Nocturnal and Morning Wakefulness Are Differentially Associated With Suicidal Ideation in a Nationally Representative Sample

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ABSTRACT

Objective: Prior studies indicate nocturnal wakefulness is associated with suicide, while morning wakefulness is linked to reduced suicidal ideation. These relationships, however, may be confounded by sociodemographic factors. Therefore, this study investigated whether timing of wakefulness was associated with suicidal ideation in a nationally representative sample.

Methods: Data were collected from the US National Health and Nutrition Examination Survey for the years 2015 to 2018, resulting in a final sample of 10,166 participants (51.1% female) with complete data available on suicidal ideation status, time to bed, and time out of bed. Population-weighted logistic regression models estimated the associations between time spent out of bed (ie, being awake) and suicidal ideation.

Results: A total of 385 survey participants (47.5% female) reported suicidal ideation in the past 2 weeks for a population-weighted prevalence of 3.37% (95% CI, 2.85%–3.87%). Wakefulness between 11:00 PM and 5:00 AM was associated with suicidal ideation (OR = 1.16; 95% CI, 1.08–1.24 per hour), even after adjustment for sociodemographic factors and symptoms of sleep disorders, but not after adjustment for the severity of depression symptoms. Conversely, wakefulness between 5:00 AM and 11:00 AM was associated with reduced odds of suicidal ideation (OR = 0.77; 95% CI, 0.70–0.85 per hour) in all models.

Conclusions: Individuals who spent more time awake at night were more likely to have recent suicidal ideation, while the opposite was true for those with more time spent awake in the morning. Moreover, these associations were independent of sociodemographic factors and thus not confounded by varying rates of suicidal ideation in different populations.

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Nearly 50,000 Americans died by suicide in 2018,[1] and there is now clear evidence that sleep disorders such as insomnia, nightmares, obstructive sleep apnea, and abnormal sleep duration increase the risk of suicide 2- to 3-fold.[2–5] Nocturnal wakefulness may represent a commonality between most (or all) of these disorders and is also associated with increased risk. Perlis and colleagues[6] reported that, after accounting for population wakefulness, death by suicide was 3.6-fold more likely to occur at night regardless of the month or method of suicide.[7] Ballard and colleagues[8] subsequently reported that increased time awake at 4:00 AM predicted next day suicidal ideation in individuals with treatment-resistant depression, while Vande Voort and colleagues[9] showed that reductions in suicidal ideation following ketamine treatment were linked to reduced nocturnal wakefulness. Taken together, these data indicate that suicide risk increases at night and that corresponding reductions in nocturnal wakefulness may mitigate risk. The mechanism connecting nocturnal wakefulness to suicide risk, however, remains unclear.

One possibility is that homeostatic sleep pressure and circadian rhythms synergize to disrupt neurocognitive functioning at night. Sleep loss increases frontal delta electroencephalogram power,[10] enhances fatigue,[11] and reduces frontal cortical functional connectivity,[12] and these changes likely undermine key executive functions (eg, impulse control, long-term planning, cognitive flexibility) that would otherwise regulate suicidal thoughts.[13,14] Additionally, these cortical deficits appear to be exaggerated in some depressed individuals especially between 4:00 AM and 8:00 AM,[15,16] which means depressed individuals may have even greater difficulty managing suicidal thinking at night. Executive functions also vary in a circadian fashion; response inhibition, problem-solving, alertness, and memory function optimally during the day and deteriorate at night.[13,17–21] Mood follows a similar circadian pattern, in which positive mood is lowest and negative mood is highest during the circadian night.[22–25] Thus, cortical impairment due to accumulated sleep pressure combined with circadian changes in executive function and mood result in an inability to manage and resolve suicidal thoughts and behaviors at night.

Alternatively, nocturnal wakefulness may be associated with suicide because nocturnal wakefulness is more prevalent in sociodemographic groups already at higher risk of suicide. Adolescents and young adults are more likely to die by accident or suicide than any other cause,[26] and these groups typically have delayed sleep patterns[27] that may increase time spent awake at night. Similarly, suicide rates are significantly higher in adults over 65 years of age (especially men),[26,28] who already experience age-related impairments in sleep consolidation that increase nocturnal awakenings.[29] Others at elevated suicide risk include those who are unmarried or have lower incomes, less education, or lower socioeconomic status[30]; these groups often report more insufficient sleep[31,32] and insomnia,[33,34]

Clinical Points

- Prior studies show that nocturnal wakefulness is linked to suicidality, although high-risk demographics may be skewing the association.
- This study found that sociodemographic factors did not eliminate the connection between nocturnal wakefulness and suicidality.
- Although nocturnal wakefulness is not a "red flag" for suicide, it may increase suicide risk, possibly owing to changes in sleep as well as wake-related brain activity in the middle of the night.

which may increase nocturnal wakefulness. Thus, while it is tantalizing to use a neurophysiologic mechanism to link nocturnal wakefulness and suicide risk, confounding sociodemographic explanations need to be ruled out first.

On a separate note, if nocturnal wakefulness is associated with suicidal thoughts and behaviors due to temporal patterns in cortical activity, cognition, and mood, then the same patterns may create a time of day when suicidal thoughts and behaviors are less likely. Indeed, a recent exploratory study[35] by our group found that morning wakefulness (5:00 AM–11:00 AM) was associated with lower odds of suicidal ideation. That study, however, oversampled individuals who were young, White, and female and who had insomnia and/or suicidal ideation, which limits inferences on whether timing of wakefulness is linked to suicidal ideation apart from sociodemographic confounders. Therefore, the present study used a nationally representative US sample to reexamine how nocturnal and morning wakefulness were associated with suicidal ideation. The main hypotheses were that nocturnal wakefulness would be positively associated with suicidal ideation, that morning wakefulness would reduce the odds of suicidal ideation, and that these associations would remain significant after adjustment for sociodemographic confounders. Secondary analyses investigated how wakefulness was related to suicidal ideation after adjustment for common symptoms of sleep disorders and/or severity of depression symptoms. Finally, the associations between specific patterns of nocturnal wakefulness and suicidal ideation were explored.

METHODS

Data Source

Data were extracted from the 2015–2018 waves of the National Health and Nutrition Examination Survey (NHANES),[36] a nationally representative survey conducted annually by the Centers for Disease Control and Prevention. The full NHANES dataset, methodology, and procedures are publicly available (www.cdc.gov/nchs/nhanes). In brief, the NHANES uses census data to select random addresses from within equally sized regions and then selects individuals at random from each address to be interviewed in-person. Responses are anonymized, and survey data are weighted to represent the civilian, noninstitutionalized population of the United States at all ages. This study was deemed exempt by the institutional review board at the University of Arizona as it examines existing, deidentified population data.

Measures

The primary outcome was the presence of suicidal ideation as assessed by item 9 of the Patient Health Questionnaire (PHQ-9).[37] The PHQ-9 asks about 9 symptoms of depression in the past 2 weeks, with subject responses arrayed from 0 to 3: "not at all" (0), "several days" (1), "more than half the days" (2), or "nearly every day" (3). Item 9 specifically asks about "thoughts that you would be better off dead or of hurting yourself in some way." Responses were recoded as "No Suicidal Ideation" (0) for "not at all" and "Suicidal Ideation" for all other responses (1–3). The internal reliability for the PHQ-9 in this sample was excellent (Cronbach $\alpha = .83$).

The primary exposure was wakefulness across the day. In the NHANES, respondents provided their usual time to bed ("What time do you usually go to sleep on weekdays or workdays?") and usual time out of bed ("What time do you usually wake up on weekdays or workdays?"), rounded to the nearest 15 minutes. These questions specified an individual's time in bed, and thus the inverse represented the period when an individual was not in bed (ie, awake). Because time spent awake during time in bed cannot be estimated from the data, this metric for wakefulness likely underestimates wakefulness at night. Wakefulness at each clock hour was binned into 4 categories based on a prior report[35]: morning (05:00 to 10:59), afternoon (11:00 to 16:59), evening (17:00 to 22:59), and night (23:00 to 04:59).

Data on age, sex, race/ethnicity, employment, education, and marital status were included to address potential confounding by sociodemographic factors. Four clinical variables were also included to disentangle nocturnal wakefulness from the effects of other sleep disorders or symptoms of depression. Insufficient sleep is associated with suicidal ideation[38] and may manifest as increased hours awake at night. The first variable, sleep duration, was determined from the question "How much sleep do you usually get at night on weekdays or workdays?" with responses categorized as < 7 hours ("Short Sleep"), 7–8.99 hours ("Recommended Sleep"), and ≥ 9 hours ("Long Sleep"). These categories were based on the U-shaped relationship observed between sleep duration and many areas of health. The second clinical variable was insomnia status because insomnia is closely linked to suicide risk.[3,4] The NHANES does not directly assess insomnia, however, so use of a prescription medication for insomnia was included as a proxy. Interviewers entered all medications taken by the respondent in the last 30 days into an automated system, which assigned an *ICD-10* code based on the reason for the medication. Individuals who used a medication for insomnia were assigned the *ICD-10* code G47.0. A third variable was extracted from the question "How often do you snort, gasp, or stop breathing while you were asleep?" in the past 12 months, with possible responses including "never," "rarely," "occasionally," and "frequently." Responses were then

Table 1. Sociodemographic Characteristics of the Sample by Suicidal Ideation[a]

Characteristic	Total Sample (n = 10,166)	No Suicidal Ideation (n = 9,781)	Suicidal Ideation (n = 385)	*P* Value
Age, y				.078
18–24	1,217 (11.5)	1,157 (11.4)	60 (16.7)	
25–34	1,600 (17.7)	1,553 (17.7)	47 (17.4)	
35–44	1,518 (16.1)	1,468 (16.1)	50 (15.7)	
45–54	1,543 (16.8)	1,481 (17.0)	62 (11.5)	
55–64	1,869 (18.3)	1,798 (18.3)	71 (19.7)	
65–79	1,810 (15.6)	1,743 (15.6)	67 (14.9)	
80+	609 (4.0)	581 (4.0)	28 (4.2)	
Sex				.2
Male	4,969 (48.3)	4,767 (48.2)	202 (52.4)	
Female	5,197 (51.7)	5,014 (51.8)	183 (47.6)	
Race/ethnicity				.017
White	3,494 (64.0)	3,360 (64.1)	134 (59.9)	
Black	2,253 (11.2)	2,190 (11.2)	63 (10.1)	
Mexican American	1,628 (9.0)	1,561 (9.0)	67 (9.2)	
Other Hispanic	1,112 (6.4)	1,054 (6.3)	58 (8.7)	
Asian	1,217 (5.1)	1,181 (5.2)	36 (4.3)	
Other	462 (4.3)	435 (4.2)	27 (7.8)	
Education				< .001
College	2,388 (32.0)	2,345 (32.5)	43 (15.5)	
Some college	3,034 (31.9)	2,918 (31.7)	116 (38.0)	
High school	2,227 (24.1)	2,138 (24.1)	89 (26.0)	
Some high school	1,100 (7.7)	1,037 (7.5)	63 (13.7)	
Middle school	919 (4.3)	866 (4.2)	53 (6.9)	
Employment				< .001
Employed	5,759 (64.1)	5,624 (64.9)	135 (42.6)	
Unemployed	4,395 (35.9)	4,145 (35.1)	250 (57.4)	
Marital status				< .001
Never married	1,759 (18.1)	1,663 (17.8)	96 (27.3)	
Married	4,855 (54.3)	4,736 (55.0)	119 (33.3)	
Widowed	713 (5.6)	674 (5.5)	39 (8.3)	
Divorced/separated	1,425 (12.5)	1,343 (12.2)	82 (20.9)	
Living with partner	919 (9.5)	891 (9.5)	28 (10.3)	

[a]Data presented as n (population-weighted prevalence, %).

dichotomized, with "never" recoded as "no" and all other responses as "yes." While not diagnostic, the presence of snorting or gasping is suggestive of obstructive sleep apnea, a condition previously associated with suicidal ideation.[39] Finally, the severity of depression symptoms was measured by summing items 1 through 8 on the PHQ-9 into the PHQ-8 score,[40] which also had excellent internal validity (Cronbach α = .83).

Statistical Analyses

All analyses were performed with R (version 4.0.3) using the survey package[41] to allow for population weighting. Only participants with complete data for suicidal ideation and timing of wakefulness were included. Chi-square tests with the Rao-Scott second-order correction were used to compare suicidal ideation across sociodemographic characteristics. Multivariable weighted logistic regression models were used to estimate the associations between wakefulness and suicidal ideation, measured as odds ratios (ORs) and 95% confidence intervals (CIs). Five models were fit for each category of wakefulness. Model 1 was unadjusted (number of hours awake within each category as the exposure), while Model 2 adjusted for age, sex, and race/ethnicity. Subsequent models adjusted for age, sex, and race/ethnicity as well as employment, education, and marital status (Model 3); sleep duration, insomnia medication, and gasping (Model 4); and PHQ-8 score (Model 5). An additional univariate weighted logistic regression model estimated the associations between patterns of nocturnal wakefulness and suicidal ideation. For statistical testing, significance was set to .05 and all tests were 2-sided.

RESULTS

Sample Characteristics

Data from 10,166 individuals aged 18 years and older were included, of whom 385 endorsed suicidal ideations in the prior 2 weeks. This yielded a population-weighted prevalence (95% CI) of 3.37% (2.85%–3.87%). Table 1 presents the prevalence of suicidal ideation across sociodemographic factors; there was significant variation in suicidal ideation by race, education, employment, and marital status, but not by age or sex.

Wakefulness and Suicidal Ideation

The distribution of wakefulness across time categories by suicidal ideation status is shown in Figure 1. In the morning, individuals with suicidal ideation were awake for a population-weighted estimate (95% CI) of 3.57 (3.31–3.84) hours versus 4.21 (4.16–4.26) hours for individuals without suicidal ideation, a significant difference of 38 minutes (*t* test, $P < .0001$). At night, individuals with suicidal ideation were awake for 1.11 (0.95–1.27) hours as compared with 0.79 (0.74–0.85) hours for individuals without suicidal ideation, a significant difference of 19 minutes (*t* test, $P = .0008$). There were no differences in afternoon and evening wakefulness by suicide ideation status.

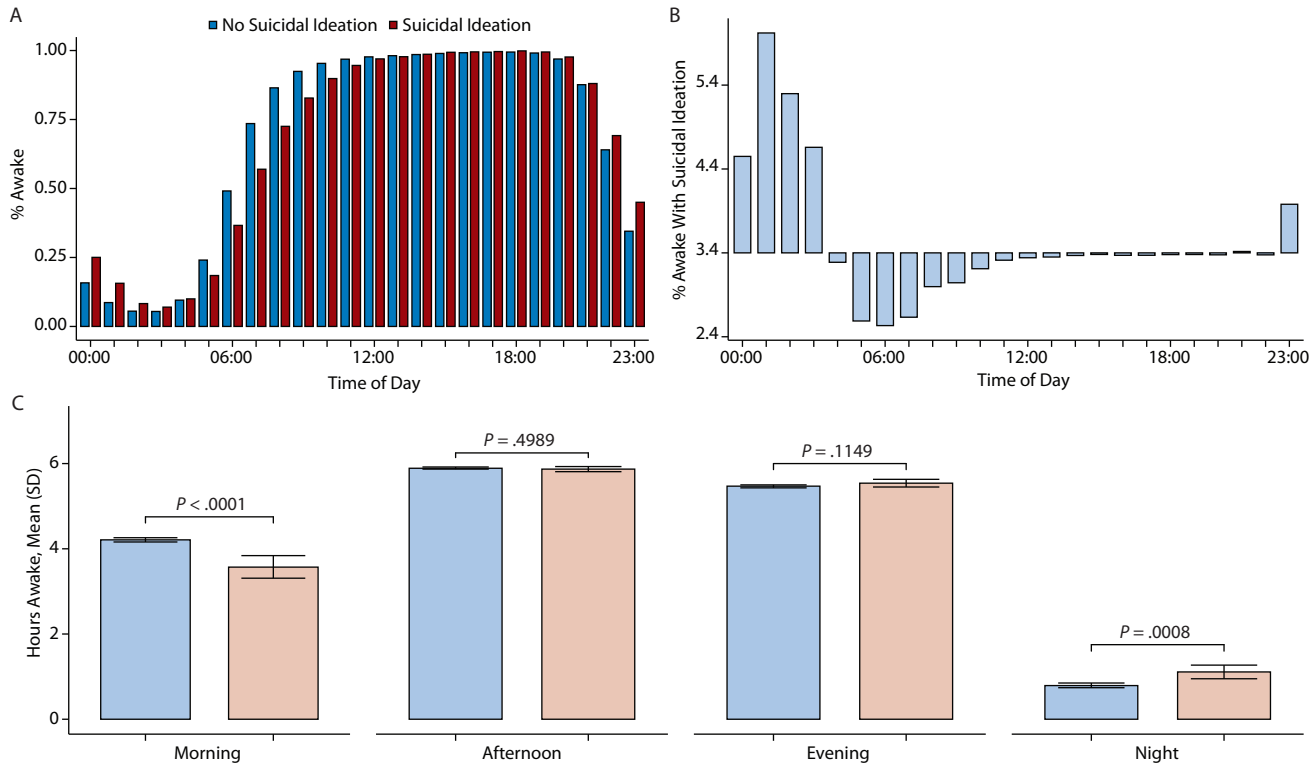
Nocturnal Wakefulness, Morning Wakefulness, and Suicidal Ideation

The results of the sequential, multivariable logistic regression analyses are presented in Table 2. In unadjusted analyses, nocturnal wakefulness was associated with increased odds of suicidal ideation (OR [95% CI] = 1.16 [1.08–1.24] per hour awake). This relationship remained significant after adjustment for sociodemographic factors and sleep variables, but not PHQ-8 score. Conversely, morning wakefulness was associated with lower odds of suicidal ideation in unadjusted analyses (OR [95% CI] = 0.77 [0.70–0.85] per hour awake), and this association remained significant across all models tested.

Patterns of Nocturnal Wakefulness and Suicidal Ideation

Because night was defined as 11:00 PM through 4:59 AM, nocturnal wakefulness could involve being awake after 11:00 PM, before 5:00 AM, or both. Therefore, survey data were segregated by

Figure 1. The Timing of Wakefulness and Suicidal Ideation[a]



[a]Part A shows the proportion of individuals who were awake who had suicidal ideation (red) and who did not have suicidal ideation (blue) across clock hours. Part B shows the percent of individuals with suicidal ideation as a percent of all individuals awake at that hour. The data are centered at 3.4%, which is the mean prevalence of suicidal ideation in the general population. Part (C) compares population-weighted estimates (95% CIs) of number of hours awake for those with and without suicidal ideation in each 6-hour time bin: morning: 05:00 to 10:59; afternoon: 11:00 to 16:59; evening: 17:00 to 22:59; night: 23:00 to 04:59.

Table 2. Associations Between Wakefulness and Suicidal Ideation[a]

Model	Odds Ratio	95% CI	*P*
Model 1[b]			
Night	1.16	1.08–1.25	<.001
Morning	0.77	0.70–0.85	<.001
Model 2[c]			
Night	1.15	1.06–1.25	.002
Morning	0.78	0.70–0.87	<.001
Model 3[d]			
Night	1.10	1.01–1.21	.039
Morning	0.84	0.75–0.95	.010
Model 4[e]			
Night	1.14	1.02–1.28	.022
Morning	0.81	0.72–0.91	.002
Model 5[f]			
Night	0.92	0.82–1.03	.200
Morning	0.88	0.79–0.97	.016

[a]Values shown are odds ratios and 95% CIs per hour awake. [b]Unadjusted. [c]Adjusted for age, sex, and race/ethnicity. [d]Model 2 + employment, education, and marital status. [e]Model 2 + sleep duration, insomnia medication, and gasping. [f]Model 2 + PHQ-8 score.
Abbreviation: PHQ-8 = items 1–8 on the 9-item Patient Health Questionnaire.

pattern of nocturnal wakefulness and summarized in Table 3. Of the 10,166 respondents, 38.5% (n = 3,911) were not awake at night, 47.8% (n = 4,858) were awake after 11:00 PM, 8.3% (n = 840) were awake before 5:00 AM, and 5.4% (n = 548) were awake at both times. Compared to individuals who were not awake at night, wakefulness at or after 11:00 PM was significantly associated with suicidal ideation (OR [95% CI] = 1.51 [1.08–2.12]), while wakefulness before 5:00 AM or at both times was not associated with suicidal ideation.

DISCUSSION

Sleep disorders increase the risk for suicide,[2–5] and recent evidence highlights nocturnal wakefulness as a contributing factor.[6,7,35] In this analysis of nationally representative survey data, nocturnal wakefulness was associated with greater odds of suicidal ideation even after adjusting for sociodemographic factors and symptoms of sleep disorders; only adjusting for the severity of depression symptoms eliminated this association. Further, as hypothesized, morning wakefulness was associated with lower odds of suicidal ideation across all models. Together, these results support a systematic difference in sleep-wake timing between individuals with and without suicidal ideation.

In accordance with the primary study hypothesis and prior evidence,[35] individuals with greater nocturnal wakefulness were more likely to report suicidal ideation in the past 2 weeks. Moreover, sequential modeling showed that the relationship between nocturnal wakefulness and suicidal ideation was not confounded by symptoms of other sleep disorders or higher rates of suicidal ideation in certain sociodemographic subgroups. While these data cannot

Table 3. Patterns of Nocturnal Wakefulness Across Sociodemographic Groups[a]

Characteristic	Not Awake (n = 3,913)	After 11:00 PM (n = 4,865)	Before 5:00 AM (n = 840)	After 11:00 PM and Before 5:00 AM (n = 548)
Age, y				
18–24	356 (8.9)	770 (14.9)	28 (3.4)	63 (14.7)
25–34	565 (16.7)	832 (19.1)	92 (11.9)	111 (22.8)
35–44	606 (16.7)	701 (15.1)	125 (18.2)	86 (17.0)
45–54	610 (18.0)	665 (15.0)	174 (22.5)	94 (14.9)
55–64	706 (16.7)	796 (17.5)	241 (27.6)	126 (22.2)
65–79	768 (17.9)	837 (14.8)	148 (14.4)	57 (6.8)
80+	302 (5.1)	264 (3.6)	32 (2.0)	11 (1.6)
Sex				
Male	1,737 (43.2)	2,423 (49.8)	484 (56.1)	325 (61.6)
Female	2,176 (56.8)	2,442 (50.2)	356 (43.9)	223 (38.4)
Race				
White	1,453 (67.0)	1,617 (62.0)	283 (66.4)	141 (54.0)
Black	745 (9.5)	1,108 (11.6)	205 (10.9)	195 (21.7)
Mexican American	764 (10.1)	616 (7.8)	175 (11.2)	73 (8.9)
Other Hispanic	426 (5.9)	556 (7.0)	78 (5.0)	52 (6.4)
Asian	382 (4.0)	709 (6.5)	61 (2.7)	65 (5.9)
Other	143 (3.5)	259 (5.1)	38 (3.8)	22 (3.1)
Education				
College	898 (32.9)	1,302 (35.8)	115 (17.1)	73 (14.5)
Some college	1,079 (30.5)	1,489 (31.6)	272 (35.8)	194 (39.7)
High school	870 (23.4)	972 (22.4)	228 (31.9)	157 (32.9)
Some high school	435 (7.8)	480 (7.2)	113 (8.9)	72 (9.7)
Middle school	488 (5.4)	290 (3.1)	103 (6.3)	38 (3.2)
Employment				
Employed	2,090 (62.5)	2,674 (61.7)	606 (78.2)	389 (75.6)
Unemployed	1,815 (37.5)	2,187 (38.3)	234 (21.8)	159 (24.4)
Marital status				
Never married	540 (13.6)	995 (22.6)	78 (8.6)	146 (29.7)
Married	2,010 (58.4)	2,180 (51.0)	453 (62.3)	212 (37.3)
Widowed	325 (6.5)	294 (4.9)	66 (5.6)	28 (3.5)
Divorced/separated	523 (11.9)	643 (11.9)	167 (16.9)	92 (15.6)
Living with partner	373 (9.6)	423 (9.6)	67 (6.6)	56 (14.0)

[a]Data presented as n (population-weighted prevalence, %).

establish causality between nocturnal wakefulness and suicidal thinking, they do implicate nocturnal wakefulness as (potentially) comorbid with suicidal ideation and support further investigation of how sleep/wake patterns vary with suicidal thinking in real time.

Interestingly, the relationship between nocturnal wakefulness and suicidal ideation was eliminated after adjusting for the severity of depression symptoms. This finding warrants further discussion. First, individuals with depression are more likely to have evening chronotypes, delayed bedtimes, and sleep continuity disturbance[42–44] which likely increase the chances of being awake between 11:00 PM and 5:00 AM. Thus, adjusting for symptoms of depression may have inadvertently reduced the analysis cohort of individuals with nocturnal wakefulness, which is consistent with a recent finding that the relationship between evening chronotype and suicidality was fully mediated by symptoms of depression.[45]

The present study also confirmed that morning wakefulness is associated with reduced odds of suicidal ideation, even after adjusting for sociodemographic and clinical confounders. One simple explanation for this relationship is the inverse of the aforementioned chronotype argument: if evening chronotypes are more likely to be depressed/suicidal and awake at night, then morning chronotypes are less likely to be depressed/suicidal and more likely to be awake in the morning. Interestingly, chrono-therapeutic treatments (eg, sleep deprivation, phase shifting, and/or bright light therapy) rapidly and effectively treat depression by advancing sleep back into circadian alignment,[46–50] a process that likely has the knock-on effect of increasing morning wakefulness. Again, while these results cannot establish whether morning wakefulness protects against suicidal thinking, replicating this association in a much larger sample eliminates sociodemographic confounding as an explanation, thus paving the way for more mechanistic investigations.

On a broader level, this investigation illustrates the benefits and drawbacks of using epidemiologic data to study suicide risk factors. On the one hand, the large, nationally representative sample available in NHANES provided the statistical power to investigate multiple exposures simultaneously and to eliminate potential confounding by population-level characteristics. However, even in the context of this much larger sample, only 385 people reported suicidal ideation, which yielded a weighted population prevalence of 3.4%. While 147 (21%) of the respondents in our previous community-dwelling study reported suicidal ideation, the 12-month national prevalence of suicidal ideation among US adults is approximately 3.8%,[51] with estimates ranging from 6.6% among those aged 18 to 25 years to 2.5% among those aged 50 years and older.[52,53] It would appear that—even within the largest of datasets—the base rate of self-reported suicidal thoughts and behaviors is so low that identifying suicide predictors from epidemiologic surveys remains statistically challenging (as the past 50 years of suicide prediction research can attest[54]). This means that rather than conducting larger epidemiologic studies, future research should focus on identifying individuals with suicidal ideation and then characterizing their ideation and sleep patterns in greater psychological and neurophysiologic detail.

It should also be noted that the associations of morning and nocturnal wakefulness with suicidal ideation are measured per hour awake (ranging from 0 to 6). Thus, in the unadjusted models, an individual awake for 1 hour at night would have an odds ratio of 1.16 for suicidal ideation, while an individual with 6 hours of nocturnal wakefulness would have an odds ratio of 2.46. Similarly, 1 hour of morning wakefulness would carry an odds ratio of 0.77, while 6 hours of morning wakefulness would have an odds ratio of 0.21. From a clinical standpoint, these associations are not particularly strong and may bear minimal predictive value for future suicidal thinking. However, this does not mean that sleep timing bears no clinical relevance for

suicide prevention. Nocturnal wakefulness is a completely modifiable exposure that, without intervention, may increase risk through the accumulation of sleep deprivation and circadian misalignment.[55] Thus, identifying the cause of nocturnal wakefulness and intervening appropriately may be a reasonable risk reduction strategy. Additionally, clarifying how nocturnal wakefulness affects suicide risk (whether through neurophysiologic dysregulation or other means) may guide future suicide prevention interventions and efforts.

The strengths of this study include the large sample size as well as the representative nature of the data set, which increases generalizability to individuals living in the United States. Limitations include the small number of individuals reporting suicidal ideation (3.4% of the population); the extensive use of self-report data, which are vulnerable to recall or reporting bias; and the lack of specific information about shift workers. Additionally, suicidal ideation was measured using a single question that could be construed as asking about thoughts of suicide and/or non-suicidal self-injury. However, the measure from which this question was drawn is well-validated,[37] and while single-item measures of suicidality are vulnerable to misclassification,[56] the present study provides a reasonable evaluation of suicidal ideation and sleep timing in a national sample. Future research should use more comprehensive assessments of suicidal thoughts and behaviors to confirm these results. Additionally, while wakefulness was calculated based on self-report, self-reported time in bed often overestimates sleep duration.[57] This means that time not in bed likely underestimates time awake due to individuals lying in bed unable to sleep and, as such, presents a conservative estimate of wakefulness. Ultimately, objective sleep monitoring is needed to validate these claims.

CONCLUSION

Suicide is the tenth leading cause of death in the United States,[1] although young adults and individuals with a lower socioeconomic status carry a significantly higher risk. This study demonstrates that nocturnal wakefulness is associated with suicidal thoughts apart from sociodemographic factors, although this association was difficult to disentangle from symptoms of depression. Additionally, this study provides the first strong evidence that morning wakefulness is linked to reduced odds of suicidal ideation irrespective of other factors. Intensive longitudinal or experimental studies are now needed to understand sleep and circadian mechanisms that connect mood disturbance and suicide. Interventional trials are also needed to determine whether reducing nocturnal wakefulness can improve suicide risk.

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Editor's Note: We encourage authors to submit papers for consideration as a part of our Focus on Suicide section. Please contact Philippe Courtet, MD, PhD, at pcourtet@psychiatrist.com.