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Poor Sleep at Baseline Predicts Worse Mood Outcomes in Patients with Co-Occurring Bipolar Disorder and Substance Dependence

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Abstract

Objective—Sleep problems are common to patients with bipolar disorder and have been shown to predict subsequent mood symptoms, and have also been shown to lead to worse substance use outcomes in those with substance use disorders. However, the relationship between sleep and clinical outcomes in a population with co-occurring bipolar disorder and substance use disorder is unclear.

Method—60 outpatients meeting DSM-IV (SCID) criteria for both bipolar disorder and substance use disorder participated in a randomized trial comparing integrated group therapy for bipolar disorder and substance use disorder to group drug counseling for substance use disorder alone. Poor sleep was assessed with the Pittsburgh Sleep Quality Index, which provides 7 component subscores and an overall sleep score.

Results—When controlling for baseline mood, substance use, and treatment condition, baseline sleep score predicted mood over the course of treatment and the 6-month follow-up: worse sleep was associated with worse mood outcomes. Sleep was not associated with substance use outcomes.

Conclusion—Impaired sleep is a prognostic factor for mood outcomes in patients with co-occurring bipolar and substance use disorders. Further investigation is warranted into the long-term clinical outcomes of poor sleep in this population with co-occurring bipolar disorder and substance use disorder so that appropriate interventions can be developed.

This clinical trial has been registered in a public trials registry at clinicaltrials.gov (identifier is NCT00227838).

Keywords

sleep problems; bipolar disorder; substance dependence

1. Introduction

Poor sleep, including problems with falling asleep and sleep duration, is common in patients with bipolar disorder (BD)^{1–3} or substance use disorders (SUDs),^{4,5} with considerably

higher rates of poor sleep in these patients than in the general population.⁶⁻⁸ Indeed, hypersomnia, insomnia, and decreased need for sleep are included as diagnostic criteria for BD.⁹

Sleep quality may play a role in the course of these disorders and affect the outcome of treatment. For example, an increase in sleep duration has been correlated with next-day or same-day depressive symptoms,^{10,11} and a decrease has been correlated with the onset or exacerbation of manic or hypomanic symptoms.¹⁰⁻¹³ Furthermore, Perlman et al,¹⁴ reported that a shorter routine sleep duration predicted depression over 6 months. Sleep quality can also affect the course of SUD: poor sleep at baseline^{15,16} and during early abstinence¹⁷ has been shown to predict relapse among alcohol dependent patients.

SUDs occur commonly in individuals with BD (60.3% of those with BD-I and 40.4% with BD-II.¹⁸ Patients with BD and a co-occurring SUD have a worse prognosis than those with BD alone, including lower remission rates from manic episodes,¹⁹ poorer medication adherence,^{19,20} and a higher risk for suicide attempts.²¹ Despite the high rates of co-occurrence, the worse prognosis, and evidence that poor sleep in both BD and SUD predicts worse outcomes, no studies have examined the quality of sleep and its potential prognostic implications in patients with co-occurring BD and SUD.

In our present study, part of a larger overall study of a new integrated group therapy,²² 60 patients with co-occurring BD and substance dependence were asked about their sleep quality, substance use, and mood throughout three months of treatment and six months after treatment completion. We hypothesized 1) that most patients would have poor sleep, and 2) that poor sleep at baseline would predict a) worse mood outcomes and b) worse substance use outcomes.

2. Method

2.1. Patients

Patients were participating in a larger study comparing two forms of group treatment that met weekly for 12 hour-long sessions: Integrated Group Therapy²³ and standard Group Drug Counseling (GDC)²⁴ for patients with co-occurring bipolar disorder and substance dependence. Integrated Group Therapy, designed specifically for patients with co-occurring BD and SUD, is based on a cognitive-behavioral model that integrates treatment for the two disorders by focusing on similarities between recovery and relapse in bipolar and substance use disorders. GDC is a standardized treatment designed to approximate the treatment patients receive in an SUD community treatment program; it has been empirically validated and is used routinely in clinical research.²⁵ Participants were randomized to either GDC or IGT. The three-month treatment preceded a six-month follow-up. Results in that study showed that IGT outperformed GDC: IGT patients reported significantly higher rates of total abstinence than GDC patients. IGT patients also reported fewer days of substance use during follow-up and were less likely to have mood episodes during treatment, compared to GDC patients.

Participants were recruited via advertisements, fliers, clinician referrals, and McLean Hospital treatment programs. Inclusion criteria were 1) current diagnoses of BD and substance dependence other than nicotine, 2) substance use within 60 days of intake, 3) a mood stabilizer regimen for 2 weeks, and 4) 18 years of age. Exclusion criteria were 1) current psychosis, 2) current danger to self or others, 3) concurrent group treatment, and 4) residential treatment restricting substance use. The McLean Hospital Institutional Review Board approved this research protocol. Written informed consent was obtained at the initial

appointment after research staff reviewed the study procedures with the patient. See Table 1 for a description of the sample.

2.2. Assessments

2.2.1. Sleep—Participants completed the Pittsburgh Sleep Quality Index (PSQI)²⁶ at baseline and every three months thereafter for nine months. The PSQI, a self-report measure designed to characterize sleep in clinical populations, has seven components, each with scores ranging from 0 (no dysfunction) to 3 (severe dysfunction); the total global score (0–21) is the sum. The components are 1) subjective sleep quality, 2) sleep latency, 3) sleep duration, 4) habitual sleep efficiency, 5) sleep disturbances, 6) use of sleeping medication, and 7) daytime dysfunction. The components and items demonstrate strong internal consistency and global and component scores are stable over time.²⁶ Although there is limited evidence of correlation with polysomnography, the scale has been repeatedly validated to identify those with insomnia.^{26–28} Defining “poor sleep” as a global score >5, as recommended,²⁶ has discriminated “good” sleepers (controls) from “poor” sleepers among patients with primary insomnia or psychiatric disorders, although the optimal cutoff ranged from 5.5–6.0.^{27,28} The PSQI has been used across diverse populations, and was the only sleep measure of 22 assessed that met the standards for reliability, validity, responsiveness, and interpretability.²⁹ Sixty of the 61 participants in the study had valid PSQI data at baseline; that is the sample considered here.

2.2.2. Mood—Participants completed the Structured Clinical Interview for DSM-IV (SCID)³⁰ and the Longitudinal Interval Follow-Up Evaluation.³¹ The SCID was administered at baseline, the end of treatment, and three months after treatment; the Longitudinal Interval Follow-Up Evaluation was administered monthly both during treatment and during the six months after treatment. Participants were considered to be “ill” during a particular week if they met criteria for a depressive, manic, hypomanic, or mixed mood syndrome.

2.2.3. Substance use—Participants were assessed monthly with the fifth edition of the Addiction Severity Index,³² using the Timeline Follow-Back method³³ to determine the number of days of substance use. SUD diagnoses were assigned using the SCID.

2.3. Data analysis

Linear regression analysis was used to examine the effects of baseline sleep scores (i.e., overall sleep scale) on mood and substance use outcomes, adjusted for treatment condition and baseline measures of mood (i.e., number of weeks ill with BD in the past month) and substance use (i.e., days of substance use in the past month); these models considered the 3-month treatment period separately from the 6-month follow-up period and pooled the repeated measures of the outcomes for each period into a single post-baseline summary outcome. Next, a complementary set of longitudinal analyses examined the effects of baseline sleep scores on mood and substance use over the combined nine months post-baseline, using generalized estimating equations to account for the correlation among the repeated measures of the outcomes; these analyses were adjusted for the same covariates described above. Analysis adjusted for gender and age showed that neither variable was significantly related to either mood or substance use, hence data are reported without adjustment for these variables. Data were analyzed with SPSS 17.0.

3. Results

3.1. Do patients with co-occurring bipolar disorder and substance dependence have “poor” sleep?

The mean PSQI score at baseline was 9.6 (sd=4.1) on a scale from 0–21, with higher scores indicating worse sleep. Using the clinical cutoff of >5 to distinguish “poor” versus “good” sleepers,²⁶ 52 of the 60 patients (86.7%) were “poor” sleepers (see Table 2 for the distribution of scores). For each component other than habitual sleep efficiency, most participants (55.0–95.0%, n=33–57) scored greater than 0, indicating some dysfunction. Almost all participants reported sleep disturbances, daytime dysfunction, and delayed sleep onset latency in the past month, with most indicating moderate to severe difficulty (a score of 2 or 3). Most patients also indicated difficulty with subjective sleep quality and sleep duration. The use of sleep medications was bimodally distributed, with most patients reporting the use of sleep medications three or more times a week (a score of 3), about a quarter using no sleep medications in the past month (a score of 0), and a few using them once or twice a week (a score of 1 or 2).

3.2. Does poor sleep at baseline predict worse mood outcomes?

Seventy percent (n=42) of patients had at least one week ill with BD (either depressed, hypomanic, manic, or mixed) in the month before baseline, with a mean of 2.3 of 4 weeks ill (sd=1.7). We collected mood data for all 12 weeks of treatment from 59 patients (98.3%) and collected all 24 weeks of post-treatment follow-up data from 52 patients (86.7%). Patients reported a mean of 1.2 weeks ill with BD per month (sd=1.2) during treatment and 1.1 weeks ill per month (sd=1.2) during the post-treatment follow-up period.

In analyses that considered the 3-month treatment period separately from the 6-month follow-up period, baseline sleep score predicted the number of weeks ill with BD during treatment and during follow-up; these analyses also adjusted for number of weeks ill with BD in the month before baseline, days of substance use in the month before baseline, and treatment condition. Specifically, those with worse sleep had more weeks ill with BD (see Table 3); interestingly, the effect of baseline sleep scores were 1.6 times higher at follow-up compared to treatment (betas=.28 and .46, respectively). For example, a 3-point increase in the baseline sleep score was associated with approximately one additional week ill with BD ($3 \times .28 = 0.84$) during treatment and approximately 1½ weeks ill with BD ($3 \times .46 = 1.38$) during follow-up. (A 3-point change in sleep score, equivalent to the range of each of the 7 components, can be considered a clinically meaningful increase.) When this analysis was repeated for each PSQI component, 3 of the 7 components were found to significantly predict weeks ill with bipolar disorder during treatment and follow-up: subjective sleep quality, sleep latency, and sleep duration at baseline; the remaining components were not significantly related to bipolar disorder.

Next, a complementary set of longitudinal analyses were used to predict the probability of a week ill with BD during the nine months (i.e., 36 weeks) post-baseline. In logistic regression analysis of the probability of a week ill with BD, baseline sleep score, adjusted for the remaining baseline predictors, was significantly related to mood. Specifically, each 3-point increase in sleep score at baseline was associated with a 60% greater likelihood of a week ill with BD during the nine months post-baseline (estimated Odds Ratio=1.6, p=0.01). That is, at any of the 36 weeks post-baseline, those with baseline sleep scores 3 points higher were approximately 60% more likely to have an additional week ill with BD.

3.3. Does poor sleep at baseline predict worse substance use outcomes?

To predict substance use outcomes across the nine months (three months of treatment and six months of follow-up), we employed a procedure similar to that for mood: baseline sleep score, number of weeks ill with BD in the month before baseline, days of substance use before baseline, and treatment condition were examined. In contrast to mood outcomes, baseline sleep score was not related to days per month of substance use during treatment or during the follow-up period; only days of substance use at baseline was related to days of substance use during these two time periods, with greater use at baseline related to greater use post-baseline (see Table 3). This analysis was repeated for each PSQI component; as expected, none of the components were significant predictors of subsequent substance use. Complementary longitudinal analysis to predict days of substance use over the nine months post-baseline also showed that baseline sleep score was not related to the number of days per month of substance use post-baseline. Finally, in additional analyses, days of alcohol use and days of drug use were considered separately, using the linear regression and GEE analyses; sleep scores at baseline were not related to either outcome (data not shown).

4. Discussion

4.1. Overview

The aim of this study was to report the characteristics of sleep in patients with co-occurring BD and SUD, and to examine the association between poor sleep at baseline and subsequent mood and substance use outcomes. We found that poor sleep at baseline was quite prevalent in our sample, and was associated with worse mood outcomes but not worse substance use outcomes during treatment and six months of post-treatment follow-up. Specifically, the sleep components of subjective sleep quality, sleep latency, and sleep duration at baseline were associated with subsequent weeks ill with bipolar disorder.

4.2. Sleep scores

More than twice as many patients with co-occurring BD and SUD met the clinical cutoff for poor sleep compared to general U.S. population sample (87% vs. 36%).⁸ This indicates that those with co-occurring BD and SUD appear to have more dysfunctional sleep than the general population. This is not surprising; poor sleep is a criterion for a diagnosis of BD,⁹ and chronic substance abuse is associated with sleep disturbances.^{15–17,34}

The rates of poor sleep in this sample are comparable to rates for patients with BD only or with SUD only, both in the proportion of patients meeting criteria for poor sleep^{1–3,34–37} and mean PSQI.^{16,35,38} Since estimates for the proportion of those with “poor” sleep in patients with BD or SUD alone are already so high, a ceiling effect could limit the likelihood that co-occurrence of these disorders would elevate the rates of poor sleep much further.

The PSQI requires patients to fill out the average value for each question. For example, a participant is asked “How long (in minutes) has it usually taken you to fall asleep each night?” Someone who can sometimes fall asleep right away but at other times takes hours to fall asleep might thus select an answer in the middle. This can mask the variability of a patient’s sleep difficulty. This variability is supported by previous research, which has shown that those with BD have more variable sleep duration³ and circadian rhythm than controls, even when the two groups do not differ on sleep measures.³⁹

4.3. Treatment outcomes

Our findings indicate that poorer subjective sleep quality, as measured by the PSQI, is associated with worse mood outcomes during and after treatment for co-occurring BD and

SUD, even while baseline mood was not; baseline sleep scores, however, were not associated with substance use outcomes.

Although several studies have shown that sleep duration in BD patients is correlated with next-day mood symptoms,^{10–13} we are aware of only one study that has examined how *usual* sleep patterns affect BD outcomes: Perlman and colleagues¹⁴ reported that shorter sleep duration was correlated with the severity of depressive symptoms in BD patients across a 6 month follow-up period after partial recovery, when controlled for baseline depression. Our study found comparable results, in that poorer sleep on the PSQI predicted worse mood outcomes during three months of treatment and six months of follow-up.

The lack of association between baseline sleep score and alcohol, drug, or total substance use during treatment and follow-up was surprising, as the effect of sleep quality on SUD outcomes is more robust, particularly for alcohol use. Greater subjective sleep onset latency,^{15,16,40} shorter subjective total sleep time,⁴⁰ and subjective estimates of awakening after sleep onset⁴⁰ have all predicted relapse either during or after treatment for alcohol dependence. One reason for the lack of correlation between sleep and substance use outcomes may be that our sample had a mix of alcohol and drug dependence, while most of the strongest evidence of a relationship between baseline sleep and substance use outcomes has been on alcohol. For other drugs, evidence that sleep affects outcomes is more limited and shows mixed results.^{5,41} This explanation is limited, however, by the fact that we found no correlation between poor sleep at baseline and either alcohol, drug, or overall substance use outcomes post-baseline. Our failure to find such an association may be related to the fact that the current sample scored better on some PSQI components (e.g., sleep quality, sleep duration, and sleep efficiency) than was reported in previous studies on patients with alcohol dependence.^{16,35}

4.4. Strengths and limitations

One strength of this study is that sleep has not been previously examined in patients with co-occurring BD and SUD. Given the high prevalence of co-occurrence and the rates of dysfunctional sleep in each disorder, understanding the effect that sleep has in this dually-diagnosed population is important.

The fact that the PSQI is a self-report and not an objective measure of sleep difficulty can be considered both a strength and a limitation of this research, since its creators²⁶ found only a weak relationship between the PSQI and polysomnographic measures of sleep. Previous studies that have utilized both subjective and objective measures have found similar results. For example, both polysomnographic and subjective sleep latency predicted alcohol use outcomes in one study.¹⁵ Even when there is a discrepancy between subjective and objective report, subjective reports are sometimes better predictors of substance use outcomes than objective measures.⁴⁰ Because subjective sleep measures are easier to administer than polysomnographic or actigraphy, and because they remain predictive of outcomes of interest (sometimes more so than objective measures), the PSQI appears to be a clinically useful tool to measure sleep in this population.

Another limitation of the PSQI is that it conflates answers across nights. For example, a patient who sleeps 4 hours a night half the time and 10 hours half the time can answer certain questions like someone who sleeps 7 hours every night. Since BD patients are distinguished from controls in part by the variability of their circadian rhythms,³⁹ and sleep duration,² and because next-day mood in patients with BD has been shown to be influenced by sleep duration the night before,^{10–13} specific nights or clusters of nights may be responsible for some of our mood outcomes. Perhaps variability of sleep measures across nights, not just the mean, may contribute to worse outcomes.

4.5. Future research

Given the impact of poor sleep on long-term mood outcomes, future studies may examine the effect of sleep interventions on clinical outcomes in this population. It is unclear whether improved sleep would have a beneficial effect on mood outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Sample description at baseline (N=60)

Baseline characteristics	
Age (mean, sd; range)	38.1, 11.1 (18–65)
Male, %	58.3
White, %	91.7
Not currently married, %	71.7
Education < college, %	51.7
Not employed, %	55.0
Bipolar disorder type, %	
I	78.3
II	15.0
NOS	6.7
Lifetime substance dependence, %	
Drugs and alcohol	65.0
Alcohol only	26.7
Drugs only	8.3
Duration, lifetime years (mean, sd; range) ^I	
Bipolar disorder	18.0, 11.9 (1–45)
Alcohol dependence	16.7, 11.3 (<1–43)
Drug dependence	15.8, 10.3 (1–33)
Mood stabilizers, %	
Valproate	30.0
Lithium	28.3
Olanzapine	18.3
>1	34.4
Other current treatment, %	
Individual psychotherapy	65.0
12-step group attendance	58.3

^I SCID duration data were incomplete for bipolar disorder (n=13), alcohol dependence (n=1), and drug dependence (n=2).

Table 3

Number of weeks ill with a mood episode and days of substance use by sleep score and other baseline characteristics^I

Baseline	# Weeks with a mood episode		Days of substance use	
	Treatment (n=58)	Follow-up (n=51)	Treatment (n=60)	Follow-up (n=54)
Sleep score	.28 *	.46 **	.15	-.60
Number of weeks ill	.40	-.10	-2.41	-1.96
Days of substance use	.03	-.03	1.07 **	.97 *
Treatment condition	.98	-.19	4.27	3.52
Adjusted R ² (%)	14.4 *	15.8 *	15.8 **	10.0

^I Coefficients (betas) for follow-up, shown here, (based on a 6-month interval) were divided by 2 for ease of comparison with betas for treatment (based on a 3-month interval).

* p<.05;

** p<.01