

# Socioeconomic Impact of Pediatric Sleep Disorders



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## KEYWORDS

- ADD/ADHD • Restless legs/Periodic leg movements in sleep • Pediatric OSA • Parasomnia
- Circadian rhythm disorder • Insomnia • Mood disorder • Guardian/parental effect

## KEY POINTS

- Pediatric disorders tend to affect the immediate support unit, adults and children.
- High costs for direct consumption of medical care are offset by early diagnosis and treatment of pediatric sleep disorders.
- Pediatric sleep disorders are underdiagnosed and undertreated.
- Attention deficit hyperactivity disorder may result from insufficient or fragmented sleep.
- Delaying school start time resulted in decreased car crashes in teen drivers and improved mood.

## INTRODUCTION

It is difficult to determine the socioeconomic impact of pediatric sleep disorders because one needs to take into account not only the impact over the lifespan of the child but also the impact the disorders can have within the other family members. Within every family unit, sleep disturbance of the young tends to affect every member of that unit. Whether it is a newborn, a new adoptee, a sleep-over, or an individual who has taken ill, there is a multiplier effect on everyone's sleep and next day function. This review concentrates on the published data of known pediatric sleep disorders and their economic impacts to date.

## DIRECT HEALTH CARE COSTS

There are limited data on prospective health care utilization by children affected by sleep disorders. In 2013,<sup>1</sup> an Australian cross-sectional study that sampled "birth" cohort at ages 0 to 1 year, 2 to 3 years old, and "preschool" cohort at ages 4 to 5 and 6 to 7 reported those that exhibited sleep problems used more health care compared with their peers. Federal Medicare

expenditure captured 98% of all children registered in Australia. Longitudinal Study of Australian Children evaluated 5107 children at ages 0 to 1 years in 2004, and 4606 of these children at ages 2 and 3 in 2006. The older group looked at 4983 children ages 4 and 5, and later, at ages 6 to 7. These children were compared with matched controls within randomly selected postal codes. Among all the subjects, 92% had complete sleep and Medicare data. Of children with reported sleep problems, the average additional annual health care costs at age 5 were \$141 and for age 7 were \$43 (in 2012 Australian dollars). Adjusting for confounders, the increase in health care costs was \$98 at age 5 and \$18 at age 7. The estimated cost to the Australian government was \$27.5 million (95% confidence interval [CI] \$9.2 to \$46.8 million). This same group also studied the health care costs of children up to age 7 with "special health care needs," with an estimated the additional costs at \$161.8 million.<sup>2</sup> It would not be surprising that children with both chronic sleep disorders and additional special health care needs would have higher health care utilization and accompanying costs in any society.<sup>3</sup>

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The costs that were captured included Medicare Benefit Schedule pays for non-hospital-based medical practitioners, and Pharmaceutical Benefits Schedule that pays for 83% of medication costs.<sup>1</sup> Parent or primary caregiver report of sleep problems and frequency was used as dichotomized variables: no/mild, moderate/severe. The investigators stipulated that subjective perceptions by caregiver of a child having a sleep problem were the “driver” to seek medical care, and more objective measures were not as cost-effective for a large population based-outcome measure. Within the “baby” cohort, the need for “specialized health care” almost doubled the infants that were not reported to have sleep problems: 9.9% as compared with 5.3%. The prekindergarten cohort similarly showed 21.2% usage of specialized health care compared with 12.1% of those without sleep problems. The natures of sleep problems were not reported, however. At age 0, 17.7% of children had “moderate/severe” sleep problems, whereas 7% did at age 7. However, because medical diagnoses were not captured in the analysis, those children with developmental and neurologic challenges might have skewed the usage of benefits and exhibited more sleep problems overall. Nonetheless, assessing overall sleep behavior at birth may help predict those children potentially requiring more medical attention subsequently.

An American study<sup>4</sup> evaluated socioeconomic conditions of sleep for 276 children in 133 girls with a mean age of 9.44 years (SD 0.71). Because of prior reports that children in poorer socioeconomic strata had shorter sleep duration per parental report, parents were interviewed on the telephone regarding their family income level, partner status (single, married), educational level, and whether the child was residing with one or more than one biological parent or other family member who was not a parent. Sleep was estimated using actigraphy on nondominant wrists for 7 consecutive nights. “Lower maternal perceived economic well-being predicted shorter sleep duration and greater variability in sleep onset in children.” In addition, when the caregiver had lower educational level, the child had lower sleep efficiency. This study found different results with African American compared with European and American children, suggesting that ethnicity may be a significant moderator in the impact of sleep disorders.

### BEHAVIORAL SLEEP PROBLEMS

An estimate of 20% to 30% of infants, toddlers, and preschoolers may present with behavioral challenges in going to sleep and repeated

awakenings according to a 2006 review.<sup>5</sup> A report by in 2014 by Meltzer and colleagues<sup>3</sup> showed only 5% of representative samples of pediatric and adolescent patients that reported sleep problems or were diagnosed with a sleep disorder actually received sleep-related treatment recommendation. Only 8% of children diagnosed with sleep disorders and 2% identified with sleep problems received “any type of treatment recommendation.” Of 750 children that had well-child visits in urban and suburban primary care settings in Philadelphia, 520 youth (69%) year 1, 490 youth (65%) year 2, and 451 youth (60%) year 3 had documented follow-ups from 2007 through 2010. Of these, 150 were randomly selected, and the average age was 6.21 years (SD 5.4; range 0.28–18 years). More sick visits and calls were incurred among children that had sleep disorders (mean 8.84; 95% CI 7.77–9.90) than those without (mean 6.34; 95% CI 5.56–7.12). Up to one-third of children showed persistence of sleep problems “across time.” The families with lower income tended not to have follow-up visits. These results point to how difficult it is to accurately estimate the socioeconomic impact to society of sleep disorders in children.

### ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

The socioeconomic impact to society of attention-deficit/hyperactivity disorder (ADHD) in children is large.<sup>6,7</sup> In the US educational system, a student with ADHD incurred an average annual incremental cost to society of \$5007 according to a 2011 report.<sup>7</sup> In 2016, the cost of medication was estimated at \$1669 per child. Sleep problems in this population are very prevalent.<sup>8–12</sup> The socioeconomic impact of ADHD is not a problem just in the United States; there is a rich international ADHD literature documenting the impact of this condition. Sung and colleagues<sup>13</sup> conducted a cross-sectional study in outpatient clinics of pediatric hospitals, private pediatric practices, and ADHD support groups to evaluate the prevalence of sleep problems among children with ADHD in Victoria, Australia. Among children that were identified to have sleep problems, these children missed or were tardy for school more than their peers without sleep problems. Of 330 families, 239 (74%) completed the survey. Sleep problems were classified as “mild” for 28.5%, and “moderate or severe” for 44.8%. In 2006, caregivers of children between 5 and 18 years completed a survey for the previous 4 weeks with the question, “Has your child’s sleep been a problem?” The answers were categorized as “none,” “mild,” or “moderate/severe.” Problems surveyed included “difficulty

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