Presence and Persistence of Sleep-Related Symptoms and Suicidal Ideation in Psychiatric Inpatients

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Abstract. *Background:* Although sleep is an important risk factor for suicidal behavior, research has yet to examine the association between sleep problems and suicidality across the course of inpatient treatment. This study examined the relationship among sleep-related symptoms and suicidal ideation across inpatient treatment. *Aims:* To examine whether poor sleep at admission longitudinally predicts less improvement in suicidal ideation over the course of treatment. Further, to examine whether suicidal ideation is reduced in patients whose sleep does not improve. *Method:* The study utilized the Beck Depression Inventory (BDI)-II, which contains items measuring depressive symptoms, sleep-related symptoms, and suicidal ideation. The study sample consisted of 1,529 adult psychiatric inpatients. Patients were assessed at admission, biweekly, and at treatment termination. *Results:* Admission fatigue, loss of energy, and change in sleep pattern were associated with higher levels of suicidal ideation at admission and discharge. Fatigue at admission predicted suicidal ideation at termination independent of admission depression and suicidal ideation. Individuals whose sleep did not improve over the course of treatment had significantly higher suicidal ideation scores at termination relative to those whose sleep symptoms improved, after controlling for sleep, depression, and suicidal ideation scores at admission. *Conclusion:* These findings suggest that persistence of sleep-related symptoms warrants clinical attention in the treatment of suicidal patients.

Keywords: sleep-related symptoms, suicidal ideation, inpatient sample, insomnia symptoms

When it becomes really impossible to get away and sleep, then the will to live evaporates of its own accord.

Louis-Ferdinand Celine

The association between sleep and psychological functioning is well known, especially in the context of clinical depression (Baglioni et al., 2011). Although sleep disturbance is a known feature of depressed mood, research has suggested that sleep problems precede the development of depressive symptoms in more than 40% of cases. Thus, sleep difficulties may play a role in the development of depression (Ohayon & Roth, 2003). Further, a recent meta-analysis of longitudinal studies found that the presence of insomnia symptoms more than doubled an individual's risk of developing depression (Baglioni, et al., 2011). In this context, it is important to note that insomnia often does not remit even with otherwise successful treatment of depression (Taylor, Walters, Vittengl, Krebaum, & Jarrett, 2009), and that this may put these individuals at greater risk of depression relapse (Ohayon & Roth, 2003).

Suicidal ideation, which commonly accompanies severe depression, may have an association with sleep disturbance apart from its association with depression. For example, there is strong evidence in the literature that

sleep disturbance is associated with suicidal behavior in various age groups and populations (Cukrowicz et al., 2006; Fujino, Mizoue, Tokui, & Yoshimura, 2005; Hall, Platt, & Hall, 1999; McGirr et al., 2007; Nadorff, Fiske, Sperry, Petts, & Gregg, 2013; Nadorff, Nazem, & Fiske, 2011, 2013) and recent research has demonstrated that relations between sleep problems and suicidality may be independent of depressive symptoms (Cukrowicz, et al., 2006; Nadorff, et al., 2011; Nadorff, Nazem, et al., 2013; Sjöström, Hetta, & Wærn, 2009). Recent research has also examined sleep and suicide in the context of the interpersonal-psychological theory of suicide, which posits that perceived burdensomeness and thwarted belongingness lead an individual to desire suicide, and acquired capability enables the individual to be able to overcome the instinct of self-preservation in order to be able to take one's own life (Joiner, 2005; Van Orden, Witte, Gordon, Bender, & Joiner, 2008). In this recent two-part study, insomnia symptoms and nightmares were added to a model that statistically corrected for the effects of depression, perceived burdensomeness, thwarted belongingness, and acquired capability. Although the results were mixed, they suggested that insomnia symptoms and nightmares may be associated with suicide attempts independent of these variables (Nadorff, Anestis, Nazem, Harris, &

Winer, 2014). However, little is known about how sleep problems affect psychiatric treatment. In the first study to examine sleep problems and mental health treatment outcomes, McCall and colleagues (2010) found that insomnia symptoms were associated with higher levels of suicidal ideation in a psychiatric clinical trial. Thus, sleep problems appear to be an important factor that may affect psychiatric treatment.

Statement of the Problem

There is substantial literature demonstrating an association between sleep disorders and suicidal ideation and behaviors. However, little is known about how sleep difficulties affect psychiatric inpatients over the course of their hospitalization. Previous findings suggest that insomnia symptoms may be an indicator of increased suicidality in a clinical trial of individuals with insomnia and depression, but it is unknown whether this relation continues over the course of treatment, or whether the presence of sleep problems impairs recovery.

Current Study

The current study examined the relation between three types of sleep-related symptoms (changes in sleep patterns, tiredness or fatigue, and loss of energy) and suicidal ideation in a large, psychiatric inpatient sample. We hypothesized that all three sleep symptoms would be positively associated with suicidal ideation at baseline. We conducted an exploratory analysis examining these sleep-related symptoms in relation to suicidal ideation, controlling for each other, to determine whether each of these sleep-related symptoms was associated with suicidal ideation independent of the others.

We also examined the association between the sleep-related symptoms and suicidal ideation over the duration of inpatient treatment. First, we utilized multilevel modeling to test whether the presence of baseline sleep difficulties resulted in different treatment trajectories over time. We then determined whether patients with elevated sleep-related symptoms at baseline have higher levels of suicidal ideation at the end of treatment. We hypothesized that the presence of sleep-related symptoms at baseline would be associated with poorer treatment outcomes (i.e., significantly less steep slopes and significantly higher posttreatment scores) on suicidal ideation. Lastly, we examined whether those whose initial sleep problems did not improve with treatment had higher levels of suicidal ideation at the final assessment than those whose sleep improved with treatment, as well as whether this relation was independent of the baseline levels of depression symptoms and suicidal ideation.

Method

Participants

The participants were 1,529 psychiatric inpatients at a private, not-for-profit psychiatric hospital in the southern United States who were taking part in a hospital-wide treatment outcomes study (e.g., Winer et al., in press). Typical patients at this facility suffer from multiple comorbid psychiatric disorders, most commonly mood disorders, substance-related disorders, and personality disorders, which have proven refractory to previous treatments. Average length of stay is 6 weeks. Because of the retrospective nature of the study, complete demographic information was not available for all patients; therefore, the number of patients (N) is denoted for each demographic. Participants' gender was evenly split (51.34% female, $N = 1,529$), and the average age of participants at the time of admission was 35.55 years ($SD = 14.33$, $N = 1,227$). Common primary axis-I diagnoses ($N = 1,214$) included depressive disorders (53.0%), bipolar disorders (16.06%), and anxiety disorder NOS (4.86%). Participants who had previously been admitted to the facility, or who were admitted just for short-term assessment, were excluded. Participants were admitted between April 2008 and August 2011. Treatment included medication management, psycho-education, milieu therapy, individual and group therapy, and social and recreational activities. Sleep-related symptoms and suicidal ideation were assessed at intake, biweekly during treatment, and at treatment termination. The number of assessment points ranged from 1 to 10 with the median being 4. The study was conducted in accordance with an approved IRB protocol with participants completing informed consent in a larger, hospital-wide treatment outcomes study.

Measures

The Beck Depression Inventory-II (BDI; Beck & Steer, 1987) is a 21-item self-report inventory of depressive symptoms. It is one of the most widely used measures of depressive symptoms and has demonstrated good psychometric properties in inpatient samples (Cole, Grossman, Prilliman, & Hunsaker, 2003). Each item is rated on a Likert scale from 0 to 3, with higher scores indicating more severe levels of depressive symptoms. Past studies have reported BDI-II means of 12.75 in a nonclinical student sample (Carmody, 2005) and of 21.02 in an inpatient sample (Steer, Rissmiller, Ranieri, & Beck, 1994). Cronbach's α for the full BDI in the current study was .93, demonstrating good internal consistency

The sleep-related symptoms, depressive symptoms, and suicidal ideation were assessed using items from the BDI. Sleep-related symptoms were assessed using items pertaining to Loss of Energy (ranging from 0, *I have as much energy as ever*, to 3, *I don't have enough energy to do anything*, baseline $M = 1.35$, $SD = 0.87$), Changes in Sleep Pattern (ranging from 0, *I have not experienced any change in my sleeping pattern*, to 3, *I sleep most of*

the day or *I wake up 1–2 hours early and can't get back to sleep*, baseline $M = 1.42$, $SD = 0.96$), and Tiredness or Fatigue (ranging from 0, *I am no more tired or fatigued than usual*, to 3, *I am too tired or fatigued to do most of the things I used to do*, baseline $M = 1.29$, $SD = 0.99$). Factor analysis studies of the BDI have demonstrated that these sleep variables load on the same factor in one-, two-, and three-factor solutions of the BDI (Hall et al., 2013; Manian, Schmidt, Bornstein, & Martinez, 2013). Similarly, a principal component analysis of the full BDI in our baseline data utilizing a varimax rotation found a three-factor solution with the three sleep items loading on the same factor. The three sleep items demonstrated good internal consistency with a Cronbach's α of .76.

Suicidal ideation was assessed using the Suicidal Thoughts and Wishes item, in which a score of 0 is *I don't have any thoughts of killing myself* and 3 is *I would kill myself if I had the chance*; baseline $M = 0.50$, $SD = 0.67$.

Depressive symptoms were assessed by summing all of the items on the BDI except for the sleep and suicide items mentioned previously to prevent overlap of measurement; baseline $M = 21.1$, $SD = 10.9$. Cronbach's α for depressive symptoms, measured at admission, was .91, demonstrating strong internal consistency.

Data Analysis

Statistical analyses were conducted utilizing SAS 9.2 statistical software (SAS Institute, 2011). The relations between variables at baseline were assessed with hierarchical linear regression. To assess whether sleep-related symptoms affect treatment over time, a multilevel linear model (MLM) was utilized. For the MLM analysis, the baseline score of each sleep-related symptom was dichotomized using a symptom threshold of 2 (i.e., 0–1 = 0; 2–3 = 1). We selected a cut-off point of 2 as these responses demonstrated impairment due to the sleep symptom (e.g., *I don't have enough energy to do very much* and *I am too tired or fatigued to do a lot of the things I used to do*; Beck & Steer, 1987). It is also consistent with other research that has used a cut-off of 2 for individual items on the BDI (Brown, Beck, Steer, & Grisham, 2000). This allowed us to assess whether the presence or absence of each symptom at baseline was associated with different treatment trajectories. To assess whether each sleep-related symptom affected suicidal ideation over time, we examined the interaction of each symptom with time in relation to suicidal ideation. We also conducted hierarchical linear regressions to examine whether baseline sleep problems were associated with final suicidal ideation both before and after controlling for baseline depression symptoms. Analyses were also conducted to determine whether these relations were significant after controlling for baseline suicidal ideation and depression diagnoses, and there were no changes in the significance of the sleep variables. To conserve space, only the analyses controlling for baseline levels of depressive symptoms and suicidal ideation are presented.

Lastly, we divided the sample into sleep symptom responders (those whose sleep disturbance improved, indicated by change scores of −1 or less) and nonresponders (those whose sleep disturbance failed to improve or worsened, indicated by change scores of 0 or greater) to assess whether nonresponders had greater risk of suicidal ideation after treatment. ANOVA analyses were utilized to determine whether treatment nonresponders had higher levels of suicidal ideation at their final assessment when compared with responders after controlling for initial levels of sleep disturbance and depressive symptoms. Analyses controlling for depression diagnosis instead of depressive symptoms were also conducted but yielded no change in significance. Thus they are not reported in the manuscript.

Results

The suicidal ideation measure was significantly skewed at baseline (skew = 1.29, kurtosis = 1.59) and at discharge (skew = 3.36, kurtosis = 13.70). To correct the skew, 1 was added to all scores of the measure to ensure all were above 0, and then the measure was log-transformed. Thus, the transformed suicidal ideation variable was used as the dependent measure in all analyses in order to meet the assumptions of the statistical tests.

To test the first hypothesis, correlation analyses were utilized to examine the relationships between baseline levels of fatigue, change in sleep pattern, and loss of energy and suicidal ideation (see Table 1). As predicted, baseline loss of energy, change in sleep pattern, and fatigue were all significantly associated with suicidal ideation. Thus, the first hypothesis was supported.

Table 1. Correlation of sleep symptoms at admission and discharge with suicidal ideation

Variable	1	2	3	4	M^a	SD^a	M^t	SD^t
1. Loss of energy	–	.41**	.72**	.30**	1.35	0.87	0.47	0.66
2. Sleeping pattern	.39**	–	.41**	.20**	1.42	0.96	0.67	0.78
3. Fatigue	.73**	.45**	–	.29**	1.29	0.99	0.44	0.65
4. Suicidal ideation	.38**	.20**	.37**	–	0.50	0.67	0.12	0.35

Notes. Correlations above the diagonal are at baseline assessment and below the diagonal are for termination assessment. Correlations are based on the log-transformed suicidal ideation measure, but the means and standard deviations are untransformed. M^a and SD^a are at admission whereas M^t and SD^t are at treatment termination. Sample size was 1,529 at baseline assessment and 1,177 at termination.
** $p < .01$.

To examine whether sleep-related symptoms were associated with suicidal ideation independent of each other, all three were entered into a regression analysis concurrently. The overall regression was significant, $F(3,1525) = 60.09$, $p < .01$, $R^2 = .11$, $F^2 = .12$, with fatigue, $\beta = 0.13$, $p < .01$, change in sleep pattern, $\beta = 0.08$, $p < .01$, and loss of energy, $\beta = 0.18$, $p < .01$, each being related to suicidal ideation independent of the other sleep problems.

Analyses with linear growth models were conducted separately to examine the relation between fatigue, change in sleep pattern, and loss of energy with changes in suicidal ideation. Participants who had scores of 2 or higher on fatigue ($t_{1527} = 11.40$, $p < .01$), change in sleep pattern ($t_{1527} = 7.99$, $p < .01$), and loss of energy, ($t_{1527} = 11.49$, $p < .01$) reported higher levels of suicidal ideation at baseline. Within the linear growth model examining each sleep difficulty in relation to suicidal ideation, there was a significant relation with time for all three analyses (fatigue $t_{3835} = 10.38$, $p < .01$; change in sleep pattern $t_{3835} = 14.83$, $p < .01$; loss of energy $t_{3835} = 9.11$, $p < .01$) suggesting that, overall, patients' suicidal ideation decreased. However, for all three analyses the interaction between baseline sleep disturbance and time was not significant (fatigue $t_{3835} = 0.31$, $p = .75$; change in sleep pattern $t_{3835} = 0.31$, $p = .75$; loss of energy $t_{3835} = 0.29$, $p = .77$), indicating no difference in rates of improvement in suicidal ideation in those with and without sleep symptoms. As would be expected given the nonsignificant interaction with time, participants who had elevated sleep-related symptoms at baseline reported significantly higher levels of suicidal ideation at their last assessment (fatigue $t_{592.87} = 3.97$, $p < .01$; change in sleep pattern $t_{397.87} = 2.41$, $p < .05$; loss of energy $t_{455.99} = 5.04$, $p < .01$). Thus, contrary to prediction, there were no significant differences in the rate of symptom improvement between those with and without sleep-related symptoms through the course of treatment; however, significant differences in suicidal ideation remained at the final assessment between those with and without initial sleep complaints at baseline.

As an exploratory analysis, we examined whether the presence of baseline sleep problems were associated with higher levels of suicidal ideation at treatment termination independent of baseline levels of depressive symptoms and suicidal ideation. To answer this question, we conducted a linear regression analysis for each of the sleep variables with baseline depressive symptoms and suicidal ideation entered into a model concurrently. We found that after controlling for depressive symptoms and suicidal ideation at admission, loss of energy and change in sleep pattern were no longer significantly associated with suicidal ideation at treatment termination. However, the association between admission fatigue and suicidal ideation at termination, $\beta = 0.07$, $t_{1173} = 2.19$, $p = .03$, remained significant after controlling for baseline depressive symptoms and suicidal ideation.

Lastly, the participants who had baseline fatigue, changes in sleep pattern, or loss of energy were divided into two groups: those who did not experience any im-
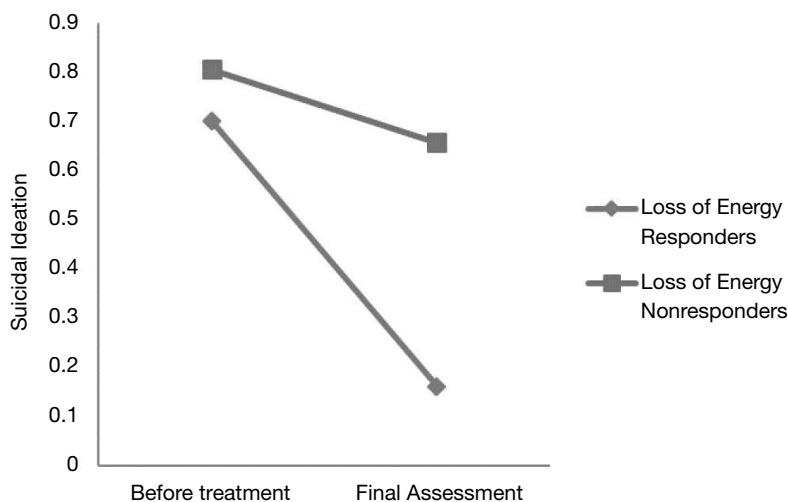

Figure 1. Loss of energy and suicidal ideation in participants with elevated baseline scores.

Table 2. Sleep symptoms at admission and discharge by response for those with elevated sleep symptoms at baseline

| | Admission | | Discharge | |
	Responders	Nonresponders	Responders	Nonresponders
Loss of energy	2.22 (0.42)	2.08 (0.27)	0.47 (0.56)	2.14 (0.35)
Fatigue	2.41 (0.49)	2.25 (0.44)	0.52 (0.61)	2.35 (0.49)
Change in sleep pattern	2.33 (0.47)	2.23 (0.42)	0.57 (0.59)	2.35 (0.48)

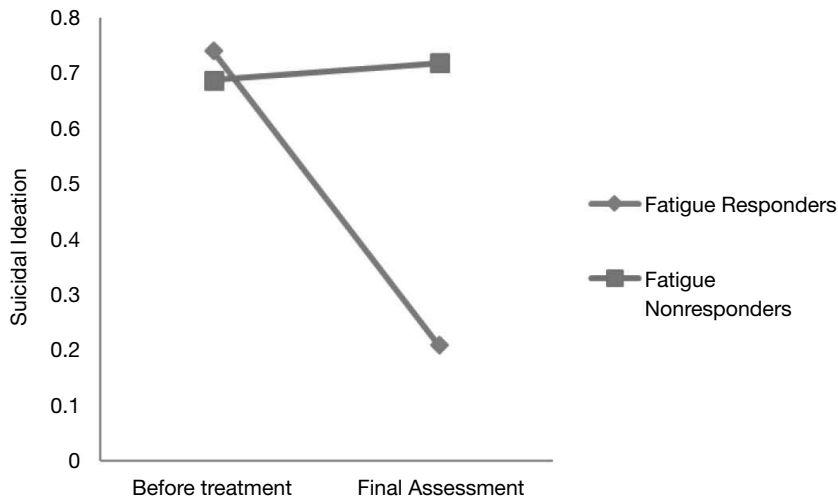*Note.* Scores are the mean score on each variable.

Figure 2. Fatigue and suicidal ideation in participants with elevated baseline scores.
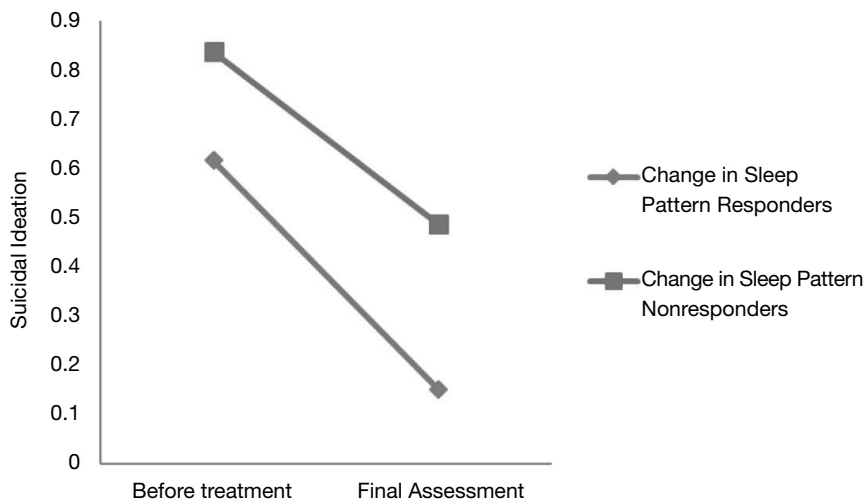

Figure 3. Change in Sleep Pattern and suicidal ideation in participants with elevated baseline scores.

provement in the sleep-related symptom over the course of treatment or got worse (fatigue $N = 31$, change in sleep pattern $N = 71$, loss of energy $N = 63$), and those whose sleep-related symptoms improved (fatigue $N = 542$, change in sleep pattern $N = 637$, loss of energy $N = 598$; see Table 2 and Figures 1, 2 and 3). At baseline, we found no significant differences in suicidal ideation between responders and nonresponders on fatigue, $t_{571} = 0.04$, $p = .97$, or loss of energy, $t_{659} = 1.60$, $p = .11$, although there was a significant difference between responders and nonresponders on change in sleeping pattern, $t_{706} = 2.45$, $p = .01$. As hypothesized, those who did not experience improvement in fatigue ($t_{32.537} = 4.84$, $p < .01$), change in sleep pattern ($t_{78.548} = 4.10$, $p < .01$), and loss of energy ($t_{69.865} = 6.20$, $p < .01$) experienced significantly higher levels of suicidal ideation at their final assessment compared with those who had improvement in their sleep. When controlling for baseline levels of the sleep symptoms, suicidal ideation, and depressive symptoms, lack of improvement in loss of energy, $F(1,509) = 64.40$, $p < .01$, R^2 change $= .10$, $F^2 = .11$, change in sleeping pattern $F(1,547) = 21.52$, $p < .01$, $R^2 = .08$, $F^2 = .09$, and fatigue $F(1,443) = 45.71$, $p < .01$, $F^2 = .03$, were as-

sociated with suicidal ideation at the final assessment. Thus, our final hypothesis was supported.

Discussion

Consistent with previous research (Barbe et al., 2005; Cukrowicz, et al., 2006), the current study found that all three sleep-related symptoms (i.e., fatigue, change in sleep pattern, and loss of energy) were significantly positively associated with suicidal ideation at the time of admission and discharge.

Our results extend the literature by showing that individuals with sleep-related symptoms at baseline are associated with significantly higher levels of suicidal ideation at discharge relative to those who did not report sleep-related symptoms. Further, baseline levels of fatigue were associated with suicidal ideation at treatment termination independent of baseline depressive symptoms and suicidal ideation. Thus, our findings suggest that the presence and persistence of sleep-related symptoms may interfere with

inpatient treatment of suicidal ideation, and may result in incomplete recovery from suicidal ideation. Additionally, our finding that individuals whose sleep did not improve over the course of treatment had higher levels of suicidal ideation at the final assessment – even after controlling for baseline sleep problems, suicidal ideation, and depressive symptoms – is critically important. Given the association between sleep-related symptoms and suicidal ideation, it is possible that sleep-focused treatment would benefit these individuals whose sleep symptoms do not respond to standard inpatient treatment.

The literature would greatly benefit from further study of the impact of sleep difficulties on the treatment of suicidal ideation. For instance, insomnia and nightmares have also been shown to be associated with suicidal ideation (Cukrowicz, et al., 2006; Nadorff, et al., 2011) and suicidal behavior (Bernert, Joiner, Cukrowicz, Schmidt, & Krakow, 2005; Fujino, et al., 2005; Sjöström, et al., 2009) but it is not known whether insomnia and nightmares are reduced during inpatient treatment, or whether they are related to incomplete recovery, as was the case in the present study with other sleep-related symptoms. Thus, research that aims to identify the sleep disorders that lead to less complete recovery from suicidal ideation is warranted. The literature would also benefit from research examining whether offering sleep treatment, in addition to standard inpatient treatment, results in more complete recovery from suicidal ideation. A recent study by Manber and colleagues (2011) examined the effect of cognitive behavioral therapy for insomnia among two groups: individuals with insomnia and high levels of depressive symptoms, and individuals with insomnia and low levels of depressive symptoms. The authors examined the subset of participants who reported suicidal ideation on the BDI at baseline, finding that cognitive behavioral therapy for insomnia resulted in a significant decrease in the participants' suicidal ideation scores, which suggests that treating sleep problems may have utility in reducing suicidal ideation. Unfortunately, no research to date has examined the utility of specifically targeting sleep-related problems in inpatient settings. Thus, research investigating sleep interventions in inpatient treatment is warranted, especially for those individuals whose sleep does not improve over the course of treatment.

Along with its strengths, the present study's limitations should also be noted, starting with the use of items from the BDI to measure sleep-related symptoms and suicidal ideation. The suicide item on the BDI has shown strong concurrent validity with the Beck Scale for Suicide Ideation (Beck & Steer, 1991), and has shown predictive validity of death by suicide using a cutoff of two (Brown et al., 2000). However, the sleep items have not been validated as a sleep scale. That said, they are consistent with sleepiness (Kryger, Roth, & Dement, 2010) and items assessing similar constructs have been utilized in validated sleep measures (Johns, 1991; Netzer, Stoohs, Netzer, Clark, & Strohl, 1999). Further, the three items loaded on the same factor in a principal components analysis of the BDI in our baseline assessments. This study lays the groundwork for future work examining the impact of sleep symptoms on treat-

ment outcomes using more specific sleep measures. A related limitation is that we utilized the remaining BDI items as a measure of depressive symptoms in several analyses. Although this is a limitation, the fact that all of the items come from the same scale, and that the scale has high internal consistency ($\alpha = .93$), introduces a conservative bias. Thus, the fact that there was a significant effect in light of this bias is notable. Further, these analyses were also conducted controlling for diagnosis of depression instead of the remaining BDI symptoms, and there were no changes in significance. Another limitation is that these sleep-related symptoms may have multiple causes. Subsequent studies may wish to consider utilizing questionnaires that are more targeted to sleep disorders or that utilize objective measures of sleep. Second, the generalizability of our results is limited by the fact that our sample was racially homogeneous and had longer stays than in most psychiatric facilities. However, the length of stay was also one of the study's greatest strengths, as it allowed for sufficient time for the participant to experience improvement. Third, although statistically significant, sleep difficulties only explained 11% of the variance in suicidal ideation. Despite this, we believe that sleep difficulties are clinically relevant, as sleep problems are modifiable risk factors and thus are potential treatment targets that may reduce suicidal ideation. Fourth, despite the study being on a psychiatric inpatient sample, the mean baseline score for suicidal ideation (0.50) was fairly low. This may be due to symptom underreporting, as other studies have suggested that psychiatry inpatients may underreport their symptoms (Pettit, Averill, Wassef, Gruber, & Schneider, 2005). Further, this mean is still highly elevated and is in line with a recent clinical study of depressed individuals with high levels of depression (0.45; Manber, et al., 2011). Lastly, our study is limited by its use of an archival dataset that lacked information about medication use, other sleep disorders, treatments received, and some demographic factors. However, the treatment was conducted in a real-world setting under real-world conditions, which increases the external validity of our study. Further, the study's sample is still a great strength as it is a large ($N = 1,529$) inpatient longitudinal sample, which is ideal for examining the impact of sleep problems on psychiatric treatment. The literature would benefit from assessing these factors in future research. In particular, given that recent research has found that nightmares and dysfunctional beliefs about sleep mediate the relation between insomnia symptoms and suicidal ideation (McCall et al., 2013), these may be particularly fruitful areas for future research. Further, research examining which components of treatment lead to more or less efficacious outcomes in respect to suicidal ideation would add to the literature.

This study is the first to show that the presence and persistence of sleep-related symptoms are associated with incomplete recovery of suicidal ideation during an inpatient admission. Future research aimed at identifying the sleep disturbances that affect the treatment of suicidal ideation, as well as whether adding sleep interventions to inpatient treatment would lead to more complete recovery, is warranted.

Acknowledgments

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