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Sleep Habits and Nighttime Texting among Adolescents

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Abstract

The aim of this study was to examine sleep habits (i.e., bedtimes and rising times) and their association with nighttime text messaging in 15- to 17-year-old adolescents. This cross-sectional study analyzed data from a web-based survey of adolescent students attending secondary schools in southern Sweden (n=278, 50% female). Less than 8 hours of time in bed during school nights was significantly associated with more sleep difficulties, wake time variability on schooldays and weekends, daytime tiredness, and less enjoyment at school (all $p < 0.05$). Sending and/or receiving text messages (SMS) at night was significantly associated with later bedtimes, shorter time in bed, daytime tiredness during school, and irregular sleep habits ($p < 0.05$). These findings highlight the importance of regular, consistent sleep habits and the problems associated with sleeping with a cell phone in the bedroom.

Keywords: adolescents, sleep habits, sleep deficiency, social jet lag, texting, school nursing

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Sleep Habits and Nighttime Texting among Adolescents

Sleep is essential for adolescent physical growth and development, as well as for socio-emotional development and wellbeing (Sivertsen, Glozier, et al., 2015; Perkinson-Gloor, Lemola, & Grob, 2013; Siversten, Harvey, Lundervold 2014; Dewald, Meijer, et al., 2010). In the U.S., the National Sleep Foundation (NSF) (2016) recommends 8 to 10 hours of nighttime sleep for adolescents, and in Sweden, the recommendation is 9 hours of sleep per night (Medical Products Agency, 2015). Despite these recommendations, the average duration of nighttime sleep among adolescents has declined by one hour in the last century (Matricciani, Olds, & Petkov, 2012). For example, an estimated 30 to 85% of U.S. and Scandinavian adolescents experience sleep deficiency, inadequate amount of sleep and/or poor-quality sleep (Titova, et al., 2015; Asarnow, McGlinchey, et al., 2014; National Sleep Foundation [NSF] Poll, 2014; NSF Poll 2006; Calamaro, Mason, & Ratcliffe 2009; Carskadon, Mindell, & Drake 2006). The 2014 NSF Poll found that 56% of adolescents obtained less than 7 hours of nighttime sleep, and 17% reported fair- to poor-quality sleep. Titova and colleagues conducted a study of 40,000 Norwegian adolescents and found that 30% obtained inadequate amounts of sleep (e.g. slept less than 7 to 8 hours on school nights), and inadequate sleep was associated with failing one academic subject after controlling for BMI, parental employment and family structure (Titova et al., 2015). Several prospective studies have shown that inadequate amounts of sleep and poor-quality sleep in adolescence predict worse mental health, impairments in academic performance, depression, anxiety, risk taking behaviors, suicidal ideation, and poorer quality of life (Fredrikson, Rhodes, Reddy et al., 2004; Roberts, Roberts, Duong, et al., 2009; Gau, Shang, et al., 2007; Chelminski, Ferraro, Petros, et al., 1999; Lee, Park, Nam, Ju, & Park, 2016; Short, Gradisar, Lack, & Wright, 2013a; Short & Louca, 2015; Titova et al., 2015; Tarokh, Saletin, & Carskadon, 2016). Sleep deficiency among adolescents is considered a public health problem not only in the U.S. (Wernett & Emory, 2016) but also in European and Asian countries (Sivertsen, Harvey, et al., 2014; Huang, Wang, & Guilleminault, 2010).

In adolescents, sleep deficiency may be voluntary due to poor sleep habits (e.g., variability in bedtimes, media device in the bedroom) or involuntary due to psychosocial and/or environmental context (e.g., homework, employment, early school start times, stress, social networks, noise, extreme temperatures) and can also arise from a sleep disorder (e.g., sleep apnea, insomnia) or circadian rhythm disorder (e.g., delayed sleep phase) (Mrug, Tyson, Turan, & Granger, 2016; Owens, Dearth-Welsey, et al., 2016; Reid Chassiaskos, Radesky, Christakis, et al., 2016; Crawley, Cain, Burns et al., 2015; LeProult & Van Cauter 2010; Calamaro et al., 2009; Carskadon, 1990). Variability in bedtimes and wake times and poor sleep habits (i.e., media and/or computer use at bedtime, nighttime texting) are common among adolescents. Many adolescents have access to smartphones around the clock, and sending or receiving text messages (SMS) not only contributes to later bedtimes and inadequate amounts of sleep but can also affect circadian rhythm (Carter, Rees, Hale, Bhattacharjee, Paradkar, 2016; Malone et al., 2016; Crowley et al., 2015; Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann, & Grob, 2015; Touitou, 2013) and lead to social jetlag (e.g., misalignment of biological and social time) (Wittman, Dinich, et al., 2006). In addition to the psychosocial and environmental contexts mentioned above, physiologic pubertal and circadian changes occur during adolescence. Adolescence is marked by a shift in circadian rhythm due to the peak production of melatonin, a sleep-inducing hormone, occurring later in the evening (Carskadon, 1990). The interaction of pubertal and circadian changes and the use of media prior to bed may further delay bedtimes. Light emitted from laptops or iPhones can suppress the secretion of melatonin and this can delay the onset of sleep timing. This study sought to explore nighttime texting and its association with sleep habits in Swedish adolescents.

Aim

The aim of this study was to investigate sleep habits (i.e., time in bed, bedtimes and rise times) and their association with text messaging during the night among adolescents attending secondary school in three municipalities in rural and urban areas in southern Sweden.

Methods

The study was conducted in accordance with Swedish legislation and the Helsinki Declaration (World Medical Association, 2013). Ethical approval was obtained from the school administration and from Kristianstad University (2015-232-310). Parental permission for participation was not needed for the students in the Swedish upper secondary schools because the schools had already approved the survey. This cross-sectional study was conducted as part of an educational program among adolescent students, 15-17 years-old, attending secondary school in three municipalities in rural and urban areas in southern Sweden between September 2013 and May 2015.

Procedure

A web-based questionnaire was sent to the students' school email addresses with information about the study one month prior to the first author presenting a lecture on sleep and media habits. The study was voluntary, and interested students completed the anonymous electronic survey during the school day. Across the three schools, 479 students received the educational program, and 312 students completed a portion of the survey (response rate of 65.1%). Of the 312 surveys, 278 students answered all the survey questions and were included in the analysis (response rate 58.0%). Information about school schedule (start and end time), school programs, student recruitment (from rural and urban areas) and student commuting time to school was provided by the school administration.

Sleep and Media Habits Questionnaire

The Sleep and Media Habits Questionnaire (SMHQ) is a 13-item adolescent-report questionnaire that assesses sleep habits and nighttime texting over the last week. Bedtimes and wake-up times on school nights and weekends were reported in hours and minutes. The frequency of sleeping difficulties, feeling tired in school, difficulties in waking up, enjoying school, and texting at night were rated on a Likert scale (never, seldom, often, and always). The reliability and validity of the questionnaire was established in school-aged children and adolescents (Garmy, Jakobsson, & Nyberg, 2012a). The test-retest reliability analyses showed that more than 90% of the estimates regarding bedtime on weeknights on the two survey occasions fell within +/- 30 minutes of each other, and the test-retest agreement regarding both sleep and media habits was adequate ($k > 0.600$) (Garmy et al., 2012a).

Power: a power calculation was conducted a priori, with a 30-minute difference in time in bed as the outcome measure (Garmy et al., 2012a). Considering a power of 80% and an alpha value of .05 (SD 1.0), a sample size of 126 individuals was needed.

Data Analysis

The descriptive statistics were analyzed as the means and standard deviations for continuous variables and frequencies and percentages for categorical variables (Field, 2009). The frequencies for Likert scale items (i.e., sleep difficulties, feeling tired at school, difficulties waking up, texting at night) were collapsed into binary variables (0=never/seldom and 1=often/always). Analyses were performed to detect differences between female and male students, those texting at night on a weekly basis versus those who did not, and those spending < 8 hours in bed and those spending \geq 8 hours in bed. Based on the NSF (2016) recommendation of 8-10 hours of sleep per night for adolescents, 8 hours was used as the cut-off for time in bed (<8 hours and \geq 8 hours). Comparisons were made using independent t-tests for continuous variables and Pearson's Chi square tests for categorical variables. The level of

significance was set at $p < 0.05$. The analysis was performed using IBM SPSS, version 21 (Field, 2009).

Results

Sample Description

The sample consisted of 278 students, 50% female, with an average age of 16.2 years. The distribution of sex and age differed between the schools (see Table 1). The school start times ranged from 8:00-8:40 AM on different weekdays, and school ended between 15:20 and 16:00 (3:20-4 PM). Half of the students had to commute more than 1 hour to get to school. The school start and end times, commuting times for the students, and response rates did not differ between the three schools.

Table 1

Sample Characteristics (age and sex)

	Total sample n=278	School 1 n=170	School 2 n=31	School 3 n=77	χ^2 (df)	p value
Mean age in years (SD)	16.23 (0.63)	15.90 (0.50)	16.74 (0.45)	16.75 (0.43)	137.1 (4)	<0.001
Sex						
Female	139 (50.0%)	62 (36.5%)	19 (61.3%)	58 (75.3%)	33.7 (2)	<0.001
Male	139 (50.0%)	108 (63.5%)	12 (38.7%)	19 (24.7%)		

Note. χ^2 =Pearson's χ^2 test; df=degree of freedom; SD=Standard deviation.

Sleep Habits

The average time in bed was 7 hours and 55 minutes on school nights and 9 hours and 35 minutes on weekends (see Table 2). Bedtimes were earlier on school nights (22:30; 10:30 PM) compared with weekend nights (00:30 AM). The average wake-up time was 6:30 AM on schooldays and 10:00 AM on weekends. The average bedtime discrepancy (difference between bedtime on schooldays and weekends) was 1 hour and 45 minutes, and the average rise-time discrepancy (schooldays and weekends) was 3 hours and 40 minutes. Table 2 shows that less than 8 hours of time in bed during the school nights was significantly associated with female sex, more sleep difficulties, wake time variability on schooldays and weekends, tiredness at school, and less enjoyment at school.

Table 2

Sleeping Habits Among Adolescents

	Total sample n=278 M (h:min) (SD)	<8 h time in bed on school nights n=98 (35.2%) M (h:min) (SD)	≥8 h time in bed on school nights n=180 (64.7%) M (h:min) (SD)	t(df)	p value
Bedtime schooldays	22:30 (0.76)	23:05 (0.74)	22:15 (0.58)	-10.78 (275)	<0.001
Bedtime weekends	24:30 (1.48)	24:40 (1.27)	24:00 (1.38)	-3.53 (275)	<0.001
Wake-up time schooldays	6:30 (0.86)	6:00 (0.63)	6:40 (0.80)	6.70 (275)	<0.001
Wake-up time weekends, mean	10:00 (1.59)	10:10 (1.63)	9:55 (1.44)	-1.41 (264)	0.160
Time in bed schooldays, mean	7:55 (1.09)	6:45 (0.47)	8:30 (0.79)	20.26 (276)	<0.001
Time in bed weekends, mean	9:35 (1.55)	9:25 (1.71)	9:50 (1.34)	2.30 (264)	0.022
Bedtime discrepancy (schooldays versus weekends)	1:45 (1.28)	1:35 (1.18)	1:50 (1.34)	1.59 (274)	0.113
Wake-up discrepancy (schooldays versus weekends)	3:40 (1.71)	4:10 (1.61)	3:15 (1.62)	-4.50 (263)	<0.001
	n (%)	n (%)	n (%)	χ² (df)	
Sex					
Female	139 (50.0)	58 (41.7)	81 (58.3)	5.11 (1)	0.033
Male	139 (50.0)	40 (28.8)	99 (71.2)		
Texting at night every week	80 (28.8)	36 (36.7)	44 (24.2)	4.55 (1)	0.038
Often having sleeping difficulties	58 (20.9)	31 (31.6)	27 (15.0)	10.63 (1)	0.002
Often tired in school	156 (56.1)	65 (66.3)	91 (50.5)	6.75 (1)	0.011
Often having difficulties waking up	180 (64.7)	74 (75.5)	106 (58.9)	7.68 (1)	0.006
Enjoying school very much	150 (54.0)	45 (45.9)	105 (58.3)	3.82 (1)	0.034

Note. M=mean; SD=Standard deviation; h=hours; min=minutes; t=Student's t-test; χ^2 =Pearson's χ^2 test. p < .05 was considered significant and is marked in bold.

Texting at Night

Sending and/or receiving SMS at night on a weekly basis was significantly associated with frequent tiredness at school (Table 3). Adolescents who sent or received SMS at night on a weekly basis had significantly later bedtimes on school nights and weekends, shorter times in bed on school nights, and irregular sleeping habits (e.g., a discrepancy between bedtime during school nights and weekends and a discrepancy between wake-up time during the school week and weekends) (see Table 3).

Table 3

Correlations Between Nighttime Texting and Sleep Habits

	Total sample n=277	Texting at night every week, n=80	Texting at night less than weekly n=197	t(df)	p value
	M (h:min) (SD)	M (h:min) (SD)	M (h:min) (SD)		
Bedtime schooldays	22:30 (0.76)	22:40 (0.81)	22:30 (0.74)	-.48 (274)	0.045
Bedtime weekends	24:30 (1.48)	24:50 (1.50)	24:00 (1.26)	-4.12 (274)	<0.001
Bedtime discrepancy (schooldays versus weekends)	1:45 (1.28)	2:05 (1.40)	1:35 (1.22)	-2.94 (273)	0.004
Wake-up discrepancy (schooldays versus weekends)	3:40 (1.71)	4:00 (1.76)	3:30 (1.48)	-2.95 (262)	0.003
	n (%)	n (%)	n (%)	χ^2 (df)	
Less than 8 h in bed, school nights	98 (35.4)	36 (45.0)	62 (31.5)	4.55 (1)	0.038
Often tired in school	156 (56.1)	53 (66.2)	102 (51.8)	5.36 (1)	0.022

Note. M=mean; SD=Standard deviation; h=hours; min=minutes; t=Student's t-test; χ^2 =Pearson's χ^2 test. $p < .05$ was considered significant and is marked in bold.

Discussion

Our findings suggest that nighttime texting was significantly associated with insufficient sleep and irregular sleep habits. We found that 35% of adolescents slept less than 8 hours per night. The recommended sleep duration for adolescents is 8 to 10 hours per night in the U.S. (NSF, 2016), and 9 hours of sleep per night in Sweden (Medical Products Agency, 2015). Similar to our findings, prior studies in the U.S. and Sweden, also report inadequate amounts of sleep (< 8 hours) among adolescents during the school week, 45% and 59%, respectively (NSF, 2006; Garby, Nyberg, & Jakobsson, 2012b). Given that adolescence is a critical period for physical (e.g., puberty), emotional and social changes that can also negatively impact sleep, school nurses are in an ideal position to educate adolescents about the importance of adequate sleep and healthy consistent sleep habits, and screen adolescents for insufficient sleep and poor sleep habits.

In the current study, less than 8 hours of time in bed was associated with sleeping difficulties, daytime tiredness, and irregular sleep habits on schooldays and weekends. Texting at night was associated with daytime tiredness, later bedtimes, and bedtime and wake time variability during school nights and weekends. Our findings are similar to those of previous studies (Carter et al., 2016; Pea et al., 2012; Shochat, Flint-Bretler, & Tzischinsky, 2010; Van den Bulck, 2004; Woods & Scott, 2016) and suggest that texting at bedtime negatively affect

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sleep quality (Doane, Gress-Smith, & Breitenstein, 2015; Fobian, Avis, & Schwebel, 2016) with bedtime and wake time variability, that can lead to social jetlag. Adolescents who are connected to social media at bedtime may struggle to settle down and relax due to feeling upset and disconnected when they cannot use social media and/or worry about missing out on new messages. Recent studies show a link between insufficient sleep and mental health problems, including anxiety, depression, low self-esteem, and suicidality (Seo, Kim, Yang, & Hong, 2016; Woods & Scott, 2016). Insufficient sleep and social jet lag have negative effects on academic performance and daytime functioning, but also on mental health (Seo et al., 2016; Woods & Scott, 2016; Short and Louca, 2015; Short et al., 2011).

Limitations

This study has limitations that deserve comment. The sample was based on a convenience sample of three schools in rural and urban areas representative of Swedish upper secondary schools where the first author was invited to conduct an educational program. Although we did not include an objective measure of sleep (e.g., actigraphy), self-report surveys are useful for obtaining data from large sample and limited due to social desirability and/or recall bias (Garmy et al., 2012a). Lastly, we did not measure psychosocial variables (anxiety, depression), which may contribute to our findings. Taken together, longitudinal studies are needed to further investigate the impact of nighttime social media on adolescent sleep and psychosocial function.

Implications for School Nursing

School nurses are key providers who have a critical role in educating adolescents on the importance of sleep, sleep health, and the consequences of inadequate amounts of sleep and poor sleep habits. School nurses are also in a unique position to discuss sleep health and educate not only students, but also teachers, and parents. For example, Healthy People 2020 includes a specific goal for adolescents “increase the proportion of students in grades 9th to 12th to get sufficient sleep” (<https://www.healthypeople.gov/2020/topics-objectives/topic/sleep-health>). In meeting the goals of Healthy People 2020, school nurses are ideally positioned to promote sleep health by screening students for poor sleep habits and assessing for inadequate amount of sleep, poor-quality sleep, and daytime deficits (e.g., daytime sleepiness, inattention, mood changes). School nurses have daily access to adolescents, thus implementing interventions that include school nurses is practical (Malone 2011; Willgerodt & Kieckhefer 2013). Individual conversations promoting healthy sleep habits and sleep health (e.g., satisfaction, timing/regularity, adequate duration, quality, and alertness; Buysse 2014), group discussions, and meetings with parents/guardians and school health staff are also recommended. The tips provided by Carskadon (2013) for teens to improve their sleep, as outlined in the Fact Box, are a good starting point for school nurses to discuss sleep health and habits with adolescents.

Conclusion

Texting at night was associated with not only poor sleep habits but also daytime deficits (tiredness). School nurses are in an ideal position to educate adolescents about the importance of sleep and healthy sleep habits on academic and psychosocial function. Consistent sleep habits during the week and weekends are critical not only for daytime function but also for circadian alignment. Parent and adolescent awareness about the negative effects of media use on sleep is also important. Given our 24/7 society, it is easy for parents and adolescents to lose sight of the use of media prior to and at bedtime. Parents may need to negotiate with their adolescent to reduce media use 1 hour before bed and to remove electronic devices from the bedroom to improve sleep duration and quality.

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Conflict of Interests

The authors have no conflicts of interest to declare

Fact Box: Tips for Teens to Improve Sleep.

- Make a sleep plan: set a bedtime for yourself that will allow enough time to sleep and keep this as consistent as you can
- Get bright light every morning when you wake up to help shift your internal clock to an earlier time, which can help you fall asleep earlier
- Avoid light at night (computers, iPhone, iPad) before bedtime to keep your internal clock from moving later
- Avoid “arousing” activities in the evening and give yourself wind-down time to relax for approximately 30 minutes before bedtime
- Do not sleep with your cell phone on or the computer, TV, or any other technology in your bedroom
- Stick as closely as you can to your sleep schedule on the weekends
- Avoid caffeine after school
- Do not nap after 4 p.m.
- Have some fun every day and enjoy your life!

Source: *Optimal Sleep Habits in Adolescents* by Carskadon, 2013, p. 86

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