

# Is sleep duration associated with self-reported overall health, screen time, and nighttime texting among adolescents?

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## Abstract

**Objectives:** We aimed to investigate whether sleep duration is associated with self-reported overall health, screen time, and nighttime texting among Swedish adolescents.

**Methods:** This was a cross-sectional survey of students ( $n = 1518$ ) aged 13 to 15 years (50.7% girls) in southern Sweden.

**Results:** Fewer than 8 hours sleep duration before a school day was reported by 31% of students. The median time spent watching television and/or at the computer was 3 hours, and 43% of students reported texting at night one or more times per week. Sleeping fewer than 8 hours was significantly associated with poorer self-reported overall health, often being tired at school, increased screen time, and a habit of nighttime texting.

**Conclusions:** Short sleep duration (<8 hours) was associated with poor self-reported health, increased screen time, and nighttime texting among respondents. These results provide information for parents, educators, and school health professionals to encourage young people to adopt healthy screen habits and sleep hygiene.

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**Keywords**

Adolescents, sleep duration, self-reported overall health, texting, screen time, Sweden

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**Background**

The adolescent period is critical for the development of individuals' cognitive and intellectual abilities and includes changes in social roles, norms, responsibilities, and relationships.<sup>1</sup> The published literature recommends 8 to 10 hours of sleep per night for adolescents aged 13 to 19 years.<sup>2</sup> It has been estimated that sleep duration among children and adolescents has declined by about 1 hour over the past century,<sup>3</sup> and sleep problems in these age groups continue to increase.<sup>4</sup> Insufficient sleep among adolescents contributes to health-related consequences including depression, obesity risk, and accidents.<sup>5</sup> Problems with falling asleep, together with early waking times on school days, may result in sleep deprivation. Compensating mechanisms, such as daytime napping and sleeping longer on weekend days, may further alter the circadian rhythm.<sup>6</sup>

The use of smartphones, tablets, and other electronic devices to access the Internet has increased. Most children and adolescents in Europe and North America use these devices for several hours every day.<sup>4</sup> Most young people watch television or use other electronic devices as sleep aids to help them fall asleep; however, evidence suggests that this strategy has the opposite impact on both sleep duration and quality.<sup>5</sup> Garmy and Ward<sup>7</sup> found that texting at night was strongly associated with later bedtimes, irregular sleep patterns, and daytime tiredness at school among adolescents. Spending more than 2 hours in front of a screen during the day (not school-related) has also been significantly associated with

shorter sleep duration;<sup>8</sup> concurrently, physical activity is decreased and sedentary behavior increased.<sup>9</sup> Sedentary lifestyles promoted by television and/or the use of computers, tablets, video games, and smartphones have emerged rapidly and continue to increase.<sup>10</sup> Results from the Slovakian contribution to the Health Behaviour in School-aged Children study showed an association between time spent on electronic devices during leisure time and problems in school, with poor sleep quality as a mediating factor.<sup>11</sup> Studies among Chinese college students have shown that low levels of physical activity and increased screen times heighten the risks of mental health problems and poor sleep.<sup>12,13</sup> However, a recent analysis found a small negative association between digital technology use and well-being among adolescents, explaining only 0.4% of the variation in well-being.<sup>14</sup> Therefore, improved understanding of the potential connections between sleep and digital media habits in adolescents will serve to improve both individual and public health. The purpose of the present study was to investigate whether sleep duration was associated with self-reported overall health, tiredness at school, screen time, and nighttime texting habits among Swedish adolescents aged 13 to 15 years old.

**Methods**

This study was a component of a larger research project (ISRCTN17006300) and was performed as a cross-sectional survey.

## Sample

The sample consisted of students at schools with grade 7 and 8 in four municipalities of southern Sweden. The largest municipality had over 100,000 inhabitants and the smallest had about 15,000.<sup>15</sup> Respondents were students in schools located in both urban and rural areas and including public as well as private schools.

## Procedure

A questionnaire was distributed by the respective school nurses, in connection with a mandatory health interview conducted during school hours. The questionnaire was completed using paper and pencil, and the school nurse was present to answer any questions related to the questionnaire. Custodians and students were informed in writing about the purpose of the study and that their participation was voluntary. Written informed consent was obtained from all respondents. This study was approved by the Regional Ethics Review Board in Lund, Sweden. Although the biological maturation of adolescents may impact sleep, we did not investigate puberty status for ethical reasons.

## Questionnaire

The survey was based on the Sleep and Media Habits Questionnaire (SMHQ), which is designed to track sleep and screen habits in school-aged children and adolescents.<sup>16</sup> The SMHQ consists of questions about the time (hours and minutes) spent in front of a TV or computer per day not related to schoolwork, as well as sleep duration (hours and minutes) on nights before school days, tiredness in school (never, rarely, often, every day), and the frequency of texting/other messaging (e.g., Snapchat, Facebook, Instagram ) at night (never, a few times a year, a few times a month, a few times a week) on school days.

Students were also asked to describe how they perceived their family's financial situation and their perceived overall health (using five ordered response categories ranging from "very good" to "not good at all").

Sleep duration on nights before school days was divided into <8 hours and  $\geq 8$  hours per night, according to adolescent sleep recommendations of the National Sleep Foundation.<sup>2</sup> Tiredness in school was divided into feeling tired at school often or every day, and never or rarely. Texting habits were divided into sending or receiving text messages at night on a weekly basis, and doing so less frequently. Overall health was divided into very or quite good self-reported overall health and poorer overall health. Perceived family financial situation was divided into very or quite good, and average or less good.

## Statistical analysis

Descriptive statistics with frequency, mean, standard deviation (SD), median, interquartile range (Q1–Q3) were used to represent the data. A  $p$ -value < 0.05 was considered statistically significant. The variables were dichotomized and analyzed regarding their relationships with sleep duration using chi-squared tests. Variables with a significance level of  $\leq 0.20$  in the bivariate analysis were then entered as independent variables in multiple logistic regression analysis,<sup>17</sup> with sleep duration on nights before school days ( $\geq 8$  hours = 0, < 8 hours = 1) as the dependent variable. Analyses were conducted using IBM SPSS version 24 (IBM Corp., Armonk, NY, USA).

## Results

The total sample consisted of 2088 students at 20 schools in the four study municipalities. The final sample comprised 1518

**Table 1.** Sample characteristics (n = 1518).

Characteristics	
Age, mean (SD)	13.89 (0.35)
Sex, n (%)	
Female	763 (50.7)
Male	741 (49.3)
Perceived family financial situation, n (%)	
Very/quite good	1227 (82.1)
Average	204 (13.7)
Not very good/not good at all	25 (1.7)
Sleep duration, n (%)	
Sleep duration before school days <8 hours	467 (30.8)
Sleep duration before school days ≥8 hours	1051 (69.2)
Overall health, n (%)	
Poorer self-reported health	182 (12.1)
Good self-reported health	1324 (87.9)
Tired in school, n (%)	
Often/every day	602 (39.9)
Never/rarely	908 (60.1)
Screen habits, n (%)	
Sending/receiving text messages at night (≥1/week), n (%)	646 (42.8)
Non-school-related TV/computer time on school days, median (hours:minutes) (Q1-Q3)	3:00 (2:00–4:30)

SD, standard deviation.

students (72.7% response rate), of which 50.7% were girls. Age varied between 13 to 15 years (mean 13.9, SD 0.4).

A sleep duration of < 8 hours before a school day was reported by 30.8% of students. The median time spent watching TV and/or at the computer was 3 hours, and 42.8% reported nighttime texting at least once a week on school days. Most respondents (82.1%) perceived their family's financial situation as very good or quite good (Table 1).

Table 2 summarizes the results of bivariate analyses for the associations with sleep duration on nights before school days (<8 hours/night vs. ≥8 hours/night). Sleeping fewer than 8 hours was slightly more common among girls (33.2%) than boys (28.2%). Other factors associated with short sleep duration before school days were perceived family finances that

were not very good, more frequent tiredness in school, poorer overall health, > 2 hours TV and/or computer time per day, and nighttime texting at least once per week (Table 2).

Because all variables but age were found to be significantly associated with sleep time (Table 2), these were included in multiple logistic regression analysis, with < 8 hours sleep duration on nights before school day as the dependent variable. All variables except for sex were identified as significantly associated with < 8 hours sleep duration before school days (Table 3). The strongest associations were those for nighttime texting, tiredness in school, and poorer overall health ( $p < .0001$ ). We also checked for possible interaction effects, which is the effect on the outcome variable (sleeping < 8 hours) of the independent variables in

**Table 2.** Associations between sleep duration before school days and background variables, tiredness, overall health, screen time, and nighttime texting (n = 1518).

	Sleep duration <8 hours n = 467 (30.8%) n (%)	Sleep duration ≥8 hours n = 1051 (69.2%) n (%)	$\chi^2$ (df)	p-value
Sex				
Female	256 (33.2)	514 (66.8)	4.5 (1)	.035
Male	211 (28.2)	537 (71.8)		
Age, years				
13	52 (27.4)	138 (72.6)	2.4 (2)	.307
14	408 (31.1)	904 (68.9)		
15	7 (43.7)	9 (56.2)		
Perceived family financial situation				
Very/quite good economic situation	345 (28.1)	882 (71.9)	21.1 (1)	<.0001
Average/less good economic situation	122 (41.9)	169 (58.1)		
Tired in school				
Often/every day	277 (46.0)	325 (54.0)	109.9 (1)	<.0001
Never/rarely	187 (20.6)	721 (79.4)		
Overall health				
Poorer self-reported health	111 (61.0)	71 (39.0)	89.4 (1)	<.0001
Good self-reported health	351 (26.5)	973 (73.5)		
Screen time <sup>a</sup>				
>2 hours/day	326 (34.0)	632 (66.0)	14.6 (1)	<.0001
≤2 hours/day	126 (24.4)	390 (75.6)		
Texting at night				
≥1x/week	189 (48.6)	200 (51.4)	77.8 (1)	<.0001
<1x/week	276 (24.6)	845 (75.4)		

$\chi^2$ , Pearson's chi-squared value; df, degrees of freedom.

<sup>a</sup>Non-school-related TV/computer time on school days.

**Table 3.** Multiple logistic regression analysis of factors associated with short (<8 hours) sleep duration before school days (n = 1518).

	Wald <sup>b</sup>	Odds ratio (95% CI)	p-value
Female sex	.004	.99 (.76–1.29)	.95
Average/less good economic situation	7.46	1.54 (1.13–2.11)	.006
Tired in school often/every day	38.58	2.30 (1.77–2.99)	<.0001
Poorer self-reported overall health	31.10	2.89 (1.99–4.21)	<.0001
Screen time <sup>a</sup>	16.19	1.13 (1.07–1.20)	<.0001
Nighttime texting ≥1x/week	43.23	2.50 (1.90–3.28)	<.0001

Hosmer–Lemeshow goodness-of-fit test,  $p = 0.893$ ; Nagelkerke  $R^2 = 0.202$ . There were no signs of multicollinearity (tolerance > 0.8).

CI, confidence interval.

<sup>a</sup>Non-school-related TV/computer time on school days.

<sup>b</sup>Wald chi-squared test.

combination; however, this investigation did not change the model (data not shown).

## Discussion

The results of our study show that students who reported sleeping fewer than 8 hours on nights before school had worse self-reported overall health and were tired more often at school than those sleeping 8 hours or more. We interpret these findings as indicating a link between limited sleep and health complaints, which has also been shown in earlier studies.<sup>18</sup> Sleeping fewer than 8 hours was also associated with perceived financial insecurity, which is likely owing to the associated stress; however, further studies are needed to better understand this association.

Students who indicated that they spent more time in front of the TV or computer (in addition to schoolwork) were more likely to sleep fewer than 8 hours on nights before a school day. This finding is in agreement with those of an earlier study<sup>19</sup> that 14-year-olds who spent more time at the computer had a higher risk of not getting their recommended hours of sleep than those who used a computer only briefly. Short sleep duration was also associated with nighttime texting. This finding is similar to the results reported by Garmy and Ward.<sup>7</sup> Electronic media devices might be negatively linked to healthy sleep habits in adolescents; however, the direction of this association could also be the opposite, i.e., adolescents may use electronic devices more because of existing sleep problems.

There are several different hypotheses as to how screen habits can affect sleep and mental health; for example, screen time may displace time for physical activity.<sup>13,20</sup> The current study showed a difference between nighttime texting and more hours in front of a TV or computer. Nighttime texting had a stronger association with

sleeping fewer than 8 hours than spending more time in front of a computer or television. This difference might be because unlike computer and TV viewing, text messaging at night might interrupt initiated sleep. Other studies<sup>7,21</sup> have attempted to explain the strong connection between nighttime texting and daytime tiredness.

Increased time in front of the TV or computer decreases the time available for other activities, such as physical activity during the day and sleeping at night. Moreover, spending time in front of the TV or computer is a sedentary activity, which in itself is a health risk.<sup>10</sup> More than 2 hours of sitting during leisure time, in addition to the time spent sitting at school, may qualify as excessive sitting.<sup>22</sup> Reduced physical activity and total energy expenditure (e.g., through excess TV/computer time) has been associated with metabolic syndrome in adults<sup>23</sup> and cardiometabolic risk behaviors in school-aged children and adolescents.<sup>24</sup> Sleep, a sedentary lifestyle, and physical activity are all linked to cardiovascular disease risk biomarkers.<sup>9</sup> The mechanistic pathways that contribute to health risks associated with sedentary behaviors are adverse alterations to cardiac function, glucose homeostasis, and lipid metabolism. The physiologic mechanisms associated with excessive sedentary behavior are different than those associated with the physiologic benefits of regular exercise.<sup>9</sup>

## Strengths and limitations

The strengths of the current study include the large sample size and use of a well-established instrument. The SMHQ questionnaire has been psychometrically evaluated as part of a previous study.<sup>16</sup> However, owing to the cross-sectional study design, it is not possible to draw conclusions about causality. It is impossible to determine which factors (such as tiredness

in school or nighttime texting) most affect sleep duration, and therefore, health. We did not investigate the biological maturation status of adolescents in this study owing to ethical reasons, but puberty is a factor affecting sleep. However, there were no significant differences in sleep duration according to age. The self-reported data might be biased by social desirability. Future studies with a longitudinal design are called for, as well as interview studies.

## Conclusions

The main outcome of the current study was that short sleep duration (<8 hours) was associated with poor self-reported health, increased screen time, and nighttime texting among adolescents. The use of electronic devices is common among today's youth, both during the day and at night. Our results show that frequent nighttime texting is significantly associated with sleeping fewer than 8 hours per night. Our results also showed that more TV or computer time in addition to schoolwork is significantly associated with sleeping fewer than 8 hours per night. These results confirm prior reports and provide additional information for parents and school health care professionals to encourage young people to adopt healthy screen habits and sleep hygiene. It is challenging for parents and school staff to encourage children and adolescents to avoid excessive screen time during the day and at night, although this is associated with health risks arising from sleep deprivation and metabolic disorders. Therefore, including questions regarding sleep patterns and screen time at health visits with adolescents might be helpful in preventing the associated health risks.

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## Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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