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Sleep duration and patterns in adolescents: correlates and the role of daily stressors

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ABSTRACT

Objectives: The first aim of this study was to assess the prevalence of sleep deficit in a large sample of adolescents. Second, the study aimed to assess whether short sleep duration in the sample was associated with emotional and behavioral problems. Lastly, the study aimed to investigate the association between daily stressors–bedtime activities and sleep duration.

Design: Cross-sectional survey.

Setting: The questionnaires were completed during school hours in 17 municipal junior high schools in Sweden.

Participants: A total of 2767 adolescents aged 12 to 16 years, 48% girls.

Measurements and Results: Sleep measures included total sleep time (TST) for schooldays and weekends, obtained as combined measures of self-reported bed-time, wake-time, and sleep onset latency. We used the new National Sleep Foundation's guidelines to operationalize sleep duration. Overall 12% of younger adolescents (age 12–13 years) and 18% of older adolescents (14–16 years) slept less than recommended (TST < 7 hours). Adolescents reporting nonrecommended TST also reported more behavioral (ie, norm-breaking behaviors) and emotional problems (ie, depression, anxiety, and anger), with effects in the small-medium range. Finally, adolescents reporting bedtime arousal and use of information and communication technology in bed were more likely to report TST < 7 hours. Stress at home (for younger adolescents) and stress of school performance (for older adolescents) were also associated with TST less than 7 hours.

Conclusions: The new National Sleep Foundation's recommendations were informative in this context. Future sleep interventions need to target barriers to good sleep practices, such as use of information and communication technology, stress, and worry that may contribute to arousal at bedtime.

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Sleep deficit is common in adolescence, and research has shown that it can have serious consequences for wellbeing. From a developmental perspective, sleep deficit is in fact normal, and most adolescents will experience it at some time point as they all go through biological and psychosocial changes that deeply affect their sleep patterns.^{1,2} Several studies involving a range of cultural groups have shown that adolescent sleep deficit is common. These studies show that 24% to 73% of adolescents sleep less than 7 hours per school night,^{3–6} which is 2 hours less than the generally recommended 9 hours.⁷ This adolescent sleep deficit appears to have increased over the past 20 years, possibly due to the expanded availability of activities late in the evening.^{8,9}

Although activities that compete with sleep such as homework, recreational activities, socializing, and use of information and communication technology (ICT) have been shown to interfere with sleep, a more recent meta-analysis has shown that the actual number of competing activities did not consistently predict sleep deficit.¹⁰ The authors suggested that it might instead be the perceived stressfulness of these activities rather than the objective amount of activity that negatively impacts sleep. This explanation would be consistent with research that has shown that adolescents who are cognitively and emotionally aroused at bedtime due to worrying, thinking about things to do the next day, or ruminating on what happened during the day are at higher risk for poor sleep.¹⁰ However, only a few studies have specifically examined the association between daily stressors and sleep duration.¹¹ Furthermore, the impact of ICT use upon sleep duration was inconsistent, suggesting that ICT's influence on sleep might depend on other features such as the timing of the activity.¹⁰

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Adolescents may also inadvertently be contributing to their own sleep deficit by attempting to compensate for insufficient sleep during the week. By delaying both bed and wake times during weekends and holidays, adolescents may place themselves at a higher risk for developing a delayed sleep phase¹²; this, in turn, can sustain later weekday bedtimes and exacerbate sleep deficit.⁷

Despite adolescent sleep deficit being developmentally typical, this deficit in required sleep is alarming because sufficient sleep is essential for adolescents' everyday functioning.¹³ There is a growing body of evidence linking emotional and behavioral problems to sleep deficit in adolescents.¹⁴ Sleep plays an important role in emotion regulation¹⁵ and poor emotion regulation in turn can contribute to psychological problems such as anxiety, depression, and anger.¹⁶ Longitudinal and cross-sectional studies have also shown a relationship between short sleep duration and behavioral problems such as aggression and norm-breaking behaviors.^{17–20} Sleep duration has been shown to be related to physical health problems such as obesity, elevated blood pressure, and pain,¹³ and there is even a strong relationship between sleep and students' academic achievement and school absenteeism.^{21,22} Given that sleep appears to impact upon a variety of areas of adolescents' functioning, designing effective interventions to promote sleep is a pressing issue.²³ To begin to address this issue, improved knowledge of adolescents' sleep patterns is required so that effective targets for preventive interventions can be identified.

To date, the development and implementation of preventive sleep interventions for adolescents has achieved limited success. Previous sleep interventions conducted in a universal arena such as a school have shown that teaching sleep hygiene alone is not enough to induce behavioral change. For example, improving adolescents' knowledge of good sleep practices does not alter sleep behavior.²³ The addition of motivational techniques, such as motivational interviewing, has also proved disappointing,²⁴ with some exceptions.²⁵ One possible reason for the failure to achieve actual behavioral change may be that these studies do not address the daytime activities competing with sleep and the arousal associated with them. The aim of this study was therefore to assess for this possibility.

The National Sleep Foundation (NSF) has recently updated its sleep duration recommendations across the life span.²⁶ These updates include recognition of excessive sleep duration as a risk, recommendations for specific age groups, and a relaxing of the criteria for insufficient sleep duration through the addition of an intermediate level, "may be appropriate for some." These guidelines are therefore likely to be more informative than dichotomized measures of sleep duration and may advance our understanding of the problem. These new guidelines were adopted when operationalizing sleep duration in this study.

The first aim of this study was to assess the prevalence of sleep deficit in a sample of Swedish adolescents using these newly updated guidelines. To our knowledge, the sleep behavior of Swedish adolescence has never previously been described in the literature. Second, this study aimed to assess whether short sleep duration in the sample was associated with emotional and behavioral problems. Lastly, this study aimed to assess whether there was any association between daily stressors—bedtime activities and sleep duration.

Method

Participants and procedure

The participants were high school students in seventh and eighth grades (age range, 12–16 years) from 17 public schools in 3 communities in middle Sweden. The target sample included a total of 3336 students. The consent procedure required active consent from students and passive consent from parents due to the fact that passive consent can increase participation rate and limit sampling bias.^{27,28}

All parents received a letter informing them about the study; overall, 122 parents declined having their child in the study. A total of 2768 eligible students (48% girls) were present at data collection (response rate, 83%). Most of the students were born in Sweden (89%) and had at least one biological parent born in Scandinavia (71%). The majority lived with both biological parents (71%). We divided students into 2 age groups according to the NSF guidelines; 43% of our sample was 12 to 13 years old (school-aged children) and 57% was 14 to 16 years old (adolescents). This study was approved by the Regional Ethical Board in Uppsala, Sweden.

Students filled out the questionnaires in their classrooms, and teachers were asked to leave in order to ensure confidentiality. Trained test leaders informed the students about confidentiality and that participation was voluntary, helped the students if necessary (eg, explaining difficult questions), and collected the completed questionnaires. Students had 180 minutes to complete the questionnaire and received a snack during data collection. In addition, each class received 300 Swedish crowns (35 US dollars) as a thank you for participating.

Measures

The questionnaire included both established instruments and questions developed specifically for this study that assessed sociodemographics, sleep, stress, use of electronic media, emotional and behavioral problems, and other variables not included as part of this study.

Sociodemographics

Items included age, sex, country of birth, family situation, and parents' country of birth.

Sleep duration

Weekday sleep duration was estimated by calculating the interval between students' self-reported bed time ("What time do you usually go to bed on school days?") and wake time ("What time do you usually wake up on school days?"), subtracting sleep onset latency ("On school days, after you got to bed at night, about how long does it usually take for you to fall asleep?"). Weekend sleep duration was calculated in an identical way. These items were taken from the School Sleep Habits Survey.²⁹ Weekday sleep duration was then transformed into a categorical variable according to the NSF guidelines for "recommended," "may be appropriate," and "not recommended" sleep duration (in this study the terms "optimal," "borderline," and "poor" will be used). Namely, for school-aged children (6–13 years), recommended sleep duration is 9 to 11, 7 to 8, or 12 hours may be appropriate, whereas less than 7 or more than 12 hours is not recommended; for adolescents (13–17 years), a sleep duration of 8 to 10 hours is recommended, 7 or 11 hours may be appropriate, and less than 7 or more than 11 hours is not recommended.²⁶

Stressors and bedtime activities/arousal

Daily stressors. Stress was measured using a short version (27 items) of the Adolescent Stress Questionnaire.³⁰ In this study, we used 4 subscales "stress of home life" (4 items, eg, "arguments at home"), "stress of school performance" (3 items, eg, "keeping up with school work"), "stress of school/leisure conflict" (3 items, eg, "not having enough time for activities outside school"), and "stress of peer pressure" (4 items, eg, "pressure to fit in with peers").³¹ Responses were on a 5-point scale (0–4) from "not stressed at all" to "extremely stressed." Reliability was Cronbach $\alpha = .84$ for "stress of home life," $\alpha = .79$ for "school performance," $\alpha = .84$ for "school/leisure conflict," and $\alpha = .84$ for "stress of peer pressure."

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