







Parents' knowledge about obstructive sleep apnea syndrome in childhood

Felipe dos Santos Carvalho¹ , Breno Wesley Leal Carvalho¹ , Emylle Eduarda da Silva Sousa¹ , Sávio Henrique Lira Campos² , André Vinícius Lira Campos² , Ana de Lourdes Sá de Lira¹ 

¹ Department of Clinical Dentistry, Area of Integrated Clinic, School of Dentistry, Universidade Estadual do Piauí (UESPI), Parnaíba, PI, Brazil.

² Medical Clinic Department, School of Medicine, Federal University of Piauí (UFPI), Teresina, PI, Brazil.

Corresponding author:

Ana de Lourdes Sá de Lira
Universidade Estadual do Piauí,
Faculdade de Odontologia
Rua Senador Joaquim Pires 2076
Ininga
Fone (86) 999595004
CEP: 64049-590 Teresina-PI-Brasil
e-mail: anadelourdessl@hotmail.com

Editor: Dr. Altair A. Del Bel Cury

Received: October 10, 2023

Accepted: June 18, 2024

Aim: To evaluate parents' knowledge about obstructive sleep apnea syndrome in preschoolers in the primary dentition in the city of Parnaíba-PI. **Methods:** The questionnaire on obstructive sleep apnea syndrome (OSAS) in children was applied to parents of children between 2 and 6 years of age, in the deciduous dentition who were attending preschool in public and private kindergarten. It contained objective questions distributed in two parts: the first that determined the epidemiological profile of parents and children; the second part with 22 questions that checked the parents' knowledge about the child's sleep and behavior during the day. As an interpretation, the questionnaires that presented 36.3% of the answers YES to the 22 specific questions, the child was considered at high probability for developing OSAS. **Results:** The average age of the children was approximately 4 years old. Regarding weight, an average of 22 kilos and an average height of 107.45 cm and an average BMI of 18.75, confirmed by notes on the vaccination card. Loud snoring, loud or heavy breathing, and overweight were significantly associated with OSAS ($p < 0.001$). From a total of 250 children, it was observed that the prevalence rate of high possibility for the development of OSAS was 6% ($n=15$). **Conclusion:** Parents were not aware of OSAS, but after applying the questionnaire, they were able to understand the suggestive signs of the syndrome and the importance of early diagnosis.

Keywords: Sleep apnea syndromes. Child. Sleep wake disorders.



Introduction

Obstructive sleep apnea syndrome in childhood (OSAS) is one of several sleep disorders, characterized by an intermittent partial or complete obstruction of the upper airways that disrupts sleep and its normal patterns, occurring more frequently in the age group between 2 and 6 year olds having very different characteristics from sleep apnea in adults in terms of their etiology, symptoms and treatment¹⁻⁴.

According to the literature, it is recognized as one of the causes of morbidity among children, and can manifest itself in both genders, at any age, including newborns. The highest incidence of the problem in childhood is in preschool children, an age group in which tonsil and adenoid hypertrophy is more frequent⁵⁻⁸.

In children, the risk factors for OSAS that stand out the most are overweight, hypertrophy of the tonsils and adenoids, the presence of maxillary or mandibular retrognathism, long face, transverse deficiency of the upper arch, craniofacial syndromes, muscle weakness and Down syndrome^{2,9,10}. It is noteworthy that during sleep, there is a considerable decrease in muscle tone and in the airways. If the tonsils and adenoids are hypertrophied, they will obstruct the airways, making airflow difficult. Many of the short pauses (lasting only a few seconds) cause brief excitement, micro-arousals, increasing muscle tone, opening the airways, thus allowing the child to resume breathing¹¹⁻¹³.

While the actual number of minutes of arousal during the night may be small, repeated interruptions can result in a poor night's sleep, which can lead to significant daytime problems in children. The child is often unaware that he or she is waking up, and parents often describe very restless sleep, but generally do not describe the child's full awakening^{1,14,15}.

Parents play a fundamental role in the diagnosis when they observe the most frequent symptoms and clinical signs, which are: snoring, night awakenings, enuresis, restlessness during sleep, daytime sleepiness, restlessness, reduced neurocognitive performance, school performance and growth below normal predicted for age^{9,14}.

The pediatric sleep questionnaire was developed and validated by the American Academy of Pediatrics¹⁶ and translated into Portuguese by authors¹⁷, and can be applied to parents by health professionals when there is suspicion of OSAS. The child should be referred to a sleep doctor for a definitive diagnosis, when the suspicion is confirmed after applying the questionnaire.

It is believed that if preventive measures were adopted and an early diagnosis of OSAS was carried out, sequelae would be avoided, such as: behavioral disorders, learning deficits, pulmonary hypertension and impaired somatic growth. Thus, the application of the pediatric sleep questionnaire to parents is justified, in order to direct suspected cases to a thorough investigation with the sleep doctor, for the application of the polysomnographic examination, thus favoring an early diagnosis and adequate treatment by a multidisciplinary team consisting of a sleep doctor, otorhinolaryngologist, orthodontist and speech therapist^{18,19}.

The aim of this research was to evaluate parents' knowledge about obstructive sleep apnea syndrome in preschoolers in the primary dentition in the city of Parnaíba-PI.

Material and methods

Ethical aspects

The research was approved by the Ethics and Research Committee of UNINOVAFAPI, number: 4.470.974. This was a cross-sectional study with a quantitative approach, carried out with parents of preschoolers in the city of Parnaíba, PI. This research was guided by compliance with all the ethical principles that guide research involving human beings, as provided for in Resolution No. 466/12 (CNS/MS). Parents over 18 years of age would sign the Free and Informed Consent Term (TCLE) and minors would sign the Term of Assent (TALE), after being advised that the participation would not be mandatory. They were informed that they could withdraw from the research at any time. Only information collected strictly within the limits of the research objectives was used.

Population Study

The sample calculation was based on the target audience: preschoolers from public and private day care centers in 2021. Thus, seeking to achieve the objective of this work, it was based on the survey carried out by the Brazilian Institute of Geography and Statistics, which pointed out a number of 6209 people in the target population: number of people enrolled in preschool. Thus, the sample size formula was calculated, considering the calculation formula: $n = N Z^2 P \cdot (1 - P) Z^2 P \cdot (1 - P) + e^2 N - 1$ / ., in which n : sample calculated, Z : normal variable, P : real probability of the event, and sampling error), obtaining as a result a number of 250, with approximation to 260, since there is a possibility of withdrawal of participation by parents of preschoolers. This minimum number of participants is considered sufficient taking into account the proposed analyses, the sampling error of 5%, in addition to a 95% confidence level, indicating that the probability of the error made by the research does not exceed 5%²⁰.

Calibration

Two researchers were calibrated at the Clinical School of Dentistry (CEO) of the State University of Piauí (UESPI). They applied the questionnaire to 10 professors from the UESPI dentistry course twice with an interval of 15 days, to acquire skills in applying the questionnaire and ability to interpret the results, as well as to obtain intra-examiner and inter-examiner agreement. Kappa values were 0.84 for inter-examiner agreement (between the two researches), 0.85 and 0.87 for intra-examiner agreement. Once qualified, the examiners applied the questionnaire on OSAS in children to the parents, after school directors authorized the development of the research.

Eligibility Criteria

The inclusion criteria that were adopted were: parents of children between 2 and 6 years of age, in the deciduous dentition, who were attending preschool in a public or private day care center and did not have visual, auditory, motor or psychic disorders. As exclusion criteria: parents who did not want to participate in the research, incomplete or improperly completed questionnaires and parents unable to understand and answer the questions.

Pilot Study

For standardization, the questionnaire was applied to 30 parents of children treated at the Clinic School of Dentistry (CSD) of the State University of Piauí, in Parnaíba-PI, who did not participate in the research, to evaluate the methods to verify if there was a need to make changes in the methodology initially proposed. The previously validated questionnaire was reapplied after an interval of 15 days, in order to evaluate the method and check whether there would be a need to make changes to the initially proposed methodology, which did not need to be changed, as the parents were able to answer all the questions in the questionnaire applied.

Data collect

Public and private day care centers were chosen by lot, so that the number of parents of students participating in the sample was equally distributed. Parents from public schools formed group 1 (G1) and those from private schools formed group 2 (G2). It is believed that the socioeconomic factor may influence parents' knowledge about OSAS, possibly due to the higher educational level of parents in group 2 and greater access to medical and dental information and guidance.

Three times a week, in both shifts (morning and afternoon), the questionnaire adapted from previous study¹⁷, was applied to parents, containing objective questions divided into two parts: the first part that determined the epidemiological profile of the parents and of children; the second part with 22 questions that checked the parents' knowledge about the child's sleep and behavior during the day. As an interpretation, based on previous study¹⁷, the questionnaires that presented 36.3% of the answers YES to the 22 specific questions, the child was considered to have a high possibility of developing OSAS.

Statistical analysis

The results were stored in the Excel Windows 2016 Microsoft® database in graphs and tables for better presentation, interpretation and discussion, after appropriate statistical analysis. Means, dispersion, and the chi-square association test were obtained, with a statistical significance level of 5%, to compare the results between G1 and G2.

Results

The final sample of 250 children consisted of 55.2% females and 44.8% males. They were divided into two groups, 54% belonged to (G1) children from public schools, and

46% belonged to (G2) children from private schools. It was observed that 12% of our sample was black, followed by 38% brown and 50% white.

As for income, 92% of parents in G2 earn more than 3 minimum wages, while in G1, 94% earn less than 3 minimum wages. Regarding maternal education, 208 mothers studied for more than 8 years, with 46% belonging to G1 and 54% belonging to G2. Regarding paternal education, 207 fathers studied for more than 8 years, 44.5% belong to G1 and 55.5% to G2 (Table 1).

Table 1. Epidemiological data of G1 and G2

Variables		G1	G2	Total	p value
Gender	Male	70	42	112	0.02
	Female	65	73	138	
Race	White	71	54	125	0.65
	Black	16	14	30	
	Brown	48	47	95	
Family income	1 to 3 minimum wages	135	9	144	< 0.001*** (2.2×10^{-16})
	>3 minimum wages	0	106	106	
Maternal education	0-7	39	3	42	< 0.001** (5.89×10^{-8})
	≥8	96	112	208	
Paternal education	0-7	43	0	43	< 0.001*** (2.91×10^{-11})
	≥8	92	115	207	

Footnote: Chi-square test;***(significance at 0.001%); G1(children from public schools); G2(children from private schools).

The children's information about age, weight and height was confirmed by notes on the vaccination card. The age range of the children ranged from 2 to 6 years, with a mean age of approximately 4 years. Regarding weight, an average of 22 kg and an average height of 107.45 cm can be observed, resulting in an average body mass index (BMI) of 18.75 (Table 2).

Table 2. Descriptive data analysis

Descriptive analysis	Age	Weight	Height	BMI
Average	4.03	22.03	107.45	18.75
Median	4	20	106	17
Standard deviation	1.17	6.42	11.60	4.30
Minimum	2	12	80	12
Maximum	6	39	140	29

The prevalence distribution of factors that indicate a high possibility of developing obstructive sleep apnea syndrome (OSAS) is described in Table 3. These data suggest that: loud snoring, loud or heavy breathing and overweight were significantly associated with OSAS ($p < 0.001$). Factors that were clearly not associated with OSAS included: breathing through the mouth during the day, waking up tired in the morning, acting as if the plug were plugged in, and being distracted by extraneous stimuli ($p > 0.30$).

Table 3. Variables about the child

Variables		(G1)	(G2)	Total	χ^2 p valor
Does he/she snore more than half of your sleep time?	Yes	18	12	30	$\chi^2 = 0.02$ $p = 0.89$
	No	117	103	220	
Does he/she always snore?	Yes	15	16	31	$\chi^2 = 0.03$ $p = 0.86$
	No	120	99	219	
Does he/she snore loudly?	Yes	12	27	39	$\chi^2 = 10.04$ $p < 0.001^{**}$
	No	123	88	211	
Does he/she have trouble breathing or struggle to breathe?	Yes	16	28	44	$\chi^2 = 0.13$ $p = 0.72$
	No	119	87	206	
Does he/she have loud or "heavy" breathing?	Yes	19	26	45	$\chi^2 = 12.69$ $p < 0.001^{**}$
	No	116	89	205	
Have you ever seen your child stop breathing at night?	Yes	3	4	7	$\chi^2 = 3.31$ $p = 0.07$
	No	132	111	243	
Does he/she tend to breathe through his mouth during the day?	Yes	9	7	16	$\chi^2 = 0.03$ $p = 0.85$
	No	126	108	234	
Does he/she have a dry mouth when he wakes up in the morning?	Yes	11	19	30	$\chi^2 = 4.12$ $p = 0.04^*$
	No	124	96	220	
Does he/she occasionally wet the bed?	Yes	19	23	42	$\chi^2 = 1.56$ $p = 0.21$
	No	116	92	208	
Does he/she wake up feeling tired in the morning?	Yes	13	11	24	$\chi^2 < 0.001$ $p = 0.99$
	No	122	104	226	
Does he/she have a problem with drowsiness during the day?	Yes	6	5	11	$\chi^2 = 0.001$ $p = 0.97$
	No	129	110	239	
Some teacher commented that your child gets drowsy during the day?	Yes	7	9	16	$\chi^2 = 0.72$ $p = 0.40$
	No	128	106	234	
Is it difficult to wake your child in the morning?	Yes	20	31	51	$\chi^2 = 5.64$ $p = 0.02^*$
	No	115	84	199	
Does the child wake up with a headache in the morning?	Yes	1	6	7	$\chi^2 = 4.57$ $p = 0.03^*$
	No	134	109	243	

Continue

Continuation

Has he/she stopped growing at a normal rate at any age since birth?	Yes	5	3	8	$\chi^2 = 0.24$ $p = 0.62$
	No	130	112	242	
Is the child overweight?	Yes	16	36	52	$\chi^2 = 14.26$ $p < 0.001^{***}$
	No	119	79	198	
Does the child seem to not listen when we talk to him/her?	Yes	15	11	26	$\chi^2 = 0.16$ $p = 0.69$
	No	120	104	224	
Does he/she have difficulty organizing tasks and activities?	Yes	51	38	89	$\chi^2 = 0.61$ $p = 0.44$
	No	84	77	161	
Is the child distracted by extraneous stimuli?	Yes	45	37	82	$\chi^2 = 0.04$ $p = 0.85$
	No	90	78	168	
Does the child have restless feet and hands or squirm when sitting down?	Yes	28	17	45	$\chi^2 = 1.49$ $p = 0.22$
	No	107	98	205	
Does the child act as if "plugged in"?	Yes	49	47	96	$\chi^2 = 0.55$ $p = 0.46$
	No	86	68	154	
Does the child intrude or interrupt others?	Yes	28	25	53	$\chi^2 = 0.04$ $p = 0.85$
	No	107	90	197	

Footnote: As an interpretation, if 8 of the answers are YES to the 22 specific questions, the child is considered at high possibility for developing OSAS. Chi-square test; *(significance at 0.05%) ***(significance at 0.001%); G1(parents of children from public schools); G2(parents of children from private schools).

In the present study, data indicate that 15 children were considered with high possibility, 10 from private schools (2 males and 8 females) and 5 from public schools (1 male and 4 females). After confirming the homogeneity of the data, the results indicated that there was no statistically significant difference between the groups, with regard to the values of the mean ages in relation to gender ($p=0.31$), race ($p=0.60$) and type of schools ($p=0.04$), not influencing the answers to the questionnaire, after applying the Analysis of Variance test (MANOVA), with a 1% significance parameter.

Discussion

Sleep-disordered breathing (SDB) is relatively common in the pediatric population, including primary snoring (PR) and obstructive sleep apnea syndrome (OSAS). Primary snoring is defined as respiratory noise, but sleep architecture, alveolar ventilation and blood oxygen levels are normal. It is found in 7% to 9% of children aged between 1 and 10 years²¹. In the present study, based on data collected from 250 children, it was possible to observe that the prevalence rate of high possibility of developing OSAS was 6%. That is, 15 children presented risk behavior, corroborating another study, whose estimated prevalence of OSAS ranged from 0.7% to 10.3%²².

This wide range of expected prevalence is due, at least in part, to the fact that sleep-disordered breathing in children has been defined based on a variety of assessment methods⁵. There was no statistical difference between genders regard-

ing the possibility of developing OSAS, similar to another study²³. However, a higher prevalence of primary snoring was identified in males¹⁵. There was an association between the presence of loud snoring, overweight and loud or heavy breathing and an increase in the probability of developing OSAS. Just as BMI, waist circumference, tonsil size, nasal drainage, turbinate hypertrophy and long soft palate were associated with risk factors⁵.

There was no association with hyperactivity, tiredness in the morning or acting as if one were plugged in, which allows us to observe that although these behaviors are present in the list of characteristic symptoms of OSAS, they cannot be used alone to define the correct diagnosis, corroborating the findings of another study¹³, which emphasized the crucial importance of polysomnography for the diagnosis of OSAS.

Based on the data collected, children were found to be at high possibility of developing sequelae directly associated with OSAS, but it is not possible to be absolutely sure of the individual's health condition, requiring specialized medical follow-up for the correct diagnosis. A similar fact was observed in another research²⁴, which emphasizes the importance of the correct diagnosis. Sleep-disordered breathing, including obstructive sleep apnea syndrome (OSAS), is recognized as a cause of morbidity in children. Clinical symptoms of OSAS in children include snoring, night awakenings, agitation during sleep, enuresis, daytime sleepiness and hyperactivity¹⁷.

Clinical symptoms may raise suspicion, but it is not possible to establish the diagnosis without polysomnography. As snoring and obstructive symptoms can resolve with time, a normal polysomnography finding may help the clinician decide on an observation period^{25,26}.

After applying the questionnaires, the parents were unanimous in stating that they were unaware of the importance of the questions addressed in the questionnaire regarding OSAS and that they did not know that the child could develop the disease. Parents were warned that a positive response to 8 of the 22 questions suggests the need for further investigations into OSAS, the most frequent being loud snoring, loud or heavy breathing and overweight. Some authors reported that the most common signs are: snoring, mouth breathing, restless sleep, drooling on the pillow, hyperactivity, aggressiveness and irritability²⁷⁻²⁹. The first step towards the diagnosis is the observation of the parents. For this, it is essential that adults know about the existence of the disorder and its symptoms.

The questionnaire used in this research can be applied by any health professional to the parents of a child and if there is a suspicion of OSAS, after obtaining at least 8 affirmative answers, the child must be forwarded to the neurologist for confirmation of the diagnosis through the examination. polysomnography, investigation of etiological factors and early treatment. All parents or guardians of children who were at high risk of developing OSAS were instructed on the importance of the diagnosis.

In conclusion, parents, in both groups, had no knowledge about OSAS, but after applying the questionnaire, they were able to understand the suggestive signs of the syndrome and the importance of early diagnosis.

Acknowledgement

Miss Ana de Lourdes Sá de Lira who was the research assistant for the project.

Funding

This research did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

None

Author Contribution

Felipe dos Santos Carvalho: methodology, project administration, supervision, writing – review and editing. All authors actively participated in the manuscript's findings and have revised and approved the final version of the manuscript. **Breno Wesley Leal Carvalho:** methodology, project administration, supervision, writing – review and editing. **Emylle Eduarda da Silva Sousa:** methodology, project administration, supervision, writing – review and editing. **Sávio Henrique Lira Campos:** methodology, project administration, supervision, writing – review and editing. **André Vinícius Lira Campos:** methodology, project administration, supervision, writing – review and editing. **Ana de Lourdes Sá de Lira:** conceptualization, data curation, methodology, investigation, data analysis, project administration, resources, writing – review and editing, funding. All authors revised and approved the final version of the manuscript.

References

1. Savini S, Ciorba A, Bianchini C, Stomeo F, Corazzi V, Vicini C, et al. Assessment of obstructive sleep apnoea (OSA) in children: an update. *Acta Otorhinolaryngol Ital.* 2019 Oct;39(5):289-97. doi: 10.14639/0392-100X-N0262.
2. Andersen IG, Holm JC, Homøe P. Obstructive sleep apnea in children and adolescents with and without obesity. *Eur Arch Otorhinolaryngol.* 2019 Mar;276(3):871-8. doi: 10.1007/s00405-019-05290-2.
3. Luzzi V, Ierardo G, Di Carlo G, Saccucci M, Polimeni A. Obstructive sleep apnea syndrome in the pediatric age: the role of the dentist. *Eur Rev Med Pharmacol Sci.* 2019 Mar;23(1 Suppl):9-14. doi: 10.26355/eurrev_201903_17341.
4. Chen VG, Fonseca VMGD, Amaral JB, Camargo-Kosugi CM, Moreira G, Kosugi EM, et al. Inflammatory markers in palatine tonsils of children with obstructive sleep apnea syndrome. *Braz J Otorhinolaryngol.* 2020 Jan-Feb;86(1):23-29. doi: 10.1016/j.bjorl.2018.08.001. Epub 2018 Aug 31.
5. DelRosso LM, Mogavero MP, Ferri R, Bruni O, Chen ML. Update and Progress in Pediatric Sleep Disorders. *J Pediatr.* 2021 Dec;239:16-23. doi: 10.1016/j.jpeds.2021.08.030.
6. Silva PMJ, Feitoza CC, Franco-Michelone AL, Pizol KEDC. [Obstructive sleep apnea and hypopnea syndrome in childhood: dental aspects]. *Rev Bras Multidiscipl.* 2021;24(1):187-98. doi: 10.25061/2527-2675/ReBraM/2021.v24i1.723. Portuguese.

7. Tapia IE, Shults J, Doyle LW, Nixon GM, Cielo CM, Traylor J, et al. Perinatal risk factors associated with the obstructive sleep apnea syndrome in school-aged children born preterm. *Sleep*. 2016 Apr;39(4):737-42. doi: 10.5665/sleep.5618.
8. Xu Z, Wu Y, Tai J, Feng G, Ge W, Zheng L, et al. Risk factors of obstructive sleep apnea syndrome in children. *J Otolaryngol Head Neck Surg*. 2020 Mar;49(1):11. doi: 10.1186/s40463-020-0404-1.
9. Saint-Fleur AL, Christophides A, Gummalla P, Kier C. Much ado about sleep: current concepts on mechanisms and predisposition to pediatric obstructive sleep apnea. *Children (Basel)*. 2021 Nov;8(11):1032. doi: 10.3390/children8111032.
10. Lee SY, Guilleminault C, Chiu HY, Sullivan SS. Mouth breathing, "nasal disuse," and pediatric sleep-disordered breathing. *Sleep Breath*. 2015 Dec;19(4):1257-64. doi: 10.1007/s11325-015-1154-6..
11. Barros EL, Pradella-Hallinan M, Moreira GA, Stefanini Dde O, Tufik S, Fujita RR. Follow-up of obstructive sleep apnea in children. *Braz J Otorhinolaryngol*. 2014 Jul-Aug;80(4):277-84. doi: 10.1016/j.bjorl.2014.05.008.
12. Au CT, Chan KCC, Liu KH, Chu WCW, Wing YK, Li AM. Potential anatomic markers of obstructive sleep apnea in prepubertal children. *J Clin Sleep Med*. 2018 Dec;14(12):1979-86. doi: 10.5664/jcsm.7518.
13. Soares MM, Romano FL, Dias FVDS, de Souza JF, de Almeida LA, Miura CS, et al. Association between the intensity of obstructive sleep apnea and skeletal alterations in the face and hyoid bone. *Braz J Otorhinolaryngol*. 2022 May-Jun;88(3):331-6. doi: 10.1016/j.bjorl.2020.06.008. Epub 2020 Jul 27.
14. Huang YS, Guilleminault C. Pediatric Obstructive Sleep Apnea: Where Do We Stand? *Adv Otorhinolaryngol*. 2017;80:136-144. doi: 10.1159/000470885.
15. Spilsbury JC, Storfer-Isser A, Rosen CL, Redline S. Remission and incidence of obstructive sleep apnea from middle childhood to late adolescence. *Sleep*. 2015 Jan;38(1):23-9. doi: 10.5665/sleep.4318.
16. Al-Shamrani A, Alharbi AS. Diagnosis and management of childhood sleep-disordered breathing. Clinical approach. *Saudi Med J*. 2020 Sep;41(9):916-29. doi: 10.15537/smj.2020.9.25262.
17. Martins CAN, de Deus MM, Abile IC, Garcia DM, Anselmo-Lima WTA, Miura CS, e al. [Translation and cross-cultural adaptation of the pediatric sleep questionnaire (PSQ*) into Brazilian Portuguese]. *Braz J Otorhinolaryngol*. 2022;88(S1):563-9. Portuguese. doi: 10.1016/j.ijporl.2014.12.002.
18. Patel AP, Meghji S, Phillips JS. Accuracy of clinical scoring tools for the diagnosis of pediatric obstructive sleep apnea. *Laryngoscope*. 2020 Apr;130(4):1034-43. doi: 10.1002/lary.28146. Epub 2019 Jun 24.
19. Camacho M, Chang ET, Song SA, Abdullatif J, Zaghi S, Pirelli P, et al. Rapid maxillary expansion for pediatric obstructive sleep apnea: A systematic review and meta-analysis. *Laryngoscope*. 2017 Jul;127(7):1712-9. doi: 10.1002/lary.26352. Epub 2016 Oct 31.
20. Luchesa CJ, Chaves Neto A. [Calculating sample size in management research]. Curitiba: Author's edition; 2011. Portuguese.
21. Perrone APF, Ferreira VR, Prado LFD, Prado GFD, Machado MA, Carvalho LBC. Translation and adaptation of the sleep apnea quality of life index (SAQLI) to Brazilian Portuguese. *Arq Neuropsiquiatr*. 2022 Jun;80(6):616-9. doi: 10.1590/0004-282X-ANP-2021-0275.
22. da Silva Gusmão Cardoso T, Pompéia S, Miranda MC. Cognitive and behavioral effects of obstructive sleep apnea syndrome in children: a systematic literature review. *Sleep Med*. 2018 Jun;46:46-55. doi: 10.1016/j.sleep.2017.12.020.

23. Corrêa CC, Cavalheiro MG, Maximino LP, Weber SA. Obstructive sleep apnea and oral language disorders. *Braz J Otorhinolaryngol*. 2017 Jan-Feb;83(1):98-104. doi: 10.1016/j.bjorl.2016.01.017. Epub 2016 Apr 28.
24. Ehsan Z, Ishman SL, Kimball TR, Zhang N, Zou Y, Amin RS. Longitudinal cardiovascular outcomes of sleep disordered breathing in children: a meta-analysis and systematic review. *Sleep*. 2017 Mar;40(3):zsx015. doi: 10.1093/sleep/zsx015.
25. Wang J, Zhao Y, Yang W, Shen T, Xue P, Yan X, et al. Correlations between obstructive sleep apnea and adenotonsillar hypertrophy in children of different weight status. *Sci Rep*. 2019 Aug;9(1):11455. doi: 10.1038/s41598-019-47596-5.
26. Huang YS, Hwang FM, Lin CH, Lee LA, Huang PY, Chiu ST. Clinical manifestations of pediatric obstructive sleep apnea syndrome: Clinical utility of the Chinese-version Obstructive Sleep Apnea Questionnaire-18. *Psychiatry Clin Neurosci*. 2015 Dec;69(12):752-62. doi: 10.1111/pcn.12331.
27. Huang YS, Guilleminault C. A review of treatment options in Paediatric sleep-disordered breathing. *Pediatr Respirol Crit Care Med*. 2017;1(3):54-8. doi: 10.4103/prom.prcm_5_17.
28. Ingram DG, Singh AV, Ehsan Z, Birnbaum BF. Obstructive sleep apnea and pulmonary hypertension in children. *Paediatr Respir Rev*. 2017 Jun;23:33-9. doi: 10.1016/j.prrv.2017.01.001.
29. Morgan KH, Groer MW, Smith LJ. The controversy about what constitutes safe and nurturant infant sleep environments. *J Obstet Gynecol Neonatal Nurs*. 2006 Nov-Dec;35(6):684-91. doi: 10.1111/j.1552-6909.2006.00099.x.