



Sleep duration, positive attitude toward life, and academic achievement: The role of daytime tiredness, behavioral persistence, and school start times



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Sleep timing undergoes profound changes during adolescence, often resulting in inadequate sleep duration. The present study examines the relationship of sleep duration with positive attitude toward life and academic achievement in a sample of 2716 adolescents in Switzerland (mean age: 15.4 years, $SD = 0.8$), and whether this relationship is mediated by increased daytime tiredness and lower self-discipline/behavioral persistence. Further, we address the question whether adolescents who start school modestly later (20 min; $n = 343$) receive more sleep and report better functioning.

Sleeping less than an average of 8 h per night was related to more tiredness, inferior behavioral persistence, less positive attitude toward life, and lower school grades, as compared to longer sleep duration. Daytime tiredness and behavioral persistence mediated the relationship between short sleep duration and positive attitude toward life and school grades. Students who started school 20 min later received reliably more sleep and reported less tiredness.

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During adolescence, bedtime shifts to later in the evening, due to both biological maturation and environmental factors such as decreased parental influence on children's bedtimes, an increase in academic obligations and workload, and social activities (Carskadon, Acebo, & Jenni, 2004; Crowley, Acebo, & Carskadon, 2007). Despite going to bed later, adolescents are usually required to wake up just as early or even earlier than they did during mid- and late childhood, due to early school start times, resulting in sleep deprivation in most adolescents (National Sleep Foundation, 2006).

Insufficient sleep during adolescence is associated with a host of negative outcomes, including emotional, cognitive, and behavioral problems (Fallone, Owens, & Deane, 2002; Fredriksen, Rhodes, Reddy, & Way, 2004; O'Brien & Mindell, 2005). In a recent study on more than 15,000 adolescents, later bedtimes were related to a higher risk of depression and suicidal ideation (Gangwisch et al., 2010). Further, sufficient sleep is important for learning and cognitive performance, which is particularly relevant for adolescents striving to meet academic demands at school. Experimentally induced sleep restriction/deprivation impairs verbal processing and abstract reasoning of children and adolescents (Randazzo, Muehlbach, Schweitzer, & Walsh, 1998) and school-based surveys indicate that adolescents who sleep less than others achieve lower school grades (Chung & Cheung, 2008; Dewald, Meijer, Oort, Kerkhof, & Bogels, 2010; Wolfson & Carskadon, 2003).

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One possible mediator of the effect of short sleep is excessive daytime tiredness, which is a frequent condition in adolescence (Fallone et al., 2002). Higher levels of daytime tiredness are associated with short sleep duration (O'Brien & Mindell, 2005), compromised well-being (Brand, Gerber, Beck, et al., 2010), and lower academic achievement (Chung & Cheung, 2008; Dewald et al., 2010). A further possible pathway through which short sleep and daytime tiredness affect well-being and academic performance is via students' diminished ability to persist in achieving goals and to engage efficiently on school work. Behavioral persistence and self-discipline have been shown to play an important role in academic performance (Andersson & Bergman, 2011; Duckworth & Seligman, 2005; Fortier, Vallerand, & Guay, 1995; Tangney, Baumeister, & Boone, 2004). Dweck (1986) differentiated between individuals with mastery goals and individuals with performance goals. Individuals with mastery goals believe that their abilities are malleable and therefore seek challenges and show high persistence to improve their skills. By contrast, individuals with performance goals believe that their abilities are fixed traits. Thus, their motivation is not oriented toward improving skills but directly toward gaining positive and avoiding negative judgments. They therefore avoid challenges and show low persistence when facing obstacles. Independent of intellectual ability, individuals with mastery goals learn new tasks easier and display higher achievement in the end, when compared to individuals with performance goals (Dupeyrat & Mariné, 2005). Beyond the impact on academic achievement, behavioral persistence can be important for general well-being, as it aids adolescents in exercising regularly, eating a healthy diet (Gillison, Standage, & Skevington, 2011; Wills, Isasi, Mendoza, & Ainette, 2007), and refraining from risky or problematic behaviors such as substance use, early sexual behavior, and delinquency (Cooper, Wood, Orcutt, & Albino, 2003).

While both sleep duration and behavioral persistence are important for well-being and achievement, few studies examine the relationship of short sleep and tiredness with behavioral persistence. One study found that a delayed sleep schedule was correlated with low self-control, a tendency to postpone tasks, and poor time management (Digdon & Howell, 2008), which can be considered indicators of behavioral persistence. Additionally, better-rested children tend to report higher achievement motivation, indicating a relationship between daytime tiredness and motivation (Meijer, Habekothé, & Van den Wittenboer, 2000).

The first aim of the present study was to examine the association of sleep duration with well-being and academic achievement. Based on recommendations for adolescent sleep made by the National Sleep Foundation, a sleep duration of less than 8 h is considered as insufficient. In comparison, borderline sufficient sleep duration is 8–8:59 h for this age, and an optimal sleep duration is considered to be 9 h or more (National Sleep Foundation, 2006).

The second aim of the study was to examine the potentially mediating roles of daytime tiredness and behavioral persistence in the relationship of sleep duration with well-being and academic achievement. We expected shorter sleep duration to be associated with more daytime tiredness, which in turn was expected to be associated with lower levels of behavioral persistence. Finally, we expected more daytime tiredness and lower behavioral persistence to be associated with compromised well-being and impaired academic achievement.

The third aim of the study was to examine the role of school start times taking advantage of the variation in school start times between the schools that participated on the study. Specifically, we compared sleep duration, daytime tiredness, behavioral persistence, and well-being of students at a school with modestly delayed start time (i.e., 8:00 am) with students at the five other schools that started 20 min earlier (i.e., at 7:40 am). There is evidence that later school start times are associated with longer sleep duration as well as improved health and well-being of adolescents (Owens, Belon, & Moss, 2010; Wahlstrom, 2002; Wolfson, Spaulding, Dandrow, & Baroni, 2007). Delay of school start times by 1 h or more has been shown to result in an extension of sleep time on school nights, less daytime sleepiness, depressive symptoms, and tardiness due to oversleeping (Wahlstrom, 2002; Wolfson et al., 2007). Despite these favorable findings, delaying school start times by 1 h or more can also raise opposition from local communities due to effects on family life and has thus not been widely introduced (Eliasson, Eliasson, King, Gould, & Eliasson, 2002; Wahlstrom, 2010). On the other hand, knowledge on effects of more modest delays of school start times is limited. An exception is a recent intervention study that found that a modest delay of school start time by 30 min resulted in increased sleep duration, less daytime sleepiness and improved alertness, mood and health (Owens et al., 2010). We compare sleep duration, daytime tiredness, behavioral persistence, and well-being of students at the school that starts modestly delayed (i.e., 20 min later) with students at the early starting schools.

In general, it is well-known that children and adolescents from families of lower socio-economic status (SES) and/or immigration status are at increased risk for mental health problems, poor school achievement, as well as poor sleep (Buckhalt, 2011; Vazsonyi, Trejos-Castillo, & Huang, 2006). Moreover, it has been argued that the role of insufficient sleep for adolescent's health, well-being, and school achievement is amplified by low SES of their families (Buckhalt, 2011). For the present work we studied lower track secondary school students in northwestern Switzerland with a large proportion of students of immigration status who are generally of lower socio-economic status (Swiss Federal Office of Statistics, 2011) than adolescents of higher track secondary schools or adolescents from the host country.

Method

Procedure

Participants were recruited from 8th and 9th grade classes of all six lower track secondary schools of a mid-size city in northwestern Switzerland, which were located in close proximity (i.e., the maximum distance between the most distant schools was 2 miles). Lower track secondary school qualifies for vocational training. The students were informed of the

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