



Original Article

Psychological correlates of poor sleep quality among U.S. young adults during the COVID-19 pandemic



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ABSTRACT

Objective: Uncertainty due to the COVID-19 pandemic may result in problematic sleep that can lead to negative effects on overall health. This unprecedented and stressful time can be even more detrimental for young adults with pre-existing mental health conditions. The purpose of this study is to investigate potential risk factors (i.e., current mental health symptoms, and COVID-19-related grief and worry) on sleep quality of U.S. young adults during the initial months of the global pandemic.

Method: This cross-sectional study examined 908 young adults in the weeks following the declaration of the coronavirus pandemic as a national emergency by the United States. A series of hierarchical multiple regression analyses examined depression, anxiety, and PTSD, as well as COVID-19-related grief and worry as predictors of young adults' sleep quality.

Results: Young adults experienced high rates of sleep problems during the first two months (April to May 2020) of the pandemic. Depressive and anxiety symptoms appear to be predictors of sleep quality regardless of any pre-existing diagnosis. Furthermore, high levels of PTSD symptoms and COVID-19-related worry were associated with young adults' poor sleep.

Conclusions: Our findings point to possible psychological factors that uniquely explain young adults' poor sleep quality during the COVID-19 pandemic in the U.S. This study shed new light on how the COVID-19 pandemic might affect the sleep behaviors of young adults without a pre-existing mental health diagnosis. Implications for supporting young adults sleep and well-being during the pandemic are addressed.

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1. Introduction

The COVID-19 pandemic has led to major societal upheaval for countries around the world. In mitigating contagion, government stay-at-home orders and lockdowns have abruptly changed the daily routines of millions of people. As of mid-December of 2020, the United States (U.S.) COVID-19 death toll has passed 300,000 [1]. Moreover, unemployment and the subsequent economic downturn are among the many concerns faced by individuals living within the U.S., with shifts to a new lifestyle and the emergence of major

worries being just some of the reasons behind the documented increase in psychological distress among U.S. young adults [2].

Of interest is the extent to which psychological distress experiences relate to problems with sleep during the pandemic. In general, approximately 50–70 million Americans experience some sleep-related problems. Prior studies indicate that psychological distress which takes place within and outside the context of a major life event is associated with poor sleep quality (e.g., trouble falling asleep, feeling drowsy during the day, awakening during sleep) [3,4]. Symptoms such as depression, anxiety, and PTSD are associated with sleep problems [5,6]. Notably, these symptoms are shown to be elevated during the pandemic [7–9].

To date, the data on sleep quality during the COVID-19 pandemic are limited. Since the pandemic, a number of papers have addressed how the outbreak might affect overall sleep health [10,11]. For example, sleep disturbance has been documented as a

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recurrent symptom during the COVID-19 pandemic [12,13]. On the other hand, some people experienced no change or even improved sleep quality during COVID-19 as their daily schedules became more flexible [14,15]. Only a few studies have assessed sleep in relation to psychosocial experiences, with findings outside of the U.S. demonstrating the comorbidity of depression and anxiety symptoms with sleep [11,16–18]. To our knowledge, there is limited information on the association between COVID-19-related psychological distress and sleep quality among young adults in the U.S.

Understanding the association between psychological distress and sleep quality for young adults is critical. Under normal conditions, young adults are vulnerable to acute sleep deprivation, with up to 60% of college students suffering from poor sleep [19,20]. Young adults have high rates of mental health diagnoses such as depression, anxiety, and suicidality [21,22]. They are also uniquely affected by the pandemic through a number of ways. For instance, within 2020, nearly half of the people between the ages of 19 and 29 years have reported feeling symptoms of anxiety or depression at a significantly higher rate compared to other age groups [23]. Many young adults have been abruptly evicted from college campuses or asked to work remotely. Others who have suffered from a job and/or housing loss may now be facing serious concerns about their immediate future, with various losses leading to feelings of grief. Rising COVID-19 rates have been observed among young adults, adding to their overall concerns about health-related risks [24].

Taken together, there are good reasons to believe that the psychological distress experienced during and specific to the pandemic are likely to be associated with sleep problems for young adults. Such associations may vary based on pre-existing mental health concerns. This study seeks to investigate the extent to which psychological distress experiences posed a risk to sleep quality in the weeks following the U.S. declaration of the COVID-19 pandemic as a national emergency. We investigated potential risk factors—current mental health symptoms including depression, anxiety, and PTSD, as well as COVID-19-related grief and worry—on U.S. young adults' sleep quality from April to May 2020.

2. Methods

2.1. Procedure

This cross-sectional study used data collected during the first wave of the COVID-19 Adult Resilience Experiences Study (CARES) 2020 Project (April to May 2020). Wave 1 data collection took place approximately one month after the U.S. declared a national state of emergency due to the COVID-19 outbreak, that led to the issuance of stay-at-home or shelter-in-place orders in all 50 states. Wave 1 data included responses from a total of 908 young adults ranging in age from 18 to 30 years, and currently residing in the U.S. or obtaining education from a U.S. institution. Participants were recruited using various outreach strategies such as social media, email listservs, and word of mouth. Once recruited, participants were asked to provide consent for study participation. They were then asked to complete a 30-min online survey with questionnaires about COVID-19 pandemic-related experiences, psychosocial factors, mental health, and sleep quality. One out of every 10 participants were randomly selected to receive a \$25 gift card. Various attention check questions and human verification strategies were embedded within the survey to ensure data quality. This study was approved by the Institutional Review Board at Boston University.

2.2. Participants

Young adults were on average 24.48 years of age. Nearly 82% of participants were women, 14.0% men, and 3.6% were self-identified

as another gender (1.0% were transgender). Approximately 60% identified as White, 21.3% Asian, 5.4% Black, 6.0% Hispanic/Latinx, 6.2% mixed race, and 1.5% as other (including American Indian/Native American participants). About 14% of the participants identified as non-U.S. born. Approximately 82% of the participants reported a yearly income less than \$50,000.

2.3. Measures

2.3.1. Risk factors

2.3.1.1. Pre-existing mental health diagnosis. Participants were asked to report whether they had ever received a clinical diagnosis for at least one of the following mental health disorders: depression, generalized anxiety disorder, PTSD, ADHD, insomnia, panic disorder, OCD, substance abuse or addiction (alcohol or other drugs), and other mental health conditions. Participants could select “No”; “Suspected, but not diagnosed”; “Yes, diagnosed but not treated”; or “Yes, diagnosed and treated.”

2.3.1.2. Depression symptoms. Participants' frequency of depressive symptoms in the past two weeks was captured using the Patient Health Questionnaire (PHQ-8; [25]). The PHQ-8 is an 8-item measure, where depressive symptoms were rated using a scale of 0–3 (0 = *not at all* to 3 = *nearly every day*), that yielded a total score with a possible range of 0–24. Higher scores reflected higher depressive symptomatology.

2.3.1.3. Anxiety symptoms. Anxiety symptoms over the previous two weeks were assessed using the Generalized Anxiety Disorder Scale (GAD-7; [26]), a widely used 7-item self-report measure. Ratings relied on a scale of 0–3 (0 = *not at all* to 3 = *nearly every day*) with a total possible range of 0–21. Higher sum scores indicated elevated anxiety.

2.3.1.4. Post-traumatic stress disorder (PTSD). PTSD symptoms were assessed through the PTSD Checklist—Civilian Version (PCL-C; [27]). The PCL-C is a 17-item rating scale that inquires how often participants were bothered by problems and experiences in response to stressful life events. Ratings used a 5-point type scale (1 = *not at all* to 5 = *extremely*) with the sum of all items (i.e., the total symptom severity score) ranging from a total possible range of 17–85.

2.3.1.5. COVID-19-related worry. A newly developed 6-item measure assessed the severity of COVID-19 pandemic-related worry on young adults [28]. Participants responded to each item on a scale of 1 (*not worried at all*) to 5 (*very worried*). Examples of items on the measure included: “I am worried that I will not be treated for COVID-19 if I contract it,” “I am worried about keeping in touch with loved ones during social distancing protocols,” “I am worried about having enough money to pay for rent and buy basic necessities.” The alpha coefficient for the overall scale was 0.70, indicating good reliability. Possible total sum scores range of 6–30.

2.3.1.6. COVID-19-related grief. Young adults' feelings of grief and loss during the COVID-19 pandemic were assessed using a newly developed 6-item measure [28]. Items were rated on a five-point scale, with 1 (*strongly disagree*) to 5 (*strongly agree*); total scores ranged from 6–30. Examples of items on the measure include “I worry about losing touch with my friends due to social distancing,” “I feel stunned or dazed over what happened,” and “I feel that life is empty.” Some items were adapted from the Inventory of Complicated Grief [29]. The alpha coefficient for the overall scale was 0.76, indicating good reliability.

2.3.2. Outcomes

2.3.2.1. Sleep problems. The Medical Outcomes Study Sleep Scale (MOS-SS) was administered to gather information about participants' sleep quality and quantity during the past four weeks [30]. For data analysis purposes, the score from the Sleep Problems Index II subscale of the MOS-SS was included. The 9-item subscale assessed participants' sleep problems such as sleep disturbance, somnolence, and snoring. Participants' responses were recoded to a standardized 0 to 100 scale. Higher scores reflected greater sleep impairment.

2.3.3. Analytic plan

To examine the unique effects of potential risk variables on young adults' sleep quality, two hierarchical multiple regressions were computed using SPSS 25.0. In order to investigate whether adding other variables would significantly improve a model's ability to predict the criterion variable while controlling for certain variables, the first hierarchical multiple regression model entered the covariates and continuous predictors in the following steps: (1) Model 1, demographic covariates such as young adults' age, race, gender, income, and student status, (2) Model 2, young adults' pre-existing mental health diagnoses, and (3) Model 3, means of continuous variables, including current depression, anxiety, PTSD symptoms, COVID-19-related grief, and COVID-19-related worry. For the second hierarchical multiple regression analysis, we analyzed two separate models stratified by young adults' pre-existing mental health diagnoses. Specifically, one model was conducted with young adults without mental health symptoms and the other model was conducted with young adults with pre-existing mental health diagnoses. For both models, covariates were entered in Model 1 and risk variables were entered in Model 2.

3. Results

The descriptive data of the demographic characteristics are shown in Table 1. Among the study participants, 44.3% of them reported that they had received a clinical diagnosis with depression and anxiety being among the most common diagnosed disorders. Table 2 displays mean scores for the continuous variables, including key predictors and sleep quality outcomes.

The hierarchical multiple regression results for predicting young adults' sleep quality using MOS are presented in Table 3. Results of the overall model gave an R-value of 0.677 and an adjusted R² value of 0.441, which was significant ($F(27, 870) = 27.245, p < 0.001$). Based on the β coefficients, young adults' depression symptoms, COVID-19-related worries, and PTSD were significant ($\beta = 0.401$; $\beta = 0.127$; $\beta = 0.160, p < 0.001$, respectively). These results demonstrated that current depression and PTSD symptoms, as well as COVID-19-related worry, contributed significantly towards young adults' sleep quality during the period of the COVID-19 pandemic.

Table 3 also includes the results of a series of hierarchical regression models, which were run separately according to young adults' pre-existing mental health conditions. For the final model of young adults with no pre-existing mental health condition, the adjusted R² value of 0.351 was significant ($F(24, 474) = 12.244, p < 0.001$). For this group, based on the β coefficients, depression and anxiety symptoms and COVID-19-related worries contributed significantly towards their sleep quality ($\beta = 0.393, p < 0.001$; $\beta = 0.120, p < 0.05$; $\beta = 0.107, p < 0.05$, respectively). In the final model of young adults with pre-existing mental health conditions, the adjusted R² value of 0.382 was significant ($F(25, 373) = 10.837, p < 0.001$). For this group, based on the β coefficients, depression and PTSD symptoms, and COVID-19-related worries contributed

Table 1

Descriptives of categorical variables from Wave I of CARES 2020 overall and by pre-existing mental health diagnosis (N = 908).

Factors	Proportions (%)			Fisher's Exact-test
	Total	No pre-existing diagnosis	Pre-existing diagnosis	
Gender				49.25***
Men	14.0	19.4	7.2	
Women	81.4	79.0	84.3	
Other	4.6	1.6	8.5	
Race				35.68***
Asian	21.3	27.7	13.2	
Black	5.4	5.9	4.7	
Hispanic or Latinx	6.0	6.7	5.0	
White	59.6	52.4	68.7	
Mixed	6.2	5.9	6.5	
Other race	1.5	1.4	1.9	
U.S.-Born				11.30***
Yes	86.2	82.8	90.5	
No	13.8	17.2	9.5	
Employed				0.002
Yes	66.7	66.8	66.7	
No	33.3	33.2	33.3	
Individual Income (USD/Year)				9.01†
No income	11.7	13.6	9.2	
<\$25,000	45.9	44.7	46.5	
\$25,000–\$49,999	24.6	21.7	27.9	
\$50,000–\$74,999	11.6	12.0	10.9	
\$75,000+	6.2	8.0	5.5	
Student				0.82
Yes	61.3	62.6	59.7	
No	38.7	37.4	40.3	
Pre-existing Diagnosis				
Yes	44.3	—	—	
No	55.7	—	—	
Types of Diagnosis				
Depression	31.6	—	—	
Anxiety	29.0	—	—	
PTSD	8.0	—	—	
ADHD	6.8	—	—	
Insomnia	6.7	—	—	
Panic disorder	5.2	—	—	
OCD	4.0	—	—	
Addiction	1.0	—	—	
Other	9.1	—	—	

† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2

Means of continuous variables, including predictors and the Medical Outcome Study – sleep index II as an outcome from Wave I of CARES 2020 (N = 908).

	Mean	SD
Age (years)	24.48	3.26
Current Depression Symptoms (PHQ-8)	9.01	5.73
Current Anxiety Symptoms (GAD-7)	9.42	5.56
PTSD	38.34	14.19
COVID-19-Related Worry	15.95	5.31
COVID-19-Related Grief	19.21	4.67
MOS-Sleep index II	40.20	17.92

significantly towards their sleep quality ($\beta = 0.392, p < 0.001$; $\beta = 0.177, p < 0.01$; $\beta = 0.163, p < 0.001$, respectively).

4. Discussion

This study demonstrated the extent to which psychological distress, specifically depression, anxiety, PTSD, and COVID-19-related grief and worry were associated with sleep problems among young adults from April to May 2020 of the COVID-19 pandemic. Moreover, the study examined whether these associations varied by pre-existing mental health conditions.

Table 3

Multiple regression predicting **sleep problem** from Medical Outcomes Scales by current symptoms, and COVID-19-related grief, worry, and PTSD overall and by pre-existing mental health diagnosis.^a

Predictor	Total (N = 898)		No Pre-existing Diagnosis (n = 499)		Pre-existing Diagnosis (n = 399)	
	Standardized coefficients		Standardized coefficients		Standardized coefficients	
	β	ΔR^2	β	ΔR^2	β	ΔR^2
Model 1		0.020***		0.001		-0.001
Age	0.001		0.000		0.023	
Race (ref = white)						
Asian	0.024		0.006		0.057	
Black	0.020		0.028		0.016	
Hispanic or Latinx	0.030		0.010		0.068 [†]	
Mixed	-0.005		-0.007		0.007	
Other race	0.004		0.004		0.003	
Gender (ref = man)						
Women	-0.014		-0.023		-0.008	
Men (transgender)	-0.009		0.060 [†]		-0.045	
Women (transgender)	-0.018		—		-0.036	
Self-identify	-0.029		-0.029		-0.046	
Income (ref = no income)						
< \$25,000	0.005		0.012		0.008	
\$25,000–\$49,999	0.072 [†]		0.041		0.114	
\$50,000–\$74,999	0.009		-0.006		0.015	
\$75,000–\$99,999	0.018		0.019		-0.002	
\$100,000–\$124,999	-0.028		-0.050		-0.025	
\$125,000–\$149,999	-0.043 [†]		-0.001		-0.076 [†]	
\$150,000–\$174,999	0.064**		0.060		0.069 [†]	
\$175,000–\$199,999	0.026		0.033		—	
\$200,000–\$249,999	0.011		0.047		-0.020	
≥ \$250,000	-0.016		—		-0.025	
Student (ref = no)	-0.019		-0.051		-0.005	
Model 2		0.118***				
Pre-existing diagnosis (ref = no)	0.109***		—		—	
Model 3		0.441***		0.351***		0.382***
Depression symptoms	0.401***		0.393***		0.392***	
Anxiety symptoms	0.061 [†]		0.120*		0.026	
COVID-19-related worry	0.127***		0.107*		0.163***	
COVID-19-related grief	-0.011		-0.043		0.044	
PTSD	0.160***		0.112 [†]		0.177**	

[†] $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

^a Adjusted covariates include age, race, gender, income, student status.

The results obtained from our study respondents suggest that overall, young adults have experienced high rates of sleep problems during the first two months of the pandemic. Their average report of sleep problems (MOS $M = 40.2$) was higher than the score previously observed among a nationally representative sample of U.S. adults aged 18–94 years during non-pandemic conditions (MOS $M = 25.79$; [31]).

Among our study participants, 44.3% reported having a pre-existing mental health diagnosis (e.g., depression, generalized anxiety disorder, PTSD, ADHD, insomnia, panic disorder, OCD, substance abuse or alcohol/other addiction, and other mental health conditions). Considering that the lifetime prevalence of mental health diagnoses in young adults ranges from 25.4% to 30.3% [21], our participants' rates were fairly high. Additionally, young adults with a pre-existing mental health diagnosis reported more sleep problems during the initial months of the COVID-19 pandemic. Given that sleep difficulty has been reported in 50–90% of patients with major depressive disorder [32,33], our results are consistent with our understanding of poor sleep being a distinctive symptom and diagnostic criterion for many psychiatric disorders, including major depression, PTSD, GAD, and substance-related disorders [34].

When examining the entire sample, respondents appeared to have high depression and anxiety symptoms during the COVID-19 pandemic, with average score values between 9.01 and 9.42. Notably, reports of depressive symptoms predicted poor sleep during this same period of time, even after accounting for the pre-

existing mental health diagnoses. Indeed, recent studies conducted during the pandemic have reported associations between poor sleep and symptoms of depression and anxiety. Among participants in China, more than 30% of participants experienced anxiety disorders, and nearly 20% of participants responded reported depressive symptoms and sleep problems [11]. Anxiety and stress were associated with sleep among individuals who self-isolated in China during the pandemic due to mild infection, suspected cases of COVID-19, and/or possible exposure to the virus [18]. In Italy, people reported elevated levels of psychological distress during the pandemic [35], and young adults with higher levels of depression and anxiety symptoms reported lower sleep quality during the initial weeks of lockdown [17]. Although these studies consistently demonstrate a relationship between mental health symptoms and sleep problems during the pandemic, none accounted for pre-existing mental health concerns.

Our analyses also showed an association between PTSD symptoms with young adults' poor sleep, even after controlling for their pre-existing diagnoses. Thus, PTSD symptoms appear to be a strong and unique predictor of sleep quality during the pandemic. While sleep problems are common among individuals with either generalized anxiety or PTSD [32], as many as 90% of people with PTSD suffer from sleep problems [36]; not only do those with PTSD have difficulties falling asleep, they are more likely to suffer from nightmares and insomnia [37]. One recent study on Italian populations revealed positive associations between COVID-19-related PTSD and sleep disturbance [38]. Together, our analyses show

that regardless of a pre-existing mental health diagnosis, symptoms of depression and PTSD are associated with reported sleep problems during the pandemic.

Our assessment of COVID-19-related worry measured specific sources of concerns resulting from the pandemic, such as getting enough groceries, getting treatment for COVID-19 if contracted, or keeping in touch with loved ones under social distancing protocols. On average, the young adults in our sample reported being between “somewhat worried” to “worried” about these experiences. As with depression and PTSD symptoms, it appears that these concerns about the COVID-19 pandemic might be related to sleep problems even when accounting for a pre-existing mental health diagnosis. As such, young adults worrying about obtaining everyday critical resources during the pandemic – regardless of their mental health history—may have trouble getting to sleep or staying asleep. It is possible that disruptions to work and school due to the pandemic (e.g. eviction from college campuses or other housing, job loss or remote work) interfere with bedtime routines that in turn negatively affect sleep quality [39]. As well, the myriad of COVID-19-related concerns may lead to ruminative thinking or increased efforts in problem-solving, both known to disrupt both routines and sleep quality [40].

We also found these associations to vary by pre-existing mental health diagnosis. When stratifying the analyses by one's report of having a pre-existing mental health diagnosis, current anxiety symptoms, but not PTSD symptoms were associated with poor sleep among young adults without such a diagnosis, whereas the reverse was observed among those with a diagnosis. That is, PTSD but not anxiety symptoms were associated with poor sleep for those with a pre-existing mental health condition. It's unclear why those with a diagnosis may be more vulnerable to the potential effects of PTSD such that it leads to poor sleep. Several studies have already highlighted the mental health risks of COVID-19 in vulnerable populations, including patients with pre-existing psychiatric illness [41,42] and it may be possible that individuals with a diagnosis are already vulnerable to poor sleep. As such, the experience of PTSD symptoms might compound any existing sleep concerns. Moreover, individuals with PTSD symptoms often suffer from high levels of vigilance, which can lead to sleep difficulties [43]. Generalized anxiety symptoms are more common among individuals without a pre-existing mental health condition and therefore exposure of such symptoms could lead them to report problematic sleep. More work is needed to understand how the differential risks of these symptoms operate with different populations.

Finally, grief related to the COVID-19 pandemic was assessed to measure experiences related to the loss of meaningful or important experiences due to the pandemic. However, unlike COVID-19 related worries, COVID-19-related grief was not a significant predictor of poor sleep in our study. One possible explanation is that COVID-19-related worries represent proximal stressors that influence sleep, relative to grief related to COVID-19. Given the major losses experienced by individuals during the pandemic, however, additional research is needed to better understand the nature of grief related to the pandemic and its impact on sleep.

The results indicate that the provision of mental and behavioral health services within schools and communities during this time is crucial. Young adults may be disproportionately impacted by negative psychological effects from the COVID-19 pandemic compared to other age groups [35,38]. Our findings demonstrating associations between PTSD symptoms and sources of COVID-19-specific worry on sleep may inform behavioral guidance for improving sleep quality. For instance, as the pandemic continues, cognitive behavioral therapy (CBT) addressing vigilance – a

possible underlying construct that explains the relationship with PTSD and COVID-19-specific worry on sleep – might be prioritized as a target for intervention among health care providers and others who work with young adults [44]. CBT techniques might include behavioral strategies for promoting calmness at bedtime, as well as redirecting attention from threats that contribute to increased vigilance and disruptions to healthy sleep practices [45].

The study has several limitations. First, this was a cross-sectional study; thus, we are limited in our ability to establish causal relationships between the predictor variables and young adults' sleep quality. Second, as the present study sample was recruited using convenience sampling, our sample is over-representative in terms of race (especially White) and gender (especially women). Moreover, our sample has a high rate of pre-existing mental health diagnoses due to sampling; caution should be taken in generalizing these findings beyond this group of young adults. Third, young adults' self-reports may be vulnerable to inherent bias. Finally, our measure of participant PTSD, the PCL-C measure, did not directly refer to the COVID-19 pandemic experience. Future studies using a longitudinal design will be able to investigate moderation effects and examine whether young adults' sleep quality may vary by circumstances or by individual characteristics.

Our study examined young adults' sleep quality during COVID-19 and its potential predictors using data collected during the first several weeks of the pandemic in the U.S. Our findings add to the emerging literature on sleep quality during the pandemic by demonstrating how current experiences of depressive symptoms, which appear to be prevalent during the pandemic regardless of participants' pre-existing diagnoses, may play a role in young adults' quality of sleep. During the lockdown, young adults may feel alone and unsure about where to seek help. A proactive and improved system of reaching out to young adults to support their sleep and mental health may be warranted during this time.

CRedit authorship contribution statement

Sunah Hyun: Conceptualization, Methodology, Writing - original draft, Writing - review & editing. **Hyeouk Chris Hahm:** Writing - review & editing, Supervision, Funding acquisition. **Ga Tin Fifi Wong:** Data curation, Writing - review & editing, Project administration. **Emily Zhang:** Data curation, Writing - review & editing, Project administration. **Cindy H. Liu:** Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Writing - review & editing, Supervision, Project administration, Funding acquisition.

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Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: <https://doi.org/10.1016/j.sleep.2020.12.009>.

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