



## Letters

## Sleep and asthma outcomes in urban children

## Does atopic dermatitis increase risk?

Urban minority children with asthma are at increased risk for disruptions in sleep and sleep loss because of sociocontextual stressors (poverty and stressors of urban living) and challenges related to following complex asthma treatment regimens.<sup>1,2</sup> Atopic dermatitis (AD) is frequently comorbid in children with asthma and can increase the risk of poor-quality sleep, including difficulty falling asleep, nighttime awakenings, time awake after sleep onset, difficulty awakening in the morning, and daytime sleepiness; sleep disturbance is reported in 47% to 80% of children with AD.<sup>3–9</sup> Thus, AD and asthma can have negative consequences on children's morbidity, sleep, and daily functioning.<sup>1,2,10</sup> Our study sought to assess whether differences in sleep exist among urban children with asthma, urban children with asthma plus AD, and urban healthy controls (with neither asthma nor AD). In addition, we examined differences in asthma outcomes and associations between asthma and sleep outcomes in children with asthma plus AD and asthma alone.

Data are from the Nocturnal Asthma and Performance in School study, a study of asthma and sleep in a sample of urban, ethnically diverse children (7–9 years of age) with persistent asthma. Data from a total of 371 children were reviewed as follows: 206 children with persistent asthma only, 35 children with asthma plus AD, and 130 healthy controls (Table 1).

Children with caregiver-reported physician diagnosis of asthma or asthma symptoms in the previous 12 months were included; each child had a current prescription for an asthma controller medication or caregiver-reported recurrent daytime or nighttime symptoms, activity limitation, rescue medication use, or 2 or more oral steroid bursts in the prior 12 months. Diagnosis of persistent asthma was confirmed by a study clinician using Expert Panel Report 3 guidelines.<sup>11</sup> The diagnosis of concurrent AD was obtained by means of a physician query or extrapolated from the use of topical corticosteroid therapy from the medication list. Healthy controls needed to be free of asthma, AD, and any chronic medical condition. Children were excluded from the study if they were taking stimulant medications for attention-deficit/hyperactivity disorder, had moderate to severe cognitive impairment, another pulmonary condition, or a sleep disorder.

Data were collected during the fall and early winter period of each study year. Asthma outcomes included asthma-related lung function, assessed from twice-daily measurements of forced expiratory volume in 1 second (FEV<sub>1</sub>) by means of a handheld device

(Jaeger AM2+, ERT, Yorba Linda, California) during a 4-week period, and the Asthma Control Test (ACT) in children with asthma. Sleep outcomes were measured objectively using actigraphy by means of home monitoring (Actiwatch 2; Philips Respironics, Pittsburgh, Pennsylvania) during the same 4-week period, recording sleep efficiency (the percentage of time asleep divided by the total time in bed for the night), the mean number of awakenings of at least 3 minutes, and sleep duration (total time between evening sleep onset and morning waking).

Using a series of generalized linear models, we assessed whether there were differences among the study groups (asthma plus AD vs asthma alone vs health controls) in the following: (1) sleep outcomes, (2) asthma outcomes (asthma plus AD vs asthma alone), and (3) sleep outcomes stratified by ethnicity. Models were specified to allow for all 2-way group comparisons. In addition, we assessed associations between sleep and asthma by group (asthma plus AD vs asthma alone) using a similar modeling approach.

Significant group differences were found in sleep efficiency ( $F = 5.82$ ,  $P = .003$ ) and number of nighttime awakenings between children with asthma alone, children with asthma plus AD, and healthy controls ( $F = 3.55$ ,  $P = .03$ ). Children with asthma plus AD had lower efficiency ( $b = -2.07$ ,  $SE = 0.68$ ,  $P = .002$ ) and greater number of awakenings ( $b = 1.14$ ,  $SE = 0.45$ ,  $P = .01$ ) vs healthy controls. No significant differences were found in sleep duration in children with asthma alone, children with asthma plus AD, and healthy controls ( $P > .05$  for all).

In children with asthma plus AD, Latino children had shorter mean sleep duration compared with their African American and non-Latino white counterparts ( $F = 8.31$ ,  $P = .001$ ); however, no significant ethnic differences in efficiency or awakenings were observed by health status in this group. In children with asthma alone, African American children had lower sleep efficiency ( $F = 3.21$ ,  $P = .04$ ) than Latino and non-Latino white children, and Latino and African American children had shorter sleep duration ( $F = 7.73$ ,  $P = .01$ ) than non-Latino white children. No significant differences were found in sleep duration ( $P = .08$ ), sleep efficiency ( $P = .19$ ), or number of awakenings ( $P = .07$ ) in healthy urban children by ethnic or racial group.

Overall, no differences were found in lung function (FEV<sub>1</sub>,  $P = .65$ ) or poorly controlled (ACT score,  $\leq 19$ ) or well-controlled (ACT score,  $\geq 20$ ) asthma ( $P = .48$ ) in children with asthma alone vs those with asthma plus AD. For children with asthma plus AD, a greater number of awakenings was associated with a lower mean FEV<sub>1</sub> ( $b = -1.36$ ,  $SE = 0.67$ ,  $P = .03$ ). In children with asthma alone, more optimal sleep efficiency was associated with better asthma control ( $b = 0.21$ ,  $SE = 0.08$ ,  $P = .03$ ).

Results from this well-characterized sample of urban children indicate that urban children with asthma and AD may be at higher

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**Table 1**  
Participant Characteristics for the Full Sample and by Groups<sup>a</sup>

| Characteristic                     | Full sample<br>(n = 371) | Asthma and AD<br>(n = 35) | Asthma alone<br>(n = 206) | Healthy controls<br>(n = 130) |
|------------------------------------|--------------------------|---------------------------|---------------------------|-------------------------------|
| Ethnicity <sup>b</sup>             |                          |                           |                           |                               |
| Latino                             | 167 (45)                 | 15 (43)                   | 108 (52)                  | 44 (39)                       |
| African American                   | 125 (34)                 | 16 (46)                   | 63 (31)                   | 46 (35)                       |
| Non-Latino white                   | 79 (21)                  | 4 (11)                    | 35 (17)                   | 40 (31)                       |
| Male sex                           | 192 (52)                 | 21 (60)                   | 102 (50)                  | 69 (53)                       |
| At or below poverty threshold      | 228 (66)                 | 20 (59)                   | 139 (71)                  | 69 (60)                       |
| No. of children in home, mean (SD) | 2.70 (1.30)              | 2.76 (1.39)               | 2.66 (1.37)               | 2.76 (1.13)                   |
| No. of adults in home, mean (SD)   | 1.80 (0.80)              | 1.88 (0.73)               | 1.76 (0.83)               | 1.83 (0.78)                   |
| Sleep outcomes                     |                          |                           |                           |                               |
| Efficiency <sup>b</sup>            | 87.05 (3.42)             | 85.74 (4.05)              | 86.79 (3.58)              | 87.81 (2.79)                  |
| Duration                           | 556.06 (35.48)           | 561.42 (36.49)            | 554.29 (35.06)            | 557.25 (35.93)                |
| Awakenings <sup>b</sup>            | 5.08 (2.34)              | 5.84 (2.82)               | 5.18 (2.45)               | 4.70 (1.92)                   |

Abbreviation: AD, atopic dermatitis.

<sup>a</sup>Data are presented as number (%) of participants unless otherwise indicated.<sup>b</sup>P < .05 between-group differences.

risk for poorer sleep outcomes. Specifically, overall quality of sleep appeared to be poorer and more nighttime awakenings occurred in this group. Ethnic and racial disparities in sleep outcomes were observed in children with asthma plus AD and children with asthma alone compared with their urban healthy peers. Latino and African American children with asthma alone and Latino children with asthma plus AD appeared to be at greater risk for sleep loss and poorer quality sleep than their non-Latino white peers. Interestingly, AD did not seem to increase risk for poorer asthma outcomes in children. More research needs to be completed with larger urban samples of children with asthma plus AD and asthma alone to confirm these findings. Interventions that consider specific challenges that may negatively affect sleep outcomes in urban children with asthma and AD are needed, particularly in those of Latino and African American descent.

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