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**Social Media Use and Sleep Quality among Adults:
The Role of Gender, Age and Social Media Checking Habit**

Liese Exelmans, PhD; Holly Scott, MSc

Corresponding author:

Liese Exelmans, Department of Communication Studies, University of Michigan, 5369

North Quad; 105 S. State St., Ann Arbor, 48104, MI | lexelman@umich.edu | +1

734.764.0420

Co-author:

Holly Scott, School of Psychology, University of Glasgow, 62 Hillhead Street, Glasgow,

G12 8QB. | h.scott.1@research.gla.ac.uk | 0141.330.5085

Abstract

This study expands knowledge on the effects of technology use on sleep by (1) focusing on social media use in an adult sample, (2) investigating the difference between overall and nighttime-specific social media use with regards to sleep, and (3) exploring a vulnerability perspective. For the latter, the moderating roles of gender, age, and habitual social media checking behavior were examined. A representative quota sample of 584 adults (18-96 years old) participated in an online survey. Results indicated that 2 out of 3 adults used social media, and that use both shortly before and in bed was prevalent. Only nighttime use was associated with poorer sleep quality. Age and habitual checking behavior moderated this association, identifying younger adults and those with strong checking habits as possible vulnerable groups for poor sleep. The findings are interpreted in light of existing research on media habits and problematic (social) media use.

Keywords: social media, sleep quality, moderator, habit, age, adults

Introduction

Social media have blurred the boundaries between day and night by facilitating continued social interactions in bed after lights out. Consequently, increasing scholarly attention has been devoted to exploring whether social media use may be harmful for sleep. Prior research reports such negative effects may occur because social media use may reduce sleep duration via delaying bedtime (a process called sleep displacement; Van den Bulck, 2010), or because the alerting effect of screen light may significantly extend sleep onset latency and impair sleep quality (Cain & Gradisar, 2010).

Although review studies suggest all screen use may have detrimental effects on sleep (Hale & Guan, 2015), social media present unique additional challenges in this regard. Because of the interactive component, the decision to cease use is jointly determined by the user at the other of the screen, opening up the possibility that sleep may be compromised involuntarily (Exelmans & Van den Bulck, 2018). Incoming alerts may potentially disrupt efforts to fall asleep and cause night awakenings, and ongoing interactions and continued rumination once disconnected may induce heightened levels of pre-sleep arousal (Woods & Scott 2016; Scott & Woods 2018). Although the mobility of screens has made all media activities more accessible in the bedroom, social media do not demand large chunks of spare time before lights out. In other words, we might be more likely to cram in a few more minutes of social media right before lights out, often ending up spending more time to (mindless) scrolling than we intended to (Bhat, Pinto-Zipp, Upadhyay, & Polos, 2018). Despite these arguments and the fact that social media continue to increase in popularity, knowledge on their association with sleep outcomes is limited. The present study aims to contribute to this growing research field in three ways.

First, there has been a particular focus on child and adolescent social media use and sleep, with concern over possible risks to health, psychological wellbeing and academic

performance during these critical developmental stages (O'Keeffe, 2016). Whilst social media use is most prevalent among these widely studied younger populations (Smith & Anderson, 2018), it remains highly relevant into adulthood and across the lifespan. The percentage of 30-49-year-olds using social media has increased from just 6% in 2006 to 80% a decade later in 2016. Furthermore, around two-thirds of 50-64-year-olds and one third of over 65s reported using social media (Greenwood, Perrin, & Duggan, 2016). Levenson and colleagues (2016) found that the volume and frequency of social media use among young adults (19-32 years old) was related to more sleep disturbances. A study among 855 adults aged 18-77 years old reported that 70% engaged in social media use in bed and that those individuals were more likely to have insomnia, anxiety, and short sleep duration on weeknights (Bhat et al., 2018). Aside from these seminal studies, adults remain an understudied population with regards to their social media use and associated sleep outcomes.

Second, the majority of the research on media use and sleep has rarely moved beyond measures of frequency and duration of overall use (Exelmans & Van den Bulck, 2018). The timing of media use seems nonetheless crucial to document its potential impact on sleep. For example, heavier nighttime-specific social media use independently predicted poorer sleep quality in both adolescents and young adults, controlling for overall social media use (Woods & Scott, 2016; Levenson, Shensa, Sidani, Colditz, & Primack, 2017).

Third, given the relatively limited evidence on adults' (social) media use and sleep, little is known about what groups may be more susceptible to potential negative effects. Media effect studies have stressed that media effects may not hold equally for all media users (Valkenburg & Peter, 2013). To identify at-risk groups, the current study will examine two demographic characteristics (gender and age), and one media-related variable (habitual social media checking behavior). Studies have reported significant gender differences in social media use among adolescents and adults (Smith & Anderson, 2018), and that females display

more intense use than males in general (Frison & Eggermont, 2016; McAndrew & Jeong, 2012), yet other studies noted no gender difference for social media use among adults (Bhat et al., 2018). Significant gender differences are documented in terms of sleep as well (Mallampalli & Carter, 2014) and the association between different types of electronic media use and sleep complaints have been shown to differ for adolescent boys and girls (Lange et al., 2017). Both social media use and sleep (Ohayon, Carskadon, Guilleminault, & Vitiello, 2004; Smith & Anderson, 2018) are strongly related to age and age also significantly moderated the relationship between bedtime mobile phone use, sleep duration and fatigue among adults (Exelmans & Van den Bulck, 2016b).

Finally, this study is the first to explore the moderating role of habitual social media checking behavior in the relationship between social media use and sleep quality. Briefly, media habits refer to an automatic form of media consumption that is formed by repetition of the same behavior under the same circumstances (e.g., checking your smartphone before you go to sleep) until the behavior becomes automatically triggered by environmental (e.g. a notification) or internal cues (e.g. boredom, stress) (LaRose, 2010). For media habits, it is argued that the triggers have become omnipresent in modern life because of the pervasiveness of media devices in daily life, and their endless network of connections with situations, people, cultural and social life. In other words, media habits can be activated by a wider range of cues than other habits (LaRose, 2010) rendering them particularly challenging to override. Because of this, it is estimated that over half of all media behaviors are habitual (Wood, Quinn & Kashy, 2002). Several studies have shown that checking social media is highly habitualized as well (Bayer, Dal Cin, Campbell, & Panek, 2016; Meier, Reinecke, & Meltzer, 2016; Oulasvirta, Rattenbury, Ma, & Raita, 2012). Moreover, every notification, message or status update acts as a reward, strengthening the habit. Given the wide range of social media platforms and apps available on smartphones, checking habits may operate as a

“gateway” to other functionalities, thus extending overall (social) media use (Oulasvirta et al., 2012). In this study, we argue that those with a strong evening checking habit, may be at higher risk of having insufficient or low-quality sleep.

To summarize, the current study will address three research questions: (1) what is the prevalence of overall and nighttime-specific social media use in adults?, (2) how do these levels of social media use relate to their sleep quality?, and (3) can we identify at risk groups based on age, gender and habitual social media checking behavior?

Method

Data collection

Data were collected in November 2016 using a quota sample stratified by gender, age, and educational level. A total of 584 [blinded] adults participated in the study. The project was presented as a study on their leisure time activities and well-being to blind the relationships we were studying. Respondents who fitted the criteria of the quota derived from recent census data were contacted by undergraduate students enrolled in a survey research methodology class. Participants had to be 18 years or older to complete the online questionnaire. To avoid an underrepresentation of older participants in online data collection (Gradisar et al., 2013), participation via paper-and-pencil surveys was also possible and used by a minority of respondents ($N = 50$). These were coded manually. Online and offline participants did not significantly differ for the variables of interest, but offline participants were significantly older, $t(57.560) = -5.78, p < .001$, and lower educated, $t(59.929) = 5.00, p < .001$. This research was conducted in accordance with the ethics requirements of [blinded] and all participants provided informed consent.¹

¹ The data used for this study stem from a pooled data collection, which also assessed variables on the association between in-bed media use and sleep latency. The respective findings are published in [blinded]. Therefore, the methods sections of both publications show strong similarities. Other than this methodological overlap, both papers address significantly different research topics and make independent contributions to the literature.

Measures

Sleep Quality. We used the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) to measure respondents' sleep quality over the past month. The index contains 19 items that can be grouped into 7 subcomponents (subjective sleep quality, sleep latency, sleep efficiency, sleep duration, use of sleep medication, daytime dysfunction, sleep disturbances) using the scoring instructions described in Buysse et al. (1989). Each subcomponent is scored between 0 and 3, with higher scores indicating more problems with that subcomponent. The total score thus ranges between 0 and 21, and respondents scoring >5 are categorized as poor sleepers. Cronbach's alpha for the index was .64, which is similar to Exelmans and Van den Bulck (2014).

Social Media Use. We asked respondents whether they used social media. Those who indicated they did continued to answer questions on their overall and nighttime-specific use based on Woods and Scott (2016). Overall social media use was assessed with two items. One item queried their frequency of use on a scale ranging between 1 (less than once a month) and 7 (multiple times per day). The second item rated the duration of their use on an average day (1 = <10 min; 2 = 10-30min; 3 = 31-60min, 4 = 1-2h, 5 = 2-3h, 6 = >3 h). We assessed nighttime social media use with 3 items on the frequency of use shortly before bed, in bed before they attempt to sleep, and in bed after they attempt to sleep. These items were rated on a 6-point Likert scale (1 = never, 6 = on a daily basis). We summed the items to obtain an estimate of overall and nighttime social media use, and a higher score indicated a more intense use. Cronbach's alpha was .69 and .74, respectively, which is comparable to Woods and Scott (2016). We also queried their nighttime habitual social media use with the four automaticity items of the Self-Report Habit Index (SRHI; Gardner, Abraham, Lally, & de Bruijn, 2012; Verplanken & Orbell, 2003). These items reflect the automatic, unconscious activation of checking behavior, and were rated on a 7-point scale (1 = completely disagree, 7

= completely agree): Checking my social media accounts at night is something . . . “I do without having to consciously remember,” “I do automatically,” “I do without thinking,” “I start doing before I realize I’m doing it”. The scale had a good internal consistency ($\alpha = .94$).

Control Variables. Gender (0 = male, 1 = female), age, educational level, shiftwork (no = 0, yes = 1), history of sleep problems (no = 0, yes = 1) and self-perceived physical health status were added as control variables. Educational level was measured by asking respondents about the highest degree they obtained: 6th-grade or 9th-grade certificate (i.e., lower secondary education), 12th-grade certificate (i.e., upper secondary education) and a college or university degree (i.e., post-secondary or higher education). To assess self-perceived physical health status, respondents were asked “In general, would you say your health is:” with response options 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent (Jenkinson, Coulter, & Wright, 1993).

Data Analysis

We first examined the frequency of responses for each social media measure and computed correlations between the variables of interest (using Pearson and Spearman correlations for continuous and categorical variables, respectively). Then, hierarchical regression analyses examined the association between social media use and sleep quality: step one included the aforementioned control variables and step two added the social media use measures. We confirmed that multicollinearity was not a concern, with Variance Inflation Factors (VIFs) below recommended levels (Kutner, Nachtsheim, Neter, & Li, 2005). Next, we conducted moderation analyses with Hayes' PROCESS computational tool (Hayes, 2013), to identify possible at-risk groups by examining whether gender, age or habitual social media checking behavior moderated the relationship between nighttime social media use and sleep quality. Johnson-Neyman regions of significance examined the range of the moderating variables where nighttime social media use was significantly associated with sleep quality.

Results

The sample ($N = 584$) was a proportional representation of adults in [blinded] for gender $\chi^2(1, N = 584) = .000, p = .99$, age $\chi^2(6, N = 584) = 1.008, p = .99$, and education $\chi^2(2, N = 584) = .302, p = .86$. Respondents' age ranged between 18 and 96 years old ($M = 48.5, SD = 18.8$), and the sample contained 51% women. Almost one in three respondents (32%) had obtained a 6th-grade or 9th-grade certificate (i.e., lower secondary education), 37% had obtained a 12th-grade certificate (i.e., upper secondary education) and 31% had a college or university degree (i.e., post-secondary or higher education). One in ten of respondents reported shiftwork and 12% indicated they had sought medical help for sleep difficulties, who were therefore identified as having a history of sleep problems.

Two out of three adults ($N = 380, 66\%$) reported that they used social media. Almost 39% indicated that they used social media on a daily basis, and 44% used social media multiple times on the same day. Moreover, one in five (22%) spent 1-2 hours on their social media per day, one in ten (11%) 2-3 hours per day, and 6% >3hours per day. Regarding their nighttime use, 44% reported never using social media in bed; while 58% of respondents used social media shortly before bedtime on a daily basis, and a further 15% did this multiple times per week. For social media use in bed, 29% did this daily, and 15% multiple times per week. Social media use after going to sleep was rather rare: 7.9% did this on a daily basis (Table 1).

	Never	Once a month	2-3 times a month	Once a week	2-3 times a week	Every day
Social media use 2h before bed	11.4	5.3	4.7	5.6	15.1	57.9
Social media use in bed	43.8	5.5	1.9	5.0	14.9	28.9
Social media use after lights out	67.8	10.6	3.9	4.0	5.8	7.9

Table 1 Frequencies of Nighttime Social Media Use (%)

Women scored significantly higher on overall social media use, $t(377) = -2.807, p < .01$, and social media checking habit, $t(378) = -2.098, p < .05$, than men, but there was no

gender difference for nighttime social media use or sleep quality score. Age showed moderate to strong negative associations with all social media use indicators. In bivariate correlations, none of the social media indicators were significantly associated with sleep quality (Table 2). However, in hierarchical regression analysis that controlled for the aforementioned confounding variables and included the social media indicators simultaneously (Table 3), nighttime social media use did predict poorer sleep quality, $\beta = .148$, $t = 1.977$, $p < .05$: adults who engage in late night social media use tended to report poorer sleep quality.

	1.	2.	3.	4.	5.	6.
1. Gender	--					
2. Age	.038	--				
3. Overall social media use	.140**	-.369***	--			
4. Nighttime social media use	.048	-.558***	.656***	--		
5. Nighttime habitual social media use	.112*	-.307***	.567***	.598***	--	
6. Sleep quality	.080	.019	.046	.085	.068	--
M		48.52	9.25	10.02	16.57	4.86
SD		18.82	2.18	4.59	8.01	2.83

Table 2 Means, Standard Deviations and Correlations for Key Variables

Note. We used Pearson correlation for continuous variables and Spearman correlations for categorical variables.

* $p < .05$, ** $p < .01$, *** $p < .001$

	B	SE	t	β
Gender	.115	.266	.433	.021
Age	.004	.010	.342	.020
Educ1	-.239	.349	-.685	-.043
Educ2	-1.013	.365	-2.775	-.178**
Shiftwork	1.147	.422	2.720	.131**
History of sleep problem	1.991	.390	5.102	.250***
Perceived health	-.665	.172	-3.865	-.200***
Overall social media use	-.122	.084	-1.446	-.097
Nighttime social media use	.088	.045	1.977	.148*
Social media habit	.007	.021	.353	.022

Table 3 Hierarchical Regression Analysis Predicting Adults' Sleep Quality

* $p < .05$, ** $p < .01$, *** $p < .001$

Moderation analyses examined whether gender, age or habitual social media checking behaviour significantly moderated this association between nighttime social media use and sleep quality. Gender was not a significant moderator of the relationship between nighttime

social media use and sleep quality, $B = -.101$, $SE = .057$, $p = .078$, 95%CI[$-.214$, $.011$]. Age significantly moderated the association between nighttime social media use and sleep quality, $B = -.007$, $SE = .002$, $p < .01$, 95%CI[$-.011$; $-.003$]. Johnson-Neyman regions of significance indicated the relationship between nighttime social media use and sleep quality was significantly positive for respondents aged ≤ 37.18 years old and significantly negative for those aged ≥ 77.54 years old. Nighttime social media use was associated with poorer sleep quality for under 37s, but slightly better sleep quality for over 77s (Figure 1). Habitual social media checking behavior was also a significant moderator: nighttime social media use was associated with poorer sleep quality only among those with a relatively strong evening checking habit, $B = .014$, $SE = .004$, $p < .001$, 95%CI[$.007$; $.022$] (Figure 1).

Discussion

This study examined the link between social media use and sleep among a representative sample of [blinded] adults, and explored a vulnerability perspective to identify potential at-risk groups based on age, gender and habitual social media checking behavior. Our findings signal an overall negative association between nighttime social media use and sleep quality, in particular for younger adults and those with a strong checking habit. In contrast, nighttime social media use was associated with better sleep quality for older adults.

The current findings indicate that nighttime social media use is a relevant topic for study across the full lifespan and not only in adolescents or young adult samples, which have been the primary focus of existing research (Harbard, Allen, Trinder, & Bei, 2016; Levenson et al. 2017; Orzech, Grandner, Roane, & Carskadon, 2016; Woods and Scott 2016). Although evidence indicates that social media use is highest amongst younger adults, the prevalence of social media use is rising across all age groups (Smith & Anderson, 2018). In the present study, older respondents did report using social media less than younger respondents, both overall and at night. However, across this representative adult sample (aged 18-96 years),

Figure 1

Vertical bold lines delineate Johnson-Neyman regions of significance for moderating role of age and habitual social media checking behavior, controlling for gender, age, shiftwork, perceived physical health, history of sleep problems, habitual social media checking behavior and overall social media use.

60% of respondents reported using social media shortly before bedtime on a daily basis. This prevalence rate supports the relevance of examining correlates of bedtime social media use across the full adult population.

Consistent with previous research in adolescent and young adult samples (Levenson et al. 2017; Woods and Scott 2016), the current results highlight that nighttime-specific social media use (rather than overall use) may be harmful for sleep quality. In regression analyses that included multiple social media measures, nighttime-specific use (and not overall use) significantly predicted poorer sleep quality, controlling for demographics and relevant lifestyle factors such as shiftwork. Nighttime social media use may delay sleep onset and increase pre-sleep cognitive arousal, lengthening sleep onset latency (Bartel & Gradisar, 2017; Harbard et al. 2016; Orzech et al. 2016; Scott & Woods, 2018), which follow-up correlational analysis with the components of the PSQI supported.

Moderation analyses were conducted to identify at risk groups with regard to age, gender or habitual checking behavior. While gender did not moderate the association between nighttime social media use and sleep quality, both age and habitual checking behavior were significant moderators, indicating that the relationship between nighttime social media use and sleep quality differs depending on individuals' age and how they engage with social media. This highlights the value of exploring a vulnerability perspective, as only considering bivariate correlations at population level can mask different underlying effects in sub-groups.

For age, the moderation results indicate that nighttime social media use was only significantly associated with poorer sleep for those under 37 years of age. In contrast, this association was reversed for older adults aged 75 and over, with nighttime social media use associated with better sleep quality. Age- and generation- differences in how users interact with and experience social media may explain this finding. Young adults favor different social media platforms than older adults, and are more likely to report that it would be

difficult to stop using social media (Smith & Anderson, 2018). In particular, younger adults tend to report higher levels of fear of missing out, using social media as a tool to maintain social engagement and avoid feeling disconnected (Przybylski, Murayama, DeHaan, & Gladwell, 2013; Vorderer, Kromer, & Schneider, 2016). This fear of missing out may not only drive social media engagement, but also increase pre-sleep cognitive arousal (Scott & Woods, 2018). This stronger emotional engagement in social media may help explain why younger adults are more vulnerable to poor sleep associated with nighttime use.

For older adults, increased social media activity has been shown to boost feelings of social connectedness and decrease loneliness (Deters & Mehl, 2013). These potential benefits may be particularly salient in later life, as older adults report high rates of social isolation, which is associated with sleep disturbance (Choi, Irwin, & Cho, 2015). Further investigation of these hypotheses in a larger sample of older adults is warranted .

In addition to age, this study is the first to identify habitual checking behavior as a significant moderator. Nighttime social media use was only associated with poorer sleep quality for those with a relatively strong social media checking habit. Habitual media use – characterized by impulsiveness - has been related to dysfunctional media usage patterns in prior studies, which indirectly resulted in decreased well-being (Meier et al., 2018) and sleep quality (Exelmans, Meier, Reinecke, & Van den Bulck, 2019). In this case, having an automatic tendency to check social media accounts at bedtime amplified the effects of social media use on sleep quality. This finding underlines the need to ask not only ‘how much’ but also ‘how’ individuals engage with social media, in both sleep research and practice. For example, previous work has shown that mindfulness (attention to one’s moment-to-moment experiences; Brown & Ryan, 2003) can influence social media experiences and associated outcomes. Individuals tend to experience more positive affect and less stress when using instant messaging more mindfully (Bauer, Loy, Masur, & Schneider, 2017), whereas less

mindful individuals reported increased emotional exhaustion related to their social media use (Charoensukmongkol, 2015). The current findings suggest that in terms of sleep quality, only relatively unconscious and automatic social media use at bedtime may be problematic, whereas more mindful and deliberate engagement does not necessarily have a negative impact. Consequently, this study suggests that efforts to increase individuals' mindfulness of bedtime social media use could present an interesting avenue for future research. Such pilot interventions could move away from reducing the frequency or duration of social media use, and instead focus on supporting users to become more aware of their social media engagement, thus aiming to maintain benefits like social connection (Deters & Mehl, 2013) while minimizing negative impact on sleep.

These cross-sectional correlational analyses cannot examine causality, and future longitudinal analysis is required to establish the nature of the relationship between nighttime social media use and poor sleep quality. The relationship may be bidirectional, in line with models of insomnia whereby individuals cope with initial sleep difficulties by developing poor sleep hygiene habits (e.g. daytime napping) that perpetuate sleep problems (Spielman, Caruso, & Glovinsky, 1987; Schwartz & Carney, 2012). Nighttime social media use and habitual checking may be one example of this: adults commonly report using media as a sleep aid, and this coping strategy is associated with poorer sleep quality and fatigue (Exelmans & Van den Bulck, 2016). It is possible that poor sleepers develop unconscious social media checking habits that are triggered by internal or environmental triggers associated with poor sleep (e.g. lying awake in bed). Future research can examine this more closely, for example by following clinical sleep samples to assess how social media habits change in response to worsening sleep problems or treatment. Further, even though the use of a quota sample is a strength of this study, the self-reported nature of our data and use of students for recruitment of participants may also be considered limitations.

In summary, this study indicates that nighttime social media use is prevalent amongst adults, making associated sleep outcomes a relevant target for study across the full lifespan. Younger adults are most vulnerable to poor sleep associated with nighttime social media use, whereas older social media users' sleep could potentially benefit, perhaps through decreased social isolation (Choi et al. 2015; Deters & Mehl, 2013). Using social media at night may not be problematic for sleep quality if engagement is mindful, rather than unintentional and habitual. Future research can explore how habitual checking behavior combines with other relevant factors – such as emotional investment, fear of missing out, difficulty disconnecting – to predict sleep outcomes. This will continue to build a more nuanced understanding of how social media use relates to sleep in different groups, acknowledging that the same reported frequency of use does not reflect the same experience for different individuals. Essentially, our study stresses that the associations between electronic media use and sleep are complex, and that we should avoid “one size fits all” sleep recommendations that do not address the unique context and needs of different groups and individuals.

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