

ORIGINAL ARTICLE

Social Media Use Before Bed and Sleep Disturbance Among Young Adults in the United States: A Nationally Representative Study

Jessica C. Levenson, PhD¹; Ariel Shensa, MA^{2,3}; Jaime E. Sidani, PhD^{2,3}; Jason B. Colditz, MEd^{2,3}; Brian A. Primack, MD, PhD^{2,3}

¹Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA; ²Center for Research on Media, Technology, and Health, University of Pittsburgh, Pittsburgh, PA; ³Division of General Internal Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA

This work was performed at the University of Pittsburgh, 230 McKee Place, Suite 600, Pittsburgh, PA, USA.

Study Objectives: Social media (SM) use has been positively associated with disturbed sleep among young adults. However, previous studies have not elucidated the specific importance of SM use immediately before bed. We aimed to determine the independent association of SM use during the 30 minutes before bed and disturbed sleep while controlling for covariates including total SM use throughout the day.

Methods: We assessed a nationally representative sample of 1763 US young adults aged 19–32. Participants estimated to what extent they used SM in the 30 minutes before bed. We assessed sleep disturbance using the brief Patient-Reported Outcomes Measurement Information System (PROMIS®) Sleep Disturbance measure. After testing the proportional odds assumption, we used ordered logistic regression to compute the independent association between SM use before bed and sleep disturbance controlling for covariates, including total SM use.

Results: Compared with those who rarely or very rarely check SM in the 30 minutes before bed, those who often or very often check SM at that time had an adjusted odds ratio of 1.62 (95% confidence interval = 1.31–2.34) for increased sleep disturbance. Additionally, we found a significant linear trend in the odds ratios between the frequency of checking SM in the 30 minutes before bed and increased sleep disturbance ($p = .007$). Results were consistent in all sensitivity analyses.

Conclusions: SM use in the 30 minutes before bed is independently associated with disturbed sleep among young adults. Future work should use qualitative and experimental methods to further elucidate the directionality of—and mechanisms underlying—this association.

Keywords: bed, social media, technology, sleep quality, PROMIS.

Statement of Significance

While total social media (SM) use has been associated with sleep disturbance, this study extends prior findings by determining that SM use in the 30 minutes before bed is independently associated with disturbed sleep. Because this study was cross-sectional, future work should focus on elucidating the direction of this association and the mechanisms underlying it. Should future work show a causal association between these variables, it will be valuable for individuals experiencing sleep disturbance to target reduction of SM use in the period before bed to potentially reduce disturbed sleep. This may be more feasible and acceptable than attempting to reduce total SM use. Future work should also focus on identifying and testing feasible prevention and intervention strategies aimed at reducing SM use before bed.

INTRODUCTION

Insufficient sleep is highly prevalent among young adults,¹ and it is associated with daytime sleepiness² and a range of poor health outcomes.^{3–6} Social media (SM) use, which has increased rapidly in recent years,^{1,7} has been positively associated with disturbed sleep among young adults.^{8–11} SM use has also been associated with factors linked to disturbed sleep—such as higher levels of anxiety and depression—among adolescents.¹² Screen media are commonly used by youth and young adults,¹³ and their use has been associated with important sleep-related outcomes such as shorter sleep duration, later sleep timing, and poorer sleep quality.¹⁴ Because SM commonly involve interactive screen time, it may be more detrimental to sleep than more passive types of screen media, such as watching television.¹⁵ Therefore, a focus on SM, rather than screen time more generally, has particular relevance for sleep and related health outcomes.

Little work has examined the specific association between the time of day of SM use and sleep outcomes. It may be that any SM use is associated with poor sleep, regardless of time of day. SM use commonly involves alerts interrupting thought processes throughout the day,¹² which may impede relaxation at bedtime and potentially disturb sleep at night.^{12,16} Additionally, increased SM use during the day may displace time that was meant to be devoted to completing other tasks; this may delay

bedtime or disturb the nighttime routine if daytime tasks are instead being completed late at night.

However, it may also be that SM use specifically near bedtime may be particularly influential with regard to poor sleep, even when compared with daytime use. For example, nighttime SM use may contribute to anxiety or depression at bedtime,¹² perhaps because of social comparison or negative interactions experienced while on SM.¹⁷ Another possibility is that SM use close to bedtime may disrupt normal sleep-wake cycles and circadian rhythms by introducing light close to the eyes from the blue end of the color spectrum; this type of short-wavelength-enriched light is emitted by many devices on which individuals use SM.^{18,19}

Determining the relative importance of SM use just before bed—compared with total SM use (SM use across the entire day)—will be valuable in the development of evidence-based recommendations for young adults regarding best practices around ubiquitous SM use. For example, if the last 30 minutes before bed is identified as a potentially critical time, clinical recommendations for individuals with disturbed sleep can be appropriately focused. Therefore, the purpose of this study was to assess the independent association of SM use during the 30 minutes before bed and poor sleep outcomes, even when controlling for total SM use. Based on some prior literature noted above,¹² we hypothesized that increased use in the 30 minutes before bed would be independently associated with poor sleep.

METHODS

Participants and Procedures

Overall methodology has been described in detail in prior reports.⁹ In brief, we assessed a nationally representative sample of US young adults, drawn from a large-scale web-based research panel developed and maintained by the survey research company Growth from Knowledge (GfK). The panel, known as the KnowledgePanel®, was formed by GfK via both random digit dialing—from both land lines and cell phones—and address-based sampling.^{20,21} Therefore, the KnowledgePanel's sampling frame represents approximately 97% of US households.

From October to November 2014, the web-based survey was sent via electronic mail to a random sample of 3048 noninstitutionalized adults between the ages of 19 to 32. These adults had consented to participate in a previous wave of a two-wave longitudinal study assessing various health behaviors (wave 1 response rate = 54%). The data used for this analysis were collected as part of the study 18-month follow-up (wave 2) because SM use was not assessed during the baseline survey. This study was approved by the Institutional Review Board of the University of Pittsburgh and was granted a Certificate of Confidentiality from the National Institutes of Health. All participants provided informed consent before commencing participation.

Measures

Independent Variable: Social Media Use Before Bed

Participants were asked to estimate how frequently over the past year they “Checked social media in the 30 minutes before falling asleep at night?” In order to capture a full range of SM use before bed, initial response choices were very rarely; rarely; sometimes; often; and very often. For analysis, these response choices were collapsed into three categories: (1) rarely and very rarely, (2) sometimes, (3) often and very often to form more clinically relevant results.

Dependent Variable: Sleep Disturbance

We assessed sleep disturbance with the Patient-Reported Outcomes Measurement Information System (PROMIS®) Sleep Disturbance scale.^{22,23} This instrument assesses problems with sleep, difficulty falling asleep, whether sleep was refreshing, and sleep quality over the past 7 days. Each item was measured on a Likert-type scale, ranging from not at all (1) to very much (5). Due to the non-normal distribution of data, we collapsed the sleep measure into tertiles (low, medium, or high sleep disturbance) based on the raw score distribution. Specific cut points were consistent with those previously reported in the literature.⁹

Covariates

In order to ensure that SM use before bed was not simply a marker for total SM use, we included as a covariate total SM use. Participants self-reported the typical total number of minutes per day they used SM for personal use. Based on the distribution of data and on prior published literature, responses were collapsed into quartiles (0–30 minutes; 31–60 minutes; 61–120 minutes; 121 minutes+).^{24–27} Participants were specifically instructed not to report on work-related use. We also assessed

multiple sociodemographic factors that have previously been associated with SM use and/or sleep problems, including age, sex, race, relationship situation, living situation, household income, and educational attainment.²⁸ We decided a priori to categorize age into tertiles based on the distribution of the data and in order to achieve more interpretable results.

Analysis

We used chi-square tests to examine differences in each of the SM use variables and covariates among each sleep disturbance group. After confirming that the proportional odds assumption was satisfied, we used ordered logistic regression to assess the independent association of SM use before bed with sleep disturbance while controlling for all covariates, including overall SM use. Ordered logistic regression was appropriate because the dependent variable (sleep disturbance) was ordered categorical. All primary analyses used survey weights that adjusted not only for undercoverage and overcoverage but also for nonresponse. Survey weights were calculated by GfK using post-stratification adjustment based on sociodemographic benchmark distributions. Because each control variable has been associated with sleep disturbance in the past,²⁸ primary analyses controlled for all measured covariates.

To confirm the robustness of our results, we conducted three sets of sensitivity analyses. First, we conducted all multivariable analyses only adjusting for covariates with bivariable associations of $p < .15$ or stronger with the outcome to ensure that our models had not overcontrolled. Second, we computed all models operationalizing all variables as continuous when possible (eg, age). Finally, we conducted all analyses without survey weights. Because all sensitivity analyses showed similar findings to primary results, only results from the primary analyses are presented here.

Statistical analyses were performed with Stata 12.1 (Stata Corp, College Station, Texas), and two-tailed p -values $< .05$ were considered significant.

RESULTS

Of the 3048 individuals to whom invitations were sent, 1796 responded (response rate = 59%). A total of 1763 individuals had complete data on our primary independent and dependent variables. There were no differences between those who provided complete responses and were thus included in our analyses ($n = 1763$) and those who did not ($n = 1285$) in terms of age ($p = .12$), sex ($p = .07$), or race ($p = .21$).

Table 1 depicts demographic characteristics of the weighted sample. Accounting for survey weights, 39.8% of our sample was categorized into the low sleep disturbance group, 27.3% was categorized into the medium disturbance group, and 32.9% was in the high sleep disturbance group. Nearly one-third of the sample reported checking SM often or very often in the 30 minutes before bed.

SM use in the 30 minutes before bed, total SM use, and household income differed significantly among the three sleep disturbance groups. Specifically, those in the low sleep disturbance group were more likely to rarely check SM (49.6%) than to check it sometimes (22.3%) or often (28.1%), while those in the high sleep disturbance group were more likely to check SM often (37.5%) than to check it rarely (34.7%) or sometimes

Table 1—Whole Sample Characteristics and Bivariate Associations With Sleep Disturbance.

Independent variables	Whole sample ^a (n = 1763)	Sleep disturbance			p value ^b
		Low ^a (n = 701)	Medium ^a (n = 482)	High ^a (n = 580)	
Social media use					
Check 30 minutes before bed					.005
Rarely	41.7	49.6	37.2	34.7	
Sometimes	25.9	22.3	29.3	27.8	
Often	32.4	28.1	33.6	37.5	
Minutes per day					.001
Q1 (0–60)	50.5	59.1	47.0	41.4	
Q2 (61–120)	24.0	20.7	24.3	28.7	
Q3 (121+)	25.4	20.2	28.7	29.9	
Covariates					
Age, years					.06
19–23	33.7	37.8	34.2	27.1	
24–26	24.6	25.2	21.4	26.9	
27–32	41.7	37.0	44.4	46.0	
Sex					.05
Female	50.1	45.5	50.5	56.3	
Male	49.9	54.5	49.5	43.7	
Race ^c					.06
White, non-Hispanic	57.3	63.4	53.0	52.6	
Black, non-Hispanic	13.2	13.0	13.4	13.2	
Hispanic	20.7	17.3	21.0	25.4	
Other ^d	8.9	6.4	12.7	8.8	
Relationship status					.36
Single ^e	44.5	47.2	41.0	43.9	
Committed relationship ^f	55.5	52.8	59.0	56.1	
Living situation					.28
Parent/guardian	34.0	36.8	30.5	33.4	
Significant other	35.4	31.1	39.6	37.8	
Other ^g	30.6	32.2	30.0	28.8	
Household income					.001
Low (under \$30,000)	22.8	18.7	19.2	32.2	
Medium (\$30,000–\$74,999)	38.6	39.1	38.5	37.9	
High (\$75,000 and above)	38.7	42.2	42.3	30.0	
Education level					.50
High school or less	35.6	33.6	36.2	38.1	
Some college	38.6	39.4	36.0	40.0	
Bachelor's degree or higher	25.8	27.0	27.8	25.8	

^aColumn percentages. Values may not total 100 due to rounding.

^bp value derived using Rao-Scott chi-square tests for independence; bolded values indicate a significant association between the 2 variables.

^cn = 1760.

^dMultiracial.

^eWidowed, divorced, and separated.

^fEngaged, married, and in a domestic partnership.

^gNot living with a parent/guardian or significant other.

(27.8%). With regard to household income, participants in the low and medium sleep disturbance groups were most likely to report high levels of household income (42.2% and 42.3%, respectively), while those in the high sleep disturbance groups were most likely to report medium levels of household income (37.9%).

In bivariable regression models, using SM before bed was significantly associated with sleep disturbance. For example, compared with those who rarely or very rarely check SM before bed, those who often or very often check SM before bed had an odds ratio (OR) of 1.69 (95% confidence interval [CI] = 1.24–2.33) for having a higher level of sleep disturbance. There was a significant linear trend in the ORs between SM use before bed and sleep disturbance ($p = .001$). In bivariable analyses, sleep disturbance was also associated with total SM, older age, female sex, Hispanic and other race/ethnicity, and low socioeconomic status (Table 2).

In fully adjusted models, participants with more frequent SM use before bed retained significantly greater odds of having sleep disturbance, even after accounting for total SM use and all covariates. In particular, compared with those who rarely or very rarely check SM before bed, those who often or very often check SM before bed had an adjusted odds ratio (AOR) of 1.62 (95% CI = 1.31–2.34) for having a higher level of sleep disturbance. Similarly, compared with those who rarely or very rarely check SM in the 30 minutes before bed, those who reported “sometimes” checking SM 30 minutes before bed had an AOR of 1.48 (95% CI = 1.06–2.08) for having a higher level of sleep disturbance. There was a significant overall linear trend in the ORs between use before bed and sleep disturbance ($p = .007$). Other covariates significantly and independently associated with increased sleep disturbance included overall SM use, older age, other race, and low socioeconomic status (Table 2).

DISCUSSION

We found that, among a nationally representative sample of young adults, greater SM use in the 30 minutes before bed was independently associated with greater sleep disturbance, even when controlling for total SM use. A second major finding was that total SM use remained independently associated with sleep disturbance in the overall adjusted model.

These findings build on previous work demonstrating greater total SM use to be associated with greater sleep disturbance.^{9,12} In particular, we extend the existing literature by identifying that there is a specific time of day, just before bed, when SM use may have a particularly strong association with sleep. The current analysis does not offer information on the specific direction of effect, limiting our ability to provide specific clinical recommendations at this time. Nevertheless, should future work show a causal association between SM use before bed and subsequent sleep disturbance, we would then be able to suggest that individuals experiencing sleep disturbance may choose to target reduction of SM use in the period before bed to potentially reduce disturbed sleep. Future work should also investigate the period before bed in which reduction of SM use would have the most impact on improving sleep (eg, 30 minutes vs. 1 hour). As opposed to the suggestion to reduce total SM use, a time-specific recommendation may be more feasible for some young adults, should future work support it. This suggestion

would be in accord with recent recommendations from the American Academy of Pediatrics that children and adolescents get adequate sleep, that they not sleep with devices in their bedrooms, and that they avoid exposure to devices/screens for 1 hour before bed.²⁹ Our findings are also consistent with a recent report showing that media use of various types in the 2 hours before bed was associated with shorter total sleep time and later bedtimes among university students.³⁰

It is interesting to note that total SM use remained a significant predictor of sleep disturbance in the adjusted model. This suggests that total amount of SM use across the day also has a meaningful association with sleep that is not explained by proximity to bedtime. Therefore, while focusing on the 30 minutes before bed may be of particular value for some young adults, for others, SM use at other times of the day may also be valuable to explore. For example, some young adults may use SM in the afternoon as a way of avoiding school work or other tasks; this may serve to push back the completion of this work further into the evening or night, delaying bedtime or impacting sleep quality. Thus, our findings serve as an important reminder of the individual differences in SM use and its association with sleep.

As mentioned above, because of the cross-sectional nature of our data, it is impossible to determine the direction of association among SM use before bed and sleep disturbance. One possibility is that increased SM use before bed contributes to greater sleep disturbance. For example, the blue light emitted by many SM devices may impact self-reported sleepiness, slow wave activity during sleep, and circadian phase, and recent work has shown that SM use before bed can impair these sleep-related outcomes.^{18,31} While preliminary research has suggested that these effects can be mitigated by daytime bright light exposure or blue-light shielding eyewear,^{32,33} using these methods may have limited practicality for some young adults. Additionally, because SM use may promote emotional or cognitive arousal, SM use before bed in particular may interfere with sleep.³⁴ This is consistent with a prior study in which nighttime-specific SM use and an emotional investment in SM were both associated with poorer sleep quality, lower self-esteem, and higher levels of anxiety and depression among adolescents.¹² Thus, in some young adults, SM use before bed may contribute to anxiety and emotional arousal, which may contribute to sleep disturbance. Future qualitative and experimental work would help to further elucidate these mechanisms.

On the other hand, it is possible that the association between SM use and sleep disturbance is in the opposite direction; that is, those who have greater levels of sleep disturbance may be more likely to use SM, especially in the 30 minutes before bed.³⁵ Some young adults who have difficulty falling asleep may turn to SM as a way of passing the time or distracting from the frustration of not sleeping while in bed attempting to do so. Indeed, a recent report showed that a substantial proportion of adults use media as a sleep aid, which was associated with increased sleep disturbance.³⁶ Thus, it may not be surprising that we found an association between sleep disturbance and SM use specifically in the 30 minutes before bed because the period just before bed may be one of the most common times of the day to use SM among those who already have difficulty sleeping. It is also possible that unmeasured variables such as anxiety may account for the association between SM use before bed

Table 2—Bivariable and Multivariable Associations Between Social Media Use and Sleep Disturbance.

Independent variables	Sleep disturbance			
	OR (95% CI)	p ^a	AOR ^b (95% CI)	p ^a
Social media use				
Check 30 minutes before bed		.001		.007
Rarely	Ref		Ref	
Sometimes	1.62 (1.17–2.25)		1.48 (1.06–2.08)	
Often	1.69 (1.24–2.33)		1.62 (1.31–2.34)	
Minutes per day		<.001		.02
Q1 (0–60)	Ref		Ref	
Q2 (61–120)	1.72 (1.22–2.43)		1.52 (1.06–2.19)	
Q3 (121+)	1.81 (1.33–2.47)		1.50 (1.06–2.15)	
Covariate				
Age, years		.009		.008
19–23	Ref		Ref	
24–26	1.31 (0.93–1.85)		1.36 (0.93–1.99)	
27–32	1.51 (1.11–2.06)		1.63 (1.14–2.34)	
Sex				
Female	Ref		Ref	
Male	0.72 (0.55–0.94)		0.79 (0.60–1.04)	
Race				
White, non-Hispanic	Ref		Ref	
Black, non-Hispanic	1.19 (0.77–1.85)		1.05 (0.64–1.71)	
Hispanic	1.59 (1.10–2.29)		1.46 (0.995–2.14)	
Other ^c	1.53 (1.03–2.27)		1.59 (1.07–2.35)	
Relationship status				
Single ^d	Ref		Ref	
Committed relationship ^e	1.14 (0.87–1.49)		1.04 (0.70–1.54)	
Living situation				
Parent/guardian	Ref		Ref	
Significant other	1.30 (0.94–1.78)		1.22 (0.78–1.90)	
Other ^f	1.01 (0.71–1.43)		0.93 (0.65–1.35)	
Household income		.001		.002
Low (under \$30,000)	Ref		Ref	
Medium (\$30,000–\$74,999)	0.63 (0.44–0.90)		0.64 (0.44–0.93)	
High (\$75,000 and above)	0.52 (0.36–0.74)		0.54 (0.37–0.79)	
Education level		.18		.67
High school or less	Ref		Ref	
Some college	0.90 (0.65–1.26)		1.09 (0.77–1.54)	
Bachelor's degree or higher	0.79 (0.57–1.10)		0.88 (0.60–1.28)	

AOR = adjusted odds ratio; CI = confidence interval; OR = odds ratio.

^ap value indicates significance level for test of overall linear trend of each ordered categorical variable. Significant effects shown in bold.

^bAdjusted for all other variables in the table.

^cMultiracial.

^dWidowed, divorced, and separated.

^eEngaged, married, and in a domestic partnership.

^fNot living with a parent/guardian or significant other.

and sleep disturbance. Some young adults feel anxious at disengaging from SM; for example, they may be concerned about the possibility of missing an SM prompt from a friend. Indeed, recent work has shown that emotional investment in SM significantly predicted poorer sleep quality among adolescents.¹² Should future research support this hypothesized direction of effect, clinical recommendations may include that individuals experiencing sleep disturbance seek evidence-based treatment for difficulty falling asleep, rather than turning to SM as a coping strategy. For these individuals, using SM as a way of passing the time may reinforce the association between being in bed and being awake, which is contrary to evidence-based approaches for treating insomnia.³⁷ Moreover, coping in this way might result in interactive screen time, which can be more stimulating than other non-SM activities such as reading a book.¹⁵

One important limitation of these analyses is the fact that both SM use and sleep disturbance were assessed via self-report. While this methodology was necessary for this large survey, future work should aim to include more robust, gold-standard measures of sleep quality, such as actigraphy, sleep diary, and/or the Pittsburgh Sleep Quality Index.³⁸ We chose to collapse the SM use response choices into three categories, based on distribution of the data and difficulty in interpreting the difference between “very rarely” and “rarely” and “very often” and “often”. Because this may have limited our understanding of the users at the extremes, it would be interesting for future research to obtain more nuanced responses such as, “on an average day, how many minutes out of the past 30 are you using social media?” Similarly, it would be useful for future research to utilize more intensive measures of SM use, such as ecological momentary assessment. Additionally, as mentioned above, it should be reiterated that, because the data included in these analyses are cross-sectional, our ability to draw causal conclusions about the direction of the observed associations is limited. While we have suggested that “state” anxiety related to SM use may account for the association between SM use and sleep disturbance, it is also possible that trait level anxiety may also play an important role. We were unable to control for trait anxiety in the current analyses, but future work should seek to determine the impact of this factor. Last, participants estimated the frequency of their SM usage before bed on average, over the course of the year. Thus, it is not possible to know whether participants were checking SM for just a minute or two prior to bed on a very frequent basis or whether they were spending the entire 30 minutes on a less frequent basis, and these two patterns of usage may have warranted the same rating.

Despite these limitations, this nationally representative study suggests that SM use in the last 30 minutes before bed is an independent risk factor for disturbed sleep among young adults. Suggestions for limiting SM use during this time, particularly to people with sleep concerns, may be a feasible and effective strategy that should be further studied in both prevention and intervention efforts.

REFERENCES

1. Gradisar M, Wolfson AR, Harvey AG, Hale L, Rosenberg R, Czeisler CA. The sleep and technology use of Americans: findings from the National Sleep Foundation's 2011 Sleep in America poll. *J Clin Sleep Med.* 2013; 9(12): 1291–1299.

2. Jiang F, VanDyke RD, Zhang J, Li F, Gozal D, Shen X. Effect of chronic sleep restriction on sleepiness and working memory in adolescents and young adults. *J Clin Exp Neuropsychol.* 2011; 33(8): 892–900.
3. Banks S, Dinges DF. Behavioral and physiological consequences of sleep restriction. *J Clin Sleep Med.* 2007; 3(5): 519–528.
4. Grandner MA, Patel NP, Gehrman PR, Perlis ML, Pack AI. Problems associated with short sleep: bridging the gap between laboratory and epidemiological studies. *Sleep Med Rev.* 2010; 14(4): 239–247.
5. Van CE, Spiegel K, Tasali E, Leproult R. Metabolic consequences of sleep and sleep loss. *Sleep Med.* 2008; 9(Suppl 1): S23–S28.
6. Shankar A, Charumathi S, Kalidindi S. Sleep duration and self-rated health: the national health interview survey 2008. *Sleep.* 2011; 34(9): 1173–1177.
7. Duggan M, Ellison NB, Lampe A, Lenhart A, Madden M. Social media update 2014. Pew Research Center. 2015. <http://www.pewinternet.org/2015/01/09/social-media-update-2014/>
8. Zimmerman FJ. Children's media use and sleep problems: issues and unanswered questions. Kaiser Family Foundation. 2008. <https://kaiser-familyfoundation.files.wordpress.com/2013/01/7674.pdf>
9. Levenson JC, Shensa A, Sidani JE, Colditz JB, Primack BA. The association between social media use and sleep disturbance among young adults. *Prev Med.* 2016; 85: 36–41.
10. An J, Sun Y, Wan Y, Chen J, Wang X, Tao F. Associations between problematic internet use and adolescents' physical and psychological symptoms: possible role of sleep quality. *J Addict Med.* 2014; 8(4): 282–287.
11. Vernon L, Barber BL, Modecki KL. Adolescent problematic social networking and school experiences: the mediating effects of sleep disruptions and sleep quality. *Cyberpsychol Behav Soc Netw.* 2015; 18(7): 386–392.
12. Woods HC, Scott H. #Sleepyteens: social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem. *J Adolesc.* 2016; 51: 41–49.
13. Lenhart A, Purcell K, Smith A, Zickuhr K. Social media & mobile internet use among teens and young adults. Pew Research Center. 2010. <http://www.pewinternet.org/2010/02/03/social-media-and-young-adults/>
14. Hale L, Emanuele E, James S. Recent updates in the social and environmental determinants of sleep health. *Curr Sleep Med Rep.* 2015; 1(4): 212–217.
15. Hale L, Guan S. Screen time and sleep among school-aged children and adolescents: a systematic literature review. *Sleep Med Rev.* 2015; 21: 50–58.
16. Thomée S, Dellve L, Härenstam A, Hagberg M. Perceived connections between information and communication technology use and mental symptoms among young adults - a qualitative study. *BMC Public Health.* 2010; 10: 66.
17. Seabrook EM, Kern ML, Rickard NS. Social networking sites, depression, and anxiety: a systematic review. *JMIR Ment Health.* 2016; 3(4): e50.
18. Chang AM, Aeschbach D, Duffy JF, Czeisler CA. Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. *Proc Natl Acad Sci U S A.* 2015; 112(4): 1232–1237.
19. Gringras P, Middleton B, Skene DJ, Revell VL. Bigger, brighter, bluer-better? current light-emitting devices - adverse sleep properties and preventative strategies. *Front Public Health.* 2015; 3: 233.
20. KnowledgePanel design summary. <http://www.knowledgenetworks.com/ganp/docs/KnowledgePanel%28R%29-Design-Summary.pdf> Accessed 29 July 2015. 2012. GfK Knowledge Panel. RefType: Online Source.
21. GfK KnowledgePanel. <https://www.gfk.com/us/Solutions/consumer-panels/Pages/GfK-KnowledgePanel.aspx> Accessed 21 August 2017. 2015. GfK KnowledgePanel. RefType: Online Source.
22. Buysse DJ, Yu L, Moul DE, et al. Development and validation of patient-reported outcome measures for sleep disturbance and sleep-related impairments. *Sleep.* 2010; 33(6): 781–792.
23. Yu L, Buysse DJ, Germain A, et al. Development of short forms from the PROMIST™ sleep disturbance and sleep-related impairment item banks. *Behav Sleep Med.* 2011; 10(1): 6–24.
24. Jones JR, Colditz JB, Shensa A, et al. Associations between internet-based professional social networking and emotional distress. *Cyberpsychol Behav Soc Netw.* 2016; 19(10): 601–608.

25. Lin LY, Sidani JE, Shensa A, et al. Association between social media use and depression among U.S. young adults. *Depress Anxiety*. 2016; 33(4): 323–331.
26. Shensa A, Sidani JE, Lin LY, Bowman ND, Primack BA. Social media use and perceived emotional support among US young adults. *J Community Health*. 2016; 41(3): 541–549.
27. Sidani JE, Shensa A, Hoffman B, Hanmer J, Primack BA. The association between social media use and eating concerns among US young adults. *J Acad Nutr Diet*. 2016; 116(9): 1465–1472.
28. Grandner MA, Patel NP, Gehrman PR, et al. Who gets the best sleep? Ethnic and socioeconomic factors related to sleep complaints. *Sleep Med*. 2010; 11(5): 470–478.
29. AAP Council on Communications and Media. Media use in school-aged children and adolescents. *Pediatrics*. 2016; 138(5): e20162592.
30. Orzech KM, Grandner MA, Roane BM, Carskadon MA. Digital media use in the 2 h before bedtime is associated with sleep variables in university students. *Comput Human Behav*. 2016; 55(A): 43–50.
31. Grønli J, Byrkjedal IK, Bjorvatn B, Nødtvedt Ø, Hamre B, Pallesen S. Reading from an iPad or from a book in bed: the impact on human sleep. A randomized controlled crossover trial. *Sleep Med*. 2016; 21: 86–92.
32. Ayaki M, Hattori A, Maruyama Y, et al. Protective effect of blue-light shield eyewear for adults against light pollution from self-luminous devices used at night. *Chronobiol Int*. 2016; 33(1): 134–139.
33. Rångtjell FH, Ekstrand E, Rapp L, et al. Two hours of evening reading on a self-luminous tablet vs. reading a physical book does not alter sleep after daytime bright light exposure. *Sleep Med*. 2016; 23: 111–118.
34. Cain N, Gradisar M. Electronic media use and sleep in school-aged children and adolescents: a review. *Sleep Med*. 2010; 11(8): 735–742.
35. Tavernier R, Willoughby T. Sleep problems: predictor or outcome of media use among emerging adults at university? *J Sleep Res*. 2014; 23(4): 389–396.
36. Exelmans L, Van den Bulck J. The use of media as a sleep aid in adults. *Behav Sleep Med*. 2016; 14(2): 121–133.
37. Morin CM, Espie CA. *Insomnia: a clinical guide to assessment and treatment*. New York: Kluwer Academic/Plenum Publishers; 2003.
38. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989; 28(2): 193–213.

ACKNOWLEDGMENTS

The authors wish to thank all individuals who participated in this study.

SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication January, 2017

Submitted in final revised form April, 2017

Accepted for publication June, 2017

Address Correspondence to: Brian A. Primack, MD, PhD, 3600 Cathedral of

Learning, 4200 5th Avenue, Pittsburgh, PA 15260. Telephone: 412-624-6880;

Fax: 412-624-6885;

E-mail: bprimack@pitt.edu