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Sleep problems and suicide attempts among adolescents: A case-control study

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Abstract

This study used a case-control design to compare sleep disturbances in forty adolescents who attempted suicide with forty never-suicidal adolescents. Using hierarchical logistic regression analyses, we found that self-reported nighttime awakenings were significantly associated with attempted suicide, after controlling for antidepressant use, antipsychotic use, affective problems, and being bullied. In a separate regression analysis, the parent-reported total sleep problems score also predicted suicide attempt status, controlling for key covariates. No associations were found between suicide attempts and other distinct sleep problems, including falling asleep at bedtime, sleeping a lot during the day, trouble waking up in the morning, sleep duration, and parent-reported nightmares. Clinicians should be aware of sleep problems as potential risk factors for suicide attempts for adolescents.

Keywords

suicide attempts; adolescence; sleep disturbances; case-control

1. Introduction

As the third leading cause of death among teenagers aged 15 to 19 years, adolescent suicide remains a paramount public health issue in the United States (Cash & Bridge, 2009). A prior suicide attempt is the most powerful risk factor for completed suicide in youths (Brent et al., 1999; Shaffer et al., 1996). In 2009, 15.8% of students in grades 9 through 12 seriously considered attempting suicide and 7.8% attempted suicide one or more times in the previous 12 months (Eaton et al., 2012).

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Another problematic health concern during adolescence is poor sleeping patterns. At approximately 11%, a relatively high proportion of adolescents suffer from insomnia according to DSM-IV criteria (Johnson et al., 2006). As youths progress into adolescence, marked changes in sleep occur, including delayed sleep phase and decreased sleep duration (Colrain & Baker, 2011). Difficulty sleeping increases the probability of substance abuse disorders, anxiety disorders, depression, suicidal thoughts, and suicide attempts (Brower et al., 2010; Carskadon, 1990; Neckelmann et al., 2007; Roane & Taylor, 2008; Teplin et al., 2006).

Adolescent suicidality and sleep problems are associated with other risk behaviors. Childhood bullying has been noted as a risk factor for attempted and completed suicide (Klomek et al., 2009). Studies have also suggested that children who have been bullied are significantly more likely to report difficulties sleeping and that bullying can lead to medication use to resolve sleep problems in adolescents (Due et al., 2007; Williams et al., 1996).

In addition to bullying, adolescent psychotropic medication use is associated with suicidal ideation, suicide attempts, and sleep problems. Sleep problems are among the most common side effects of selective serotonin reuptake inhibitor (SSRI) medications (Birmaher et al., 2007). While Bridge and colleagues (2007) concluded that the benefits of antidepressants generally outweigh their risks, they cautioned that antidepressants led to a small increased risk in ideation/attempts relative to placebos in pediatric mood and anxiety disorder trials. In addition, sedation and chronic insomnia are common sleep disturbances associated with some of the atypical and conventional antipsychotic medications (Miller, 2004).

Seven previous studies have directly studied suicide attempts and sleep problems in adolescents (Bailly et al., 2004; Fitzgerald et al., 2011; Liu, 2004; Nrugham et al., 2008; Vignau et al., 1997; Wong et al., 2011; Wong & Brower, 2012). All studies but the Bailly et al. (2004) and Vignau et al. (1997) investigations controlled for depression, a characteristic that is significantly linked with both suicide attempts and sleep problems (Bridge et al., 2006; Roberts et al., 2012). However, none of these previous studies controlled for bullying or psychotropic medication use.

In the present study, we sought to clarify the association between adolescent suicide attempts and sleep concerns while considering potential confounding variables such as bullying and psychotropic medication use. While previous studies on sleep and adolescent suicide attempt were either longitudinal or cross sectional, our study utilized a case-control design to investigate whether sleep disturbances differentiated adolescents with a recent history of suicide attempt from youths who have psychiatric symptoms but have never been suicidal. We hypothesized that suicide attempters would report more sleep problems than comparison subjects and that group differences in sleep problems would persist after controlling for potential confounders, like affective problems, psychotropic medication use, and bullying.

2. Methods

This study is a secondary analysis of data collected for investigation of impaired decision making in adolescent suicide attempters. For a more detailed description of methods from the original study, refer to Bridge et al. (2012).

2.1 Participants and Procedures

The sample in this study included 40 adolescents, 13 through 18 years of age, who had attempted suicide and 40 adolescents who had never engaged in suicidal behavior or had suicidal ideation. As this study matched suicide attempters with comparison subjects on age (± 1 year), sex, and race, the demographic variables were consistent between groups (Table 1). The suicide attempters were a convenience sample recruited from local community behavioral health services and the emergency department of a large metropolitan children's hospital, and were primarily female (75%) and white (70%). Comparison subjects were recruited from the same community behavioral health service settings.

To be considered for the study, both groups had to have at least one parent or legal guardian who was available for direct interview and willing to participate in the study. For this study, suicide attempt was defined as self-injurious behavior with stated or inferred intent to die, within 1 year of the recruitment date. Youths exhibiting self-injurious behavior that was purely self-mutilatory in nature (e.g. self-cutting) were excluded from both groups. Additional exclusion criteria for both suicide attempters and comparison subjects were IQ < 70, non-English-speaking, and out of home placement. The overall study participation rate among eligible suicide attempters was 60% (40/67). The participation rate among comparison subjects who consented to the study was 82% (40/49). Inability to contact families and failure to show for scheduled appointments were the reasons for nonparticipation. The study was approved by the Institutional Review Board of The Research Institute at Nationwide Children's Hospital. Informed consent and assent were obtained from all participants and their parents (if the participant was <18 years of age).

2.2 Measures

Suicidality—During separate interviews, both adolescents and parents completed interviews and questionnaires on various topics related to suicidal behavior. Lifetime history of suicide attempt was assessed through child and parent interviews using the Columbia University Suicide History Form, which investigates number of suicide attempts, methods, medical lethality, and triggering events (Mann et al., 1992). The Pierce Suicide Intent Scale was used to assess contextual factors related to the suicide attempt, including plans, preparation, and lethality (Pierce et al., 1977).

Sleep concerns—Sleep problems in youths were assessed using the BEARS Sleep Screening Questionnaire (Owens & Dalzell, 2005). The following five BEARS questions were asked of the adolescents: 1) "Do you have any problems falling asleep at bedtime?"; 2) "Do you feel sleepy a lot during the day?"; 3) "Do you wake up a lot at night?"; 4) "Do you have trouble getting back to sleep?"; 5) "Do you have trouble waking up in the morning?" We also inquired about the usual time that the youths go to bed and wake up on school days

and weekends. Parents were asked similar questions about their child's sleep but were not asked to complete the item regarding trouble getting back to sleep because it was assumed that the adolescent would be a more accurate informant of this specific sleep problem. Instead, parents were asked, "Do you think your child is getting enough sleep?" We did not specify a timeframe when inquiring about sleep problems using the BEARS. As part of the Child Behavior Checklist (CBCL), the parents also answered a single question about whether their child experienced nightmares in the past six months (Achenbach & Rescorla, 2001). In this study, we evaluated the association between suicidal behavior and each sleep problem. A total BEARS score was also computed, with higher scores indicating more severe sleep disturbance (range=0–5).

Confounding variables—Affective problems in youths were established using the DSM-oriented Affective Problems Scale of the CBCL (Achenbach et al., 2003; Achenbach & Rescorla, 2001); the borderline cut-point (T score ≥ 65) was used to indicate the presence of clinically significant affective problems. T scores at or above this threshold significantly discriminate between children who are referred for mental health services for mood problems and demographically similar children who are not referred (Achenbach & Rescorla, 2001). Participation in bullying was assessed by a single question, "How often have you taken part in bullying another person in the previous month?" (Nansel et al., 2001). Similarly, being bullied was assessed by a single question, "How often have you been bullied in the previous month?" Response categories to questions about bullying ranged from "never" to "more than once a week." Psychotropic medication use was assessed by using the Current Medications Form of the Services Assessment for Children and Adolescents (SACA) (Horwitz et al., 2001; Stiffman et al., 2000). Only adolescents answered the questions related to bullying, while both parents and adolescents filled out the Current Medications Form of the SACA.

2.3 Statistical Analyses

Demographic and clinical characteristics were compared between attempters and comparison subjects by using χ^2, Fisher's exact test, and independent samples t-tests, as appropriate. Multivariate hierarchical logistic regression was used to test whether sleep variables independently contributed to the prediction of suicide attempt status beyond the effect of other predictors. In these regression models, non-sleep factors that significantly differentiated attempters and comparison subjects were entered first. Then, the individual sleep problems that distinguished attempters and comparison subjects were added to the model at the second step. In separate regression models, the same analytic approach was used to test the independent contribution of the total sleep problems score to the prediction of suicide attempt status. All statistical tests were two-tailed, and p values < 0.05 and 95% confidence intervals not containing 1.0 were considered statistically significant. Statistical analyses were conducted with SPSS, version 21.0 (IBM SPSS Statistics, Somers, NY).

3. Results

3.1 Sleep Variables and Suicide Attempt

As shown in Table 2, rates of self-reported waking up a lot at night and trouble getting back to sleep on the BEARS questionnaire were significantly higher in suicide attempters than comparison subjects. Univariate logistic regressions showed that attempters were approximately 4 times more likely than comparison subjects to self-report waking up a lot at night (OR = 4.2; CI = 1.55, 11.55) and approximately 3 times more likely to report having trouble getting back to sleep (OR = 3.4; CI = 1.27, 9.13). According to parent report, the two groups differed significantly with regard to waking up a lot at night. In addition, both self-ratings and parent report of total sleep scores were higher in attempters than comparison subjects, indicating significantly more sleep disturbances.

According to both parent report and adolescent report, there were no significant group differences between suicide attempters and comparison subjects on measures of problems falling asleep at bedtime, sleeping a lot during the day, trouble waking up in the morning, and sleep duration during school nights and weekend nights. Attempters and comparison subjects also showed no significant difference regarding parent-reported nightmares (all p values > .05).

3.2 Non-sleep Variables and Suicide Attempt

Suicide attempters were more likely than comparison subjects to be victims of bullying (35% vs. 15%; $\chi^2 = 4.27$; $p = 0.039$), have clinically significant affective problems (70% vs. 40%; $\chi^2 = 7.27$; $p = 0.007$), and currently use antidepressant medications (57.5% vs. 15%; $\chi^2 = 15.63$; $p < .001$) and antipsychotic medications (32.5% vs. 12.5%; $\chi^2 = 4.59$; $p = .03$) (Table 1).

3.3 Sleep Variables and Suicide Attempt, Controlling for Confounding Factors

Table 3 shows the results of the hierarchical logistic regression analyses used to examine the multivariate associations between specific sleep variables and suicide attempt status. All non-sleep factors that differentiated suicide attempters and comparison subjects—antidepressant use, antipsychotic use, being a victim of bullying, and having an affective problem—were entered in the first step. In Model 1, antidepressant use was the only non-sleep factor that remained a significant predictor of suicide attempt status. In the second step of the analysis (Step 2[a]), parent-reported child waking up a lot at night did not remain a significant predictor of suicide attempt. The parent-reported total sleep problem score, however, predicted suicide attempt status above and beyond the effects of non-sleep factors (Step 2[b]).

In separate logistic regression analyses testing whether self-reported sleep problems predicted suicide attempt status, only waking up a lot at night remained a significant predictor of suicide attempt status after controlling for non-sleep factors (see Table 3, Step 2[c]). The total sleep problem score did not significantly predict suicide attempt status above and beyond the effects of non-sleep factors (Step 2[d]).

3.4 Sensitivity Analysis

In this study, all controls were recruited from community behavioral health services, whereas 26/40 (65%) attempters were recruited from these same settings. Therefore, we examined sleep problems in attempters and comparison subjects recruited only from behavioral health services. These analyses revealed a pattern of sleep disturbance that was very similar to the pattern found between groups in the primary analyses. Specifically, both self-ratings and parent report of total sleep scores were significantly higher in attempters than comparison subjects (p values < 0.05). Attempters also had significantly higher rates of self-reported nighttime awakenings and trouble getting back to sleep, and higher rates of parent-reported nighttime awakenings (p values < 0.05). There were no significant differences between the groups on any other sleep measure.

3.5 Sleep Problems and Characteristics of the Suicide Attempters

Self-reported waking up a lot at night and parent-reported total sleep problem score were not correlated with age at first attempt, lethality of most recent attempt, number of previous attempts, time since most recent attempt, current suicidal ideation, or either of the Suicide Intent Scale subscales (all p values > 0.05).

4. Discussion

This study indicated that among adolescents seeking behavioral health or emergency department services, those who had recently attempted suicide, compared with controls, had four times greater odds of frequent awakenings. Our study is the first to suggest, after controlling for the confounding variables of antidepressant and antipsychotic medication use, affective problems, and bullying, that trouble maintaining sleep is a significant risk factor for adolescent suicide attempt.

Our primary findings are consistent with previous literature that has noted positive associations between sleep problems and suicide attempts in adolescents. Nrugham and colleagues (2008) obtained a result that was very similar to our chief finding; specifically these authors found that adolescents with middle insomnia were six times more likely to attempt suicide relative to those without middle insomnia. However, there was no differentiation between recent suicide attempt and lifetime suicide attempt in Nrugham et al. (2008). The finding of parent-reported total sleep problems predicting suicide attempt status is convergent with several studies that have examined general sleep difficulties and have found a similar association (Bailey et al., 2004; Vignau et al., 1997; Wong et al., 2011; Wong & Brower, 2012). Taken together, these findings suggest that adolescent sleep problems in general and perhaps nighttime awakenings in particular are associated with suicide attempts.

With regard to clinical implications, these findings suggest that focused assessment on sleep problems in adolescents at risk for suicidal behavior may be of particular clinical importance in this population, as sleep disturbances may increase vulnerability to suicidal behavior above and beyond the effects of affective problems and being bullied. Moreover, the BEARS sleep screening tool is a brief, easy to administer, measure that could be used as part of screening efforts or to monitor the success of treatment targeting sleep disturbances.

The potential mechanism linking frequent awakenings to adolescent suicide attempts is unknown. However, we speculate that frequent awakenings may be indicative of cognitive difficulties like hopelessness (Joiner, Brown, & Wingate, 2005) and rumination (Carney, Edinger, Meyer, Lindman, & Istre, 2006).

This study has several potential limitations. First, the data are based upon parent and adolescent report and hence may be subject to recall biases. Polysomnography and actigraphy represent more objective forms of measuring sleep and might increase the validity of the findings. Second, the version of the BEARS questionnaire used in this study did not assess snoring, which has been shown to be associated with depression and other risk behaviors (Beebe et al., 2012). Third, a larger, more diverse sample size would help make the conclusions more applicable to a general population, especially since the sample is primarily female, white, and non-Hispanic. Fourth, this study was a secondary analysis of a prior study (Bridge et al., 2012) and it may have been underpowered to detect differences in some sleep measures (e.g. problems falling asleep, nightmares). Fifth, and perhaps most importantly, the data are cross-sectional and the temporal association between the reported sleep problems and suicide attempts is not determinable from the design of this study. Future research should use longitudinal designs to test the predictive effects of the association between sleep problems and future suicidal behavior. Despite the limitations, it is important to note the main strengths of this study. The case-control design with verification of suicide attempt by clinician rating in the past 12 months and the control of bullying and psychotropic medication use make this study unique.

Conclusion

We found that nighttime awakenings were associated with adolescent suicide attempt after controlling for confounding variables that were not accounted for in previous studies. In addition, total sleep problems as reported by parents were associated with suicide attempts. Based on the results of this study and the emerging literature linking sleep problems with suicidal behavior in youth, suicide prevention efforts may someday benefit from recognizing and treating sleep disturbances.

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References

Achenbach, TM.; Rescorla, LA. Manual for the ASEBA School-Age Forms & Profiles. Burlington, VT: University of Vermont, Research Center for Children, Youth, & Families; 2001.

Achenbach TM, Dumenci L, Rescorla LA. DSM-oriented and empirically based approaches to constructing scales from the same item pools. Journal of clinical child and adolescent psychology: the official journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53. 2003; 32(3):328–340.10.1207/S15374424JCCP3203_02

Bailly D, Bailly-Lambin I, Querleu D, Beuscart R, Collinet C. Sleep in adolescents and its disorders. A survey in schools. L'Encéphale. 2004; 30(4):352–359.

Beebe DW, Rausch J, Byars KC, Lanphear B, Yolton K. Persistent snoring in preschool children: predictors and behavioral and developmental correlates. Pediatrics. 2012; 130(3):382–389.10.1542/peds.2012-0045 [PubMed: 22891224]

Birmaher B, Brent D, Bernet W, Bukstein O, Walter H, Medicus J. AACAP Work Group on Quality Issues. Practice parameter for the assessment and treatment of children and adolescents with depressive disorders. Journal of the American Academy of Child and Adolescent Psychiatry. 2007; 46(11):1503–1526.10.1097/chi.0b013e318145ae1c [PubMed: 18049300]

Brent DA, Baugher M, Bridge J, Chen T, Chiappetta L. Age- and sex-related risk factors for adolescent suicide. Journal of the American Academy of Child and Adolescent Psychiatry. 1999; 38(12):1497–1505.10.1097/00004583-199912000-00010 [PubMed: 10596249]

Brent DA, Perper JA, Moritz G, Allman C, Friend A, Roth C, Baugher M. Psychiatric risk factors for adolescent suicide: a case-control study. Journal of the American Academy of Child and Adolescent Psychiatry. 1993; 32(3):521–529.10.1097/00004583-199305000-00006 [PubMed: 8496115]

Bridge JA, Goldstein TR, Brent DA. Adolescent suicide and suicidal behavior. Journal of child psychology and psychiatry, and allied disciplines. 2006; 47(3–4):372–394.10.1111/j.1469-7610.2006.01615.x

Bridge JA, McBee-Strayer SM, Cannon EA, Sheftall AH, Reynolds B, Campo JV, Brent DA. Impaired decision making in adolescent suicide attempters. Journal of the American Academy of Child and Adolescent Psychiatry. 2012; 51(4):394–403.10.1016/j.jaac.2012.01.002 [PubMed: 22449645]

Brower KJ, McCammon RJ, Wojnar M, Ilgen MA, Wojnar J, Valenstein M. Prescription sleeping pills, insomnia, and suicidality in the National Comorbidity Survey Replication. The Journal of clinical psychiatry. 2011; 72(4):515–521.10.4088/JCP.09m05484gry [PubMed: 20868634]

Carney CE, Edinger JD, Meyer B, Lindman L, Istre T. Symptom-focused rumination and sleep disturbance. Behavioral sleep medicine. 2006; 4(4):228–241.10.1207/s15402010bsm0404_3 [PubMed: 17083303]

Carskadon MA. Patterns of sleep and sleepiness in adolescents. Pediatrician. 1990; 17(1):5–12. [PubMed: 2315238]

Cash SJ, Bridge JA. Epidemiology of youth suicide and suicidal behavior. Current opinion in pediatrics. 2009; 21(5):613–619.10.1097/MOP.0b013e32833063e1 [PubMed: 19644372]

Colrain IM, Baker FC. Changes in sleep as a function of adolescent development. Neuropsychology review. 2011; 21(1):5–21.10.1007/s11065-010-9155-5 [PubMed: 21225346]

Due P, Hansen EH, Merlo J, Andersen A, Holstein BE. Is victimization from bullying associated with medicine use among adolescents? A nationally representative cross-sectional survey in Denmark. Pediatrics. 2007; 120(1):110–117.10.1542/peds.2006-1481 [PubMed: 17606568]

Eaton DK, Kann L, Kinchen S, Shanklin S, Flint KH, Hawkins J, Chyen D. Youth risk behavior surveillance-United States, 2011. MMWR Surveill Summ. 2012; 61(4):1–162. [PubMed: 22673000]

Goldstein TR, Bridge JA, Brent DA. Sleep disturbance preceding completed suicide in adolescents. Journal of consulting and clinical psychology. 2008; 76(1):84–91.10.1037/0022-006X.76.1.84 [PubMed: 18229986]

Horwitz SM, Hoagwood K, Stiffman AR, Summerfeld T, Weisz JR, Costello EJ, Norquist G. Reliability of the services assessment for children and adolescents. Psychiatric services (Washington, DC). 2001; 52(8):1088–1094.

Janelidze S, Mattei D, Westrin Å, Träskman-Bendz L, Brundin L. Cytokine levels in the blood may distinguish suicide attempters from depressed patients. Brain, behavior, and immunity. 2011; 25(2):335–339.10.1016/j.bbi.2010.10.010

Johnson EO, Roth T, Schultz L, Breslau N. Epidemiology of DSM-IV insomnia in adolescence: lifetime prevalence, chronicity, and an emergent gender difference. Pediatrics. 2006; 117(2):e247–256.10.1542/peds.2004-2629 [PubMed: 16452333]

Joiner TE Jr, Brown JS, Wingate LR. The psychology and neurobiology of suicidal behavior. Annual review of psychology. 2005; 56:287–314.10.1146/annurev.psych.56.091103.070320

Klomek AB, Sourander A, Niemelä S, Kumpulainen K, Piha J, Tamminen T, Gould MS. Childhood bullying behaviors as a risk for suicide attempts and completed suicides: a population-based birth cohort study. Journal of the American Academy of Child and Adolescent Psychiatry. 2009; 48(3): 254–261.10.1097/CHI.0b013e318196b91f [PubMed: 19169159]

Liu X. Sleep and adolescent suicidal behavior. Sleep. 2004; 27(7):1351–1358. [PubMed: 15586788]

Mann JJ, McBride PA, Brown RP, Linnoila M, Leon AC, DeMeo M, Stanley M. Relationship between central and peripheral serotonin indexes in depressed and suicidal psychiatric inpatients. Archives of general psychiatry. 1992; 49(6):442–446. [PubMed: 1376106]

Nansel TR, Overpeck M, Pilla RS, Ruan WJ, Simons-Morton B, Scheidt P. Bullying behaviors among US youth: prevalence and association with psychosocial adjustment. JAMA: the journal of the American Medical Association. 2001; 285(16):2094–2100.

Neckelmann D, Mykletun A, Dahl AA. Chronic insomnia as a risk factor for developing anxiety and depression. Sleep. 2007; 30(7):873–880. [PubMed: 17682658]

Nrugham L, Larsson B, Sund AM. Specific depressive symptoms and disorders as associates and predictors of suicidal acts across adolescence. Journal of affective disorders. 2008; 111(1):83–93.10.1016/j.jad.2008.02.010 [PubMed: 18395267]

Owens JA, Dalzell V. Use of the “BEARS” sleep screening tool in a pediatric residents’ continuity clinic: a pilot study. Sleep medicine. 2005; 6(1):63–69.10.1016/j.sleep.2004.07.015 [PubMed: 15680298]

Pandey GN, Rizavi HS, Ren X, Fareed J, Hoppensteadt DA, Roberts RC, Dwivedi Y. Proinflammatory cytokines in the prefrontal cortex of teenage suicide victims. Journal of psychiatric research. 2012; 46(1):57–63.10.1016/j.jpsychires.2011.08.006 [PubMed: 21906753]

Pierce DW. Suicidal intent in self-injury. The British journal of psychiatry: the journal of mental science. 1977; 130:377–385. [PubMed: 870128]

Roane BM, Taylor DJ. Adolescent insomnia as a risk factor for early adult depression and substance abuse. Sleep. 2008; 31(10):1351–1356. [PubMed: 18853932]

Robert G, Zadra A. Measuring nightmare and bad dream frequency: impact of retrospective and prospective instruments. Journal of sleep research. 2008; 17(2):132–139.10.1111/j.1365-2869.2008.00649.x [PubMed: 18482103]

Roberts RE, Duong HT. Depression and insomnia among adolescents: a prospective perspective. Journal of affective disorders. 2013; 148(1):66–71.10.1016/j.jad.2012.11.049 [PubMed: 23261135]

Sahlman J, Miettinen K, Peuhkurinen K, Seppä J, Peltonen M, Herder C. Kuopio Sleep Apnoea Group. The activation of the inflammatory cytokines in overweight patients with mild obstructive sleep apnoea. Journal of sleep research. 2010; 19(2):341–348.10.1111/j.1365-2869.2009.00787.x [PubMed: 20040038]

Shaffer D, Gould MS, Fisher P, Trautman P, Moreau D, Kleinman M, Flory M. Psychiatric diagnosis in child and adolescent suicide. Archives of general psychiatry. 1996; 53(4):339–348. [PubMed: 8634012]

Spirito A, Esposito-Smythers C. Attempted and completed suicide in adolescence. Annual review of clinical psychology. 2006; 2:237–266.10.1146/annurev.clinpsy.2.022305.095323

Stiffman AR, Horwitz SM, Hoagwood K, Compton W 3rd, Cottler L, Bean DL, Weisz JR. The Service Assessment for Children and Adolescents (SACA): adult and child reports. Journal of the American Academy of Child and Adolescent Psychiatry. 2000; 39(8):1032–1039.10.1097/00004583-200008000-00019 [PubMed: 10939232]

Teplin D, Raz B, Daiter J, Varenbut M, Tyrrell M. Screening for substance use patterns among patients referred for a variety of sleep complaints. The American journal of drug and alcohol abuse. 2006; 32(1):111–120. [PubMed: 16450646]

Tishler CL, McKenry PC, Morgan KC. Adolescent suicide attempts: some significant factors. Suicide & life-threatening behavior. 1981; 11(2):86–92. [PubMed: 7256821]

Vignau J, Bailly D, Duhamel A, Vervaecke P, Beuscart R, Collinet C. Epidemiologic study of sleep quality and troubles in French secondary school adolescents. The Journal of adolescent health: official publication of the Society for Adolescent Medicine. 1997; 21(5):343–350.10.1016/S1054-139X(97)00109-2 [PubMed: 9358298]

Williams K, Chambers M, Logan S, Robinson D. Association of common health symptoms with bullying in primary school children. BMJ (Clinical research ed). 1996; 313(7048):17–19.

Wojnar M, Ilgen MA, Wojnar J, McCammon RJ, Valenstein M, Brower KJ. Sleep problems and suicidality in the National Comorbidity Survey Replication. Journal of psychiatric research. 2009; 43(5):526–531.10.1016/j.jpsychires.2008.07.006 [PubMed: 18778837]

Wong MM, Brower KJ. The prospective relationship between sleep problems and suicidal behavior in the National Longitudinal Study of Adolescent Health. Journal of psychiatric research. 2012; 46(7):953–959.10.1016/j.jpsychires.2012.04.008 [PubMed: 22551658]

Wong MM, Brower KJ, Zucker RA. Sleep problems, suicidal ideation, and self-harm behaviors in adolescence. Journal of psychiatric research. 2011; 45(4):505–511.10.1016/j.jpsychires.2010.09.005 [PubMed: 20889165]

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TABLE 1

Characteristics of Adolescents with Recent History of Suicide Attempt and Non-Suicidal Comparison Subjects

Characteristic	Suicide Attempters (*n*=40)		Comparison Subjects (*n*=40)		Analysis		
	Mean	**SD**	**Mean**	**SD**	**Statistic**	**df**	***P*-Value**
Age (years)[a]	15.5	1.4	15.6	1.4	t=−0.28	78	0.81
	N	**%**	***n***	**%**			
Female[a]	30	75.0	30	75.0			
Race/ethnicity[a]							
White, non-Hispanic	28	70.0	28	70.0			
Black	10	25.0	10	25.0			
Other race	1	2.5	1	2.5			
Hispanic	1	2.5	1	2.5			
Lives with both biological parents	12	30.0	14	35.0	χ^2=0.2	1	0.63
Suicide attempt method							
Ingestion	27	67.5					
Cutting	9	22.5					
Asphyxia/hanging	4	10.0					
Bullying measures							
Victim of bullying (past month)	14	35.0	6	15.0	χ^2=4.27	1	0.039
Perpetrator of bullying (past month)	9	22.5	9	22.5	χ^2=.00	1	1.00
Current Affective Disorder (CBCL)[b]	28	70.0	16	40.0	χ^2=7.27	1	0.007
Psychotropic Medication Use							
Antidepressants	23	57.5	6	15.0	χ^2=15.63	1	<0.001
Antipsychotics	13	32.5	5	12.5	χ^2=4.59	1	0.032
Mood stabilizers	6	15.0	1	2.5	FET	1	.108
Stimulants	2	5.0	7	17.5	FET	1	.154
Anti-anxiety agents	3	7.5	0	0.0	FET	1	.241

[a] Comparison subjects were matched to suicide attempters on age (± 1 year), sex, and race.

[b] Based on Child Behavior Checklist (CBCL) DSM-IV-Oriented Scales (borderline cut-off scores, T ≥ 65) FET indicates Fisher's exact test

TABLE 2

Sleep Disturbances in Suicide Attempters and Non-Suicidal Comparison Subjects

Characteristic	Suicide Attempters (*n*=40)		Comparison Subjects (*n*=40)		Analysis		
	Mean	**SD**	**Mean**	**SD**	**Statistic**	**df**	***P*-Value**
Sleep Duration Parent							
Number of hours sleep school nights	8.04	1.25	8.03	1.08	t=−0.013	77	0.990
Number of hours sleep weekend nights	10.23	1.64	10.13	1.41	t=−0.29	76	0.773
Sleep Duration Child							
Number of hours sleep school nights	7.78	1.51	7.75	1.51	t=−0.06	76	0.951
Number of hours sleep weekend nights	9.46	2.33	9.56	2.17	t=0.19	77	0.847
Total Sleep Score - Parent	2.54	0.85	2.00	0.93	t=2.67	77	0.009
Total Sleep Score - Child	2.85	1.59	2.03	1.23	t=2.59	78	0.011
	N	**%**[b]	**N**	**%**			
Parent-reported Nightmares (CBCL)	14	35.0	11	27.5	χ^2=1.56	1	0.469
BEARS Sleep Measures - Parent							
Problems falling asleep at bedtime	26	68.4	18	48.6	χ^2=3.02	1	0.082
Getting enough sleep	16	47.1	21	53.6	χ^2=0.34	1	0.563
Wakes up a lot at night	10	30.3	3	9.7	χ^2=4.20	1	0.040
Trouble waking up in the morning	21	52.5	16	40	χ^2=1.26	1	0.262
Sleepy during the day	27	71.1	23	57.5	χ^2=1.56	1	0.212
BEARS Sleep Measures - Child							
Problems falling asleep at bedtime	22	57.9	18	47.4	χ^2=0.358	1	0.358
Wakes up a lot at night	21	53.8	8	21.6	χ^2=8.36	1	0.004
Trouble getting back to sleep	19	51.4	9	23.7	χ^2=6.134	1	0.013
Trouble waking up in the morning	23	62.2	20	52.6	χ^2=0.696	1	0.404
Sleepy during the day	29	72.5	26	66.7	χ^2=0.318	1	0.573

[*] P-value < 0.05

TABLE 3

Summary of Hierarchical Logistic Regression Analyses Predicting Suicide Attempt Status

Variable	*β*	SE	Adjusted Odds Ratio	95% Confidence Interval	*P* Value
Model 1 adding parent-reported sleep data at step 2					
Step 1					
Antidepressant use	2.50	0.75	12.18	(2.78, 53.37)	.001
Antipsychotic use	1.14	0.75	3.13	(0.72, 13.58)	.128
Victim of bullying	0.73	0.73	2.08	(0.50, 8.73)	.315
Affective disorder	0.10	0.75	1.11	(0.26, 4.80)	.893
Step 2[a]					
Child waking up a lot at night	−0.08	1.00	0.93	(0.13, 6.62)	.939
Step 2[b]					
Total sleep score	0.77	0.38	2.15	(1.01, 4.57)	.046
Model 2 adding self-reported sleep data at step 2					
Step 1					
Antidepressant use	1.97	0.62	7.17	(2.12, 24.26)	.002
Antipsychotic use	1.07	0.66	2.91	(0.80, 10.52)	.104
Victim of bullying	1.08	0.67	2.94	(0.80, 10.85)	.105
Affective disorder	−0.24	0.63	0.78	(0.23, 2.70)	.699
Step 2[c]					
Waking up a lot at night	1.42	0.64	4.13	(1.19, 14.35)	.026
Trouble getting back to sleep	0.37	0.65	1.44	(0.40, 5.18)	.575
Step 2[d]					
Total sleep score	0.35	0.19	1.42	(0.97, 2.06)	.070

[a] Includes all variables in Step 1 of model + Parent-reported child wakes up a lot at night

[b] Includes all variables in Step 1 of model + Parent-reported total sleep problems score

[c] Includes all variables in Step 1 of model + Self-reported waking up a lot at night and Self-reported trouble getting back to sleep

[d] Includes all variables in Step 1 of model + Self-reported total sleep problems score