

# Emotional and Cognitive Impact of Sleep Restriction in Children



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## KEYWORDS

• Sleep restriction • Daytime functioning • Cognitive functioning • Emotional functioning

## KEY POINTS

- Evidence is mounting to suggest that sleep restriction in the pediatric population has marked negative effects.
- Inadequate quantity and quality of sleep are associated with various impairments in daytime functioning.
- Studies reveal that even moderate amounts of sleep restriction over just a few days impair aspects of emotional and cognitive functioning.
- A few hypotheses have been advanced to explain how sleep restriction affects daytime functioning in adults, but these have not been assessed in the pediatric population.
- The high prevalence of poor sleep and the multitude of negative consequences emphasize the need for increased public awareness about the importance of sleep and the value of early identification and treatment of sleep problems in children.

## INTRODUCTION

Approximately 30 years ago, Carskadon and colleagues<sup>1</sup> conducted seminal studies examining the effects of sleep loss in children. In addition to finding impairments in some areas of daytime functioning after sleep restriction, they also found that children might not recover from sleep restriction as rapidly as adults. Since that time, several observational, cross-sectional, and longitudinal studies, as well as a few well-controlled experimental studies, have been published, and the emerging results indicate that sleep plays a critical role in the regulation of cognitive and emotional functioning in children.

The goals of this article are to review the current pediatric literature examining sleep restriction effects on daytime functioning, highlight the general findings, and pose questions to direct future research. The impact of poor sleep on daytime sleepiness, emotional functioning, and cognitive functioning is reviewed first. Then 3 hypotheses, derived from the adult literature, are introduced about how sleep restriction affects daytime functioning, and the extent to which they can be applied to children is reviewed, based on the pediatric literature. The results of experimental sleep restriction studies conducted in the pediatric population are highlighted (**Table 1** has an overview of these studies). This article concludes by

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**Table 1****Summary of the studies examining the effects of sleep restriction on emotional and cognitive functioning in school-aged children**

<b>Study</b>	<b>Participants/Age</b>	<b>Design</b>	<b>Sleep Restriction Protocol</b>	<b>Findings</b>
Carskadon et al, 1981a	12 Participants (11–15 y; 67% boys)	Within-participants	No sleep for 1 night compared with 10 h time in bed for 1 night	Objective (MSLT) and subjective sleepiness increased. Performance on addition and memory tasks were impaired in sleep restriction condition.
Carskadon et al, 1981b	9 Participants (11–13 y; 33% boys)	Within-participants	4 h Time in bed for 1 night compared with 10 h time in bed for 1 night	Objective sleepiness (MSLT) increased. No significant changes on cognitive tasks.
Randazzo et al, 1998	16 Participants (10–14 y; 44% boys)	Between-participants (8 per group)	5 h In bed for 1 night compared with 11 h in bed for 1 night	Sleep restriction impaired performance on 3 measures of creativity and a measure of reasoning. Nine other measures of cognitive performance were not affected.
Fallone et al, 2001	82 Participants (8–15 y; 49% boys)	Between-participants (37 sleep-extended; 45 sleep-restricted)	4 h Time in bed compared with 10 h time in bed	Sleep restriction increased objective (MSLT) and subjective sleepiness and inattentive behaviors (RA-rated) but not hyper/impulsive behaviors. No differences were found on objective tests of attention.
Sadeh et al, 2003	77 Participants (9–12 y; unknown gender distribution)	Mixed within- and between-participants (21 sleep-extended; 28 sleep-restricted; 23 no sleep change)	2 Nights of normal sleep and 3 nights of $\pm 1$ h difference in normal sleep duration	Extended sleep led to improved memory function and CPT performance, and maintained performance on a simple reaction time test.
Fallone et al, 2005	74 Participants (6–12 y; 53% boys)	Within-participants	6.5–8 h Per night for 1 wk compared with 10+ h per night for 1 wk and compared with baseline week of self-selected sleep	Sleep restriction increased teacher-reported sleepiness, academic problems, and inattention.

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