

# The Relations Between Sleep, Personality, Behavioral Problems, and School Performance in Adolescents

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**KEYWORDS:** Adolescence, Emotion regulation, Personality, School performance, Sleep

## KEY POINTS

- Adolescents on average do not get the recommended amount of more than 9 hours of sleep per night.
- Delaying school start times allows adolescents to get more sleep, thereby increasing attendance rates and academic achievement, especially in evening-type individuals.
- Neuroticism, anxiety, type D personality, perfectionism, and impulsivity are risk factors for sleep problems.
- Insufficient sleep in adolescents contributes to problems with emotional-behavioral regulation and, as a consequence, to a range of potentially self-harming and other-harming behaviors, such as drug use, risky driving, hyperactivity, and aggression.
  - Insufficient sleep in adolescents also contributes to poor academic achievement.
- The negative effects of insufficient sleep on emotional-behavioral regulation and academic achievement are more pronounced in adolescents from families with lower socioeconomic status.
- Multicomponent treatment programs specifically designed for adolescents have been developed on the basis of cognitive-behavioral therapy for insomnia

## SLEEP NEEDS AND PATTERNS IN ADOLESCENTS

Accumulating empirical evidence suggests that, across different countries and cultures, adolescents do not get the recommended amount of sleep. Although longitudinal studies of sleep needs through puberty have suggested that adolescents require more than 9.0 hours of sleep at night, on average they obtain between 7.5 and 8.5 hours per night, with approximately 25% of adolescents obtaining fewer than 6.5 hours and only approximately 15% obtaining 8.5 hours or more.<sup>1</sup> As for gender differences, a meta-analysis has indicated that, on school days, girls sleep on average 11 minutes per night more than do boys, and that on nonschool days, girls sleep 29 minutes more.<sup>2</sup> Across adolescence, sleep time declines on average by 14 minutes per year of age on school days and by 7 minutes per year of age on nonschool days, essentially due to a shift toward later bedtimes.<sup>2,3</sup> On nonschool days,

adolescents typically sleep 1.5 hours longer than they do on school days, suggesting that they accrue a sleep debt across the week that is relieved by oversleep on weekends.<sup>3</sup>

Regarding cultural differences, 2 meta-analyses have found that adolescents from Asian countries sleep significantly less each night than do adolescents from North America, Australia, and Europe, essentially because of later bedtimes.<sup>2,3</sup> Another recent comprehensive meta-analysis of data on 690,747 children and adolescents from 20 countries has revealed that between 1905 and 2008, sleep duration generally decreased by more than 1 hour per night. However, rates of change varied according to geographic region: whereas sleep duration decreased in Europe (not including Scandinavia and the United Kingdom), the United States, Canada, and Asia, it increased in Scandinavia, the United Kingdom, and Australia.<sup>4</sup>

Apart from intrinsic factors, such as the pubertal shift in chronotype preference from morningness to eveningness<sup>5</sup> or specific sleep disorders (eg, insomnia, obstructive sleep apnea, restless legs syndrome), a number of extrinsic factors may contribute to insufficient sleep in teens; namely, extracurricular activities, after-school jobs, and homework.<sup>1</sup> For instance, nearly 20% of a sample of high school students indicated spending 20 hours per week or more on extracurricular activities (eg, sports, music, social clubs) and those students also reported significantly later bedtimes and less total sleep time when compared with students who spent fewer than 20 hours in extracurricular activities.<sup>6</sup> Moreover, almost 60% of this sample of high school students reported having a part-time job and nearly 30% indicated working more than 20 hours per week. As with extracurricular activities, students who worked more than 20 hours per week at a part-time job indicated significantly later bedtimes and less total sleep time when compared with students who worked less than 20 hours per week.<sup>6</sup> Engaging in extracurricular activities or holding a job also may delay school homework completion, thereby further postponing bedtime.<sup>1</sup>

When at home in the evening, adolescents increasingly use electronic devices for information, communication, and entertainment, whereby sleep also may be delayed.<sup>7</sup> In the hour before going to bed on school nights, 76% of adolescents report watching TV, 44% surfing the Internet or sending instant messages, 40% talking on the phone, and 26% playing electronic or video games.<sup>8</sup> A review of 36 studies with school-aged children and adolescents showed that electronic media use is significantly related to delayed bedtime and shorter total sleep time.<sup>9</sup> Several mechanisms may mediate the effect of electronic media use on sleep: (1) media use may directly displace sleep or other activities related to good sleep hygiene (eg, physical activity); (2) media use may increase sleep-interfering physiologic, affective, and cognitive arousal; and (3) bright light exposure from television and computer screens may delay melatonin secretion, thereby delaying the circadian rhythm.<sup>9</sup> As might be expected, adolescents reaching pathologic levels of electronic media use run a particularly high risk of suffering from sleep problems.<sup>10</sup>

After going to bed late in the evening because of extracurricular activities, jobs, school homework, or use of electronic devices, adolescents typically have to get up early in the

morning to attend school, resulting in insufficient sleep. A number of observational and intervention studies have consistently shown that when school start times are delayed by 25 to 85 minutes, bedtimes typically do not change and adolescents get on average 30 to 60 minutes more sleep.<sup>11-15</sup> In turn, this additional sleep time is associated with higher attendance rates, less sleepiness and dozing in class, lower depression scores, reduced caffeine consumption, better concentration, and higher grades.<sup>11-15</sup>

## PERSONALITY TRAITS AS RISK FACTORS FOR SLEEP PROBLEMS IN ADOLESCENTS

It has been postulated that a number of personality traits might make adolescents and adults vulnerable to developing sleep problems, particularly when under stress.<sup>16</sup> Early research indicated that internalization, or the excessive inhibition of outward behaviors, might entail a state of constant emotional arousal, thereby contributing to sleep disturbance. Accumulating evidence does indeed suggest that poor sleepers often display high scores on internalization, neuroticism (= enduring tendency to experience negative emotional states), anxiety, and perfectionism.<sup>16</sup> In a recent extension of this line of research, it has been found that adolescents with a type D personality, or distressed personality (= tendency to experience negative emotions and, concomitantly, to inhibit self-expression in social interaction), incur an approximately 4 times higher risk of having sleep disturbances.<sup>17</sup> The recent literature also suggests that the relations between personality traits and sleep problems are best conceptualized as bidirectional. For instance, a longitudinal study has shown that sleep-onset problems during adolescence are a direct risk factor for heightened neuroticism in midlife.<sup>18</sup>

Another line of research has revealed that not only excessive inhibition of behaviors, as in internalization, but also excessive disinhibition of behaviors, as in externalization, may result in an affective imbalance that manifests itself in sleep-interfering emotional arousal. For example, studies with undergraduate students have shown that those scoring high on impulsive urgency are particularly prone to experience feelings of regret, shame, and guilt at bedtime, likely because they compare their rash daytime behavior with how they would have liked to behave.<sup>19</sup> Impulsive urgency can be defined as the tendency to act rashly, especially under conditions of negative affect,<sup>20</sup> and has been associated with the use of inappropriate emotion-regulation strategies, such as self-attacking and rumination, which may contribute to sleep-interfering mental activity at bedtime.<sup>21,22</sup>

Finally, the personality dimension of chronotype preference (morningness/eveningness; “larks” vs “owls”) is of importance when considering the relations among sleep, daytime behavior, and school performance in adolescents. Self-report studies have associated eveningness with later bedtimes, shorter sleep, and reduced sleep quality on school nights, greater tendency to fall asleep at school, diminished alertness, depressed mood, and poorer school performance.<sup>23,24</sup> An experimental study in which intelligence tests were administered to adolescents at their optimal and nonoptimal times of day lent further support to the

findings from the self-report studies.<sup>25</sup> Specifically, a 6-point difference in IQ estimates was observed as a function of the match between the individual's circadian arousal pattern and the time of testing. Moreover, evening-type adolescents obtained higher scores on measures of attention problems and aggressive behavior, suggesting that they have comparatively more conduct problems at home and school.

## SLEEP AND BEHAVIORAL PROBLEMS IN ADOLESCENTS

Independently of circadian phase preference, insufficient sleep in adolescents has been associated with a number of potentially self-harming or other-harming behaviors, such as cigarette smoking, alcohol consumption, drug use, and risky sexual behaviors.<sup>26-29</sup> In addition, more than half of 10th to 12th graders report drowsy driving in the past year,<sup>5</sup> which is all the more worrying because motor vehicle accidents account for the greatest number of adolescent deaths in the United States.<sup>1</sup>

Longitudinal investigations have, furthermore, associated insufficient sleep with a range of externalizing behaviors, such as hyperactivity, irritability, aggression, and other conduct problems.<sup>30</sup> These associations also were highlighted by an intervention study that examined the effects of a 6-week behavioral sleep treatment in adolescents with substance-related difficulties.<sup>31</sup> It was found that increases in sleep time were associated with decreases in aggressive ideation and aggressive actions occurring during conflicts. These findings in adolescents indicate that inadequate sleep undermines emotional and behavioral regulation,<sup>32</sup> in accord with sleep deprivation studies in adults, which suggest that sleep loss impairs the functional connectivity between the prefrontal cortex (area involved in voluntary control) and the amygdala (area involved in emotional reactions).<sup>33</sup>

Some longitudinal studies have indicated that the negative effects of inadequate sleep on behavioral adjustment are particularly marked in adolescents from homes of lower socioeconomic status (SES).<sup>32</sup> Other longitudinal studies have suggested that the initial presence of sleep problems is less important in predicting later behavioral adjustment than whether these problems persist or worsen over time.<sup>34</sup>

## SLEEP AND SCHOOL PERFORMANCE IN ADOLESCENTS

Since the 1980s, a series of studies have strongly suggested that self-reported short sleep duration, poor sleep quality, late bed and rise times, and irregular sleep schedules are negatively associated with academic performance for adolescents from middle school through the college years.<sup>22,35</sup> A meta-analytic review of one longitudinal and 16 cross-sectional studies found that sleep duration, sleep quality, and sleepiness were all negatively related to school performance in children and adolescents.<sup>36</sup> The effect was strongest for sleepiness, followed by sleep quality and sleep duration. Moreover, the effect sizes were larger for younger participants, which might, according to the investigators of the study, be explained by the important maturation-related changes of the prefrontal cortex in early adolescence.

Few longitudinal investigations have been done, however, on the effects of chronic short sleep on scholastic performance in adolescents. One such study has recently found that late school year bedtime was associated with worse educational outcomes and emotional distress 6 to 8 years later, but that short total sleep time was not longitudinally related to these outcomes.<sup>37</sup> As the investigators of this study note, in accord with the findings of the earlier-mentioned meta-analysis,<sup>36</sup> the effects of short sleep might be most pronounced in young adolescents because with maturation, older adolescents may experience a decrease in sensitivity to sleep loss and extended wakefulness.<sup>38,39</sup> Moreover, again in line with the findings of the meta-analysis,<sup>36</sup> another recent study suggests that sleepiness may be a better predictor of objective school performance than either sleep quality or sleep duration.<sup>40</sup> According to the investigators of this study, sleepiness during the first hours of school may be a key mechanism whereby insufficient sleep negatively impacts academic performance.

Emerging research also suggests that lower SES is related to shorter sleep duration and that, in addition, the negative effects of inadequate sleep on academic achievement may be comparatively greater in children and adolescents from lower SES families.<sup>32</sup> Among the various indicators of SES, the level of parental education turned out to be an important moderator between sleep and scholastic performance in children and adolescents. Parental education presumably is a proxy for a wide range of circumstances and conditions that can amplify or dampen the effects of insufficient sleep. For instance, lower educational level may be linked to more family stressors or less parental monitoring. In combination with such factors, insufficient sleep may contribute to the so-called achievement gap; that is, academic underachievement in children and adolescents from lower SES families.<sup>32</sup>

The exact mechanisms whereby sleep may affect academic achievement still remain to be explored. The available empirical evidence indicates that academic performance results from a complex interplay among multiple factors, including cognitive functioning, achievement motivation, personality, and emotional-behavioral regulation.<sup>32,41</sup> As for cognitive functioning, correlational studies and experimental investigations suggest that inadequate sleep leads to more daytime sleepiness, inattention, and impairments in executive functioning, which may all adversely affect academic achievement in children and adolescents.<sup>34,41</sup> Executive functioning refers to higher-order, prefrontal cortex-related cognitive processes, including impulse control, set shifting, and working memory, which underlie the monitoring and control of thought and action. Longitudinal studies have revealed that sleep problems in childhood, especially if they persist, may predict executive functioning in later childhood and adolescence.<sup>42,43</sup> Importantly, experimental evidence also indicates that even very moderate (eg, “just 1 more TV show” of 1 hour), but accumulated, sleep loss may impair executive functioning in children and adolescents.<sup>41</sup> Of note is a consistent body of experimental evidence from studies with adults suggesting that sleep is essential for processes of memory consolidation<sup>44</sup>; processes that are also pivotal for academic performance in adolescents.<sup>45</sup>

Academic success also depends on emotional- behavioral regulation, in particular the ability and motivation to behave in compliance with teachers' expectations within the constraints of a typical school environment and to avoid conflict with teachers and classmates.<sup>32</sup> Recent evidence suggests that certain personality traits may predispose adolescents toward emotional-behavioral dysregulation, thereby increasing the risk of poor academic performance. For instance, one longitudinal study found that adolescents scoring high on impulsive urgency were particularly prone to report symptoms of insomnia, signs of hyperactivity, and poor school grades, with hyperactivity partially mediating the negative effect of sleep problems on school grades.<sup>46</sup> Highlighting the role of motivation, another study found that chronic sleep reduction in preadolescents was linked to lower achievement motivation, a poorer self-view as a pupil, and a more negative perception of the teacher's behavior, and that these 3 variables partially mediated the relation between chronic sleep reduction and lower school achievement.<sup>47</sup>

## INTERVENTIONS FOR SLEEP PROBLEMS IN ADOLESCENTS

Over the past years, several researchers have begun to develop sleep intervention programs that are specifically adapted to children and adolescents. For instance, a comprehensive sleep treatment for youth has been proposed that encompasses the following components<sup>48</sup>: (1) assisting the young person to find his or her internal motivation for enhancing sleep; (2) providing sleep and circadian education to correct unhelpful sleep habits while constructing new healthy sleep habits; (3) practicing "stimulus control," that is, limiting sleep-incompatible behaviors within the bedroom environment (eg, television watching or text messaging), while increasing cues for sleep-compatible behaviors; (4) addressing worry and rumination, for example by diary writing or scheduling a "worry period" to encourage the processing of worry several hours before bedtime; (5) targeting media use and social activities to achieve an earlier bedtime; and (6) preventing relapse by summarizing the young person's learning and achievements, as well as by setting specific goals and goal-conducive plans for the future.

A recent randomized controlled trial of cognitive-behavioral therapy (CBT) for children aged 7 to 13 found that compared with waitlist controls, children receiving CBT showed significant improvements in sleep latency, wake after sleep onset, and sleep efficiency, with all gains being maintained 6 months posttreatment.<sup>49</sup> In another recent study, a school-based intervention aimed to provide adolescents with information about sleep and to motivate them to make changes in several target sleep behaviors.<sup>50</sup> Although the intervention successfully enhanced adolescents' knowledge about sleep and their motivation to regularize out-of-bed times, parallel improvements in sleep and daytime functioning were not significantly different from the control group. A general problem with school-based sleep-promoting programs is that they effectively enhance sleep knowledge but usually do not succeed in maintaining sleep behavior changes.<sup>51</sup> This shortcoming highlights the



importance of integrating motivational components into the programs; for example, motivational interviewing in an individually tailored setting.<sup>51</sup>

Regarding possible interventions at the organizational level of schools, research has revealed that setting later start times leads to more sleep in adolescents, as mentioned earlier. Moreover, given that adolescents from lower SES families are particularly at risk of getting insufficient sleep and suffering from the negative consequences on academic achievement, individual, group, and school-level interventions to improve sleep in this group of adolescents merit special attention by researchers and practitioners.

## SUMMARY

Empirical evidence suggests that, across different countries and cultures, adolescents do not get the recommended amount of at least 9 hours of sleep per night. The scientific literature has identified a number of factors that are liable to postpone bedtime in adolescents and in this way to contribute to insufficient sleep; namely, extracurricular activities, after-school jobs, homework, and electronic media use (eg, TV, computer, smartphone) in the evening. At the same time, research indicates that insufficient sleep in adolescents contributes to problems with emotional-behavioral regulation and, as a consequence, to a range of potentially self-harming and other-harming behaviors, such as drug use, risky driving, hyperactivity, and aggression. Moreover, insufficient sleep may impair academic achievement, especially in adolescents from lower SES families, and several personality traits may render individuals particularly vulnerable to insufficient sleep and its negative consequences; for example, neuroticism, impulsivity, or eveningness. Regarding sleep-promoting interventions, delaying school start times allows adolescents to get more sleep, whereby attendance rates, attention, and academic achievement are increased, especially in evening-type individuals. In addition, multicomponent treatment programs are available that have been developed on the basis of CBT for insomnia and specifically adapted for use with adolescents.

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