

# Sleepiness in Children

## An Update

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### KEYWORDS

- Sleepiness • Daytime somnolence • Children • Narcolepsy • Obstructive sleep apnea
- Sleep deprivation

### KEY POINTS

- Sleepiness in children has increased in the last decades as a consequences of sleep habits changes and diminished sleep duration.
- Chronic pain, movement disorder, and sleep-disordered breathing in children impair sleep quality and predispose to daytime sleepiness.
- Many questionnaire have been validated to evaluate sleep problems in children and are an important tools to evaluate subjective sleepiness.
- Children with central hypersomnia or circadian rhythm disorders have significant daytime problems and impairment of daytime functioning.

Sleep is essential for children's learning, memory processes, school performance, and general well-being.<sup>1</sup> Sleep deprivation and fragmented sleep are the main mechanism that leads to daytime sleepiness in children.<sup>2</sup> Evaluation of sleepiness in this age group is quite challenging owing to the age-dependent maturation of the central nervous system. As age progresses, time spent sleeping is reduced and the polyphasic sleep pattern of preschool children matures to an exclusive nocturnal monophasic sleep in older children. This may, in part, explain why the evaluation of sleepiness in children is taxing. Many tools have been developed to evaluate sleep in a pediatric age group, however, a limited number of questionnaires have been fully validated to comprehend sleepiness in children.<sup>3</sup>

### PREVALENCE OF SLEEPINESS IN CHILDREN

A survey of 1413 Swedish children aged 6 to 11 years highlighted a prevalence of 4% prevalence

rate of daytime sleepiness. In this age group, there were no differences between boys and girls. A Korean study validated the School Sleep Habits Survey for a sample of 1457 schoolchildren aged 9 to 19 years. They found that 6.6% of the respondents admitted to daytime sleepiness being a major problem. As grade levels increased from the 5th to 12th grade, so did the prevalence of daytime sleepiness. Sleep duration decreased by approximately 3 hours on school nights from grades 5 to 12. The authors noted that sleepiness was slightly more prevalent in girls than boys. The increasing prevalence of daytime sleepiness with advancing grade level in children and adolescents is further corroborated by other studies.<sup>4,5</sup> In a study of 535 Brazilian adolescents, daytime sleepiness increased from 10 to 17 years of age. Students from private schools had higher sleepiness scores than students from public schools. More than 2 hours of sleep debt, measured as the difference of the mean sleep duration between school night and weekend nights, was present in 39% of these adolescents.<sup>4</sup>

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## EFFECTS OF SLEEP DEPRIVATION

In the last few decades, the time adults, adolescents and children have spent sleeping has decreased. This change in habits is mainly owing to the overwhelming use of electricity. Currently, artificial light and electronic gadgets have invaded the lives of humans, day and night. Many studies have showed that increases in screen time have reduced the duration of sleep in children.<sup>6</sup> It is not surprising that these reductions of sleep duration have daytime consequences, such as sleepiness, behavior problems, cognitive deficits, poor school performance, inflammation, and metabolic dysfunction.<sup>1,2,7-9</sup> A recent systematic review demonstrated a consistent correlation of screen time with reduced sleep duration.<sup>6</sup> The authors suggested that the reduction in sleep time can be associated with biological, psychological, and environmental factors. The 2013 International Sleep Poll reported that 7% to 21% of adults in the United States, Germany, the United Kingdom, Canada, Mexico, and Japan sleep fewer than 6 hours per night on work days.<sup>10</sup> The 2011 Sleep in America Poll reported that about 60% of adolescents in the United States receive less than 8 hours of sleep on school nights. In the same report, 90% of 13 to 18 years olds had at least 1 electronic device (TV, laptop, cell phone, tablet, video game, and/or music player) in their bedroom.<sup>11</sup> With the ubiquitous presence of media items in a child's or an adolescent's bedroom, screen time is hypothesized to be a cause of insufficient and low-quality sleep, operating through several mechanisms. The first is time displacement. With more time spent in front of screens, less time is naturally available for sleep. Second, psychological and physiologic arousals owing to the content of the media and social interaction may also interfere with the ability to fall and stay asleep. Finally, there is the effect of light on both circadian rhythm and general alertness. The effect in the circadian rhythm is mainly owing to light suppression of melatonin secretion.<sup>6</sup>

Recent reviews have shown that sleep quantity and quality in children correlates with levels of daytime sleepiness.<sup>12-14</sup> Sleep quality and sleep duration may be seen as 2 separate sleep domains. Although these sleep domains overlap to some extent, qualitative differences do exist between them. Sleep quality refers to the subjective indices of how sleep is experienced, including the feeling of feeling rested when waking up and experiencing satisfaction with sleep. Sleep duration, on the other hand, is a more objective sleep domain, namely, the actual time during which the individual is asleep. Correlations between children and adolescents' sleep duration and sleep quality

are low or not significant, supporting the idea that sleep quality and sleep duration represent 2 separate sleep domains. In fact, the strength of association of sleep quantity and sleep duration with sleepiness may vary by student age and sex; 1 recent metaanalysis of sleep and school functioning reported that studies of younger children, particularly those that enrolled more boys, tended to show the greatest effects.<sup>14</sup>

Poor sleep quality owing to pain,<sup>15</sup> periodic limb movement,<sup>16</sup> and sleep-disordered breathing<sup>17</sup> may also lead to sleepiness in children.<sup>18</sup> Obstructive sleep apnea (OSA) is a sleep disorder characterized by repetitive upper airway obstruction during sleep, leading to hypoxemia, hypercapnia, fragmented sleep, and daytime symptoms.<sup>17</sup> Although daytime somnolence in children with OSA is not as significant as when seen in adults,<sup>19</sup> studies have shown that OSA in children aged 5 to 12 years has been linked to poor classroom grades, sleepiness, inattention, hyperactivity, oppositional behavior, and mood deregulation.<sup>20</sup> Further evidence that links pediatric OSA and sleepiness is the fact that treatment with adenotonsillectomy<sup>21,22</sup> or positive airway pressure<sup>23</sup> improves daytime behavior, sleepiness, and quality of life. Restless leg syndrome and period limb movements disorder may also lead to sleep fragmentation and, consequently, daytime dysfunction. Cross-sectional studies have shown associations of restless leg syndrome and period limb movements disorder with hyperactivity, impulsivity, attention, and daytime sleepiness.<sup>16,24,25</sup> Currently, there is no evidence that intervention for movement disorders in children may improve these symptoms.

## ASSESSMENT OF SLEEPINESS

There are a few tools for the assessment of sleep duration and sleepiness in children. Approximately 57 pediatric sleep questionnaires were developed to evaluate sleep problems in children and/or adolescents. Only a few underwent a thorough validation process.<sup>3</sup> The questionnaires evaluate sleep environment and settling down periods, sleep behavior, sleep habits, circadian typology, emotional well-being, scholastic achievement, and sleepiness. Assessment of sleepiness represented whole or part of the questionnaires (**Table 1**). These tools look to age differences in sleep patterns, split into infants, preschoolers, school-age children, and adolescents. The age range varies from 2 to 18 years, although most of them focus on adolescents. The Epworth Sleepiness Scale, a well-known scale used in adults, was modified in 2 items to be more applicable to

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