disturbance, and sleep quality. This is one of the rare studies that employed polysomnography as a sleep outcome measure. Twelve participants (50% diagnosed with PTSD, 42% women) completed one session of group IRT. Results revealed significant reductions in retrospective nightmare frequency, prospective bad dream frequency, anxiety, and PTSD symptoms at posttreatment. Sleep quality remained unchanged according to PSG assessment (Germain & Nielson, 2003).

A randomized controlled trial examined the efficacy of a cognitive behavioral intervention for insomnia and chronic nightmares in a sample of 49 civilians (81% female, 75% Caucasian) who had been exposed to trauma, 67% met criteria for PTSD. The intervention consisted of three two-hour individual or group sessions of ERRT. Posttreatment assessments demonstrated significant reduction in nightmare intensity and PTSD symptoms. At three month and six month follow-up treatment gains were maintained with the addition of improvement in sleep quality and quantity, PTSD, and depression. The results of this study lend support to the

concept that treatment benefits may not be fully actualized at posttreatment and instead come with time and practice of cognitive behavioral techniques (Davis & Wright, 2007).

A randomized controlled study by Rhudy and colleagues (2010) evaluated the effects of three sessions of ERRT on subjective and physiological markers of fear (heart rate, skin conductance and facial EMG) caused by nightmares in a sample of 40 civilians (73% female) with a history of trauma. The results indicated significant reductions in subjective and physiological markers of fear as a result of ERRT compared to the control condition at posttreatment. These reductions were mostly maintained and in some cases enhanced at three and six follow-up. This study supports the idea that nightmare related fear increases nighttime physiological arousal which in turn effects one's ability to fall asleep and return to sleep. Authors discuss the possibility that the physiological reactions to chronic nightmares could have implications for cardiovascular and metabolic health (Rhudy et al., 2010; Blanchard, 1990).

A randomized controlled study was conducted by Lancee and colleagues (2010) to test the efficacy of IRT, exposure therapy, and nightmare monitoring. Participants (399 Dutch civilians, 78% women) were randomized to one of four conditions: a six week self-administered IRT protocol, nightmare exposure protocol delivered in book format, six weeks of dream monitoring or a waitlist control condition. Approximately 70% of the study participants reported experiencing a traumatic event but participants endorsing significant trauma-related symtomology (as measured by the impact of events scale) were excluded from the study. Results indicated that the IRT and exposure conditions were both associated with reductions in nightmare frequency, intensity, depression and anxiety compared to controls. In addition, there were significant improvements in sleep quality in both conditions. Improvements were maintained at 10.5 month follow-up (Lansee, Spoormaker, Krakow, & Van der Bout, 2011).

Thunker and Pietrowski (2012) recently conducted a study with a non-traditional partially controlled design. The study evaluated the effects of an eight sessions IRT protocol on a sample of 69 German participants who suffered from chronic nightmares (47% female). A third of the sample had primary nightmares, another third had nightmares which co-occurred with depression, and the final third had nightmares comorbid with PTSD. Half of the participants from the PTSD sub-group were randomized to a control condition in which they received intensive trauma-focused treatment. The results of the study showed a significant decline in nightmare frequency in all of the sample sub-groups. However, there was not a significant condition by time interaction for the treatment condition compared to the control condition from pre-treatment to posttreatment. A noteworthy finding of the study was an age by time interaction for nightmare frequency which suggested that young participants experienced significantly greater benefit from the IRT protocol than older participants.

Combination cognitive behavioral treatment for insomnia and nightmares in the context of civilians with PTSD. An uncontrolled study examined the effects of a three session group CBT-I plus IRT intervention in a sample of sixty-two crime victims (84% women, 61% Caucasian) with PTSD. At posttreatment, results indicated the treatment was associated with significantly improved sleep quality, nightmare frequency, as well as a reduction in PTSD depression and anxiety symptoms (Krakow et al., 2001).

In a recent pilot study, researchers tested the efficacy of a single-session (90 minutes) intervention that combined components of CBT-I and IRT in a sample of seven adults with PTSD (57% women, 29% Caucasian). The treatment was associated with significant improvement in PTSD symptoms and clinically significant improvements in sleep quality (Germain, Shear, Hall, & Bussye, 2007). This study provides preliminary evidence that even a

brief one session intervention could have utility for improving for sleep disturbance in individuals with PTSD, and could be considered as one of the preliminary steps in a stepped care model for insomnia treatment (Mack & Rybarczyk, 2011).

Cognitive Behavioral Interventions for Insomnia and Chronic Nightmares in Veterans with PTSD

There are a growing number of studies that investigate the efficacy of cognitive behavioral interventions for insomnia and/or nightmares in the veteran population. Of those that exist most are uncontrolled and underpowered making it difficult to draw conclusions about the efficacy of treatment. However, as the VHA brings more attention to sleep disturbances with its recent CBT-I roll out (Karlin et al., 2013), perhaps increased research attention be focused on this important area.

Cognitive behavioral treatment for insomnia in the context of veterans with PTSD. There are two uncontrolled studies which have investigated the effects of CBT-I in samples of veterans with PTSD. The first investigated a CBT-I intervention in a sample of twenty veterans (25% female, 95% Caucasian, 35% with PTSD) who suffered from chronic insomnia comorbid with medical or mental health conditions. Individuals with PTSD were included in the study as long as they did not have co-occurring traumatic nightmares. The CBT-I treatment consisted of eight to ten weekly group sessions. Findings from this study indicated significant improvement in sleep quality, sleep efficiency, and total sleep time. Participants also reported significant improvements in depression and anxiety (Perlman, Arnedt, Earnheart, Gorman, & Shirley, 2008).

In the second study, eight male veterans (12.5% African American, 87.5% Vietnam veterans) completed five sessions of individual CBT-I. Posttreatment results indicated significant

improvements in self-reported sleep variables and depression. These improvements were not reflected in objective measures of sleep (actigraphy). There were also no significant improvements in nightmare frequency, anxiety, PTSD symptoms or daytime functioning (Gellis & Gehrman, 2012).

Cognitive behavioral treatment for nightmares in the context of veterans with PTSD. The evidence in support of cognitive behavioral treatments for nightmares in veterans with PTSD consists mostly of a collection of uncontrolled pilot studies. One such uncontrolled pilot study examined the efficacy of IRT in a sample of 12 male Vietnam veterans (100% Caucasian) with PTSD and combat-related nightmares. The treatment consisted of six 90-minute group sessions. Participants reported significant reductions in frequency and intensity of nightmares targeted for rescripting but not overall nightmares, in addition to improvements in measures of PTSD and depression (Forbes, Phelps & McHugh, 2001). Twelve-month follow-up data from this pilot study indicated that treatment gains were maintained over time (Forbes et al., 2003).

Another uncontrolled study of 17 male veterans (53% Vietnam, 88% Caucasian) with PTSD and trauma-related nightmares, who had not had trauma-focused PTSD treatment, was conducted to determine the effect of six IRT group sessions on nightmares and trauma symptoms. Although no treatment effects were observed at posttreatment, trauma-related nightmare frequency significantly decreased at three and six month follow-up. PTSD symptoms also significantly decreased at three month follow-up according to intent-to-treat analysis. There were no significant changes in depression or sleep quality across the time points. The results of this study indicated that the techniques learned in IRT treatment may take time and practice before they have any effect on traumatic nightmares. Another implication from this study could

be that IRT may be less effective for veterans who have not completed trauma focused therapy. In light of the results, the researchers suggest that IRT should be used as an adjunctive treatment for PTSD rather than a first-line treatment (Lu, Wagner, Van Male, Whitehead, & Boehnlein, 2009).

A chart review of veterans who sought treatment for chronic nightmares was conducted to determine the effectiveness, feasibility and acceptability of an IRT intervention. Fifty eight veterans were enrolled in the study (79% with PTSD diagnosis, 84% male, 56% Caucasian). Those who completed the five session IRT protocol, administered in both an individual and group format, reported significant decreases in nightmare frequency and intensity, severity of insomnia, and PTSD symptoms at posttreatment. Mean scores on measures of insomnia severity and PTSD symptoms were below clinical cutoffs, and 11% of participants reported experiencing no nightmares at posttreatment (Nappi, Drummond, Thorp, & McQuaid, 2010).

Researchers carried out a case series study which examined the effects of four individually administered sessions of IRT in a sample of eleven U.S. combat soldiers in Iraq who suffered from acute nightmares after experiencing a traumatic event within the past 30 days. Frequency of nightmares, posttraumatic stress symptom severity, and insomnia severity were significantly reduced at posttreatment and one month follow-up (Moore & Krakow, 2007).

Long and colleagues (2011) performed a retrospective chart review study of 37 male veterans who underwent six group sessions of imagery rescripting and rehearsal therapy (IRRT) which was described by the authors as a modified version of ERRT developed specifically for veterans which includes extended nightmare rescripting practice. Study results revealed that the treatment was associated with significantly decreased PTSD symptoms, and large effect sizes for improvements in nightmare frequency and sleep quality.

The only randomized controlled study of a cognitive behavioral treatment for nightmares in a veteran population to date was conducted by Cook et al. (2010). In this study, 124 male Vietnam veterans with PTSD were randomly assigned to an IRT condition or an active comparison group. Participants in the treatment condition participated in six sessions of group IRT while those in the control condition completed six session a group intervention which consisted of psychoeducation about sleep and traumatic nightmares in addition to elements of CBT-I. Contrary to hypothesis, there were no differences in the treatment condition compared to control condition from pretreatment to one, three or six month follow-up on primary outcome variables including nightmare frequency, sleep quality, depression, or PTSD. The authors propose that the lack of significant findings could be a result of a possible treatment effect of the active control condition rather than a waitlist control condition. They also assert that the severity of PTSD and duration of chronic nightmares in the sample of Vietnam veterans could have set this study apart from the earlier studies of veterans and civilians which have shown significant treatment effects of IRT.

Combination cognitive behavioral treatment for insomnia and nightmares in the context of veterans. In an effort to address both the insomnia and nightmares that frequently co-occur in veterans with PTSD, several studies have tested hybrid interventions which combine behavioral treatments for insomnia and nightmares for veterans with PTSD. Similar to the treatment studies already reviewed, two of the studies discussed in this section are uncontrolled with small sample sizes. For example, a study by Swanson and colleagues (2009) tested a 10 session group CBT-I plus ERRT intervention in a sample of male combat veterans (n = 10) with PTSD (90% Vietnam, 10% African American). The treatment was associated with significant improvements in insomnia severity, sleep quality, and sleep diary variables and a decrease in

nightmare frequency and distress. However, the treatment was not associated with a significant reduction in PTSD symptoms (Swanson et al., 2009). Another pilot study evaluated the feasibility and efficacy of an individually administered combined CBT-I and IRT protocol in a sample of 11 male Iraq war veterans (45% African American). The 7-8 session CBT-I/IRT intervention was associated with a reduction in nightmare frequency, PTSD symptoms, insomnia severity and an increase in sleep quality (Harb, Cook, Gehrman, Gamble, & Ross, 2009).

Recently, several randomized controlled studies have evaluated the efficacy of a combined CBT-I/IRT intervention for veterans with chronic insomnia, nightmares and PTSD (Germain et al., 2012; Ulmer et al., 2011; Ochsner Margolies, Rybarczyk, Vrana, Leszczyszyn & Lynch, 2013). Germain and colleagues (2012) conducted a study which compared three conditions: a behavioral sleep intervention consisting of CBT-I and IRT components delivered in an individual format over eight sessions, a medication condition which involved an eight week course of prazosin, and a medication placebo control condition. Fifty combat veterans (90% male, 82% Caucasian, 48% OEF/OIF) were randomly assigned to one of the three conditions. Assessment using subjective and objective measures from pretreatment to posttreatment indicated that both the behavioral sleep intervention and prazosin conditions were more effective that the placebo condition in reducing insomnia symptoms, nightmare frequency, but there was no difference between the two active treatments. Surprisingly, all conditions showed significant improvement with no condition by time interactions on mood symptoms. Posttreatment results were maintained at four-month follow-up. Not only is this one of the few randomized controlled studies of a cognitive behavioral intervention for chronic insomnia and nightmares, it is the only study in the literature so far that compares behavioral treatment for nightmares and insomnia to medication with a placebo control. Other superlative methodological features of this study were

the use objective measures of sleep (PSG) and a follow-up assessment to evaluate durability of treatment.

A pilot study with a randomized controlled design tested of the feasibility and efficacy of a cognitive behavioral intervention for insomnia and nightmares (Ulmer et al., 2011). The sample consisted of 22 veterans with PTSD (11% Vietnam veterans, 67% male and 33% Caucasian) who were randomly assigned to either a treatment or treatment as usual condition. A combined CBT-I and IRT intervention was delivered individually over the course of six bi-weekly sessions. The intervention was associated with significant improvements in sleep diary variables, insomnia severity, sleep quality, nightmare frequency and PTSD symptoms. The invention was not associated with significant improvements in depression or PTSD-related sleep disturbance compared to the control condition.

Ochsner Margolies and colleagues (2013) recently conducted a randomized controlled study which examined the effects of a four session individually administered CBT-I plus IRT treatment for OEF/OIF veterans with PTSD. Participants (n = 40, 90% male, 60% African American) were randomly assigned to either a treatment condition or a wait-list control condition. Participants completed objective (actigraphy) and subjective measures of sleep (diaries and self- report questionnaires) at pretreatment and posttreatment. Participants in the treatment condition demonstrated significant improvements on subjective and objective measures of sleep, as well as significant reductions in PTSD, PTSD-related sleep disturbance, depression and distressed mood compared to controls at posttreatment.

Table 1.

Published Studies that have Tested Cognitive Behavioral Interventions for Insomnia in the Context of PTSD.

Authors and year	*n* and Participants	Control Group	Treatment	Measures	Posttreatment Results	Follow-up
Insomnia TX						
DeVida et al., 2005	5 female civilians with PTSD	No	Individual CBT-I. 5 sessions.	Subjective	Improvements in subjective measures of sleep.	No
Perlman et al., 2008	20 mixed theater veterans (25% female, 35% with PTSD)	No	Group CBT-I. 8-10 sessions.	Subjective	Significant improvements in subjective measures of sleep. Significant reductions in fatigue, anxiety, depression. Decreased use of hypnotics.	No
Gellis & Gehrman, 2012	8 male veterans with PTSD (88% Vietnam)	No	Individual CBT-I. 5 sessions.	Subjective	Significant improvements in subjective measures of sleep and depression. No changes in objective measures of sleep. No significant changes in functioning, PTSD, nightmares.	No

PTSD = Posttraumatic Stress Disorder, CBT-I = Cognitive behavioral therapy for insomnia

Table 2.

Published Studies that have Tested Cognitive Behavioral Interventions for Nightmares in the Context of PTSD.

Authors and year	***n* and Participants**	**Control Group**	**Treatment**	**Measures**	**Posttreatment Results**	**Follow-up**
Nightmare TX						
Krakow et al., 2001	168 female civilians (95% with PTSD)	Waitlist	Group IRT. 3 sessions.	Subjective	Significant reduction of nightmares and PTSD symptoms. Significant improvement in sleep quality.	6 month
Germain & Nielson, 2003	12 civilians (50% with PTSD, 42% women).	No	Group IRT. 1 session.	Objective and subjective	Significant reductions in retrospective nightmare frequency, prospective bad dream frequency, anxiety and PTSD symptoms.	No
Davis & Wright, 2007	49 civilians with PTSD	Waitlist	Individual or group ERRT. 3 sessions.	Subjective	Reductions in nightmare frequency/intensity and PTSD symptoms at 3-6 month follow-up. Significant reductions in nightmare frequency/ intensity, PTSD and depression symptoms. Significant improvement in sleep quality and quantity.	3 month, 6 month

PTSD = Posttraumatic Stress Disorder, IRT = Imagery rehearsal therapy, ERRT = Exposure, Relaxation, Rescripting Therapy.

Authors and year	*n* and Participants	Control Group	Treatment	Measures	Posttreatment Results	Follow-up
Lancee, Spoormaker & van den Bout, 2010; 2011	399 civilians	Waitlist	6 week self-administered IRT and exposure treatment	Subjective	IRT and exposure were both associated with reductions in nightmare frequency, intensity, depression and anxiety. Significant improvement in sleep quality maintained at 10.5 month follow-up.	4 month, 10.5 month
Rhudy et al., 2010	40 civilians (73% female) exposed to trauma	Waitlist	Individual ERRT. 3 sessions.	Subjective	Reductions in objective physiological and subjective emotional reactions to nightmares.	3 month, 6 month.
Thunker & Pietrowsky, 2011	66 civilians (39% with PTSD)	For PTSD group, Active control group	Individual IRT. 8 sessions	Subjective	Reduction in nightmare frequency and depression in PTSD treatment group but no condition x time interaction for either variable. Results maintained at follow-up.	10 weeks.
Forbes et al., 2001; 2003	12 male Vietnam veterans with PTSD	No	Group IRT. 6 sessions	Subjective	Significant reductions in target but not overall nightmare frequency and intensity. Significant improvement in PTSD and depression maintained at 1two month follow-up.	3 month, 12 months
Moore & Krakow, 2007	11 Iraq war soldiers.	No	Individual IRT. 4 sessions	Subjective	Significant reduction in nightmare frequency, PTSD symptoms and insomnia severity. Reductions maintained at one month follow-up.	1 month

PTSD = Posttraumatic Stress Disorder, IRT = Imagery rehearsal therapy, ERRT = Exposure, Relaxation, Rescripting Therapy.

Authors and year	*n* and Participants	Control Group	Treatment	Measures	Posttreatment Results	Follow-up
Lu et al., 2009	17 mixed theater male veterans with PTSD	No	Group IRT. 6 sessions.	Subjective	No significant changes at posttreatment. Significant reduction in nightmares and PTSD at 3 and 6 month follow up.	3 month, 6 month
Nappi et al., 2010.	58 mixed theater veterans (16% female)	No	Individual and group IRT. 5 sessions.	Subjective:	Significant decreases in nightmare frequency and intensity, severity of insomnia, and PTSD Symptoms. Insomnia severity and PTSD scores below clinical cutoffs.	No
Cook et al., 2010	124 male Vietnam veterans with PTSD	Comparison condition	Group IRT. 6 sessions	Subjective	No significant reductions in nightmare, PTSD, or sleep measures.	6 month
Long et al., 2011	37 male veterans with PTSD. (95% Vietnam)	No	Group modified ERRT. 6sessions	Subjective	Significant reductions in nightmare frequency, total sleep time and PTSD symptoms.	No

PTSD = Posttraumatic Stress Disorder, IRT = Imagery rehearsal therapy, ERRT = Exposure, Relaxation, Rescripting Therapy.

Table 3.

Published Studies that have Tested Cognitive Behavioral Interventions for Insomnia and Nightmares in the Context of PTSD.

Authors and year	***n* and Participants**	**Control Group**	**Treatment**	**Measures**	**Posttreatment Results**	**Follow-up**
Combined Treatment for insomnia and nightmares						
Krakow et al., 2001	62 civilians with PTSD (84% female)	No	Group CBT-I + IRT. 3 sessions.	Subjective:	Significant improvement in insomnia severity and sleep quality. Significant reductions in anxiety, depression, and PTSD symptoms.	No
Germain et al., 2007	7 civilians with PTSD	No	Individual CBT-I + IRT. 1 session.	Subjective:	Significant improvement in sleep quality, and PTSD symptoms. Depression and anxiety unchanged.	No
Swanson et al., 2009	10 male veterans with PTSD (90% Vietnam)	No	Group CBT-I + ERRT. 10 sessions	Subjective:	Significantly reduced nightmare frequency and nightmare distress. Significant improvements in sleep quality and insomnia severity. No significant improvements in PTSD symptoms.	No

PTSD = Posttraumatic Stress Disorder, CBT-I = Cognitive behavioral therapy for insomnia, IRT = Imagery rehearsal therapy, ERRT = Exposure, Relaxation, Rescripting Therapy.

Authors and year	*n* and Participants	Control Group	Treatment	Measures	Posttreatment Results	Follow-up
Harb et al., 2009	11 male Iraq veterans with PTSD	No	Individual CBT-I+IRT. 7-8 sessions.	Subjective	Significant improvements in quality and quantity of sleep, reduction in nightmare frequency and PTSD symptoms.	No
Germain et al., 2012	50 veterans. (90% male, 12% Vietnam, 58% with PTSD).	Placebo	Individual CBT-I+IRT. 8 sessions.	Objective and Subjective	Significant improvement in insomnia severity, mood symptoms and nightmare frequency. Treatment grains maintained at follow-up.	4 month
Ulmer, Edinger, & Calhoun (2011)	22 mixed theater, mixed gender veterans with PTSD.	Treat-ment as usual.	Individual CBT-I+IRT. 6 bi-weekly sessions	Subjective	Significant improvements in sleep diary variables, insomnia severity, sleep quality, nightmare frequency, and PTSD symptoms.	No
Ochsner Margolies et al., (2013	40 OEF/OIF veterans (90% male) with PTSD	Waitlist	Individual CBT-I+IRT. 4 sessions	Objective and Subjective	Significant improvements in objective and subjective measures of sleep parameters. Significant reduction in symptoms of PTSD, PTSD-related sleep disturbance, depression, and distressed mood	No

PTSD = Posttraumatic Stress Disorder, CBT-I = Cognitive behavioral therapy for insomnia, IRT = Imagery rehearsal therapy

Statement of Problem

The number of military personnel who have been living with PTSD and related sleep disturbance since Vietnam, along with the growing number of veterans who are developing PTSD post-deployment from the Persian gulf, Iraq and Afghanistan wars, adds to the urgency of developing and testing a cost-efficient and effective group treatment for PTSD-related sleep disturbance. This is especially important given the evidence which shows that sleep disturbance has negative implications for mental and physical health (Belleville, Guay, & Marchand, 2009; Bryant, Creamer, O'Donnell, Silove, McFarlane, 2010) and plays a role in the development, maintenance, and exacerbation of PTSD (Germain et al., 2008; Nappi et al., 2012)

A growing number of studies have indicated that CBT-I and IRT alone and in combination can be effective in reducing and in some cases eliminating insomnia and nightmares in civilian and veteran populations with PTSD. However, most studies have lacked methodological components necessary for drawing conclusions about the effectiveness of cognitive behavioral interventions, such as a control condition, a sufficient sample size, follow-up measures, and state of the art treatment protocol.

Although group interventions are frequently used in VA settings and may be lower in cost and more efficient to deliver that individual treatment, studies have yet to test the feasibility and efficacy of a group CBT-I/IRT combination treatment for veterans with PTSD. The current pilot study fills a gap in the treatment literature by being the first randomized controlled trial to investigate the feasibility and efficacy of a combined CBT-I and IRT protocol intervention for insomnia and nightmares delivered in a group format to a sample of mixed theater veterans with PTSD. Conservation of resources is especially important in the current economic climate and

continued reduction of the federal budget, so a focus on testing group interventions is warranted in an effort to reduce treatment costs.

The current study extends the work of a previous study conducted at the Hunter Holmes McGuire Veterans Administration Medical Center (McGuire VAMC) by Ochsner Margolies and colleagues (2013) which investigated individual treatment of insomnia and nightmares in OEF/OIF veterans with PTSD. The purpose of the current study was to investigate a combined CBT-I and IRT group intervention for insomnia and nightmares in a sample of mixed theater combat veterans with PTSD using a randomized controlled study design.

Aims and Hypotheses

The aims of the current study are three-fold: 1) To investigate the impact of a cognitive-behavioral treatment for insomnia and nightmares in a sample of combat veterans with PTSD on measures of self-reported sleep and nightmares; 2) To determine if improvements in sleep lead to improvements in PTSD and depression symptoms; 3) To explore the feasibility of conducting a randomized controlled study of combined CBT-I and IRT in a sample of Veterans with PTSD comparing the efficacy of a group protocol to an individual protocol for combined CBT-I/IRT. Based on the exiting literature and the aims of the proposed study, the following hypotheses will be tested:

1. Participants in the treatment condition will report significantly improved sleep compared to the waitlist control condition at posttreatment.

2. Participants in the treatment condition will report significantly decreased nightmare frequency compared to the waitlist control condition at posttreatment.

3. Improvements in sleep resulting from the intervention will be associated with secondary improvements in PTSD symptom severity and depression compared to controls at posttreatment.

4. Improvements in sleep, nightmare frequency, PTSD symptoms, and depression will be maintained at two-month follow-up for participants who complete the treatment protocol.

5. Participants in the treatment condition will show significant reductions in dysfunctional beliefs and attitudes about sleep compared to waitlist controls at posttreatment.

6. More participants in the treatment condition will report clinically significant sleep outcomes compared to those participants in the waitlist control condition at posttreatment.

Exploratory questions are also proposed regarding the feasibility of implementing a randomized controlled study of a group intervention for insomnia and nightmares in a sample of veterans with PTSD. Also of interest is investigating the efficacy of group CBT-I/IRT treatment compared to individual CBT-I/IRT treatment in a veteran sample. To address this question, we will compare the results of the current study to the results of Ochsner Margolies and colleagues' (2013) study.

Methods

Overview

The study was approved by the Virginia Commonwealth University's Institutional Review Board and the McGuire VAMC's Institutional Review Board under the name, "Effects of a Group Intervention for Veterans with PTSD Related Insomnia." The project was identified at the VCU IRB using the IRB ID number HM13247 and at the McGuire VA IRB using the IRB ID number 01668. The study took place in the PTSD Clinic at the McGuire VAMC in Richmond, Virginia.

Vietnam, Persian Gulf, and OEF/OIF veterans who completed a 10-week PTSD treatment for combat and warzone-related PTSD at the McGuire VAMC were invited to participate in the randomized controlled study which compared a six week combined CBT-I and IRT group intervention to a waitlist control condition. Assessments were administered at baseline, posttreatment or post-waiting period, and at two month follow-up. The assessment battery included self-report measures of sleep parameters, insomnia severity, sleep quality, PTSD symptoms, depression symptoms, PTSD related sleep disturbance, and beliefs about sleep.

Participants

Mixed theater combat veterans enrolled in the McGuire VAMC PTSD clinic were recruited to participate in the study between November 2010 and November 2011.

Inclusion criteria. In order to participate in the study, veterans were required to have a diagnosis of PTSD as determined by an intake conducted through the PTSD clinic which included a clinical interview and the administration of the PTSD Checklist–Military Version (PCL-M; Weathers, Litz, Herman, & Keane, 1993). To receive a diagnosis of PTSD from the PTSD clinic, veterans must score above a 53 on the PCL-M and meet the Diagnostic and Statistical Manual for Mental Disorders (American Psychological Association, 2000) criteria for PTSD. Veterans also had to meet criteria for chronic insomnia which includes: 1) at least three episodes of insomnia per week for at least six months (an episode is considered to be ≥30 minutes to fall asleep, being awake for ≥60 minutes after falling asleep, or accumulating less than 6.5 hours of sleep per night) and 2) daytime consequences of insomnia, such as fatigue, irritability, or difficulty concentrating. This definition is based on typical research criteria (Edinger et al., 2004; Rybarczyk et al., 2005). Veterans with reoccurring nightmares were included in the study but such nightmares were not an inclusion requirement.

Exclusion criteria. Participants were excluded from the study if they met the following exclusion criteria: 1) current alcohol or substance dependence or abuse, 2) bipolar or any psychotic disorder, and severe, untreated major depression; and 3) other sleep disorders such as restless leg syndrome, periodic limb movement disorder, REM behavior disorder, sleep apnea, etc., as indicated by patient report and medical record review. Other exclusionary criteria include medical conditions that are highly likely to cause sleep disturbances such as Parkinson's disease (Rybarczyk et al., 2005). Research has shown that sleep deprivation is riskier for individuals with bipolar or seizure disorder as it may facilitate a manic episode or lower the seizure threshold (Smith et al., 2005). Individuals who take sleep medication were included in the study but the medications were monitored and reported in nightly sleep diaries. In both treatment and waitlist conditions, there were no restrictions for participants on continuing or initiating treatment for PTSD or insomnia outside the study.

Measures

Only self-report measures of sleep (sleep diaries, questionnaires) were employed in this study. Some argue that when assessing insomnia subjective measures of sleep are preferable to objective measures (polysomnography, actigraphy) since insomnia is a subjective condition (Lacks & Morin, 1992).

Demographic measures. A demographics questionnaire as administered to participants to collect data on basic information such as age, gender, socioeconomic status, education, height, weight, duration of insomnia and presence of reoccurring nightmares (See Appendix A).

Sleep diaries. Sleep diaries, the most common outcome measure in sleep research (Mimeault & Morin, 1999), are paper-and-pencil records that were completed by participants each morning for the two week prior to treatment, during the treatment phase, and during two

weeks posttreatment. Participants recorded naps, medication/alcohol used for sleep, bedtime, number of minutes to fall asleep, awakenings (quantity and duration), rising time, and time they got out of bed. As a complement to this information, participants also rated their quality of sleep and how refreshed they felt upon awaking. Sleep diaries were modified slightly from their traditional form to include space to record information about frequency and intensity of nightmares. Sleep diaries are a useful way to measure standard sleep indices such as total sleep time (TST), sleep onset latency (SOL), wake after sleep onset (WASO), sleep interruptions (SI) and sleep efficiency (SE). SE is calculated by dividing time spent actually asleep by time spent in bed and then multiplying the dividend by 100 (See Appendix B). In general practice sleep dairies are considered to be the most valid instrument for measuring insomnia (Espie, Espie, Inglis, Tessier, & Harvey, 2001).

Insomnia Severity Index (ISI). The ISI (Bastien, Vallieres, & Morin, 2001) is a seven-item measure that yields a global score of sleep impairment. Scores range from 0-28 (higher scores equal greater levels of impairment) and are based on a 5-point Likert scale. Respondents rate sleep difficulty in terms of its severity, degree of interference with daily functioning, degree of recognition of such impairment to others, level of distress and overall satisfaction with sleep. This scale has good internal validity and appropriate test–retest reliability over a two-week interval (Bastien, Vallieres, & Morin, 2001; See Appendix C).

Pittsburgh Sleep Quality Index (PSQI). The PSQI (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is a self-rated questionnaire that assesses sleep quality during the past month. Nineteen individual items lead to seven component scores: Component 1: subjective sleep quality (PSQI C1), Component 2: sleep latency (PSQI C2), Component 3: sleep duration (PSQI C3), Component 4: habitual sleep efficiency (PSQI C4), Component 5: sleep disturbances (PSQI

C5)., Component 6: use of sleeping medication (PSQI C6), and Component 7: daytime dysfunction (i.e., level of sleepiness and enthusiasm; PSQI C7). The sum of scores for these seven subscales yields one global score of overall sleep quality. The PSQI is frequently used in sleep research and has demonstrated good test-retest reliability and validity (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002; See Appendix D).

Pittsburgh Sleep Quality Index Addendum for PTSD (PSQI-A; Germain, Hall, Krakow, Shear, & Buysse, 2005)*.* The PSQI-A is an addendum to the PSQI and is designed to assess the frequency of PTSD related sleep disturbance. Specifically, participants rate the frequency of seven items that sleep disturbance related to PTSD: general nervousness, memories or nightmares of traumatic experience, severe anxiety or panic not related to traumatic memories, bad dreams not related to traumatic memories, episodes of terror or screaming during sleep without fully awakening, and episodes of acting out dreams, such as kicking, punching, running or screaming. The PSQI-A has demonstrated good internal consistency and convergent validity (Germain et al., 2005; See Appendix E).

PTSD Symptom Scale- Self Report (PSS-SR). The PSS (Foa, Riggs, Dancu, & Rothbaum, 1993*)* is a self-report, 17-item measure reflecting the *DSM-IV* symptoms of PTSD. Symptom frequency is assessed by calculating symptoms endorsed on re-experiencing, avoidance, and arousal subscales: The PSS-SR has high internal consistency and good test-retest reliability (Foa, Riggs, Dancu, & Rothbaum, 1993) (See Appendix F).

Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 (Kroenke, Spitzer, & Williams, 2001) is a brief nine item self-report measure used to access depression symptoms and functional impairment which for diagnostic and treatment monitoring purposes. The PHQ-9 was developed

from the diagnostic criteria for major depressive disorder in the Diagnostic and Statistical Manual Fourth Edition (American Psychological Association, 2000; see Appendix G).

Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS). The DBAS (Morin et al., 1993) is a 30-item scale designed to measure various beliefs, attitudes, expectations, and attributions about sleep and insomnia. These cognitions involve five conceptually-derived themes: misattributions or amplification of the consequences of insomnia, diminished perception of control and predictability of sleep, unrealistic sleep expectations, misconceptions about the causes of insomnia, and faulty beliefs about sleep promoting practices. The answer format includes a three inch (7.6 cm) visual analog scale, with "strongly disagree" and "strongly agree" descriptors at each end of the scale. Scores were then converted to percentages for interpretation. The DBAS has demonstrated adequate reliability and validity (Morin et al., 1993).

Although the DBAS-30 was used in the study as part of the original data collection, items were extracted from the longer form to create the DBAS-16 for the analysis. The DBAS-16 is the newest version of the DBAS (Morin, Vallières, & Ivers, 2007) and consists of 16 statements relating to maladaptive sleep-related cognitions that load onto four factors (or components): 1) sleep-related worry and feelings of helplessness; 2) beliefs about sleep medications; 3) expectations about sleep need; and 4) beliefs about the consequences of insomnia. The DBAS-16 was used for analysis study rather than the longer DBAS-30 because of the availability of the scoring information for the subscales (Carney et al., 2010; see Appendix H).

Insomnia Treatment Evaluation Questionnaire (ITEQ; Mimeault & Morin 1999*).* The ITEQ was developed to measures insomnia treatment plausibility. Using a visual analog scale, participants rate the treatment on the following criteria: (a) if the rationale made sense, (b) how acceptable the treatment was for them, (c) suitability for their sleep problems, and (d) expected

effectiveness for their sleep problems (See Appendix I). The answer format includes a 3.5 inch (8.9 cm) visual analog scale, with "NOT AT ALL" and "VERY MUCH SO" descriptors at each end of the scale. Scores were then converted to percentages for interpretation. This measure was administered during the posttreatment assessment to those participants who completed the treatment.

Procedure

Participants were recruited from one of two PTSD treatment programs both of which were offered by the PTSD clinic. When the study was first initiated at the McGuire VAMC, the PTSD clinic was transitioning from PTSD Boot Camp to the PTSD Recovery program. PTSD Boot Camp was a 10 week treatment program for veterans with PTSD that provided psychoeducation and coping skills in a large group setting (50-70 veterans). In August 2010, the PTSD clinic replaced PTSD Boot Camp with the PTSD Recovery program.

The PTSD Recovery program was designed to be delivered in a group format with 5-14 veterans per group. The program is comprised of 10 weekly sessions each lasting 90 minutes. The main objectives of the program are to educate veterans about PTSD and to teach them coping skills to help manage their PTSD symptoms. The purpose of this cognitive behavioral therapy-based treatment is to reduce PTSD symptom severity and improve psychosocial adjustment. The PTSD Recovery program represents a broad approach to PTSD treatment which includes elements of psychoeducation, cognitive behavioral therapy, in vivo exposure, stress management, acceptance and commitment therapy, mindfulness, and interpersonal effectiveness skills training. Veterans who completed the 10 week recovery program had significantly reduced PTSD symptom severity and increased psychosocial adjustment (Lynch, McDonald, & Mack, 2012). During the final session PTSD Boot Camp before the new PTSD Recovery groups were

implements, veterans were surveyed for their interest in learning more about additional treatment for insomnia, anger, or mindfulness. Similarly, once the PTSD Recovery groups started running, in the tenth and final session of the groups, group therapists asked participants if they were interested in learning more about an invention study for sleep disturbance in veterans with PTSD. Group leaders gave the names of interested participants to the lead investigator, Laurin Mack, M.S., who then contacted the interested veteran to inform them about the study. If the veteran was interested in participating, Ms. Mack screened them via telephone for inclusion/exclusion criteria. Participants who met preliminary criteria were invited to attend a pre-treatment session with Ms. Mack and the Principle Investigator of the study and Ms. Mack's McGuire VAMC research sponsor, Dr. John Lynch. As required by the McGuire VA IRB policies, Dr. Lynch conducted the signed consent process for all participants in the study. Once consented, participants were given a copy of the signed consent document and the original was filed in a locked drawer accessible only to the treatment team. Participants were then administered baseline assessment measures and were provided with a sleep diary to complete nightly for the following two weeks. The dependant variables were assessed at all three assessment points with the following measures: Sleep parameters (sleep diary), nightmare frequency (sleep diary), insomnia severity (ISI), sleep quality (PSQI), beliefs about sleep (DBAS-16), PTSD symptoms (PSS), PTSD-related sleep disturbance (PSQI-A), and depression (PHQ-9).

Randomization and assessment process. After the consent and baseline assessment process was complete, participants were randomly assigned (based on a coin toss) to either a treatment or waitlist condition using a matched randomization procedure in order to ensure an equal number of Vietnam (or older) veterans in each group. Treatment group size ranged from

two to six participants. Groups were launched within one to two weeks after the previous group ended as long as at least four veterans were available to start a group. Unfortunately, due to last minute schedule conflicts, some participants would be unable to join a scheduled group thus contributing to the variability in the group size. Participants assigned to the waitlist control condition were given a self-addressed stamped envelope in which to return their two week sleep diary. Those assigned to the treatment condition were instructed to bring their completed sleep diary to the first group treatment session as it would be used as part of the treatment process.

After completing two weeks of sleep diary data, participants assigned to the treatment condition joined the next available intervention group available which consisted of six 90 minute combined CBT-I and IRT group sessions delivered over a six-week period. In the sixth and final session of the treatment condition, participants completed posttreatment questionnaires and were given a two week sleep diary to complete and return in a self-addressed stamped envelope that was provided with the sleep diary. The ITEQ was administered only once during the study at posttreatment assessment.

Participants in the waitlist control condition were called bi-weekly in an effort to keep them engaged in the study through the post-waiting period assessment. Waitlist participants were reminded to send in their completed two week sleep diary during the first bi-weekly phone call. At the end of the eight-week waitlist control monitoring period, participants were sent post-waitlist assessment measures by mail which included a second two week sleep diary. They were asked to complete measures at home and return them in an enclosed self-addressed, stamped envelope to the study team. These participants were then given the opportunity to cross over to the treatment condition and join the next available intervention group (see Figure 1).

Regardless of condition to which they were initially assigned, participants who completed the six week intervention were sent via U.S. mail follow-up assessments at two months posttreatment which included study measures and a one-week sleep diary. A self-addressed stamped envelope was included with the assessment package to use for returning follow-up assessments.

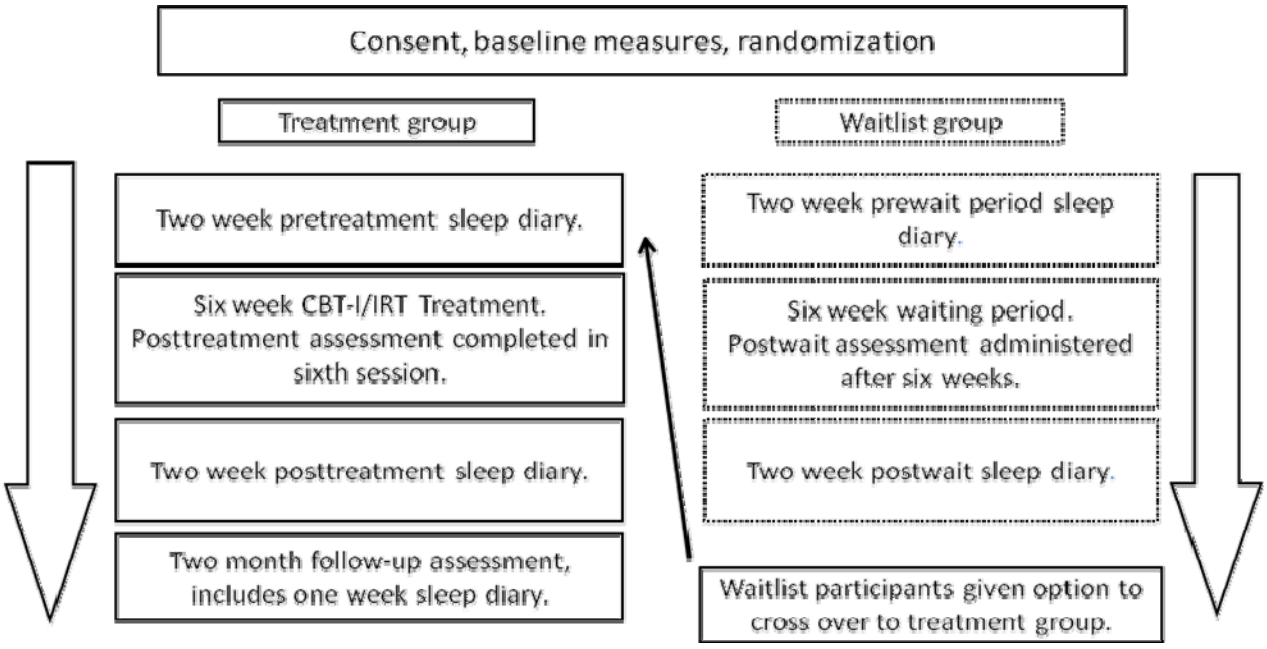

Figure 1. Flowchart of study procedures.

Combined CBT-I and IRT intervention. The intervention program was largely based on Morin's (2003) insomnia treatment program with the added component of IRT (Krakow & Zadra, 2006). Ms. Mack had been trained to provide group CBT-I by Dr. Bruce Rybarczyk, an expert in CBT-I with significant experience in delivering CBT-I in a group format (Rybarczyk et al., 2005). Dr. Lynch also had experience with CBT-I and underwent formal training with Dr. Rachel Manber as part of the VA's CBT-I rollout training program. Ms. Mack developed a treatment manual, based off of materials from Dr. Rybarczyk, that was used to guide each of the seven groups. Groups were conducted one after another from January 2011 through February 2012.

The treatment consisted of six weekly 90-minute group sessions and was administered by Laurin Mack, M.S. and John Lynch, Ph.D. at the McGuire VAMC in one of the designated PTSD group treatment rooms. Each of the six sessions included a review of information provided the week before, an educational component during which new materials was introduced, a review of each participant's sleep diary during which a sleep window for the week was determined, and a group discussion aimed at addressing problems the participants experience in treatment implementation (Rybarczyk et al., 2005). In the first session, veterans were provided with basic psychoeducation about sleep architecture and insomnia. Then therapists reviewed the basic rational for sleep restriction, reviewed participants' diaries individually and calculated their sleep windows (i.e. scheduled bed and rise times) for the week. In order to calculate a sleep window, veterans would choose their preferred wake time which they agreed to maintain until the end of treatment. With this wake time as the anchor, the bedtime would be set based on the participant's average amount of sleep per week as reported in the sleep diary (i.e. if a participant slept an average of six hours per night and chose 6 AM as their rise time, their sleep window would be from 12:00 AM to 6:00 AM). Participants were instructed that they could sleep only during their designated sleep window with no daytime naps, early bedtimes or sleeping past their scheduled wake time.

In the second session, therapists reviewed patients sleep diaries and calculated their average weekly sleep efficiency based on reported bedtime, SOLO, WASO and rise times. If a participants SE was $\geq 85\%$, 30 minutes would be added to their sleep window. If SE was $\leq 85\%$ their sleep window would stay the same. Stimulus control was introduced and participants were instructed that the bed and bedroom are for sleep and sex only. If they found themselves awake in bed for longer than 15 minutes, they were to get out of bed and engage in a quiet, not

stimulating activity until they felt sleepy and were ready to go back to bed. Participants were also taught about the importance of a wind down period before bed to allow for their mind and bodies to transition to sleep. In the section session, the therapist led the participants in a relaxation exercise (diaphramatic breathing). Unlike in other CBT-I protocols, relaxation was emphasized in this study's protocol because of the hypervigilance and arousal characteristic of PTSD.

In the third session, therapists reviewed participants' sleep diaries and calculated average SE from the past week which was used to set the participants' sleep window for the coming week. Therapists then led the group in additional relaxation exercises (progressive muscle relaxation and pleasant imagery). In the third session IRT was introduced using the model described in Krakow and Zadra (2006). Participants who did not experience reoccurring nightmares were given permission to leave early from session as the material would not be relevant to them. Participants with reoccurring nightmares were asked to select a nightmare to be rescripted the following week.

In the fourth session after therapists reviewed participants' sleep diaries, calculated average SE from the past week and set participants' sleep windows for the coming week, cognitive restructuring was introduced. Therapists engaged the group in a discussion about the influence of thoughts on behavior, how to identify unhelpful thoughts about sleep and how to challenge these thoughts. In the second half of the session, therapists led the veterans in an imagery changing exercise and then instructed the participants how to rescript their target nightmare accordingly. This process included identifying the "hot spot" in their reoccurring nightmare and rescripting the dream from that point on in any way they liked. Veterans were then instructed to rehearse this rescripted dream for 15-20 minutes daily for the next week.

In the fifth session, after therapists reviewed participants' sleep diaries, calculated average SE from the past week, and set participants' sleep windows for the coming week, cognitive restructuring was continued with a discussion about how to manage racing thoughts. In the second half of the session, participants reported on their rehearsal of the rescripted dream from the week before and there was a group discussion aimed at problem-solving issues that came up while rehearsing the rescripted dream.

In the sixth and final session, after therapists reviewed sleep diaries and set participants sleep windows, sleep hygiene education was introduced which included guidelines for how to create conditions that are conducive to sleep. Topics such as amount and timing of exercise, diet, room temperature, light, noise were discussed. Therapist reviewed all components covered during the course of the six week treatment and participants spent the last 30 minutes of session filling out posttreatment measures. See Figure 2 for a summary of each treatment session.

Week 1	Psychoeducation about insomnia Sleep restriction
Week 2	Stimulus control Relaxation
Week 3	Relaxation *Introduction to IRT
Week 4	Cognitive restructuring *IRT: dream rescripting and imagery rehearsal
Week 5	Cognitive restructuring *IRT: imagery rehearsal trouble shooting
Week 6	Sleep hygiene Program review Posttreatment assessment

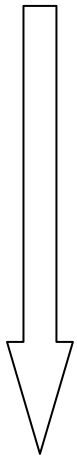

Figure 2. Summary of combined CBT-I and IRT intervention.
*Indicates IRT component

Statistical Analysis

Participant characteristics were summarized using descriptive statistics. The success of randomization was tested using t-tests for continuous variables and chi-square analysis for

categorical variables to ensure there were no differences in demographic and sleep variables between conditions ($p > .05$).

An intent-to-treat analysis or "last observation carried forward" (LOCF) technique was conducted to deal with issues of missing data. That is, data from participants who dropped out of the study after randomization or who do not return study measures were included in the analysis by substituting those participants' pretreatment data for missing data at posttreatment. This conservative approach to analyzing treatment effects was used in order to limit attrition bias and strengthen any conclusions that can be made about the intervention (Kazdin, 2003). It was thought appropriate to use the LOCF technique because the study had a low attrition rate (11.7%). The Institute of Medicine (2007) recommends that LOCF should not be used when the study attrition rate is greater than 10%. Partial eta squared or η^2 was used as an estimate of effect size for most analyses in this study: small effect size = .01, medium effect size =.09 and large effect size = .25 (Cohen, 1988). Partial eta squared shows the proportion of the total variability attributed to the independent variable (Tabachnick & Fidell, 2007).

Using intent-to-treat analysis, a repeated measures multivariate analyses of variance (MANOVA) was used to determine if the treatment condition had significantly improved sleep parameters compared to the waitlist condition at posttreatment (Hypothesis 1). For the repeated measures MANOVA the independent variables (IVs) were condition (treatment vs. control) and the repeated factor was time (pretreatment and posttreatment) and dependent variables (DVs) were SOL, WASO, SI, SE, and TST. Follow-up 2 x 2 repeated measures ANOVAs were conducted on individual sleep diary variables which included daily diary nightmare frequency variables (Hypothesis 2) not included in the sleep parameter MANOVA (number of nightmares per night, number of nights with nightmares per week). Due to the amount of missing sleep diary

data, a separate "completer" analysis was conducted which repeated the steps laid out above but using only data from participants who had provided some kind of pre-and posttreatment sleep diaries. Finally, paired samples t-tests were conducted on each sleep diary variable using a larger sample of participants who had completed treatment (treatment condition combined with waitlist crossovers; n = 29) to determine the pre- to posttreatment effects of treatment on each sleep diary variable.

To determine if the treatment condition had significantly improved insomnia severity and sleep quality (Hypothesis 1) and beliefs about sleep (Hypothesis 5) compared to the waitlist condition at posttreatment, intent-to-treat 2 x 2 repeated measures ANOVAs were conducted on individual sleep questionnaires (ISI, PSQI, DBAS-16). For the 2 x 2 repeated measures ANOVA the independent variables (IVs) were condition (treatment vs. control) and the repeated factor was time (pretreatment and posttreatment) and dependent variables (DVs) were ISI, PSQI, DBAS-16 total score and component scores respectively. Follow-up paired samples t-tests were conducted on each sleep questionnaire variable using a larger sample of participants who had completed treatment (treatment condition combined with waitlist crossovers; n = 29) to determine the pre- to posttreatment effects of treatment on each sleep questionnaire variable.

To determine if the treatment condition had significantly improved PTSD, Depression (Hypothesis 3) and PTSD-related Sleep Disturbance (Hypothesis 2) compared to the waitlist condition at posttreatment, intent-to-treat 2 x 2 repeated measures ANOVAs were conducted on individual mood questionnaires (PSS, PHQ-9, PSQI-A). For the repeated measures ANOVA the independent variables (IVs) were condition (treatment vs. control) and the repeated factor was time (pretreatment and posttreatment) and dependent variables (DVs) were PSS, PHQ-9, PSQI-A respectively. Follow-up paired samples t-tests were conducted on each mood questionnaire

variable using a larger sample of participants who had completed treatment (treatment condition combined with waitlist crossovers; n = 29) to determine the pre- to posttreatment effects of treatment on each mood questionnaire variable.

One way repeated measures ANOVAs were used to determine if there was a significant difference in outcome measures at pre-, post, and follow-up treatment for all participants who completed treatment (Hypothesis 4). In cases where there were significant main effects for time, Bonferoni posthoc tests were used to determine which specific assessment points differed from one another.

The clinical significance of the change in sleep efficiency from baseline to posttreatment was calculated and described for the treatment condition and the control condition (Hypothesis 6). Lichstein et al.'s (2000) method of comparing the data with established norms for self-reported sleep efficiency (M = 86.1%, SD = 9.7%; Lichstein, 1997) was used to determine clinical significance of treatment outcome in this sample. This method defines three separate categories of clinically significant change. For all three categories sleep efficiency must improve by at least 0.5 SD of the norm (4.85%). C*linically significant improvement* means that the individual's SE increases by 4.85% and their posttreatment sleep efficiency is greater than or equal to 86.1%. *Moderately clinically significant improvement* means that the posttreatment sleep efficiency improves by 4.85%, does not reach 86.1%, but is within one standard deviation of the mean of the normative group (76.4%). Finally, the classification of *substantial improvement* is given to individuals who had very low baseline sleep efficiency but who make posttreatment gains of greater than two standard deviations of the norm (more than 19.4%). A chi-square analysis was used to test Hypothesis 6. The IVs were combined clinical significance

categories (clinically significant improvement, moderately clinically significant improvement, substantial improvement, and no improvement) and condition (treatment and control).

In addition to change in SE as an indication of clinically significant outcome, we also used Morin et al.'s (2009) method for using change in ISI to determined clinically significant outcomes. Using his guidelines, an ISI score of less than eight is considered in remission from insomnia, and participants with scores of 8-14 are considered to have sub-threshold insomnia (Ochsner Margolies et al., 2013). Rates of remission and treatment response at posttreatment were compared between the treatment and control conditions.

Results

Demographics

Demographic characteristics for the entire sample and each condition are displayed in Table 4. Although not systematically recorded, over 100 veterans were referred to the study and of those, approximately 28 had a diagnosis of sleep apnea and 15 had a diagnosis of current substance abuse/dependence. Thirty four veterans met study criteria and gave written consent to participate in the study. Of the 34 participants who were randomly assigned to treatment or waitlist control condition the mean age was 58.91 (SD 9.02); 97.1% were male; 70.6% were Vietnam veterans; 70.6% Black; 55% were married; and 82.4% completed high school. Approximately 65% of the sample completed the 10 session PTSD recovery group while 35% of the sample completed PTSD Boot Camp. Participants' reported an average insomnia duration of 16.94 years (13.06), 73.5% of the sample endorsed reoccurring nightmares and 14 out the 29 participants who completed pretreatment sleep diaries indicated that took sleep medication within two weeks of the baseline assessment. Participants who took sleeping medication reported that they took medications an average of 5.55 nights per week.

Demographic characteristics of the treatment and waitlist control condition were compared using t-tests for continuous measures (age, insomnia duration, and number of nights on medication) and Chi square analyses for categorical measures (gender, race, combat theater, etc.). No group differences were found ($p > .05$).

Table 4.

Participant Characteristics by Condition.

	Treatment Condition (n = 17)	Control Condition (n = 17)	Total Sample (n = 34)	Cross-over Condition (n = 12)
Gender	16 males (94.1%) 1 female (5.9%)	17 males (100%)	33 males (97.1%) 1 female (2.9%)	12 males (100%)
Age	59 (8.35) Range = 43-71	58.82 (9.91) Range = 40-72	58.91 (9.02) Range = 40-72	60.33 (9.29) Range = 40-72
Race/ Ethnicity	6 Caucasian (35.29) 11 Black (64.71)	4 Caucasian (23.53) 13 Black (76.47)	10 Caucasian (29.4%) 24 Black (70.6)	3 Caucasian (25.00) 9 Black (75.00)
Education	3 Some high school (17.6%) 6 High school (35.3%) 3 Some college (17.6%) 3 College (17.6%) 1 Graduate School (5.9%)	1 Some high school (5.9%) 5 High school (29.4%) 6 Some college (35.3%) 4 College (23.5%)	4 Some high school (11.8%) 11 High school (32.4%) 9 Some college (26.5%) 7 College (20.6%) 1 Graduate school (2.9%) 2 Missing data (5.9%)	1 Some high school (8.3%) 3 High school (25.0%) 4 Some college (33.3%) 3 College (25.0%)
Marital status	8 Married (47.1%) 4 Single (23.5%) 5 Widowed/Divorced (29.4%)	11 Married (64.7%) 3 Single (17.6%) 3 Widowed/Divorced (17.6%)	19 Married (55.9%) 7 Single (20.6%) 8 Widowed/Divorced (23.5%)	8 Married (66.7%) 1 Single (8.3%) 3 Widowed/Divorced (25.0%)

	Treatment Condition (n = 17)	Control Condition (n = 17)	Combined (n = 34)	Cross-over Condition (n = 12)
Combat Theater	12Vietnam (70.6%) 1 Persian Gulf (5.9%) 1 OEF/OIF (5.9%) 1 Vietnam & Iraq (5.9%) 2 Persian Gulf & OEF/OIF (11.8%)	12 Vietnam (70.6%0 2 Persian Gulf (11.8%) 1 OEF/OIF (5.9%) 2 Persian Gulf & OEF/OIF (11.8%)	24 Vietnam (70.6%) 3 Persian Gulf (8.8%) 2 OEF/OIF (5.9%) 1 Vietnam & Iraq (2.9%) 4 Persian Gulf & OEF/OIF (11.8%)	9 Vietnam (75.0%) 1 Persian Gulf (8.3%) 1 OEF/OIF (8.3%) 1 Persian Gulf & OEF/OIF (8.3%)
PTSD TX Type	6 PTSD Boot Camp (35.3%) 11 PTSD Recovery Group (64.7%)	6 PTSD Boot Camp (35.3%) 11 PTSD Recovery Group (64.7%)	12 PTSD Boot Camp (35.3%) 22 PTSD Recovery Group (64.7%)	3 PTSD Boot Camp (25.0%) 8 PTSD Recovery Group (66.7%)
Insomnia Duration	19.6 (13.59) Range = 5-42 years	14.44 (12.89) Range = 1-41 years	16.94 (13.02) Range = 1-42 years	12.36 (12.73) Range = 1-42 years
Reoccurring nightmares	12 (70.6%)	13 (76.5%)	25 (73.5%)	10 (83%)
Sleep Medication (Y/N)	9 (52.9%)	5 (33.3%)	14 (41.17%)	4 (33.1%)
Days per week on sleep meds.	5.69 (2.19)	5.13 (2.59)	5.55 (2.23)	6.33 (0.58)

OEF/OIF = Operation Enduring Freedom/Operation Iraqi Freedom

Data Screening and Manipulation Checks

Randomization. Out of the 34 participants who completed pretreatment measures, 17 were randomly assigned to the treatment condition and waitlist control condition respectively. Pretreatment characteristics of each condition were compared to determine if there were any differences between conditions. T-test were used to determine if there were significant baseline differences between veterans randomized to the treatment or control condition (see Table 5 for means and standard deviations). There were no significant between condition differences on any of the pretreatment questionnaire measures ($p > .05$) or sleep diary variables ($p > .05$).

T-test were also used to determine if there were significant pretreatment differences between participants initially assigned to the treatment condition or to the group of participants from the waitlist condition who crossed over to the treatment condition ($n = 12$) after completing the waiting period (see Table 5 for means and standard deviations). This allowed for the two groups to be combined in future analyses. There were no significant between group differences on any of the baseline questionnaire measures ($p > .05$).or sleep diary variables ($p > .05$).

Table 5.

Comparisons between Conditions at Pretreatment.

	Treatment (n = 17)	Waitlist (n = 17)	Combined (n = 34)	Cross-over (n = 12)
Insomnia Severity (ISI)	21.84 (4.66)	20.35 (3.50)	21.15(4.14)	20.25 (3.84)
Sleep Quality (PSQI)	14.88 (3.97)	14.41(3.24)	14.65(3.58)	13.42 (2.75)
PTSD-Related Sleep Disturbance (PSQI-A)	9.65 (4.36)	8.06 (6.8)	8.85 (5.68)	8.0 (4.73)
Beliefs about Sleep (DBAS-16)	59.94 (18.38)	54.08 (11.75)	57.00 (15.48)	49.95 (12.29)
Depression (PHQ-9)	14.41 (6.99)	12.65 (5.69)	13.53 (6.34)	13.33 (6.39)
PTSD Symptom Scale (PSS)	41.35(16.17)	36.59 (16.17)	38.97 (16.47)	39.58 (12.79)
Sleep Onset Latency	41.09 (33.52)	33.29 (13.22)	37.86 (26.95)	28.28 (9.23)
Wake After Sleep Onset	42.09 (27.95)	53.89 (40.11)	46.97 (33.37)	46.22 (35.76)
Total Sleep Time	5.45 (1.22)	4.77 (1.51)	5.16 (1.37)	4.82 (1.68)
Sleep Efficiency	71.80 (13.64)	65.61 (16.13)	69.24 (14.77)	68.80 (18.77)
Sleep Interruptions	2.02 (1.02)	1.9 (0.67)	1.97 (0.86)	1.95 (0.91)
Number of nightmares per night	.91 (0.72)	.79 (0.64)	.85 (0.67)	1.1 (0.58)
Number of nights per week with nightmares	4.09 (2.24)	2.85 (2.04)	3.55 (2.20)	4.17 (2.06)

Outliers and tests of normality. Both pre and posttreatment data were examined for evidence of skewness, kurtosis, and outliers using frequency distributions, z-scores and visual

inspection of data plotted in histograms using SPSS 20. In order to detect outliers, the standardized scores of variables were calculated and cases with z-scores greater than 2.58 ($p < .01$) were changed to the next closest value that was under the cut off. This technique was determined the most acceptable way to deal with outliers for this dataset rather than deletion due to the relatively small sample size. By replacing the outlier with the next closest value in the population, the shape of the sample distribution is maintained but the outlier is unable to distort the data (Tabachnick & Fidell, 2007). Outliers were detected and changed in four of the sleep diary data variables at the baseline assessment: sleep onset latency (n = 1) Z = 3.79, wake after sleep onset (n = 1) Z = 2.89, number of nightmares per night (n = 1) Z = 2.99, and total sleep time (n = 1) Z = -2.63. Outliers were detected and changed in four of the sleep diary data variables at the posttreatment assessment (note one case was responsible for all four outliers): Sleep interruptions (n =1) Z = 3.33, wake after sleep onset (n =1) Z =3.03, sleep efficiency (n=1) Z = 2.88, number of nightmares per night (n = 1) Z = 3.10. Outliers were detected and changed in one of the questionnaire variables at baseline assessment: Insomnia Severity Index (n = 1) Z = -2.62. Outliers were detected and changed in two of the questionnaire variables at the posttreatment assessment: Insomnia Severity Index (n =1) Z = -2.95 and Dysfunctional Beliefs about Sleep-16 (n =1) Z = 2.74.

Attrition. Thirty four participants completed randomization and baseline measures. Four participants dropped out of the study before completing posttreatment or post-waitlist assessment (see Figure 3). Of the participants in the treatment condition, two dropped out after two treatment sessions: one was lost to follow-up and the other due to complications with PTSD not related to the study. Two participants effectively dropped out of the control condition because they did not return post-waitlist assessment measures.

Several participants had missing data but did not drop out of the study. One participant from the waitlist control condition did not return post-waitlist questionnaires but did crossover to the treatment condition and completed posttreatment questionnaires. Another participant from the treatment condition was unable to attend the final two treatment sessions due to surgery but returned posttreatment measures seven weeks after posttreatment and was considered a treatment completer. Twelve participants from the control condition crossed over to the treatment condition and all twelve completed posttreatment measures. Rates of participation in the treatment and control protocol were the same with 88.74% of each group completing condition requirements. The baseline questionnaire data from the four participants who dropped out of the study was replicated as their posttreatment data.

In addition to keeping sleep diaries two weeks before and after treatment, participants kept sleep diaries during treatment to guide sleep restriction procedures. These treatment diaries were used as pretreatment and/or posttreatment diaries for participants who did not complete pre- or posttreatment diaries. For example, if a participant did not complete pretreatment diaries, his sleep diary from the first week of treatment would be used as in place of his pre-treatment diary so as to capture some information about pretreatment sleep. For both participants in the treatment condition who dropped out of the study before the posttreatment assessment, their most recent treatment diary information was used as the posttreatment diary data. There were four members of the control condition who crossed over to the treatment condition who did not return their pre-waitlist sleep diaries or their post-waitlist sleep diary. In these cases their treatment diary from the first week of treatment was used as both their pre-waitlist sleep diary and their post waitlist sleep diary.

On average, participants in the treatment condition attended 4.94 (SD = 1.30) out of six groups while those who crossed over to the treatment condition from the waitlist control condition completed an average of 5.33 (SD = 0.89) sessions. There were seven treatment groups with 2-6 members per group depending upon participant availability and recruitment flow.

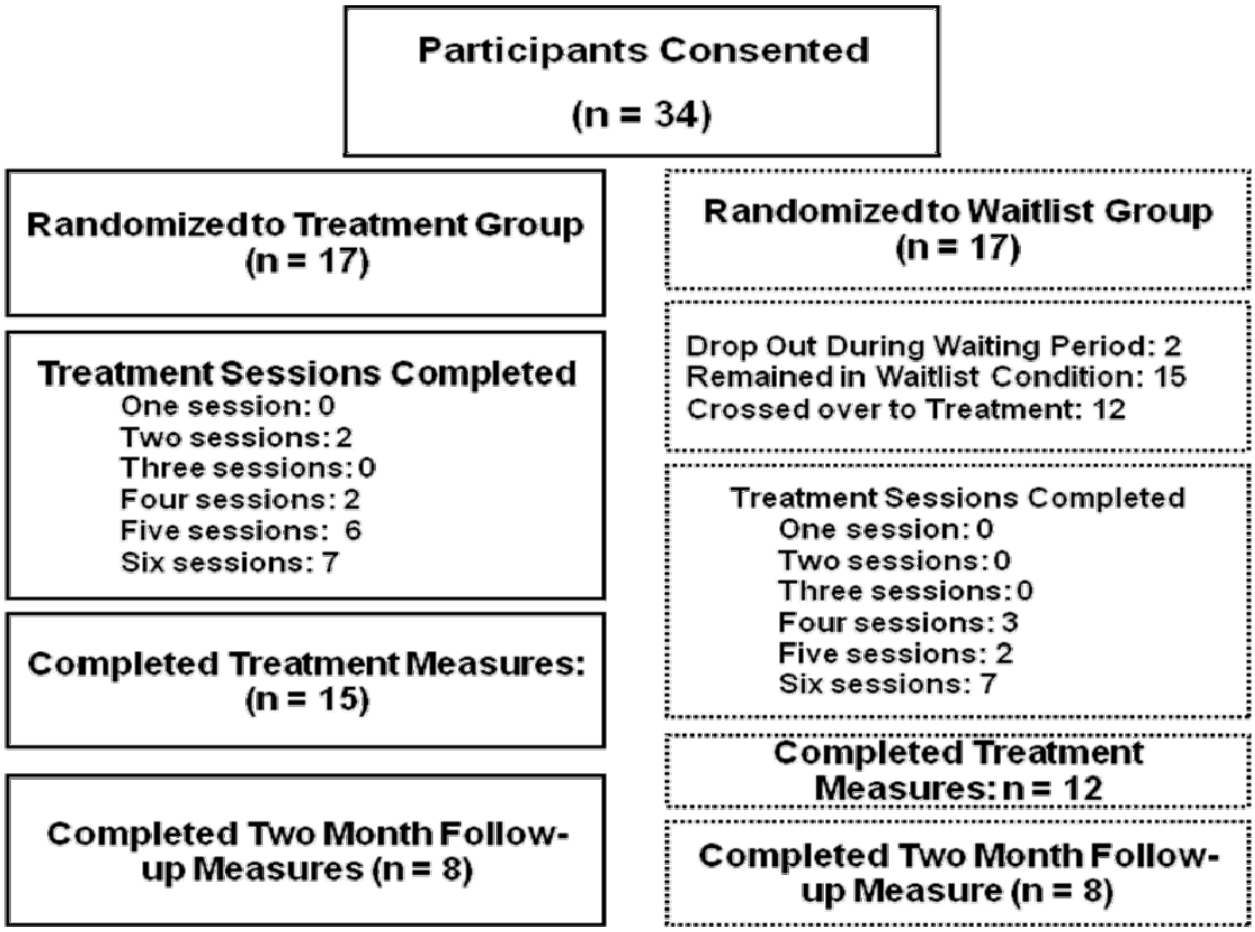

Figure 3. Study attrition.

Hypothesis #1

Intent-to-treat analysis for sleep diary variables. The first hypothesis stated that participants in the treatment condition would report significantly improved sleep compared to waitlist controls at posttreatment on sleep diary variables (WASO, SOL, SI, SE and TST) and global sleep questionnaires (ISI, PSQI). In an effort to limit type 1 error, a repeated measures

MANOVA was used be used to examine the overall condition by time interaction for sleep diary variables. The analysis did find a significant condition by time interaction across the five sleep variables with a large effect size, $F(5, 26) = 3.89$, $p = .009$, $\eta_p^2 = .428$.

Follow-up repeated measures ANOVAs were conducted to determine condition by time interactions for individual sleep diary variables. Results indicated significant condition by time interactions in favor of the treatment condition for sleep onset latency, $F(1, 30) = 4.94$, $p = .034$, $\eta_p^2 = .141$ (see Figure 4) and sleep interruptions, $F(1, 30) = 15.78$, $p < .001$, $\eta_p^2 = .345$ (see Figure 5). The condition by time interaction effect for sleep efficiency approached significance SE, $F(1, 30) = 3.26$, $p = .086$, $\eta_p^2 = .098$ (see Figure 6) as did wake after sleep onset $F(1, 30) = 3.11$, $p = .088$, $\eta_p^2 = .094$. Total sleep time was not significant $F(1, 30) = .86$, $p = .360$, $\eta_p^2 = .028$ (see Table 6 for sleep diary variable mean scores). All sleep diary variables, with the exception of TST, had moderate to large effect sizes.

Completer analyses for sleep diary variables. The analysis of data from only those who had some kind of pre and posttreatment sleep diary data did find a significant condition by time interaction across the five sleep variables with a large effect size, $F(5, 21) = 3.17$, $p = .027$, $\eta_p^2 = .431$.

Follow-up repeated measures ANOVAs were conducted to determine condition by time interactions for individual sleep diary variables. Results indicated significant condition by time interactions in favor of the treatment condition remained for sleep interruptions $F(1, 25) = 12.67$, $p = .002$, $\eta_p^2 = .336$. The condition by time interaction effect for sleep onset latency trended in the expected direction, $F(1, 25) = 3.09$, $p = .091$, $\eta_p^2 = .110$. Sleep efficiency SE, $F(1, 25) = 1.47$, $p = .237$, $\eta_p^2 = .056$, wake after sleep onset $F(1, 25) = 1.18$, $p = .287$, $\eta_p^2 = .045$ and total sleep

time, $F(1, 25) = .95$, $p = .340$, $\eta_p^2 = .037$ did not show significant condition by time interactions for the completer analysis.

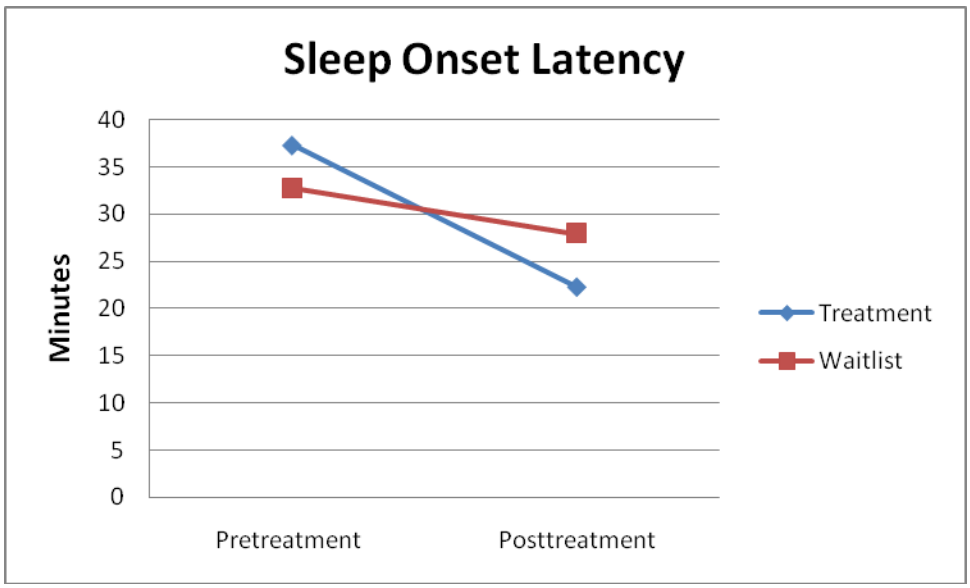

Figure 4. Intent-to-treat analysis of sleep onset latency (SOL) at pretreatment and posttreatment for the treatment and waitlist conditions.

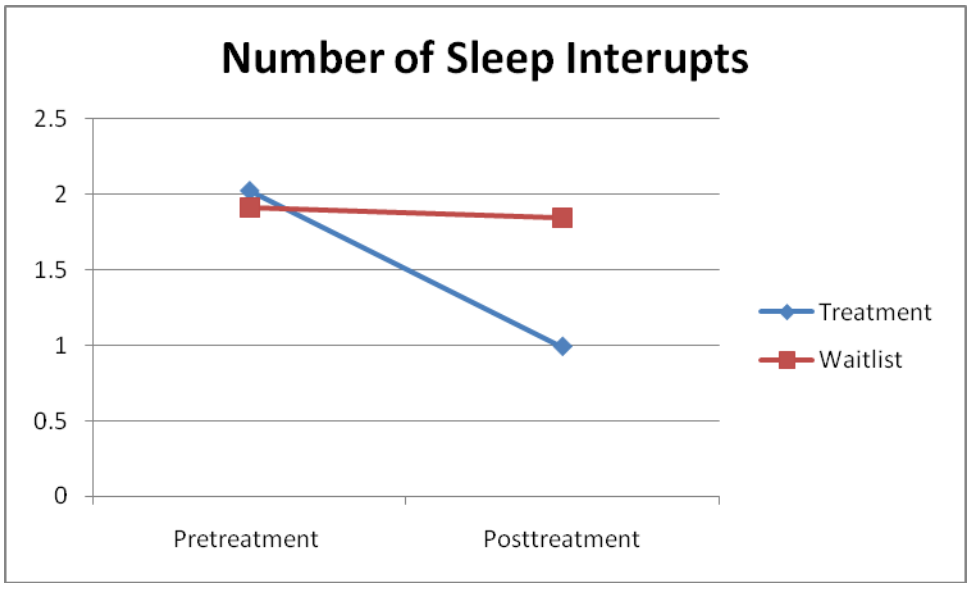

Figure 5. Intent-to-treat analysis of sleep interuptions (SI) at pretreatment and posttreatment for the treatment and waitlist conditions.

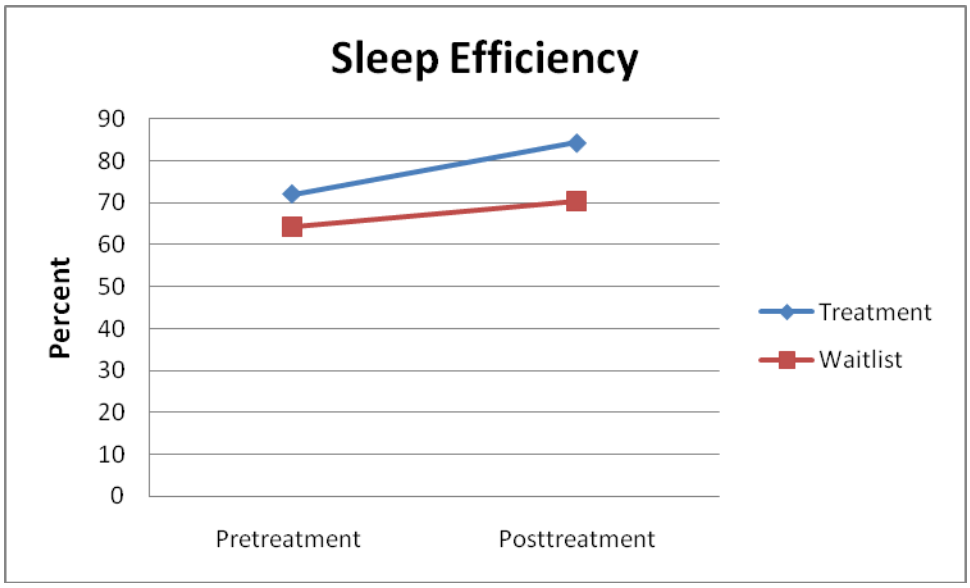

Figure 6. Intent-to-treat analysis of sleep efficiency (SE) at pretreatment and posttreatment for the treatment and waitlist condition.

Table 6.

Intent-to-treat Means (Standard Deviations) and Effect Sizes of Sleep Diary Variables:

Treatment and Waitlist Conditions.

	Pretreatment M (SD)		Posttreatment M (SD)		Effect Size
	CBT-I/IRT	Waitlist	CBT-I/IRT	Waitlist	
Sleep onset latency	37.33(23.95)	32.72 (12.44)	22.29 (17.57)	27.93 (9.34)	.141
Wake after sleep onset	42.08 (27.95)	48.14 (33.07)	19.39 (15.58)	41.32 (33.34)	.094
Sleep Interruptions	2.02 (1.02)	1.91 (.67)	.99 (.85)	1.84 (.85)	.345
Sleep Efficiency	72.02 (13.05)	64.16 (15.34)	84.30 (11.20)	70.34 (16.14)	.098
Total Sleep Time	5.45 (1.22)	4.64 (1.35)	5.34 (1.49)	4.85 (1.39)	.028

Combined treatment and crossover group analysis for sleep diary variables. The sleep diary data of the participants from the waitlist condition who crossed over to treatment condition (n = 12) was combined with the treatment condition (n = 17) to determine the effects of the treatment using a larger sample size. Results of paired sample t-tests indicated a significant pre to posttreatment change for the following sleep variables in the sample of participants who completed treatment (n = 29): sleep efficiency, $t(28) = -6.44$, $p < .001$, sleep onset latency, $t(28) =$

5.74, p< .001, wake after sleep onset, $t(28) = 5.05$, p< .001, sleep interruptions, $t(28) = 5.58$, p< .001. There was not a significant pre to posttreatment change for total sleep time, $t(28) = .15$, p = .886. Means for the combined sample are presented in Table 7 below.

Table 7.

Sleep Diary Variable Means (Standard Deviations) and Significance Level for Combined Crossovers and Treatment Sample at Pretreatment and Posttreatment.

	Pretreatment M (SD)	Posttreatment M (SD)	P-value
Sleep Onset Latency	33.58(19.54)	19.50 (14.27)	.000
Wake After Sleep Onset	43.80 (30.87)	21.15 (18.33)	.000
Sleep Interruptions	1.99 (.96)	1.14 (.81)	.000
Sleep Efficiency	70.69 (15.44)	84.23 (10.36)	.000
Total Sleep Time	5.18 (1.44)	5.15 (1.58)	.886

Intent-to-treat analyses for sleep questionnaires. Repeated measures ANOVAs revealed significant improvements in insomnia severity and sleep quality from pretreatment to posttreatment as measured by the ISI and PSQI (see Table 8 for means and standard deviations). Intent-to-treat analysis indicated a significant condition by time interaction in favor of the treatment condition for insomnia severity (ISI) with a large effect size, $F(1, 32) = 13.62$, $p = .001$, $\eta_p^2 = .299$ (see Figure 7). A significant condition by time interaction was also detected for sleep quality (PSQI), $F(1, 32) = 12.54$, $p = .001$, $\eta_p^2 = .282$ (see Figure 8).

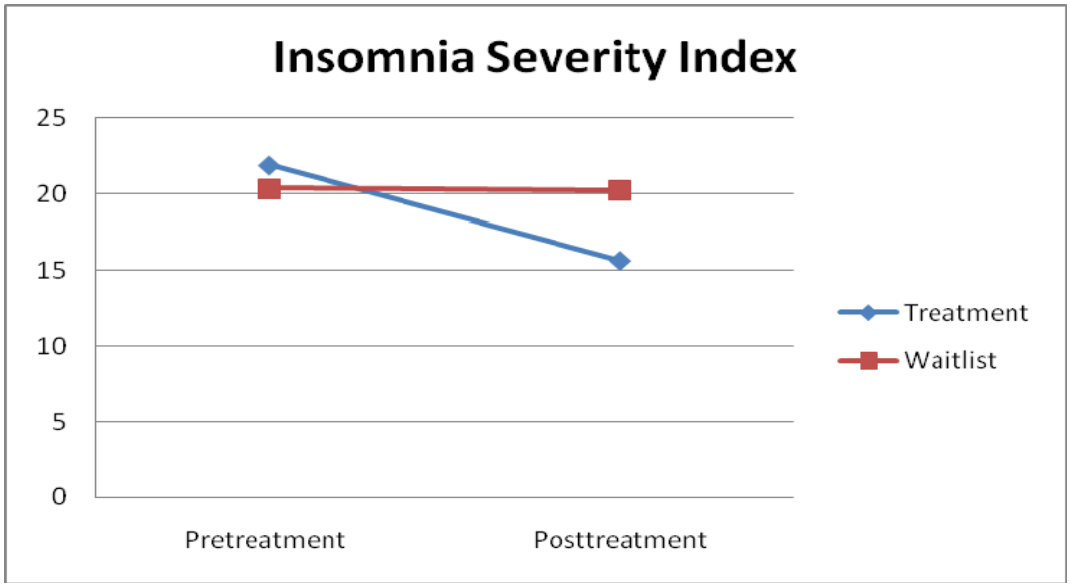

Figure 7. Intent-to-treat analysis of Insomnia Severity Index (ISI) at pre-treatment and posttreatment for the treatment and waitlist conditions.

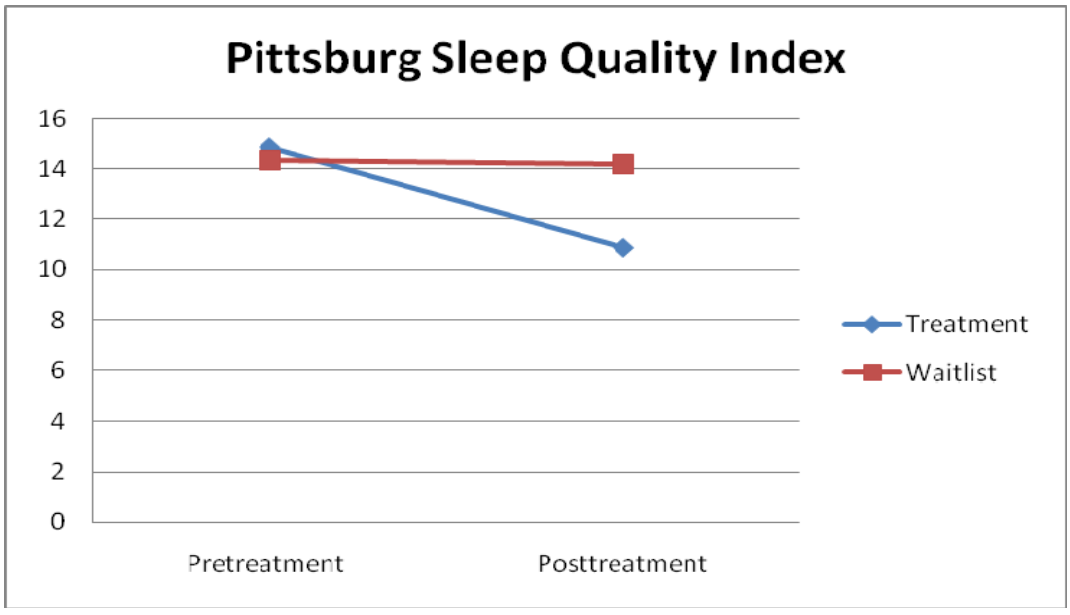

Figure 8. Intent-to-treat analysis of overall sleep quality (PSQI) at pre-treatment and posttreatment for the treatment and waitlist condition.

Table 8.

Intent-to-treat Means (Standard Deviations) and Effect Sizes of Sleep Questionnaires (ISI and PSQI) at Pretreatment and Posttreatment for Treatment and Waitlist Conditions.

	Pretreatment M (SD)		Posttreatment M (SD)		Effect Size
	CBT-I/IRT	Waitlist	CBT-I/IRT	Waitlist	
IS1	21.94 (4.66)	20.35 (3.50)	15.62 (6.51)	20.24 (3.88)	.299
PSQI	14.88 (3.97)	14.41 (3.20)	10.76 (4.19)	14.18 (2.92)	.282

*ISI = Insomnia Severity Index, PSQI = Pittsburg Sleep Quality Index

Combined treatment and crossover group analysis for sleep questionnaires. The sleep questionnaire data (PSQI and ISI) of the participants from the waitlist conditions who crossed over to treatment condition (n = 12) was combined with the treatment condition (n = 17) to determine the effects of the treatment using a larger sample size. Results of paired sample t-tests indicated a significant pre to posttreatment change for the following measures: PSQI, $t(27) = 5.46$, $p < .001$, and ISI, $t(28) = 6.08$, $p < .001$. Means for the combined sample are presented in Table 9 below.

Table 9.

Sleep Questionnaire Means (Standard Deviations) and Significance Level for Combined Crossovers and Treatment Sample at Pretreatment and Posttreatment.

	Pretreatment M (SD)	Posttreatment M (SD)	p-value
IS1	21.24 (4.35)	14.05 (6.74)	.000
PSQI	14.36 (3.57)	9.89 (4.79)	.000

*ISI = Insomnia Severity Index, PSQI = Pittsburg Sleep Quality Index.

Hypothesis #2

The second hypothesis stated that participants in treatment condition would report significantly decreased nightmares compared to waitlist control condition at posttreatment.

Intent-to-treat analyses for nightmare frequency. Repeated measures ANOVAs were conducted to determine if there was a significant condition by time interactions for either of the two nightmare variables (see Table 10 for means and standard deviations). Results of the repeated measures ANOVA demonstrated significant condition by time interactions for number of nightmares per week, $F(1, 23) = 6.16$, $p = .021$, $\eta_p^2 = .211$ (see Figure 9) and number of nights per week with nightmares, $F(1, 23) = 4.94$, $p = .036$, $\eta_p^2 = .177$ (see Figure 10). Both variables had effect sizes in the moderate range.

Completer analyses for nightmare frequency. Repeated measures ANOVAs were conducted to determine if there was a significant condition by time interactions for either of the nightmare frequency variables. Results of repeated measures ANOVAs demonstrated that there was not a significant condition by time interaction for number of nightmares per week, $F(1, 20) = 3.37$, $p = .084$, $\eta_p^2 = .151$ or number of nights with nightmares per week, $F(1, 19) = 4.94$, $p = .082$, $\eta_p^2 = .151$. However, both variables approached significance and demonstrated a moderate effect size.

Intent-to-treat for PTSD-related sleep disturbance. A repeated measures ANOVA revealed that there was not a significant condition by time interaction for nighttime PTSD symptoms as measured by the PSQI-A, $F(1, 31) = .002$, $p = .965$, $\eta_p^2 = .000$ (see Table 10 for means and standard deviations).

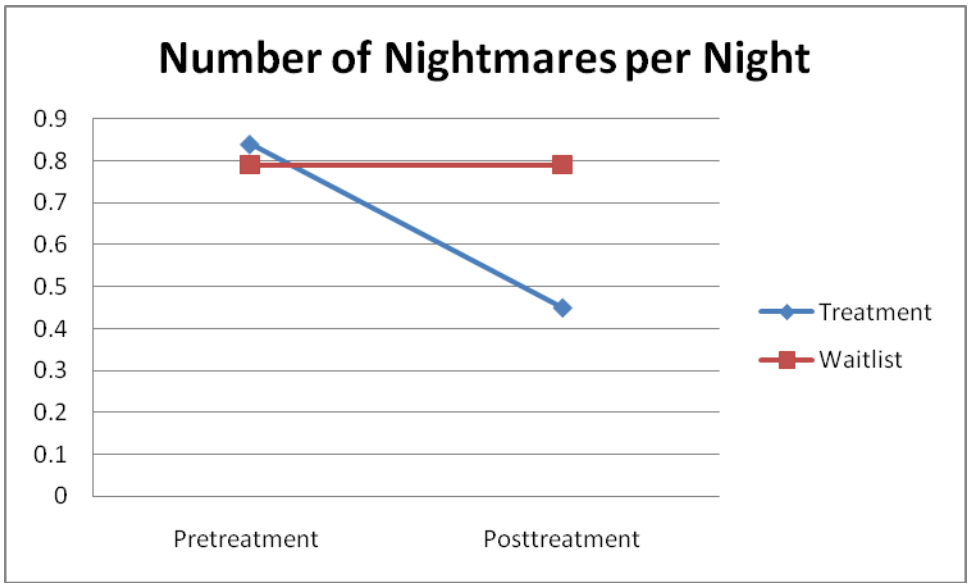

Figure 9. Intent-to-treat analysis of number of nightmares per night at pretreatment and posttreatment for the treatment and waitlist conditions.

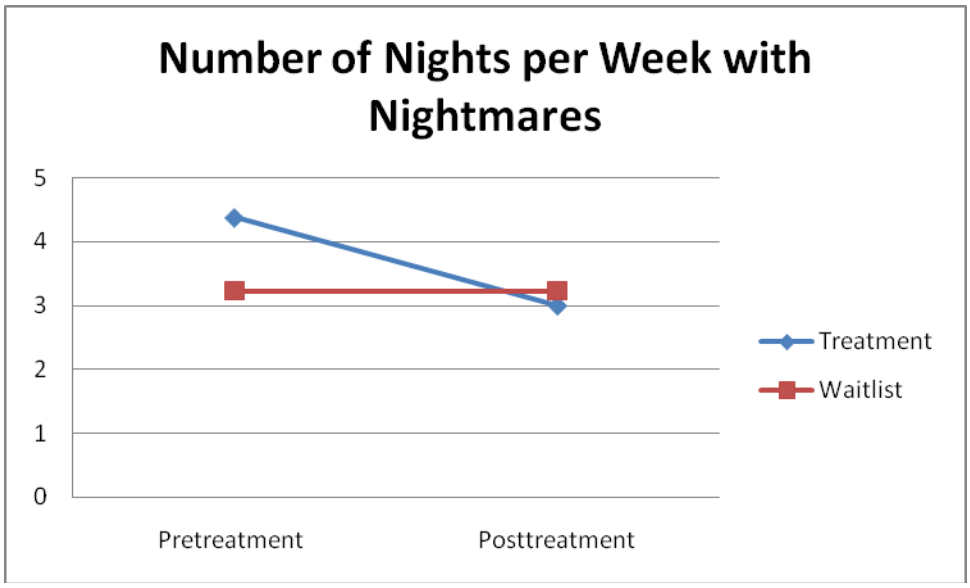

Figure 10. Intent-to-treat analysis of number of nights with nightmares per week at pretreatment and posttreatment for the treatment and waitlist conditions.

Table 10.

Means (Standard Deviations) and Effects Sizes for PSQI-A and Nightmare Frequency Variables at Pretreatment and Posttreatment for Treatment and Waitlist Conditions.

	Pretreatment M (SD)		Posttreatment M (SD)		Effect Size
	CBT-I/IRT	Waitlist	CBT-I/IRT	Waitlist	
PSQI-A	9.65 (4.36)	8.44 (6.83)	8.76 (5.27)	7.5 (5.37)	.000
# of nightmares per night	.84 (.53)	.79 (.64)	.45 (.53)	.79 (.73)	.211
# of nights with nightmares per week	4.38 (2.07)	3.23 (2.00)	3.00 (2.04)	3.23 (2.50)	.117

*PSQI-A = Pittsburg Sleep Quality Index-Addendum for PTSD.

Combined treatment and crossover group analysis. The nightmare frequency variables and the PSQI-A of the participants from the waitlist condition who crossed over to the treatment group (n =12) were combined with the treatment condition (n = 17) to determine the effects of the treatment on nightmares using a larger sample size. Results of paired sample t-tests indicated a significant pre to posttreatment change for number of nightmares per night, $t(21) = 3.62$, p = .004, and number of nights per week with nightmares, $t(20) = 2.12$, p = .046. There was not a significant difference in nighttime PTSD symptoms as measured by the PSQI-A, $t(26) = 1.59$, p = .123. Means for the combined sample are presented in Table 11 below.

Table 11.

PTSD-Relates Sleep Disturbance Symptoms and Nightmare Frequency Variable Means (Standard Deviations) and Significance Level for Combined Crossovers and Treatment Sample at Pretreatment and Posttreatment.

	Pretreatment M (SD)	Posttreatment M (SD)	P-value
PSQI-A	9.04 (4.59)	7.85 (5.44)	.123
# of nightmares per night	.95 (.56)	.62 (.60)	.004
# of nights with nightmares per week	4.29 (2.01)	3.41 (2.54)	.046

*PSQI-A = Pittsburg Sleep Quality Index-Addendum for PTSD.

Hypothesis #3

The third hypothesis stated that improvements in sleep resulting from the intervention would lead to secondary improvements in depression and PTSD symptom severity compared to controls at posttreatment. Means and standard deviations of pretreatment and posttreatment scores for both treatment and waitlist conditions are presented in Table 12.

Repeated measures ANOVAs demonstrated significant condition by time interactions for depression as measured by score the PHQ-9, $F(1, 32) = 7.46$, $p = .01$, $\eta_p^2 = .189$ (see Figure 11). There was not a significant condition by time interaction for PTSD symptoms as measured by the PSS, $F(1, 32) = .95$, $p = .337$, $\eta_p^2 = .029$.

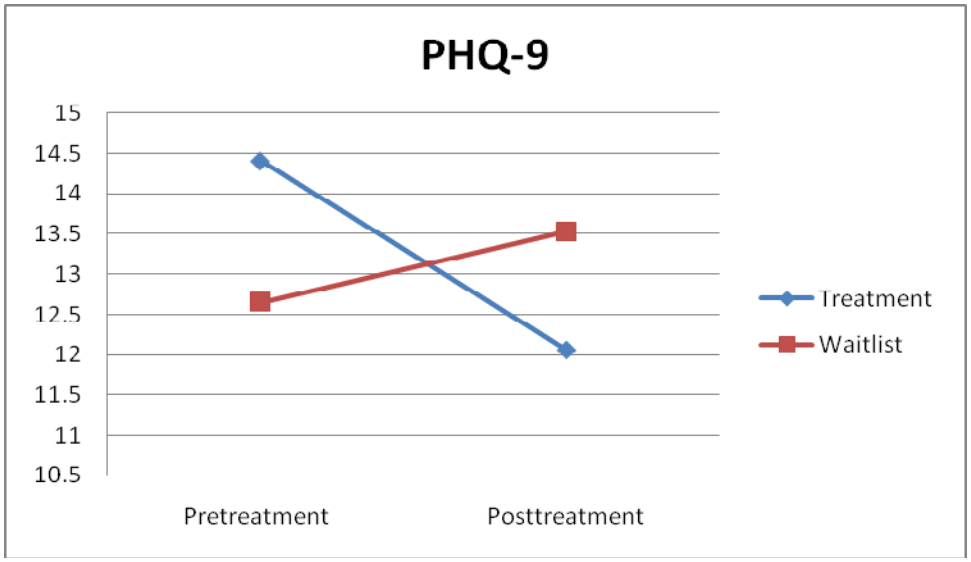

Figure 11. PHQ-9 scores at pretreatment and posttreatment for the treatment and waitlist conditions.

Table 12.

Means (Standard Deviations) and Effect Size of PHQ-9 and PSS at Pretreatment and Posttreatment for the Treatment and Waitlist Conditions.

	Pretreatment M (SD)		Posttreatment M (SD)		Effect Size
	CBT-I/IRT	Waitlist	CBT-I/IRT	Waitlist	
PHQ-9	14.41 (6.99)	12.65 (5.96)	12.06 (6.80)	13.53 (5.94)	.189
PSS	41.35 (16.17)	36.59 (16.92)	40.59 (18.39)	38.88 (16.19)	.029

*PHQ-9 = Patient Health Questionnaire-9, PSS = PTSD Symptom Scale

Combined treatment and crossover group analysis for PTSD and Depression. The PSS and PHQ-9 data of the 12 participants from the waitlist condition who crossed over to treatment were combined with the treatment condition to determine the effects of the treatment on depression and PTSD using a larger sample size. Results of paired sample t-tests indicated a significant pre to posttreatment reduction for depression, $t(28) = 3.32$, $p = .002$, but not PTSD symptoms, $t(28) = 1.51$, $p = .140$. Means for the combined sample are presented in Table 13 below.

Table 13.

Means (Standard Deviations) and Significance Levels for PSS and PHQ-9 for Combined Treatment and Crossover Sample at Pretreatment and Posttreatment.

	Pretreatment M (SD)	Posttreatment M (SD)	p-value
PHQ-9	13.97 (6.65)	10.97 (6.91)	.002
PSS	40.62 (14.65)	36.76 (18.12)	.140

PHQ-9 = Patient Health Questionnaire-9, PSS = PTSD Symptom Scale

Hypothesis #4

The fourth hypothesis states that any improvements in sleep, PTSD symptoms and depression would be maintained at two-month follow-up for those in the treatment condition. Sixteen out of the 29 participants who completed posttreatment assessment completed follow-up

data. Eight of the sixteen participants who completed two month follow-up measures were originally randomized to the treatment condition while the additional eight participants crossed over to the treatment condition after completing the waitlist condition.

Sleep diary variables. One way repeated measures ANOVAs were used to determine if there was a significant difference between outcome measures of sleep (SOL, WASO, SI, TST, SE,) at pre-, post, and follow-up in the treatment condition. See Table 14 for means and standard deviations of sleep variables across three assessment points.

A repeated measures ANOVA demonstrated that there was a significant difference in sleep onset latency (SOL) between time points, $F(2,14) = 13.41$, $p < .001$, $\eta_p^2 = .657$ (see Figure 12). Posthoc tests (Bonferroni correction) demonstrated that the intervention was associated with a reduction in SOL from baseline to posttreatment, ($p < .001$) and from baseline to follow-up assessment ($p = .004$). No significant differences were observed from posttreatment to follow-up assessment ($p = .100$) indicating that treatment gains were maintained from posttreatment to follow-up assessment.

A repeated measures ANOVA demonstrated that there is a significant difference in WASO (WASO) between time points, $F(2,14) = 14.69$, $p < .001$, $\eta_p^2 = .677$ (see Figure 13). Posthoc tests (Bonferroni correction) demonstrated that the intervention was associated with a reduction in WASO from baseline to posttreatment, ($p = .001$) but not from baseline to follow-up assessment ($p = .096$). No significant differences were observed from posttreatment to follow-up assessment ($p = .178$) indicating that treatment gains were maintained from posttreatment to follow-up assessment.

A repeated measures ANOVA demonstrated that there is a significant difference in sleep interruptions (SI) between time points, $F(2,14) = 9.21$, $p = .003$, $\eta_p^2 = .568$ (see Figure 14).

Posthoc tests (Bonferroni correction) demonstrated that the intervention was associated with a reduction in SOL from baseline to posttreatment, (p = .002) and but not from baseline to follow-up assessment (p =.084). No significant differences were observed from posttreatment to follow-up assessment (p = .236) indicating that treatment gains were maintained from posttreatment to follow-up assessment.

A repeated measures ANOVA demonstrated that there is a significant difference in sleep efficiency (SE) between time points, $F(2,14) = 36.49$, $p < .001$, $\eta_p^2 = .839$ (see Figure 15). Posthoc tests (Bonferroni correction) demonstrated that the intervention was associated with an increase in SE from baseline to posttreatment, (p < .001) and from baseline to follow-up assessment (p =.02). No significant differences were observed from posttreatment to follow-up assessment (p = .398) indicating that treatment gains were maintained from posttreatment to follow-up assessment.

A repeated measures ANOVA demonstrated that there is not a significant difference in total sleep time (TST) between time points, $F(2,14) = 2.70$, $p = .102$, $\eta_p^2 = .278$. Although not significant, there was an increase in TST overtime (see Figure 16).

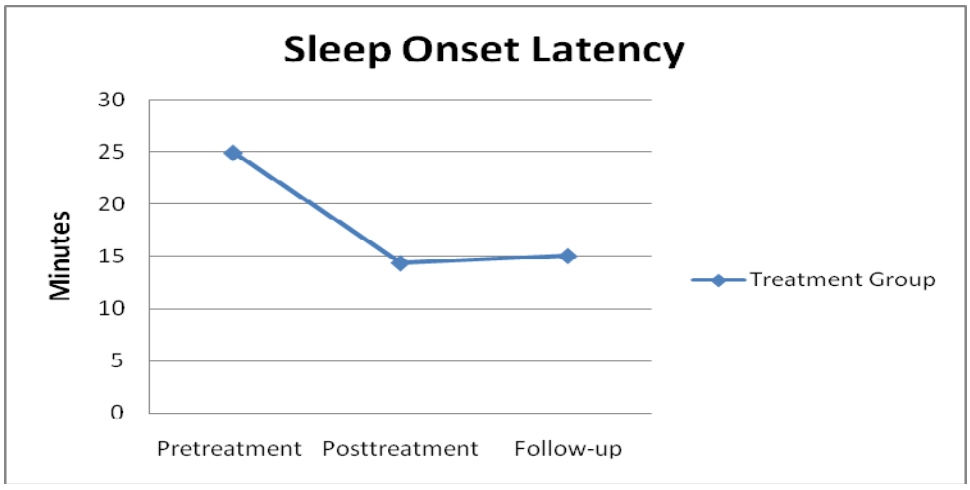

Figure 12. Sleep onset latency (SOL) for treatment completers at pretreatment, posttreatment and two month follow-up.

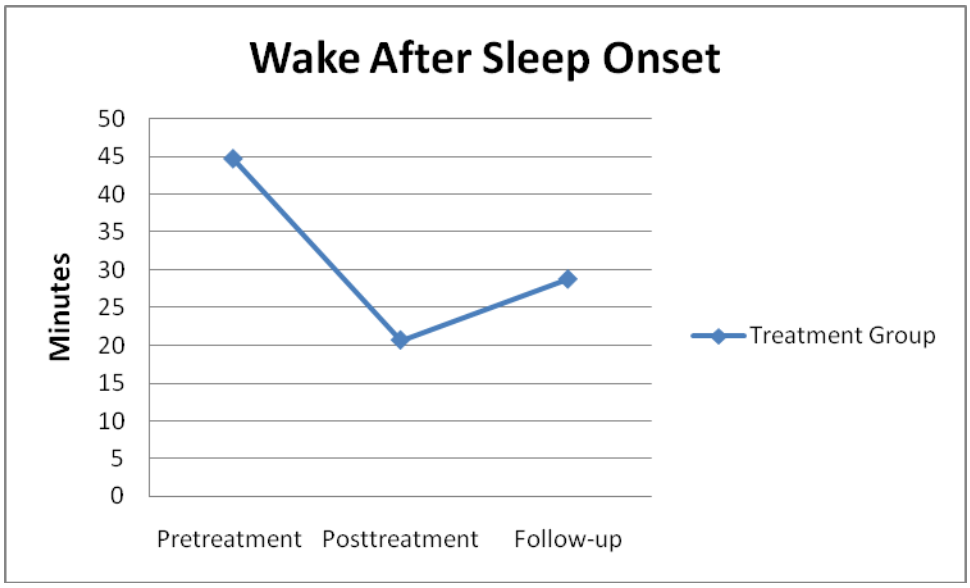

Figure 13. Wake after sleep onset (WASO) for treatment completers at pretreatment, posttreatment, and two months follow-up.

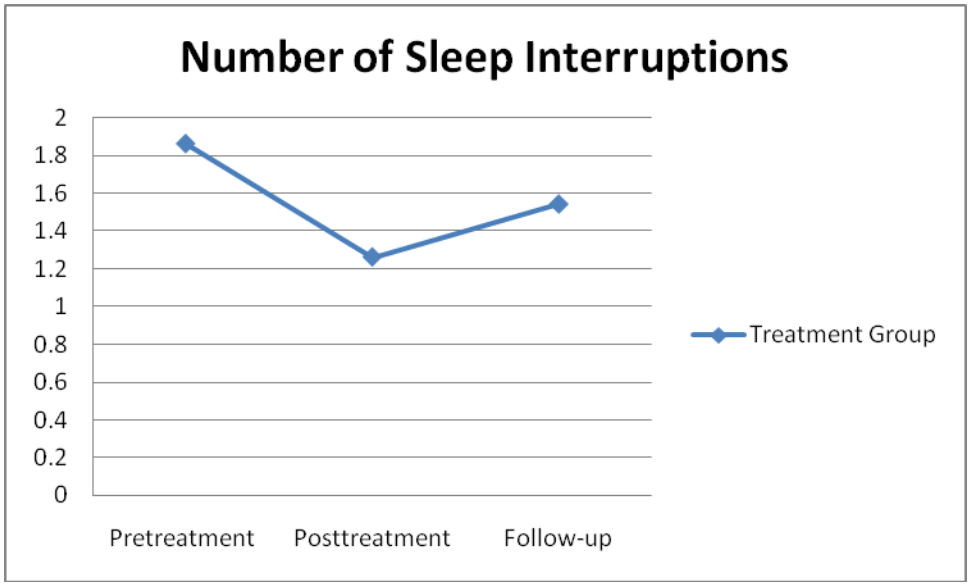

Figure 14. Sleep interruptions (SI) for treatment completers at pretreatment, posttreatment, and two month follow-up.

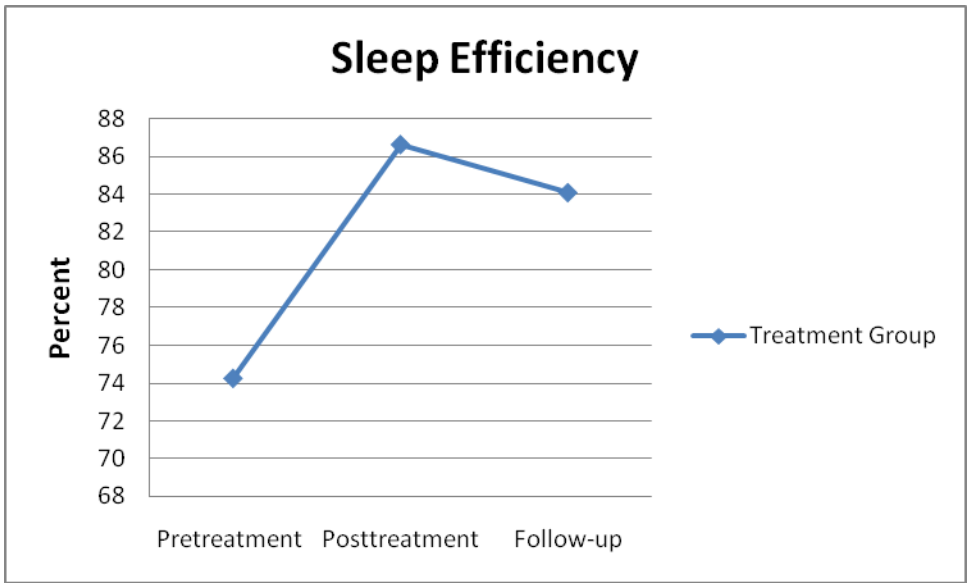

Figure 15. Sleep efficiency (SE) for treatment completers at pretreatment, posttreatment, and two month posttreatment.

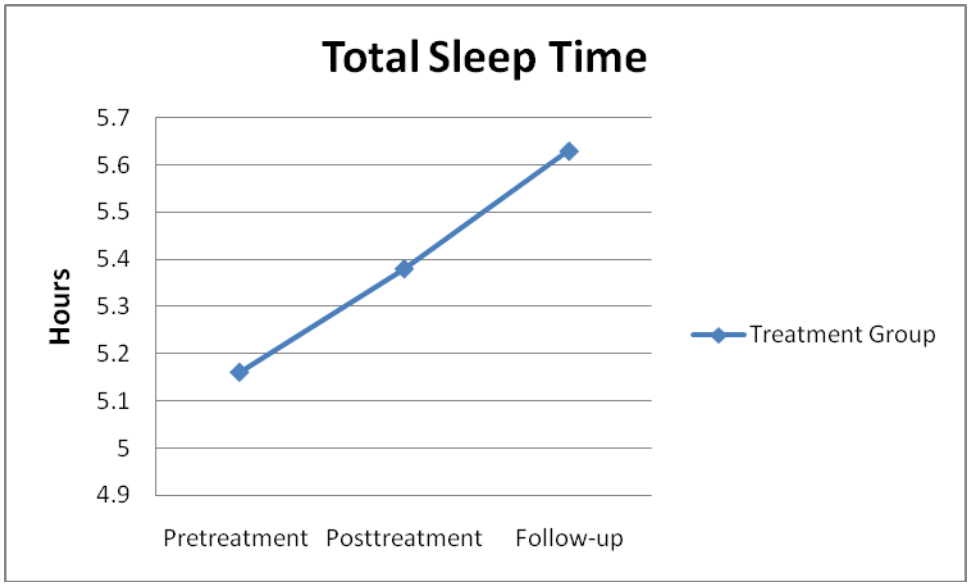

Figure 16. Total Sleep Time (TST) for treatment completes at pretreatment, posttreatment, and two month posttreatment.

Table 14.

Means (Standard Deviations) of Sleep Diary Variables across Three Assessment Time Points: Pretreatment, Posttreatment and Two Month Follow-up.

	Pretreatment M (SD)	Posttreatment M (SD)	Follow-up
Sleep Onset Latency	24.93 (12.61)	14.39 (6.94)	15.06 (8.55)
Wake After Sleep Onset	44.68 (30.85)	20.64 (18.12)	28.72 (18.59)
Sleep Interruptions	1.86 (.85)	1.26 (.70)	1.54 (0.77)
Sleep efficiency	74.24 (12.25)	86.63(7.44)	84.08 (6.33)
Total Sleep Time	5.16 (1.03)	5.38 (1.29)	5.63 (1.10)

Sleep questionnaires. Repeated measures ANOVAs were used to determine if there is a significant difference in global measures (ISI, PSQI, DBAS-16) of sleep at pre-, post, and follow-up in the treatment condition. See Table 15 for means and standard deviations. A repeated measures ANOVA demonstrated that there is a significant difference in insomnia severity (ISI) between time points, $F(2,13) = 11.78$, $p = .001$, $\eta_p^2 = .645$ (see Figure 17). Posthoc tests (Bonferroni correction) demonstrated that the intervention was associated with a reduction in insomnia severity from baseline to posttreatment ($p = .001$), and significant difference from baseline to follow-up assessment ($p = .04$). No significant differences were observed from posttreatment to follow-up assessment ($p = .083$) indicating that treatment gains were maintained from posttreatment to follow-up assessment.

A repeated measures ANOVA demonstrated that there was a significant difference in sleep quality (PSQI) between time points, $F(2,14) = 10.90$, $p < .001$, $\eta_p^2 = .609$ (see Figure 18). Posthoc tests (Bonferroni correction) demonstrated that the intervention was associated with a reduction in insomnia severity from baseline to posttreatment, ($p = .003$) and from baseline to follow-up assessment ($p = .001$). No significant differences were observed from posttreatment to follow-up assessment ($p = 1.00$) indicating that treatment gains were maintained from posttreatment to follow-up assessment.

A repeated measures ANOVA demonstrated that there is a significant difference in beliefs about sleep (DBAS-16) between time points, $F(2,13) = 4.23$, $p < .039$, $\eta_p^2 = .394$ (see Figure 18). Posthoc tests (Bonferroni correction) demonstrated that the intervention was associated with a reduction in insomnia severity from baseline to posttreatment (p = .036), but not from baseline to follow-up assessment (p =.547). No significant differences were observed from posttreatment to follow-up assessment (p = .631) indicating that treatment gains were maintained from posttreatment to follow-up assessment.

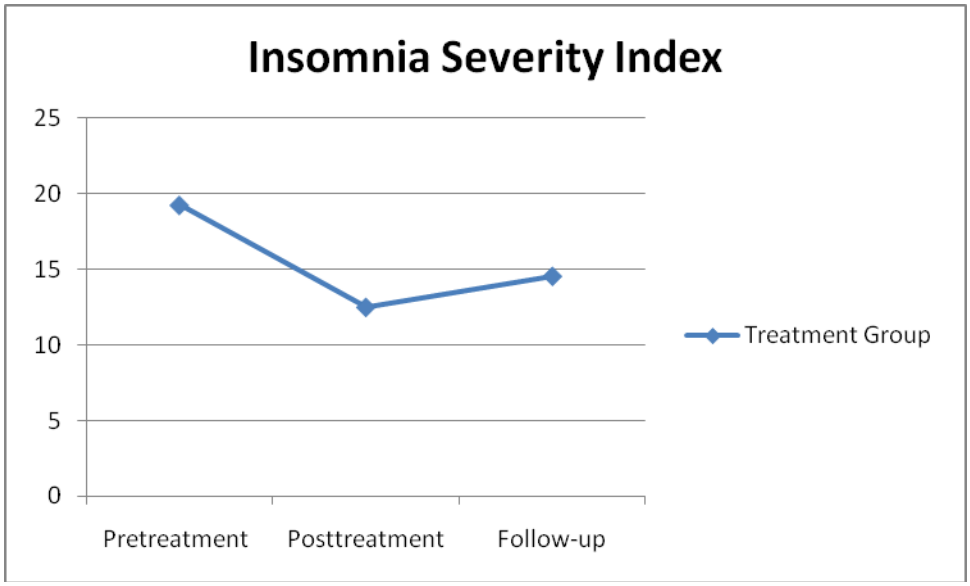

Figure 17. Insomnia Severity Index (ISI) for treatment completers at pretreatment, posttreatment and two month follow-up.

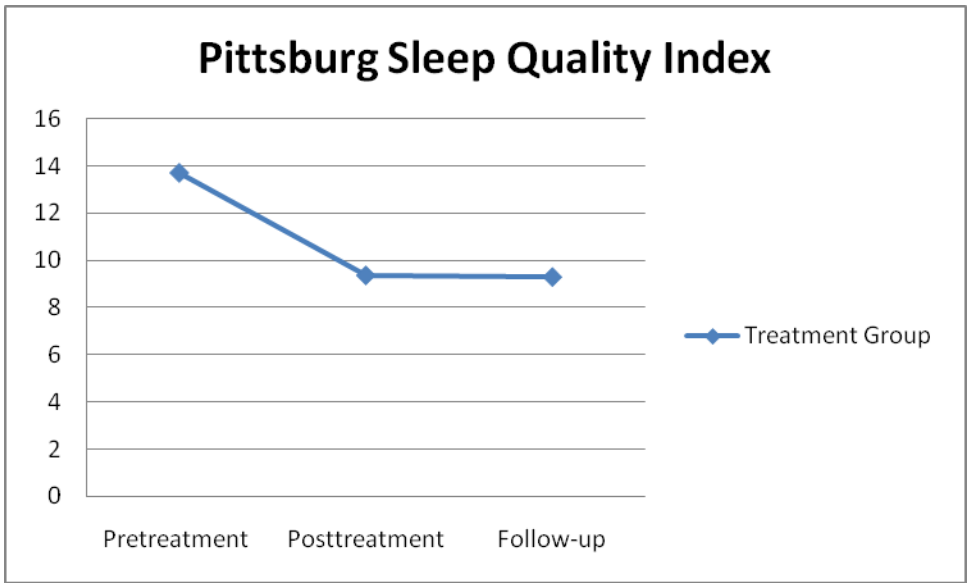

Figure 18. Pittsburg Sleep Quality Index (PSQI) for treatment completers at pretreatment, posttreatment and two month follow-up.

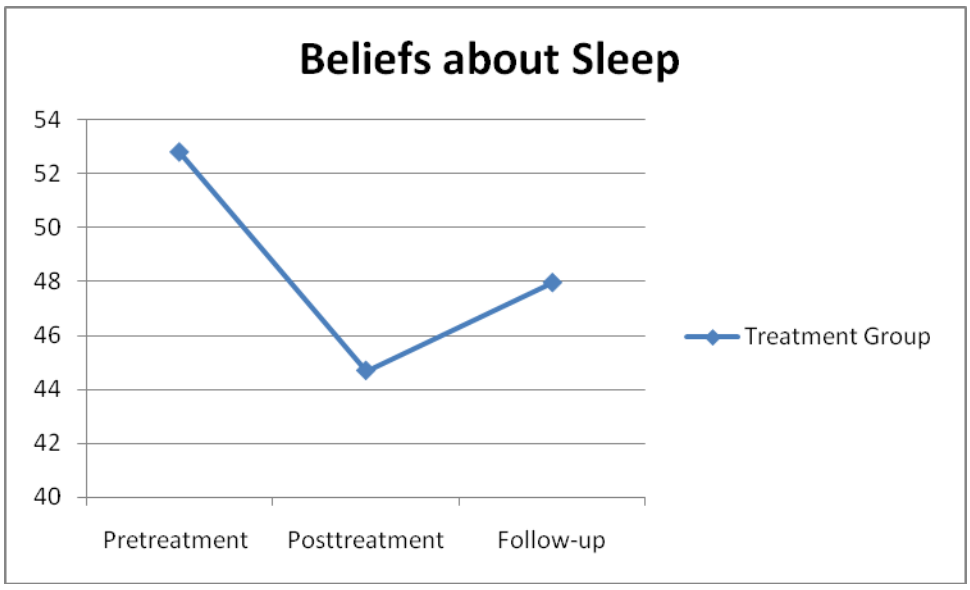

Figure 19. Dysfunctional Beliefs about Sleep (DBAS-16) scores for treatment completers at pretreatment, posttreatment and two month follow-up.

Table 15

Means (Standard Deviations) of Sleep Questionnaire Variables across Three Assessment Time Points (Pretreatment, Posttreatment and Two Month Follow-up).

	Baseline M (SD)	Posttreatment M (SD)	Follow-up
IS1	19.67 (3.72)	11.73 (5.47)	14.60 (5.60)
PSQI	13.69 (3.72)	9.31 (4.77)	9.31 (4.16)
DBAS-16	52.79 (11.80)	44.69 (11.96)	47.95 (13.46)

*ISI = Insomnia Severity Index, PSQI = Pittsburg Sleep Quality Index, DBAS = Dysfunctional Beliefs about Sleep-16.

Nightmare frequency and PTSD-related sleep disturbance. A repeated measures ANOVA was used to determine if there is a significant difference in nightmare frequency at pre-, post, and follow-up for those who completed the treatment. Means and standard deviations are presented in Table 16.

A repeated measures ANOVA demonstrated that there was not a significant difference in number of nightmares per night between time points, $F(2,10) = .72$, $p = .512$, $\eta_p^2 = .125$, nor was there a significant difference in number of nights with number of nightmares with nightmares per week between time points, $F(2,10) = .458$, $p = .645$, $\eta_p^2 = .084$.

There was also not a significant difference in PTSD-related sleep disturbance (PSQI-A) symptoms between time points, $F(2,13) = .846$, $p = .451$, $\eta_p^2 = .115$. Although there was not a significant change over time in any of these three nightmare related variables, it should be noted that all three variables (number of nightmares per night, number of nights with nightmares per week, and PTSD-related sleep disturbance) declined over the course of the three assessment points.

Table 16.

Means (Standard Deviations) of Nightmare Frequency and PSQI-A Variables across Three Assessment Time Points (Pretreatment, Posttreatment and Two month Follow-up).

	Baseline M (SD)	Posttreatment M (SD)	Follow-up
NMPN	1.00 (.57)	.88 (.65)	.83 (.59)
NNWNMpW	4.75 (2.23)	4.25 (2.35)	4.08 (2.47)
PSQI-A	8.47 (3.7)	8.00 (5.46)	7.73 (4.91)

*NMPN = Nightmares per night, NNWNMpW = Number of nights with Nightmares per week,

A repeated measures ANOVA was used to determine if there is a significant difference in PTSD and depression symptoms at pre-, post, and follow-up in the treatment condition (see Table 17 for means and standard deviations). A repeated measures ANOVA demonstrated that there is a significant difference in depression (PSQ-9) between time points, $F(2,14) = 7.97$, $p = .005$, $\eta_p^2 = .532$ (see Figure 20). Posthoc tests (Bonferroni correction) demonstrated that the intervention was associated with a reduction in depression from baseline to posttreatment, ($p = .027$) and but not from baseline to follow-up assessment ($p > .05$). A significant difference was observed from posttreatment to follow-up assessment ($p = .018$) indicating that treatment gains were not maintained from posttreatment to follow-up assessment.

A repeated measures ANOVA demonstrated that there is not a significant difference in PTSD symptoms (PSS) between time points, $F(2,14) = 1.30$, $p = .288$, $\eta_p^2 = .080$.

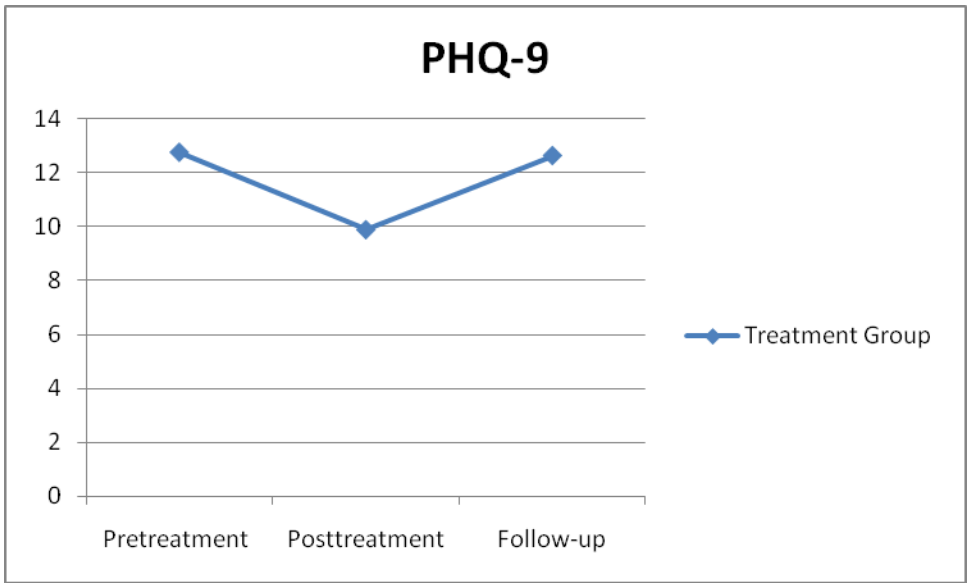

Figure 20. Patient Health Questionnaire-9 (PHQ-9) for treatment completers at pretreatment, posttreatment and two month follow-up.

Table 17.

Means (Standard Deviations) of PSS and PHQ-9 Scores across Three Assessment Time Points (Pretreatment, Posttreatment and Two Month Follow-up).

	Baseline M (SD)	Posttreatment M (SD)	Follow-up
PHQ-9	12.75 (6.47)	9.88 (6.94)	12.63 (7.69)
PSS	39.56 (11.18)	35.50 (18.24)	37.81 (18.38)

PHQ-9 = Patient Health Questionnaire-9, PSS = PTSD Symptoms Scale.

Hypothesis #5

The fifth hypothesis stated that participants in the treatment condition will show significant reductions in dysfunctional beliefs and attitudes about sleep compared to waitlist controls at posttreatment (see Table 18). A repeated measures ANOVA was used to determine if participants in the treatment condition would show significant reductions in dysfunctional beliefs about sleep compared to waitlist controls at posttreatment compared to pre-treatment. There was

not a significant condition by time interaction for beliefs about sleep (DBAS-16), $F(1, 32) = 2.85$, $p = .101$, $\eta_p^2 = .082$ although results trended in the expected direction.

Analyses examining the individual subscales demonstrated a significant condition by time interaction for the following subscales: beliefs about sleep meds (Component 2), $F(1, 32) = 4.99$, $p = .033$, $\eta_p^2 = .135$, and expectations about sleep need (Component 3), $F(1, 32) = 5.72$, $p = .023$, $\eta_p^2 = .152$ (see Figures 21 and 22). These results suggest that treatment had a significant impact on participants' beliefs about the necessity of sleep medication and expectations for sleep need. The condition by time interaction effects were not significant for patients' sleep related worry (Component 1), $F(1, 32) = .787$, $p = .382$, $\eta_p^2 = .024$ or belief about the consequence of poor sleep (Component 4), $F(1, 31) = .03$, $p = .868$, $\eta_p^2 = .001$.

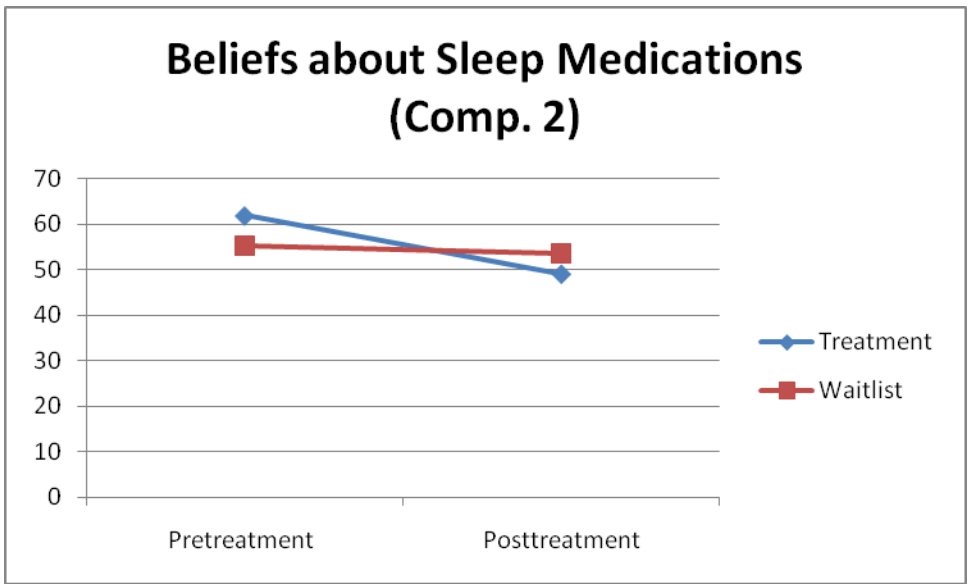

Figure 21. Beliefs about sleep medications (DBAS-16: component score 2) at pretreatment and posttreatment for the treatment and waitlist conditions.

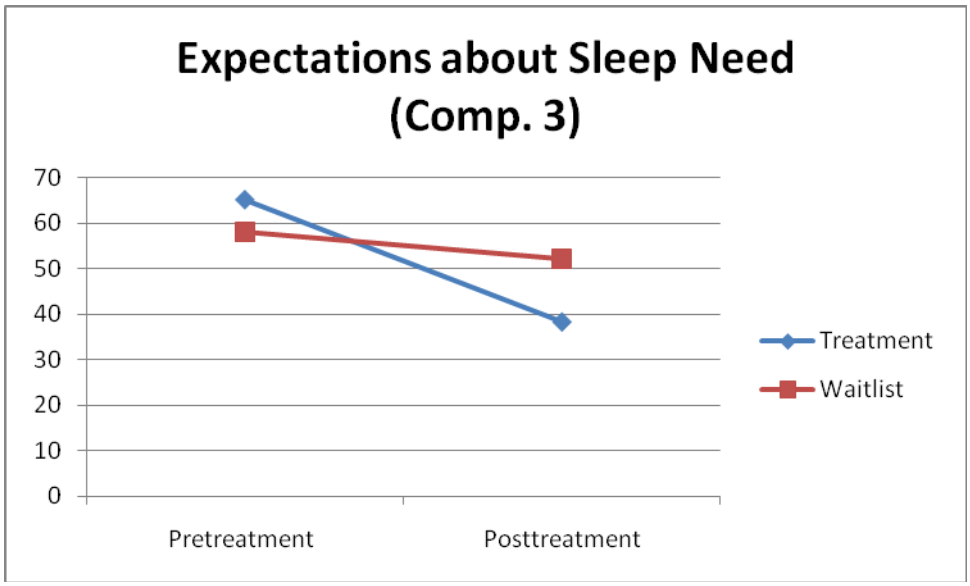

Figure 22. Expectations about sleep need (DBAS-16: component score 3) at pretreatment and posttreatment for the treatment and waitlist conditions.

Table 18.

Means (Standard Deviations) of Beliefs about Sleep (DBAS-16 Total and Component Scores) at Pretreatment and Posttreatment for the Treatment and Waitlist Conditions.

	Baseline M (SD)		Posttreatment M (SD)		Effect Size
	CBT-I/IRT	Waitlist	CBT-I/IRT	Waitlist	
DBAS-16	59.94 (18.38)	54.05 (11.75)	51.60 (12.14)	52.75 (12.36)	.082
Component 1	67.81 (20.76)	61.57 (15.30)	60.46 (22.03)	59.52 (12.16)	.024
Component 2	61.85 (21.4)	55.13 (15.83)	49.10 (17.60)	53.45 (15.13)	.135
Component 3	65.15 (23.53)	58.12 (25.87)	38.97 (20.97)	52.18 (33.10)	.152
Component 4	39.53 (24.87)	36.63 (22.67)	41.69 (28.71)	39.77 (24.63)	.001

*DBAS-16 = Dysfunctional Beliefs about Sleep Scale, Component 1 = sleep-related worry and feelings of helplessness, Component 2 = beliefs about sleep medications, Component 3 = expectations about sleep need, Component 4 = beliefs about the consequences of insomnia.

Combined treatment and crossover group analysis for beliefs about sleep. The DBAS-16 and component scores of the participants from the waitlist condition who crossed over to treatment condition (n = 12) were combined with the treatment condition (n = 17) to determine the effects of the treatment on dysfunctional beliefs about sleep using a larger sample size. Results of paired sample t-tests indicated a significant pre to posttreatment reduction for

beliefs about sleep DBAS-16, $t(27) = 2.63$, p = .014, component 1, $t(27) = 2.36$, p = .026, component 2, $t(24) = 2.22$, p = .035, component 3, $t(27) = 3.59$, p = .001. There was not a significant difference from pre to posttreatment in component 4, $t(27) = .302$, p = .765. Means for the combined sample are presented in Table 19 below.

Table 19.

Means (Standard Deviations) and Significance Levels for DBAS-16 and Component Scores for Combined Crossovers and Treatment Sample at Pretreatment and Posttreatment.

	Baseline M (SD)	Posttreatment M (SD)	p-value
DBAS-16	56.02 (16.76)	48.04 (12.95)	.014
Component 1	64.54 (17.98)	55.84 (19.96)	.026
Component 2	57.65 (20.21)	48.55 (16.74)	.035
Component 3	59.5 (27.08)	37.95 (22.10)	.001
Component 4	36.42 (21.34)	35.40 (25.19)	.765

*DBAS-16 = Dysfunctional Beliefs about Sleep Scale, Component 1 = sleep-related worry and feelings of helplessness, Component 2 = beliefs about sleep medications, Component 3 = expectations about sleep need, Component 4 = beliefs about the consequences of insomnia.

Hypothesis #6

The sixth hypothesis states that more participants in the treatment condition will report clinically significant sleep outcomes than participants in the waitlist control condition at posttreatment. In this study, clinically significant sleep outcomes were determined using Lichstein and colleagues' (2000) method of comparing sample sleep efficiency data to established sleep efficiency norms (M = 86.1%, SD = 9.7%; Lichstein, 1997). This model defines three separate categories of clinically significant change. For all three categories sleep efficiency must improve by at least 0.5 *standard deviations* of the norm or 4.85%. C*linically significant improvement* means that the improvement by 4.85% criterion is met and the individual's post-treatment sleep efficiency is greater than or equal to 86.1%. *Moderately clinically significant improvement* means that the improvement by 4.85% criterion is met and although the

posttreatment sleep efficiency does not reach 86.1%, it is at least within one *standard deviation* of the mean of the normative group (76.4%). Finally, the classification of *substantial improvement* is given to individuals who reported very low pretreatment sleep efficiency but who make posttreatment gains of more than 19.4% (greater than two standard deviations) of the norm. Only participants who had pre and posttreatment sleep diary information were included in this analysis.

The clinically significant changes in SE from pre-treatment assessment to posttreatment for the treatment condition (n = 16) by category were as follows: eight participants (47.1 %) with clinically significant improvement, three participants (17.6 %) with moderately clinically significant improvement, one participant (5.9 %) with substantial improvement and four participants (23.5 %) who did not experience clinically significant changes in SE (see Table 20).

The clinically significant sleep changes from baseline to posttreatment for the waitlist condition (n = 11) by category were as follows: zero participants with clinically significant improvement, two participants (11.8%) with moderately clinically significant improvement, one participant (5.9%) with substantial improvement and eight participants (47.1 %) who did not experience clinically significant changes in SE (see Table 20).

The clinically significant sleep changes from baseline to post-treatment for the cross-over condition (n = 12) by category were as follows: Four participants (33.3%) with clinically significant improvement, three participants (25%) with moderately clinically significant improvement, two participants (16.7%) with substantial improvement and three participants (25%) who did not experience clinically significant changes in SE.

When the three categories of sleep improvement (clinically significant, moderately significant improvement and substantial improvement were collapsed into one variable called

combined clinical significance, 12 participants (75%) of the treatment condition indicated some amount of clinically significant improvement in SE compared to three participants (17.6%) of the waitlist condition. Of those participants from waitlist condition who crossed over to the treatment condition, nine participants (75%) had some amount of clinically significant change in sleep efficiency.

A chi-square analysis was used to test Hypothesis 6. The independent variables for the chi-square were combined clinically significant change in SE at posttreatment (yes, no) and condition (treatment and control). According to a chi-square analysis, the two conditions had significantly different rates of combined clinically significant change in SE at posttreatment, $\chi^2(1, n = 27) = 6.01, p = .014$. Fisher's Exact Probability Test ($p = .022$) was used to confirm analysis as recommended for 2 x 2 tables with small sample sizes.

Additionally, the ISI criterion for insomnia in a clinical sample is a score of 11 (Morin, Belleville, Belanger & Ivers, 2011). This criterion was used to compare clinically significant change in sleep from pre to posttreatment between the treatment and control conditions. At pre-treatment none of the 34 participants scored below the clinical cut off (>11) on the ISI. At posttreatment, 3/15 (20%) in the treatment condition and 6/12 (50%) of the crossovers scored below the clinical cutoff score. One of 14 (7.1%) participants in the waitlist condition scored below the clinical cutoff score at post-waitlist assessment. For those who completed treatment, 9/27 (33%) scored below the clinical cutoff at posttreatment (>11).

The PSQI is yet another measure that can be used to determine clinical improvement. A cut off score of five (a lower score indicates better sleep quality; Buysee, Ancoli-Israel, Edinger, Lichstein, & Morin 2006) indicates normal sleep on the PSQI. At pre-treatment none of the 34 participants scored in the normal or even sub-threshold range on the PSQI. Of the participants

who completed posttreatment questionnaires, 2/15 (13%) of those in the treatment condition and 5/12 (42%) of the crossovers reported normal sleep according the PSQI. No participants in the waitlist condition achieved normal sleep at post-waitlist assessment. The rate of remission according to the PSQI at posttreatment for those who completed treatment was 7/27(26%).

Table 20.

Clinically Significant Change in Sleep Efficiency from Baseline to Posttreatment in the Waitlist and Control Condition.

	CBT-I/IRT (n = 16)	Waitlist (n = 11)	Cross-over (n = 12)
Clinically Significant Improvement	8 (47.1%)	0	4 (33.0%)
Moderately clinically significant improvement	3 (17.6%)	2 (11.8%)	3 (25.0%)
Substantial improvement	1 (5.9%)	1 (5.9%)	2 (16.7%)
No improvement	4 (23.5%)	8 (47.1%)	3 (25.0 %)
Missing data	1 (5.8%)	6 (35.2%)	0
Combined Clinical Significance	12 (75%)	3 (17.6%)	9 (75.0%)

Exploratory Question: Group versus Individual Treatment

The authors proposed an exploratory question regarding the efficacy of group CBT-I/IRT treatment compared to individual CBT-I/IRT treatment. To address this, the results of current study's group CBT-I plus IRT intervention for insomnia and nightmares for mixed theater veterans with PTSD are compared to the results of Ochsner Margolies and colleagues' (2013) recent study of an individually administered CBT-I with adjunctive IRT for insomnia and nightmares for OEF/OIF veterans with PTSD. Intent-to-treat analyses including pre and posttreatment means and effect sizes sleep and secondary analysis variables (PTSD and depression symptoms) for both the current study and Ochsner Margolies' study are displayed below (See Tables 21 and 22).

Table 21.

Intent-to-treat Means (Standard Deviations) and Effect Sizes of Sleep Variables and Mood Variables for Treatment and Waitlist Conditions of Current Study.

	Pretreatment M (SD)		Posttreatment M (SD)		Effect Size
	CBT-I/IRT	Waitlist	CBT-I/IRT	Waitlist	
Sleep Onset Latency	37.33(23.95)	32.72 (12.44)	22.29 (17.57)	27.93 (9.34)	.14
Wake After Sleep Onset	42.08 (27.95)	48.14 (33.07)	19.39 (15.58)	41.32 (33.34)	.09
Sleep Efficiency	72.02 (13.05)	64.16 (15.34)	84.30 (11.20)	70.34 (16.14)	.10
Total Sleep Time	5.45 (1.22)	4.64 (1.35)	5.34 (1.49)	4.85 (1.39)	.03
IS1	21.94 (4.66)	20.35 (3.50)	15.62 (6.51)	20.24 (3.88)	.30
PSQI	14.88 (3.97)	14.41 (3.20)	10.76 (4.19)	14.18 (2.92)	.28
DBAS-16	59.94 (18.38)	54.08 (11.75)	51.52 (12.14)	52.71 (12.28)	.08
PSQI-A	9.65 (4.36)	8.44 (6.83)	8.76 (5.27)	7.5 (5.37)	.00
PSQI-A, Item1C	1.81 (1.01)	1.92 (1.16)	2.00 (1.0)	1.91 (1.08)	.02
PHQ-9	14.41 (6.99)	12.65 (5.96)	12.06 (6.80)	13.53 (5.94)	.19
PSS	41.35 (16.17)	36.59 (16.92)	40.59 (18.39)	38.88 (16.19)	.03

*ISI = Insomnia Severity Index, PSQI = Pittsburg Sleep Quality Index, DBAS-16 = Dysfunctional Beliefs about Sleep Scale, PSQI-A = Pittsburg Sleep Quality Index-Addendum for PTSD, PSQ-A, Item 1C= Pittsburg Sleep Quality Index-Addendum for PTSD, Item 1C (Nightmare frequency), PHQ-9 = Patient Health Questionnaires-9, PSS = PTSD Symptom Scale.

Table 22.

Intent-to-treat Means (Standard Deviations) and Effect Sizes of Sleep Variables and Mood Variables for Treatment and Waitlist Conditions Ochsner Margolies et al., (2013) study.

	Pretreatment M (SD)		Posttreatment M (SD)		Effect Size
	CBT-I/IRT	Waitlist	CBT-I/IRT	Waitlist	
Sleep onset latency	33.4 (20.4)	28.7 (15.6)	15.3 (9.4)	32.8(24.1)	.27
Wake After Sleep Onset	36.9 (23.6)	40.9 (20.2)	18.4 (13.8))	40.0 (23.4)	.13
Sleep Efficiency	71.5% (11.6)	76.6% (15.34)	86.5% (6.8)	75.7% (9.0)	.40
Total Sleep Time	282.4 (93.7)	333.63 (112.4)	311.7 (98)	327.4 (98.5)	.05
IS1	19.9 (3.8)	21.4 (3.9)	14.4 (5.9)	21.4 (4.3)	.32
PSQI	14.8 (2.9)	14.8 (3.4)	10.8 (3.95)	15.5 (3.3)	.42
DBAS-16	59.94 (18.38)	54.05 (11.75)	51.60 (12.14)	52.75 (12.36)	.08
PSQI-A	10.1 (3.6)	11.6 (5.8)	7.5 (5.6)	12.8 (5.4)	.24
PSQ-A, Item 1C	2.0 (1.0)	2.0 (1.2)	1.7 (1.2)	2.5 (.93)	.18
PHQ-9	13 (3.3)	12.6 (5.1)	8.4 (4.7)	14.1 (2.8)	.44
PSS	41.35 (14.2)	39.8 (16.76)	33.5 (13.7)	47.1 (9.7)	.40

*ISI = Insomnia Severity Index, PSQI = Pittsburg Sleep Quality Index, DBAS-16 = Dysfunctional Beliefs about Sleep Scale, PSQI-A = Pittsburg Sleep Quality Index-Addendum for PTSD, PSQ-A, Item 1C = Pittsburg Sleep Quality Index-Addendum for PTSD, Item 1C (Nightmare frequency), PHQ-9 = Patient Health Questionnaires-9, PSS = PTSD Symptom Scale.

Insomnia Treatment Evaluation

The Insomnia Treatment Questionnaire (ITEQ) was administered to patients at posttreatment assessment to assess participants' reaction to the group intervention. The ITEQ was not administered to the first treatment group due to an administrative oversight. Norms have not been established for the ITEQ so the author proposes that the ITEQ means presented below represent percentage of agreement with the prompting item. Those who completed the treatment found the treatment to be plausible overall (M = 79.04, SD = 14.02). Those who completed the treatment condition found the treatment rational to make sense (M = 80.48, SD = 14.54) and they found the treatment to be acceptable (M = 76.95, SD = 16.4), suitable (M = 78.38, SD = 19.54), and effective for their sleep problem (Mean = 80.48, SD = 16.17).

Exploratory Analysis of Combat Era of Veteran

Additional exploratory analyses were conducted after primary analyses were complete to investigate if type of combat theater or treatment group had a significant effect on treatment outcome. These results should be interpreted with extreme caution given the small sample and unequal condition size. Of the 29 veterans who participated in the group CBT-I/IRT intervention, 22 were Vietnam veterans and seven were either OEF/OIF and/or Persian Gulf veterans. Intent-to-treat analysis indicated that there were no significant time by group (Vietnam veteran versus OEF/OIF and/or Persian Gulf veterans) interactions for any outcome variables. However, there was a trend toward significance for insomnia severity, ISI, $F(1, 27) = 3.353$, $p = .078$, $\eta_p^2 = .110$ which suggests that veterans from the Vietnam era reported greater improvement in insomnia severity from pre to posttreatment than veterans in OEF/OIF and/or Persian Gulf veterans. Analyses were also conducted to determine if there were significant differences in treatment

outcome between treatment groups. Intent-to-treat analysis indicated that there were no significant time by treatment group interactions for any outcome variables.

Discussion

The present pilot study investigated the feasibility and efficacy of a combined CBT-I and IRT protocol delivered in a group format to a sample of mixed theater veterans with sleep disturbance and PTSD. After a thorough review of the literature, the author believes that this is the first randomized controlled study of a group cognitive behavioral treatment addressing both insomnia and nightmares in a sample of veterans with PTSD. Participants assigned to the treatment condition participated in six ninety-minute weekly sessions of combined CBT-I and IRT. Those in the waitlist condition waited for six weeks before being given the opportunity to cross over to the treatment condition if so desired. The authors hypothesized that the treatment condition would experience significant improvement on measures of self-reported sleep, nightmare frequency, PTSD-related sleep disturbance and beliefs about sleep in addition to reductions in PTSD and depression severity compared to the waitlist condition at posttreatment and that treatment gains would be maintained at two month follow-up for the reduced number of participants who participated in follow-up (16/29 or 55.2% of the posttreatment sample). These hypotheses were largely supported by the study results with some notable exceptions which will be discussed further in this section. In sum, the findings of this study indicate that a combined CBT-I and IRT intervention delivered in a group format was effective in reducing insomnia symptoms, nightmare frequency, and depression in a sample of mixed theater veterans with PTSD. The study also demonstrated the feasibility of this treatment approach with this population suggesting that a larger randomized controlled study is warranted.

Effects of the Intervention on Self-reported Sleep and Nightmares

Effects of intervention on self-reported sleep. Results from intent-to-treat analyses revealed that participants in the treatment condition experienced significant improvement in global measures of sleep and some sleep diary variables compared to the waitlist control condition at posttreatment. The large effect sizes for reductions in insomnia severity as measured by the ISI and improvement in sleep quality as measured by the PSQI in the treatment condition were comparable with the results of the two other randomized controlled studies of a combined CBT-I and IRT intervention for veterans with PTSD (Ulmer et al., 2011; Ochsner Margolies et al., 2013).

According to intent-to-treatment analysis of sleep diary variables, participants in the treatment condition demonstrated significantly reduced sleep interruptions and sleep onset latency at posttreatment compared to controls with trends in the expected direction for sleep efficiency and time awake after sleep onset. The effect sizes were moderate to large for these four sleep diary variables. As is often the case with pilot studies, the small sample size could have limited the ability to detect statistical differences between conditions that did indeed exist. In order to address the issue of sample size, a follow-up within group analysis was conducted for each of the sleep diary variables, combining participants who had crossed over to the treatment group after completing the waitlist condition (n = 12) with the treatment condition (n = 17). Using this larger sample (n = 29), analysis of pre- to posttreatment scores revealed significant improvements in all sleep variables with the exception of total sleep time.

The intervention did not have a significant effect on total sleep time as was also the case in Ochsner Margolies and colleagues' (2013) study. This finding did not come entirely as a surprise because it is not uncommon in the CBT-I literature to have total sleep time remain the

same and even decrease at posttreatment (Morin & Benca, 2012). This phenomenon is most likely due that fact that the focus of CBT-I is to improve sleep quality by consolidating fragmented sleep. Once quality sleep has been established, the amount of sleep can be expanded over time. However, the CBT-I treatment period is quite short, and it can take participants time to fully integrate the behavior changes necessary to experience the full treatment benefits (Morin et al., 1999). As a result, the effect size for total sleep time is often larger at follow-up assessments than at posttreatment (Okajima, Komada, & Inoue, 2011). Although the treatment condition did not show significant increases in total sleep time at posttreatment or two month follow-up, mean total sleep time did increase across assessment points.

In addition to improvements on sleep parameters and global sleep measures, participants in the treatment condition demonstrated clinically significant sleep outcomes compared to waitlist controls. At baseline, 3 of 16 (19%) participants in the treatment condition and 0/11 in the waitlist condition reported sleep efficiency in the normal range (>86.1%). At posttreatment 10/16 (63%) in the treatment condition and 1/11 (9%) in the waitlist condition reported sleep efficiency in the normal range. Not only did the treatment contribute to significant improvements in sleep, a majority of the participants who received treatment became normal sleepers according to sleep efficiency criteria for clinical improvement. However, according to criteria determined by the PSQI and ISI, only 26% and 33% respectively of those receiving treatment scored below the established clinical cutoff for insomnia (PSQI < 6, ISI < 11), thus indicating that the intervention resulted in substantially improved sleep rather than normal sleep. These improvements in clinically significant outcomes are comparable to other treatment studies targeting this population (Ulmer et al., 2011; Ochsner Margolies et al., 2013; Swanson et al., 2009)

The present study included a two month follow-up assessment which is a methodological design feature found in only a few other studies of cognitive behavioral interventions for sleep disturbance in veteran populations (see Germain et al., 2012; Forbes et al., 2003; Lu et al., 2009, Cook, et al., 2010). This two month follow-up period allowed the durability of the treatment effects to be evaluated, although there was a high rate (i.e., 44.8%) of attrition at this follow-up time point. Thus, caution needs to be exercised in drawing conclusions from this data.

Results of the follow-up analysis demonstrated that participants who received treatment maintained gains on four out of five sleep diary variables (SOL, WASO, SI, SE). Participants' posttreatment improvements in sleep quality and insomnia severity also were maintained at follow-up. These results are similar to those of Germain et al.'s 2012 study in which treatment gains of those who received active treatment (Prazosin or behavioral intervention) were maintained at six month follow-up assessment. These findings are congruent with the CBT-I literature which shows durability of treatment over time. This durability is one of the features that makes CBT-I superior to medication for the treatment of chronic insomnia (Sivertsen et al., 2006; Morin et al., 1999). Taken together these results lend support to the hypothesis that the combined CBT-I and IRT treatment resulted in significantly improved sleep quality and insomnia severity and these improvements were maintained over time for the subset of individuals who participated in the follow-up assessment.

The results regarding beliefs about sleep as measures by the DBAS-16 were mixed. Although there was not a significant difference from pre- to posttreatment between the treatment and control conditions in the DBAS-16 total score, there were significant differences between conditions on two DBAS-16 component scores. The treatment condition indicated significantly reduced dysfunctional beliefs about sleep need and sleep medication compared to controls at

posttreatment. To further investigate beliefs about sleep, the larger sample of combined treatment and crossover group was used to determine if there were changes in the DBAS-16 scores from pre- to posttreatment. These combined data indicated that there was a significant pre- to posttreatment decrease in the DBAS-16 total score as well as a decrease in three out of four component scores: expectations about sleep, beliefs about sleep need, and sleep related worry. There was not a change in beliefs about consequences of poor sleep. The reduction in DBAS-16 total score was maintained at two month follow-up. This finding suggests enduring changes in participants' sleep cognitions.

Although it is common in the insomnia treatment literature to assess beliefs about sleep (Carney et al., 2010) with the exception of a few studies (Devida et al., 2005; Ochsner Margolies et al., 2013), evaluation of beliefs about sleep have been largely left out of treatment studies for sleep disturbance in samples of veterans with PTSD (Swanson et al., 2009; Ulmer et al., 2011; Germain et al. 2012). It would be helpful for future studies to assess veterans' beliefs about sleep pre- and posttreatment to get a better understanding of these beliefs might affect treatment response in a way that differs from civilian samples. In addition, future researchers might consider developing a dysfunctional beliefs scale that is specific to beliefs about PTSD-related insomnia.

Effects of intervention on self-reported nightmares. In accordance with the second hypothesis, intent-to-treat analyses revealed that participants in the treatment condition experienced reduced nightmare frequency at posttreatment compared to controls as measured by sleep diary variables (number of nightmares per night and number of nights with nightmares per week). These results were further confirmed with a pre to posttreatment analysis using a

combined sample of treatment condition participants and crossovers which also demonstrated significant decrease in both nightmare frequency variables.

The nightmare frequency findings from past cognitive behavioral intervention studies in veteran samples with PTSD have been mixed. Several studies indicate that treatment did significantly reduce nightmare frequency (Ulmer et al., 2011; Germain et al., 2012: Swanson et al., 2009: Harb et al, 2009). However, the results of a fully powered randomized controlled study of IRT (n = 124) in a sample of Vietnam veterans with reoccurring nightmares showed no treatment effect for nightmare frequency. Authors attributed these null finding to the severity and chronicity of the PTSD and sleep disturbance of the veterans' in the sample (Cook et al., 2010). In light of the significant improvement in nightmare frequency demonstrated by this study and other studies of combined CBT-I and IRT protocols (Ulmer et al., 2011; Germain et al,. 2012), and the null findings of the study which tested an IRT only protocol (Cook et al., 2010), one might hypothesize that the CBT-I component of the combined treatment plays an important role in the reduction of nightmare frequency. In light of the mixed evidence, further research comparing IRT alone to combined CBT and IRT for veterans is needed.

In the current study, reductions in nightmare frequency were not maintained at two month follow-up. This is a puzzling finding given the fact that sleep improvements were maintained at two month follow-up. One possible explanation for this finding is that nightmares are not the primary maintaining factor for sleep disturbance in veterans with PTSD. In other words, in keeping with the model of comorbid insomnia (Stepanski & Rybarczyk, 2006), insomnia develops in part due to nightmares but can take on a life of its own over time and thus respond successfully to insomnia focused treatment even if nightmares do not remit or return over time (Ulmer et al., 2011). Additionally, it may be the case that IRT effects are not nearly as durable as

CBT-I effects have proven to be. Unfortunately, studies by Ulmer et al. (2011) or Ochsner Margolies, et al. (2013) did not include a follow-up assessment. Germain et al. (2012) is the only other study using a combined CBT-I and IRT protocol in a sample of veterans with PTSD that included a follow-up assessment. The results of that study indicated that after four months, the significant decrease in nightmare frequency in the combined CBT-I and IRT condition was maintained. There are several studies of IRT using samples of veterans with PTSD that included follow-up assessments but the findings regarding the durability of treatment on nightmare frequency are mixed. Forbes et al. (2003) found significantly decreased nightmare frequency at 12 month follow-up compared to baseline assessment. Similarly, Lu et al. (2009) found significantly reduced nightmare frequency at three and six month follow-up despite no significant decrease at posttreatment assessment. However, Cook et al. (2010) found no significant reduction in nightmare frequency at posttreatment or six month follow-up.

Effects of Intervention on PTSD and Depression Symptoms

It was hypothesized that participants in the treatment condition would experience significant decreases in PTSD and depression symptoms compared to the control condition at posttreatment. This hypothesis was partially supported by the study results. The participants in the treatment condition experienced significantly reduced depression but not PTSD symptoms at posttreatment compared to the control condition. The results of the pre- to posttreatment analysis using the larger sample of combined treatment and crossovers participants also revealed a significant improvement in PHQ-9 scores from pretreatment to posttreatment. However, at two months posttreatment PHQ-9 scores returned to baseline levels despite the fact that sleep improvements were maintained. Furthermore, there was no change in PSS scores from pre- to posttreatment or follow-up in the combined treatment group.

Effect of intervention on depression. These findings lend support to the hypothesis that the combined CBT-I and IRT treatment not only improved insomnia and nightmares but also had a positive effect on depression. This finding is not surprising given the well-established correlation between depression and insomnia. It is a common finding in the sleep literature that improvements in sleep have reciprocal effects for depression (Perlis et al., 2006). Therefore, it was puzzling that changes in depression were not durable over time. It is possible that the posttreatment improvements in depression symptoms were a reflection of behavioral activation inherent in participating in the weekly treatment group which involved both social interaction and prescribed daily tasks. By the two month follow-up assessment, participants could have reverted back to pre-treatment social behavior while maintaining improved sleep habits.

These results are similar to several other studies of cognitive behavioral treatment for insomnia and/or nightmares using veteran populations which also found significant improvements in depression at posttreatment (Ochsner-Margolies et al., 2013; Gellis & Gehrman, 2010; Forbs et al., 2001). Conversely, Ulmer's 2011 study did not show significant findings for depression at posttreatment which could very well have been due to measurement error since the depression measure used in the study (PHQ-2) has a restricted range.

Effect of intervention on PTSD and PTSD-related sleep disturbance. Participants in the treatment condition did not experience significant reductions in PTSD symptoms or PTSD-related sleep disturbance at posttreatment or two month follow-up. This finding is perhaps the most notable difference between this study and similar studies which found significant differences in PTSD symptoms from pre to posttreatment with moderate to large effect sizes (Ulmer et al., 2011; Ochsner Margolies et al., 2013; Harb et al., 2009). In fact, in Ulmer and

colleagues' study (2011) over 50% of the participants in the treatment condition remitted from PTSD according to scores on the PCL-M (≤ 49).

The null findings for PTSD-related sleep disturbance symptoms at posttreatment (as measured by the PSQI-A) and two-month follow-up are puzzling given the significant reduction in nightmare frequency and sleep interruptions reported at posttreatment. One might think these reductions in sleep disruption would be reflected in participants' responses to the PSQI-A. The results from other similar studies which have employed the PSQI-A are mixed with one study showing null findings for condition by time decrease in PTSD- related sleep disturbance (Ulmer, Edinger, & Calhoun, 2011), another study did identify a significant condition by time decrease in e PSQI-A at posttreatment (Ochsner Margolies et al., 2013) while still another found a significant decrease in PTSD- related sleep disturbance for both the treatment and control conditions at posttreatment (Germain et al., 2012).

There are several possible reasons that PSS and PSQI-A scores did not decrease in the current study. Firstly, in order to participate in the present study, participants were required to have completed a ten week PTSD recovery group. Other similar studies that did show a significant condition by time decrease in PTSD symptoms did not require PTSD treatment before participation in the study although many participants had undergone or were concurrently engaged in PTSD treatment (Ulmer et al., 2011; Ochsner Margolies et al., 2013). Therefore, it is possible that veterans' PTSD symptoms had already improved to some degree as a result of the PTSD treatment thus leaving less variance in the PSS scores to be accounted for by the CBT-I and IRT intervention.

Another possible explanation for the lack of significant change in PTSD and PTSD-related sleep disturbance symptoms could have to do with the chronic nature of the PTSD in the

current sample, the majority of whom were Vietnam veterans (74%). These veterans in most cases have been living with the symptoms of PTSD for over 40 years without remission. It is possible that severe, chronic PTSD does not respond to cognitive behavioral interventions for sleep and nightmares to the same degree or in the same time-frame as those who have suffered from PTSD for shorter durations. In studies that did show a significant treatment effect for PTSD symptoms, Vietnam veterans were either not included in the sample (Harb et al., 2009; Ochsner Margolies et al., 2013) or were in the minority of the sample (Ulmer et al., 2011).

Several studies with majority Vietnam veterans had similar null findings for PTSD symptoms. The results of a pilot study of CBT-I for veterans with chronic PTSD (88% of the sample were Vietnam veterans) indicated no significant improvements in PTSD symptoms or daytime functioning (Gellis & Gehrman, 2012). Swanson et al. (2009) did not find a significant decrease in PTSD symptoms among study participants, 90% of which were Vietnam veterans. Perhaps the most substantial support for the explanation that chronicity of PTSD limits responsiveness to cognitive behavioral interventions for sleep disturbance comes from Cook et al.'s (2010) randomized controlled study of IRT in a sample of Vietnam veterans with chronic nightmares. Findings from this study also did not detect changes in PTSD compared to the control condition as a result of treatment. Authors explained these results by proposing that the severity of PTSD and duration of chronic nightmares in the sample of Vietnam veterans could have limited treatment responsiveness. The results of the current study and others indicate that while combined CBT-I and IRT can be helpful at reducing sleep disturbance in veterans with PTSD, this treatment should be used in conjunction with PTSD focused treatment. Future studies could investigate the most effective sequencing of insomnia and nightmare treatment with PTSD treatment (Nappi, 2012).

Feasibility and Acceptability of Group Treatment

One of the main purposes of this study was to determine if it is feasible to conduct a randomized controlled study of a group CBT-I and IRT intervention for veterans with PTSD and if the intervention is acceptable to patients. Overall, the findings indicate that the intervention was feasible to implement and the treatment was acceptable to the patients. However, there were a few minor logistical challenges to address in a larger trial. The first of these challenges is treatment scheduling. The groups met on the same day and time each week during normal business hours. Several veterans who were interested in the study were unable to participate because they could not to attend scheduled group times. Future studies should involve group meeting times during evening hours to accommodate participants' who have daytime jobs or other regular commitments. Another logistical challenge was treatment accessibility. Reimbursement for travel to treatment groups was not available which meant that study participation was limited to veterans who could afford transportation costs and lived in relative proximity to the McGuire VAMC.

The broader issue of accessibility is important to consider as future studies. As research evidence continues to acuminate in support of the efficacy of cognitive behavioral treatments for sleep disturbance in veterans with PTSD, there is a critical need to make these interventions more easily accessible. One strategy to increase access to such treatments is to increase the number of behavioral sleep medicine trained clinicians. The national CBT-I training program in the VA system (Karlin et al., 2013) is a valuable initiative that will certainly contribute to improved accessibility to evidence-based treatments by increasing the number of trained clinicians. In addition to ramping up numbers of behavioral sleep medicine therapists, new models of CBT-I and IRT delivery need to be explored in order to address the treatment need

(Espie, 2009). Futures studies should test the effectiveness of tele-health or self-help as treatment delivery methods that could increase accessibility to cognitive behavioral treatment for sleep disturbance as well as reduce costs. In fact, one self-help IRT protocol has already been tested (Lancee, Spoormaker, & van den Bout, 2010) in a sample of Dutch civilians with promising treatment effects.

To our knowledge, none of the veterans recruited opted out of the study because of the group format and there were no complaints about the groups during the treatment period. Overall, treatment sessions generally had a feeling of camaraderie, support, and often humor. This anecdotal evidence of the acceptability of the group protocol is substantiated by scores on the ITEQ, a measure developed to assess insomnia treatment plausibility (Mimeault & Morin, 1999). Judging by the ITEQ ratings the participants found the treatment to be plausible, understandable, acceptable, suitable, and effective for their sleep problems. Another indication of treatment acceptability was the low treatment group attrition rate. Only three participants dropped out during treatment, none for reasons related to content of the treatment according to their report.

The stigma of seeking treatment for mental health issues, especially PTSD, in the VA system and avoidance symptoms inherent in PTSD are significant barriers to treatment for veterans with PTSD (Ouimette et al., 2011). Due to its relative acceptability, CBT-I could be used as a "gateway therapy" to help engage veterans in the VA system and learn the basics of cognitive behavioral treatment which could make them more willing to consider trauma focused treatment at a later time point. For this reason, Ulmer and colleagues (2011) suggest that CBT-I and IRT could be valuable first-line treatment for PTSD. However, treatment preference and sequencing remain empirical questions which should be explored in a larger study.

Several participants expressed doubt about the IRT protocol and in some cases resisted participating in nightmare rescripting and imagery rehearsal. Some of the principles of IRT are abstract and more challenging to grasp initially than CBT-I which is arguably more concrete and behaviorally focused. Several veterans voiced difficulty conceptualizing their replay nightmare as a dream that could be changed and struggled to differentiate nightmares from memories or flashbacks. However, the majority of participants who completed treatment were willing to try IRT. It is possible that by combining CBT-I and IRT and introducing IRT in the third week of the treatment the participants had a chance to acclimatize to the treatment format and cognitive behavioral principles before introducing IRT. It is unknown to what extent participants actually practiced imagery rehearsal (i.e. rehearsing rescripted dreams daily) outside of treatment sessions. In the few previous studies that collected IRT adherence rates, reports are conflicting. In one study of IRT using a veteran sample, less than half of the participants practiced IRT (Lu et al., 2009). Whereas in another study 76% of the participants reported rehearsing the rescipted dream (Swanson et al., 2009). The overall findings of this study suggest that it is feasible to conduct a randomized controlled study and the treatment is acceptable to participants. Thus, a larger, fully powered study of group CBT-I and IRT is warranted.

Group Treatment Compared to Individual Treatment

The authors proposed an exploratory question regarding the efficacy of group CBT-I/IRT treatment compared to individual CBT-I/IRT treatment. To address this question, we compared the results of this study to the results of Ochsner Margolies and colleagues' (2013) study of an individually administered intervention, also conducted in the PTSD clinic at the McGuire VAMC, to determine if the two treatment modalities differed regarding treatment outcome. Interestingly, the effect sizes for global sleep questionnaires and sleep diary variables in Ochsner

Margolies and colleagues' (2013) study were about twice the size of those in the current study. In addition, improvements in PTSD and PTSD-related sleep disturbance symptoms were present in Ochsner Margolies and colleagues (2013) study but not in the in the current study.

It is impossible to draw firm conclusions about the group versus individual treatment from the comparison of these studies due to the differences in sample make up (mixed theater veterans versus OEF/OIF only), duration of insomnia (insomnia duration of participants in the current study averaged 16.94 years) and treatment protocol (six ninety minute sessions with IRT introduced in the third session versus four 60 minute sessions with IRT introduced in the first session). However, the differences in outcomes bring up important questions to be addressed in future studies such as is individual treatment in fact more effective than group treatment, is group treatment more cost effective than individual, are certain patient characteristics better suited for one treatment format over another, and what factors of group or individual treatment contribute to positive outcomes?

To our knowledge, there are no studies that have directly compared group to individual cognitive behavioral treatment for sleep distances in veterans with PTSD. However, the design of a study by Nappi et al. (2010) allowed for a naturalistic comparison of group IRT to individual IRT. Although the study started off with an individual IRT protocol, due to the high number of veterans interested in treatment, the authors opened up a group treatment option in order to meet treatment demand. Veterans who could not attend the group sessions due to schedule conflicts were offered individual treatment. Comparison of the individual versus group IRT showed that those undergoing individual treatment exhibited a greater decrease in insomnia severity compared to those receiving group treatment. These results should be interpreted cautiously given the low power, absence of randomized assignment, and unequal sample size between

conditions. The authors speculate that the difference between conditions could be a result of the intervention being tailored to the specific needs of the veteran undergoing individual treatment.

These studies provide some initial evidence that while both individual and group treatment may be effective treatment formats for the delivery of a combined CBT-I and IRT intervention for sleep disturbance in veterans with PTSD, individualized therapy may be more effective than group treatment. A randomized controlled study comparing group to individual combined CBT-I and IRT is clearly warranted.

Limitations and Future Directions

There were several study limitations which will be discussed in the following section and should be considered when designing future fully powered randomized controlled studies of combined CBT-I and IRT for veterans with PTSD.

A significant limitation of the study is the generalizability of the results to both genders. The study only had one female participant, which although reflective of the gender make-up of the McGuire VAMC PTSD clinic, largely limits the generalizability of the results to only male veterans. In a larger study, special effort should be made to recruit female veterans which may require adding additional recruitment sources such as military sexual trauma clinics. The generalizability of the results is also limited by the participants' level of insomnia severity. In order to participate in this study, veterans had to have had at least three episodes of insomnia per week for at least six months, and had to have suffered from daytime consequences of insomnia such as fatigue or trouble concentrating. The majority of the veterans had been struggling with insomnia for 10 or more years (n = 18). Therefore, the generalizability of the results is limited to male veterans who suffer from severe, chronic insomnia. It is possible that the success of the

treatment is due in part to the fact that the participants in this study had very erratic sleep schedules that were substantially improved by behavioral instruction.

Veterans with PTSD have high rates of comorbid sleep disordered breathing (Maher et al., 2006), and substance abuse (Petrakis, Rosenheck, & Desai, 2011) both of which were exclusionary criteria for the current study. By excluding these populations the studies recruitment pool was greatly reduced as was the generalizability of the results. In future studies, veterans with sleep apnea and substance abuse should be included and daytime sleepiness, the hallmark of sleep apnea, and substance use should be monitored and used as covariate. However, it should be noted that the exclusion rule for obstructive sleep apnea was relatively unreliable in this study since PSG assessment was not included. It is possible that veterans with undiagnosed OSA were included in the study unknowingly.

In the current study a combined CBT-I and IRT treatment protocol was used in order to address both insomnia and nightmares. However, by combining the two treatments, it is impossible to determine which is the "active ingredient." In other words, the combined treatment makes it impossible to tell which treatment was responsible for treatment gains. Despite the fact that insomnia is distressing, can negatively affect daytime functioning, and exacerbates PTSD symptoms, few studies have investigated the impact of CBT-I alone on insomnia and nightmare symptoms in veterans with PTSD (Gellis & Gehrman, 2012). A larger randomized controlled study of CBT-I alone and in combination with IRT for veterans with PTSD and sleep disturbance is called for (Nappi et al., 2012).

Another limitation of the study was the relatively small sample size, which restricted the ability to draw conclusions about treatment outcome comparisons of participant subgroups (i.e. Vietnam veterans compared to more recent theater veterans). The small sample size also led to

relatively unequal treatment group sizes, which ranged from two to six participants. Variation in the treatment groups was largely a result of study attrition and scheduling conflicts with group times as well as a slow recruitment rate. During the course of treatment, it became clear that treatment groups should be small (preferably between 4-6 people) due to the time necessary to review individual's sleep diaries and conduct individualized treatment plans.

It is possible that demand effects influenced participant responses since the author was involved in all aspects of the study including study design, recruitment, assessment and treatment. In a larger study, recruitment and assessments should be handled by research personnel who are not involved in treatment implementation. In addition, ideally there would be several different therapists administering the treatment protocol to control for therapist effects. In a similar vein, an active control condition, such as a psychoeducation group about insomnia and nightmares, would help to minimize factors such as treatment expectancy and therapeutic alliance that could have easily confounded the results of this study and other recent pilot studies (Ulmer et al., 2011; Ochsner Margolies et al., 2013).

There are several measurement related study limitations that should be addressed in a larger study. First, outcome variables were solely based on self-report. It would have been better to have included an additional objective measure of sleep such as actigraphy to measure treatment outcome in conjunction with self-report data. Second, the method of assessing nightmare frequency was not sufficient. Items in the sleep diary used to measures nightmare frequency and intensity could have been confusing to participants (see Appendix B) and should be streamlined. In a larger study it is recommended that a standardized nightmare assessment such as the Nightmare Frequency Questionnaire (NFQ; Krakow et al., 2000) be used in addition to sleep diary items to determine frequency and intensity of nightmares. Third, it would also be

helpful to include measures of treatment adherence for IRT and CBT-I to determine if participants are actually practicing imagery rehearsal and engaging in behavioral changes as instructed. The Ochsner Margolies et al. (2013) study found that approximately half of the veterans actually adhered to the IRT treatment elements.

Fourth, the researchers made several measure selections for the assessment battery that should be reconsidered when conducting a larger study. A quality of life measure was not included in the battery in an effort to cut down on participant burden. However, it is regrettable that such information was not collected since quality of life is an important outcome variable to be considered for both sleep disturbance and PTSD. In addition, the Posttraumatic Stress Disorder Checklist-Military version (PCL-M; Weathers, Huska, & Keane, 1991) should replace the PSS as a measure for PTSD in future studies because the PCL-M was developed specifically to be used in a veteran population.

Fifth, although this study did include a two month follow-up assessment, the low response rates (55%) limit our ability to draw reliable conclusions about the long term durability of treatment. Several cognitive behavioral intervention studies for sleep disturbance using samples of veterans have included follow-up assessment which range from one month (Moore & Krakow, 2007) to twelve months (Forbes et al., 2003) , including response rates ranging from 38% (Davis & Wright, 2007) to 100% (Lu et al., 2009). The two month follow-up period of the current study was chosen because of time constraints of the researcher. In a larger study a longer follow-up period window is warranted to determine durability of treatment over an extended time period.

Finally, the use of technology is another way in which assessment techniques could be improved in a larger study. Paper and pencil sleep diaries are laborious and time consuming for

participants and researchers alike and can result in measurement error due to calculation errors, illegible handwriting, and missing data. Hand held electronic devices programmed to calculate average sleep times, weekly SE, and set reminders for participants to complete daily inputs should be used in future studies. Electronic sleep diaries have already been successfully developed (Blake & Kerr, 2010) and used in research (Ulmer et al., 2011).

Implications and Significance

The current study provides further support for the efficacy of cognitive behavioral treatment of insomnia and nightmares in veterans with PTSD. The results indicate that a combined CBT-I and IRT group intervention significantly improved insomnia, nightmare frequency, and depression at posttreatment, and sleep improvements were maintained at two month follow-up among the subset of participants who completed this set of measures. Furthermore, the treatment's group format offers cost-effective alternative to individual treatment. To the best of the author's knowledge, this was the first randomized controlled study of a combined CBT-I and IRT intervention for insomnia and veterans in a sample of mixed veterans. The results of the study provide support for a larger fully powered randomized controlled trial to be conducted.

The number of military personnel who have been living with PTSD and PTSD-related sleep disturbance since Vietnam, along with the growing number of veterans who are developing PTSD post-deployment from the Persian Gulf, Iraq and Afghanistan wars, adds to the urgency of developing and testing a cost-efficient and effective group treatment for PTSD-related sleep disorders. This is especially important given the evidence which shows that sleep disturbance has negative implications for mental and physical health (Belleville et al., 2009; Bryant et al. 2010)

and plays a role in the development, maintenance, and exacerbation of PTSD (Germain et al., 2008; Nappi et al., 2012).

Furthermore, this study aligns with the Veterans Administration's commitment to providing high quality, evidence-based collaborative mental health care to veterans. Like other health care systems, the VA is moving away from offering mental health services exclusively in a specialty mental health clinic emphasizing an individual treatment model in favor of coordinated, interdisciplinary care models (Tew, Klaus, & Oslin, 2010). The implementation of a group cognitive behavioral treatment for insomnia and nightmares for veterans with PTSD provides an opportunity for multidisciplinary collaboration between PTSD specialty mental health clinics, primary care, and sleep clinics within VA medical centers.

In sum, the hypotheses that combined CBT-I and IRT group intervention would produce significant improvements in insomnia, nightmare frequency, and mood symptoms in veterans with PTSD were largely supported by the results of this study. These findings strengthen the existing literature which has shown similar results regarding the efficacy of cognitive behavioral treatments on insomnia and nightmares in veteran populations (Germain et al., 2012; Swanson et al., 2009; Harb et al., 2009; Ulmer et al., 2011; Ochsner Margolies et al., 2013). This study contributes to the literature by virtue of being the first randomized controlled study to demonstrate the effectiveness of a cognitive behavioral intervention for insomnia and nightmare delivered in a group format. This format allows for the conservation of resources while providing a larger number of veterans access to the state-of-the-art evidence-based treatment they deserve.

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Appendix A

Demographics Form

Participant Information

Study ID: _____

Telephone number: _____(home) _____ (cell)

At which number do you prefer we call you? _____

Mailing address: _____

_____

Age:_____

Gender *(Circle one):* Male Female

Education *(Circle one):*
Some High School
High School
Some College
College
Graduate School

Marital Status *(Circle one):* Married Single Divorced/Widowed

Ethnicity *(Circle one):* African America Asian Caucasian
Hispanic Alaskan/Native American Other

Height: _____lbs **Weight: _____**feet _____inches

Please list current health conditions:

1)_____ 4)_____

2)_____ 5)_____

3)_____ 6)_____

Please list all medications currently taking including sleep-related/non-sleep related medications:

Medication *Dosage*

1)_____

2)_____

3)_____

4)_____

5)_____

How long have you had difficulty sleeping? _____months _____years

Do you have reoccurring nightmares? *(Circle one):* Yes No

If yes, how many nights per week do you have nightmares? _____

Appendix B

Sleep Diary with Nightmare Items

Week 1

SLEEP DIARY

Name: _____

Date:

	10/9 *Example*							
1. Yesterday, I napped from ___ to ___ (note the times of all naps).	*1:50 to 2:30 p.m.*							
2. Yesterday, I took ___ mg of medication and/or ___ oz of ___ alcohol as a sleep aid.	*Ambien 5 mg*							
3. Last night, I went to bed and turned the lights off at ___ o'clock.	*11:15*							
4. After turning the lights out, I fell asleep in ___ minutes.	*40 min*							
5. My sleep was interrupted ___ times (specify number of nighttime awakenings).	*3*							
6. My sleep was interrupted for ___ minutes (specify duration of each awakening).	*10 5 45*							
7. This morning, I woke up at ___ o'clock (note time of last awakening).	*6:15*							
8. This morning, I got out of bed at ___ o'clock (specify the time).	*6:40*							
9. When I got up this morning, I felt ___. (1 = exhausted, 5 = refreshed)	*2*							
10. Overall, my sleep last night was ___. (1 = very restless, 5 = very sound).	*3*							
11. I had ___ nightmares while I was asleep.	*2*							
12. I dreamed my **target nightmare** (yes or no)	*Yes*							
13. My **target nightmare** was _____disturbing. (1 = extremely, 5 = not at all)	*3*							

Appendix C

The Insomnia Severity Index (ISI) is protected by copyright so it is not reproduced in this document.

Appendix D

The Pittsburgh Sleep Quality Index (PSQI) is protected by copyright so it is not reproduced in this document.

Appendix E

The Pittsburgh Sleep Quality Index Addendum for PTSD (PSQI-A) is protected by copyright so it is not reproduced in this document.

Appendix F

The PTSD Symptom Scale (PSS) is protected by copyright so it is not reproduced in this document.

Appendix G

The Patient Health Questionnaire-9 (PHQ-9) is protected by copyright so it is not reproduced in this document.

Appendix H

Beliefs and Attitudes about Sleep Scale

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, place a mark (/) along the line wherever your *personal* rating falls. Try to use the whole scale, rather than placing your marks at one end of the line.

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

Strongly disagree _____ *Strongly agree*

2. When I don't get a 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.

Strongly disagree _____ *Strongly agree*

3. Because I am getting older, I need less sleep.

Strongly disagree _____ *Strongly agree*

4. I am worried that if I go for one or two nights without sleep, I may have a nervous breakdown.

Strongly disagree _____ *Strongly agree*

5. I am concerned that chronic insomnia may have serious consequences for my physical health.

Strongly disagree _____ *Strongly agree*

6. By spending more time in bed, I usually get more sleep and feel better the next day.

Strongly disagree _____ *Strongly agree*

7. When I have trouble getting to sleep, I should stay in bed and try harder.

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

9. Because I am getting older, I should go to bed earlier in the evening.

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

13. Because my bed partner falls asleep as soon as his or her head hits the pillow and stays asleep through the night, I should be able to do so too.

Strongly disagree _____ *Strongly agree*

14. I feel that insomnia is basically the result of aging, and there isn't much that can be done about this problem.

Strongly disagree _____ *Strongly agree*

15. I am sometimes afraid of dying in my sleep.

Strongly disagree _____ *Strongly agree*

16. When I have a good night's sleep, I know that I will have to pay for it on the following night.

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

21. 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.

Strongly disagree _____ *Strongly agree*

22. I get overwhelmed by my thoughts at night and often feel I have no control over my racing mind.

Strongly disagree _____ *Strongly agree*

23. I feel I can still lead a satisfactory life despite sleep difficulties.

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

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

Strongly disagree _____ *Strongly agree*

27. A "nightcap" before bedtime is a good solution to sleep problems.

Strongly disagree _____ *Strongly agree*

28. Medication is probably the only solution to sleeplessness.

Strongly disagree _____ *Strongly agree*

29. My sleep is getting worse all the time, and I don't believe anyone can help.

Strongly disagree _____ *Strongly agree*

30. It usually shows in my physical appearance when I haven't slept well.

Strongly disagree _____ *Strongly agree*

Appendix I

TREATMENT EVALUATION QUESTIONNAIRE

---

1. Does this treatment and its rationale make sense to you?

NOT AT ALL _____VERY MUCH SO

2. How acceptable do you consider this insomnia treatment?

NOT AT ALL ACCEPTABLE_____ VERY ACCEPTABLE

3. How suitable is this treatment for your sleep problem?

NOT AT ALL SUITABLE _____ VERY SUITABLE

4. How effective do you expect this treatment to be for your sleep problem?

NOT AT ALL EFFECTIVE _____ VERY EFFECTIVE

Vita

Laurin Mack was born in Virginia in 1978 and she is an American citizen. She graduated from the University of Virginia in 2001 with a double major in History and Foreign Affairs and a minor in Russian studies. After working as a research coordinator at Mount Sinai School of Medicine, she enrolled in the clinical psychology doctoral program at Virginia Commonwealth University in 2007. She received a Predoctoral Rehabilitation Research Fellowship from the Department of Veterans Affairs, Office of Academic Affiliations to complete her dissertation research on the efficacy of a cognitive behavioral group intervention for insomnia and nightmares in a sample of veterans diagnosed with posttraumatic stress disorder. She completed her internship at Alpert Medical School of Brown University in July, 2013 and expects to graduate with her doctorate in Clinical psychology in August, 2013. She will then complete a clinical research postdoc at Rush University Medical Center in the Department of Preventative Medicine.