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## Onset insomnia and insufficient sleep duration are associated with suicide ideation in university students and athletes

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### Abstract

**Background**—Previous work has shown that poor sleep is a prospective risk factor for suicide in clinical populations and might contribute to risk in the general population. The present study evaluated whether sleep distress, onset insomnia, and insufficient sleep are associated with suicide ideation in university students and athletes participating in the 2011–2014 National College Health Assessment (NCHA;  $n = 113,185$ ).

**Methods**—In the NCHA survey, students self-reported the presence or absence of suicide ideation within the past 12 months. SLEEP DISTRESS was assessed with an item indicating that “sleep difficulties” were “particularly traumatic or difficult to handle.” ONSET INSOMNIA was

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#### Contributors

Michael Grandner acquired the archival data. Ariana Haghighi and Michael Grandner devised the research topic and planned the initial analyses. Michael Grandner and Andrew Tubbs computed the analyses of the data. Waliuddin Khader and Ariana Haghighi prepared the manuscript, with assistance from Jo-Ann Gherels and Pamela Alfonso-Miller. Amy Athey, Michael Grandner, Andrew Tubbs, and Fabian Fernandez all contributed to the interpretation of data and editing the manuscript. All authors have reviewed and approved the article.

#### Declaration of Competing interests

None

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assessed as at least 3 nights per week where survey participants reported an “extremely hard time falling asleep.” INSUFFICIENT SLEEP was operationalized as the number of days per week where the participants felt they did not get “enough sleep to feel rested.” All variables were yes/no except INSUFFICIENT SLEEP, which was categorized as 0–1 (reference), 2–3, 4–5, or 6–7 nights. Binary logistic regression analyses examined suicide ideation as the outcome and sleep variable as a predictor, adjusted for age, sex, year in school, recent depressed mood, and survey year. Associations within student-athletes were likewise assessed.

**Results**—7.4% of students reported suicide ideation within the past 12 months. In adjusted models, this was significantly associated with SLEEP DISTRESS (OR = 3.01, 95% CI [2.86, 3.16],  $p < 0.0001$ ), ONSET INSOMNIA (OR = 1.95, 95% CI [1.86, 2.04],  $p < 0.0001$ ), as well as INSUFFICIENT SLEEP (4–5 nights, OR = 1.41, 95% CI [1.28, 1.56],  $p < 0.0001$ ; 6–7 nights, OR = 1.92, 95% CI [1.74, 2.13],  $p < 0.0001$ ). Although suicide ideation was less common among athletes, ORs were similar for athletes for all sleep variables of interest.

**Conclusion**—Sleep distress, onset insomnia, and insufficient sleep were all strongly related to suicide ideation among university students. These relationships were the same among collegiate athletes, even though this group reported less overall suicide ideation. Our findings suggest that university students may benefit from educational materials linking sleep disruption to maladaptive thinking and suicide ideation.

### Keywords

Sleep; Insomnia; Suicide; Suicide ideation; University; Young Adult

## 1. Introduction

Suicide is now the second leading cause of death among young adults aged 18–34 (WISQARS, 2018). While suicide ideation has been historically linked to mood, anxiety, and substance-abuse disorders (Chioqueta and Stiles, 2003; Poorolajal et al., 2016; Sareen et al., 2005), unique associations have also been found with insomnia and other types of sleep distress (Michaels et al., 2017). These associations are evident within the general population and are observed independent of depression (Pigeon et al., 2012). Research suggests that the operative link between sleep distress and suicidality might be wakefulness at night (i.e., any situation—irrespective of its cause—where a person is awake during their normally scheduled nighttime sleep). The middle of the night is a time when individuals are cognitively impaired relative to how they function during the day (Alhola and Polo-Kantola, 2007; Fortier-Brochu and Morin, 2014), and this transient impairment may increase the risk of suicidal thinking (Perlis et al., 2016; Tubbs et al., 2020). The present study evaluated whether sleep distress, onset insomnia, and insufficient sleep play a role in suicidal ideation among collegiate student athletes and non-athletes.

Suicidal ideation is pervasive among those participating in college sports (Rao et al., 2015). Student athletes experience significant physical and psychosocial stress due to program expectations, where a systematic balance among the trifecta of athletic performance, academic achievement, and social obligations is demanded (Hwang and Choi, 2016). Unfortunately, for some student-athletes, their involvement in sports can strain their mental

stability and create conflicts with meeting institutional expectations (Brown et al., 2014). A frequent cause of instability is the potential to experience failure. The possibility of failure in so many different areas of the student-athlete's life can be a source of tension that ultimately impairs their self-identity and estimate of self-worth (Brown et al., 2014); resulting symptoms of depression and anxiety impact daily functioning and pose serious challenges to healthy sleep (Kadison and DiGeronimo, 2004).

College students, in general, also experience a significant amount of psychological stress, which abets suicidal ideation (Kadison and DiGeronimo, 2004). High academic expectations, especially for students who excelled in high school, place substantial pressures on them to perform at a high level (Cleary et al., 2011). Moreover, the transition from home to college—and the accompanying feelings of displacement—are significant add-on stressors for students as they compare their abilities to their peers. For some students who determine their abilities to be poor, it is the first instance of dealing with self-doubt and may lead to maladaptive coping behavior as well as problems sleeping (Cleary et al., 2011). Several types of sleep distress (e.g., nightmares, insomnia) operate as prognostic factors for increased suicidal ideation in adolescents and young adults (Nadorff et al., 2011). Similarly, sleep loss or decreased need for sleep has been noted to confer greater risk of suicidal ideation among patients with psychiatric disorders whose symptoms often first manifest during college (Becker et al., 2018; Pedrelli et al., 2014). Given the unique daily pressures that university students and athletes experience—and the potential of these stresses to interfere with sleep—we examined how sleep problems relate to suicidal ideation in these populations. Considering our previous work in this area (Tubbs et al., 2020), we hypothesized that all three types of sleep disruption would significantly increase the likelihood of having suicidal thoughts over the past year.

## 2. Methods

### 2.1 Data Source

Data were collected from the 2011–2014 National College Health Assessment (NCHA; N=113,185). The NCHA is a national survey administered across educational institutions assessing health issues in US college students. The survey consists of 300 items examining habits, behaviors, and perceptions of health (American College Health Association, 2009). In the current study, the relationships between sleep, recent depression, and suicide are explored. Variables of interest were self-reported sleep distress, onset insomnia, insufficient sleep and suicidal ideation. Table 1 provides the characteristics of the sample and the variables that were investigated.

### 2.2 Measures

Sleep distress was assessed as “yes” when respondents indicated that “sleep difficulties” were “particularly traumatic or difficult to handle” within the past 12 months. Onset insomnia was assessed as an “extremely hard time falling asleep” reported at least 3 times per week. This was also scored as “yes” or “no.” Insufficient sleep was assessed as number of days per week of self-reported not “enough sleep to feel rested.” This was categorized as 0–1, 2–3, 4–5, or 6–7 nights per week of insufficient sleep, with 0–1 as the reference group.

Suicide ideation was self-reported and reflected the presence of any suicide ideation in the past 12 months (“yes” or “no”). Depressed mood was assessed by self-reported presence or absence within the past 30 days (“yes” or “no” to a question asking if the respondent felt so depressed that it was difficult to function). Covariates in this study were age, sex, and year in school, as well as survey year and athlete status.

### 2.3 Statistical Analyses

All variables were examined visually and with descriptive statistics (mean and standard deviation for continuous variables and percentages for categorical variables). To examine the relationship between sleep variables and suicide ideation, each sleep variable was entered in a separate binary logistic regression model (with “no” or “0–1 nights” as reference groups) with suicide ideation as the outcome. This was done across 3 models: unadjusted, adjusted for covariates, and adjusted for covariates as well as the presence of depressed mood. Then, athlete status by sleep interaction terms were evaluated to justify stratification. Stratified analyses were performed using the same 3 binary logistic regression models. All calculations were performed using STATA 14.0 (STATA Corp, College Station, TX). Results are reported as unadjusted or adjusted Odds Ratios (ORs) and 95% Confidence Intervals (95% CI).

## 3. Results

### 3.1 Characteristics of Sample

Sample demographics are shown in Table 1. The sample included a diverse representation of college/university students; the mean age was approximately 21.5 years and the group was 66% female. Twenty-eight percent of participants identified as athletes. Sleep distress was reported in about 26% of the sample and onset insomnia symptoms were reported in about 24%.

Insufficient sleep was commonly experienced, with approximately 30%, 36%, and 23% reporting insufficient sleep on 2–3, 4–5, and 6–7 nights in the past week, respectively. Approximately 31% of those participating in the survey reported a recent history of depressed mood and 7% reported suicide ideation within the past 12 months.

### 3.2 Sleep Disturbances and Suicide Ideation

Results of regression analyses are reported in Table 2. In the unadjusted model, sleep distress was associated with an approximately 4-fold likelihood of suicide ideation; this was maintained in the adjusted model and attenuated slightly (to 3-fold likelihood) in the model that included recent depressed mood. Onset insomnia was associated with a 2.5-fold likelihood of suicide ideation, which was also maintained after adjustment and slightly attenuated (to 2.0-fold likelihood) after including depressed mood in the model. Insufficient sleep was similarly associated with suicide ideation, with 2–3, 4–5, and 6–7 nights of insufficient sleep linked—in a dose-dependent fashion—to a 1.3-fold, 2.0-fold, and 3.0-fold likelihood of suicide ideation in the unadjusted model. These associations remained significant (with slight mitigation) in the adjusted models.

### 3.3 Stratification by Student Athlete Status

Suicidal ideation was less prevalent among student-athletes than non-athletes (23% vs. 29%). However, sleep distress, onset insomnia, and extreme insufficient sleep (6–7 nights per week) were significantly related to suicidal ideation in all models (Table 2). Other basic comparisons in the sleep of university students versus athletes are enumerated within Supplementary Table (S1).

## 4. Discussion

The present study found that sleep disruption (variously defined) was consistently associated with suicidal ideation among college students and athletes. These findings are in agreement with previous work showing that students who experience nightmares and night terrors are more likely to experience suicidal ideation (Nadorff et al., 2011), and point to sleep distress as a generalizable risk factor within the university student population. The fact that student-athletes share this vulnerability is noteworthy given that the NCHA data summarized here, along with other historical data, indicate that college athletes tend to report *lower*—not higher—overall levels of suicidal ideation than other students (e.g., Miller and Hoffman, 2009; Rao et al., 2015). These trends suggest that abrupt changes in student-athlete sleep health resulting from psychological stress may be issues worth monitoring by social support networks associated with university athletic programs. Factors that can precipitate stress among student-athletes include not just the daily stressors of academic performance and social/community obligations, but also the possibility of reduction or loss of scholarship, sustaining an injury, loss of travel or competition eligibility, removal from the team, or a premature end to their athletic professional career (Hwang and Choi, 2016; Selby et al., 1990; Smith and Milliner, 1994; Storch et al., 2005).

In March 2016, the NCAA published a consensus document providing guidelines for how campus stakeholders can support and promote student-athlete mental health. It advocates for greater care and surveillance of athletes' psychological wellbeing, with key recommendations that athletes be instructed on best practices for healthy sleep and screened for sleep disorders (National Collegiate Athletic Association Sport Science Institute, 2016). The NCAA has followed up this publication with a recent position statement identifying sleep as a particular area of focus for athletes; here, sleep is identified as an important contributor to emotional health and resilience (Kroshus et al., 2019). These communiqués provide a framework for promoting further research on sleep and wellbeing in college athletes and may benefit from the incorporation of educational materials on how sleep disruption (nocturnal wakefulness) has the potential to promote affective states and maladaptive forms of reasoning that feed into suicidal ideation.

## 5. Study Limitations

Our study carries a few caveats. First, the analyses were cross-sectional and cannot be used to establish causality. Second, the measures used to infer sleep have not been validated and may not adequately capture all information related to sleep health. Third, the data examining suicide and depression were collected with somewhat vague terminology and may not yield a perfectly precise description of the relationships between sleep, affect, and suicide

ideation. Fourth, due to the nature of the question assessing suicidal ideation (i.e., indicating “yes” or “no” to the presence of suicidal ideation within the past 12-months), it is unclear if suicidal ideation preceded sleep distress or vice versa. As such, it is not possible to establish a temporal association between the two variables. Finally, self-reported information from the participants is unverified and diagnoses of disorders and information on sleep patterns cannot be confirmed.

## 6. Conclusion

Sleep distress, problems with sleep initiation, and insufficient sleep were all significantly associated with increased odds of suicide ideation in college student athletes and non-athletes. These relationships remained significant in student athletes even though they reported less overall suicide ideation. Given the stressful environment that universities can create for both types of students, the importance of healthy sleep requires emphasis in the campus community. Future studies will be necessary to identify additional mediators that might exacerbate the relationships described here.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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### Highlights

- Sleep problems relate to suicide ideation in university students
- Association is stronger among collegiate athletes
- Increased awareness of healthy sleeping habits may be beneficial

**Table 1:**

Characteristics of the sample by suicidal ideation status, N (%).

<b>Demographics</b>	<b>No Suicidal Ideation</b>	<b>Suicidal Ideation</b>
Age (mean $\pm$ sd)	22.21 $\pm$ 5.97	21.37 $\pm$ 5.14
Male	35,914 (33.69)	1,577 (30.02)
Female	70,685 (66.31)	3,677 (69.98)
<b>Academic Year</b>	<b>No Suicidal Ideation</b>	<b>Suicidal Ideation</b>
Freshmen	26,160 (24.6)	1,479 (27.85)
Sophomore	20,166 (18.96)	1,149 (21.64)
Junior	20,743 (19.51)	1,118 (21.05)
Senior	16,935 (15.93)	773 (14.56)
Super-senior	5,567 (5.24)	294 (5.54)
Graduate Student	15,868 (14.92)	453 (8.53)
Not Seeking Degree	237 (0.22)	16 (0.3)
Other	659 (0.62)	28 (0.53)
<b>Athlete Status</b>	<b>No Suicidal Ideation</b>	<b>Suicidal Ideation</b>
No	74,885 (70.68)	4,071 (77.12)
Yes	31,065 (29.32)	1,208 (22.88)
<b>Sleep Distress</b>	<b>No Suicidal Ideation</b>	<b>Suicidal Ideation</b>
No	81,442 (75.82)	2,438 (45.54)
Yes	25,972 (24.18)	2,916 (54.46)
<b>Onset Insomnia</b>	<b>No Suicidal Ideation</b>	<b>Suicidal Ideation</b>
No	82,011 (76.48)	3,208 (59.99)
Yes	25,217 (23.52)	2,140 (40.01)
<b>Insufficient Sleep</b>	<b>No Suicidal Ideation</b>	<b>Suicidal Ideation</b>
0–1 days	12,113 (11.29)	337 (6.3)
2–3 days	32,388 (30.18)	1,206 (22.54)
4–5 days	38,492 (35.87)	2,027 (37.88)
6–7 days	24,319 (22.66)	1,781 (33.28)
<b>Depressed Mood</b>	<b>No Suicidal Ideation</b>	<b>Suicidal Ideation</b>
No	101,890 (94.58)	4,504 (83.97)
Yes	5,838 (5.42)	860 (16.03)
<b>NCHA Survey Year</b>	<b>No Suicidal Ideation</b>	<b>Suicidal Ideation</b>
2011	26,365 (24.41)	1,182 (21.96)
2012	26,682 (24.7)	1,222 (22.7)

2013	30,783 (28.5)	1,587 (29.48)
2014	24,181 (22.39)	1,392 (25.86)

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**Table 2:**

Logistic regression models predicting suicidal ideation status by sleep disturbances.

	Model 1: Unadjusted			Model 2: Adjusted <sup>1</sup>			Model 3: Adjusted + Mood <sup>2</sup>		
Complete Sample	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Sleep Distress	4.311	(4.119, 4.512)	<0.0005	4.286	(4.090, 4.492)	<0.0005	3.007	(2.864, 3.157)	<0.0005
Onset Insomnia	2.525	(2.438, 2.671)	<0.0005	2.495	(2.381, 2.615)	<0.0005	1.948	(1.855, 2.044)	<0.0005
Insufficient Sleep									
0–1 Nights/Week		<b>Reference</b>			<b>Reference</b>			<b>Reference</b>	
2–3 Nights/Week	1.305	(1.179, 1.443)	<0.0005	1.269	(1.144, 1.408)	<0.0005	1.094	(0.984, 1.216)	0.098
4–5 Nights/Week	1.96	(1.781, 2.158)	<0.0005	1.886	(1.709, 2.082)	<0.0005	1.412	(1.276, 1.562)	<0.0005
6–7 Nights/Week	3.022	(2.744, 3.329)	<0.0005	2.886	(2.612, 3.189)	<0.0005	1.922	(1.735, 2.129)	<0.0005
<b>Non-Athletes</b>	<b>OR</b>	<b>95% CI</b>	<b>p</b>	<b>OR</b>	<b>95% CI</b>	<b>p</b>	<b>OR</b>	<b>95% CI</b>	<b>p</b>
Sleep Distress	4.252	(4.055, 4.458)	<0.0005	4.224	(4.024, 4.434)	<0.0005	2.979	(2.833, 3.134)	<0.0005
Onset Insomnia	2.546	(2.430, 2.672)	<0.0005	2.487	(2.369, 2.611)	<0.0005	1.946	(1.850, 2.046)	<0.0005
Insufficient Sleep									
0–1 Nights/Week		<b>Reference</b>			<b>Reference</b>			<b>Reference</b>	
2–3 Nights/Week	1.304	(1.173, 1.448)	<0.0005	1.259	(1.131, 1.402)	<0.0005	1.083	(0.971, 1.209)	0.153
4–5 Nights/Week	1.983	(1.794, 2.191)	<0.0005	1.878	(1.695, 2.080)	<0.0005	1.405	(1.265, 1.560)	<0.0005
6–7 Nights/Week	3.04	(2.749, 3.362)	<0.0005	2.864	(2.583, 3.175)	<0.0005	1.909	(1.717, 2.122)	<0.0005
<b>Athletes</b>	<b>OR</b>	<b>95% CI</b>	<b>p</b>	<b>OR</b>	<b>95% CI</b>	<b>p</b>	<b>OR</b>	<b>95% CI</b>	<b>p</b>
Sleep Distress	5.067	(4.187, 6.132)	<0.0005	4.913	(4.035, 5.982)	<0.0005	3.378	(2.753, 4.145)	<0.0005
Onset Insomnia	2.503	(2.062, 3.037)	<0.0005	2.402	(1.967, 2.934)	<0.0005	1.879	(1.529, 2.308)	<0.0005
Insufficient Sleep									
0–1 Nights/Week		<b>Reference</b>			<b>Reference</b>			<b>Reference</b>	
2–3 Nights/Week	1.256	(0.834, 1.892)	0.275	1.392	(0.893, 2.171)	0.144	1.206	(0.769, 1.891)	0.415
4–5 Nights/Week	1.651	(1.111, 2.454)	0.013	1.889	(1.229, 2.904)	0.004	1.414	(0.914, 2.189)	0.12
6–7 Nights/Week	2.838	(1.903, 4.231)	<0.0005	3.166	(2.051, 4.889)	<0.0005	2.119	(1.361, 3.300)	0.001

<sup>1</sup>Includes age, sex, year in school, survey year, and athlete status (as applicable) as covariates

<sup>2</sup>Further addition of depressed mood as a covariate