

SHORT REPORT

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## Are you Sleeping? Pilot Comparison of Self-Reported and Objective Measures of Sleep Quality and Duration in an Inpatient Alcoholism Treatment Program

Alyssa T. Brooks, Michael C. Krumlauf, Barbara P. Whiting, Rosa J. Clark and Gwenyth R. Wallen  
National Institutes of Health Clinical Center, Bethesda, MD. Corresponding author email: [todaroad@mail.nih.gov](mailto:todaroad@mail.nih.gov)

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**Abstract:** Sleep disturbances are common among alcohol-dependent individuals and can increase risk of relapse. The current study compares subjective and objective measures of sleep quality and duration and describes the prevalence of baseline sleep disturbances in an inpatient population of alcoholics undergoing their first week of detoxification. At baseline, the PSQI revealed that 79% of participants were above the cutoff score ( $\geq 5$ ) for clinically meaningful sleep disturbances (mean = 12.57, SD = 4.38). Actigraphy results revealed that average sleep efficiency was 75.89%. Sleep efficiency scores were significantly correlated with self-reported sleep efficiency ( $P = 0.04$ ,  $r = 0.47$ ). Sleep duration measured by the actigraphy watches was not significantly correlated with self-reported sleep duration ( $P = 0.65$ ,  $r = 0.10$ ). Ongoing assessment of sleep disturbances may be a valuable tool for informing the development of customized sleep interventions in a similar inpatient alcohol treatment sample.

**Keywords:** alcohol, sleep, actigraphy, relapse, sleep disturbances

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## Introduction

Alcohol-dependent individuals suffer disproportional rates of sleep disorders when compared with the general population.<sup>1</sup> People with a history of chronic and heavy alcohol consumption suffer from poor sleep, particularly during the first few days and months of abstinence/detoxification.<sup>2,3</sup> Insomnia and other sleep disturbances can increase risk of relapse among alcoholics.<sup>4-7</sup> Specifically, patients who suffer insomnia (reported subjectively) after alcohol treatment programs are twice as likely to relapse within five months of treatment completion.<sup>8</sup>

Evidence suggests discordance between subjective and objective measures of sleep quality and duration. In particular, subjective reports overestimate sleep onset latency and underestimate wake time after sleep onset as compared to objective measures.<sup>9</sup> In a study of blind individuals, significant correlations were observed when comparing sleep duration and sleep/wake times, but objective measures showed significantly shorter sleep latency, increased night sleep duration, and increased number of night awakenings.<sup>10</sup> A study among patients with depression revealed that patients could accurately judge sleep time and latency, but they were not able to accurately report their number of night-time awakenings.<sup>11</sup> Evidence comparing subjective and objective sleep measures in women found that they self-reported shorter and poorer sleep than men while objective measures revealed poorer sleep in men.<sup>12</sup> Some sleep interventions improve subjective sleep outcomes while actigraphic (objective) outcomes are not significantly changed,<sup>13</sup> suggesting a cognitive influence on self-reported sleep disturbances. To our knowledge, no research has been conducted monitoring sleep quality during inpatient treatment for alcoholic individuals using the combination of actigraphy and self-reported measures, and there is a lack of understanding of whether subjective and objective measures converge in this population.

The purpose of this analysis was to compare self-reported sleep quality and duration to objective measures and to describe the prevalence of baseline sleep disturbances in an inpatient population of alcoholics during their first week of detoxification treatment. Understanding whether subjective and objective sleep measures correlate could help us assess sleep quality more accurately in this population.

Furthermore, understanding whether patients seeking treatment are suffering from sleep disorders and identifying which types are most prevalent could help providers tailor treatment to decrease risk of relapse.

## Methods

All adult research participants admitted to the inpatient behavioral health unit and enrolled in the National Institute of Alcohol Abuse and Alcoholism (NIAAA) intramural study NCT00106093: *Assessment and Treatment of People with Alcohol Drinking Problems* were recruited and consented to participate in the current study. Patients were not paid to participate in the main treatment study as per NIH protocol (with the exception of a \$20 incentive for undergoing an MRI). No additional payments were provided for completing the sleep assessment portion of the study. The NIH Combined Neuroscience Institutional Review Board approved this study. Participants completed the Pittsburgh Sleep Quality Index (PSQI) on day two. The PSQI provides a measure of sleep quality and disturbances over a one-month (30 days) time interval. Nineteen individual items generate seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Examples of these items include “During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes?” with response options ranging from “not during the past month” to “three or more times a week.” A global summation score of 5 or higher is indicative of poor sleep quality.<sup>14</sup> To our knowledge, the PSQI has not yet been validated in a sample of alcoholic patients but has been validated in populations with insomnia and other sleep disorders, with psychiatric patients, and in normal populations.<sup>15,16</sup> Participants completed the self-reported Epworth Sleepiness Scale (ESS) on day five after admission. The ESS is an eight-item questionnaire that provides a measure of an individual’s general level of excessive daytime sleepiness.<sup>17</sup> A score higher than ten is indicative of excessive daytime sleepiness.<sup>18</sup> All subjective measures were administered by the nursing staff along with the standard battery of tests of the parent protocol. Participants were asked to complete daily sleep diaries assessing sleep quality and duration, which have been shown to correlate with



sleep scales.<sup>19</sup> Each participant agreed to wear an actigraph watch throughout the duration of his or her stay (typically 5–6 weeks), which measures ambient light and motion to calculate sleep/wake intervals objectively. Considerable evidence exists surrounding the use of actigraphy as a clinical assessment tool for analyzing sleep patterns for both “normal” populations and those with a variety of sleep disorders.<sup>20,21</sup>

## Results

Sample characteristics are presented in Table 1. Our sample ( $n=22$ ) was 54.5% male, ranging in age from 22 to 53 years (mean = 40.14,  $SD=9.34$ ). The mean Day 5 ESS score (7.45,  $SD=5.19$ ) did not indicate excessive daytime sleepiness at baseline in our sample. Only 23% of patients met the criteria for “excessive daytime sleepiness” as measured by the ESS (score > 5). The PSQI revealed that 79% of participants were above the cutoff score ( $\geq 5$ ) for clinically meaningful sleep disturbances (mean = 12.57,  $SD=4.38$ ). Self-reported sleep efficiency as measured by the PSQI was correlated significantly with objective sleep efficiency as measured by the actigraph watches for the first week of treatment ( $P=0.04$ ,  $r=0.47$ ). Self-reported sleep duration as captured in the daily sleep diaries was not correlated significantly with objective sleep duration as measured by the actigraph watches for the first week of treatment ( $P=0.65$ ,  $r=0.10$ ).

**Table 1.** Sample characteristics.

	n (%)
Gender	
Male	12 (54.5)
Female	10 (45.5)
Race	
White	11 (50)
Black	10 (45.5)
Other	1 (4.5)
Ethnicity	
Hispanic/Latino	0 (0%)
Non Hispanic/Latino	22 (100%)
Average sleep efficiency	75.89%
	<b>Mean (<math>\pm SD</math>)</b>
Age	
Range: 22–53	40.14 (9.34)
ESS score (day 5)	
Possible range: 0–24	7.45 (5.19)
PSQI score (day 2)	
Possible range: 0–21	12.57 (4.38)
Average sleep onset latency	15.26 minutes

A paired-samples *t*-test was conducted to compare self-reported sleep duration as it appeared in the sleep diaries with sleep duration as measured by actigraphy, in addition to sleep efficiency as reported by the PSQI compared to sleep efficiency as recorded by actigraphy. There was a significant difference in subjective (mean = 6.89,  $SD=1.11$ ) and objective (mean = 5.08,  $SD=1.23$ ) sleep duration scores;  $t(21)=5.43$ ,  $P<0.01$ . There was no significant difference between subjective (mean = 73.78,  $SD=10.74$ ) and objective (mean = 73.78,  $SD=20.75$ ) sleep efficiency scores;  $t(19)=0.20$ ,  $P=0.84$ .

Results from the actigraphy revealed that average sleep onset latency was 14.93 minutes ( $SD=11.46$ ). The average number of hours of sleep recorded was 5.08 ( $SD=1.22$ ) as measured by actigraphy and 7.08 ( $SD=2.77$ ) as measured by the PSQI. Average recorded sleep efficiency was 75.55 ( $SD=10.43$ ) as measured by actigraphy and 83.74 ( $SD=43.64$ ) and as measured by the PSQI.

## Conclusions

Based on these preliminary results, our sample of inpatient alcohol treatment patients reported experiencing poor sleep efficiency on average and significant sleep disturbances during the month before entering treatment. Subjective and objective (eg, actigraphic sleep efficiency) measures of sleep quality converged at baseline in this pilot sample, but measures of sleep duration did not correlate. Our findings also indicate discordance between subjective and objective measures of sleep duration, which is congruent with a considerable number of previous findings.<sup>9–12</sup> These results suggest that self-reported measures may not be sufficient to determine sleep quality and duration in this population. When sleep quality is not the only concern, objective measures may be necessary to validate sleep duration and efficiency. Additional research on the validity of self-reported sleep measures and corresponding objective measures, including actigraphy and clinician progress notes, may provide a more complete and accurate quantification of sleep quality, duration and efficiency among alcoholics. Clinician medical record progress notes may also provide additional clinical details, such as any associated withdrawal symptoms, laboratory tests, or procedures that were being conducted concomitantly during periods of alcohol withdrawal and could affect sleep.



Given our small sample size for this analysis, this study was not meant to generalize results to a broader population of alcoholics but to describe a small preliminary sample in one facility. One major limitation, as with other work that includes self-reported sleep measurements,<sup>1</sup> involves comparing “baseline” data collected during the first week of treatment via actigraphy with PSQI data, which asks patients about the month prior to entering treatment. Research findings indicating divergence between certain aspects of subjective and objective sleep measures may call for placing more emphasis on more costly objective measures, but our early findings continue to support the use of the PSQI as a subjective measure for evaluating baseline sleep disturbances in alcoholics. Further work should be conducted with a larger sample size. Ongoing analysis of sleep data in a larger sample may provide evidence to support subjective and objective sleep measures as valuable clinical assessment tools for informing the development of interventions designed to improve sleep quality in a similar future sample of patients receiving inpatient alcohol treatment. Identification of the most troublesome aspects of sleep for this particular population and tailoring treatments based on individual needs is warranted, placing emphasis on patient-centered care designed to increase chances of sustained abstinence.

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## Competing Interests

Author(s) disclose no potential conflicts of interest.

## Author Contributions

Conceived and designed the experiments: BW, RC, GW. Analyzed the data: AB, MK, GW. Wrote the first draft of the manuscript: AB. Contributed to the writing of the manuscript: AB, MK, GW. Agree with manuscript results and conclusions: AB, MK, BW, RC, GW. Jointly developed the structure and arguments for the paper: AB, GW. Made critical revisions and approved final version: AB, MK, BW, RC, GW. All authors reviewed and approved of the final manuscript.

## Disclosures and Ethics

As a requirement of publication author(s) have provided to the publisher signed confirmation of compliance with legal and ethical obligations including but not limited to the following: authorship and contributorship, conflicts of interest, privacy and confidentiality and (where applicable) protection of human and animal research subjects. The authors have read and confirmed their agreement with the ICMJE authorship and conflict of interest criteria. The authors have also confirmed that this article is unique and not under consideration or published in any other publication, and that they have permission from rights holders to reproduce any copyrighted material. Any disclosures are made in this section. The external blind peer reviewers report no conflicts of interest.

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