Snoring in Portuguese Primary School Children

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Snoring in Portuguese Primary School Children

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ABSTRACT. *Objective.* **To determine the prevalence of snoring and its potential associations with sleep problems, such as daytime symptoms, medical conditions, school performance, and behavioral disturbances in Portuguese children attending primary school.**

Methods. **A previously validated questionnaire was sent to the parents of 1381 children attending primary schools in a parish of Coimbra, Portugal. To assess behavioral disturbances, the Portuguese version of Rutter's Children's Behavior Questionnaire for completion by teachers was used.**

Results. **Of the 988 questionnaires returned (71.5%), complete information concerning snoring was obtained for 976 children (496 girls and 480 boys; mean age: 8.1 ± 1.5 years). Loud snoring during sleep was reported as frequent or constantly present (LSn) in 84 children (8.6%), as occasionally present in 299 children (30.6%), and as never present (NSn) by 593 children (60.8%). The LSn and NSn groups did not differ with respect to age, gender, sleep duration, time to fall asleep, frequency of night wakings, bedwetting, daytime tiredness, and school achievement. However, LSn was significantly associated with increased bedtime problems (fears and struggles), increased need for comforting activities to fall asleep, behaviors suggestive of parasomnias (sleep talking, teeth grinding, and night terrors), increased daytime sleepiness and irritability, and behavioral disturbances. Children in the LSn group were also more likely to report recurrent medical problems particularly those involving infections of the respiratory tract.**

Conclusions. **Snoring is a common symptom in Portuguese children that is associated with behavioral daytime and sleep time disturbances. Children with loud snoring may benefit from early evaluation and intervention.** *Pediatrics* **2000;106(5). URL: http://www.pediatrics.org/cgi/content/full/106/5/e64; *snoring, children, epidemiology, sleep patterns, behavior.***

ABBREVIATIONS. OSAS, obstructive sleep apnea syndrome; NS, not significant; LSn, loud snoring frequent or constantly present; NSn, loud snoring never present.

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Snoring during sleep, the paramount manifestation of obstructive sleep apnea syndrome (OSAS) in children, has long been recognized.[1] However, the recognition that snoring-related disorders can be associated with significant morbidities has only occurred much more recently.[2] In Portugal, the few published reports of sleep-associated breathing disorders in children have primarily addressed OSAS,[3–6] and no systematic survey of Portuguese children regarding their snoring patterns is currently available. This is further compounded by a paucity of information regarding snoring patterns in children around the world.

Snoring is a vibratory sound produced during sleep within the upper airway that usually coincides with the inspiratory phase of the respiratory cycle.[7] According to the *International Classification for Sleep Disorders*,[8] snoring can be considered benign if it is not associated with airway obstruction during sleep, and in such instances, it is usually denominated primary snoring. However, snoring is a nonspecific symptom that can also reflect the presence of OSAS. Excessive daytime sleepiness is the most frequent presenting symptom of adult OSAS, whereas snoring or breathing difficulties during sleep are the primary reasons for clinical referral among children.[7] Furthermore, clinical history in children does not seem to be sufficiently sensitive and specific to distinguish primary snoring from OSAS in children.[1,9,10] Although the impact of primary snoring is unclear, the presence of snoring is indicative of some degree of upper airway obstruction and may be associated with the presence of diurnal symptoms.[7,11,12] It is, therefore, likely that the staging theory proposed by Lugaresi et al[13] for adults could also be applicable to children. In this context, a wide spectrum of more or less symptomatic children would be present, and their severity could span from completely asymptomatic children with primary snoring to those with snoring and florid OSAS. Therefore, within this severity spectrum, the possibility exists that a disease state will be present without fulfilling all of the criteria for OSAS. Such condition, the pediatric variant of the upper airway resistance syndrome, has been demonstrated to exist and adversely impacts daytime behavior.[11,14]

In addition to daytime neurobehavioral morbidity, long-term snoring could also lead to craniofacial changes in children, such as altered mandibular and maxillary bone growth patterns, which in turn could compromise the mechanical properties of the upper

airway musculature and promote progression toward frank upper airway obstruction and OSAS.[14] Thus, it becomes evident that early detection is important to allow for implementation of effective interventions.[12,15] Based on aforementioned considerations, we aimed to determine the prevalence of loud snoring in children, and also to assess whether snoring is associated with other sleep problems, daytime symptoms, or concurrent medical conditions. Therefore, we conducted an epidemiologic survey of sleep patterns in children attending primary school and included assessments of school performance and behavioral disturbances.

METHODS

Questionnaires

In a first stage, a parental questionnaire was developed for our epidemiologic survey and aimed to assess children's sleep and wake behavioral patterns. The questions included in the questionnaire addressed sleep/wake times, total sleep time, bedtime and nighttime sleep-related behaviors, daytime sleepiness, irritability, and tiredness. In addition, parents were also asked whether the child had any sleep problem, whether they sought professional help for any sleep problem in their child, and whether they administered any sleep medications to their children. Finally, information on the medical history of the child was also sought. Most questions, including those concerning snoring, were rated on a 4-point scale, ranging from never (coded as 1) to always (coded as 4; see the "Appendix"). The stability of the questionnaire, tested on an independent sample of primary school-aged children within a 1-month interval was found to be satisfactory. Indeed, the test–retest reliability of the snoring question was highly significant with a correlation coefficient of .88.

The Children's Behavior Questionnaire developed by Michael Rutter[16] for completion by teachers was used to assess behavioral disturbances in the children's cohort. It consists of a 26-item questionnaire concerning the child's behavior at school, rated on a 3-point scale, and is widely used as a reliable screening instrument for behavioral disorders in community samples of children.[16–21] A score of 9 points or more on the total scale is considered to be a reliable indicator for the presence of some behavioral disorder.[22] In the present study, we decided to increase the specificity of this indicator tool, and, therefore, we raised the cutoff for behavioral disturbance to ≥10 points. The reliability of the Portuguese version of the Children's Behavior Questionnaire has already been found to be high.[23] To assess the child's educational performance at school by the teacher an additional item was included in the questionnaire as follows: "How do you rate this child concerning his/her school performance? Very poor = 1; poor = 2; within average = 3; good = 4; very good = 5."

Experimental Protocol

Following approval by the Regional Director of Education, which serves as the Institutional Human Subject Protection Committee for the schools, all 10 primary schools located in a parish of the city of Coimbra (~30 000 inhabitants) were included in the survey. The latter was conducted during the school year of 1994–1995, and all schools agreed to participate in the study. This particular parish was selected because it is the most populous in the city of Coimbra and is representative of all social and economic groups.

Every school was visited by the investigators and the aims of the project were outlined in detail to all teachers involved. An envelope containing the questionnaire and a personally addressed letter asking for consent and co-operation in the survey was sent to the parents by giving the envelopes to the children. The accompanying letter which included the informed consent, emphasized the strict confidentiality of all information volunteered by the parents. The survey ran from April 1995 until the end of the school year in the middle of July 1995. The schools were periodically visited by the investigators to collect all completed questionnaires, request the teachers to remind non-respondents to comply, and encourage class teachers to complete the Children's Behavior questionnaires.

Numerical data were tabulated and analyzed using χ^2, Mann-Whitney U, and Student's t tests as appropriate with a commercially available statistical package (*Systat 5.0 for Windows*, Systat, Chicago, IL). A P value $<.05$ was considered statistically significant.

RESULTS

Of 1381 children enrolled, 988 questionnaires were returned by the parents indicating a response rate of 71.5%. Information on snoring was available from a total of 976 children (Table 1). Sixteen children >11 years old were further excluded from analysis to allow for improved homogeneity of the sample cohort. Girls accounted for 50.8% of responders (P = .726; χ^2 = .123; df = 1), and the mean age for the cohort was 8.0 ± 1.5 years (range: 6–11 years), with no significant age predominance for either gender (P = not significant [NS]).

The vast majority of the children were attending the first through fourth grades in school during the survey (Table 1). They came predominantly from middle to lower social backgrounds (social class III and IV; 65%) as indicated by parental social status.

Five hundred seventy-seven parents (60.1%) reported that their children never snored loudly; 299 (31.1%) answered that their children snored loudly only occasionally; 70 parents (7.3%) reported patterns of snoring loudly frequently; and 14 parents (1.5%) stated that their children snored loudly always. Based on these responses, we grouped the children that snored loudly either frequently or always (LSn; n = 84; 8.8%), and the remainder were grouped as nonsnorers (NSn). The mean age for the LSn group was 7.95 ± 1.72 years versus 8.04 ± 1.39 years for NSn (P = NS; Table 2), and no gender or socioeconomic status differences emerged between the 2 groups.

As shown in Table 2, LSn did not differ from NSn in terms of sleep length (P = .192; t = 1.312), time to fall asleep (P = .616; U = 24 083.5), number of night wakings episodes (P = .863; U = 24 629.0), bedwet-

TABLE 1. Characteristics of 960 Responders to the Survey

	n	(%)
Sex		
Girls	488	(50.8)
Boys	472	(49.2)
Age		
6–8	594	(62.0)
9–11	366	(38.0)
School grade		
1–2	451	(47.0)
3–4	430	(44.8)
5–7	79	(8.2)
Social class		
I	220	(23.4)
II	109	(11.6)
III	416	(44.3)
IV	195	(20.7)
Loud snoring		
Never	577	(60.1)
Occasionally	299	(31.1)
Frequently	70	(7.3)
Always	14	(1.5)

TABLE 2. Comparison Between Loud Snorers and Never Snorers

Parents' Questionnaire	Loud Snorers Mean ± SD	Never Snorers Mean ± SD	*P* Value
Sleep duration	9.6 ± .7	9.7 ± .9	NS*
Time to fall asleep	1.5 ± .6	1.5 ± .6	NS†
Night wakings (*n*)	1.4 ± .7	1.4 ± .6	NS†
Bed wetting	1.2 ± .5	1.2 ± .4	NS†
Daytime tiredness	1.6 ± .7	1.6 ± .6	NS†
Bedtime struggles	1.94 ± .82	1.72 ± .79	.01†
Comforting habits to sleep	1.82 ± 1.22	1.43 ± .97	.01†
Night light to fall asleep	2.02 ± 1.24	1.73 ± 1.11	.03†
Afraid of sleeping alone	1.52 ± .74	1.39 ± .72	.02†
Teeth grinding	1.51 ± .79	1.31 ± .61	.01†
Sleep talking	1.89 ± .66	1.66 ± .70	.001†
Night terrors	1.30 ± .51	1.21 ± .49	.04†
Sleepy during the d	1.68 ± .73	1.44 ± .54	.005†
Irritable during the d	1.81 ± .70	1.64 ± .68	.03†
Medical problems	13.1% (11/84)	.50% (3/590)	.0001‡
School achievement	3.59 ± .87	3.65 ± .92	NS†
Behavioral disturbance (score, ≥10)	24.3% (18/74)	14.9% (80/537)	.03‡

SD indicates standard deviation. When not indicated otherwise in the left column of the Table, the values for both groups represent the questionnaire score for the particular item.
* *t* test.
† Mann-Whitney *U* test.
‡ χ^2 test.

ting ($P = .537$; $U = 24\,000.0$), and daytime tiredness ($P = .103$; $U = 22\,224.0$).

However, LSn were more likely to have bedtime struggles ($P = .014$; $U = 20\,736.5$), to have an increased need for comforting activities to fall asleep ($P = .014$; $U = 21\,370.5$), to require a night light to fall asleep ($P = .028$; $U = 21\,365.5$), and also more likely to be afraid of sleeping alone ($P = .023$; $U = 21\,498.0$). In addition, a higher frequency of teeth grinding ($P = .019$; $U = 21\,593.0$), sleep talking ($P = .001$; $U = 20\,037.5$), night terrors ($P = .041$; $U = 22\,210.0$), daytime sleepiness ($P = .005$; $U = 20\,745.0$), and daytime irritability ($P = .027$; $U = 21\,420.0$) was reported in the LSn group. When the parental replies to the question eliciting information about medical conditions present in their children were examined the following findings emerged: compared with NSn children, children in the LSn group were significantly more likely to suffer from medical problems (13.1% vs .5%; $P = .0001$; $\chi^2 = 52.273$; $df = 1$), and such medical problems primarily included recurrent infections of the upper respiratory tract (tonsillitis, adenoiditis, and otitis media).

As shown in Table 2, school achievement was similar in the 2 groups ($P = .65$). However, the LSn group had a significantly higher prevalence of abnormal behavioral scores than did the NSn group ($P = .038$; $\chi^2 = 4.292$; $df = 1$) in the Teachers' Behavioral Questionnaire (Fig 1).

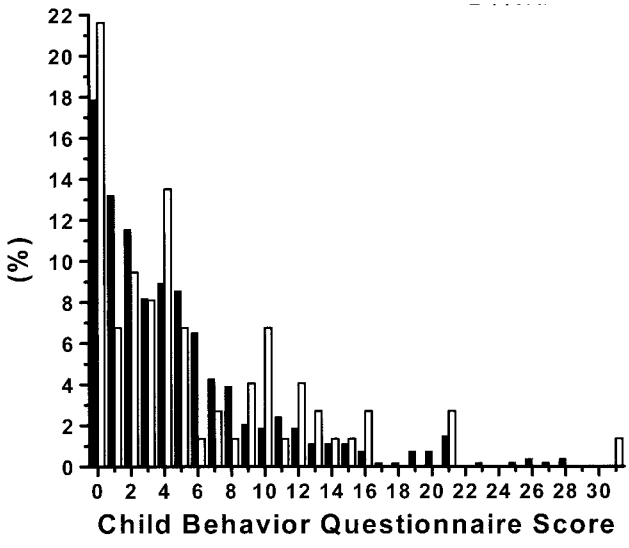

Fig 1. Distribution of Child Behavior Questionnaire scores among 74 LSn children (open columns) and 537 NSn children (closed columns). To normalize across the groups, results are shown as percentage from total.

DISCUSSION

This study confirms that loud snoring, defined as snoring loudly frequently or always, is common among primary school-aged children, affecting 8.8% of all children. More importantly, the loud snoring children group displays significant behavioral problems and more frequent upper respiratory tract infections.

Before we discuss the potential implications of our findings, we need to emphasize that this study is hampered by the fact that none of the children surveyed were studied in the sleep laboratory and that, therefore, we cannot document the nature and severity of any of the sleep symptoms reported in the parental questionnaire and we cannot establish which children had OSAS. Thus, we are prevented from making a definitive determination of whether the symptoms associated with loud snoring were attributable to snoring or to OSAS. Notwithstanding these concerns, the previously established high test–retest reliability of the questionnaire would suggest the constancy of the parental perceptual trends on their child's behaviors, thereby allowing for valid extrapolations to be made.

Although comparisons among the available studies assessing the prevalence of snoring in children are difficult by virtue of the different tools used for this assessment, a few epidemiologic similarities and discrepancies emerge between our study and those previously published. In the study reported by Corbo et al,[24] the age span of the children surveyed as well as the definition of snoring and sample size of the cohort were similar to the present study. These investigators found habitual snoring among 7.3% of 1615 children 6 to 13 years old in Italy. In contrast, Gislason and Benediktsdottir[25] reported that snoring often or very often occurred in only 3.2% of 555 children 6 months to 6 years old living in Iceland. Ali et al[26] reported a prevalence of 12.1% in 996 English children between the ages of 4 to 5 years, while Hulcrantz et al[27] found that among five hundred 4-year-old children snoring every night was reported in 6.2% during the course of a routine well-child visit. Our current findings concur with most of these studies. However, and perhaps more importantly, these differences in prevalence among the various populations could be attributable to true differences in snoring prevalence or to culturally related differences in parental perception of what represents snoring.

It is important to emphasize that our survey did not reveal any statistical differences between NSn and LSn for age, gender, parental socioeconomic status, sleep duration, difficulty in initiating and/or maintaining sleep, bed wetting, daytime tiredness, and school achievement. This is contrast with Corbo et al[24] who found a decrease in snoring frequency and severity with age and also found differences in the prevalence of snoring in boys, compared with girls. These findings have not been confirmed, however, by other investigators.[25,27] Similarly, in the only report addressing socioeconomic status, lower socioeconomic groups were indeed identified as an independent risk factor for snoring and respiratory symptoms.[26]

OSAS has been associated with both bedwetting and academic problems,[1,28] and although sleep disturbances were suspected in a group of snoring children with clinical histories highly suggestive of OSAS,[26] a more meticulous investigation of sleep architecture in children with OSAS has yielded somewhat conflictive findings regarding the presence of a disrupted sleep structure in these children. In contrast, Carroll and colleagues[1] did not find evidence supporting abnormalities of sleep architecture when assessing the latter by standard sleep stage scoring procedures, such that the percentage of time spent in δ sleep was not modified by the presence of OSAS. In contrast, using more in-depth analysis that included spectral decomposition of electroencephalogram signals, Bandla and Gozal[29] have recently shown that during obstructive apneic episodes that are not associated with evidence of arousal by visual electroencephalogram inspection, significant decreases in δ power occur and are suggestive of ongoing alterations in sleep structure.

We found that bedtime problems (fears and struggles), the use of comforting activities to initiate sleep, and behaviors characteristic of parasomnias were all more common among LSn children. These findings are in close agreement with Owens et al[30] who reported behavioral sleep disturbances in nearly one quarter of children with OSAS. Similarly, Hulcrantz et al[27] found that the snoring children in their survey were more likely to use pacifiers. Although restless sleep is more frequently reported by snoring children,[25,26] we are unaware of any studies examining other bedtime and sleep-associated behaviors that we report herein. In the adult, snoring could result in a greater number of arousals,[31] triggering the appearance of parasomnias. The child, however, is more prone to parasomnias when there is a preceding over-tiredness or when the arousal threshold is increased.[32] Thus, it is conceivable that some degree of sleep deprivation and consequent increase in arousal threshold may be present in our LSn population, thereby, facilitating the occurrence of parasomnias. Similarly, bruxism is apparently aggravated by sleep apnea in adults,[33] and our findings now extend this observation to children. Of note, an increased incidence of parasomnias, particularly sleep terrors and sleepwalking, has also been noted in children with OSAS.[34]

The parents of LSn children reported greater irritability and daytime sleepiness, compared with the parents of NSn children. This findings concurs with those reported by many other investigators in snoring children[25,26] or in children with OSAS.[1,2,11,14] Our study further shows that behavior disturbances as assessed by the class teacher are more common in LSn children as a group. It is important to emphasize that this observation is independent of social class, because the LSn and NSn groups were similar in this respect. Using the Conner's Child Behavior Scale, which was completed by parents and teachers in a subgroup of 73 snoring children, Ali and colleagues[26] reported that although both parents and teachers were more likely to consider these snoring children to be inattentive and hyperactive compared with a control group of 88 nonsnoring children, the parents, but not the teachers, were also more likely to consider their snoring children as more prone to aggressive behavior. Similarly, children with the upper airway-resistance syndrome demonstrated more frequent behavioral problems.[14] In accordance with the present and aforementioned findings, it is possible to deduce that the presence of snoring in children, even in the absence of apnea, hypopnea, or hypoxemia, may adversely impact the child's well-being, similar to the findings reported for the adult population.

Finally, we would like to draw attention to the observed association between snoring and medical problems, namely adenotonsillitis in our study. This association, previously recognized by 3 other epidemiologic studies,[26,27,35] may indicate the existence of an important relationship between viral exposures during childhood and snoring. One possible mechanism accounting for such a relationship may involve the enhanced growth of lympathic tissue within the upper respiratory tract, leading to increased upper

APPENDIX. Sleep-Related Questions Included in the Survey Questionnaire

	Score
Bedtime behaviors	
How long does your child usually take to fall asleep?	
<10 min ☐ 10–30 min ☐ >30 min ☐	(1–3)
How often does your child:	
1) Need a special object to fall asleep (thumbsucking, doll, cloth, etc)?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
2) Require lights on to fall asleep?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
3) Refuse to go to bed at bedtime (cries, screams, makes up excuses, etc)?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
Nighttime behaviors	
How often does your child usually wake up during the night?	
Never ☐ 1 time ☐ 2 times ☐ 3 times ☐ >3 times ☐	(1–5)
During the night, how often does your child:	
1) Snore loudly during sleep?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
2) Wet the bed during sleep?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
3) Talk during sleep?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
4) Suddenly scream during sleep, appears to be terrified, is not consolable, and does not remember anything the next morning?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
5) Grind teeth during sleep?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
6) Is afraid of sleeping alone?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
Daytime behaviors	
1) Is your child sleepy during the day?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
2) Is your child tired during the day?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)
3) Is your child irritable (grumpy) during the day?	
Never ☐ occasionally ☐ frequently ☐ always ☐	(1–4)

airway resistance and increased propensity for snoring during sleep.

CONCLUSION

Loud snoring is common among primary school children and is associated with increased daytime, bedtime, and nighttime problems that are independent of social class, gender, or age. Although as of yet there is no true consensus on diagnostic criteria for what is normal or abnormal in the snoring child,[36] there seems to be a large degree of overlap between our current findings in LSn children and many of the clinical features reported in children with OSAS. Thus, we speculate that children with habitual LSn should receive early referral and evaluation to prevent or resolve multiple associated comorbidities.

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