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Symptoms Related to Sleep-Disordered Breathing in White and Hispanic Children*

The Tucson Children's Assessment of Sleep Apnea Study

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Study objectives: **The Tucson Children's Assessment of Sleep Apnea (TuCASA) study is designed to investigate the prevalence and correlates of objectively measured sleep-disordered breathing (SDB) in preadolescent children. This article describes the parental report of sleep symptoms associated with SDB in Hispanic and white children.**

Design: **A 13-question sleep habits screening questionnaire designed to assess the severity of sleep-related symptoms associated with SDB in children 4 to 11 years of age.**

Setting: **Questionnaires were completed by the parents of children attending elementary school in the Tucson Unified School District, Tucson, AZ.**

Participants: **There were 1,494 questionnaires returned, which comprised a sample of whites (38%), Hispanics (45%), and other races (17%). Of these questionnaires, 1,214 were returned for the children of white (45.8%; 556 children) or Hispanic (54.2%; 658 children) ethnicity only. The primary analysis was completed on these 613 boys (50.5%) and 601 girls (49.5%).**

Results: **In the total sample of 1,494 children, parents were more likely to report excessive daytime sleepiness (EDS) in female children than in male children ($p < .01$), however, this association did not achieve significance in the sample of only white and Hispanic children ($p < .07$). Composite variables for EDS and witnessed apnea (WITAP) show that parents of Hispanic children were more likely to report EDS ($p < .01$) and WITAP ($p < .007$). Hispanic children were also more likely to have learning problems (LPs) [$p < .03$] and to snore frequently (SN) [$p < .02$] than were white children. There were no significant differences between boys and girls for SN or WITAP. Hispanic boys were more likely to have reports of EDS ($p < .02$) and LPs ($p < .04$) than white boys, however, there were no other significant differences in gender or ethnicity in reports of EDS or LPs for white or Hispanic boys and girls. Those children with frequent LPs were significantly more likely to have SN ($p < .001$), EDS ($p < .001$), and WITAP ($p < .001$). A logistic regression model predicting LP resulted in significant adjusted odds ratios (ORs) of 2.4 for SN, 2.5 for EDS, and 2.1 for children aged 8 to 11 years. A similar model for EDS resulted in significant adjusted ORs of 3.2 for SN, 5.7 for WITAP, and 1.6 for female gender. Ethnicity was not significant in either model.**

Conclusions: **Hispanic children in the population-based TuCASA study experienced more frequent symptoms associated with SDB, such as SN, EDS, WITAP, and LPs, than did white children. Children with LPs are 2.4 times more likely to have SN, 2.5 times more likely to have EDS, and were 2.1 times more likely to be between the ages of 8 and 11 years. Children with EDS were 3.2 times more likely to have SN, 5.7 times more likely to have WITAP, and were 1.6 times more likely to be a girl.** ***(CHEST 2003; 124:196–203)***

Key words: children; excessive daytime sleepiness; Hispanic; sleep; sleep apnea; sleep-disordered breathing; white; witnessed apnea

Abbreviations: CI = confidence interval; EDS = excessive daytime sleepiness; LP = learning problem; OR = odds ratio; OSA = obstructive sleep apnea; OSAS = obstructive sleep apnea syndrome; SDB = sleep-disordered breathing; SN = snoring frequently or almost always; TuCASA = Tucson Children's Assessment of Sleep Apnea; TUSD = Tucson Unified School District; WITAP = witnessed apnea

There is increasing recognition that sleep disturbances and snoring are important factors in childhood development. Sleep-disordered breathing (SDB) including obstructive sleep apnea (OSA) syndrome (OSAS) is acknowledged as an important cause of morbidity in children. Clinical symptoms of OSAS in children include daytime sleepiness, snoring, restlessness during sleep, hyperactivity, nocturnal arousals, and enuresis.[1–4] Evidence also suggests that the adverse effects of frequent nighttime arousals include learning, behavioral, and personality problems.[5–8] A recent review of evidence[9] has shown an almost threefold increase in behavioral and neurocognitive abnormalities in children with SDB.

Snoring in children has been associated with daytime sleepiness, restless sleep, and hyperactivity, and is an indicator for the presence of OSA.[10–13] Despite the fact that no definitive epidemiologic study to determine the prevalence of OSA in children has been done, estimates range from 1 to 3%.[12,14–16] This would place an estimated 320,000 of the 32 million children between 6 and 11 years old in the United States at risk for adverse health consequences due to OSA.[17]

Excessive daytime sleepiness (EDS) occurs less frequently in children with OSAS than in adults with OSAS.[18,19] This may occur because children with OSAS are less prone than adults to develop sleep fragmentation.[20,21] In addition, EDS in children tends to occur mostly among those who are more obese or have severe OSAS.[19] Cross-sectional studies[4,22] have reported EDS ranging from 8 to 62% of children with OSAS, thus, estimates of the prevalence of EDS in children at risk for OSAS vary substantially.

The American Thoracic Society has stated[23,24] that the assessment of OSAS in children is important work that needs to be extended to include a larger number of children from different risk groups. One study[15] showed an increased risk of OSAS for African-American children, however, no studies have been performed to examine the risk of OSAS for Hispanic children. The year 2000 US census[25] shows that the Hispanic population increased 50% from 1990 to 2000, with Hispanics accounting for 12.5% of the US population. An estimated 4 million Hispanic children from 6 to 11 years of age currently live in the United States,[26] therefore, estimates of the prevalence of symptoms associated with OSAS in Hispanic children are becoming essential. Many reports of sleep symptoms that are indicative of OSAS occur in clinical or small samples, therefore, it would be useful to determine the prevalence of these conditions in a population-based sample of children and to assess whether there are differences between Hispanic and white children.

The Tucson Children's Assessment of Sleep Apnea (TuCASA) study is a prospective cohort study that was designed to determine the prevalence of objectively documented SDB in preadolescent children and to investigate its relationship to symptoms, performance on neurobehavioral measures, and physiologic and anatomic risk factors. This report describes the prevalence of reported symptoms associated with SDB in Hispanic and white children obtained while screening children for home polysomnography in the TuCASA study.

Materials and Methods

The design of the TuCASA study specified the recruitment of Hispanic and white children aged 6 through 11 years to undergo unattended home polysomnography, to complete a pediatric sleep-habits questionnaire, and to perform a neurocognitive assessment.[27] Recruitment was accomplished by soliciting the cooperation of selected elementary schools in the Tucson Unified School District (TUSD). TUSD is a very large district with an elementary school population that is representative of children living in southern Arizona. To ensure that an adequate number of Hispanic children were surveyed and recruited for polysomnography, elementary schools were contacted that had a larger proportion of Hispanic children than white children. The population of the schools recruited was 33.7% white vs 52.5% Hispanic, to achieve approximately equal participation of Hispanic and white children.

Typically, a short sleep-habits screening questionnaire was sent home with children in a "notes home" folder. Parents were asked to complete the questions and to provide their contact information if they agreed to allow study personnel to call and schedule a polysomnogram for their child. Because we sent questionnaires home to all children attending a school targeted for recruitment, some questionnaires (292 questionnaires; 19%) were received from schoolchildren who were below the recruitment window for polysomnography of 6 years of age. However, these questionnaires were accepted and included in this analysis since we kept all questionnaires from children who would have the potential to complete polysomnography before the end of data collection. In order to maximize parent participation, a letter of endorsement from the principal of the school was included with the screening questionnaire. Incentives such as pizza parties were provided to classrooms that returned the highest number of screening questionnaires. Additionally, an honorarium based on the percentage

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of questionnaires returned was given to the school in order to encourage maximum response from all students.

The screening questionnaire is a one-page, English/Spanish survey designed to assess the severity of sleep-related symptoms in addition to requesting demographic information such as ethnicity, age, and gender. The survey was forward-translated and backward-translated into Spanish, then it was pilot tested prior to implementation for Spanish-speaking parents. Parents were asked to answer 13 questions pertaining to their child's sleep habits (Appendix). These questions were evaluated by the parent on the scale of "never," "rarely," "occasionally," "frequently," "almost always," or "don't know." Parents were encouraged to answer the 13 questions and to return the survey even if they wished to provide little or no other demographic information. The questionnaire informed the parent that we would complete sleep studies on approximately 300 children, but it did not give any information about the purpose of the research. The complete list of survey questions is provided in the "Appendix."

Composite variables were created based on a combination of some of the survey items. Subjects were classified as having EDS if the parent reported that their child was sleepy in the daytime, fell asleep while watching TV or in school "frequently" or more. Witnessed apnea (WITAP) was present if the parent reported that their child stopped or struggled to breathe, their child's lips turned blue, or they shook their child because they were worried about their child's breathing during sleep "frequently" or more. Snoring was present if parents reported their child snored loudly "frequently" or "almost always" (SN). The child was classified as having learning problems (LPs) if the parent reported them "frequently" or more.

Statistical analysis was done using a statistical software package (SPSS, version 11.0 for Windows; SPSS, Inc; Chicago, IL). Comparisons of proportions were based on contingency tables. Statistical significance ($p \leq 0.05$) was determined using the Pearson χ^2 test. Logistic regression was used to model those variables found to be significant during an exploratory bivariate analysis. Cronbach α was used to model the internal consistency of the screening survey for reliability analysis.

Results

Of the 4,880 screening questionnaires that were sent home, a total of 1,494 were returned, for a response rate of 30.6%. The return rate was similar for boys and girls (49.7% and 49.4%, respectively), and was higher for Hispanics than for whites (45.4% and 38.1%, respectively). Other ethnicities comprised 16.6% (247 surveys) of the surveys. As shown in Table 1, from a sample of 1,481 children reporting gender and race, the prevalence of SN was 10.5%. The percentages of parents reporting EDS and WITAP in their children were 8.1% and 3.8%, respectively. The parents of girls were more likely to report EDS than those of boys (9.9% vs 6.3%, respectively; $p < 0.01$). However, the prevalences of reported SN, WITAP, and LP did not differ between boys and girls.

A date of birth was reported on 1,416 of the 1,494 returned questionnaires. There were 763 children (53.9%) who were between 4 years and 7 years of age, and 653 children (46.1%) who were between 8 years and 11 years of age. No significant differences were found between age categories for SN (10.7% vs 10.4%, respectively; $p > 0.05$), EDS (8.5% vs 7.7%, respectively; $p > 0.05$), or WITAP (3.3% vs 3.8%, respectively; $p > 0.05$). However, the prevalence of LPs in children 8 to 11 years old was higher than that observed in those 4 to 7 years old (7.2% vs 3.8%, respectively; $p < 0.01$). Further analysis showed that this effect was more evident among older girls (*ie*, 8 to 11 years of age, 6.3%; 4 to 7 years of age, 2.5%; $p = 0.02$) than among older boys (*ie*, 8 to 11 years of age, 8.1%; 4 to 7 years of age, 5.0%; $p = 0.12$).

Of the 1,494 surveys, 1,247 reported white or Hispanic ethnicity (83.4%). We restricted further analyses to this sample due to the small number of children with other ethnicities in Tucson elementary schools and because the primary focus of the TuCASA study was SDB in Hispanic and white children. Table 1 shows the reported prevalence of symptoms for Hispanic and white children as well as gender differences. The parents of Hispanic children were more likely to report SN than were those of white children (11.4% vs 7.4%, respectively; $p < 0.02$), as well as being more likely to report EDS

Table 1—*Prevalence of Symptoms Reported Frequently on the TuCASA Sleep-Habits Screening Questionnaire*

	Gender			Ethnicity		
Variables	Boys (n = 743)	Girls (n = 738)	Total (n = 1,481)	White (n = 556)	Hispanic (n = 658)	Total (n = 1,214)
SN*	11.6	9.3	10.5	7.4	11.4†	9.5
LP‡	5.4	4.2	4.8	3.7	6.5†	5.2
EDS§	6.3	9.9†	8.1	5.8	9.6†	7.9
WITAP‖	3.5	4.1	3.8	1.9	4.7†	3.4

*Relates to question 6 in Appendix.
†$p < 0.05$.
‡Relates to question 13 in Appendix.
§Relates to questions 10, 11, and 12 in Appendix.
‖Relates questions 1 to 4 in Appendix.

(9.6% vs 5.8%, respectively; $p < 0.01$) and WITAP (4.7% vs 1.9%, respectively; $p < 0.007$). Hispanic children were also more likely to have LPs than were white children (6.5% vs 3.7%, respectively; $p < 0.03$). This observation was a result of there being more LPs seen in Hispanic boys than in white boys (8.2% vs 4.0%, respectively; $p < 0.03$). No difference was found in LPs between Hispanic and white girls.

An examination of the sleep-habits screening questionnaire was undertaken to see whether the increased symptoms reported by Hispanic parents could be due to translation anomalies. Hispanic parents had the option of completing the questionnaire in either English or Spanish. Questions completed by the parents of Hispanic children were analyzed to see whether these differences were dependent on the language version of the questionnaire that was completed. For all composite variables, there were no statistically significant differences in Hispanic reports regardless of whether the English or Spanish translations were used. On each individual question that comprised the composite variables, there were also no statistically significant differences for those reporting symptoms frequently or more often. The only question that was used in this report that showed a statistically significant difference between questionnaire versions within those reporting Hispanic ethnicity was "How often does your child snore loudly." Hispanic parents completing the questionnaire in Spanish (333 parents) were more likely to report that their child snored loudly than were Hispanic parents completing the questionnaire in English (13.8% vs 9.0%, respectively; $p < 0.05$). Finally, the internal consistency of the questionnaire was found to be satisfactory with a Cronbach α of 0.768, which is a level that remained similar regardless of whether the questionnaire was completed in Spanish or English, or whether by white or Hispanic parents.

In addition to the higher prevalence of LPs in Hispanics and in older children, LPs were significantly associated with SN, EDS, and WITAP (Fig 1). However, there was no overall relationship between LPs and gender. As shown in Table 2, additional stratified analyses were conducted to further explore the association of LPs with SN, EDS, and WITAP as a function of ethnicity and gender. LPs remained associated with these symptoms across ethnicity and gender categories, although, in a few cases, statistical significance was not quite achieved.

The prevalence rates of EDS as a function of SN, WITAP, gender, and age are shown in Figure 2. In addition to a greater prevalence in Hispanics, EDS was more common in those children with SN and WITAP. In this analysis, which was restricted to whites and Hispanics only, EDS also was more common in girls than in boys (9.3% vs 6.5%, respectively), although statistical significance was not achieved ($p = 0.07$). Thus, it is consistent with the same analysis performed in the sample of children with all ethnicities (see above). No differences were noted between older and younger children.

SN was highly associated with WITAP (17.9 vs 1.8,

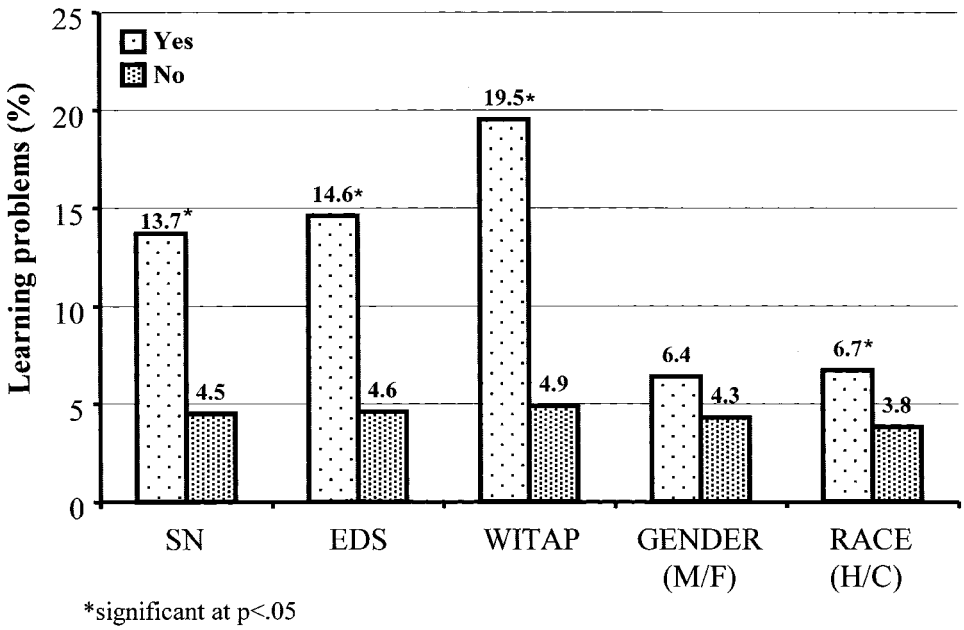

FIGURE 1. Associations between LPs and SN, EDS, WITAP, gender, and race.

Table 2—*Relationship of LPs to Symptoms Associated With OSA According to Ethnicity and Gender (n = 1,214)

		Ethnicity				Gender			
		White (n = 556)		Hispanic (n = 658)		Boys (n = 613)		Girls (n = 601)	
Variables	LPs	Ratio	%	Ratio	%	Ratio	%	Ratio	%
SN	Yes	5:41	12.2†	11:76	14.5†	10:69	14.5†	6:48	12.5†
	No	16:515	3.1	33:582	5.7	29:544	5.3	20:553	3.6
EDS	Yes	3:33	9.1	11:63	17.5†	7:40	17.5†	7:56	12.5†
	No	18:523	3.4	33:595	5.5	32:573	5.6	19:545	3.5
WITAP	Yes	2:11	18.2†	6:30	20.0†	2:18	11.1	6:23	26.1†
	No	19:545	3.5	38:628	6.1	37:595	6.2	20:578	3.5

*See Table 1 for information relating variables to questions in the Appendix.
†$p < 0.05$, LPs vs no LPs.

respectively; $p < 0.001$). However, there were no significant differences in SN between boys and girls or between older and younger children.

Logistic regression was used to model LPs with those variables found to be associated in the exploratory bivariate analysis ($p < 0.10$). The adjusted odds ratio (OR) for SN was 2.4 (95% confidence interval [CI], 1.2 to 4.70; $p < 0.02$), the adjusted OR for EDS was 2.5 (95% CI, 1.2 to 5.0; $p < 0.01$), and the adjusted OR for age 8 to 11 years was 2.1 (95% CI, 1.2 to 3.5; $p < 0.01$). However, WITAP and ethnicity were not significant in this model. A similar model was constructed to predict EDS, which showed an adjusted OR for SN of 3.2 (95% CI, 1.8 to 5.5; $p < 0.001$), an adjusted OR for WITAP of 5.7 (95% CI, 2.8 to 11.7; $p < 0.001$), and an adjusted OR for female gender of 1.6 (95% CI, 1.01 to 2.45; $p < 0.04$). Similar to the model constructed for LPs, ethnicity was not significant.

Discussion

The TuCASA study has demonstrated that children with LPs who are between 4 years and 11 years of age were significantly more likely to have a parental report of SN and EDS. Also, children with EDS were much more likely to have SN and

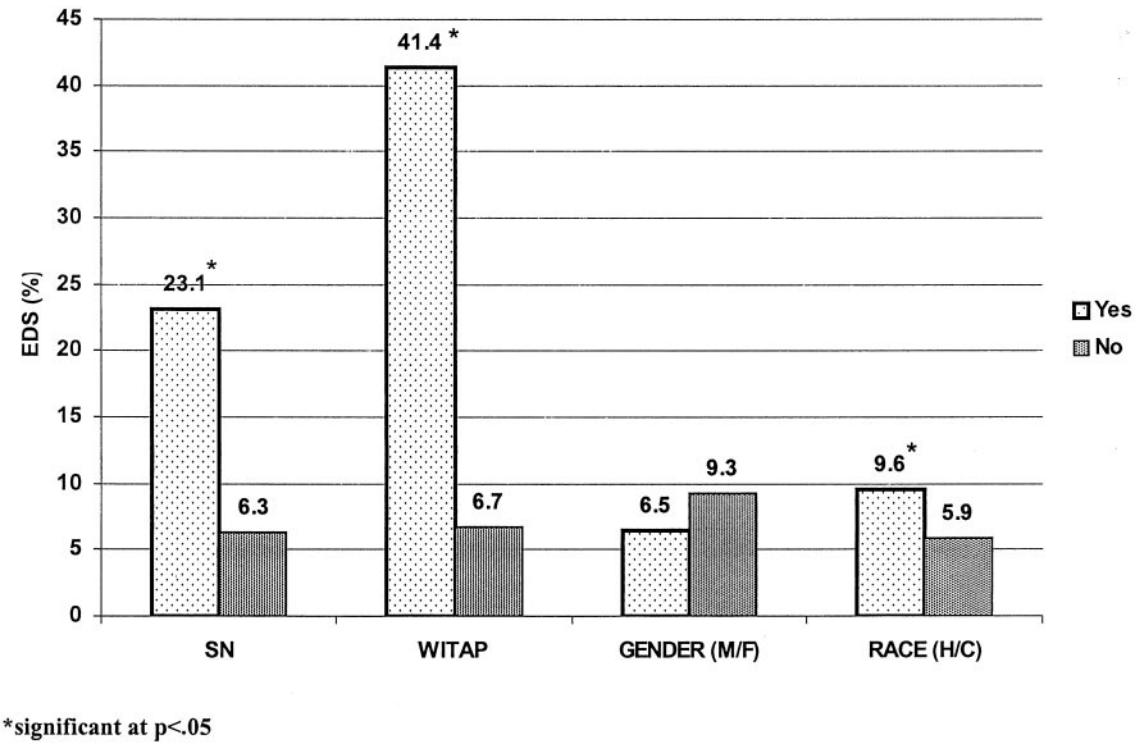

Figure 2. Associations between EDS and SN, WITAP, gender, and race.

WITAP, and to be female. Additionally, the parents of Hispanic children reported significantly more EDS, WITAP, and SN in their children than did white parents. Furthermore, Hispanic boys were more likely to have reports of EDS and LPs than were Hispanic girls or whites of both genders. Finally, the parents of children of all ethnicities were significantly more likely to report frequent daytime sleepiness in girls than in boys.

LPs were consistently and significantly associated with EDS, SN, WITAP, and all of their component variables, regardless of gender or ethnicity. Although LPs are frequently reported in clinical studies that include patients with confirmed SDB, few studies have shown that LPs are common in a general population across gender and ethnicity for those children with reported EDS, WITAP, and SN. Our findings were similar to those of Gozal et al,[28] who reported that SN during early childhood resulted in an OR of 2.79 for those children with LPs vs those with no LPs, a result that is very similar to that of the TuCASA study (OR, 2.4). These associations were highly significant in this sample, however, we were not able to control for variables known to be associated with LPs, such as socioeconomic status or parent education. Because our sample included Hispanic children in schools in which a large proportion of the population are in low income census tracts and/or eligible for reduced lunch programs, it is possible that these LPs are magnified due to other social problems. In several of the TUSD schools in our sample, English-as-a-second-language programs are employed as part of the curriculum for those students in grades 1 to 3 who may not be US citizens or speak English fluently. Although teaching is done in both English and Spanish for these children until they are assimilated into full English-speaking classes, it is possible that Hispanic parents may perceive a LP in a child who does not speak fluent English. However, not only Hispanics, but also whites with reported LPs were more likely to have EDS, WITAP, and SN. Finally, our assessment of LPs was based on the answer to one question on the screening survey, therefore, parental report could be subject to interpretation or cultural bias. We realize that LPs constitute a broad area that encompasses issues with scholastic performance and class discipline as well as interactions with the home learning environment.

Several studies[7,15,28,29] have reported the prevalence of sleep problems, suggestive of SDB in a population-based sample of children. Our overall snoring prevalence of 10.5% is within the upper end of the range reported by others.[13,29,30] Snoring rates in these studies vary considerably depending on the questionnaire wording and the definition used for ascertainment. There are fewer epidemiologic studies that have reported the prevalence of WITAP and EDS.[11,31] However, our overall WITAP prevalence rate of 3.8% is comparable to that of previous studies[11,14] despite differences in questionnaire wording. We observed that EDS was present in 8.1% of our children, which is approximately twice the prevalence observed by Camhi et al[32] in a different cohort of Tucson children but is similar to that observed by others.[33,34] Like the other sleep apnea symptoms that we assessed, the comparison of our EDS prevalence to other studies is difficult because of differences in the definition of EDS. For example, in the study by Camhi et al,[32] "excessive daytime sleepiness" was the only symptom used to define EDS. In contrast, in our study, EDS was present if there was parental report of one of three symptoms of "sleepiness." Thus, it is not surprising that our reported prevalence rate of EDS is higher than those of previous studies. Other studies of children in this age group have not reported the gender difference in parental report of EDS that we found in this sample. Given the limited amount of information obtained on our screening survey, a plausible explanation for the higher prevalence of EDS in girls is not readily available.

There are no previous studies documenting the prevalence of sleep symptoms associated with OSA in Hispanic children. However, our findings are consistent with the few reports comparing sleep symptoms in Hispanic adolescents and adults to other ethnic groups. A study by Roberts et al[35] reported a higher prevalence of insomnia and hypersomnia in Mexican-American youths (in grades 6, 7, and 8) compared to that in white youths. Hicks et al[36] found that Hispanic college students were more likely to be dissatisfied with their sleep quality than were white college students. Therefore, it might be expected that the parents of young Hispanic children would also report a higher prevalence of OSAS-associated symptoms. Although it cannot be excluded that differences between Hispanic and white children are due to translation irregularities, the consistency of reporting within the Hispanic group, regardless of whether the Spanish or English version was used, would argue that the differences are not due to translation problems.

Some studies[20,37,38] have found that hyperactivity and other types of neurobehavioral abnormalities are common in children with reports of SDB, whereas EDS is unusual. In addition, a Finnish study[11] found that the absence of excessive sleepiness was protective against OSAS in children. However, this study supports the contention that children also experience EDS as a result of SDB.[12,13,33,34] Furthermore, the presence of SN

and WITAP were found to be predictive of those children with EDS, a finding that supports the premise that symptoms associated with SDB can be used to predict EDS.

Although the specific range and order of questions used in the TuCASA screening questionnaire have not been validated previously, most are standard questions that are seen on sleep-habits questionnaires pertaining to SDB in children. The subsequent composite variables also have not been systematically validated, although they do have face validity. A conscientious decision to limit the number and breadth of questions was made in order to keep the questionnaire short in hopes that this would encourage maximum response on essential items related to SDB. This was done with the knowledge that further questionnaires would be administered to those parents and children who were recruited for polysomnography.

It is possible that selection bias occurred if parents who believed that their children had a sleep problem were more likely to return the completed questionnaire. Efforts to reduce this bias were made by giving incentives for classroom and whole-school participation, as well as allowing the parent to return the survey anonymously. The prevalence of symptoms such as SN, EDS, and WITAP in our sample were similar to those reported in other population-based samples, therefore, we believe selection bias has been reduced to the minimum possible. This leads us to believe that our survey return rate of 30.6 was a good representation of the general population of Tucson public school children.

In conclusion, the TuCASA study has shown that children between 4 years and 11 years of age with LPs are more likely to have SN and EDS, and are more likely to be older. Children with EDS were more likely to have SN and WITAP, and to be female. Additionally, Hispanic children who were 4 to 11 years of age were more likely to have a parental report of EDS, WITAP, and SN. Hispanic boys were more likely to have reports of EDS and LPs than were white boys or girls of the same age group. Furthermore, girls who were 4 to 11 years of age were more likely to have parental reports of daytime sleepiness than were boys. These differences in sleep symptoms that are associated with OSA do not appear to be attributable to language or interpretation anomalies.

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Appendix

TuCASA Screening Questionnaire

1. Does your child stop breathing during sleep?
2. Does your child struggle to breathe during sleep?
3. Do you ever shake your child during sleep to make him/her breathe again?
4. Do your child's lips ever turn blue or purple while he/she is sleeping?
5. Are you ever concerned about your child's breathing during sleep?
6. How often does your child snore loudly?
7. How often does your child have a sore throat?
8. Does your child complain of morning headaches?
9. Is your child a daytime mouth breather?
10. Is your child sleepy during the daytime?
11. Does your child fall asleep at school?
12. Does your child fall asleep while watching television?
13. Does your child have learning problems?

Possible Responses

1. Don't know
2. Never
3. Rarely
4. Occasionally
5. Frequently
6. Almost always

References

1 Gaultier C. Clinical and therapeutic aspects of obstructive sleep apnea syndrome in infants and children. Sleep 1992; 15:S36–S38
2 Guilleminault C. Obstructive sleep apnea. Med Clin North Am 1985; 69:1187–1203
3 Guilleminault C. Obstructive sleep apnea syndrome in children. In: Guilleminault C, ed. Sleep and its disorders in children. New York, NY: Raven, 1987; 213–224
4 Carroll J, Loughlin G. Obstructive sleep apnea syndrome in infants and children: clinical features and pathophysiology. In: Ferber R, Kryger M, eds. Principles and practice of sleep medicine in the child. Philadelphia, PA: WB Saunders, 1995; 163–191
5 Chervin R, Archbold K. Hyperactivity and polysomnographic findings in children evaluated for sleep-disordered breathing. Sleep 2001; 24:313–320
6 Gozal D. Sleep-disordered breathing and school performance in children. Pediatrics 1998; 102:616–620
7 Owens J, Opipari L, Nobile C, et al. Sleep and daytime behavior in children with obstructive sleep apnea and behavioral sleep disorders. Pediatrics 1998; 102:1178–1184
8 Hansen D, Vandenberg B. Neuropsychological features and differential diagnosis of sleep apnea syndrome in children. J Clin Child Psychol 1997; 26:304–310
9 American Academy of Pediatrics. Clinical practice guideline: diagnosis and management of childhood sleep apnea syndrome. Pediatrics 2002; 109:704–712
10 Chervin R, Dillon J, Panahi P, et al. Inattention, hyperactivity, and symptoms of sleep-disordered breathing. Pediatrics 2002; 109:449–456
11 Nieminen P, Tolonen U, Lopponen H, et al. Snoring children: factors predicting sleep apnea. Acta Otolaryngol Suppl 1997; 529:190–194

12 Ali N, Pitson D, Stradling J. Snoring, sleep disturbances, and behaviour in 4–5 year olds. Arch Dis Child 1993; 68:360–366
13 Ali N, Pitson D, Stradling J. Natural history of snoring and related behaviour problems between the ages of 4 and 7 years. Arch Dis Child 1994; 71:74–76
14 Gislason T, Benediktsdottir B. Snoring, apneic episodes, and nocturnal hypoxemia among children 6 months to 6 years old. Chest 1995; 107:963–966
15 Redline S, Tishler P, Schluchter M, et al. Risk factors for sleep-disorders breathing in children: associations with obesity, race, and respiratory problems. Am J Respir Crit Care Med 1999; 159:1527–1532
16 Brunetti L, Rana S, Lospalluti M, et al. Prevalence of obstructive sleep apnea syndrome in a cohort of 1,207 children of southern Italy. Chest 2001; 120:1930–1935
17 Greene M, Carroll J. Consequences of sleep-disordered breathing in childhood. Curr Opin Pulm Med 1997; 3:456–463
18 Rosen C. Clinical features of obstructive sleep apnea hypoventilation syndrome in other wise healthy children. Pediatr Pulmonol 1999; 27:403–409
19 Gozal D, Wang M, Pope D Jr. Objective sleepiness measures in pediatric obstructive sleep apnea. Pediatrics 2001; 108: 693–697
20 Frank Y, Kravath C, Pollak C, et al. Obstructive sleep apnea and its therapy: clinical and polysomnographic manifestations. Pediatrics 1983; 71:737–742
21 McNamara F, Issa F, Sullivan C. Arousal pattern following central and obstructive breathing abnormalities in infants and children. J Appl Physiol 1996; 81:2651–2657
22 Carroll J, McColley S, Marcus C, et al. Inability of clinical history to distinguish primary snoring from obstructive sleep apnea syndrome in children. Chest 1995; 108:610–618
23 American Thoracic Society. Standards and indications for cardiopulmonary sleep studies in children. Am J Respir Crit Care Med 1996; 153:866–878
24 American Thoracic Society. Cardiorespiratory sleep studies in children: establishment of normative data and polysomnographic predictors of morbidity. Am J Respir Crit Care Med 1999; 160:1381–1387
25 United States Census Bureau, Population Division. United States census, 2000
26 United States Census Bureau, Population Division, Racial Statistics Branch. United States census, 2000
27 Goodwin J, Enright P, Morgan W, et al. Feasibility of using unattended polysomnography in children for research: report of the Tucson Children's Assessment of Sleep Apnea Study (TuCASA). Sleep 2001; 24:937–944
28 Gozal D, Wang M, Pope D, et al. Snoring during early childhood and academic performance at ages thirteen to fourteen years. Pediatrics 2001; 107:1394–1399
29 Anuntaseree W, Rookkapan K, Kuasirikul S, et al. Snoring and obstructive sleep apnea in Thai school-age children: prevalence and predisposing factors. Pediatr Pulmonol 2001; 32:222–227
30 Owen G, Canter R, Maw R. Screening for obstructive sleep apnoea in children. Int J Pediatr Otorhinolaryngol 1995; 32(suppl):S67–S69
31 Bower C, Gungor A. Pediatric obstructive sleep apnea syndrome. Otolaryngol Clin North Am 2000; 33:49–75
32 Camhi S, Morgan W, Pernisco N, et al. Factors affecting sleep disturbances in children and adolescents. Sleep Med 2000; 1:117–123
33 Owens J, Spirito A, McGuinn M, et al. Sleep habits and sleep disturbances in elementary school-aged children. J Dev Behav Pediatr 2000; 21:27–36
34 Archbold K, Pituch K, Panahi P, et al. Symptoms of sleep disturbances among children at two general pediatric clinics. J Pediatr 2002; 140:97–102
35 Roberts R, Roberts C, Chen I. Ethnocultural differences in sleep complaints among adolescents. J Nerv Ment Dis 2000; 188:222–229
36 Hicks R, Lucero-Gorman K, Bautista J. Ethnicity, sleep duration, and sleep satisfaction. Percept Mot Skills 1999; 88:234–235
37 Rosen CL. Obstructive sleep apnea syndrome (OSAS) in children: diagnostic challenges. Sleep 1996; 19:S274–S277
38 Carroll JL, McColley SA, Marcus CL. Reported symptoms of childhood obstructive sleep apnea syndrome (OSA) vs. primary snoring. Am Rev Respir Dis 1992; 145:A177

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