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Poor sleep associates with recent nonsuicidal self-injury engagement in adolescents

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Abstract

Objective/Background: Poor sleep has been shown to have multiple negative outcomes during adolescence, in both academic and mental health domains. Several studies have identified the association between poor sleep and suicide risk in adolescents. However, onset of and engagement in nonsuicidal self-injury (NSSI) is also common in this age group, but this behavior has rarely been studied in association with sleep in adolescent samples. In the current study, it was expected that poorer sleep and more symptoms of insomnia would associate with a greater likelihood of recent NSSI engagement and greater NSSI severity.

Participants: Data were collected from 387 community adolescents (mean age = 14.19, SD=1.08), 9% of whom reported NSSI in the past 6 months. The gender breakdown was about even (52% female) and the majority of the sample was White (88.5%).

Methods: Adolescent participants were recruited from middle and high schools for a study on mental health and risk behaviors. Researchers visited schools and administered self-report questionnaires to students in large groups. Measures assessed NSSI engagement and severity features, overall sleep quality, and insomnia symptoms.

Results: Results indicated that greater insomnia symptoms, but not overall sleep quality, significantly associated with greater likelihood of recent NSSI engagement. Sleep variables were not significantly associated with NSSI severity among adolescents with recent NSSI.

Conclusions: Insomnia symptoms seem to be associated with recent engagement in NSSI. Adolescents who report symptoms of insomnia should also be assessed for self-harm behavior.

Conflict of Interest: The authors have no conflicts of interest to report

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Keywords

adolescence; sleep; nonsuicidal self-injury; insomnia

Sleep quality is a notable concern during adolescence with the majority of adolescents reporting insufficient sleep (McKnight-Elly et al., 2011). Specifically, 70% of adolescents report getting insufficient sleep on the average school night (McKnight-Elly et al., 2011) and nearly 10% of adolescents report experiencing insomnia symptoms (Roane & Taylor, 2008). Previous research has found poor sleep in adolescents to be associated with a variety problematic outcomes including substance use (alcohol, marijuana, and tobacco), increased feelings of hopelessness, increased diagnosis of depression, and increased risk for suicide (Lundh, Bjarehed, & Wangby-Lundh, 2012; Mcknight-Elly et al., 2011; Roane & Taylor, 2008). However, even with a growing body of research linking poor sleep to suicide risk, there are very few studies that have examined the link between nonsuicidal self-injury (NSSI) and sleep in samples of non-clinical adolescents. Given the high prevalence rates of both NSSI behavior and poor sleep in adolescents, it is important to determine how poor sleep is associated with NSSI behavior and its severity.

NSSI has been a focus of research in the adolescent demography for close to two decades and is defined as the deliberate destruction of one's own body tissue, for reasons not socially sanctioned, and without suicidal intent (Nock, 2009). The most common forms of NSSI are cutting, burning, scratching, and hitting one's self (Klonsky & Muehlenkamp, 2010). NSSI often emerges in adolescence (Nock, 2009) and rates of adolescent engagement in non-clinical samples are around 20% (Swannell, Martin, Page, Hasking, & St John, 2014). NSSI is particularly problematic due to its association with difficulties in affect regulation (Nock, 2009) and suicidal behaviors; among adolescents with a history of NSSI, 70% have made at least one lifetime suicide attempt and 55% have made multiple attempts (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). Adolescents who engage in NSSI are more likely to engage in other health and risk behaviors, such as disordered eating and substance use (Brausch & Boone, 2015; Brausch & Gutierrez, 2010). NSSI is also associated with greater psychopathology, such as emotion dysregulation, and depressive symptoms (Buckholdt et al., 2015; Kerr & Muehlenkamp, 2010; Marshall, Tilton-Weaver, & Stattin, 2013). Given the strong overlap between NSSI and other maladaptive health and risk behaviors, it is surprising that very little research has focused on the association between poor sleep and NSSI behavior.

A larger body of research is available linking poor sleep to suicide risk in adolescents, as poor sleep has been consistently linked to suicide ideation (Choquet & Menke, 1989; Franic, Kralj, Marcinko, Knez, & Kardum, 2014; Park, Yoo, & Kim, 2013; Wong, Brower, & Zucker, 2010), suicide attempts (Koyawala, Stevens, McBee-Stayer, Cannon, & Bridge, 2015; Nrugham, Larsson, & Sund, 2008), and deaths by suicide (Goldstein, Bridge, & Brent, 2008). Additionally, the relationship between sleep and suicide is evident for a wide variety of sleep characteristics including general sleep problems (Choquet & Menke, 1989; Franic et al., 2014), sleep duration (Matamura, 2014; Park et al., 2013), non-restorative sleep (Park et

al., 2013), insomnia symptoms (Goldstein et al., 2008), and waking at night (Koyawala et al., 2015; Nrugham, et al., 2008).

Due to the association between suicide and NSSI, one would expect a relationship between NSSI and sleep as well. However, there are a limited number of existing studies that have examined this association, particularly in adolescents, and most studies are lacking in comprehensive assessment of either NSSI, sleep, or both. In a population-based study of Norwegian adolescents, those reporting a history of deliberate self-harm had poorer sleep quality than those with no self-harm history. However, assessment of deliberate self-harm included intentional overdose and self-injury and did not make a distinction about intent to die (Hysing, Sivertsen, Stormark, & O'Conner, 2015). Additionally, any (lifetime) NSSI was assessed and compared to current sleep quality making it difficult to draw conclusions about the relationship between recent NSSI and sleep quality (Hysing et al., 2015). In a sample of non-clinical Chinese adolescents, a number of poor sleep markers were associated with a greater likelihood of recent NSSI engagement, but NSSI was assessed as a dichotomous variable and NSSI severity was not examined (Liu, Chen, Bo, Fan, & Jia, 2016). A longitudinal study using a sample of Swedish adolescent girls found that poor sleep at an earlier time point predicted later engagement in NSSI using a valid measure of recent (previous 6 months) NSSI (Lundh et al., 2012), but assessment of sleep was limited to one dichotomous item that asked adolescents if they slept well. Regarding samples from the United States, only two identified studies have examined the connection between NSSI and sleep. One study found that nightmares, but not insomnia symptoms, were significantly associated with NSSI in both clinical and university samples of adults (Ennis et al., 2017); however, this study included only adults and assessed any NSSI (lifetime) making it impossible to know if the sleep problems were present at the same time as NSSI engagement. Further, this study only looked at the occurrence of NSSI with a single item and did not look at frequency or severity of NSSI in relation to sleep (Ennis et al., 2017). The other study conducted in the United States found that adolescents presenting to an outpatient clinic with more severe sleep complaints reported greater NSSI frequency compared to those without sleep complaints (McGlinchey, Courtney-Seidler, German, & Miller, 2017). Unfortunately, this study used questions from a depression measure to assess sleep quality and also assessed for lifetime NSSI rather than recent NSSI (McGlinchey et al., 2017). Once again, the disconnect between the timeframe of the sleep difficulties and NSSI engagement creates a problem when interpreting the results related to NSSI engagement and sleep quality.

As mentioned, all existing studies on NSSI and sleep are limited in their measurement of NSSI, most often relying on a single item or dichotomous questions to categorize adolescents as having or not having NSSI behavior (Liu, et al., 2016). Additionally, not all studies exclusively studied NSSI, as some did not explicitly assess self-harm with no suicidal intent (Hysing et al., 2015). Utilizing a comprehensive assessment of NSSI behavior that includes questions about its severity will help to address this gap in the existing literature. There are similar limitations with the comprehensiveness of assessment for sleep in studies to date, with some researchers using very few items or novel measurements of sleep rather than validated sleep measures (e.g. Lundh et al., 2013; McGlinchey et al., 2017). The one study that used comprehensive measures for sleep and NSSI included an adult

sample and was conducted outside the United States (Hysing et al., 2015). However, the measure for sleep quality was created for that study, and separately examined responses to questions about insomnia symptoms, time asleep, time in bed, and daytime napping. Finally, as previously noted, many of these studies assessed lifetime NSSI engagement although sleep measures assessed current sleep behaviors making it hard to accurately interpret these findings given the disconnect in the timeframe of the measures (Ennis et al., 2017; Hysing et al., 2015; McGlinchey et al., 2017).

To summarize, general understanding of the association between nonsuicidal self-injury and sleep characteristics is nascent at this time, particularly for non-clinical adolescents. It appears that only one study to date has examined sleep and NSSI using comprehensive measures for both (Hysing et al., 2015); however, this study used a broader definition of deliberate self-harm and was not limited to NSSI. Previous research does suggest a significant relationship between poor sleep and likelihood of engagement in NSSI (Hysing et al., 2015; Ennis et al., 2017; Lui et al., 2016; Lundh et al., 2013; McGlinchey et al., 2016); however, further investigation is needed to examine this relationship more thoroughly using validated measures for both NSSI and sleep quality. Further, there is a need for research that assesses specific time frames for poor sleep and NSSI rather than examining current sleep behavior as it relates to lifetime NSSI. Research could benefit enormously from assessing recent NSSI and its relationship with current sleep behaviors as this would improve understanding of the concurrent relationship between the two. Additionally, no previous research has examined how NSSI severity, including frequency and versatility (number of NSSI methods), may associate with poor sleep.

Rationale and Hypotheses

In this study, the goal was to expand upon the limited body of research examining the relationship between sleep and NSSI in non-clinical adolescents. This study fills a previous gap in the literature by using an unselected, community adolescent sample in the United States and validated measurements to assess both sleep and NSSI. Additionally, this study seeks to provide further information regarding the association between sleep quality and insomnia symptoms and both recent (past 6 months) NSSI engagement and NSSI severity, an aspect that previous research has yet to investigate. Due to the association between NSSI and a variety of negative outcomes in adolescents (increased substance use, increased likelihood of mental illness diagnosis, and increased risk for suicide) understanding potential concurrent maladaptive behaviors is important (Brausch & Boone, 2015; Nock et al., 2006). Expanding on the current understanding of sleep as a potential correlate to NSSI may play an important role in the development of prevention, detection, and treatment programs for NSSI. The study had three goals: 1) determine if poor sleep was prominent in adolescents with recent NSSI engagement (past 6 months), 2) determine if poor sleep associated with increased likelihood of recent NSSI engagement, and 3) determine if poor sleep significantly associated with greater NSSI severity. First, it was hypothesized that a greater proportion of adolescents with recent NSSI would be categorized as having poor sleep compared to those with no recent NSSI. Next, it was hypothesized that worse sleep (more insomnia symptoms and poorer overall sleep quality) would be significantly associated with recent NSSI engagement. Finally it was expected that among adolescents with recent NSSI, worse sleep

quality and greater insomnia symptoms would associate with greater NSSI severity (frequency and versatility). Sleep variables were expected to associate with NSSI engagement and severity after controlling for the effects of depressive symptoms in all analyses.

Method

Participants

Data were collected as part of an on-going study on the development of NSSI and suicidal behaviors in a community sample of adolescents. Data for the current study were taken from the third time-point when measures of sleep quality were added. Adolescents were initially assessed at baseline and then at 6-month follow-ups. At the third time point, 387 adolescents participated, split evenly between 8th graders and 10th graders. The mean age was 14.19 (*SD* = 1.08) with a range of 13–17. Most participants identified as female (52%) or male (46.9%) and 1.2% identified as transgendered or "other." Most of the sample also identified as heterosexual (88.4%), with some students identifying as gay or lesbian (1.1%), bisexual (1.4%), "not sure" (4.6%) and "decline to state" (1.5%). In terms of racial diversity, 88.5% of the participants identified as White; 2.9% as Black, 6.3% as Multiethnic, 1.3% as Asian, and 1% did not respond. Most participants identified as non-Hispanic/Latino (94%). See Table 1 for details on participant demographics.

Procedure

Data collection occurred at two public middle and high schools in the south-central region of the United States. The research study was approved by administration at all school districts and the Institutional Review Board at Western Kentucky University. Active parental consent was required and parent consent forms were sent home with all 7th grade students at two middle schools (~700 students), and all 9th grade students at two high schools (~476 students). The response rate for 7th graders was 42.7% (n=299; 257 positive consent, 42 negative) and for 9th graders was 47.5% (n=226; 221 positive consent, 5 negative). Adolescent participants with positive parent consent were also given a written assent form to complete before beginning the study. Out of 478 total positive parent consent forms returned 91.2% of adolescents participated in the study at Time 1 (n=436) and 387 participated at Time 3 (data for current study; retention rate of 88%). Data collection occurred during school hours at each school in the spring, most often in the morning hours, and all participants at completed the research study in one large group (e.g., spread out in the school cafeteria) or in individual classrooms. The Ph.D.-level researcher was present at all data collection sessions, in addition to up to four master's level graduate students and up to 6 undergraduate research assistants. Students were informed that they may be referred to speak to a school counselor if the research team assessed their responses to indicate suicide risk.

The research team was present during each data collection session and answered questions from participants. As students completed their packets, measures were checked by the research team to ensure complete participation. After all students were dismissed back to class, packets were thoroughly checked for pre-determined critical items from several

measures that indicate suicide risk. If a student was determined to be at risk on any of the identified measures, he or she was called out of a different class period later in the day to follow-up with a school counselor. An Intervention Record was completed by the research team for each identified student to classify them at one of three levels of severity (Low, Moderate, or High) with a recommendation for follow-up (ranging from monitor/review to immediate interview/follow-up). The completed records were left with the school counselors at each school to facilitate follow-up with the identified students. In the current study, 5.2% of participants (n=19; 10 high school, 9 middle school) were determined to be at increased risk and referred to school counselors for further assessment and intervention. At all schools, counselors assisted with parent consent distribution and collection, scheduling and organizing data collection sessions, and agreed to provide follow-up services to students identified as being at risk for suicide behaviors. School counselors followed established policies and procedures at their school for working with students at risk based on their determination of level of intervention needed.

Measures

Demographics.—Participants completed a demographics page that asked for information about age, year in school, race and ethnicity, gender identity, and sexual orientation.

Inventory of Statements About Self-Injury—(ISAS; Klonsky & Glenn, 2009). The ISAS is a self-report measure that assesses engagement in and multiple features of nonsuicidal self-injury. Participants indicate lifetime frequency of all methods of NSSI, and provide details regarding duration, most recent NSSI, and pain experience during NSSI. The ISAS also includes 39 statements about reasons why individuals engage in NSSI (which assesses 13 functions), and participants are asked to rate each reason on a 3-point scale about its relevance to them. The ISAS function scales have demonstrated good internal consistency (α=.80-.88; Klonsky & Glenn, 2009) and test-retest reliability (α =.52-.89; Glenn & Klonsky, 2011). In the current study, instructions on the ISAS were modified to only assess NSSI behaviors in the previous 6 months, and responses for NSSI frequency and NSSI versatility (total number of NSSI methods) were used.

Pittsburgh Sleep Quality Index—(PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is a widely used 19-item self-report questionnaire assessing overall current sleep quality. The PSQI is composed of seven component scores including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction due to sleepiness. The seven component scores are summed to create a global PSQI score. Higher global PSQI scores indicate worse sleep quality and a global PSQI score above 5 indicates poor sleep quality. Cronbach's alpha for the PSQI components (α=.83) demonstrates a coherent overall construct (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). In this study, global PSQI scores were used as one measure of sleep quality and internal consistency was good (α=.73).

Sleep Condition Indicator—(SCI; Espie, Kyle, Hames, Gardani, Fleming, & Cape, 2014). The SCI is an 8-item self-report questionnaire specifically assessing symptoms of insomnia disorder. Items are presented on a 5-point scale ranging from 4 to 0, with higher

responses corresponding to better sleep and lower responses corresponding to poorer sleep. Items are summed and lower scores indicate more insomnia symptoms; total scores at or below 16 indicate probable insomnia disorder. For the current study, total scores from the SCI were used as an indicator of insomnia symptoms. The SCI has shown strong internal consistency (α=.86; Espie et al., 2014), and was also strong in the current study (α=.86).

Reynolds Adolescent Depression Scale – Second Edition (RADS-2; Reynolds, 2002).—The RADS-2 is a 30-item self-report measure intended for use with adolescents between the ages of 11 and 20 and provides a global picture of the severity of all depressive symptoms. A total score is calculated by summing all items. The RADS-2 is presented in a 4-point Likert format ranging from 1 (almost never) to 4 (most of the time). Adolescents are asked to respond to each item by indicating how they usually feel and total scores can range from 30 to 120. The RADS-2 has demonstrated good internal consistency reliability with reliability estimates ranging from .80 to .93 in adolescent samples. For the current study, the internal consistency reliability value was .95 for the overall total. The RADS-2 total score was used as a covariate in all analyses.

Results

Data Management and Analytic Plan

Differences between participants with and without NSSI behavior were examined using chi-square analyses, and differences were found for gender groups (male, female, and transgender) (χ^2 (2) = 10.61, p =.006), but not ethnicity χ^2 (2) =.105, p =.95); however, only four adolescents identified as transgendered and two of them reported NSSI. Although data were collected from 387 adolescents at this particular time point, complications with completion of the two sleep measures resulted in missing or invalid data. The Sleep Condition Index measure had missing data for about 15% of participants, with 309 adolescents completing the measure. Unfortunately, adolescents tended to skip this measure and only complete the PSQI instead. However, the PSQI also had missing or invalid data for about 10% of participants, with 324 adolescents completing the measure in the correct way to allow it to be appropriately scored. Adolescents struggled to provide numerical responses for some items asking about average times they go to sleep and wake-up, and they struggled to provide responses that were feasible (i.e., indicating they sleep more hours per night than they listed as hours spend in bed). Due to the nature of these measures in terms of coding and scoring, it is not possible to impute missing data. Both chi-square and ANOVA were used to check for differences between those who had completed and not completed the SCI and PSQI measures. There were no differences in the proportion of adolescents with and without NSSI across those who completed or did not complete the SCI (χ^2 (1) =.027, p =.87) or the PSQI (χ^2 (1) =.754, p =.39). For completers vs. non-completers of the SCI, ANOVA results found no differences for NSSI frequency, F(1, 360) =.307, p =.58, number of NSSI methods, F(1, 385) =.975, p =.32, or PSQI total score, F(1, 325) =.138, p =.71. For completers vs. non-completers of the PSQI, ANOVA results also found no differences for NSSI frequency, F(1, 360) =.392, p =.53, number of NSSI methods, F(1, 385) =.985, p =.32, or SCI total score, F(1, 309) =.356, p =.55. Given that there were no differences on NSSI severity or sleep scores for adolescents who completed or did not complete either or

both sleep measure, analyses proceeded with participants for whom complete and valid data were available.

Variables were also checked for normality and adjusted as appropriate. Both sleep measures (PSQI and SCI) were normally distributed, but data for measures of NSSI severity were not normally distributed. For the sample of adolescents with recent NSSI (n=33), the distribution for total NSSI frequency was skewed (3.2) and kurtotic (10.3). A square-root transformation resulted in improved values for skew (1.94) and kurtosis (3.17). A similar pattern was seen with NSSI versatility, with the initial distribution having higher than ideal values for skew (2.14) and kurtosis (5.4). A square-root transformation for this variable also resulted in improved values for skew (0.25) and kurtosis (1.31). See Table 1 for descriptive statistics for all study variables.

To test the hypothesis that a greater proportion of adolescents with recent NSSI would be categorized as having poor sleep compared to those with no recent NSSI, chi-square analyses were used. Adolescents were categorized into recent NSSI and no recent NSSI groups, as well as scoring above or below the cut-offs for the overall sleep quality and insomnia measures. To test the hypothesis that poor overall sleep and insomnia symptoms would significantly associate with greater likelihood of recent NSSI engagement, hierarchical logistic regression was used. Depression was entered in the first step, and the total scores for overall sleep quality and insomnia symptoms were entered in the second step. Recent NSSI engagement was entered as the outcome variable and was dichotomous (yes/no). To test the hypothesis that poor sleep and insomnia symptoms would significantly associate with greater NSSI severity in adolescents with recent NSSI (n=33), hierarchical linear regressions were used. Depression was again entered in the first step, followed by total scores for sleep quality and insomnia symptoms. The first model used NSSI frequency in the past 6 months as the outcome variable, and the second model used NSSI versatility in the past 6 months (total # of NSSI methods used) as the outcome variable.

Hypothesis Testing

Hypothesis 1 expected that adolescents with recent NSSI would be more likely to have sleep scores in the poor range and report more insomnia symptoms (based on clinical cut-offs) compared to adolescents without recent NSSI. Chi-square analyses showed that adolescents with recent NSSI were more likely to score above the clinical cut-off on both measures of sleep difficulties. On the PSQI, 80.6% of adolescents with recent NSSI were above the cut-off, indicating overall poor sleep quality, compared to 45% of adolescents with no NSSI, χ^2 (1) = 16.06, p <.001. On the SCI, 27.3% of adolescents with recent NSSI scored above the clinical cut-off for insomnia disorder symptoms compared to only 5.8% of adolescents with no NSSI, χ^2 (1) = 18.28, p <.001.

Hypothesis 2 proposed that poor overall sleep and insomnia symptoms would significantly associate with greater likelihood of recent NSSI engagement. Results from a hierarchical logistic regression found that the overall model was significant, with 40% of the variance explained. After controlling for depression, insomnia symptoms were significantly associated with an increased likelihood of recent NSSI engagement (Odds Ratio [OR] = 1.15, p =.05), but overall sleep quality was not (OR=1.15, p =.23; see Table 2). Bivariate

Spearman correlations were also run between the seven component scores of the PSQI sleep measure and engagement in NSSI (yes/no). Results indicated that subjective sleep quality, sleep latency, sleep disturbances, use of sleep medications, and daytime dysfunction were all significantly and positively correlated with engagement in NSSI (see Supplemental Table 1).

Hypothesis 3 proposed that among adolescents with NSSI behavior in the past 6 months, both poor sleep quality and insomnia symptoms would be significantly associated with greater NSSI severity, as measured by NSSI frequency and versatility in the past 6 months. In the sample, 33 adolescents reported recent NSSI behavior. After controlling for depressive symptoms, the linear regression analysis predicting NSSI frequency found that adding the sleep variables did not add significant variance to the overall model ($F(1, 19) = 2.07$, $p = .16$). However, the total score for insomnia symptoms was trending toward significance as a predictor of NSSI frequency ($\beta = -1.06$, $t = -1.95$, $p = .068$). The analysis predicting NSSI versatility also found that the sleep variables did not add significant variance to the model after controlling for depressive symptoms ($F(1, 22) = 2.24$, $p = .13$). Similarly to the previous model, the total score for insomnia symptoms was again trending toward significance as a predictor of NSSI versatility ($\beta = --0.70$, $t = -2.03$, $p = .056$). See Table 3 for full regression results.

Discussion

Findings from this study suggest that sleep is an important factor for NSSI engagement. Specifically, results from the first two hypotheses demonstrated that poor sleep is a significant risk factor for NSSI behavior. First, it was hypothesized that adolescents with NSSI in the past 6 months would be more likely to have sleep quality scores in the poor range as well as more insomnia symptoms compared to adolescents with no NSSI. This hypothesis was supported as results found 80.6% of those with recent NSSI also fall into the poor overall sleep category compared to 45% without recent NSSI. Results for insomnia symptoms also confirmed this hypothesis, as 27.5% of those with recent NSSI endorsed clinically significant insomnia symptoms compared to 5.8% without recent NSSI. Second, the association of sleep quality and insomnia symptoms with the likelihood of recent NSSI engagement was examined. It was hypothesized that poorer overall sleep quality and more insomnia symptoms would predict greater likelihood of recent NSSI engagement. This hypothesis was partially supported with results showing that more insomnia symptoms, but not poorer overall sleep quality, were significantly predictive of recent NSSI engagement.

These results provide further evidence to support the growing body of literature linking sleep problems and NSSI engagement (Ennis et al., 2017; Hysing et al., 2015; McGlinchey et al., 2017). However, this study is the first to examine this relationship in adolescents using both specific and validated measures for NSSI and sleep. These findings also expand upon previous research by using measures with clinical cutoffs and suggest that recent NSSI engagement is not only associated with worse sleep compared to non-self-injurers, but may also be linked to clinically significant sleep difficulties. These findings have important implications for clinicians working with adolescents. Specifically, monitoring and assessing sleep as well as specific interventions designed to improve sleep hygiene (e.g. Cognitive Behavioral Therapy for Insomnia [CBT-I]) may need to be considered for this population.

Contrary to our hypotheses, poor sleep was not found to associate with increased NSSI severity. In the third hypothesis, the relationship between NSSI severity and both sleep quality and insomnia symptoms were examined in the subsample of adolescents with recent NSSI. It was expected that within this subsample, both poor sleep quality and insomnia symptoms would be significantly associated with greater NSSI severity. After accounting for the effects of depressive symptoms, the addition of sleep variables did not result in overall significance for the model. However, insomnia symptoms were independently associated with NSSI frequency. The sample size for adolescents with recent NSSI was small, and a replication of this study with a larger sample of adolescents with recent NSSI could confirm and provide more evidence for this tentative finding. Overall, these findings suggest that sleep quality, specifically insomnia symptoms, may be an important risk factor for greater NSSI severity and deserves further study.

Findings related to NSSI severity and insomnia symptoms underlines the importance of clinicians assessing and monitoring sleep when working with adolescents. In particular, if a clinician is working with an adolescent who endorses NSSI engagement, sleep quality may be an important indicator of NSSI severity. These clinicians may also consider treatments specifically designed to increase sleep quality such as CBT-I because better sleep may act as a protective factor from more severe NSSI.

There are a few limitations to consider regarding the findings from this study. First, adolescents struggled to complete, as well as provide usable answers to, both the PSQI and SCI. Numerous participants had to be removed from analyses due to non-numeric responses, misunderstanding questions, or not completing the questionnaires. Future studies could consider adapting the PSQI to be more user-friendly, especially for adolescents, or consider the use of an alternative measure designed specifically for use with this age group. Another limitation for this study is the homogenous nature of the sample. The sample for this study was primarily White, non-Hispanic, and therefore not easily generalized to other regions of the United States. Future studies should seek to replicate these findings with a more diverse and nationally representative sample. Additionally, the study used a non-clinical sample; therefore, we have limited base rates of NSSI compared to studies using a clinical sample. However, it is important to examine these issues in a normative, nonclinical sample as well. Finally, this was a cross-sectional design, therefore the causality between sleep quality and insomnia symptoms and NSSI engagement and severity cannot be examined. Future research should employ a longitudinal design in an attempt to examine the casual relationship between sleep and NSSI.

Overall, this study adds to the growing body of literature supporting sleep as an important risk factor for NSSI. These results add to the existing literature by using specific and validated measures of NSSI and sleep, using a community adolescent sample, and examining NSSI engagement and severity. These findings have important implications for future research, clinicians, and public officials and overall suggests adolescent sleep needs to be of greater concern.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Descriptive data for NSSI and no-NSSI groups and means and standard deviations of all study measures across groups

Demographics	**NSSI (*n* = 33)**	**No NSSI (*n* = 354)**
Age (*M, SD*)	14.23 (1.03)	14.19 (1.09)
Gender		
Female	25 (64.1%)	166 (50.6%)
Male	12 (30.8%)	160 (48.8%)
Transgender	0 (0%)	2 (0.6%)
Other	2 (5.2%)	0 (0%)
Ethnicity		
White	33 (8.9%)	269 (85.1%)
Black	1 (2.7%)	9 (2.8%)
Hispanic/Latino	0 (0%)	9 (2.8%)
Native American	0 (0%)	2 (0.6%)
Multi-Ethnic	1 (2.7%)	15 (4.7%)
Other	2 (5.4%)	5 (1.6%)
Sexual Orientation		
Heterosexual/Straight	27 (69.2)	291 (90.4%)
Gay/Lesbian	2 (5.1%)	2 (0.6%)
Bisexual	2 (5.1%)	3 (0.9%)
Other/Not Sure	7 (18.4%)	25 (7.8%)
Study Variables (*M, SD*)		
Depressive Symptoms	75.90 (21.32)	48.06 (13.50)
Insomnia Symptoms	20.85 (7.44)	26.99 (5.19)
Sleep Quality	7.56 (3.70)	4.84 (2.84)

Table 2.

Logistic regression model for sleep variables predicting recent NSSI engagement (n = 252)

Model	B (S.E.)	OR	95% CI	χ^2	Nagelkerke R^2
DV: NSSI Engagement				51.83**	0.40
1. Depressive Symptoms	0.12 (0.02)	1.12**	[1.08, 1.17]		
2. Insomnia Symptoms (SCI)	0.14 (0.07)	1.15*	[1.00, 1.32]		
Sleep Quality (PSQI)	0.14 (0.12)	1.15	[0.92, 1.45]		

* p <.05

** p <.01

Table 3.

Linear regression results for sleep variables predicting NSSI frequency and versatility (n=33)

Model	β	*t*	*F*	R^2
DV: NSSI Frequency				
1. Depressive Symptoms	0.58**	3.10	9.58**	0.34
2. Insomnia Symptoms	−0.93**	−1.95	2.07	0.47
Sleep Quality	−0.52	−1.75		
DV: NSSI Versatility				
1. Depressive Symptoms	0.62**	4.04	16.30**	0.43
2. Insomnia Symptoms	−0.70	−2.03	2.24	0.53
Sleep Quality	−0.17	−0.73		

** p <.01