Original Article

Sleep Duration, Sleep Hygiene, and Insomnia in Adolescents With Asthma

Lisa J. Meltzer, PhD[a], Maureen Ullrich, MD[b], and Stanley J. Szefler, MD[a] *Denver, Colo*

What is already known about this topic? Sleep disruption due to nocturnal asthma symptoms is common. Poor sleep quality and short sleep duration may contribute to increased daytime asthma symptoms.

What does this article add to our knowledge? Compared with adolescents with mild or no asthma, more adolescents with severe asthma have insufficient sleep, poorer sleep hygiene, more symptoms of insomnia, and more daytime sleepiness.

How does this study impact current management guidelines? Clinical providers should inquire about adolescent sleep habits, encourage good sleep hygiene and increased sleep duration, and refer when necessary for the treatment of insomnia.

BACKGROUND: There is a need to understand more about modifiable health behaviors that may be related to asthma control. Sleep is one such health behavior that has received little attention in pediatric asthma research.

OBJECTIVE: To examine sleep duration, sleep hygiene, and insomnia in adolescents with and without asthma.

METHODS: Adolescents (n = 298; 51% boys; age range, 12-17 years; 48% with asthma) from the general community completed an online survey that included the International Study of Asthma and Allergies in Childhood questionnaire, the Children's Report of Sleep Patterns, and the Insomnia Severity Index.

RESULTS: Sleep duration did not differ between the asthma severity groups, yet more adolescents with severe asthma reported insufficient weekday sleep (44%) versus adolescents without asthma (31%). Significant asthma group differences were found for sleep hygiene, with adolescents with severe asthma reporting poorer sleep hygiene. Almost twice as many adolescents with severe asthma reported clinically significant insomnia than adolescents with mild or no asthma. Sleep hygiene variables were correlated with insomnia, although these associations did not differ between adolescents with and without severe asthma. Finally, both insomnia severity and asthma severity were significant predictors of daytime sleepiness; however, asthma severity accounted for only 2% of the variance compared with 28% of the variance accounted for by insomnia severity.

CONCLUSIONS: Many adolescents with severe asthma regularly obtain insufficient sleep, have poor sleep hygiene, and experience clinically significant insomnia. It is important to ask adolescents with asthma about sleep duration, sleep hygiene, and insomnia because there are effective interventions that can improve sleep for these youths. © 2014 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2014;■:■-■)

Key words: *Sleep; Sleep disorders; Sleep deprivation; Adolescents; Asthma*

Asthma is the most common chronic disease among youth.[1] In spite of medical advances in the diagnosis and treatment of asthma, asthma prevalence has increased from 8.7% to 9.6% over the past decade.[2] The economic burden of asthma in the United States is approximately $56 billion, with 33% of children and adolescents with asthma who reported an emergency department or urgent care visit in 2008, and 8% of youths were hospitalized for asthma.[2,3] Beyond required medical care, youths with asthma miss an estimated 14.4 million school days annually because of asthma-related illness or exacerbation,[2,4,5] which highlights a major functional consequence of this disease.

Nocturnal asthma symptoms are a marker of asthma severity.[6,7] Mechanisms of inflammation and cytokine production have been shown to be under circadian control and involved in nocturnal asthma.[8-10] Further, sleep may play a direct role in the worsening of asthma via a variety of factors, including the supine posture, nocturnal increase in airway inflammation and bronchial responsiveness, and greater airway resistance.[9,10] For youths with asthma, sleep problems are common,[11] including prolonged sleep-onset latency, frequent night wakings, and

[a]Department of Pediatrics, National Jewish Health, Denver, Colo
[b]Department of Psychiatry, University of Colorado School of Medicine, Aurora, Colo

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Corresponding author: Lisa J. Meltzer, PhD, National Jewish Health, 1400 Jackson Street, G311, Denver, CO 80206. E-mail: meltzerL@njhealth.org.
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Abbreviation used
ISI- *Insomnia Severity Index*

daytime sleepiness, even when asthma symptoms are well controlled.[12-16] Further, when nocturnal asthma symptoms improve, an improvement in sleep and daytime functioning has also been found.[11] Although it is well known that asthma affects sleep, there also is evidence that sleep affects asthma expression. One study found that youths who reported lower sleep quality had more severe asthma symptoms the following day; yet asthma symptoms did not significantly predict sleep the following night.[17] Given that sleep may affect asthma symptoms, sleep habits are a possible target for intervention for youths with asthma.

In general, adolescents are known to be chronically sleep deprived, with decreased total sleep time, delayed sleep onset, and increased daytime sleepiness.[18] This is due to a variety of factors, including decreased parental involvement, increased school and work obligations, and the misalignment of biologic circadian rhythms and early school start times.[19] However, there are a number of other factors under the control of adolescents that also may contribute to insufficient sleep, including inconsistent bedtimes and poor sleep hygiene (eg, caffeine use late in the day, technology in the bedroom). Results of recent studies have demonstrated that brief interventions are effective in improving sleep patterns and sleep hygiene in adolescents.[20,21] Insomnia also impacts a significant number of adolescents, with rates that range from 7% to 36%, depending on definition used and data collection methods.[22,23] Recently, cognitive-behavioral therapy for insomnia, an empirically validated treatment for insomnia and the frontline treatment for insomnia in adults,[24] has also been shown to be effective for adolescents.[25,26]

Based on the current literature, the purpose of this exploratory study was to examine sleep duration, sleep hygiene, and insomnia in adolescents with and without asthma, with the following 3 questions: (1) do sleep duration, sleep hygiene, and insomnia differ between adolescents with and without asthma; (2) is sleep hygiene related to sleep duration and insomnia, and does this differ between adolescents with and without severe asthma; and (3) does daytime sleepiness differ in adolescents with and without severe asthma, and, if so, is this a result of asthma or insomnia?

METHODS

Participants were 298 adolescents ages 12 to 17 years, (51% boys; 48% with asthma). Adolescents with and without asthma were recruited by using a national online research panel with approximately 3 million members (ZoomPanel; SurveyMonkey, Palo Alto, CA) who have opted-in to participate in surveys. The demographics of panel members is similar to US Census data, including race, household income, and region. Members receive points for completing each survey (worth approximately $1-$3 per survey), which can later be exchanged for prizes (eg, movies, music, gift cards). In September 2012, approximately 2600 members received an e-mail invitation to participate in the study, with 1532 (approximately 59%) responding to and viewing the survey (see Figure 1 for flow diagram). Quotas were established to prevent an oversampling of any age, sex, or asthma status ("Do you have asthma?"). The use of online survey panels has been shown to be reliable and valid compared with telephone and household surveys[27,28] and has been used in multiple studies.[29-32] This study was approved by the institutional review board at National Jewish Health.

Measures

The International Study of Asthma and Allergies in Childhood Questionnaire. This 8-item measure was developed as a core questionnaire to assess the prevalence and severity of asthma in a large international epidemiologic study.[33] By following the guidelines of the International Study of Asthma and Allergies in Childhood Phase 3 Study Group,[34] the International Study of Asthma and Allergies in Childhood questionnaire was used to create our groups of adolescents with and without asthma by using the question "Have you ever had asthma?" (Asthma Ever). For those with asthma, we further distinguished those with Current Wheeze ("Have you ever had wheezing or whistling in the chest at any time in the past?" and "Have you had wheezing or whistling in the chest in the past 12 months?") and those with Severe Asthma (positive response to Current Wheeze and whether the adolescent in the past 12 months had (1) >4 attacks of wheeze or (2) >1 night per week sleep disturbance from wheeze, or (3) wheeze that affected speech).

Children's Report of Sleep Patterns. The Children's Report of Sleep Patterns is a 52-item self-report measure of sleep that includes modules for sleep patterns, sleep hygiene, sleep disturbances, and daytime sleepiness, and has been validated in children and adolescents with and without chronic illnesses.[35-38] From this measure, we obtained sleep duration (calculated as hours from bedtime to wake time, less sleep-onset latency, and wake after sleep onset) as well as sleep hygiene and daytime sleepiness modules. The sleep hygiene indices included Caffeine Use, Stimulating Activities in the Hour Before Bed (eg, video games), Electronics Use at Sleep Onset (eg, television), Sleep Location (ie, falling asleep or waking up somewhere other than the child's bed), and Negative Bedtime Cognitions (eg, worries about the next day that prevent sleep onset). Higher scores indicate poorer sleep hygiene and more daytime sleepiness. Categories of insufficient sleep duration (<7 hours), borderline sleep duration (7-9 hours), and optimal sleep duration (≥9 hours) were created based on US Centers for Disease Control and Prevention criteria.[39]

Insomnia Severity Index. The Insomnia Severity Index (ISI) has 7 items that evaluate the severity of insomnia symptoms (eg, difficulties initiating and maintaining sleep) and the consequences of sleep problems and/or disruptions.[40] Cutoff scores have been established to identify insomnia severity (no clinically significant insomnia [ISI score of 0-7], subthreshold clinically significant insomnia [ISI score of 8-14], clinically significant insomnia—moderate/severe [ISI score equal to or higher than 15]). Minimally important differences for the ISI have recently been identified in adult populations, with a reduction in ISI score by 6 points associated with improved health-related quality of life in 1 study[41] and a reduction in ISI score by 7 points associated with moderately improved insomnia in another trial.[42]

Data analysis

Outcome variables (sleep duration, sleep hygiene, insomnia severity, and daytime sleepiness) were examined for normality, and square root and logarithm transformations were conducted