Research report

Sleep problems outperform depression and hopelessness as cross-sectional and longitudinal predictors of suicidal ideation and behavior in young adults in the military☆

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ABSTRACT

Background: Sleep problems appear to represent an underappreciated and important warning sign and risk factor for suicidal behaviors. Given past research indicating that disturbed sleep may confer such risk independent of depressed mood, in the present report we compared self-reported insomnia symptoms to several more traditional, well-established suicide risk factors: depression severity, hopelessness, PTSD diagnosis, as well as anxiety, drug abuse, and alcohol abuse symptoms.

Methods: Using multiple regression, we examined the cross-sectional and longitudinal relationships between insomnia symptoms and suicidal ideation and behavior, controlling for depressive symptom severity, hopelessness, PTSD diagnosis, anxiety symptoms, and drug and alcohol abuse symptoms in a sample of military personnel (N=311).

Results: In support of a priori hypotheses, self-reported insomnia symptoms were cross-sectionally associated with suicidal ideation, even after accounting for symptoms of depression, hopelessness, PTSD diagnosis, anxiety symptoms, and drug and alcohol abuse symptoms. Self-reported insomnia symptoms also predicted suicide attempts prospectively at one-month follow up at the level of a non-significant trend, when controlling for baseline self-reported insomnia symptoms, depressive symptoms and hopelessness were controlled.

Limitations: The assessment of insomnia symptoms consisted of only three self-report items. Findings may not generalize outside of populations at severe suicide risk.

Conclusions: These findings suggest that insomnia symptoms may be an important target for suicide risk assessment and the treatment development of interventions to prevent suicide.

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“In the states of depression in spite of great need for sleep, it is for the most part sensibly encroached upon; the patients lie for hours, sleepless in bed, ... although even in bed they find no refreshment.” Emil Kraepelin (1921)

1. Introduction

If asked to list the top few warning signs for imminent suicidal behavior, relatively few mental health professionals – even experienced ones; indeed even specialists – would list insomnia. But perhaps should, as mounting evidence makes clear (Ağargün and Cartwright, 2003; Bernert et al., 2005; Fawcett et al., 1990; Krakow et al., 2011; Turvey et al., 2002; Wojnar et al., 2009). Here, we extend this evidence by documenting robust links between sleep problems and suicidality, both cross-sectionally and longitudinally, and both with regard to suicidal ideation and suicidal behavior. Crucially, in all cases, we show that the links between sleep problems and suicidality exist beyond the involvement of factors mental health professionals would list as among the top few clinical risk indices for suicidality – namely, depression, hopelessness, PTSD, anxiety, and drug and alcohol abuse (Beck et al., 1990; Nock et al., 2010; Oquendo et al., 2002, 2004).

2. Why would sleep problems be involved in suicidality?

In the moments before their deaths, suicide decedents are almost never described by others as “sluggish” or “slowed down” – a perhaps surprising fact given the well-known association between depression – which can certainly slow people down – and suicidality. How are they usually described then? Descriptors of severe anxiety and terms such as “agitated,” “on edge,” and “keyed up” come up quite regularly (Busch and Fawcett, 2004; Hall et al., 1999). If others are queried about the days and nights preceding the death, another term is likely to surface: “sleepless” (Hall et al., 1999; McGirr et al., 2007; Tanskanen et al., 2001).

Suicide is inherently difficult because it requires overcoming basic self-preservation instincts (Joiner, 2005). This may be one factor that contributes to why decedents, in the moments before death, are rarely viewed as “sluggish” and are frequently viewed as “keyed up.” Those whose death by suicide is imminent are physiologically aroused (Busch and Fawcett, 2004; Busch et al., 2003; Hall et al., 1999); were they not, something as daunting as death would likely be too difficult to enact. Indeed, many of them are physiologically overaroused (Busch and Fawcett, 2004; Busch et al., 2003; Kovaszny et al., 2004).

This state of overarousal appears to be a higher-order, underlying substrate with several manifest indicators, including various aspects of agitation and sleep disturbance. The focus in the current study is insomnia, which, for the purposes of this investigation, refers to a difficulty initiating or maintaining sleep that results in daytime consequences (e.g., fatigue). In this context, insomnia may be understood as one indicator of a psychological overarousal, which in turn may be associated with elevated risk for acute death by suicide. The emphasis of the current project is placed on insomnia not only because it is believed to be a key indicator of the overarousal, but also because it may be a clinically modifiable risk factor (Fawcett et al., 1990); furthermore, it is a topic many patients may be more likely to discuss with clinicians, in contradiction to topics like suicidality and depression (Britt et al., 2008; Green-Shortridge et al., 2007; Hoge et al., 2004).

It is important to emphasize that the mechanisms underling the relationship between insomnia symptoms and suicide remain unclear and under-researched. The overarousal hypothesis is offered as one potential explanation; however, there are a number of other possible explanatory pathways that might account for the link. Of note, there is some evidence to suggest that insomnia symptoms may impair decision making (Killgore et al., 2006), impulsivity (Schmidt et al., 2010), and exacerbate mood symptoms (Baglioni et al., 2010) – all of which may serve to mediate the relationship between insomnia symptoms and suicidal ideation and behavior.

3. Past research on sleep problems and suicidality

Despite the lack of theoretical research on why sleep would be associated with suicide risk, a growing body of evidence suggests that disturbed sleep may constitute an important, modifiable risk factor for suicide. Multiple sleep problems appear to predict elevated risk for suicide including insomnia, poor sleep quality, and nightmares (Ağargün and Cartwright, 2003; Ağargün et al., 1998; Bernert et al., 2005; Fawcett et al., 1990; Tanskanen et al., 2001). Supporting the construct validity of this association, this effect has been demonstrated controlling for depression, across diverse populations (clinical, nonclinical; Bernert et al., 2005, 2008), designs (longitudinal, cross-sectional; epidemiologic, psychological autopsy studies; Bernert et al., 2005; Bernert et al., 2007; Goldstein et al., 2008; Sabo et al., 1991), assessment techniques (objective, subjective sleep indices; Bernert et al., 2005; Goldstein et al., 2008; Sabo et al., 1991) and outcome measures (suicide ideation, suicide death; Ağargün et al., 1997a; Barracough and Pallis, 1975; Bernert et al., 2007).

Of specific sleep disturbances that may increase suicidality, insomnia and its attendant fatigue have received the most research attention, but even so, there remain important research questions to address. Cross-sectionally, insomnia has repeatedly been linked to greater levels of suicidal ideation (Ağargün et al., 1997a; Barracough and Pallis, 1975) even after controlling for depressive symptoms (Bernert et al., 2005, 2009; Chellappa and Araújo, 2007), and suicidal behavior (Goldstein et al., 2008; Sjöström et al., 2007). Longitudinal studies (though few) provide even more compelling evidence, indicating that insomnia emerges as a significant predictor of later suicidal ideation (McCall et al., 2010) and death by suicide (Fawcett et al., 1990; Fujino et al., 2005; Turvey et al., 2002).

4. The present study

In the current study, the literature on insomnia and suicidality is built upon. As can be discerned in Table 1, studies conducted to date vary considerably in terms of whether they examine suicidal ideation, behavior, or death by suicide as outcomes, whether they consider depression or other covariates, whether their assessment approach included multi-method features, and whether their designs incorporated cross-sectional or longitudinal elements. As Table 1 shows, no study did all of these. The present study is the first to do
so. In addition, it is the first study to our knowledge that evaluates sleep disturbance in association with suicide risk in a military population.

Using archival data of a sample of young adults in the military referred for suicidality, the cross-sectional associations at baseline between insomnia symptoms and interviewer-assessed suicidal ideation are examined, controlling for hopelessness, depression, PTSD diagnosis, anxiety, drug abuse and alcohol abuse. A substantial subset of the participants was assessed one month later, allowing for the examination of longitudinal associations, between insomnia symptoms and suicidal ideation and behavior.

5. Method

5.1. Participants

Participants for this study included 311 individuals (255 men [82%]; 56 women), evaluated as they entered a study on the efficacy of treatments for suicidal young adults (Rudd et al., 1996). All participants were referred for severe suicidality from two outpatient clinics, an inpatient facility, and an emergency room. All facilities were affiliated with a major U.S. Army Medical Center. Approximately 40% had a diagnosis of major depressive disorder, 15% had a bipolar spectrum diagnosis (i.e., Bipolar I Disorder, Bipolar II Disorder, Cyclothymic Disorder, and Bipolar Disorder-NOT Otherwise Specified), 13% had anxiety disorders, 5% had been diagnosed with a schizophrenia spectrum disorder, 20% had co-morbid post-traumatic stress disorder (PTSD), and about 20% had a co-morbid substance use disorder. The total number of diagnoses averaged approximately three. Diagnoses were assigned using a computerized version of the Diagnostic Interview Schedule (Blouin et al., 1988). Average age was 22.19 (SD = 2.77). Sixty percent was Non-Hispanic White; 25.3% was African-American; 10.5% was Hispanic; 1.5% was Native American; 1.2% was Asian-American or Pacific Islander; ethnicity was not classified for the remaining 1%. Forty-four percent was single; 37% was married; 10% was separated; 7% was divorced; 1% was widowed. Further details regarding the military experience of the sample (e.g., length of service, active duty status) are unavailable. Given the alarming increase in death by suicide in the military with close to 300 suicide deaths in active-duty military in 2009 alone (Luxton et al., 2009), the relevance and importance of the topic of the current study are difficult to overstate.

Of the 311 participants evaluated upon entry to the study, 239 were re-evaluated one month later. There were no differences on study variables between those who did and did not return except that those who did not return had slightly more suicidal ideation at baseline than those who did return (correlation between return/not and suicidal ideation was .12, p < .05).

5.2. Procedures

All participants provided full, informed, and written consent for research participation and were thoroughly clinically evaluated at pre-treatment (i.e., “baseline” assessment). All patients were offered rigorous treatment and were randomly-assigned to a problem-solving treatment or treatment-as-usual (as described by Rudd et al., 2000). A follow-up assessment was conducted post-treatment, one month after baseline. Interviews and administration of measures were conducted by clinical staff. Refer to Rudd et al., 1996 for more detailed information on procedures.

5.3. Measures

5.3.1. Insomnia symptoms

Assessed at both baseline and follow-up, the insomnia symptom index consisted of three items: Beck Depression Inventory (BDI; Beck et al., 1961) Items 16 (sleeplessness) and 17 (fatigue), as well as Suicide Probability Scale (SPS; Cull
of the three-item index is in the range of .71 to .76, and the ceiling coefficient for the insomnia symptom index is .71, with higher scores indicating greater symptom severity. Of note, BDI items 16 and 17 have been used in past literature as an index of sleep symptom severity (e.g., Perlis et al., 1997). Moreover, the use of a brief index has precedence in the literature on suicide risk. For example, the four-item Suicide Behaviors Questionnaire-Revised (SBQ-R; Osman et al., 2001) is psychometrically sound. The same can be said of the four-item Depressive Symptom Index—Suicidality Subscale (Metalsky and Joiner, 1997) and of the four-item P4 screener (Dube et al., 2010).

At baseline, the coefficient alpha of these three items was adequate at .71 and at follow-up was .76. As would be expected for a phenomenon that has episodic and state-like qualities (Buysse et al., 2010; Perlis et al., 1997; Vallières et al., 2005), the test–retest coefficient for the insomnia symptom index was in the moderate range \(r = .44, p < .01\). Test–retest coefficients in the moderate range are the norm for validated indices of insomnia, when the test–retest interval is three weeks or longer (as in the present study). For instance, in a sample of 50 undergraduates selected into a separate study for the presence of suicidal ideation, test–retest of the Insomnia Severity Index (Morin, 1993) over the course of three weeks was .41, \(p < .05\) (Bernert and Joiner, in preparation).

Regarding validity, in approximately 200 undergraduates who completed the BDI and the Insomnia Severity Index for a separate study (Ribeiro et al., in press), the correlation between the composite of BDI Items 16 and 17 and ISI scores was .60, \(p < .01\) (the SPS was not available in this particular sample)—substantial considering that the reliability ceiling of the three-item index is in the range of .71–.76, and the ceiling for the composite of the two BDI items is lower. Similarly, in the undergraduate sample alluded to above, the average correlation across the three week study between the composite of the two BDI items and the Insomnia Severity Index was .61, \(p < .05\).

The insomnia symptom index at baseline served as the main independent variable of interest in the prediction of suicidal ideation cross-sectionally and of both suicidal ideation and suicide attempt longitudinally. Also, analyses were conducted in which the insomnia symptom index at follow-up served as the dependent variable and suicidal ideation served as a predictor, which allowed for examination of directionality of effects.

5.3.2. Modified Scale for Suicidal Ideation (MSSI; Miller, Norman, Bishop, & Dow, 1986)

The MSSI is an 18-item scale that is designed to assess several aspects of suicidality. Each MSSI item was rated on a 0 to 3 scale; a total score of 11 or greater indicates clinical significance. Miller et al. (1986) have reported reliability coefficients and construct validity data for this measure (see also Clum and Yang, 1995).

5.3.3. Psychosocial history

This interviewer-rated form assessed demographic information and relevant personal history. The form administered at follow-up included a question on whether a suicide attempt had occurred since baseline. Of the 239 participants who returned for follow-up, ten reported suicide attempts between baseline and follow-up. We thus created a dichotomous variable (i.e., reflecting whether or not a suicide attempt occurred between baseline and follow-up), which served as a dependent variable in our longitudinal analysis predicting follow-up attempt status using the baseline insomnia symptom index, controlling for baseline suicidal ideation, depression, and hopelessness.

5.3.4. Millon Clinical Multiaxial Inventory (MCMI; Millon and Davis, 1997)

The original MCMI is a 175-item, true–false inventory. For the present purposes, the major depression, anxiety, alcohol abuse, and drug abuse subscales were used as covariates. The scales’ reliability and validity appear to be adequate (Millon and Davis, 1997). The congruence of various versions of the MCMI scales has also been adequate (Marlowe et al., 1998). We use the depression subscale as measure of depression instead of the BDI to avoid contamination between predictor and dependent variables.

5.3.5. Beck Hopelessness Scale (BHS; Beck et al., 1974)

The BHS includes 20 true–false items that assess hopeless cognitions. The scale’s reliability and validity have been supported (Metalsky et al., 1993). The BHS was used as a covariate; given that the BHS and the BDI share content and were developed by the same investigator, its use as a covariate in analyses involving our insomnia symptom index, also based in part on the BDI, may be considered a reasonably stringent data-analytic approach.

5.4. Data-analytic strategy

For cross-sectional analyses, we used multiple regression analyses, predicting MSSI suicidal ideation. The insomnia symptom index, BHS hopelessness scores, and MCMI depression scores were entered simultaneously as predictors. Recognizing viable covariates beyond depression and hopelessness, we also entered PTSD diagnosis, baseline MSSI anxiety scores, substance abuse, and alcohol abuse scores as control variables.

Regarding longitudinal analyses, a similar approach was used to evaluate whether the insomnia symptom index at baseline predicted MSSI suicidal ideation at follow-up, controlling for baseline MSSI, BHS, PTSD, and MCMI scores. To evaluate directionality, we conducted a similar analysis in which the insomnia symptom index and MSSI “switched places:” The dependent variable was the insomnia symptom index at follow-up, and predictors included baseline insomnia symptom index, MSSI, BHS, PTSD, and MCMI scores. Additional analyses involved a logistic regression examining the relation of baseline insomnia symptom index to a variable reflecting whether or not participants reported a suicide attempt occurring between baseline and follow-up. Baseline MSSI, BHS, MCMI anxiety, MCMI substance abuse, and MCMI alcohol abuse scores as well as PTSD diagnosis were controlled in these analyses.

6. Results

Means, standard deviations, and intercorrelations for all variables are presented in Table 2. Notably, symptom scores
are elevated at baseline. For the insomnia symptom index, the mean score was 4.42 (SD = 2.67). Mean MSSI scores were also elevated (M = 23.30, SD = 10.42), as expected. Participants reported an average score of 8.73 (SD = 6.36) on the BHS, 66.53 (SD = 13.43) on the MCMI depression subscale, 87.77 (SD = 20.35) on the MCMI anxiety subscale at baseline, 59.66 (SD = 17.63) on the MCMI alcohol abuse subscale, and 62.55 (SD = 19.34) on the MCMI anxiety subscale (scores above 65 are in the clinical range). Further, all symptom scores were significantly intercorrelated at baseline, and with the insomnia symptom index (M = 2.83, SD = 2.30) and MSSI (M = 5.98, SD = 9.77) at one-month follow-up, as anticipated. Additional suicide attempts at one month follow-up were positively correlated with sleep score at baseline (r = .14, p < .05), with MSSI total score at follow-up (r = .26, p < .01), as well as with PTSD diagnosis (r = .18, p < .01).

6.1. Cross-sectional analyses: does the insomnia symptom index predict MSSI suicidal ideation controlling for hopelessness, depression, PTSD, anxiety, and drug and alcohol abuse?

The answer to this question is yes. For this analysis, the insomnia symptom index, BHS, MCMI depression, anxiety, alcohol abuse and drug abuse scores, and PTSD diagnosis were entered simultaneously as predictors into a multiple regression equation, predicting MSSI. The insomnia symptom index emerged as a significant predictor of suicidal ideation, beyond the effects of hopelessness, depression, PTSD, anxiety, alcohol and drug abuse (pr = .12, t [307] = 2.11, p < .05). Hopelessness (pr = .34, t [307] = 6.35, p < .001) also emerged as a significant predictor of suicidal ideation, beyond the effects of the other rival covariates.

6.2. Longitudinal analyses: 1) Does the insomnia symptom index at baseline predict MSSI suicidal ideation at follow-up, controlling for baseline MSSI, and for hopelessness, depression, PTSD, anxiety, and drug and alcohol abuse?

Here, too, the answer to this question is yes. A similar multiple regression approach as outlined above was used to evaluate whether the insomnia symptom index at baseline predicted MSSI scores at follow-up, controlling for baseline MSSI, BHS, PTSD, and MCMI depression, anxiety, drug abuse, and alcohol abuse scores. As would be expected, MSSI scores at baseline predicted MSSI scores at one-month follow-up (pr = .19, t [234] = 2.97, p < .01). Of the remaining predictors, only the insomnia symptom index evinced a significant longitudinal relationship to increased suicidal ideation at follow-up (pr = .14, t [234] = 2.13, p < .05). Hopelessness (pr = .01, t [234] = 0.21, p = ns), depression (pr = .03, t [234] = 0.39, p = ns), PTSD (pr = .09, t [234] = 1.31, p = ns), anxiety (pr = .12, t [234] = .69, p = ns), drug abuse (pr = .01, t [234] = .07, p = ns), and alcohol abuse (pr = .03, t [234] = .38, p = ns) failed to do so.

6.3. Longitudinal analyses: 2) The question of directionality: Does MSSI suicidal ideation at baseline predict the insomnia symptom index at follow-up, controlling for baseline insomnia symptoms, and for hopelessness, depression, PTSD, anxiety, and drug and alcohol abuse?

No. To evaluate directionality, analyses were conducted in which the dependent variable was the insomnia symptom index at follow-up, and predictors included the insomnia symptom index at baseline, and baseline MSSI, BHS, PTSD diagnosis, MCMI depression, anxiety, drug abuse, and alcohol abuse scores.

Baseline suicidal ideation did not predict insomnia symptom scores at follow-up, controlling for baseline insomnia symptom scores (pr = -.07, t [234] = -1.09, p = ns). This suggests that the longitudinal association between insomnia symptoms and suicidal ideation flows from insomnia symptoms to suicidal ideation.

6.4. Longitudinal analyses: 3) does the insomnia symptom index at baseline predict suicide attempts occurring between baseline and follow-up, controlling for baseline MSSI, and for hopelessness, depression, PTSD, anxiety, and drug and alcohol abuse?

Not quite. In a logistic regression equation controlling for baseline MSSI, BHS, PTSD MCMI depression, anxiety, drug and alcohol abuse scores, baseline insomnia symptom index scores were used as a predictor of suicide attempt status at follow-up. The insomnia symptom index emerged as a non-significant trend predicting a suicide attempt at follow-up [exponentiated beta [Exp[B]], which is an index of effect.
size, was 1.33; Wald coefficient = 2.68, p = .10). Only PTSD ($\exp(B) = 6.71$; Wald coefficient = 5.83, p < .05) and MCCI alcohol abuse ($\exp(B) = 9.2$; Wald coefficient = 6.22, p < .05) emerged as significant predictors of subsequent suicide attempt. Although the effect of insomnia was not significant in this analysis, it is important to highlight that this was within the context of controlling for very robust predictors of suicidal behavior and, even then, the effect approached significance.

Of note, in a separate logistic regression when baseline insomnia symptom index scores were entered as a predictor of later suicide attempt, controlling for MCCI depression and BHS hopelessness scores, insomnia symptom index showed a significant longitudinal relationship to suicide attempt at follow-up ($\exp(B) = 1.45$; Wald coefficient = 6.28, p < .01). Neither baseline suicidal ideation ($\exp(B) = 0.98$; Wald coefficient = 0.19, p = ns), hopelessness ($\exp(B) = 0.91$; Wald coefficient = 1.64, p = ns), nor depression ($\exp(B) = 1.00$; Wald coefficient = 0.01, p = ns) performed similarly.

7. Discussion

The current study’s findings converge with a growing body of research, indicating a relationship between sleep disturbance and suicidality (Goldstein et al., 2008; Goodwin and Marusic, 2008; Keshavan et al., 1994; Liu, 2004; Sabo et al., 1991; Sjöström et al., 2007). This link has been reported in both clinical (Ağargün and Cartwright, 2003; Bernert et al., 2005; Sabo et al., 1991) and nonclinical population-based samples (Fujino et al., 2005; Goodwin and Marusic, 2008; Turvey et al., 2002) regarding suicidal ideation, suicide attempt, and death by suicide.

This investigation builds upon past findings by evaluating sleep problems as cross-sectional and longitudinal predictors of interviewer-assessed suicidal ideation and attempts, in direct comparison with depression, hopelessness, PTSD diagnosis, anxiety, drug and alcohol abuse, in a military sample. The present study revealed that insomnia symptoms served as a unique predictor of suicidal ideation assessed cross-sectionally, and for suicidal ideation and suicide attempt longitudinally (though the latter only held when controlling for only depression, hopelessness and baseline suicidal ideation, which are still strong predictors of death by suicide). This is a stringent test, given that depression is among the strongest predictors of suicide risk, and considering that insomnia and suicidality are symptoms of depression and highly associated with PTSD. An additional strength of this study was use of interviewer-assessed suicidal ideation and behavior. With a few exceptions (Bernert et al., 2005, 2009), the majority of past reports used single-item measures of suicidal ideation (Ağargün et al., 1997a, 1997b; Fawcett et al., 1990; Roberts et al., 2001).

This is also the first examination to our knowledge of such relationships in a military sample. There is some evidence that military status is associated with increased risk for suicide across cultures (Kim et al., 2006), and rates of suicide in the U.S. military have surged to record numbers in recent years (Kuehn, 2009; Lorge, 2011; US Army, 2011). The prevalence of sleep complaints appears significantly increased among military personnel when compared to civilians (Hoge et al., 2004; Neylan et al., 1998; Seeig et al., 2010), which does not appear to be explained by a PTSD diagnosis (Lewis et al., 2009).

The current study included limitations, which should be considered in interpreting the findings. The approach to the assessment of insomnia can be improved upon. One particular concern may be the construct validity of the insomnia symptom index as a measure of insomnia, as only one item indexes insomnia directly and the other two are assessments of fatigue. Although fatigue is highly associated with insomnia, it is also related to many other constructs as well (e.g., depression, physical illness, and eating disorders). Given the strong evidence base on sleep problems and suicidality, it would be reasonable to hypothesize that sleep problems are likely accounting for the effects. It is also important to note that analyses controlled for another strong potential confounding variable that is associated with fatigue, insomnia, and suicidality—namely, depressive symptoms. Therefore, future research using comprehensive self-report and objective measures of sleep problems is needed. In addition, findings involved relatively small effect sizes and did not examine potential variables (e.g., rumination, physiological effects of sleeplessness) that might mediate the results. Nevertheless, it should be emphasized that results conform to stringent, a priori hypotheses, persisted after controlling for relevant variables, emerged within a multi-method assessment strategy, and were similar to – and in some cases exceeded – effects for variables with traditionally strong effects. It should also be acknowledged that the current findings may not be generalizable outside of a severe risk sample. However, studying a severe sample will likely serve to highlight the highly salient risk factors.

Importantly, the results do not diminish the importance of depression and hopelessness as indicators of increased suicide risk as much as they underscore the importance of sleep problems. Based on the present findings, incorporating sleep problems into suicide risk assessment may be clinically important and potentially enhance detection of at-risk military members as sleep disturbances are often easily detectable (Goldstein et al., 2008), in contrast to many other suicide risk factors (e.g., past suicide attempt history). Information regarding more traditional suicide risk factors provides a context for determining how much weight to place on sleep problems, which likely informs on-going risk assessment and treatment (Gutierrez et al., 2009).

Overarousal may be an overarching factor underlying the association between insomnia and suicidality, as absence of sleep may be an indicator of agitation. Though limited, there is an emerging body of literature that suggests agitation or overarousal is an acute risk factor for suicide (Busch and Fawcett, 2004; Busch et al., 2003; Kovaszny et al., 2004). In addition to literature directly examining the role of agitation per se, research on agitation-related constructs also provides some support for this hypothesis. Anxiety disorders, for instance, appear to confer additional risk to suicidal ideation and behavior in individuals with bipolar disorder as compared to both depressed patients and individuals who do not have a mood disorder (Dilsaver et al., 2006). Further research is needed to clarify how insomnia is related to suicidality and whether overarousal is the higher-order factor accounting for the relationship between sleep disturbance and suicide.
Impaired emotional processing is another possible explanatory pathway. Sleep restriction is associated with mood decrements and emotional volatility (Dinges et al., 1997; Leotta et al., 2005). Dysregulated sleep has been found to predict mood lability and elevated suicidality (Bernert and Joiner, 2010)—and mood lability predicts suicidality when controlling for depression severity (Bronisch, 1992; Zlotnick et al., 1997). Future research should focus on examining whether overarousal, mood dysregulation, or their interaction may explain the relationship between disturbed sleep and suicidality.

In combination with the past literature on sleep disturbance and suicide, the present findings also suggest that evaluating the efficacy of sleep-focused interventions on suicidal symptoms may be promising. If found to be effective, sleep-focused interventions may be particularly important to consider in military populations, where stigma is well-documented and an obstacle to successful treatment implementation and mental health care utilization (Hoge et al., 2004). In stark contrast to mental health concerns, soldiers appear willing to seek help for sleep-related problems. Sleep problems are also common among active-duty military, especially while deployed (Peterson et al., 2008). The current findings converge with recent treatment trials showing that brief behavioral interventions for insomnia are associated with decreased depressive symptoms and suicidality post-treatment (Buysse et al., 2011; Manber et al., 2008, in submission; Morin et al., 2006, 2009; NIH Consensus Science Statements). The current findings combine with that of others to affirm the restorative power of sleep, and the potentially disastrous effects of its absence.

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Conflict of interest

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