Published in final edited form as:
Fam Community Health. 2014 ; 37(4): 288–297. doi:10.1097/FCH.0000000000000040.

The Prevalence of Sleep Disturbance in Alcoholics Admitted for Treatment:

A Target for Chronic Disease Management

Dr. Gwenyth R. Wallen, PhD,
National Institutes of Health Clinical Center, Bethesda, Maryland

Mss. Alyssa T. Brooks, BS,
National Institutes of Health Clinical Center, Bethesda, Maryland

Mss. Barbara Whiting, MSN,
National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Bethesda, Maryland

Rosa Clark, RN,
National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Bethesda, Maryland

Mr. Michael C. Krumlauf, RN,
National Institutes of Health Clinical Center, Bethesda, Maryland

Li Yang, MS,
National Institutes of Health Clinical Center, Bethesda, Maryland

Dr. Melanie L. Schwandt, PhD,
National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Bethesda, Maryland

Dr. David T. George, MD, and
National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Bethesda, Maryland

Dr. Vijay A. Ramchandani, PhD
National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Bethesda, Maryland

Abstract

Prolonged and heavy use of alcohol is associated with persistent sleep disturbances. Objective and subjective measures of sleep quantity and quality were collected on 164 individuals undergoing

Correspondence: Gwenyth R. Wallen, PhD, National Institutes of Health Clinical Center, Bldg 10/Room 2B09, Bethesda, MD 20892 (gwallen@cc.nih.gov).

Authors' contributions are as follows: G.R.W., B.W., and R.C. conceived and designed the study; A.T.B., M.C.K., V.A.R., M.L.S., L.Y., and G.R.W. analyzed the data; G.R.W., A.T.B., B.W., and R.C. wrote the first draft of the manuscript. All authors contributed to the writing of the manuscript. All authors agree with manuscript results and conclusions. A.T.B., M.C.K., and G.R.W. made critical revisions. All authors read and approved the final manuscript.

detoxification. A high prevalence of sleep disturbance was found in this sample. Sleep quality improved by week 4 but continued to be altered, signaling a target area for recovery management. This study supports the high prevalence of sleep disturbance in individuals undergoing alcohol treatment. Health promotion strategies in an addiction recovery model should address quality-of-life enhancements for individuals and their families including optimizing sleep quality and duration through sustained recovery.

Keywords

actigraphy; addiction; alcohol; insomnia; sleep disturbances

Alcoholism constitutes a significant public health concern with considerable clinical, economic, and social consequences. Excessive alcohol use is associated with an increased risk of multiple health problems,[1] and the effects of alcohol dependency often reach far beyond the individuals who suffer with the addiction. The treatment of alcoholism requires careful consideration of personal, familial, community, and societal level factors that have the potential to affect an individual's recovery efforts. Increasingly, researchers and clinicians are advocating for a shift in addiction treatment that focuses less on the acute model of biopsychosocial stabilization and more on a sustained chronic health management recovery model.[2] Health promotion strategies in an addiction recovery model should address quality-of-life enhancements for individuals and their families including optimizing sleep through sustained recovery. Examples of such strategies include cognitive-behavioral therapy for insomnia (CBT-I), which targets behaviors, cognitions, and associations that negatively affect sleep,[3] and is the most common and well-accepted nonpharmacologic treatment of insomnia. CBT-I has been tested on alcohol-dependent populations and has demonstrated improvements in general sleep quality,[4] sleep efficiency,[5–9] wake after sleep onset (WASO),[7,8] and general fatigue.[6] The benefits of CBT-I may extend beyond insomnia and include improvements in overall well-being and depressive symptom severity,[10] which may have implications for alcoholics who often suffer comorbid mental disorders and whose lives are otherwise negatively affected by addiction.

Alcoholism is known to impact sleep quality and duration and has become a targeted area of interest for researchers and clinicians.[11] Acutely, alcohol accelerates the onset of sleep but often leads to fragmented sleep later in the night.[12] Prolonged and heavy use of alcohol is associated with persistent sleep disturbances. Alcoholics frequently experience prolonged sleep latency, decreased sleep time, decreased rapid eye movement sleep, decreased sleep efficiency, difficulty maintaining sleep, early awakening, and non-restorative sleep. Addressing sleep issues from inpatient detoxification and treatment through the community-based recovery process is an important aspect of comprehensive care for individuals undergoing alcohol rehabilitation to ensure the best possible treatment outcomes.

Despite evidence suggesting that insomnia and alcoholism are significantly associated,[11,13] causal explanations for the relationships remain unclear[14] and clear temporality is yet to be established. Insomnia is a common symptom among alcoholic patients and can persist for weeks or months following abstinence, suggesting that sleep problems may originate prior to

the development of alcoholism.[14] Individuals with in-somnia, in the absence of other psychiatric conditions, are more than twice as likely to develop alcohol abuse problems.[15] Sleep disturbances are particularly common among those who are alcohol-dependent during the early stages of recovery and are far more common among those with comorbid depression.[16] A study conducted by Mahfoud and colleagues[17] among alcoholics reported sleep impairment in 96% of their sample (n = 30). Sixty-three percent of individuals in this study reported a history of a comorbid mood disorder, and 7% also reported a history of comorbid anxiety disorder.[17]

While there is evidence to support that sleep may improve during the first 2 weeks of abstinence among alcohol-dependent individuals, abnormal sleep may persist for months to years during the recovery and abstinence process.[18] Up to 91% of alcohol-dependent individuals report sleep disturbances after 1 week of abstinence,[19] which may persist for up to 27 months of abstinence.[20] Many of these sleep disturbances may persist for years after sobriety.[21]

There is considerable evidence that alcoholics with insomnia are more at risk for relapse.[22] Both objective and subjective measures of sleep disturbances can predict relapse to drinking.[18] Among alcohol-dependent individuals seeking treatment, baseline sleep problems upon entering treatment may be predictive of subsequent relapse to drinking.[23] Individuals who report insomnia within 6 months before quitting are more likely to relapse after 5 months of abstinence.[14]

Clinical assessment of sleep quality during early treatment and abstinence is well established yet not necessarily accurately quantified. Understanding the prevalence of insomnia and trajectory of sleep disturbances may be of particular importance among patients who are undergoing treatment because of the potential link between sleep disturbances and relapse. The objective of this study was to determine the prevalence of sleep disturbances in adults with alcohol dependence undergoing detoxification and treatment in an inpatient clinical research setting and to explore the relationship between sleep disturbances and clinical and patient-reported outcomes.

METHOD

S Sample

Adult participants (N = 164) consented to participate in a study, titled *Assessment and Treatment of People With Alcohol Drinking Problems* (NCT00106093), approved by the intramural institutional review board for the National Institute on Alcohol Abuse and Alcoholism. Following a telephone recruitment interview, participants came to the National Institutes of Health Clinical Center to be admitted on an inpatient unit. Upon admission, patients gave consent for assessment and treatment of alcohol withdrawal and other acute conditions, using an impaired consent form. Following detoxification (indicated by the absence of withdrawal symptoms), when patients were deemed unimpaired by the study physician or nurse practitioner and nursing staff, they signed an unimpaired consent form. The treatment protocol involved 4–6 weeks of inpatient treatment including medically assisted alcohol withdrawal in a clinical research facility. As part of this study, participants

were asked to complete several patient-reported outcome sleep-related measures (detailed later), including Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). In addition, patients completed a daily sleep diary and were asked to wear actigraphy wristbands to assess the quality and duration of sleep and daytime sleepiness during their inpatient stay.

Primary sleep outcome measures

Pittsburgh Sleep Quality Index—The PSQI is a self-rated questionnaire that provides a measure of sleep disturbances over a 1-month time interval. Nineteen individual items generate 7 "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction.[24] The sum of scores for these 7 components yields 1 global score. Initially, Buysse and colleagues[24] assessed clinical and psychometric properties of the PSQI over an 18-month period with "good" sleepers and "poor" sleepers. Acceptable measures of internal homogeneity, consistency (test-retest reliability), and validity were obtained. A global PSQI score greater than 5 yields a diagnostic sensitivity of 89.6% and specificity of 86.5% ($P \leq .001$) in distinguishing between good and poor sleepers. The psychometric and clinical properties of the PSQI affirm its utility both in psychiatric clinical practice and in research activities.[24] Patients completed a PSQI on 2nd and 28th day of treatment (if they were not discharged prior to the 28th day).

Epworth Sleepiness Scales—The ESS is an 8-item self-administered questionnaire that provides a measure of an individual's general level of daytime sleepiness.[25] Respondents are asked to rate their usual chances of dozing off or falling asleep on a 4-point scale (0–3) in 8 distinct situations or activities that most people engage in during their daily lives but not necessarily every day. Potential situations include "sitting and reading," "watching TV," and "lying down to rest in the afternoon when circumstances permit." The total ESS score is the sum of 8-item scores ranging from 0 to 24, with higher scores indicating higher levels of daytime sleepiness. Completing the ESS generally takes 2 to 3 minutes. Total ESS scores are reliable in a test-retest sense over a period of months ($\rho = 0.82$; n = 87; $P < .001$). There is a high level of internal consistency within the ESS as demonstrated by Cronbach α statistic ranging from 0.74 to 0.88 in 4 different groups of subjects. Patients were asked to complete an ESS each week beginning on the fifth day of inpatient treatment.

Actigraphy—"Actiwatches" are small actigraphy-based wristband data loggers that record a digitally integrated measure of gross motor activity. For this study, the Respironics Actiwatch-2 was used to provide objective data on sleep schedule variability, sleep quantity and quality statistics, and daytime activity patterns. In addition to sleep/wake activity recording, the Actiwatch-2 measured the amount and duration of ambient white light illuminance. Participants' level of activity was scored at 1-minute increments (epochs), and participants were instructed to wear the device continuously on their nondominant wrist from enrollment until discharge from the hospital. If any participant's stay lasted more than 28 days, a new Actiwatch-2 was given to the participant to replace the original for continuous data collection. After device removal and data download, raw data were analyzed using computerized sleep scoring software (Respironics Actiware v.5.70.1; Phillips

Respironics, Bend, Oregon), which scores each epoch on the basis of a threshold method algorithm. The medium threshold setting (40 counts/min) was used for this analysis. Prior studies have shown high sensitivity with moderate accuracy for detecting sleep in populations with normal and disturbed sleep when compared with polysomnography.[26,27] Investigators reviewed each sleep period prior to analysis to screen for malfunctioning watches, corrupt data, and required adjustments using bedtimes and wake times from the diary self-reports when necessary.

Daily sleep diaries—Daily sleep diaries were used in addition to actigraphy to cross-validate subjective and objective data. The variables measured by the subjective daily diaries include sleep-onset latency (SOL), WASO, early morning awakening, total wake time, total sleep time, time in bed, sleep efficiency, number of awakenings, and sleep quality. Sleep quality was assessed with a scale asking patients to rate "How well did you sleep last night?" from 0 ("very poorly") to 10 ("excellent"). Patients could mark anywhere on the scale between 0 and 10, and responses were scored to the nearest half-integer. Patients completed diary entries that included self-assessment each morning and night.

Secondary measures

Alcohol Dependence Scale—This scale assesses the severity of alcohol dependence in a variety of clinical settings.[28] It consists of 25 questions and takes about 5–10 minutes to complete.

Clinical Institute Withdrawal Assessment–Alcohol Revised—This validated tool is used to determine the severity of alcohol withdrawal based on symptoms and physical signs.[29] This revised version of the Clinical Institute Withdrawal Assessment is administered by the clinical research nurses on the inpatient unit.

Structured Clinical Interview for *Diagnostic and Statistical Manual (Fourth Edition)*—The *Structured Clinical Interview for Diagnostic and Statistical Manual (Fourth Edition)* is the standard interview to evaluate criteria for a psychiatric diagnosis, including that of alcohol dependence and substance use disorders as well as mood and anxiety disorders that are frequently comorbid with alcohol dependence.[30] It is a structured interview consisting of 11 modules with between 35 and 292 items per module that takes about 120 to 180 minutes. Interrater reliability was continuously monitored for these interviews that were conducted by trained mental health care professionals.

Comprehensive Psychopathological Rating Scale—The Comprehensive Psychopathological Rating Scale[31] consists of 19 items that were assessed by nursing staff to assess affective and anxiety syndromes.[32] Two subscales, the Montgomery Asberg Depression Rating Scale and the Brief Scale for Anxiety, were examined from this scale.

Data analysis

Initial analysis was descriptive and exploratory in nature to establish the prevalence of sleep disturbances and sleep quality in this inpatient alcohol treatment sample. Data were normally distributed, thus enabling parametric testing. Descriptive statistics were expressed

as means and standard deviations for continuous variables and frequencies and percentages for categorical variables. The prevalence of sleep disturbances as measured by the PSQI was calculated for days 2 and 28. A McNemar test was used to compare sleep disturbance prevalence at the 2 time points. Paired *t* tests were performed to compare the PSQI total score, sleep duration, and sleep latency components. The prevalence of excessive daytime sleepiness was calculated at days 5 and 26. The prevalence was compared using a McNemar test. Patients' self-reported sleep duration and actigraphy-recorded sleep duration were compared using a paired *t* test. A *P* value of less than .05 indicated statistical significance. All data analyses were performed using IBM SPSS 20.0.

RESULTS

The total number of patients who participated in this study was 164 (Table 1). The average length of inpatient stay was 31.6 days. The average age of patients was 45.6 years, and the sample was mostly male (70.1%), with close to half of the sample self-identifying as black/African American (47.6%). Of note was the high prevalence of comorbid psychiatric disorders, with 54.2% having 1 or more mood disorders, and 48.1% of the sample having 1 or more anxiety disorders, with approximately one quarter (24.4% of the total sample) having experienced posttraumatic stress disorder in their lifetime.

Pittsburgh Sleep Quality Index

The PSQI was administered on days 2 and 28 (Table 2). A PSQI score of more than 5 indicates sleep disturbance. The total PSQI mean score for participants (n = 146) at day 2 admission from the community was 10.91 (SD = 4.14), with 90.4% of participants reporting having sleep disturbances. By day 28, the total PSQI mean score for participants (n = 95) was 6.39 (SD = 3.64), with 50.5% of participants reporting having sleep disturbances. A McNemar test was performed to compare the prevalence of sleep disturbances at the 2 time points. Eighty-two patients had valid data for both time points. Of those with data at both time points, the prevalence of sleep disturbances was significantly higher at day 2 (91.5%) than at day 28 (53.7%; $P < .001$). Sleep latency significantly decreased ($t = 4.41$; $P < .001$) and sleep time significantly increased ($t = -5.13$; $P < .001$) at day 28 compared with day 2.

Epworth Sleepiness Scale

The ESS was administered on days 5 and 26. An ESS score of more than 10 is indicative of excessive daytime sleepiness. Only 38 of 152 patients (25.0%) reported having excessive daytime sleepiness at day 5. Using the McNemar test, the day 5 ESS score was compared with the day 26 ESS score that corresponded closely with the timing for the PSQI administration. On the basis of 113 patients who had data for both time points, no significant differences were found in reported daytime sleepiness between days 5 and 26 ($P = .359$).

Sleep diaries

Average sleep quality at week 1 was 6.32 (SD = 1.25) on a 0 to 10 self-rated scale. This increased slightly to 6.52 (SD = 1.10) at week 4, although this difference was not statistically significant.

Actigraphy data

Actiwatches were used to assess sleep efficiency (ratio of total sleep time to time in bed), sleep duration, SOL (time period in minutes from bedtime to sleep onset), WASO (refers to the time in minutes activity was above the sleep threshold after initiation of sleep), total sleep time (time period from sleep onset to awakening minus any recorded as awake time), and number of wake bouts (awakenings) recorded through the night. For consistency with other measured time points, mean values of these variables during week 1 (days 1–7) and week 4 (days 22–28) were calculated for comparison (Table 3). Mean sleep efficiency during the first week of admission was 75.78% (SD = 14.15), with a slight increase to 77.43% (SD = 11.26) during week 4. Sleep duration decreased from 6.39 (SD = 2.01) to 6.24 (SD = 1.71) hours, total sleep time increased slightly from 5.33 (SD = 1.78) to 5.4 (SD = 1.55) hours, number of wake bouts increased from 24.13 (SD = 10.17) to 24.43 (SD = 10.09), SOL decreased from 14.32 (SD = 23.09) to 13.97 (SD = 20.6) minutes, and WASO showed an improvement from 67.95 (SD = 38.86) to 63.48 (SD = 34.05) minutes between weeks 1 and 4, respectively.

Among the subset of 114 participants with data from both week 1 and week 4, there was a significant improvement in sleep efficiency from 75% to 78% ($t = -3.98$; $P < .001$). WASO significantly decreased from 69 to 63 minutes ($t = 3.14$; $P = .002$). No significant differences were observed in sleep duration, SOL, sleep time, and wake bouts.

Comparison between objective and subjective data

Actigraphy and sleep diary data were paired and combined to compare daily sleep duration from the 2 methods. A paired *t* test was then performed to evaluate the 2 sets of sleep durations. The paired sample correlation was 0.546 ($P < .001$). Although the *t* test showed a statistically significant ($P = .003$) difference between the 2 measured sleep durations; diary-reported sleep duration was only 4.5 minutes longer than the actigraphy-recorded sleep duration. This difference is relatively small, particularly if some of the participants estimated the times recorded in their diaries rather than verifying on a watch or clock.

DISCUSSION

The primary findings of this study are that sleep disturbances are highly prevalent in alcoholics undergoing inpatient detoxification and treatment. Examination of sleep measures at admission and following 4 weeks of inpatient treatment indicated significant reduction in severity of sleep disturbances. However, the mean PSQI scores at week 4 (6.39) indicate that there is some degree of sleep disturbance remaining in the sample. Data from the ESS showed low variability in the ESS scores, which may be related to the validity of the ESS in an inpatient setting since each question addresses activities of daily living such as driving in a car that could not be assessed accurately during an inpatient stay.

The current study addresses gaps identified by previous work in alcohol-dependent individuals[17] by adding objective measures of sleep efficiency through the use of actigraphy. Actiwatches generated objective measures that showed a very consistent pattern of sleep disturbances on admission and small but significant improvements in sleep

efficiency following 4 weeks of treatment in this sample. However, the clinical significance of this slight improvement is not currently well understood and requires further study particularly during the community-based recovery phase.

Similar to the Landolt and Gillin[18] study, the current study found that there were improvements in sleep by week 4 of treatment; however, sleep disturbances were still present with sleep efficiency still only 77.43% by week 4 of abstinence. Given the relationship between sleep disturbances and relapse, it is critical to identify individuals at high risk for continued sleep disturbances. This will enable community clinicians to provide more tailored and integrated care during the recovery phase, with particular focus on strategies for improved sleep hygiene in these high-risk individuals.

This study also supports previous evidence[17] indicating the presence of comorbid mood (54.2%) disorders in alcoholics. However, the current study sample was larger than the Mahfoud and colleagues[17] study (n = 30) and in addition to a high percentage of participants reporting mood disorders, there was a larger percentage reporting anxiety disorders (48.1% in the current study compared with 7% in the Mahfoud and colleagues study).

Although this study has limitations in that our sample was predominately male and may not be generalizable to women, the sample was racially diverse with 47.6% of participants self-identifying as black/African American. Another limitation of the study was the absence of data after discharge from inpatient treatment to examine the relationship between sleep abnormalities and treatment outcome, including relapse. This will be a focus of future research.

CONCLUSIONS

Quantifying the prevalence of sleep disturbance among alcoholics at the time of admission to an inpatient treatment program and how the disease impacts their sleep during detoxification and abstinence is essential to ensuring the best possible outcomes for patients once they begin their recovery phase back in their family and community environments. This study provides evidence for the high prevalence of sleep disturbance in individuals admitted for alcohol treatment, and the prevalence of residual sleep disturbances even following 4 weeks of inpatient treatment. Given the relationship between sleep disturbances and relapse, this study also supports the premise, suggested by White,[2] that health promotion strategies in an addiction recovery model should address quality-of-life enhancements for individuals and their families, particularly optimizing sleep quality and duration through sustained recovery.

Acknowledgments

This project has been funded in whole or in part with federal funds from the National Institutes of Health, Clinical Center, intramural research program (trial no. NCT00106093). The content of this publication does not necessarily reflect the views or policies of the Department of Health and Human Services. The authors gratefully acknowledge the patients who participated in this research as well as the nursing staff from the 1SE inpatient unit and clinic.

References

1. Centers for Disease Control and Prevention. [Accessed December 29, 2013] Alcohol and public health. http://www.cdc.gov/alcohol. Published January 7, 2013
2. White W. A lost vision: the mobilization of community resources to support long-term addiction recovery. J Subst Abuse Treat. 2009; 36:146–158. [PubMed: 19161895]
3. Lund HG, Rybarczyk BD, Leszczyszyn D, Stepanski E. The discrepancy between subjective and objective measures of sleep in older adults receiving CBT for comorbid insomnia. J Clin Psychol. 2012; 69:1108–1120. [PubMed: 23280680]
4. Greeff AP, Conradie WS. Use of progressive relaxation training for chronic alcoholics with insomnia. Psychol Rep. 1998; 82:407–412. [PubMed: 9621711]
5. 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 Med. 2007; 68:176–180. [PubMed: 17239658]
6. Arnedt JT, Conroy DA, Armitage R, Brower KJ. Cognitive-behavioral therapy for insomnia in alcohol dependent patients: a randomized controlled pilot trial. Behav Res Ther. 2011; 49:227–233. [PubMed: 21377144]
7. Bootzin RR, Stevens SJ. Adolescents, substance abuse, and the treatment of insomnia and daytime sleepiness. Clin Psychol Rev. 2005; 25:629–644. [PubMed: 15953666]
8. Britton WB, Bootzin RR, Cousins JC, Hasler BP, Peck T, Shapiro SL. The contribution of mindfulness practice to a multicomponent behavioral sleep intervention following substance abuse treatment in adolescents: a treatment-development study. Subst Abuse. 2010; 31:86–97.
9. 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]
10. Manber R, Bernert RA, Suh S, Nowakowski S, Siebern AT, Ong JC. CBT for insomnia in patients with high and low depressive symptom severity: adherence and clinical outcomes. J Clin Sleep Med. 2011; 7:645–652. [PubMed: 22171204]
11. Smith N, Hill R, Marshall J, Keaney F, Wanigaratne S. Sleep related beliefs and their association with alcohol relapse following residential alcohol detoxification treatment. Behav Cogn Psychother. 2013; 28:1–12.
12. Currie SR, Clark S, Rimac S, Malhotra S. Comprehensive assessment of insomnia in recovering alcoholics using daily sleep diaries and ambulatory monitoring. Alcohol Clin Exp Res. 2003; 278(8):1262–1269. [PubMed: 12966320]
13. Ford DE, Kamerow DB. Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? JAMA. 1989; 262:1479–1484. [PubMed: 2769898]
14. Brower KJ. Insomnia, alcohol and relapse. Sleep Med Rev. 2003; 7(6):523–539. [PubMed: 15018094]
15. Weissman MM, Greenwald S, Niño-Murcia G, Dement WC. The morbidity of insomnia uncomplicated by psychiatric disorders. Gen Hosp Psychiatry. 1997; 19:245–250. [PubMed: 9327253]
16. Gillin JC, Smith TL, Irwin M, Kripke DF, Schuckit M. EEG sleep studies in “pure” primary alcoholism during subacute withdrawal: relationships to normal controls, age, and other clinical variables. Biol Psychiatry. 1990; 27:477–488. [PubMed: 2310803]
17. Mahfoud Y, Talih F, Streem D, Budur K. Sleep disorders in substance abusers: how common are they? Psychiatry. 2009; 6:38–42. [PubMed: 19855859]
18. Landolt HP, Gillin JC. Sleep abnormalities during abstinence in alcohol-dependent patients. Aetiology and management. CNS Drugs. 2001; 15:413–425. [PubMed: 11475945]
19. Cohn TJ, Foster JH, Peters TJ. Sequential studies of sleep disturbance and quality of life in abstaining alcoholics. Addict Biol. 2003; 8:455–462. [PubMed: 14690882]
20. Drummond SP, Gillin JC, Smith TL, DeModena A. The sleep of abstinent pure primary alcoholic patients: natural course and relationship to relapse. Alcohol Clin Exp Res. 1998; 22:1796–1802. [PubMed: 9835298]

21. Irshaad E, Colin M, Shapiro A, Fenwick P. Alcohol and sleep, part I: effects on normal sleep. Alcohol Clin Exp Res. 2013; 37(4):539–549. [PubMed: 23347102]
22. Brower KJ, Conroy DA, Arnedt JT. Treatment options for sleep disturbances during alcohol recovery. J Addict Dis. 2007; 26(4):41–50. [PubMed: 18032231]
23. Brower KJ, Aldrich MS, Robinson EAR, Zucker RA, Greden JF. Insomnia, self-medication, and relapse to alcoholism. Am J Psychiatry. 2001; 158(3):399–404. [PubMed: 11229980]
24. Buysse DL, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989; 28:193–213. [PubMed: 2748771]
25. Johns MW. A new method for measuring daytime sleepiness: the Epworth Sleepiness Scale. Sleep. 1991; 14:540–545. [PubMed: 1798888]
26. Kushida CA, Chang A, Gadkary C, Guilleminault C, Carrillo O, Dement WC. Comparison of actigraphic, polysomnographic, and subjective assessment of sleep parameters in sleep-disordered patients. Sleep Med. 2001; 2:389–396. [PubMed: 14592388]
27. Paquet J, Kawinska A, Carrier J. Wake detection capacity of actigraphy during sleep. Sleep. 2007; 30:1362–1369. [PubMed: 17969470]
28. Skinner HA, Allen BA. Alcohol dependence syndrome: measurement and validation. J Abnorm Psychol. 1982; 91(3):199–209. [PubMed: 7096790]
29. Sullivan JT, Sykora K, Schneiderman J, Naranjo CA, Sellers EM. Assessment of alcohol withdrawal: the revised Clinical Institute Withdrawal Assessment for Alcohol Scale (CIWA-Ar). Br J Addict. 1989; 84:1353–1357. [PubMed: 2597811]
30. First, MB.; Spitzer, RL.; Gibbon, M.; Williams, JBW. User's Guide for the SCID-I: Structured Clinical Interview for DSM-IV-TR Axis I Disorders—Research Version—SCID-I for DSM-IV-TR, November 2002 Revision. New York, NY: Biometrics Research; 2002.
31. Svanborg P, Åsberg M. A new self-rating scale for depression and anxiety states based on the Comprehensive Psychopathological Rating Scale. Acta Psychiatr Scand. 1994; 89:21–28. [PubMed: 8140903]
32. Asberg M, Montgomery SA, Perris C, Schalling D, Sedvall G. A comprehensive psychopathological rating scale. Acta Psychiatr Scand. 1987; S271:5–27.

Table 1

Demographics of Sample and Clinical Data Descriptive Statistics (N = 164)

Age, mean (SD) (range, 22–64y)	45.6 (9.5)
Gender, n (%)	
Male	115 (70.1)
Female	49 (29.9)
Race, n (%)	
Black/African American	78 (47.6)
White	72 (43.9)
Asian	3 (1.8)
American Indian/Alaska Native	1 (0.6)
> 1 race	4 (2.4)
Unknown	6 (3.7)
Ethnicity, n (%)	
Hispanic	5 (3.0)
Non-Hispanic	157 (95.7)
PTSD (current), n (%)	
Yes	27 (16.5)
No	126 (76.8)
Missing	11 (6.7)
PTSD (ever—lifetime), n (%)	
Yes	40 (24.4)
No	113 (68.9)
Missing	11 (6.7)
Anxiety disorders, n (%)	
0	74 (45.1)
1	52 (31.7)
2	15 (9.1)
3+	12 (7.3)
Mood disorders, n (%)	
0	64 (39.0)
1	76 (46.3)
2	13 (7.9)
Alcohol Dependence Scale score, mean (SD) (n = 150; range, 1–37)	20 (7.0)
Maximum CIWA days 1–4, mean (SD) (n = 153; range, 0–26)	8.0 (6.0)
Baseline Anxiety—BAS, mean (SD) (n = 161; range, 0–32)	11 (7.0)
Baseline Depression—MADRS, mean (SD) (n = 161; range, 0–42)	16 (9.0)
Number of drinking days in the past 90 d, mean (SD) (n = 153; range, 7–90)	72.0 (22.0)
Average drinks per day, mean (SD) (n = 153; range, 2.98–27)	13.16 (5.70)

Abbreviations: BAS, Brief Scale for Anxiety; CIWA, Clinical Institute Withdrawal Assessment; MADRS, Montgomery Asberg Depression Rating Scale; PTSD, posttraumatic stress disorder.

Table 2

Pittsburgh Sleep Quality Index

	Day 2	Day 28	*P*
Sleep disturbance, n (%)	132 (90.4)	48 (50.5)	
No sleep disturbance, n (%)	14 (9.6) (n = 146)	47 (49.5) (n = 95)[a]	
Global PSQI score, mean (SD)	10.91 (4.14) (n = 146)	6.39 (3.64) (n = 95)	.000[b]
Sleep-onset latency, mean (SD), min	47.50 (46.78) (n = 155)	24.94 (19.85) (n = 100)	.000[b]
Sleep duration, mean (SD), h	5.37 (1.78) (n = 155)	6.15 (1.46) (n = 101)	.000[b]
Time in bed, mean (SD), h	6.84 (2.21) (n = 156)	6.98 (1.22) (n = 101)	.487

[a] Sample size decreased over time since many patients were discharged sooner than day 28.

[b] $P < .001$.

Table 3

Actigraphy Data[a]

	Week 1 (n = 152)	Week 4 (n = 115)
Sleep efficiency, %	75.78 (14.15)	77.43 (11.26)
Duration, h	6.39 (2.01)	6.24 (1.71)
Wake bouts	24.13 (10.17)	24.43 (10.09)
Wake after sleep onset, min	67.95 (38.86)	63.48 (34.05)
Total sleep time, h	5.33 (1.78)	5.40 (1.55)
Sleep-onset latency, min	14.32 (23.09)	13.97 (20.60)

[a]The values given are mean (SD).