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Insomnia symptoms and suicidality in the National Comorbidity Survey - Adolescent Supplement

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1. Introduction

According to Center for Disease Control and Prevention, suicide is the third leading cause of death for youth between the ages of 10 to 24 (Center for Disease Control and Prevention, 2015). Current research demonstrates that sleep problems are concurrently associated with, and longitudinally predict, suicidality¹ in both adolescents and adults (Bernert et al., 2015, Pigeon et al., 2012). Yet no adolescent study examined the relationship between sleep problems and suicidality while controlling for the presence of psychiatric disorders.

Sleep difficulties and insufficient sleep are common among our nation's youth. The National Sleep Foundation found that approximately 60% of 6th to 8th graders did not sleep the recommended 9 hours per night on school nights (National Sleep Foundation, 2006). Less than 10% of 9th to 12th graders reported getting this recommended amount in the same study. This is likely due to a combination of biopsychosocial and contextual factors (Becker et al., 2015).

Both sleep homeostasis and circadian timing show marked changes in adolescence (Carskadon and Tarokh, 2013). Compared to younger children, the pressure to fall asleep after a period of wakefulness builds up more slowly in adolescents (Jenni et al., 2005, Taylor et al., 2005). Moreover, the circadian system appears to move to a delayed position (Carskadon et al., 2004, Carskadon et al., 1993). These changes result in a preference for

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Contributors

This research uses data from the National Comorbidity Survey - Adolescent Supplement (NCS-A). Dr. Wong managed the literature searches and wrote the first draft of the manuscript. Dr. Brower, Ms. Craun and Dr. Wong revised the manuscript. Dr. Wong conducted all the statistical analyses for the study. Ms. Craun and Dr. Wong made the tables for the study.

¹In this paper, suicidality refers to suicidal thoughts, plans, and attempts.

eveningness and later bedtimes, even though the need to sleep does not change. 24/7 access to information via phone and computers leads to late-night arousal and prolonged light exposure (National Sleep Foundation, 2011). Increased academic demands and early school start time also decrease the amount of sleep time on school nights and increase the need to catch up on weekend (Becker, Langberg, 2015, Carskadon and Tarokh, 2013). Insufficient and irregular sleep may have serious consequences on adolescent health. The brain undergoes considerable growth and development in adolescence (Becker, Langberg, 2015, Dahl and Lewin, 2002). Insufficient sleep and sleep difficulties may affect this development, potentially put the adolescents at risk for a trajectory of physical, emotional and mental health problems (Colrain and Baker, 2011, Shochat et al., 2014).

A significant relationship between sleep problems and suicidality has been observed in adolescents. Sleep problems were associated with suicidal thoughts (Bailly et al., 2004, Barbe et al., 2005), attempts (Bailly, Bailly-Lambin, 2004, Nruham et al., 2008), and suicide (Goldstein et al., 2008). Nightmares have been linked to both suicidal thoughts (Choquet and Menke, 1990, Liu, 2004) and suicide attempts (Koyawala et al., 2015, Liu, 2004). These relationships have been found in clinical samples (Barbe, Williamson, 2005) as well as population and community samples (Liu, 2004, Nruham, Larsson, 2008).

Several prospective studies have found that sleep problems predicted subsequent suicidal behaviors in community samples. In a study of Norwegian adolescents ($N=265$; Nruham et al., 2008), sleep problems at age 15 predicted suicide attempts between ages 15–20. However, the relationship became non-significant after controlling for baseline suicidal thoughts and depressive symptoms. Another study reported a longitudinal relationship between sleep difficulties and suicidality in a community sample of 392 children of alcoholics and controls (Wong et al., 2011). Controlling for gender, parental alcoholism, parental suicidal thoughts, child's depressive symptoms, nightmares, aggressive behaviors, substance-related problems, as well as suicidal thoughts and self-harm behaviors at ages 12–14, having trouble sleeping at ages 12–14 significantly predicted suicidal thoughts and self-harm behaviors at ages 15–17. Two additional studies used data from the National Longitudinal Study of Adolescent Health to examine the relationship between sleep problems and suicidality. In this nationally representative sample, sleep problems longitudinally predicted a new incidence of suicide thoughts of attempts among subjects with no frequent depressive symptoms ($N=4494$) (Roane and Taylor, 2008). Additionally, sleep problems predicted subsequent suicidal thoughts and attempts in all subjects ($N=6504$), even after controlling for alcohol-related problems, illicit drug use, depressive symptoms, chronic physical problems and demographics variables including gender, age, race, education and poverty status (Wong and Brower, 2012).

Sleep problems are symptoms of many psychiatric disorders (e.g., mood, anxiety disorders and substance use disorders (SUD)) (American Psychiatric Association, 2013). These disorders are correlated with suicide thoughts and attempts in adolescence (Pena et al., 2012, Wolitzky-Taylor et al., 2010). Thus an important question is whether sleep problems are associated with suicidality after these psychiatric disorders are controlling for. If the relationship between sleep and suicidality is non-significant once psychiatric disorders are taken into account, then relationship is likely due to the presence of these disorders.

However, if the relationship between sleep problems and suicidality remains significant even after controlling for these psychiatric disorders, then sleep problems are an independent risk factor of suicidality. To our knowledge, only one adult study had examined the relationship between sleep difficulties and suicidality while controlling for the presence of psychiatric disorders (Wojnar et al., 2009). No adolescent studies has focused on this issue.

The present study analyzed data from the National Co-morbidity Study - Adolescent Supplement (NCS-A), examining whether sleep problems (i.e., problems falling or maintaining asleep, and early morning awakening) have a significant relationship with suicidal thoughts, plans and attempts while controlling for mood, anxiety and SUD.² Chronic physical conditions and important demographic variables such as gender, age, ethnicity, education and poverty were also controlled for in the analyses. While similar work has been conducted among adults (Wojnar, Ilgen, 2009), no such work has been done in nationally representative samples of adolescents. Additionally, we examined whether different symptoms of insomnia have an additive or a multiplicative effect on suicidal behavior (Kessler et al., 1999, Pena, Matthieu, 2012).

Even though data from NCS-A are cross-sectional, they offer a unique opportunity to examine the relationship between sleep problems and suicidality while controlling for psychiatric disorders that are known to be associated with both variables. We hypothesized that insomnia symptoms and suicidality would be significantly correlated after controlling for known correlates.

2. Methods

2.1 Participants

Study participants were 10,123 adolescents from the National Comorbidity Survey Replication Adolescent Supplement (NCS-A). NCS-A is a nationally representative epidemiological face-to-face survey of U.S. adolescents between the ages of 13 to 18 (Kessler et al., 2009a, b, Merikangas et al., 2009). The survey was conducted between February 2001 and January 2004. It used a dual-frame sampling design – 904 adolescent residents from the households that participated in the National Comorbidity Study Replication (NCS-R) and 9244 adolescent students from a representative sample of 320 schools in the same nationally representative sample of counties as the NCS-R (Kessler, Avenevoli, 2009b). NCS-A was designed to provide estimates of lifetime and current prevalence, age-of-onset, course, comorbidity, risk and protective factors, as well as services utilization patterns for *DSM-IV* mental disorders. The survey used a modified version of the World Health Organization Composite International Diagnostic Interview (CIDI). Details regarding the background, measures and study design of NCS-A have been described in other publications (Kessler, Avenevoli, 2009a, b, Merikangas, Avenevoli, 2009).

²Attention deficit hyperactivity disorder (ADHD) is associated with both sleep problems (Konofal et al., 2010) and suicidality (Hurtig et al., 2012, Impey and Heun, 2012). In analyses not shown here, we controlled for the effects of both 12-month and lifetime ADHD on suicide thoughts, plan and attempts. However, we did not find any significant relationship between ADHD and suicide variables. We therefore decided not to include ADHD in the analyses presented in the paper.

2.2 Measures

This study analyzed data on sleep problems (i.e., difficulty initiating sleep, difficulty maintaining sleep and early morning awakening) and suicidal behavior (i.e., suicide ideation, plans and attempts). Important covariates (i.e., SUD, mood and anxiety disorders, serious physical problems that may affect sleep) and demographics characteristics of participants (e.g., age, gender) were controlled for in all analyses.

Sleep problems—Participants were asked whether they had any one of the three problems with their sleep that lasted two weeks or longer in the past 12 months: (1) Problem falling asleep (PFA) -- “Problems getting to sleep, when nearly every night it took you a long time to fall asleep?”; (2) Problem staying asleep (PSA) – “Problems staying asleep, when you woke up nearly every night and took a long time to get back to sleep?”; (3) Early morning awakening (EMA) – “Problems waking too early, when you woke up nearly every morning much earlier than you wanted to?” (0 = no, 1 = yes). Additionally, an insomnia score was created by summing the absence (0) or presence (1) of each sleep problems (Range: 0–3). These three items had a strong association with one another (problem falling asleep and staying asleep: $\chi^2(1) = 2287.15, p < .001$; problem falling asleep and early morning awakening: $\chi^2(1) = 1184.84, p < .001$; problem staying asleep and early morning awakening: $\chi^2(1) = 1855.50, p < .001$). Thus they are internally consistent.

Suicidality—Three items were used to assess suicidal thoughts, plans and attempts respectively -- “You seriously thought about killing yourself;” “You made a plan for killing yourself;” and “You tried to kill yourself.” Participants were asked whether the above experiences ever happened to them and whether the experiences happened to them at any time in the past 12 months (0 = no, 1 = yes).

Covariates—Variables that have been documented to have an association with sleep problems and suicidality were controlled for in the analyses. DSM-IV substance use disorders (SUD), anxiety disorders and mood disorders were measured by a modified version of the World Health Organization Composite International Diagnostic Interview (CIDI). Lifetime chronic health problems were measured by separate questions pertaining to each problem – “The next few questions are about health problems you might have had at any time in your life. Have you ever had ...” Health problems included in the analyses were seasonal allergies, heart problems, asthma, diabetes, stomach problems, epilepsy, cancer and other serious health problems (not specified) (0 = no, 1 = yes). Demographics variables included gender (1 = male, 2 = female), age, race (0 = non-Caucasian, 1 = Caucasian), education (0 = 12th grade or below, 1 = 12th grade or above), parents’ poverty (range: 1 – 4; higher counts = more severe poverty).

2.3 Analytic plan

We first examined the bivariate relationship between sleep problems and suicidal thoughts, plan and attempts using chi-square analyses and logistic regression models. We then examined the relationships between sleep problems and suicidal variables in multivariate logistic regression models, while controlling for psychiatric disorders, i.e., substance use disorders (alcohol/drug abuse or dependence), anxiety disorders (general anxiety disorder,

separation anxiety, posttraumatic stress disorder, phobias, panic attack, and panic disorder) and mood disorders (major depression, minor depression, dysthymia, mania, hypomania and recurrent brief depression), chronic health problems and demographics variables that were known to associate with sleep problems and suicidality (i.e., gender, age). All analyses were carried out by SPSS version 23 complex samples methods (IBM Corporation, 2015), taking into account clustering, weighting and stratification of the NCS-A sample.

In order to find out whether the number of insomnia symptoms significantly increased the risk of suicidality, we compared subjects with no symptoms versus those who had one, two or three symptoms. We also examined whether types of insomnia symptoms interacted to predict suicidal ideation, plan and attempts. Two-way and three-way interactions between PFA, PSA and EMA were included in the models as predictors. When conducting interaction analyses, main effects of symptoms were also included in the model.

3. Results

3.1 Descriptive statistics

23% of adolescents had problem falling asleep (PFA) that lasted two weeks or longer in the last 12 months. 14% had problem staying asleep (PSA) and 17% woke up too early in the morning (EMA). All three problems were significantly associated with substance use (PFA: $OR=2.18$; PSA: $OR=2.27$; EMA: $OR=1.77$, all $p<.05$), anxiety (PFA: $OR=2.18$; PSA: $OR=3.62$; EMA: $OR=2.96$, all $p<.05$) and mood disorders (PFA: $OR=3.74$; PSA: $OR=4.30$; EMA: $OR=3.02$, all $p<.05$) in the last 12 months. 5% of adolescents had suicide ideation, 1% made a suicide plan and 1% attempted suicide in the last 12 months. Rates of lifetime suicide variable were higher – 12% had suicide ideation; 4% reported a plan while 4% made an attempt.

3.2 Bivariate relationships between sleep problems and suicidality in the last 12 months

There was a significant bivariate relationship between all sleep problems and suicidal thoughts, plan and attempts (Table 1). For instance, adolescents who had problems falling asleep (PFA) were 3.5 times more likely to have seriously thought about suicide, 5.6 times more likely to have made suicidal plans and 5.4 times more likely to have attempted suicide compared to those without such a problem. Adolescents who had problems staying asleep (PSA) were 4.4 times more likely to report suicidal thoughts, 5.4 times more likely to have made a suicidal plan and 6.0 times more likely to have made a suicide attempt compared to those without problems staying asleep. Adolescents who reported early morning awakening (EMA) were 2.5, 3.5 and 2.6 times more likely to have seriously thought about killing themselves, to have made a plan to kill themselves or to have attempted to kill themselves, respectively. Insomnia score (the sum of all three sleep problems) was also significantly correlated with suicidality variables. However, the relationship between insomnia score and suicidality was not linear. Specifically, those who had no insomnia symptoms or just one symptom were less likely than those who had all three symptoms to report suicidal thought, plan and attempt. However, those who had two symptoms were no more likely than those with three symptoms to make such a report.

3.2 Multivariate relationships between sleep problems and suicidality in the last 12 months

Substance use, anxiety and mood disorders were associated with all suicide variables. Women reported more suicidal ideation and attempts than men. Older participants reported more suicidal attempts than younger participants. Moreover, participants with a higher family income were more likely to make a suicide plan than those with a lower family income. When the analyses controlled for psychiatric disorders and other covariates, problems falling asleep were associated with suicidal thoughts and plan, while problems staying asleep were associated with suicidal thoughts (Tables 2a and 2b). However, early morning awakening did not have a significant relationship with any suicide variables.

Insomnia symptom counts were associated with suicidal thoughts and plans, but not attempts. Adolescents with insomnia symptoms were significantly more likely than those with no symptoms to have suicidal thoughts (0 vs. 1 or more: *OR* [95% CI] =2.08 [1.45–2.99], $p<.05$). However, number of symptoms did not significantly increase the risk of suicidal thoughts (1 vs. 3: *OR* = .93 [.65–1.32], n.s.; 2 vs. 3: *OR* =.83, [.51–1.35], n.s.). Adolescents with one symptom were no more likely than those without any symptoms to report a suicide plan (0 vs. 1: *OR* [95% CI] =1.49 [.68–3.27], n.s.). But those with two or three symptoms were more likely to report a suicide plan (0 vs. 2: *OR* [95% CI] =2.79 [1.18–6.58], $p<.05$; 0 vs. 3: *OR* =2.34 [1.04–5.26], $p<.05$). No insomnia symptoms had a significantly relationship with suicidal attempts in the presence of other variables (0 vs. 1 or more: *OR* [95% CI] =1.82 [.89–3.74], n.s.). Insomnia symptoms did not interact with each other to predict suicidal ideation, plan or attempts in the last 12 months (Appendix).

3.3 Multivariate relationships between sleep problems and lifetime suicidality

All psychiatric disorders were positively associated with lifetime suicidal ideation, plan and attempts. Adolescent girls reported lifetime suicidal ideation, plan and attempts more often than boys. Caucasian participants were more likely than non-Caucasian participant to have suicidal ideation. Controlling for psychiatric disorders and other covariates, problems falling and staying asleep were significantly associated with all lifetime suicide outcomes after. Early morning awakening was not associated with any suicide outcomes when other variables were controlled for.

Insomnia symptom counts were associated with lifetime suicidal thoughts, plans and attempts. Adolescents with insomnia symptoms were significantly more likely than those without any symptoms to have suicidal thought (0 vs. 1 or more symptoms: *OR* =1.97 [1.47–2.63], $p<.05$). However, number of symptoms did not significantly increase the risk of suicidal thoughts (1 vs. 3: *OR* =1.24 [.90–1.71], n.s.; 2 vs. 3: *OR* =.94 [CI=.67–1.32], n.s.). Adolescents with one symptom were no more likely than those without any symptom to make a suicide plan (0 vs. 1: *OR* =1.05 [.64–1.73], n.s.). However, adolescents with 2 or 3 symptoms were more likely than those with no symptoms to plan a suicide (0 vs. 2: *OR* =1.59 [1.02–2.48], $p<.05$; 0 vs. 3: *OR* =2.01 [1.14–3.21], $p<.05$). Adolescents with one or more symptoms had a higher likelihood to report a suicide attempt than those without any symptoms (0 vs. 1 or more symptoms: *OR* =1.77 [1.13–2.78], $p<.05$). Yet number of symptoms was not associated with risk in suicide attempts (1 vs. 3: *OR* = 1.39 [.95–2.03],

n.s.; 2 vs. 3: $OR = 1.24$ [.69–2.22], n.s.). Insomnia symptoms did not interact with each other to predict lifetime suicide ideation, plan or attempts (Appendix).

4. Discussion

This study extended past research by showing the relationship between insomnia symptoms and suicidality in a nationally representative sample of adolescents while controlling for demographic variables, psychiatric disorders and medical problems. In multivariate analyses, problems falling and staying asleep were associated with all lifetime suicide variables, as well as suicidal thoughts and plans in the last 12 months. Early morning awakening had no relationship with suicide variables when covariates were controlled for. Number of insomnia symptoms did not increase the risk of suicidality in most analyses, suggesting that the presence of any symptom was associated with suicide risk in adolescents.

The three psychiatric disorders were significant associated with all suicide variables. Thus a thorough psychiatric diagnosis is important to identify youth at risk for suicide. Individuals with SUD, anxiety and mood disorders often experience sleep difficulties {American Psychiatric Association, 2013 #143}. In this study, insomnia symptoms were associated with all three disorders. If psychiatric disorders were left out of the analyses, all three insomnia symptoms were significantly related to suicidal thoughts, plans as well as attempts. These results indicated that adolescents who were suicidal had insomnia symptoms and such symptoms were often associated with psychiatric disorders.

The non-significant relationship between early morning awakening and suicide variables after controlling for psychiatric disorders may indicate that early morning awakening is strongly associated with psychiatric disorders in adolescence. This finding is different from results of a previous study in adults showing a significant relationship between early morning awakening and suicidal variables while controlling for psychiatric disorders (Wojnar, Ilgen, 2009). There is evidence that both homeostatic sleep drive and circadian timing change throughout adolescent development (Carskadon and Tarokh, 2013). The homeostatic sleep drive shows slower buildup of sleep pressure during daytime (Carskadon et al., 1986, Taylor, Jenni, 2005) and the circadian system becomes delayed (Carskadon, Acebo, 2004, Roenneberg et al., 2004). However, the need to sleep does not change. Thus adolescents tend to go to bed later at night and get up later in the morning. Early morning awakening may be uncommon in adolescents without psychiatric disorders and therefore has no relationship with suicidality when psychiatric disorders are controlled for.

Our findings suggest that an assessment of sleep may provide important information regarding suicidality, both recent and lifetime. An evaluation of suicidality should include an assessment of sleep difficulties. The presence of these difficulties may imply a higher risk of suicide, above and beyond the effects of other risk factors such as mental disorders. Clinicians should inquire about sleep disturbances, especially problems falling and staying asleep, when assessing for suicidality in adolescents.

In a clinical setting, sleep assessment may be especially helpful when diagnoses about psychiatric disorders could not be made, e.g., when patients are not willing to reveal their

symptoms. Insomnia symptoms are relatively easy to assess in a clinical interview. Adolescents may be more comfortable talking about sleep issues than substance use, depression or anxiety. Future research could determine if early intervention with sleep disturbances reduces the risk for suicidality among adolescent patients seeking treatment. Longitudinal studies comparing patients with or without treatment for their sleep problems and the risk of suicide may shed light on this matter.

National data indicate that sleep problems are common among adolescents in the U.S. In one study, approximately one third of adolescents reported having sleep difficulties at night at least once a week in the last two weeks (National Sleep Foundation, 2006). This study indicated that sleep difficulties are often associated with psychiatric disorders. The implication is that these difficulties will disappear with the successful treatment of the disorders. However, psychiatric disorders cannot be diagnosed unless the adolescent is seeking help from a clinician. It may be useful for suicide prevention programs to include discussions of the importance of sleep, sleep hygiene and the management of insomnia in suicide prevention programs. The effectiveness of including sleep-related issues in adolescent suicide prevention programs is an important topic for future research.

What may explain the relationship between sleep problems and suicidality? A growing body of research shows that sleep problems adversely affect the control of affect, cognitive processes and behavior. A meta-analysis of 19 empirical studies reported that sleep deprivation had the greatest negative effect on mood, followed by negative effects on cognitive and motor tasks (Pilcher and Huffcutt, 1996). In an experimental study, participants experienced less positive affect and more anxiety in a catastrophizing task, rating the likelihood of potential catastrophes as higher when sleep deprived, compared to when rested (Talbot et al., 2010). The changes in positive and negative affect associated with sleep loss may make adolescents more impulsive, which may increase the risk of thinking about, planning or attempting suicide (Pilcher and Huffcutt, 1996, Talbot, McGlinchey, 2010).

Sleep problems also appear to adversely affect cognitive and neurocognitive processes. Sleep deprivation and fragmentation affects executive functions, working memory and divergent cognitive tasks such as multitasking and flexible thinking in adults (Durmer and Dinges, 2005, Pilcher and Huffcutt, 1996). There is evidence that sleep deprivation adversely affects inhibition among adults, including the ability to suppress a prepotent response (Chuah et al., 2006). One longitudinal study found that early childhood sleep problems predicted lower response inhibition in adolescence (Wong et al., 2010). The adverse impact of sleep deprivation on executive functions in general and inhibitory processes in particular, may increase the likelihood of engaging in risk behaviors including thinking about, planning and attempting suicide (Blume et al., 2000, Giancola and Parker, 2001, Nigg et al., 2006). Future research could focus on identifying self-regulatory processes that mediate the relationship between sleep difficulties and suicidality.

This study has several limitations. First, NCS-A data are cross-sectional. No temporal relationships could be established. Past studies have demonstrated a longitudinal relationship between sleep difficulties and subsequent suicidal behavior, while controlling for other risk

factors of suicidality. However, those studies did not measure psychiatric diagnoses. The longitudinal relationship between sleep problems and suicidality while controlling for psychiatric diagnoses remains an important topic for future research. Second, all measures were based on self-report, thus the data were subject to response and recall bias. Though insomnia and suicide items used in NCS-A have been validated (Kessler, Avenevoli, 2009a, b, Merikangas, Avenevoli, 2009), these are rather general measures without much specific information. Future research should consider using objective measures of sleep such as polysomnography (PSG) or actigraphy to examine the relationship between specific sleep parameters (e.g., sleep onset, sleep duration, wake time after sleep onset, and sleep architecture variables such as amount of REM and non-REM sleep) and suicidality. Third, although we examined three different suicide variables (thoughts, plans and attempts), other important aspects of suicidality such as severity of intent and frequency of attempts were not included. Including these variables in future research could reveal a more complex relationship between sleep problems and suicidal behavior. Fourth, even though we examined several covariates in the analyses, other variables that may affect adolescent suicidality (e.g., sexual abuse, physical abuse, impulsivity) were not included. Future research on sleep and suicidality could incorporate these variables.

To summarize, in a nationally representative sample of adolescents between the ages of 13–17, there was a significant bivariate relationship between three insomnia symptoms and suicidal thoughts, plan and attempts. These symptoms were associated with substance use, mood and anxiety disorders. Controlling for these disorders in the analyses, difficulties falling asleep and staying asleep was significantly associated with suicidal thoughts and plan in the last 12 months, as well as lifetime suicidal thoughts, plan and attempts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1
Bivariate relationship between sleep difficulties and suicide ideation, plan and attempt in the last 12 months

Ideation		Plan		Attempt	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>
Difficulty falling asleep ^a					
No (<i>N</i> =7641)	269/7641	3.6 ± 0.3	65/7640	0.6 ± 0.1	59/7640
Yes (<i>N</i> =2254)	239/2254	11.5 ± 1.4	65/2254	3.5 ± 0.7	62/2253
χ^2	215.59 ***		110.52 ***		115.08 ***
Odds ratio	95% CI	2.51–4.90 *	5.56	3.03–10.20 *	5.37
					2.48–11.64 *
Ideation		Plan		Attempt	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>
Difficulty maintaining sleep ^a					
No (<i>N</i> =8531)	329/8531	3.9 ± 0.3	80/8531	0.8 ± 0.2	69/8530
Yes (<i>N</i> =1366)	179/1366	15.2 ± 1.6	50/1365	4.4 ± 0.9	52/1365
χ^2	285.87 ***		110.88 ***		137.24 ***
Odds ratio	95% CI	3.42–5.75 *	5.44	3.08–9.60 *	5.95
					2.61–13.56 *
Ideation		Plan		Attempt	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>
Early morning awakening ^a					
No (<i>N</i> =8184)	344/8184	4.4 ± 0.4	80/8182	0.9 ± 0.2	75/8181
Yes (<i>N</i> =1712)	164/1712	10.2 ± 1.2	50/1713	3.2 ± 0.7	46/1713
χ^2	91.30 ***		54.90 ***		31.52 ***
Odds ratio	95% CI	1.77–3.43 *	3.52	2.07–6.01 *	2.64
					1.64–4.26 *
Ideation		Plan		Attempt	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>
Insomnia score (0–3)					
0 (<i>N</i> =6669)	188/6669	2.7 ± 0.3	43/6668	0.5 ± 0.1	39/6668
1 (<i>N</i> =1718)	138/1718	9.0 ± 1.4	32/1718	1.6 ± 0.5	31/1717
2 (<i>N</i> =916)	102/916	12.7 ± 1.6	32/916	4.2 ± 1.1	24/916
3 (<i>N</i> =594)	80/594	14.5 ± 2.5	23/594	5.2 ± 1.5	27/594
χ^2	326.58 ***		156.36 ***		218.90 ***

Odds ratio	95% CI			
0 vs. 3	6.19	3.67–10.47 [*]	10.40	4.35–24.84 [*]
1 vs. 3	1.70	1.09–2.66 [*]	3.43	1.56–7.52 [*]
2 vs. 3	1.17	.71–1.90	1.23	.52–2.93
				.66–3.37

N was unweighted. Percentages, chi-squares and odds ratios were calculated using weighted N, taking into account clustering, weighting and stratification of the sample.

^{*} $p < .05$,

^{***} $p < .001$.

Table 2

a *Logistic regression models using difficulties falling asleep and staying asleep to predict 12-month suicidality*

Variable	Difficulty falling asleep			Difficulty staying asleep		
	OR	95% CI	OR	95% CI	OR	95% CI
Gender	1.54	1.16–2.03*	1.73	0.78–3.84	2.00	1.06–3.77*
Age	1.01	0.92–1.11	0.96	0.82–1.13	1.20	1.03–1.40*
Race-ethnicity	1.14	0.84–1.55	1.14	0.56–2.32	1.08	0.67–1.73
Education	0.79	0.46–1.36	0.23	0.05–0.99	0.78	0.10–5.71
Poverty status	0.98	0.84–1.16	1.35	1.06–1.71*	1.29	0.94–1.77
Chronic health conditions	1.29	1.00–1.67	1.64	0.96–2.80	1.23	0.60–2.50
Substance use disorder	2.75	1.87–4.05*	1.74	0.75–4.03	3.24	1.59–6.58*
Anxiety disorder	2.37	1.58–3.57*	2.17	1.12–4.18*	3.87	2.07–7.20*
Mood disorder	6.63	4.95–8.89*	11.62	5.70–23.68*	11.24	5.98–21.12*
Sleep difficulty	1.65	1.17–2.33*	2.21	1.23–3.95*	1.91	0.86–4.22

b *Logistic regression models using early morning awakening and insomnia score to predict 12-month suicidality*

Variable	Early morning awakening			Insomnia – 0 vs. 1 or more symptoms		
	OR	95% CI	OR	95% CI	OR	95% CI
Gender	1.56	1.18–2.05*	1.77	0.81–3.86	2.02	1.10–3.74*
Age	1.02	0.93–1.13	0.98	0.83–1.15	1.22	1.04–1.42*
Race-ethnicity	1.14	0.84–1.55	1.16	0.57–2.37	1.06	0.67–1.70
Education	0.77	0.44–1.33	0.21	0.04–0.95	0.69	0.09–5.03
Poverty status	0.98	0.83–1.16	1.34	1.06–1.70*	1.28	0.93–1.78
Chronic health conditions	1.30	1.00–1.70	1.62	0.92–2.86	1.24	0.60–2.54
Substance use disorder	2.85	1.93–4.20*	1.85	0.82–4.14	3.41	1.72–6.74*
Anxiety disorder	2.44	1.63–3.64*	2.20	1.13–4.29*	4.06	2.12–7.77*

Table 1
Logistic regression models using early morning awakening and insomnia score to predict 12-month suicidality

Variable	Early morning awakening				Insomnia – 0 vs. 1 or more symptoms			
	Ideation		Plan		Attempt		Plan	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Mood disorder	7.16	5.34–9.59*	13.18	6.54–26.56*	12.82	6.80–24.16*	11.56	5.67–23.55*
Sleep difficulty	1.25	0.87–1.79	1.52	0.84–2.77	1.08	0.68–1.71	2.08	1.07–4.02*

Note. OR = Odds ratio.

* $p < .05$.

Table 3

a
Logistic regression models using difficulties falling and staying asleep to predict lifetime suicidality

Variable	Difficulty falling asleep			Difficulty staying asleep		
	OR	95% CI	OR	95% CI	OR	95% CI
Gender	1.45	1.18–1.78*	1.64	1.12–2.40*	2.74	1.83–4.11*
Age	0.93	0.87–0.99	0.88	0.78–1.00	0.97	0.83–1.12
Race-ethnicity	1.27	1.04–1.55*	1.33	0.93–1.91	1.09	0.67–1.77
Education	1.41	0.84–2.36	1.10	0.51–2.38	0.99	0.39–2.46
Poverty status	0.97	0.88–1.07	1.11	0.94–1.30	1.05	0.87–1.26
Chronic health conditions	1.18	0.96–1.44	1.17	0.81–1.69	1.17	0.70–1.96
Substance use disorder	2.91	2.23–3.79*	3.02	1.95–4.69*	4.10	2.59–6.47*
Anxiety disorder	2.08	1.67–2.58*	2.47	1.62–3.78*	2.17	1.43–3.29*
Mood disorder	3.75	3.12–4.51*	4.96	3.72–6.60*	5.73	3.89–8.46*
Sleep difficulty	2.02	1.52–2.69*	1.50	1.05–2.16*	1.75	1.16–2.65*

b
Logistic regression models using early morning awakening and insomnia score to predict lifetime suicidality

Variable	Early morning awakening			Insomnia - 0 vs. 1 or more symptoms		
	OR	95% CI	OR	95% CI	OR	95% CI
Gender	1.48	1.21–1.81*	1.67	1.15–2.43*	2.79	1.88–4.13*
Age	0.94	0.88–1.01	0.89	0.78–1.02	0.99	0.84–1.15
Race-ethnicity	1.26	1.03–1.55*	1.33	0.93–1.88	1.08	0.67–1.77
Education	1.38	0.79–2.41	1.08	0.47–2.44	0.96	0.37–2.52
Poverty status	0.97	0.88–1.08	1.11	0.94–1.30	1.05	0.86–1.27
Chronic health conditions	1.21	0.98–1.48	1.18	0.81–1.72	1.18	0.70–2.00
Substance use disorder	3.05	2.35–3.95*	3.12	2.02–4.82*	4.28	2.68–6.84*
Anxiety disorder	2.19	1.78–2.70*	2.55	1.68–3.87*	2.28	1.50–3.48*

Table 4
Logistic regression models using early morning awakening and insomnia score to predict lifetime suicidality

Variable	Early morning awakening						Insomnia - 0 vs. 1 or more symptoms					
	Ideation			Plan			Attempt			Plan		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Mood disorder	4.09	3.46–4.84 [*]		5.25	3.84–7.17 [*]		6.29	4.13–9.58 [*]		4.72	3.50–6.36 [*]	
Sleep difficulty	1.29	0.98–1.70		1.17	0.82–1.65		1.13	0.78–1.62		1.40	0.99–1.98	

Note. OR = Odds ratio.

^{*} $p < .05$.