

Prospective Study of Insufficient Sleep and Neurobehavioral Functioning Among School-Age Children

Elsie M. Taveras, MD, MPH; Sheryl L. Rifas-Shiman, MPH; Kristen L. Bub, EdD; Matthew W. Gillman, MD, SM; Emily Oken, MD, MPH

From the Division of General Academic Pediatrics, Massachusetts General Hospital for Children (Dr Taveras), Department of Nutrition, Harvard T. H. Chan School of Public Health (Drs Taveras and Gillman), Department of Population Medicine, Harvard Medical School/Harvard Pilgrim Health Care Institute (Ms Rifas-Shiman, and Drs Gillman and Oken), Boston, Mass; and Department of Educational Psychology, University of Illinois (Dr Bub), Urbana-Champaign

The authors have no conflicts of interest to disclose. Address correspondence to Elsie M. Taveras, MD, MPH, Division of General Academic Pediatrics, Department of Pediatrics, Massachusetts General Hospital, 125 Nashua St, Suite 8600, Boston, MA 02114 (e-mail: elsie.taveras@mgh.harvard.edu).

Received for publication September 16, 2016; accepted February 1, 2017.

ABSTRACT

OBJECTIVE: To examine associations between insufficient sleep and neurobehavioral functioning in childhood as reported by mothers and teachers.

METHODS: Participants were 1046 children in a prebirth cohort study. Main exposures were insufficient sleep durations at 3 time points: 6 months to 2 years, defined as sleep <11 h/d, 11 to <12 h/d (vs ≥ 12); 3 to 4 years, defined as sleep <10 h/d, 10 to <11 h/d (vs ≥ 11); and 5 to 7 years, sleep <9 h/d, 9 to <10 h/d (vs ≥ 10). Outcomes at age 7 years were executive function, behavior, and social-emotional functioning, assessed using the Behavioral Rating Inventory of Executive Function (BRIEF) and the Strengths and Difficulties Questionnaire (SDQ). Higher scores indicate poorer functioning. Mothers and teachers completed both instruments independently.

RESULTS: At age 7 years, mean (SD) mother and teacher report of the BRIEF global executive composite scale were 48.3 (7.9) and 50.7 (9.4) points, respectively, and of the SDQ total

difficulties score was 6.5 (4.7) and 6.2 (5.7). In multivariable models, children who slept <10 h/d at 3 to 4 years had worse maternal-reported scores for the BRIEF (2.11 points; 95% confidence interval, 0.17–4.05) and SDQ (1.91 points; 95% confidence interval, 0.78–3.05) than those with age-appropriate sleep. Children who slept <9 h/d at 5 to 7 years also had worse scores. At both ages, associations with teacher-reported results were consistent with those of mothers. Infants who slept 11 to <12 h/d had higher teacher- but not mother-reported scores.

CONCLUSIONS: Insufficient sleep in the preschool and early school years is associated with poorer mother- and teacher-reported neurobehavioral processes in midchildhood.

KEYWORDS: behavior; executive function; neurobehavior; sleep

ACADEMIC PEDIATRICS 2017;17:625–632

WHAT'S NEW

Impaired neurobehavioral functioning is associated with adverse child health and development. In this study we found that insufficient sleep in the preschool and early school years is associated with poorer mother- and teacher-reported neurobehavioral processes in mid-childhood.

ACROSS INFANCY, CHILDHOOD, and adolescence, evidence from multiple US and international studies suggests a consistent decline in average sleep duration of approximately 30 to 60 minutes over the past 20 years.¹ Multiple observational studies in children show that shorter sleep duration and chronic insufficient sleep are associated with a range of adverse health and developmental outcomes.^{2–6} However, major questions remain regarding the mechanisms and behaviors that might underlie the relationship between insufficient sleep and adverse health

outcomes. One potential answer is the role of sleep in influencing neurobehavioral processes including executive function, behavior, or social-emotional functioning.

It is well known that sleep loss adversely affects neurobehavioral functioning in adults, manifested as poor attention, memory, and cognitive dysfunction, but few studies have been conducted with young children.^{7,8} In older children, sleep has been associated with behavioral self-regulation, which encompasses executive function, or the cognitive processes of attention-shifting, working memory, and inhibitory control.^{9,10} For example, in a study by Gruber et al of 35 children ages 7 to 11 years, shorter sleep duration, measured objectively using polysomnography, was associated with higher levels of teacher-reported cognitive problems and inattention assessed using the Conners Teacher Rating Scale.¹¹ Insufficient sleep might also affect emotional regulation, which represents attempts by an individual to modify his/her

emotional response to a situation. Thus, mounting evidence suggests associations between sleep and neurobehavioral functioning across early childhood.¹⁰

The purpose of this study was to examine sleep duration from infancy onward and neurobehavioral functioning in a prospective cohort of children in whom neurobehavioral functioning was assessed in midchildhood. We hypothesized that insufficient sleep at multiple time points throughout childhood would be associated with poorer child executive function, behavior, and social-emotional functioning as independently reported by mothers and teachers.

METHODS

SUBJECTS AND STUDY DESIGN

Study subjects were participants in Project Viva, a prospective, prebirth cohort study that recruited women during early pregnancy from Atrius Health, a multispecialty group practice in eastern Massachusetts. Details of recruitment and retention procedures are available elsewhere.¹² Of the 2128 women who delivered a live infant, 1683 children were eligible for 7- to 10-year (midchildhood) follow-up of whom 1116 attended a midchildhood in-person visit. Because our main exposure was insufficient sleep from 6 months to 7 years, we excluded 70 participants who did not have sleep data for these time points. Thus, our sample size for analysis was 1046 children. Compared with the 1046 participants in this analysis, nonparticipants were less likely to have college-educated mothers (59% vs 71%) and to have annual household income exceeding \$70,000 (52% vs 63%). Parity (48% vs 48% nulliparous) and mean maternal age (31.3 vs 32.3 years), however, were fairly similar.

After obtaining written informed consent from mothers, we performed in-person study visits with the mother at the end of the first and second trimesters of pregnancy, and with mother and child in the first few days after delivery and in infancy (median 6.2 months), early childhood (median 3.3 years) and midchildhood (median 7.7 years). Mothers completed mailed questionnaires at 1, 2, 4, 5, and 6 years after birth. Institutional review boards of participating institutions approved the study protocols.

MEASUREMENTS

MAIN EXPOSURES

At 6 months and yearly from 1 to 7 years, mothers reported their children's sleep duration in a usual 24-hour period.⁵ The main exposure was insufficient sleep at 3 age periods, 6 months to 2 years, 3 to 4 years, and 5 to 7 years. We first averaged sleep hours per day during each of these 3 age periods. On the basis of age-specific sleep recommendations from the National Sleep Foundation,¹³ we then categorized sleep in each period and defined insufficient sleep duration at each time period as follows: from 6 months to 2 years, sleep <11 h/d or 11 to <12 versus ≥ 12 ; from 3 to 4 years, sleep <10 h/d or 10 to <11 versus ≥ 11 ; and from 5 to 7 years, sleep <9 h/d or 9 to <10 versus ≥ 10 .

OUTCOME MEASURES

The main outcomes were mother- and teacher-reports of child executive function, behavior, and social-emotional functioning in midchildhood (median 7.7 years). To assess executive function, mothers and teachers were mailed the self-administered Behavioral Rating Inventory of Executive Function (BRIEF),¹⁴ a validated 86-item questionnaire designed to assess executive function behaviors in home and school environments. The BRIEF includes the following subscales: inhibit, shift, emotional control, initiate, working memory, plan/organize, organization of materials, and monitor. The subscales form 2 broadband indexes: 1) the behavioral regulation index, which indicates the ability of the child "to shift cognitive set and modulate emotions and behavior via appropriate inhibitory control," and 2) the metacognition index, which reflects the child's ability to "initiate, plan, organize, and sustain future-oriented problem-solving in working memory." The BRIEF indices are each scaled to a mean of 50 and SD of 10. The global executive composite is the average of the 2 indices, representing a summary measure of executive function. Higher BRIEF scores represent poorer executive function.

To assess child behavior and social-emotional functioning also in midchildhood, mothers and teachers were mailed the self-administered Strengths and Difficulties Questionnaire (SDQ), a validated 25-item questionnaire designed to assess children's social, emotional, and behavioral functioning.¹⁵ The SDQ is used widely in research and clinical settings¹⁶ and has 5 subscales: prosocial behavior, hyperactivity/inattention, emotional symptoms, conduct problems, and peer relationship problems. Possible scores range from 0 to 40 points. Higher total difficulties scores (with the exclusion of the prosocial scale) indicate greater difficulties. Normative data for the SDQ derive from a representative sample of US children.¹⁷

OTHER MEASURES

At enrollment, we collected information about maternal age, education, parity, and household income. We collected data on child's race and ethnicity in early childhood. In midchildhood (median 7.7 years), we administered the Home Observation Measurement of the Environment short form,¹⁸ which is used to assess cognitive stimulation and emotional support in the environment. Possible scores range from 0 to 22. Higher scores indicate environments more supportive of development. In midchildhood, we also asked parents to report the number of hours their children watched television/videos on an average weekday and weekend day in the past month. Response categories included, "none, <1 hour a day, 1 to 3 hours a day, 4 to 6 hours a day, 7 to 9 hours a day, and ≥ 10 hours a day." We did not ask specifically about the content of the programming viewed.

STATISTICAL ANALYSIS

We first examined bivariate relationships of children's sleep duration in each age period with each covariate and

Download English Version:

<https://daneshyari.com/en/article/5716848>

Download Persian Version:

<https://daneshyari.com/article/5716848>

[Daneshyari.com](https://daneshyari.com)