SLEEPJ, 2021, 1–6

doi: 10.1093/sleep/zsab032
Advance Access Publication Date: 11 February 2021
Original Article

ORIGINAL ARTICLE

Insomnia symptom severity is associated with increased suicidality and death by suicide in a sample of patients with psychiatric disorders

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Abstract

Study Objectives: Insomnia is a risk factor for suicidal behavior including attempts and death by suicide. We investigated whether insomnia symptom severity was associated with suicidality and death by suicide in patients with psychiatric disorders.

Methods: The sample included 180 deceased patients with psychiatric disorders seen at Weber Human Services between 2008 and 2018 who completed the Outpatient Questionnaire-45.2 (OQ) prior to death. Insomnia symptom severity was assessed using item 41 from the OQ. Manner of death was determined by death records and autopsy reports. History of suicidality was determined through electronic medical records. Cases were grouped into four lifetime categories: non-suicidal (n = 30), suicidal ideation (n = 36), suicide attempt (n = 95), and death by suicide (n = 19). Demographic, medical, and psychiatric features of each group were compared using linear regression. Logistic regression was used to determine whether insomnia symptom severity was associated with lifetime suicidality severity grouping, adjusting for psychiatric disorders commonly linked to suicidality.

Results: Lifetime suicidality was associated with sleep problems, fatigue, headaches, and psychiatric disorders (i.e. depressive, personality, and trauma-related disorders). Referenced to the non-suicidal group, greater insomnia symptom severity was significantly associated with suicide attempts and death by suicide, with odds ratios (OR) of OR = 2.67, p = 0.011, and OR = 5.53, p = 0.002, respectively, even after adjusting important psychiatric diagnoses.

Conclusions: Results suggest that insomnia symptom severity endorsed during a clinical visit is associated with heightened suicidality, especially suicidal behavior. The presence of insomnia symptoms in patients with psychiatric disorders may indicate risk for suicide and is a target for suicide prevention.

Statement of Significance

Using a sample of 180 adult patients with psychiatric disorders, we found that insomnia symptoms were associated with the lifetime severity of suicidality, especially suicidal behavior, even after adjusting for psychiatric diagnoses commonly associated with suicide risk. The presence of insomnia symptoms in patients with psychiatric disorders may indicate risk for suicide and is a target for suicide prevention.

Key words: insomnia; suicidality; suicide; suicidal behavior

Submitted: 28 October, 2020; **Revised:** 6 January, 2021

Introduction

Globally, nearly 800,000 people die from suicide each year [1]. Across the United States, suicide is the tenth leading cause of death, and rates of suicide have increased by nearly 30% since 1999 [2]. Further, the Center for Disease Control (CDC) reported in August 2020 a 2-fold increase in serious consideration of suicide for adults in the United States in the previous 30 days as compared to 2018 [3]. It is estimated that between 60% and 98% of suicides are by those who have a psychiatric illness [4]. Because suicide is preventable, identifying modifiable risk factors of suicidality in these patients is imperative. Insomnia is associated with suicidality, but its potential as a modifiable risk factor for suicide remains untapped. Greater insight into the relationship between insomnia symptoms and suicide risk may have implications for suicide prevention.

Insomnia symptoms, including difficulty initiating and reinitiating sleep, are common among patients with psychiatric disorders and have been linked to suicidal ideation [5–9], suicide attempts [10–13], and death by suicide [14]. Further, several studies have shown that the association between insomnia and suicidality persists after controlling for depressive symptoms [15–17]. Studies have suggested that insomnia has a significant proximal risk factor to death by suicide [14, 18] and that insomnia predicts higher lethality suicide attempts [19]. Few studies have explored how insomnia severity differs across groups with suicidal ideation, previous suicide attempts, and even fewer studies have used samples including those who have died by suicide. We previously reported that older adults with depression who attempted suicide had greater insomnia severity than depressed patients with suicidal ideation or no history of suicidality [12]. An earlier study reported that insomnia was a better predictor of suicide attempts than a specific suicide plan [11]. These studies suggest that insomnia may contribute to greater severity of suicidality, especially suicide attempts and suicide.

There is a handful of studies [14, 18, 20–24] of insomnia and suicidality that include a sample of participants who died by suicide. However, many of these are large cohort-based studies that are limited in the variables that were assessed and also do not generalize well with samples of patients with psychiatric disorders. This is a notable gap in the literature, as a recent meta-analysis has revealed that our prediction of suicide has not improved over the last 50 years [25]. Therefore, there is a great need for research that identifies risk factors, like insomnia symptoms, which may predict death by suicide and also be useful in predicting variance above and beyond what is currently assessed by suicide risk assessments. In a sample of deceased patients with psychiatric disorders, we posited that insomnia symptoms reported prior to death would be associated with a lifetime history of suicidality. We were particularly interested in determining whether death by suicide was associated with more severe insomnia symptoms at the patients' final clinical visit when referenced to patients who died without a history of suicidality.

Methods

Patients were seen clinically at Weber Human Services, a community behavioral health treatment facility in Ogden, Utah that offers services to those who are eligible for Medicaid or who have been civilly committed for mental health treatment. These services include individual and group therapy, behavior management, medication management, and residential treatment. The patients in our sample died between 2008 and 2018 and had a documented cause of death. Utah has one of the highest rates of suicide in the country [26] and Weber Human Services has taken systematic steps to document suicides of patients in their care. These systematic efforts provide a valuable resource amenable to researching clinical precursors of suicide. Demographics, mental illness diagnoses based on the International Statistical Classification of Diseases and Related Health Problems 10th edition, and prescription medications were extracted from the medical record. Due to the low representation of non-white patients in our sample (n = 17), we dummy coded race (white = "0" & non-white = "1") in our analyses. During the initial clinical intake assessment, each patient completed a comprehensive biopsychosocial assessment including questions related to the presence of various illness/conditions (e.g. allergies, cancer, problems sleeping); these data were also extracted from the medical record. Patient deaths were actively documented by routine monitoring of local obituaries, contact with patient family members, review of client reports, reports from community partners, and through case manager home visits. The patients' cause of death was documented by their death records. Suicide was determined by death records and/or autopsy reports obtained from the state coroner. In total, 20 patients had a documented suicide. Patient demographics were collected through all of each patient' electronic medical records including information gathered on medical conditions at the patients' intake. Due to missing data, 16 patients were excluded, including one suicide patient, resulting in an analysis sample of 180 patients.

As part of routine medical care, patients included in this study had completed the Outcome Questionnaire (OQ-45.2) [27], a validated, widely used, 45-item self-report survey designed to assess patient progress across a variety of mental health-related domains throughout therapy. Item 41 on the OQ completed nearest to death (range 16 days to 2.8 years prior to death) was used to determine patients' insomnia symptom severity (i.e. trouble falling asleep or staying asleep over the previous week). Scoring for this item ranges from "0" (never) to "4" (always).

To document each patient's history of suicidality, we searched for the terms "suicide" or "suicidal" in each patient's medical records including intake assessments and general clinical notes. When those terms did not yield information on suicidal history, we also searched for word roots for ideation ("ideat"), "attempt," "death," and "dying" to determine whether attempts or ideation occurred. Patients with no mention of suicidality in the medical record were categorized as having suicidal ideation if they endorsed >0 on item 8 of the OQ during the time they were receiving services at the facility. A subset of participants (n = 40) competed the Columbia-Suicide Severity Rating Scale, Lifetime/Recent (C-SSRS), a validated, sensitive, and specific measure of suicidality [28]. Based on death records, autopsies, medical record review, the OQ, and the C-SSRS, participants were ultimately categorized into four groups: no history of suicidality (n = 30), history of suicidal ideation (n = 36), history of suicide attempt (n = 95), and death by suicide (n = 19). Those who had evidence of a suicide plan were included in the suicidal ideation group.

We used linear regression to determine whether there were associations between level of suicidality and demographic,

medical, and psychiatric features. Further linear regression analyses were conducted on each suicidal group to determine whether they differed from the non-suicidal group on demographic, medical, and psychiatric features. Chi-squared analysis was used to determine associations between marital status groups and level of suicidality. We also compared patients' mean self-reported insomnia frequencies on OQ item 41 (insomnia). To represent the results of this analysis, we plotted the mean differences in insomnia severity on the OQ across each group (Figure 1). To rule out the potential confound of time between final assessment and death, we compared this variable in a follow up linear regression analysis. Ordered logistic regression (*ologit*) was used to model self-reported severity of insomnia and severity of suicidality in unadjusted and adjusted models that accounted for depressive and personality disorders when compared to the non-suicidal group.

We conducted a sensitivity power analysis to determine the minimal correlation detectable given $\alpha = 0.05$ and $\beta = 0.2$, with $N = 180$. A similar study reported 85% power to detect small effects ($N = 552$) [7] whereas another reported ≥80% power to detect correlations ≥0.4 ($N = 50$) [29]. Given these studies and our available sample size, we aimed to detect small to medium effect sizes. Results suggested that the sample size of 180 had 80% power to detect population correlations ≥0.21 among insomnia and suicidality severity (G*Power 3). Our sample size of 180 was sufficient for detecting a medium effect size between insomnia symptom severity and suicidality severity. Analyses were performed with STATA 15 (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC).

Results

Table 1 shows the demographic, medical, and psychiatric features across groups. Patients with a history of suicide attempts or who died by suicide died at a younger age than those who had no history of suicidality and died by other causes. The suicidal groups were otherwise similar to the non-suicidal group in terms of sex, race, education, income, and marital status. At the initial intake, the suicidal groups were more likely to endorse problems with fatigue, headaches, immune system, and sleep than the non-suicidal group. Also compared to those who had no history of suicidality, we found that those who had attempted suicide or died by suicide had significantly more instances of personality disorder diagnoses coded in their medical record, and those who attempted suicide had more instances of depressive disorders. The suicide attempt and suicide groups had significantly higher insomnia severity endorsed on the OQ than the non-suicidal group. We also report the median length of time in days between each groups' last administration of the OQ and their deaths; the suicidal groups did not significantly differ from the non-suicidal group on this variable. Figure 1 illustrates differences across the four groups in mean self-reported insomnia symptom severity (OQ item 41).

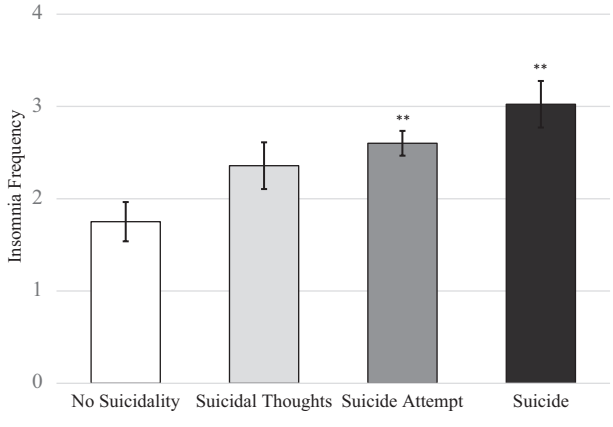

Figure 1. Self-reported symptom severity of insomnia across varying levels of suicidality. Note. Comparisons of patients' mean self-reported insomnia frequencies on OQ (0 "never" to 4 "almost always") across levels of suicidality. Self-reported insomnia symptom severity was significantly higher in groups with greater suicidality than the non-suicidal group. $^{**}p \leq 0.01$.

Table 2 reports the odds ratios of each group reporting greater insomnia symptom severity on OQ item 41 as compared to the group with no history of suicidality. In the unadjusted ordered logistic regression model, the suicide attempt and death by suicide groups had significantly more frequent insomnia than the non-suicidal group. After adjusting for depressive and personality disorders, the suicide attempt and suicide groups remained significantly different from the group with no history of suicidality in insomnia symptom severity; the suicidal ideation group did not have significantly different insomnia symptom severity from the other groups in either model.

Discussion

Findings suggest that those who exhibit suicidal behavior (attempts or death by suicide) reported greater insomnia symptom severity during their final clinical visit prior to their death than those with no lifetime history of suicidality. This association remained after accounting for the presence of depressive and personality disorder diagnoses. These results extend the findings of a previous study that suggested insomnia severity is associated with suicidal behavior above and beyond its association with depression diagnoses in at-risk samples of patients with psychiatric disorders [12].

The mechanisms of this relationship are unclear and understudied. Kay et al. found that patients with insomnia had less NREM sleep–wake differences in relative glucose metabolism in the left middle frontal gyrus, left parietal cortex, fusiform/lingual/occipital gyri, posterior cingulate cortex, and precuneus [30]. These are brain regions involved in decision-making and integration of self-referential thought, memory, and affective processes. Previous research has suggested that suicidal patients have decreased activity in the middle and superior frontal gyri when compared to non-suicidal patients [31] and increased activation in the anterior and posterior cingulate cortices [32]. Other studies have found that suicidal patients have a decreased volume in their right and left orbitofrontal cortices [33], dorsolateral prefrontal cortex [34], caudate nuclei, and rectal and superior temporal gyri [32], and an increase in right amygdala volumes [33]. These brain regions have implications for suicidal behavior as impairments within them have been associated with impulsive behavior [31–33], emotion dysregulation [35], and impaired decision-making [33, 34]. It is notable that many abnormalities in brain regions affecting patients with insomnia are also seen in patients who are suicidal. Kay et al. have posited that insomnia may represent a form of "localized sleep deprivation" in brain networks involved in executive control, self-referential thinking, and affect [12]. Although

Table 1. Demographic, medical, and psychiatric features across suicide severity groups.

Characteristic	Non-suicidal (*n* = 30)	Suicidal ideation (*n* = 36)	Suicide attempt (*n* = 95)	Suicide (*n* = 19)	$\chi 2/F$	*df*	*p*-value
Sex, female	14 (47%)	14(39%)	54 (57%)	9 (45%)	0.98	1	0.323
Age, years	57 (15)	54 (14)	51 (13)[A]	42 (12)[A]	14.46	1	<0.001***
Race, white	26 (87%)	32 (89%)	88 (93%)	17 (89%)	0.61	1	0.437
Education, years	12 [11,14]	12 [11,12]	12 [11,14]	12 [11,14]	0.07	1	0.794
Income, >$0	25 (83%)	30 (83%)	74 (78%)	17 (89%)	0.01	1	0.908
Marital status					χ^2=20.71	4	0.090
Married	3 (10%)	3 (8%)	18 (19%)	3 (16%)			
Widowed	7 (23%)	0 (0%)	6 (6%)	1 (5%)			
Divorced	7 (23%)	13 (36%)	35 (37%)	8 (42%)			
Separated	3 (10%)	8 (22%)	14 (15%)	2 (11%)			
Never married	10 (33%)	12 (33%)	20 (21%)	5 (26%)			
Medication use							
Benzodiazepine	1 (3%)	1 (3%)	9 (10%)	2 (10%)	1.72	1	0.196
Antidepressant	6 (20%)	4 (11%)	17 (18%)	4 (21%)	0.17	1	0.681
Antipsychotic	4(13%)	7 (19%)	20 (21%)	3 (16%)	0.01	1	0.939
Other sedative	0 (0%)	1 (3%)	1 (1%)	1 (5%)	0.51	1	0.478
Mood stabilizer	1 (3%)	1 (3%)	2 (2%)	0 (0%)	0.95	1	0.334
Total # of medications	2 [1,3]	2 [1,3]	3 [2,3]	2 [2,4]	1.55	1	0.219
Conditions/illnesses endorsed at intake							
Allergies	9 (30%)	9 (25%)	35 (37%)	7 (37%)	1.00	1	0.318
Cancer	2 (7%)	7 (19%)	14 (15%)	1 (5%)	0.00	1	0.955
Diabetes	7 (23%)	9 (25%)	22 (23%)	4 (22%)	0.05	1	0.826
Dizziness	6 (20%)	10 (28%)	22 (23%)	5 (26%)	0.07	1	0.794
Fatigue	8 (27%)	18 (50%)	53 (56%)[A]	12 (63%)[A]	8.53	1	0.004**
Headaches	6 (20%)	16 (44%)[A]	48 (51%)[A]	8 (42%)	5.28	1	0.023*
Heart condition	4 (13%)	10 (28%)	22 (23%)	2 (11%)	0.00	1	0.968
Immune system problems	2 (7%)	8 (22%)[A]	5 (5%)	0 (0%)	2.96	1	0.087
Kidney disease	2 (7%)	3 (8%)	11 (12%)	2 (11%)	0.56	1	0.454
Liver disease	4 (13%)	2 (6%)	11 (12%)	2 (11%)	0.00	1	0.979
Lung disease	4 (13%)	11 (31%)	23 (24%)	0 (0%)	0.34	1	0.563
Problems sleeping	7 (23%)	17 (47%)[A]	56 (59%)[A]	13 (68%)[A]	14.69	1	<0.001***
Seizures	3 (10%)	6 (17%)	11 (12%)	4 (21%)	0.30	1	0.582
Stomach aches/pains	5 (17%)	10 (28%)	32 (34%)	6 (32%)	2.56	1	0.111
Tuberculosis	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0.23	1	0.631
Ulcer or stomach disease	3 (10%)	4 (11%)	16 (17%)	2 (11%)	0.42	1	0.519
Total # of illnesses/conditions	2 [1,3]	3 [2,6][A]	4 [2,6][A]	3 [2,5]	5.49	1	0.020*
Mental disorders							
Depressive disorders	7 (23%)	12 (33%)	46 (48%)[A]	7 (37%)	4.25	1	0.041*
Psychotic disorders	12 (40%)	17 (47%)	26 (27%)	5 (26%)	3.31	1	0.071
Anxiety disorders	7 (23%)	9 (25%)	36 (38%)	5 (26%)	1.38	1	0.242
Personality disorders	1 (3%)	4 (11%)	30 (32%)[A]	8 (42%)[A]	17.64	1	<0.001***
Substance use disorders	6 (20%)	8 (22%)	26 (27%)	7 (37%)	1.90	1	0.170
Bipolar disorders	3 (10%)	4 (11%)	16 (17%)	4 (21%)	1.73	1	0.190
Neurodevelopmental disorders	1 (3%)	0 (0%)	0 (0%)[A]	0 (0%)	5.96	1	0.078
Neurocognitive disorders	3 (10%)	0 (0%)[A]	3 (3%)	0 (0%)	2.55	1	0.112
Trauma-related disorders	1 (3%)	3 (8%)	13 (14%)	4 (21%)	4.45	1	0.036*
Obsessive-compulsive disorders	0 (0%)	0 (0%)	2 (2%)	1 (5%)	2.25	1	0.136
Somatic disorders	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0.23	1	0.630
Total # of mental disorders	1 [1,2]	2 [1,2]	2 [2,3][A]	2 [2,3][A]	18.34	1	<0.001***
Insomnia symptom severity, OQ	1.4 (1.2)	2.1 (1.5)[A]	2.4 (1.3)[A]	2.9 (1.1)[A]	18.42	1	<0.001***
Time between death and last OQ, days	151 [40,1008]	158 [51,731]	73 [28,224]	20 [16,106]	1.81	1	0.180

Note. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. Non-suicidal: no suicidality reported in medical record, Suicidal ideation: suicidal ideation endorsed in medical record, Suicide attempt: lifetime history of suicide attempt noted in medical record. Suicide: documented death by suicide, *M*(SD), *Mdn*[IQR], *n*(%), *p*-value indicates an association between level of suicidality and demographic, medical, and psychiatric features. [A]Significantly different than non-suicidal group using linear regression.

highly speculative, the overlap in brain regions altered during sleep in insomnia and the brain regions altered during wakefulness associated with suicidality raises the possibility that insomnia confers risk for suicidal behavior through its impact on brain processes associated with cognition, memory and affect. Future research is needed to test the model that localized sleep disturbance in the brain networks associated with insomnia is a mechanism through which insomnia confers risk for suicide.

In this study, we used a single OQ item to assess insomnia symptom severity over the past week in relation to suicidality. Although routine clinical assessment of insomnia using validated methods such as the Structured Clinical Interview for DSM

Table 2. Self-reported insomnia symptom severity in each suicidal group compared to the non-suicidal group.

	Unadjusted model			Adjusted model		
Group	Odds ratio	95% CI	*p*	Odds ratio	95% CI	*p*
Suicidal ideation (*n* = 36)	2.32	0.96–5.57	0.061	2.05	0.86–4.91	0.108
Suicide attempt (*n* = 94)†	3.52	1.70–7.31	0.001**	2.67	1.25–5.72	0.011*
Suicide (*n* = 19)	6.53	2.30–18.52	<0.001***	5.53	1.89–16.17	0.002**

Note. Odds ratios of a group reporting greater insomnia symptom severity per OQ item 41 as compared to the no suicidality group. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The adjusted model controls for depressive and personality disorders. †One participant was removed from the analysis due to missing data on mental disorder diagnosis.

Disorders to diagnose insomnia would be ideal, a limitation of investigating the insomnia–suicidality association using clinical data is the spotty documentation of insomnia diagnosis in the medical record. Thus, the use of a single-item measure is often done in sleep and suicide studies [10]. The use of a single item reduces variability, and thus power, and likely introduces a conservative bias into our results. Despite its limitations, our findings suggest that the OQ insomnia severity item has high research utility for investigating the insomnia–suicidality association and high value for clinicians in assessing patients' suicide risk, especially given how widely used the OQ is in various clinical settings. Sleep problems endorsed during the initial intake assessment were also associated with heightened suicidality, including death by suicide. Research is needed to determine whether widely used single-item sleep measures at intake and throughout treatment can assess and reduce suicide risk.

Related to the previous limitation is that the time gap between the OQ assessment and death varied across participants, in some cases by as much as 2.5 years. Given the unpredictability of suicidal behavior, we note that this limitation is inherent to this field of research. Indeed, previous studies of insomnia and suicidality with a sample containing deaths by suicide utilized a single time point [23, 24], 6 months [18], and 3 years [20, 21] follow-ups, whereas others collected data from informants after the death by suicide [14, 22]. We note that the median time between final OQ assessment in our study was relatively close to the time of death (78 days). Moreover, in terms of our main finding, the suicidal groups did not differ from the non-suicidal group in relation to the time between their last OQ and death. Our use of the final OQ insomnia severity score to compare these two groups demonstrates the potential power of greater insomnia severity in gauging suicide risk. However, lifetime suicidal ideation and suicide attempts were determined from retrospective medical record review, and it was impossible to quantify when they occurred in relation to the final OQ insomnia assessment. Thus, the comparison between the suicide attempt and the non-suicidal group suggests an association between insomnia severity and the lifetime occurrence of suicide attempts. The limited timeframe of insomnia severity assessment, although relatively narrow in comparison to lifetime suicidal events, is mitigated by the chronic nature of insomnia and suicidality. Evidence suggests that, especially in a population of patients with psychiatric disorders, both insomnia and suicidality follow chronic courses, implicating support for the accurate assessment of insomnia severity in relation to suicidality using a routine single item clinical assessment tool, such as OQ item 41 [36, 37].

This study involved additional limitations. This study has the absence of research tools to fully characterize patients' psychological functioning. In this study, we used patient diagnoses to control for mental disorders. We did not have data pertaining to patients' specific depressive symptoms which limited us in our ability to determine if insomnia symptoms account for the risk of suicidality above-and-beyond that of non-insomnia depressive symptoms. Notably, some studies of sleep disturbance and suicidal ideation found that the association between insomnia and suicidal ideation was mediated by non-insomnia depressive symptoms [38, 39]. However, additional research is needed to determine differences between diagnosed depression and non-insomnia depressive symptoms. Although patient deaths were closely examined and documented by Weber Human Services, it is possible that patients could have moved away and died without the facilities' knowledge. The relatively small number of deaths by suicide in a sample of patients with psychiatric disorders may also limit the generalizability of these results. However, this is one of the few studies that has examined death by suicide as an outcome and one of the very few that have utilized samples that have received psychiatric care instead of population-based studies. This is important as it greatly increases generalizability to those who are treatment-seeking, and it demonstrates the importance of sleep symptoms in samples of patients with psychiatric disorders. Results require replication in different patient samples known to have high rates of suicide.

In conclusion, insomnia symptoms reported during clinical visits may be a valuable indicator of suicide risk in patients with psychiatric disorders. Sleep problems reported at initial intake and insomnia symptom severity reported during treatment may be a potent marker of suicidal behavior and a potential target for preventing suicide in patients with psychiatric disorders. The single insomnia item on the OQ has high clinical utility and feasibility that clinicians may use to help identify suicidality in patients with psychiatric disorders. Further research should focus on replicating these results with clinical diagnoses of sleep disorders, validated sleep questionnaires, and physiological sleep measures, including polysomnography. Future research is also needed to determine the mechanisms through which insomnia and suicidal behavior are related.

Acknowledgments

We would like to thank Jed Burton, Kim Myers, and David Barron for providing their assistance and access to their facilities to perform this research. Lastly, we thank Justin Martin for managing the data used in this project.

Disclosure Statements

Financial Disclosure: none.
Non-financial Disclosure: none.

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