



Published in final edited form as:

*J Psychiatr Res.* 2017 December ; 95: 54–59. doi:10.1016/j.jpsychires.2017.07.027.

## Comorbid Sleep Disorders and Suicide Risk Among Children and Adolescents with Bipolar Disorder

Ian H. Stanley, M.S.<sup>a</sup>, Melanie A. Hom, M.S.<sup>a</sup>, Joan L. Luby, M.D.<sup>b</sup>, Paramjit T. Joshi, M.D.<sup>c</sup>, Karen D. Wagner, M.D., Ph.D.<sup>d</sup>, Graham J. Emslie, M.D.<sup>e,f</sup>, John T. Walkup, M.D.<sup>g</sup>, David A. Axelson, M.D.<sup>h</sup>, and Thomas E. Joiner, Ph.D.<sup>a</sup>

<sup>a</sup>Department of Psychology, Florida State University, Tallahassee, FL USA

<sup>b</sup>Department of Psychiatry, Washington University School of Medicine, St. Louis, MO USA

<sup>c</sup>Division of Psychiatry and Behavioral Sciences, Children's National Health System, Washington, DC USA

<sup>d</sup>Department of Psychiatry, University of Texas Medical Branch, Galveston, TX USA

<sup>e</sup>Department of Psychiatry, University of Texas Southwestern Medical Center, Dallas, TX USA

<sup>f</sup>Division of Child and Adolescent Psychiatry, Children's Medical Center, Dallas, TX USA

<sup>g</sup>Department of Psychiatry, Weill Cornell Medical College, New York, NY USA

<sup>h</sup>Nationwide Children's Hospital Research Institute and The Ohio State University College of Medicine, Columbus, OH, USA

### Abstract

Children and adolescents with bipolar disorder are at increased risk for suicide. Sleep disturbances are common among youth with bipolar disorder and are also independently implicated in suicide risk; thus, comorbid sleep disorders may amplify suicide risk in this clinical population. This study examined the effects of comorbid sleep disorders on suicide risk among youth with bipolar disorder. We conducted secondary analyses of baseline data from the Treatment of Early Age Mania (TEAM) study, a randomized controlled trial of individuals aged 6-15 years (mean  $\pm$ SD=10.2 $\pm$ 2.7 years) with *DSM-IV* bipolar I disorder ( $N=379$ ). Sleep disorders (i.e., nightmare, sleep terror, and sleepwalking disorders) and suicide risk were assessed via the WASH-U-KSADS and the CDRS-R, respectively. We constructed uncontrolled logistic regression models as well as models controlling for trauma history, a generalized anxiety disorder (GAD) diagnosis, and depression symptoms. Participants with a current comorbid nightmare disorder versus those without were nearly twice as likely to screen positive for suicide risk in an uncontrolled model and models controlling for trauma history, a GAD diagnosis, and depression symptoms. Neither a

---

Corresponding Author: Correspondence concerning this article should be addressed to Ian H. Stanley, Department of Psychology, Florida State University, 1107 West Call Street, Tallahassee, Florida 32306. stanley@psy.fsu.edu. Phone: 850-644-2040. Fax: 850-644-7739.

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

current comorbid sleep terror disorder nor a sleepwalking disorder was significantly associated with suicide risk. This pattern of findings remained consistent for both current and lifetime sleep disorder diagnoses. Youth with bipolar I disorder and a comorbid nightmare disorder appear to be at heightened suicide risk. Implications for assessment and treatment are discussed.

### Keywords

bipolar disorder; sleep disturbances; suicide risk; nightmares; youth

---

Suicide is a leading cause of death among children and adolescents (Centers for Disease Control and Prevention [CDC], 2017). Robust evidence suggests that children and adolescents with bipolar disorder are at markedly increased risk for suicide (Brent et al., 1993; Brent and Mann, 2005; Geller et al., 2008, 2004; Goldstein et al., 2005; Hauser et al., 2013; Inder et al., 2016; Kochman et al., 2005). A recent systematic review of 14 studies examining suicidal thoughts and behaviors among youth with bipolar disorder found weighted mean averages of current suicide ideation and attempts in this population to be 50.4% and 25.5%, respectively (Hauser et al., 2013). These prevalence rates starkly contrast with past-year rates of suicide ideation (17.7%) and attempts (8.6%) found among the general youth population (Kann et al., 2016). Given these high rates of suicidal thoughts and behaviors among youth with bipolar disorder, as well as the devastating consequences of suicide for families (Cerel et al., 2008), increased efforts are needed to identify and understand the associated features of bipolar disorder that may elevate suicide risk.

One associated feature of bipolar disorder that may increase suicide risk is sleep disturbances (Bernert, Kim, Iwata, & Perlis, 2015; Goldstein, Bridge, & Brent, 2008; Nadorff, Nazem, & Fiske, 2013; Pigeon, Piquart, & Conner, 2012; Sjöström, Wærn, & Hetta, 2007). Prominent examples of sleep disturbances include insomnia (i.e., difficulties falling or staying asleep, waking up too early) and nightmares (i.e., frightening dreams). Sleep disturbances are a core feature of bipolar disorder, present in both manic and depressive phases (Harvey et al., 2009). Parent-reported restless sleep and nightmares have also been found to be significantly more prevalent among youth with bipolar disorder than matched controls (Mehl et al., 2006). Though no study of which we are aware has examined sleep disturbances and suicide risk among individuals with bipolar disorder, among the general population, sleep disturbances appear to serve as a potent suicide risk factor (Bernert et al., 2015; Bernert and Joiner, 2007).

For example, Goldstein and colleagues (2008) examined the psychological autopsies of 140 adolescents who died by suicide and found higher rates of insomnia in the week prior to their death compared to community controls, even after controlling for the possible effects of a current affective disorder diagnosis (e.g., bipolar disorder). Regarding nightmares and suicide risk, few studies have examined samples of children and adolescents. A study of young adults found that nightmares were associated with suicidal ideation even after controlling for the effects of insomnia as well as symptoms of posttraumatic stress disorder (PTSD), anxiety, and depression (Nadorff et al., 2011). The potent effects of nightmares on suicide risk have similarly been observed among adult psychiatric inpatient samples

(Sjöström et al., 2007), and of particular concern, nightmares have also been shown to predict death by suicide (Tanskanen et al., 2001).

These findings converge with a meta-analysis of 39 studies, which found that insomnia (RR = 2.84, 95% CI = 2.44-3.31), nightmares (RR = 2.61, 95% CI = 2.03-3.36), and other sleep disturbances (RR = 2.72, 95% CI = 2.00-3.70) were significantly associated with increased risk for any suicide-related outcome (i.e., suicide ideation, attempts, or fatalities; Pigeon et al., 2012). Importantly, sleep disturbances have been shown to predict suicide risk independent of one another as well as of other risk factors, including depression and hopelessness (Bernert and Joiner, 2007; Bernert and Nadorff, 2015). Thus, insomnia and nightmares provide incremental information regarding suicide risk (Pigeon et al., 2012; Ribeiro et al., 2012). Together, findings suggest that both insomnia and nightmares are implicated in suicide risk, including among youth (Liu, 2004; Liu and Buysse, 2006).

Given that sleep disturbances are common among youth with bipolar disorder and are also independently implicated in suicide risk, comorbid sleep disorders may augment risk for suicide. Thus, utilizing a large sample of children and adolescents diagnosed with bipolar I disorder, manic or mixed phase, the purpose of this study is to examine the relationship between current and lifetime *DSM-IV* sleep disorders and current suicide risk. The specific comorbid *DSM-IV* sleep disorders examined were nightmare disorder, sleep terror disorder, and sleepwalking disorder. Due to the nature of the data collected for the larger study from which these data were obtained, we were unable to investigate other sleep disorders, such as insomnia, which also demonstrate strong associations with suicidal thoughts and behaviors (Bernert et al., 2015; Chu et al., 2016; Pigeon et al., 2012). Since sleep disturbances, such as nightmares, are common reactions to trauma (American Psychiatric Association, 1994) and also commonly co-occur with anxiety (Alfano et al., 2007), we also examined the relationship between sleep disturbances and suicide risk controlling for the possible confounding effects of trauma exposure and a comorbid generalized anxiety disorder (GAD) diagnosis. In exploratory analyses, we also examined models controlling for depression symptoms (see Rogers et al., 2016, for a discussion of issues inherent in controlling for depression symptoms when examining suicidality as the outcome variable).

## Method

### Participants and Procedures

Participants were individuals aged 6 to 15 years (mean±SD = 10.2±2.7 years) who participated in the baseline assessment for the Treatment of Early Age Mania (TEAM) study (53.8% female; 73.6% white, 17.9% black, and 8.5% other). The TEAM study was a controlled, randomized, 8-week parallel comparison of the efficacy and tolerability of three antimanic medications (i.e., risperidone, lithium carbonate, and divalproex sodium) as an initial treatment for bipolar I disorder, mixed or manic phase (Geller et al., 2012).

Participants were recruited from one of five medical centers from 2003 to 2008. Study eligibility criteria included: (1) *DSM-IV* diagnosis of bipolar I disorder, manic or mixed episode, for at least four consecutive weeks preceding the baseline assessment; (2) poor overall functioning as assessed by the Children's Global Assessment Scale (CGAS; Bird, Canino, Rubio-Stipec, & Ribera, 1987; i.e., a score of 60 or less at baseline); and (3) good

physical health. Study exclusion criteria included: (1) IQ less than 70; (2) lifetime history of schizophrenia, pervasive developmental disorder, or major medical or neurological disease; (3) substance use dependency, alcohol or drug abuse within the four weeks prior to baseline; (4) currently pregnant, sexually active and not using contraceptives, or nursing; (5) imminent suicide risk; or (6) lifetime history of receiving psychotropics being investigated in this study or their equivalents. Further details of the study methodology, including allowed polypharmacy, have been reported elsewhere (Geller et al., 2012). Consent was obtained from the caretakers and assent was obtained from the youth. All procedures were approved by the human studies committees at each site. Individuals in the present secondary analysis include all youth who met eligibility criteria and were assigned to a stratum for randomization ( $N = 379$ ).

## Measures

**Washington University in St. Louis Kiddie Schedule for Affective Disorders and Schizophrenia (WASH-U-KSADS; Geller et al., 2001, 2012)**—The WASH-U-KSADS is a semi-structured clinical interview administered by trained researchers to parents and children separately to assess for the presence of current and lifetime *DSM-IV* psychiatric disorders. The WASH-U-KSADS was utilized to make diagnostic determinations regarding current and lifetime bipolar I disorder (the primary inclusion criteria for the TEAM study), as well as current and lifetime sleep disorders (i.e., nightmare, sleep terror, and sleepwalking) and a current GAD diagnosis. Research has documented the reliability of the WASH-U-KSADS (Geller et al., 2001).

Further, given that the vast majority of trauma-exposed individuals report nightmares (Leskin et al., 2002), the WASH-U-KSADS was also utilized to derive an approximation of trauma exposure for utilization as a control in analyses. Specifically, the posttraumatic stress disorder (PTSD) section assesses lifetime exposure to a Criterion A traumatic event. This criterion is necessary but not sufficient for a PTSD diagnosis; however, only a small proportion (i.e., 0.5%) of individuals in this sample met *DSM-IV* diagnostic criteria for PTSD, whereas a greater proportion was exposed to a Criterion A trauma (i.e., 32.5%). Thus, the variable assessing exposure to Criterion A events provides a more encompassing index of trauma exposure and, as such, was utilized as a control in logistic regression analyses.

**Children's Depression Rating Scale—Revised (CDRS-R; Poznanski & Mokros, 1996)**—The CDRS-R is a clinician-rated assessment of depression symptoms. In this study, Item 13 was utilized to assess current suicide risk, specifically. Responses on this item are coded by an examiner from 1 to 7, and increasing scores reflect more severe suicide risk (1 = “Understands the word *suicide*, but does not apply the term to himself/herself,” 2 = “Sharp denial of suicidal thoughts,” 3 = “Has thoughts about suicide, or of hurting himself/herself [if he/she does not understand the concept of suicide], usually when angry,” 4 = No anchor provided, 5 = “Has recurrent thoughts of suicide,” 6 = No anchor provided, and 7 = “Has made a suicide attempt within the last month or is actively suicidal”). Consistent with past research (Salpekar et al., 2015), responses were bifurcated such that scores 2 suggest low suicide risk and scores 3 indicate the presence of increased suicide risk. Since this measure

assesses both current suicidal ideation as well as lifetime suicidal behavior, this variable is collectively referred to as *suicide risk*. The convergence of these suicide-related metrics as an indicator of suicide risk is consistent with gold-standard approaches (Batterham et al., 2015; Osman et al., 2001). The CDRS-R is a reliable and valid measure (Brooks and Kutcher, 2001), and the suicidality item, specifically, has demonstrated convergent validity (Poznanski et al., 1984).

### Data Analysis Strategy

First, we utilized descriptive statistics to characterize the sample and identify rates of *DSM-IV* sleep disorders and CDRS-R suicide risk. Next, we constructed a series of logistic regression models with the presence of each sleep disorder (i.e., nightmare, sleep terror, sleepwalking) serving as a predictor variable and suicide risk serving as the criterion variable. We constructed uncontrolled models as well as models controlling for trauma history and GAD. As noted, trauma history was included as a control given that trauma exposure is associated with the experience of nightmares (American Psychiatric Association, 2013; Leskin et al., 2002). GAD was included as a control based on past research demonstrating that of children with GAD, nightmares are among the most commonly reported sleep complaint (Alfano et al., 2006). All analyses were conducted with SPSS version 23.

### Results

Of the 379 children and adolescents with bipolar I disorder, 216 (57.0%) screened positive for elevated suicide risk. Regarding current sleep disorders, 96 (25.3%) met *DSM-IV* diagnostic criteria for nightmare disorder, 17 (4.5%) for sleep terror disorder, and 27 (7.1%) for sleepwalking disorder. Regarding lifetime sleep disorders, 136 (35.9%) met *DSM-IV* diagnostic criteria for nightmare disorder, 41 (10.8%) for sleep terror disorder, and 49 (12.9%) for sleepwalking disorder. Overall, 53 (14.0%) met *DSM-IV* diagnostic criteria for a current GAD diagnosis and 123 (32.5%) reported a *DSM-IV* PTSD Criterion A trauma.

Results of the logistic regression analyses revealed that participants with a current comorbid nightmare disorder versus those without were nearly twice as likely to screen positive for suicide risk in an uncontrolled model (OR = 1.833, 95% CI = 1.126-2.984,  $p = 0.015$ ), a model controlling for trauma history (aOR = 1.814, 95% CI = 1.112-2.958,  $p = 0.017$ ), and a model controlling for trauma history and a comorbid GAD diagnosis (aOR = 1.773, 95% CI = 1.085-2.898,  $p = 0.022$ ). Findings persisted when examining a lifetime nightmare disorder diagnosis as the predictor variable in an uncontrolled model (OR = 1.647, 95% CI = 1.069-2.539,  $p = 0.024$ ), a model controlling for trauma history (aOR = 1.626, 95% CI = 1.053-2.510,  $p = 0.028$ ), and a model controlling for trauma history and GAD diagnosis (aOR = 1.581, 95% CI = 1.021-2.449,  $p = 0.040$ ). There were no significant effects on suicide risk of a current or lifetime comorbid sleep terror disorder or a current or lifetime comorbid sleepwalking disorder in both uncontrolled and controlled models (Table 1).

## Exploratory Analyses

**Specificity of nightmare disorder**—We additionally conducted exploratory analyses to determine if the association between nightmare disorder and suicide risk remains statistically significant when controlling for the other sleep disorders (i.e., sleep terror disorder and sleepwalking disorder). Such a finding would suggest that it is not simply the functional impairment or distress associated with sleep disorders that are associated with suicide risk but instead is a unique feature of the nightmares themselves. Indeed, even controlling for sleep terror disorder and sleepwalking disorder, the presence of a comorbid nightmare disorder was significantly associated with increased suicide risk in models not also controlling for trauma history and/or GAD (current diagnoses: aOR = 1.890, 95% CI = 1.143-3.125,  $p = 0.013$ ; lifetime diagnoses: aOR = 1.621, 95% CI = 1.049-2.507,  $p = 0.030$ ) and models also controlling for trauma history (current diagnoses: aOR = 1.884, 95% CI = 1.138-3.121,  $p = 0.014$ ; lifetime diagnoses: aOR = 1.611, 95% CI = 1.040-2.494,  $p = 0.033$ ) as well as trauma history and GAD (current diagnoses: aOR = 1.846, 95% CI = 1.112-3.064,  $p = 0.018$ ; lifetime diagnoses: aOR = 1.570, 95% CI = 1.011-2.437,  $p = 0.045$ ).

**Depression symptoms**—To determine if the significant effects of a comorbid nightmare disorder on suicide risk persist beyond depression symptoms, we constructed additional models with depression symptoms included as a covariate. We present these analyses as exploratory for two reasons. First, recent research has highlighted issues inherent in covarying depression symptoms out of a suicidality criterion variable (see Rogers et al., 2016). Second, the only measure available in the dataset that assesses depression symptoms is the CDRS-R. As noted, the suicidality item from the CDRS-R was used as the criterion variable in this study. Thus, controlling for symptoms assessed via the same measure as the criterion variable may pose measurement issues. Nevertheless, we constructed a CDRS-R total score that removed the suicidality variable, and we utilized this new variable as a control. Findings revealed that a current nightmare disorder was associated with increased likelihood of screening positive for suicide risk when (1) controlling for depression symptoms (OR = 1.695, 95% CI = 1.025-2.805,  $p = 0.040$ ), (2) controlling for depression symptoms in addition to trauma history (OR = 1.690, 95% CI = 1.020-2.799,  $p = 0.042$ ), and (3) controlling for depression symptoms, trauma history, and a GAD diagnosis (OR = 1.687, 95% CI = 1.017-2.797,  $p = 0.043$ ). Regarding lifetime nightmare disorder diagnoses, results were non-significant, though trending in the expected direction, across models controlling for (1) depression symptoms (OR = 1.476, 95% CI = 0.943-2.309,  $p = 0.089$ ), (2) depression symptoms and trauma history (OR = 1.464, 95% CI = 0.935-2.293,  $p = 0.096$ ), and (3) depression symptoms, trauma history, and a GAD diagnosis (OR = 1.461, 95% CI = 0.931-2.293,  $p = 0.099$ ).

**Age**—Although the sample is composed of mostly children, we were interested to see if effects differed by age. As such, we conducted exploratory analyses to determine if age moderated the association between nightmare disorder and suicide risk. To conduct these moderation analyses, the PROCESS macro within SPSS was utilized, consistent with recommendations by Hayes (2013). The PROCESS macro allows for a bootstrap approach to moderation testing, which is ideal given the relatively fewer number of adolescents compared to children in our sample. Findings revealed that age did not interact with present



and lifetime diagnoses of nightmare disorder in the prediction of suicide risk across an uncontrolled model (present:  $p = 0.920$ ; lifetime:  $p = 0.301$ ) and models controlling for trauma history (present:  $p = 0.988$ ; lifetime:  $p = 0.266$ ) and trauma history and a GAD diagnosis (present:  $p = 0.982$ ; lifetime:  $p = 0.293$ ).

## Discussion

The present study found that among children and adolescents with bipolar I disorder, mixed or manic phase, the presence of a current or lifetime comorbid sleep disorder—namely, nightmare disorder—was associated with increased suicide risk. These effects were significant even after controlling for trauma exposure, a GAD diagnosis, and depression symptoms, suggesting that a nightmare disorder is uniquely associated with elevated suicide risk. In contrast, neither the presence of a co-occurring sleep terror disorder nor sleepwalking disorder appeared to be associated with elevated suicide risk in both uncontrolled and controlled models.

Together, these findings extend a growing compendium of research demonstrating robust links between sleep disturbances and suicide risk across populations (Bernert et al., 2015; Pigeon et al., 2012). Specifically, research has demonstrated that nightmares are cross-sectional correlates of elevated suicide risk (Nadorff et al., 2013) and also prospectively predict subsequent suicide attempts (Sjostrom et al., 2009) and death by suicide (Tanskanen et al., 2001). Consistent with past research (Bernert and Joiner, 2007; Bernert and Nadorff, 2015), the present study also demonstrated that the effects of nightmares on suicide risk persist even after controlling for psychiatric symptoms such as depression and anxiety, as well as trauma exposure (see Nadorff et al., 2011).

The present study extends this literature in four important ways. First, whereas several studies have examined insomnia and suicide risk among children and adolescents (e.g., Goldstein et al., 2008), few studies of which we are aware have examined nightmares and suicide risk among this unique population. Second, this study examined nightmares as a *DSM* diagnosis based on a semi-structured clinical interview, rather than self-reported nightmare symptom severity. Therefore, individuals in this sample with a nightmare disorder experienced a degree of nightmares associated with clinically significant distress and/or impairment (American Psychiatric Association, 1994). Third, this study examined the effects of sleep disorders among an already high suicide risk sample, that is, individuals with bipolar I disorder (Hauser et al., 2013). Finally, this study demonstrated that the association between nightmares and suicide risk among children and adolescents exists irrespective of trauma exposure, GAD, and depression symptoms. This finding is consistent with past research among other samples (Bernert and Joiner, 2007; Bernert and Nadorff, 2015) and is important in demonstrating that nightmares need not occur only in the context of PTSD, anxiety, or depression to amplify suicide risk. Though the mechanisms by which nightmares confer risk for suicide are heretofore unknown, findings of the present study have implications for the assessment and management of suicide risk among youth with bipolar disorder.

## Clinical Implications

Existing suicide risk assessment frameworks highlight the importance of monitoring the concomitant presence of psychiatric disorders, such as bipolar disorder, as well as the presence, severity, and content of nightmares, specifically (Chu et al., 2015; Joiner et al., 1999). Indeed, the presence of nightmares, regardless of whether they reach the threshold for a diagnosis of nightmare disorder, indicate particularly elevated risk (Bernert et al., 2015). The present study suggests that the presence of a nightmare disorder among an already high-risk group—that is, youth with bipolar disorder—is a notable risk correlate of suicide risk, above and beyond the effects of trauma exposure and GAD. Thus, assessing for nightmares may provide unique information regarding suicide risk.

Briefly, regarding the treatment of nightmare disorder, the American Academy of Sleep Medicine (AASM) recommends the provision of imagery rehearsal therapy (IRT; Aurora et al., 2010). IRT is a cognitive behavior therapy (CBT)-based approach in which the nightmare is recalled, modified to yield a more positive outcome, and rehearsed regularly to change the narrative and in turn mitigate the attendant negative cognitive and physical symptoms. Although IRT has been adapted for use in children and adolescents (Simard and Nielsen, 2009; St-Onge et al., 2009), we are unaware of any study examining its efficacy in youth with bipolar disorder, specifically. When nightmares are present, IRT may augment existing pharmacotherapy and psychotherapy for bipolar disorder, including interpersonal and social rhythm therapy (IPSRT), for which psychoeducation about sleep hygiene is a core component (Hlastala et al., 2010). The reader is referred to Nadorff and colleagues (2014) for a comprehensive review of pharmacological and non-pharmacological treatments for nightmare disorder. Of note, preliminary evidence among the general population suggests that targeting sleep disturbances, such as nightmares, may in turn mitigate suicide risk (Ellis et al., 2017). Given the results of the present study, in which youth with bipolar disorder and a comorbid nightmare disorder were at markedly increased risk for suicide, we welcome further intervention research.

## Limitations

Our results must be interpreted in the context of several study limitations. First, the data are cross-sectional, and the temporality between bipolar I disorder, sleep disorders, and suicide risk cannot be definitively established. Second, the *DSM-IV* was utilized for diagnostic determinations. Although the use of the *DSM-5* diagnostic criteria would enhance the relevance of this study to contemporary clinical practice, the *DSM-5* was not published at the time of data collection. Third, participants in this study are individuals seeking treatment, and findings may not generalize to non-treatment-seeking youth with bipolar disorder. Fourth, as noted, compared to the sample prevalence rate for a current diagnosis of nightmare disorder (25.3%), the prevalence rates of a current sleep terror disorder (4.5%) and current sleepwalking disorder (7.1%) in our sample were relatively low. Accordingly, it is possible that we were underpowered to detect an effect on suicide risk for current diagnoses of these latter two sleep disorders. Fifth, although individuals with suicidality who were stable enough for outpatient care were not excluded from this study, imminent suicide risk was a study exclusion criterion; it is possible that this may have diminished the sizes of effects observed. Sixth, although adolescents were included in this study, the sample was



comprised predominately of children (i.e., mean age of 10.2 years); since sleep disturbances may manifest differently for children versus adolescents, results may not generalize to an older adolescent sample. Nevertheless, in exploratory moderation analyses, effects did not appear to differ by age. Seventh, as noted, the available data precluded an investigation of other sleep disturbances, such as insomnia or circadian rhythm sleep problems. Relatedly, we were also unable to assess for other important indicators of sleep disturbance, such as sleep time. We were also unable to investigate if antidepressant use was associated with an increase in the frequency or intensity of nightmares. Finally, the larger study from which these data were obtained was not designed to comprehensively assess suicide risk and all its nuances (i.e., separate ratings of ideation, intent, plans, preparations, and attempts). However, the index of suicide risk utilized in this study is an approximation of overall suicide risk, and provides an initial step in understanding the ways in which bipolar disorder and sleep disorders interact to confer risk for suicide.

## Conclusions

Children and adolescents with bipolar I disorder, mixed or manic phase, are at increased risk for suicide. This risk may be augmented in the presence of a comorbid sleep disorder—namely, nightmare disorder. Clinicians assessing and treating suicide risk among youth with bipolar disorder should consider the presence of a co-occurring nightmare disorder.

## Acknowledgments

The authors gratefully acknowledge the pivotal contributions of Barbara Geller, M.D., of Washington University, in designing and overseeing this project from its inception through to its publication.

Funding: The Treatment of Early Age Mania (TEAM) study was supported by National Institute of Mental Health (NIMH) grants U01 MH064846, U01 MH064850, U01 MH064851, U01 MH064868, U01 MH064869, U01 MH064887, U01 MH064911, and R01 MH051481. The opinions and assertions contained in this report are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of Health and Human Services, NIH, or NIMH.

Mr. Stanley and Dr. Joiner were supported in part by the Military Suicide Research Consortium (MSRC), an effort supported by the Office of the Assistant Secretary of Defense for Health Affairs under Award No. (W81XWH-10-2-0181, W81XWH-16-2-0003). Opinions, interpretations, conclusions and recommendations are those of the authors and are not necessarily endorsed by the MSRC or the Department of Defense.

**Disclosures/Conflicts of Interest:** The following authors report no disclosures relevant to this article: Ian H. Stanley, M.S., Melanie A. Hom, M.S., Thomas E. Joiner, Ph.D. Joan L. Luby, M.D., has received funding from the National Institute of Mental Health (NIMH) & Guilford Press. Paramjit T. Joshi, M.D., has no financial disclosures. She reports leadership roles with the American Board of Psychiatry and Neurology (ABPN) & Children's National Medical Center. Karen D. Wagner, M.D., Ph.D., has received honorarium from UBM Medica. Graham J. Emslie, M.D., reports acting as a consultant for the following institutions: Allergan; Assurex Health, Inc.; INC Research, Inc.; Lundbeck; NCS Pearson; Neuronetics; Otsuka; Pfizer Inc.; & Texas Dept. of State Health Services. He also reports research support from Duke University (Pfizer) & the Forest Research Institute, Inc. (partner of Merck KgaA). John T. Walkup, M.D., has past research support for federally funded studies including free drug and placebo from Pfizer's pharmaceuticals in 2007 to support the Child Adolescent Anxiety Multimodal study; free medication from Abbott pharmaceuticals in 2005 for the Treatment of the Early Age Media study; free drug and placebo from Eli Lilly in 2003 for the Treatment of Adolescents with Depression study. He currently receives research support from the Tourette's Association of America and the Hartwell Foundation. He also receives royalties from Guilford Press and Oxford Press for multi-author books published about Tourette syndrome. David A. Axelson, M.D., reports acting as a consultant for Janssen Research & royalties from Wolters Kluwer/UpToDate.

## References

- Alfano CA, Beidel DC, Turner SM, Lewin DS. Preliminary evidence for sleep complaints among children referred for anxiety. *Sleep Med.* 2006; 7:467–473. DOI: 10.1016/j.sleep.2006.05.002 [PubMed: 16931154]
- Alfano CA, Ginsburg GS, Kingery JN. Sleep-related problems among children and adolescents with anxiety disorders. *J Am Acad Child Adolesc Psychiatry.* 2007; 46:224–232. DOI: 10.1097/01.chi.0000242233.06011.8e [PubMed: 17242626]
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition: DSM-5.* American Psychiatric Association; Washington, DC: 2013.
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV).* American Psychiatric Association; Washington, DC: 1994.
- Aurora RN, Zak RS, Auerbach SH, Casey KR, Chowdhuri S, Karippot A, Maganti RK, Ramar K, Kristo DA, Bista SR, Lamm CI, Morgenthaler TI. Best practice guide for the treatment of nightmare disorder in adults. *J Clin Sleep Med.* 2010; 6:389–401. [PubMed: 20726290]
- Batterham PJ, Ftanou M, Pirkis J, Brewer JL, Mackinnon AJ, Beautrais A, Fairweather-Schmidt AK, Christensen H. A systematic review and evaluation of measures for suicidal ideation and behaviors in population-based research. *Psychol Assess.* 2015; 27:501–512. DOI: 10.1037/pas0000053 [PubMed: 25496086]
- Bernert RA, Joiner TE. Sleep disturbances and suicide risk: A review of the literature. *Neuropsychiatr Dis Treat.* 2007; 3:735–743. [PubMed: 19300608]
- Bernert RA, Kim JS, Iwata NG, Perlis ML. Sleep disturbances as an evidence-based suicide risk factor. *Curr Psychiatry Rep.* 2015; 17:554. doi: 10.1007/s11920-015-0554-4 [PubMed: 25698339]
- Bernert RA, Nadorff MR. Sleep disturbances and suicide risk. *Sleep Med Clin.* 2015; 10:35–39. DOI: 10.1016/j.jsmc.2014.11.004 [PubMed: 26055671]
- Bird HR, Canino G, Rubio-Stipec M, Ribera JC. Further measures of the psychometric properties of the Children's Global Assessment Scale. *Arch Gen Psychiatry.* 1987; 44:821–824. [PubMed: 3632256]
- Brent DA, Mann JJ. Family genetic studies, suicide, and suicidal behavior. *Am J Med Genet Part C Semin Med Genet.* 2005; 133C:13–24. DOI: 10.1002/ajmg.c.30042 [PubMed: 15648081]
- Brent DA, Perper JA, Moritz G, Allman C, Friend A, Roth C, Schweers J, Balach L, Baugher M. Psychiatric risk factors for adolescent suicide: A case-control study. *J Am Acad Child Adolesc Psychiatry.* 1993; 32:521–529. DOI: 10.1097/00004583-199305000-00006 [PubMed: 8496115]
- Brooks SJ, Kutcher S. Diagnosis and measurement of adolescent depression: A review of commonly utilized instruments. *J Child Adolesc Psychopharmacol.* 2001; 11:341–376. DOI: 10.1089/104454601317261546 [PubMed: 11838819]
- Centers for Disease Control and Prevention [CDC]. *WISQARS: Web-Based Injury Statistics Query and Reporting System.* 2017.
- Cerel J, Jordan JR, Duberstein PR. The impact of suicide on the family. *Crisis.* 2008; 29:38–44. DOI: 10.1027/0227-5910.29.1.38 [PubMed: 18389644]
- Chu C, Hom MA, Rogers ML, Stanley IH, Ringer FB, Podlogar MC, Hirsch JK, Joiner TE. Insomnia and suicide-related behaviors: A multi-study investigation of thwarted belongingness as a distinct explanatory factor. *J Affect Disord.* 2016; doi: 10.1016/j.jad.2016.08.065
- Chu C, Klein KM, Buchman-Schmitt JM, Hom MA, Hagan CR, Joiner TE. Routinized assessment of suicide risk in clinical practice: An empirically informed update. *J Clin Psychol.* 2015; 71:1186–1200. DOI: 10.1002/jclp.22210 [PubMed: 26287362]
- Ellis TE, Rufino KA, Nadorff MR. Treatment of nightmares in psychiatric inpatients with imagery rehearsal therapy: An open trial and case series. *Behav Sleep Med.* 2017; :1–14. DOI: 10.1080/15402002.2017.1299738
- Geller B, Luby JL, Joshi P, Wagner KD, Emslie G, Walkup JT, Axelson DA, Bolhofner K, Robb A, Wolf DV, Riddle MA, Birmaher B, Nusrat N, Ryan ND, Vitiello B, Tillman R, Lavori P. A randomized controlled trial of risperidone, lithium, or divalproex sodium for initial treatment of bipolar I disorder, manic or mixed phase, in children and adolescents. *Arch Gen Psychiatry.* 2012; 69:515–528. DOI: 10.1001/archgenpsychiatry.2011.1508 [PubMed: 22213771]

- Geller B, Tillman R, Bolhofner K, Zimmerman B. Child bipolar I disorder: Prospective continuity with adult bipolar I disorder; characteristics of second and third episodes; predictors of 8-year outcome. *Arch Gen Psychiatry*. 2008; 65:1125–1133. DOI: 10.1001/archpsyc.65.10.1125 [PubMed: 18838629]
- Geller B, Tillman R, Craney JL, Bolhofner K. Four-year prospective outcome and natural history of mania in children with a prepubertal and early adolescent bipolar disorder phenotype. *Arch Gen Psychiatry*. 2004; 61:459–467. DOI: 10.1001/archpsyc.61.5.459 [PubMed: 15123490]
- Geller B, Zimmerman B, Williams M, Bolhofner K, Craney JL, Delbello MP, Soutullo C. Reliability of the Washington University in St. Louis Kiddie Schedule for Affective Disorders and Schizophrenia (WASH-U-KSADS) mania and rapid cycling sections. *J Am Acad Child Adolesc Psychiatry*. 2001; 40:450–455. DOI: 10.1097/00004583-200104000-00014 [PubMed: 11314571]
- Goldstein TR, Birmaher B, Axelson D, Ryan ND, Strober MA, Gill MK, Valeri S, Chiappetta L, Leonard H, Hunt J, Bridge JA, Brent DA, Keller M. History of suicide attempts in pediatric bipolar disorder: Factors associated with increased risk. *Bipolar Disord*. 2005; 7:525–535. DOI: 10.1111/j.1399-5618.2005.00263.x [PubMed: 16403178]
- Goldstein TR, Bridge JA, Brent DA. Sleep disturbance preceding completed suicide in adolescents. *J Consult Clin Psychol*. 2008; 76:84–91. DOI: 10.1037/0022-006x.76.1.84 [PubMed: 18229986]
- Harvey AG, Talbot LS, Gershon A. Sleep disturbance in bipolar disorder across the lifespan. *Clin Psychol Sci Pract*. 2009; 16:256–277. DOI: 10.1111/j.1468-2850.2009.01164.x
- Hauser M, Galling B, Correll CU. Suicidal ideation and suicide attempts in children and adolescents with bipolar disorder: A systematic review of prevalence and incidence rates, correlates, and targeted interventions. *Bipolar Disord*. 2013; 15:507–523. DOI: 10.1111/bdi.12094 [PubMed: 23829436]
- Hayes, AF. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. Guilford Press; New York, NY: 2013.
- Hlatala SA, Kotler JS, McClellan JM, McCauley EA. Interpersonal and social rhythm therapy for adolescents with bipolar disorder: Treatment development and results from an open trial. *Depress Anxiety*. 2010; 27:457–464. DOI: 10.1002/da.20668 [PubMed: 20186968]
- Inder ML, Crowe MT, Luty SE, Carter JD, Moor S, Frampton CM, Joyce PR. Prospective rates of suicide attempts and nonsuicidal self-injury by young people with bipolar disorder participating in a psychotherapy study. *Aust New Zeal J Psychiatry*. 2016; 50:167–173. DOI: 10.1177/0004867415622268
- Joiner TE, Walker RL, Rudd DM, Jobes DA. Scientizing and routinizing the assessment of suicidality in outpatient practice. *Prof Psychol Res Pract*. 1999; 30:447–453. DOI: 10.1037/0735-7028.30.5.447
- Kann L, McManus T, Harris WA, Shanklin SL, Flint KH, Hawkins J, Queen B, Lowry R, Olsen EO, Chyen D, Whittle L, Thornton K, Lim C, Yamakawa Y, Brener N, Zaza S. Youth Risk Behavior Surveillance—United States, 2015. *Morb Mortal Wkly Rep*. 2016; 65
- Kochman FJ, Hantouche EG, Ferrari P, Lancrenon S, Bayart D, Akiskal HS. Cyclothymic temperament as a prospective predictor of bipolarity and suicidality in children and adolescents with major depressive disorder. *J Affect Disord*. 2005; 85:181–189. DOI: 10.1016/j.jad.2003.09.009 [PubMed: 15780688]
- Leskin GA, Woodward SH, Young HE, Sheikh JI. Effects of comorbid diagnoses on sleep disturbance in PTSD. *J Psychiatr Res*. 2002; 36:449–452. DOI: 10.1016/S0022-3956(02)00025-0 [PubMed: 12393315]
- Liu X. Sleep and adolescent suicidal behavior. *Sleep*. 2004; 27:1351–1358. [PubMed: 15586788]
- Liu X, Buysse DJ. Sleep and youth suicidal behavior: A neglected field. *Curr Opin Psychiatry*. 2006; 19:288–293. DOI: 10.1097/01.yco.0000218600.40593.18 [PubMed: 16612215]
- Mehl RC, O'Brien LM, Jones JH, Dreisbach JK, Mervis CB, Gozal D. Correlates of sleep and pediatric bipolar disorder. *Sleep*. 2006; 29:193–197. DOI: 10.1093/sleep/29.2.193 [PubMed: 16494087]
- Nadorff MR, Lambdin KK, Germain A. Pharmacological and non-pharmacological treatments for nightmare disorder. *Int Rev Psychiatry*. 2014; 26:225–236. DOI: 10.3109/09540261.2014.888989 [PubMed: 24892897]

- Nadorff MR, Nazem S, Fiske A. Insomnia symptoms, nightmares, and suicide risk: Duration of sleep disturbance matters. *Suicide Life-Threatening Behav.* 2013; 43:139–149. DOI: 10.1111/sltb.12003
- Nadorff MR, Nazem S, Fiske A. Insomnia symptoms, nightmares, and suicidal ideation in a college student sample. *Sleep.* 2011; 34:93–98. DOI: 10.1093/sleep/34.1.93 [PubMed: 21203379]
- Osman A, Bagge CL, Gutierrez PM, Konick LC, Kopper BA, Barrios FX. The Suicidal Behaviors Questionnaire-Revised (SBQ-R): Validation with clinical and nonclinical samples. *Assessment.* 2001; 8:443–454. DOI: 10.1177/107319110100800409 [PubMed: 11785588]
- Pigeon WR, Piquart M, Conner K. Meta-analysis of sleep disturbance and suicidal thoughts and behaviors. *J Clin Psychiatry.* 2012; 73:e1160–e1167. DOI: 10.4088/JCP.11r07586 [PubMed: 23059158]
- Poznanski, E., Mokros, H. *Children's Depression Rating Scale-Revised (CDRS-R)*. Western Psychological Services; Los Angeles, CA: 1996.
- Poznanski EO, Grossman JA, Buchsbaum Y, Banegas M, Freeman L, Gibbons R. Preliminary studies of the reliability and validity of the Children's Depression Rating Scale. *J Am Acad Child Psychiatry.* 1984; 23:191–197. DOI: 10.1097/00004583-198403000-00011 [PubMed: 6715741]
- Ribeiro JD, Pease JL, Gutierrez PM, Silva C, Bernert RA, Rudd MD, Joiner TE. Sleep problems outperform depression and hopelessness as cross-sectional and longitudinal predictors of suicidal ideation and behavior in young adults in the military. *J Affect Disord.* 2012; 136:743–750. DOI: 10.1016/j.jad.2011.09.049 [PubMed: 22032872]
- Rogers ML, Stanley IH, Hom MA, Chiurliza B, Podlogar MC, Joiner TE. Conceptual and empirical scrutiny of covarying depression out of suicidal ideation. *Assessment.* 2016; doi: 10.1177/1073191116645907
- Salpekar JA, Joshi PT, Axelson DA, Reinblatt SP, Yenokyan G, Sanyal A, Walkup JT, Vitiello B, Luby JL, Wagner KD, Nusrat N, Riddle MA. Depression and suicidality outcomes in the Treatment of Early Age Mania study. *J Am Acad Child Adolesc Psychiatry.* 2015; 54:999–1007.e4. DOI: 10.1016/j.jaac.2015.09.016 [PubMed: 26598475]
- Simard V, Nielsen T. Adaptation of imagery rehearsal therapy for nightmares in children: A brief report. *Psychother Theory, Res Pract Train.* 2009; 46:492–497. DOI: 10.1037/a0017945
- Sjostrom N, Hetta J, Waern M, Sjöström N, Hetta J, Waern M. Persistent nightmares are associated with repeat suicide attempt: a prospective study. *Psychiatry Res.* 2009; 170:208–211. DOI: 10.1016/j.psychres.2008.09.006 [PubMed: 19900715]
- Sjöström N, Wærn M, Hetta J. Nightmares and sleep disturbances in relation to suicidality in suicide attempters. *Sleep.* 2007; 30:91–95. DOI: 10.1093/sleep/30.1.91 [PubMed: 17310869]
- St-Onge M, Mercier P, De Koninck J. Imagery rehearsal therapy for frequent nightmares in children. *Behav Sleep Med.* 2009; 7:81–98. DOI: 10.1080/15402000902762360 [PubMed: 19330581]
- Tanskanen A, Tuomilehto J, Viinamaki H, Vartiainen E, Lehtonen J, Puska P. Nightmares as predictors of suicide. *Sleep.* 2001; 24:844–847. DOI: 10.1093/sleep/24.7.845 [PubMed: 11683487]

**Table 1**  
**Logistic Regression Models Examining Current and Lifetime DSM-IV Sleep Disorder Diagnoses as Predictors of Suicide Risk Among Children and Adolescents with DSM-IV Bipolar I Disorder, Mixed or Manic Phase**

	Suicide Risk									
	Uncontrolled			Controlled for Trauma History			Controlled for Trauma History and Current GAD			p
	OR	95% CI	p	aOR	95% CI	p	aOR	95% CI	p	
<b>Nightmare Disorder (Current)</b>										
Current Diagnosis	1.833	1.126-2.984	0.015	1.814	1.112-2.958	0.017	1.773	1.085-2.898	0.022	
Trauma History	--	--	--	1.462	0.937-2.281	0.095	1.444	0.924-2.257	0.106	
GAD	--	--	--	--	--	--	1.430	0.770-2.655	0.258	
<b>Nightmare Disorder (Lifetime)</b>										
Lifetime Diagnosis	1.647	1.069-2.539	0.024	1.626	1.053-2.510	0.028	1.581	1.021-2.449	0.040	
Trauma History	--	--	--	1.457	0.934-2.272	0.097	1.439	0.921-2.247	0.110	
GAD	--	--	--	--	--	--	1.408	0.758-2.616	0.278	
<b>Sleep Terror Disorder (Current)</b>										
Current Diagnosis	1.404	0.508-3.879	0.513	1.328	0.478-3.690	0.587	1.285	0.460-3.592	0.632	
Trauma History	--	--	--	1.470	0.945-2.289	0.088	1.449	0.929-2.258	0.102	
GAD	--	--	--	--	--	--	1.504	0.815-2.777	0.192	
<b>Sleep Terror Disorder (Lifetime)</b>										
Lifetime Diagnosis	1.074	0.556-2.072	0.833	1.044	0.539-2.022	0.899	1.031	0.531-2.000	0.929	
Trauma History	--	--	--	1.480	0.951-2.303	0.082	1.456	0.935-2.270	0.097	
GAD	--	--	--	--	--	--	1.514	0.821-2.792	0.184	
<b>Sleepwalking Disorder (Current)</b>										
Current Diagnosis	0.939	0.427-2.065	0.876	0.892	0.403-1.972	0.777	0.875	0.395-1.940	0.742	
Trauma History	--	--	--	1.489	0.956-2.319	0.078	1.466	0.940-2.286	0.092	
GAD	--	--	--	--	--	--	1.520	0.824-2.805	0.180	
<b>Sleepwalking Disorder (Lifetime)</b>										
Lifetime Diagnosis	1.350	0.726-2.510	0.343	1.251	0.667-2.346	0.486	1.221	0.649-2.296	0.536	
Trauma History	--	--	--	1.448	0.926-2.262	0.104	1.428	0.913-2.235	0.119	
GAD	--	--	--	--	--	--	1.498	0.811-2.767	0.196	

*Note.* Statistically significant effects are bolded. GAD = generalized anxiety disorder.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript