Published in final edited form as:

Behav Res Ther. 2011 April ; 49(4): 227–233. doi:10.1016/j.brat.2011.02.003.

COGNITIVE-BEHAVIORAL THERAPY FOR INSOMNIA IN ALCOHOL DEPENDENT PATIENTS: A RANDOMIZED CONTROLLED PILOT TRIAL

J. Todd Arnedt, Ph.D.^{a,*}, Deirdre A. Conroy, Ph.D.^b, Roseanne Armitage, Ph.D.^a, and Kirk J. Brower, M.D.^b

^aSleep and Chronophysiology Lab, Department of Psychiatry, University of Michigan

^bUniversity of Michigan Addiction Treatment Services, Department of Psychiatry

Abstract

In a randomized controlled trial, we evaluated the efficacy of cognitive-behavioral treatment for insomnia to improve sleep and daytime symptoms, and to reduce relapse in recovering alcohol dependent (AD) participants. Seventeen abstinent AD patients with insomnia (6 women, mean age 46.2 ± 10.1 years) were randomized to 8 sessions of cognitive behavioral treatment for insomnia for AD (CBTI-AD, $n=9$) or to a behavioral placebo treatment (BPT, $n=8$). Subjective measures of sleep, daytime consequences of insomnia and AD, alcohol use, and treatment fidelity were collected at baseline and post-treatment. Diary-rated sleep efficiency and wake after sleep onset, and daytime ratings of General Fatigue on the Multidimensional Fatigue Inventory improved more in the CBTI-AD compared to the BPT group. In addition, more subjects were classified as treatment responders following CBTI-AD. No group differences were found in the number of participants who relapsed to any drinking or who relapsed to heavy drinking. The findings suggest that cognitive-behavioral insomnia therapy benefits subjective sleep and daytime symptoms in recovering AD participants with insomnia more than placebo. The benefits of treating insomnia on drinking outcomes are less apparent.

Keywords

alcohol dependence; insomnia; relapse; cognitive-behavioral therapy

INTRODUCTION

Alcoholism is a devastating chronic disorder that affects up to 10% of U.S. adults in a given year, costs medical, economic, and social sectors of society as much as \$185 billion in direct and indirect costs, and contributes to more than 100,000 deaths annually. Despite effective medical treatments, most alcoholic patients achieve only short-term periods of abstinence. Thus, new treatment models that target established risk factors for relapse require development and evaluation.

© 2011 Elsevier Ltd. All rights reserved.

*Corresponding Author: J. Todd Arnedt, Ph.D., Sleep and Chronophysiology Laboratory, Department of Psychiatry, University of Michigan, 4250 Plymouth Road, Ann Arbor, MI 48109-2700, Phone: 734-764-1234, Fax: 734-764-1229, tarnedt@med.umich.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Insomnia is among the most reliable and persistent consequences of recovery from alcohol dependence (AD) (Brower, Aldrich, Robinson, Zucker, & Greden, 2001). During the first weeks of abstinence from alcohol, 36–91% of patients report sleep disturbances, depending on the scale used (Baekeland, Lundwall, Shanahan, & Kissin, 1974; Brower, et al., 2001; Caetano, Clark, & Greenfield, 1998; Cohn, Foster, & Peters, 2003; Foster, Marshall, & Peters, 2000; Mello & Mendelson, 1970). The duration of insomnia persists well beyond alcohol withdrawal, even with continued abstinence (Cohn, et al., 2003; Gann, et al., 2001), and objective studies indicate that sleep disturbances persist for months to years during sobriety (Drummond, Gillin, Smith, & DeModena, 1998). Untreated insomnia in the general population is also costly and contributes to similar daytime consequences as alcoholism, namely mood impairments, cognitive deficits, increases in errors and accidents, and increased utilization of healthcare services among others. Untreated insomnia during recovery may therefore exacerbate some of the most persistent and disabling consequences of AD.

In addition to exacerbating daytime impairment, studies have independently linked the presence of sleep disturbances during early recovery to alcohol relapse (Arnedt, Conroy, & Brower, 2007), but no studies have shown that treating insomnia improves drinking outcomes. For example, a recent 12-week placebo-controlled trial of trazodone found improved sleep quality, but significantly worse drinking outcomes than placebo (Friedmann, et al., 2008). Other hypnotic agents with different mechanisms of action have been shown to improve relapse outcomes but not sleep relative to placebo (Brower, et al., 2008).

Nonpharmacological treatments may be particularly suited to this population because of the abuse and overdose potential with some pharmacological agents when mixed with alcohol or other substances. Physician reluctance to prescribe hypnotics to substance abusers may also relate to the perception that reliance on any drugs may reinforce drug use behavior and/or be a conditioned cue to trigger relapse. Moreover, nonpharmacological therapies for insomnia result in longer-lasting improvements than pharmacotherapy (Riemann & Perlis, 2009). To date, only two studies have evaluated nonpharmacological approaches to insomnia complaints in AD subjects during early recovery. The first found that self-reported sleep quality improved in men who were assigned to 2 weeks of daily progressive muscle relaxation training, but the study failed to use a validated scale to assess sleep or an active control condition (Greeff & Conradie, 1998). In a more recent study, Currie and colleagues (2004) randomized sixty alcoholic outpatients (mean age 43.3 ± 10.9 years, 42 men) to one of three groups: individual cognitive-behavioral therapy for insomnia (five 1-hour sessions over seven weeks); self-help manual describing the use of the same CBT techniques with five 20-minute telephone support calls; or wait-list control. Participants in both active treatment groups had greater post-treatment improvements than wait-list controls on diary measures of sleep quality, sleep latency, sleep efficiency (total sleep time/time in bed), and number of awakenings. These gains were maintained at 3- and 6-month follow-up. The study, however, did not include an active control condition without cognitive-behavioral therapy techniques. Thus, whether cognitive-behavioral therapy for insomnia is more effective than a credible placebo in AD patients is unknown. Moreover, treatment appeared to have little positive impact on alcohol relapse.

In a recent open label study, we found improvements in both sleep quality and daytime consequences of insomnia and AD without relapse to alcohol following 8 sessions of cognitive-behavioral therapy for insomnia in recovering AD patients (CBTI-AD) with comorbid insomnia (Arnedt, et al., 2007). Here, we report on a randomized controlled pilot trial comparing the efficacy of CBTI-AD to an active behavioral placebo treatment (BPT). We hypothesized that, compared to BPT, CBTI-AD would improve subjective sleep quality, daytime symptoms, and reduce the frequency and severity of drinking at post-treatment.

METHODS

Participants

Participants were recruited from local outpatient clinics, residential substance abuse treatment facilities, and the local community by advertisement. Compensation for participation was provided and study procedures were approved by the University of Michigan Medical School Institutional Review Board.

Volunteers 18–65 years of age were eligible if they met DSM-IV criteria for AD and study criteria for insomnia, which included a self-reported sleep latency or wake after sleep onset >30 minutes on three or more nights per week for ≥1 month plus a score of ≥8 on the Insomnia Severity Index (ISI, Morin, 1993).

Exclusion criteria at in-person screening included: (1) current (past month) DSM-IV diagnosis of other substance dependence except for nicotine; (2) lifetime DSM-IV diagnosis of bipolar I or II disorder, schizophrenia, or other psychotic disorder, and current (past month) DSM-IV diagnosis of major depressive disorder; (3) chronic medical condition that was causally related to insomnia; (4) evidence of alcohol withdrawal, as indicated by a score ≥8 on the Clinical Institute Withdrawal of Alcohol Scale, Revised (Sullivan, Sykora, Schneirderman, Naranjo, & Sellers, 1989); and (5) medications known to influence drinking outcomes (e.g., naltrexone, disulfiram, or acamprosate). Participants taking sleep medications for one week or longer prior to screening but still exhibiting insomnia symptoms were required to maintain a stable dose during treatment.

Eligible participants underwent screening polysomnography (PSG) for one night to rule out sleep disorders other than insomnia and completed sleep/wake and drinking diary assessments for two weeks to confirm insomnia study criteria and absence of hazardous drinking during that interval (National Institute on Alcohol Abuse and Alcoholism, 1995).

Of 41 participants who began in-person screening and met inclusion criteria, 24 were excluded: 14 were lost to follow-up before completing screening, 3 had PSG-confirmed sleep disorders (2 had obstructive sleep apnea, 1 had periodic limb movements in sleep), 4 had insufficient insomnia, 1 had a positive urine drug screen for cocaine, and 2 met study criteria for hazardous drinking between screening and treatment session 1.

Procedures

After the 2-week screening phase, subjects participated in an 8-week randomized, single-blind parallel group trial of CBTI-AD vs. BPT. Qualified participants (n=17, 6 women) were randomized to 8 weekly individual sessions of CBTI-AD (n=9) or BPT (n=8), controlling for age and sex (Stout, Wirtz, Carbonari, & Del Boca, 1994). Participants, but not study therapists, were blind to treatment condition. Participants underwent breath testing and urine drug screens at each in-person session. Sleep and drinking outcome measures were collected in-person at treatment sessions 1, 2, 5, and 8; daytime symptom measures were completed at sessions 1 and 8 only.

Treatment Groups

The 8-week individual CBTI-AD was developed and manualized by the lead author in consultation with recognized experts in insomnia and AD. The treatment was piloted in an open label trial to establish preliminary efficacy and feasibility (Arnedt, et al., 2007). The manualized BPT treatment was based on the work of Steinmark and Borkovec (1974) and used as a placebo treatment in previous insomnia trials (Edinger, Wohlgemuth, Radtke,

Marsh, & Quillian, 2001; Espie, Lindsay, Brooks, Hood, & Turvey, 1989; Manber, et al., 2008).

For both treatment conditions, sessions 1, 2, 5, and 8 were conducted in-person (30–60 minutes) and sessions 3, 4, 6, and 7 were conducted by phone (15–30 minutes). Both treatments were delivered by two of the authors (JTA, DC), who have certification in Behavioral Sleep Medicine. All treatment sessions were audio-taped with participant consent and a portion was reviewed for treatment integrity by an independent consultant. Study therapists additionally completed treatment fidelity checklists at the conclusion of each session.

CBTI-AD—Cognitive-behavioral therapy for insomnia is a multi-component treatment that incorporates behavioral, cognitive, and educational components, which primarily target factors that perpetuate insomnia over time (Morin & Espie, 2003). The behavioral components included sleep restriction and stimulus control. Sleep restriction curtails the amount of time in bed to the patient's estimated total sleep time to consolidate sleep and then increases it gradually until an optimal sleep time is achieved (Spielman, Saskin, & Thorpy, 1987). Stimulus control provides a set of instructions designed to discourage sleep-incompatible behaviors and reinforce a regular sleep/wake schedule. The study instructions were: (1) go to bed if sleepy at the prescribed bedtime; (2) do not use the bed for activities other than sleep and sex; (3) get out of bed after 15–20 minutes if unable to fall or return to sleep; return to bed only when very sleepy; (4) get up at the same time each morning; and (5) do not take daytime naps. Cognitive therapy aimed to alter dysfunctional thoughts and beliefs about sleep and help patients develop realistic sleep expectations. Examples of faulty beliefs that were targeted included unrealistic sleep expectations (e.g., the need to obtain 8 hours of sleep nightly) and amplification of the consequences of inadequate sleep (e.g., inability to function during the day with inadequate sleep). Sleep hygiene education promoted the following practices: regular meals and a light snack before bed; consistent and regular daytime exercise; limited intake of caffeine, nicotine, and liquids in the evening, and a sleep-promoting sleep environment (quiet, dark, and comfortable). In addition to these standard components, CBTI-AD included education about the specific effects of use and withdrawal from alcohol and other substances on sleep and emphasized the importance of continued abstinence for the long-term recovery of sleep. Cognitive techniques also targeted unhelpful thoughts about alcohol relapse, the consequences of AD on multiple aspects of daily life, and focused on identifying alternative nighttime behaviors to drinking.

BPT—The rationale for BPT was to “reduce the conditioned arousal that develops in response to repeated pairings of frustration about not sleeping with difficulties initiating and/or maintaining sleep.” Therapists initially helped participants to develop a 10-item arousal hierarchy of behavioral and cognitive activities that occur while trying to fall asleep or while awake during the night (e.g., looking at the clock, tossing and turning, worrying about not sleeping) and then order each item from least to most arousing. A 6-item neutral hierarchy was then collaboratively developed (e.g., opening the window, brushing teeth). The treatment involved successive pairing of each item on the arousal hierarchy with all 6 neutral hierarchy items, such that all arousal hierarchy items were paired with all neutral hierarchy items by the conclusion of treatment. Sessions were audio-taped and the participant was instructed to practice the exercise once daily at home, but not within two hours of bedtime.

Assessment Measures

Sleep—Participants maintained sleep/wake diaries beginning two weeks prior to treatment and then daily during the 8 weeks of treatment. The primary dependent variables derived

from the sleep diaries were pre-treatment and session 8 sleep efficiency (total sleep time/time in bed*100) and total sleep time; secondary variables included sleep latency, frequency of nighttime awakenings, wake after sleep onset, and sleep quality ratings. The Insomnia Severity Index (Morin, 1993) is a 7-item self-report measure that yields a total score ranging from 0–28, with higher scores indicative of more severe insomnia. It was administered at session 1 and 8.

Drinking—The self-report 25-item Alcohol Dependence Scale (Skinner & Horn, 1984) was completed at session 1 to determine the severity of AD. The ADS ranges from 0 to 47, with higher scores indicative of greater AD (mean outpatient score is 23.1 ± 1.3 (Skinner & Horn, 1984)). The Time Line Follow Back (TLFB) interview (Sobell, Sobell, Leo, & Cancilla, 1988) measured drinking frequency and quantity during the 3 months prior to screening (baseline period) and during the 8-week treatment period. The primary drinking outcomes derived from the measure included % days abstinent (PDA), % heavy drinking days (PHDD), and drinks per drinking day (DDD). Heavy drinking was defined as consuming >3 and >4 alcoholic beverages in a single occasion for women and men, respectively.

Daytime Symptoms—Measures to assess daytime symptoms (completed at treatment sessions 1 and 8) included the Beck Depression Inventory – II (BDI) (Beck, Steer, & Brown, 1996), State-Trait Anxiety Inventory - Trait subscale (STAI-T) (Spielberger, Gorsuch, & Luchene, 1970), the Multidimensional Fatigue Inventory (MFI-20) (Smets, Garssen, Bonke, & de Haes, 1995), and the 36-item Short Form Health Survey from the Medical Outcomes Study, version 2 (SF-36v2) (Ware, Snow, Kosinski, & Gandek, 1993).

Treatment Fidelity and Credibility—Participants completed a 15-item true/false sleep knowledge questionnaire designed by the first author at sessions 1 and 8. The questionnaire items included facts about sleep and insomnia (e.g., Because I am getting older, I need less sleep) and appropriate/inappropriate sleep habits (e.g., Exercise in the evening helps people fall asleep) that were addressed in the CBTI-AD condition. Treatment credibility was assessed with the 7-item Therapist Evaluation Questionnaire (TEQ) (Borkovec & Nau, 1972). The first five items of the TEQ assess perceived logic of the treatment, confidence in its success, confidence in recommending it to a friend, willingness to undergo treatment, and perceived success at treating others' insomnia. The final two questions ask about therapist warmth/caring and confidence in therapist skills. Items are rated from 1 to 7, with higher scores indicative of more positive feelings. Participants completed the first five questions at treatment session 1 and all seven at session 8.

Statistical Analyses

Descriptive and inferential statistics were conducted using SPSS 18.0 (SPSS, Inc., Chicago, IL). Data are reported as mean $\pm$ standard deviation unless otherwise indicated, with significance level set at 0.05.

Treatment groups were initially compared on baseline demographic, sleep, drinking, and daytime symptom variables with chi-square tests and independent samples t-tests and any significant differences were used as covariates in the primary analyses. The primary analyses were based on a 2 (treatment groups) $\times$ 2 (baseline and week 8) split-plot randomized design, with all analyses based on the intent-to-treat model. To avoid imputation of missing data, we used linear mixed models to test main effects of group and session, and the group $\times$ session interaction effects for the sleep and daytime symptom variables. Given the small sample size, we verified the findings from the intent-to-treat analyses by repeating the analyses for completers only. For each analysis, we modeled the pattern of covariances

using Akaike's Information Criteria to determine goodness of fit (Littell, Pendergast, & Natarajan, 2000).

Due to limited variability, we transformed the primary drinking variables into two dichotomous variables for analysis (relapse and relapse to heavy drinking) and analyzed group differences using chi-square tests. We analyzed the knowledge test and TEQ on completers using repeated measures ANOVA with main effects of group and session and group by session interaction.

RESULTS

Baseline Characteristics

The CBTI-AD and BPT treatment groups did not differ on baseline demographic, sleep and daytime functioning, or drinking variables. As shown in Table 1, the randomized sample consisted primarily of middle-aged, Caucasian men, with nearly half of them unemployed and more than half unmarried, separated, or divorced. Scores on the ADS were consistent with those for outpatients seeking treatment for AD (Skinner & Horn, 1984) and pre-treatment ISI scores were consistent with moderate insomnia severity. Both AD and insomnia were longstanding problems, but 82% of participants reported that the onset of AD predated insomnia. Nearly 90% of participants also reported a positive family history of AD and almost $\frac{3}{4}$ had a family history of insomnia. Seven participants (3 CBTI-AD, 4 BPT) were lost to follow-up before completing treatment. Compared to completers, dropouts were more likely to report worse sleep quality ($t(15) = -2.4, p < .05$) and higher scores on the MFI-20 Physical Fatigue subscale ($t(15) = 2.3, p < .05$), but were not different on the drinking variables. The majority of study completers were medication free; one CBTI-AD participant was stabilized on trazodone 50 mg and one BPT participant took Tylenol pm 50–100 mg during the study.

At baseline, participants reported abstinence from alcohol for a median of 62 days (range 8–433 days); 10 subjects (58.9%) had achieved abstinence within 90 days of the screening evaluation. Subjects who had been abstinent for longer than 90 days reported heavy drinking patterns in the month prior to quitting (PDA $26.7 \pm 39.3\%$, PHDD $66.8 \pm 36.4\%$, DDD 11.0 ± 3.6). Drinking variables were strongly correlated with baseline diary-rated sleep efficiency (PDA $r = .64, p < .005$; PHDD $r = -.59, p < .05$) and total sleep time (PDA $r = .61, p < .009$; PHDD $r = -.57, p < .05$; DDD $r = -.50, p < .05$).

Subjective Sleep Diary Outcomes

Means, standard deviations, and Cohen's d values for the sleep diary variables are shown in Table 2. After 8 weeks of treatment, CBTI-AD participants reported more improvements in sleep efficiency (18.8 vs. 5.7%, $p < .05$) and wake after sleep onset (-79 vs. 7 minutes, $p < .05$) than BPT participants. Main effects of session were evident for both sleep onset latency ($p < .006$) and frequency of nighttime awakenings ($p < .007$), but treatment group by session interactions were not significant. No significant main effects or interactions were found for total sleep time or ratings of sleep quality. For the CBTI-AD group, within-group effect sizes were large for all diary outcome variables with the exception of total sleep time. By contrast, the BPT treatment produced moderate effects for only sleep latency and sleep quality, while all other diary variables showed small effects. At the end of treatment, CBTI-AD participants showed more robust improvements in most sleep diary outcomes than BPT participants.

In addition to statistical significance, we evaluated the clinical significance of observed changes in the sleep outcomes by comparing the number of responders and remitters to insomnia by treatment group. Consistent with previous insomnia treatment trials (Morin, et

al., 2009), we defined treatment response as a change in ISI score >7 from baseline to post-treatment and remission as a post-treatment ISI score <8 . Using these criteria, all six of the CBTI-AD completers were classified as treatment responders compared to 50% (2/4) of the BPT subjects ($X^2(1) = 3.75, p < .05$). Additionally, 5 of the 6 CBTI-AD participants and the two BPT responders achieved a post-treatment ISI score less than 8 ($X^2(1) = 1.27, p = .26$).

Daytime Symptoms

Means, standard deviations, and Cohen's d values for the daytime symptom variables are shown in Table 2. Ratings on the Insomnia Severity Index improved significantly more in the CBTI-AD compared to the BPT participants (-13.6 vs. -7.6 points, $p < .05$). Post-treatment reductions in depressive symptom severity ($p < .001$) and trait anxiety ($p < .003$) were found for both treatments, with no treatment group by session interaction. Scores on all five subscales of the MFI-20 were reduced at post-treatment for both groups, but the CBTI-AD group reported more improvements in General Fatigue (-8.7 vs. -2.9 points, $p < .05$) and a trend for more improvement on the Reduced Activity subscale ($p < .06$). Post-treatment scores on the eight subscales of the SF-36 were significantly improved relative to baseline for all subscales except for General Health, with CBTI-AD participants reporting more improvements on the Physical Functioning subscale than BPT participants ($p < .05$).

Alcohol Use Variables

Alcohol use variables in both groups based on the TLFB are shown in Table 3. Fourteen of the seventeen participants were completely abstinent at the first treatment session. Since we were unable to confirm drinking outcomes for any of the dropouts, we conservatively classified these participants as having relapsed to heavy drinking. Chi-square analyses indicated no group differences in the number of participants who relapsed to any drinking (CBTI-AD 4 of 9 vs. BPT 4 of 8, $p > .05$) or who relapsed to heavy drinking (CBTI-AD 4 of 9 vs. BPT 4 of 8, $p > .05$). Relapsers were more likely to have a family history of substance abuse than non-relapsers ($X^2(1) = 7.1, p < .008$), but were not different on other demographic, clinical, or drinking variables.

Treatment Fidelity

All of the treatment sessions were audio-taped with subject permission and a subset (3 CBTI-AD, 3 BPT) were selected for independent evaluation by an expert consultant. The consultant evaluated each taped session against a checklist of all elements to be covered from the manualized treatment. The consultant rated these sessions as being 100% pure with no content overlap between the BPT and CBTI-AD treatments.

Scores on the true/false knowledge test improved more in the CBTI-AD than the BPT group (post-treatment scores 13.3 ± 1.0 vs. 11.0 ± 0.8 , $p < .02$). Mean scores on the TEQ at baseline were not significantly different between completers and dropouts, but dropouts rated themselves as less willing to undergo their assigned treatments ($t(15) = 2.6, p < .05$). Among treatment completers, post-treatment ratings of confidence in the treatment's success ($p < .002$) and perceived success for treating others' insomnia ($p < .05$) were higher than pre-treatment ratings in both groups, with no significant session by group interactions. However, significant main effects of group indicated that CBTI-AD participants rated their treatment overall as more logical ($p < .001$), expressed more confidence in its success ($p < .01$), and reported being more likely to recommend it to a friend ($p < .05$) than BPT participants. Post-treatment participant ratings of therapist warmth and confidence did not differ by group.

DISCUSSION

The primary focus of this study was to evaluate the efficacy of a cognitive-behavioral intervention for insomnia (CBTI-AD) for improving sleep and daytime symptoms, and for reducing relapse in recovering alcoholic patients. Our primary findings were that CBTI-AD participants demonstrated greater improvements on one of our primary sleep diary outcomes (sleep efficiency) and select daytime symptoms (ratings of insomnia severity and fatigue) and were more likely to be classified as sleep treatment responders than BPT participants. However, no differences in the number of participants who relapsed to any drinking or who relapsed to heavy drinking were found between the treatment groups. The strengths of our study design over previous work were the inclusion of an active behavioral placebo control, the assessment of multiple daytime symptoms that are commonly affected by insomnia and AD, and the inclusion of a manipulation check to assess the credibility of our two interventions.

Our active intervention improved our primary measure of sleep continuity (sleep efficiency) more than the placebo treatment, despite a small sample size that limited our study power. CBTI-AD participants reported a nearly 80 minute reduction in wakefulness during the night and a 20% improvement in sleep consolidation post treatment, compared to 7 minute and 6% improvements in the BPT group, respectively. Moreover, self-rated insomnia severity fell from the moderate to no insomnia range and all of the CBTI-AD completers were classified as sleep treatment responders relative to only half of BPT completers. These findings are consistent with our previous open label study (Arnedt, et al., 2007) and with the only previous randomized clinical trial of CBT for insomnia in this population (Currie, Clark, et al., 2004), which reported a roughly 37 minute reduction in wake after sleep onset and 10% improvement in sleep efficiency with a 5-session in-person individual treatment. The clinical characteristics of participants in the two randomized controlled studies are generally comparable, although our subjects reported a longer AD duration and worse sleep at baseline; however, subjects in our study reported fewer drinks per drinking day in the 90 days prior to study entry (41% of our sample was abstinent longer than the 90 day assessment period).

It is noteworthy that sleep continuity improvements in the CBTI-AD group were evident early in treatment and sustained until post-treatment. For example, CBTI-AD wake after sleep onset values at treatment sessions 3 and 5 were 33 ± 39 minutes and 23 ± 19 minutes, respectively; values for sleep efficiency at the same sessions were $87.7 \pm 12.3\%$ and $91.7 \pm 6.0\%$. These rapid improvements may indicate that the behavioral sleep scheduling strategies (sleep restriction and stimulus control) are particularly important treatment components for improving sleep quality in these subjects. Future studies could reduce the number of therapy sessions and perhaps modify the treatment to deliver those components that are putatively most therapeutically active.

Consistent with the work of Currie and colleagues (Currie, Clark, et al., 2004), our CBTI-AD intervention improved depression symptoms in AD subjects, but our placebo group also showed improvements in these daytime symptoms. We confirmed our earlier uncontrolled findings that insomnia treatment improves multiple areas of daytime symptoms and quality of life for AD subjects. For CBTI-AD participants, scores on the Trait subscale of the STAI fell 1.5 standard deviations, post-treatment ratings for all five subscales of the MFI-20 indicated minimal fatigue, and self-ratings of quality of life on most SF-36 subscales were higher after treatment. Improvements on most of these daytime symptom scales were also noted in the BPT group, however, resulting in few significant group by session interactions. Thus, CBTI-AD may provide more benefits than placebo in only select areas of daytime

functioning or we may have failed to detect more consistent advantages to CBTI-AD due to the low power in our study.

In contrast to the robust effects on sleep and daytime functioning, CBTI-AD demonstrated no obvious benefit over placebo with respect to relapse. These findings, however, must be interpreted cautiously in light of the 40% attrition and unknown status of study drop-outs. Considering only treatment completers, one CBTI-AD subject reported two heavy drinking days and one became totally abstinent during the course of the study. All other CBTI-AD and BPT completers remained abstinent throughout the study. The absence of benefit to relapse despite sleep and daytime improvements is consistent with the other study of cognitive-behavioral insomnia therapy in AD individuals (Currie, Clark, et al., 2004). In neither study, however, did drinking worsen differentially, as was the case in a pharmacotherapy trial in which improved sleep with trazodone was associated with more relapse than placebo (Friedmann, et al., 2008). Thus, the only controlled studies to date to examine this issue have failed to find any association between improved sleep and less relapse. It is premature, however, to draw definitive conclusions due to the different treatments evaluated and small number of studies conducted. Since naturalistic studies have consistently demonstrated associations between sleep disturbance and relapse when controlling for other confounding factors (Brower, 2003; Brower, Aldrich, & Hall, 1998), experimental studies are needed to help clarify the nature of this relationship.

The 40% attrition during treatment is high, but consistent with other treatment trials in substance abusers (Kranzler, Escobar, Lee, & Meza, 1996). It is, however, decidedly higher than the rate in the previous randomized controlled trial (Currie, Clark, et al., 2004), which may relate to the differences in sample characteristics or to the different setting in which the two studies were conducted. Treatment studies conducted within addiction clinics may make it easier to engage substance abusers in research and alert clinicians to the possibility of using nonpharmacological approaches to sleep disturbances. Despite the high attrition rate in our study, dropouts had similar sleep, clinical, and drinking profiles to completers, except that their self-reported sleep quality was worse at baseline. We also obtained similar results when conducting analyses on the completer versus the intent-to-treat data set. Nevertheless, self-reports of poor sleep quality may signal the need for more intensive and immediate intervention than we were able to provide in our study. Although we do not know the drinking outcomes of those who failed to complete our study, we assumed for our intent-to-treat analyses that they relapsed, which is consistent with worse sleep predicting relapse.

Other limitations of our study should be noted. Our subjective outcomes may have been influenced by response bias. Inclusion of collateral information about sleep and drinking would have strengthened our study, but such information was mostly unavailable. Actigraphy has also been used previously with AD subjects, but may not corroborate subjective reports (Currie, Clark, et al., 2004; Currie, Malhotra, & Clark, 2004), complicating the interpretation of findings. Our small sample size limits our ability to generalize to a larger population of AD outpatients, although our findings were consistent with the only other randomized clinical trial of nonpharmacological insomnia treatment in this population. Finally, responses on the TEQ indicated that CBTI-AD was more credible to subjects than the BPT despite our best efforts to make the treatments appear equally credible. It is interesting to note, however, that BPT subjects still reported improvements on most outcome measures. Our TEQ findings highlight the potential importance of using therapists who are naïve to the study interventions.

In summary, we have shown in a randomized controlled trial that a nonpharmacological sleep treatment tailored to AD patients in recovery improves sleep and daytime symptoms more than an active behavioral placebo. The benefits of a sleep-focused treatment on relapse

to alcohol are less clear. Future experimental studies and adequately powered treatment trials are needed to clarify the role of sleep as a risk factor for relapse and determine whether sleep treatments positively influence the course of recovery.

Acknowledgments

This project was supported by National Institute on Alcohol Abuse and Alcoholism (R21 AA014408, T32 AA07477, and K24 AA00304). We are grateful to the study consultants - Charles Morin, PhD, Jack Edinger, PhD, Timothy Roehrs, PhD, Donn Posner, PhD, Damaris Rohsenow, PhD, and Peter Friedmann, PhD. - who were instrumental in the development of both the active and placebo treatments.

REFERENCES

- Arnedt JT, Conroy D, Rutt J, Aloia MS, Brower KJ, Armitage R. An open trial of cognitive-behavioral treatment for insomnia comorbid with alcohol dependence. *Sleep Medicine*. 2007; 8:176–180. [PubMed: 17239658]
- Arnedt JT, Conroy DA, Brower KJ. Treatment options for sleep disturbances during alcohol recovery. *Journal of Addictive Diseases*. 2007; 26:41–54. [PubMed: 18032231]
- baekeland F, Lundwall L, Shanahan TJ, Kissin B. Clinical correlates of reported sleep disturbance in alcoholics. *Quarterly Journal of Studies on Alcohol*. 1974; 35:1230–1241. [PubMed: 4445463]
- Beck, AT.; Steer, RA.; Brown, GK. Manual for Beck Depression Inventory - II. San Antonio, TX: Psychological Corporation; 1996.
- Borkovec T, Nau SD. Credibility of analogue therapy rationales. *Journal of Behavior Therapy and Experimental Psychiatry*. 1972; 3:247–260.
- Brower KJ. Insomnia, alcoholism and relapse. *Sleep Medicine Reviews*. 2003; 7:523–539. [PubMed: 15018094]
- Brower KJ, Aldrich MS, Hall JM. Polysomnographic and subjective sleep predictors of alcoholic relapse. *Alcoholism: Clinical and Experimental Research*. 1998; 22:1864–1871.
- Brower KJ, Aldrich MS, Robinson EAR, Zucker RA, Greden JF. Insomnia, Self-Medication, and Relapse to Alcoholism. *American Journal of Psychiatry*. 2001; 158:399–404. [PubMed: 11229980]
- Brower KJ, Kim HM, Strobbe S, Karam-Hage MA, Consens F, Zucker RA. A Randomized Double-Blind Pilot Trial of Gabapentin Versus Placebo to Treat Alcohol Dependence and Comorbid Insomnia. *Alcoholism: Clinical and Experimental Research*. 2008; 32:1429–1438.
- Caetano R, Clark CL, Greenfield TK. Prevalence, trends, and incidence of alcohol withdrawal symptoms: Analysis of general population and clinical samples. *Alcohol Health and Research World*. 1998; 22:73–79. [PubMed: 15706737]
- Cohn TJ, Foster JH, Peters TJ. Sequential studies of sleep disturbance and quality of life in abstaining alcoholics. *Addiction Biology*. 2003; 8:455–462. [PubMed: 14690882]
- Currie SR, Clark S, Hodgins DC, el-Guebaly N. Randomized controlled trial of brief cognitive-behavioural interventions for insomnia in recovering alcoholics. *Addiction*. 2004; 99:1121–1132. [PubMed: 15317632]
- Currie SR, Malhotra S, Clark S. Agreement among subjective, objective, and collateral measures of insomnia in postwithdrawal recovering alcoholics. *Behavioral Sleep Medicine*. 2004; 2:148–161. [PubMed: 15600230]
- Drummond SPA, Gillin JC, Smith TL, DeModena A. The sleep of abstinent pure primary alcoholic patients: Natural course and relationship to relapse. *Alcoholism: Clinical and Experimental Research*. 1998; 22:1796–1802.
- Edinger JD, Wohlgenuth WK, Radtke RA, Marsh GR, Quillian RE. Cognitive behavioral therapy for treatment of chronic primary insomnia: a randomized controlled trial. *Journal of the American Medical Association*. 2001; 285:1856–1864. [PubMed: 11308399]
- Espie CA, Lindsay WR, Brooks DN, Hood EM, Turvey T. A controlled comparative investigation of psychological treatments for chronic sleep-onset insomnia. *Behaviour Research and Therapy*. 1989; 27:79–88. [PubMed: 2914008]

- Foster JH, Marshall EJ, Peters TJ. Application of a quality of life measure, the life situation survey (LSS), to alcohol-dependent subjects in relapse and remission. *Alcoholism: Clinical and Experimental Research*. 2000; 24:1687–1692.
- Friedmann PD, Rose JS, Swift R, Stout RL, Millman RP, Stein MD. Trazodone for Sleep Disturbance After Alcohol Detoxification: A Double-Blind, Placebo-Controlled Trial. *Alcoholism: Clinical and Experimental Research*. 2008; 32:1652–1660.
- Gann H, Feige B, Hohagen F, van Calker D, Geiss D, Dieter R. Sleep and the cholinergic Rapid Eye Movement sleep induction test in patients with primary alcohol dependence. *Biological Psychiatry*. 2001; 50:383–390. [PubMed: 11543743]
- Greeff AP, Conradie WS. Use of progressive relaxation training for chronic alcoholics with insomnia. *Psychological Reports*. 1998; 82:407–412. [PubMed: 9621711]
- Kranzler HR, Escobar R, Lee DK, Meza E. Elevated rates of early discontinuation from pharmacotherapy trials in alcoholics and drug abusers. *Alcoholism: Clinical and Experimental Research*. 1996; 20:16–20.
- Littell RC, Pendergast J, Natarajan R. Modelling covariance structure in the analysis of repeated measures data. *Statistics in Medicine*. 2000; 19:1793–1819. [PubMed: 10861779]
- Manber R, Edinger JD, Gress JL, San Pedro-Salcedo MG, Kuo TF, Kalista T. Cognitive behavioral therapy for insomnia enhances depression outcome in patients with comorbid major depressive disorder and insomnia. *Sleep*. 2008; 31:489–495. [PubMed: 18457236]
- Mello NK, Mendelson JH. Behavioral studies of sleep patterns in alcoholics during intoxication and withdrawal. *Journal of Pharmacology and Experimental Therapeutics*. 1970; 175:94–112. [PubMed: 4319478]
- Morin, CM. *Insomnia: Psychological assessment and management*. New York: The Guilford Press; 1993.
- Morin, CM.; Espie, CA. *Insomnia: A clinical guide to assessment and treatment*. New York: Kluwer Academic/Plenum Publishers; 2003.
- Morin CM, Vallieres A, Guay B, Ivers H, Savard J, Merette C, Bastien C, Baillargeon L. Cognitive Behavioral Therapy, Singly and Combined With Medication, for Persistent Insomnia: A Randomized Controlled Trial. *Journal of the American Medical Association*. 2009; 301:2005–2015. [PubMed: 19454639]
- National Institute on Alcohol Abuse and Alcoholism. *The Physician's Guide to Helping Patients with Alcohol Problems*. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism; 1995.
- Riemann D, Perlis ML. The treatments of chronic insomnia: A review of benzodiazepine receptor agonists and psychological and behavioral therapies. *Sleep Medicine Reviews*. 2009; 13:205–214. [PubMed: 19201632]
- Skinner, HA.; Horn, JL. *Alcohol Dependence Scale Users guide*. Toronto: 1984.
- Smets EM, Garssen B, Bonke B, de Haes JC. The Multidimensional Fatigue Inventory (MFI) psychometric qualities of an instrument to assess fatigue. *Journal of Psychosomatic Research*. 1995; 39:315–325. [PubMed: 7636775]
- Sobell LC, Sobell MB, Leo GI, Cancilla A. Reliability of a timeline method: Assessing normal drinkers' reports of recent drinking and a comparative evaluation across several populations. *British Journal of Addiction*. 1988; 83:393–402. [PubMed: 3395719]
- Spielberger, CD.; Gorsuch, RL.; Luchene, R. *The State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologist Press; 1970.
- Spielman AJ, Saskin P, Thorpy MJ. Treatment of chronic insomnia by restriction of time in bed. *Sleep*. 1987; 10:45–56. [PubMed: 3563247]
- Steinmark SW, Borkovec TD. Active and placebo treatment effects on moderate insomnia under counterdemand and positive demand instructions. *Journal of Abnormal Psychology*. 1974; 83:157–163. [PubMed: 4825210]
- Stout RL, Wirtz PW, Carbonari JP, Del Boca FK. Ensuring balanced distribution of prognostic factors in treatment outcome research. *Journal of Studies on Alcohol*. 1994; 12 Supplement:70–75.
- Sullivan JT, Sykora K, Schneirderman J, Naranjo CA, Sellers EM. Assessment of alcohol withdrawal: The revised Clinical Institute Withdrawal Assessment for Alcohol scale (CIWA-Ar). *British Journal of Addiction*. 1989; 84:1353–1357. [PubMed: 2597811]

Ware, JE.; Snow, KK.; Kosinsld, M.; Gandek, B. SF-36 health survey: Manual and interpretation guide. Boston: Nimrod; 1993.

Table 1

Demographic characteristics for randomized participants (mean (sd) or n (%)) by treatment group.

	CBTI-AD (n=9)	BPT (n=8)	Total (n=17)
Sex (M/F)	6/3	5/3	11/6
Age (years)	46.2 (8.9)	46.1 (12.0)	46.2 (10.1)
Race			
White	7 (77.8)	6 (75.0)	13 (76.5)
Black	1 (11.1)	2 (25.0)	3 (17.6)
Other	1 (11.1)	0 (0.0)	1 (5.9)
Marital Status			
Unmarried	3 (33.3)	4 (50.0)	7 (41.2)
Married	2 (22.2)	2 (25.0)	4 (23.5)
Separated or Divorced	4 (44.4)	2 (25.0)	6 (35.3)
Employment Status			
Full-time employment	3 (33.3)	3 (37.5)	6 (35.3)
Part-time employment	1 (11.1)	2 (25.0)	3 (17.6)
Unemployed	4 (44.4)	3 (37.5)	7 (41.2)
Student	1 (11.1)	0 (0.0)	1 (5.9)
Alcohol Dependence			
Alcohol dependence duration (years) ^a	22.5 (1–26)	20 (12–32)	20 (1–32)
ADS score ^b	21.5 (11.2)	21.9 (9.7)	21.7 (10.1)
Positive family history of alcohol dependence	9 (100.0)	6 (75.0)	15 (88.2)
Abstinence duration (days) ^a	58 (27–433)	134 (8–410)	62 (8–433)
Insomnia			
ISI score ^c	16.4 (4.1)	16.8 (3.2)	16.6 (3.6)
Insomnia duration (years) ^a	8.25 (.08–43.5)	6 (.8–21)	7.2 (.08–43.5)
Positive family history of insomnia	7 (77.8)	5 (62.5)	12 (70.6)

^aValues are median (minimum to maximum)^bADS=Alcohol Dependence Scale;^cISI=Insomnia Severity Index

Table 2

Sleep and daytime symptom outcomes (mean (sd)) at baseline and post-treatment.

Variable	CBT-I-AD				BPT		
	Pre-treatment (n=9)	Post-treatment (n=6)	Within-group effect size (d) ^a	Pre-treatment (n=8)	Post-treatment (n=4)	Within-group effect size (d) ^a	Between-group effect size (d) ^b
Sleep Diary							
Sleep Efficiency (%) ^c	73.6 (7.8)	92.4 (6.5)	2.57	66.5 (13.8)	72.2 (29.3)	0.29	1.08
Total Sleep Time (mins) ^c	390 (78)	410 (58)	0.28	315 (98)	364 (172)	0.39	0.4
Sleep latency (mins)	40 (23)	10 (8)	-1.60	56 (35)	34 (28)	-0.67	-1.31
Frequency of awakenings (#)	2.5 (1.4)	1.4 (1.0)	-0.87	2.1 (1.2)	1.6 (1.1)	-0.43	-0.19
Wake after sleep onset (mins)	100 (34)	21 (17)	-2.75	94 (48)	87 (109)	-0.10	-0.97
Sleep Quality (1-5) ^d	3.0 (0.3)	3.9 (0.6)	2.04	2.7 (0.5)	3.1 (1.0)	0.58	1.03
Daytime Symptoms							
Insomnia Severity Index	16.4 (4.1)	2.8 (3.3)	-3.57	16.8 (3.2)	9.2 (5.0)	-1.98	-1.59
BDI-II	13.9 (4.5)	3.2 (2.3)	-2.81	18.7 (13.3)	12.0 (13.6)	-0.50	-1.03
STAI-Trait	42.2 (9.8)	27.2 (6.6)	-1.72	50.1 (17.4)	39.5 (17.1)	-0.61	-1.05
MFI-20							
General Fatigue	15.0 (2.5)	6.3 (3.3)	-3.07	14.4 (3.6)	11.5 (6.4)	-0.63	-1.1
Physical Fatigue	12.3 (3.3)	6.7 (2.5)	-1.86	12.1 (4.4)	9.2 (3.8)	-0.69	-0.82
Reduced Activity	12.9 (3.6)	6.0 (1.4)	-2.34	10.8 (3.4)	7.5 (2.4)	-1.05	-0.82
Reduced Motivation	11.0 (3.4)	6.0 (2.6)	-1.6	11.0 (3.7)	7.8 (3.5)	-0.88	-0.61
Mental Fatigue	10.7 (3.7)	7.3 (2.8)	-1.01	13.4 (5.1)	9.5 (3.1)	-0.85	-0.75
Short Form-36							
Physical Functioning	47.6 (6.6)	52.9 (4.6)	0.90	45.5 (12.0)	51.2 (8.8)	0.51	0.26
Role-Physical	47.4 (7.8)	54.8 (2.4)	1.18	43.7 (13.0)	52.0 (6.9)	0.72	0.60
Bodily Pain	46.2 (9.8)	48.7 (5.6)	0.30	37.8 (11.6)	47.3 (12.7)	0.80	0.16
General Health	41.8 (8.8)	49.3 (9.8)	0.82	42.5 (10.7)	44.8 (10.8)	0.21	0.44
Vitality	37.5 (5.9)	52.9 (7.0)	2.43	33.9 (8.2)	41.5 (12.0)	0.80	1.24
Social Functioning	37.9 (8.5)	47.4 (1.8)	1.41	32.9 (13.0)	39.4 (7.1)	0.56	1.75
Role-Emotional	33.8 (11.5)	44.9 (2.7)	1.21	34.4 (10.7)	40.3 (8.8)	0.58	0.79

Variable	CBTL-AD			BPT		
	Pre-treatment (n=9)	Post-treatment (n=6)	Within-group effect size (d) ^a	Pre-treatment (n=8)	Post-treatment (n=4)	Within-group effect size (d) ^a
Mental Health	38.6 (6.9)	49.0 (2.7)	1.84	31.4 (14.4)	41.0 (9.1)	0.74
						(d) ^b
						1.34

^a Within-group d = Post-treatment mean – pre-treatment mean/pooled standard deviation

^b Between-group d=CBTL-AD post-treatment mean – BPT post-treatment mean/pooled standard deviation

^c Primary dependent variables for sleep diary

^d Sleep Quality Scale 1=very poor; 2=poor; 3=fair; 4=good; 5=excellent

Table 3

Alcohol use variables from Time Line Follow Back interview (mean (sd)) at baseline and post-treatment by treatment group.

Variable	Baseline		Post-treatment	
	CBTI-AD (n=9)	BPT (n=8)	CBTI-AD (n=6)	BPT (n=4)
Abstinent Days (%)	73.2 (26.0)	80.1 (25.2)	98.8 (2.0)	100.0 (0.0)
Heavy Drinking Days (%)	24.6 (25.0)	16.4 (19.8)	1.0 (2.4)	0
Drinks per Drinking Day (#)	8.7 (7.9)	5.9 (7.5)	1.2 (2.4)	0