Diagnostic capability of questionnaires and clinical examinations to assess sleep-disordered breathing in children: A systematic review and meta-analysis*

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De Luca Canto G[1], Singh V[2], Major MP[3], Witmans M[4], El-Hakim H[5], Major PW[6], Flores-Mir C[7]

1 Adjunct professor, Department of Dentistry, Federal University of Santa Catarina, Brazil. Postdoctoral Fellow, School of Dentistry*A. 2 Clinical Instructor, Orofacial Pain Graduate Program, School of Dentistry*. 3 Clinical Assistant Professor and Director of the Inter-disciplinary Airway Research Clinic, School of Dentistry*. 4 Associate Clinical Professor, Pediatrics*. 5 Associate Professor, Pediatric Otolaryngology*. 6 Professor and Chair, School of Dentistry, Senior Associate Dean, Dental Affairs*. 7 Associate Professor, Division Head of Orthodontics, School of Dentistry*.

***Faculty of Medicine and Dentistry, University of Alberta, Canada**

Background. The gold standard for the diagnosis of pediatric Sleep Disorder Breathing (SDB) is a full polysomnography (PSG). Access to full PSG is not easy, therefore the diagnostic value of alternative pediatric SDB diagnostic methods (clinical history and/or physical examination) was evaluated.

Practical Implications. Involvement of dentists in pediatric SDB screening and referring process can contribute significantly to the children's health. The identified questionnaire (PSQ) could be considered an acceptable screening test before referring to the pediatric sleep medicine specialist.

METHODS

Eligibility Criteria. Population: individuals from 0 to 18 years of age. Intervention: studies whose primary objective was to evaluate the diagnostic capability of clinical evaluation and/or questionnaires to diagnose pediatric SDB. Comparison: Full overnight PSG (gold standard) as a reference test.

Search. Databases: MEDLINE, PubMed, EMBASE, The Cochrane Library, LILACS, and Google Scholar. References cited in the selected articles. End search date: August 19, 2013.

Study Selection. Phase 1: two reviewers independently reviewed the titles and abstracts of all citations. Phase 2: the same selection criteria were applied to the full articles. Any disagreement in study selection process was resolved again by discussion and mutual agreement between the authors.

Data Collection Process and Data Items. One author collected the required information from the selected articles. A second author crosschecked all the retrieved information. Any disagreement in data collection process was resolved again by discussion and mutual agreement between the authors.

Risk of Bias in Individual Studies. The methodology of selected studies was evaluated using the 14- item Quality Assessment Tool for Diagnostic Accuracy Studies (QUADAS)[1].

Summary Measures. Sensitivity and specificity of the diagnostic tests were the main outcome evaluated.

Synthesis of Results. Review Manager 5.2[2] was used to constructed ROC graphs and Forest plots as part of the meta-analysis.

Risk of Bias Across Studies. To decrease the heterogeneity, the studies were separated in 4 groups to provide the meta-analysis according with the index test.

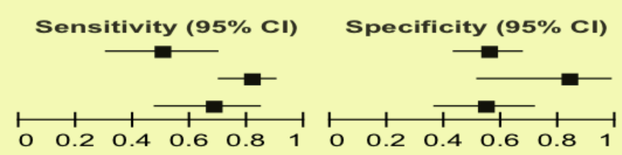
Additional Analyses. Additional analysis was done using PPV, NPV, LR+, LR-, diagnostic OR, and *Youden's* Index.

RESULTS

From 1,127 different citations, 35 were retrieved for more detailed full-text evaluation. At the end 11 articles had data enough to meta-analysis. **Only one test (PSQ[4]) had diagnostic accuracy good enough to be used as a screening method for pediatric SDB as we can see below.**

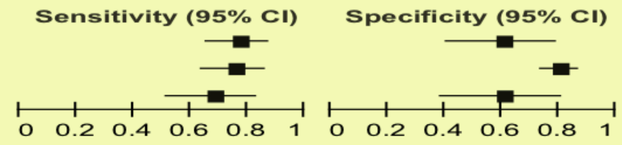
A Questionnaire

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Chan et al 2012	14	33	14	41	0.50 [0.31, 0.69]	0.55 [0.43, 0.67]
Chervin et al 2000	56	2	13	10	0.81 [0.70, 0.90]	0.83 [0.52, 0.98]
Yang et al 2010	19	16	9	19	0.68 [0.48, 0.84]	0.54 [0.37, 0.71]



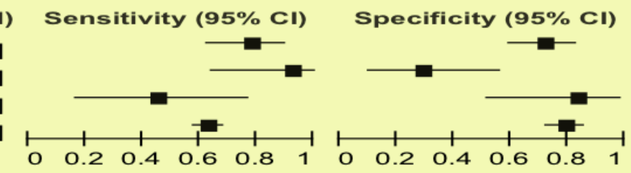
B Questionnaire and physical examination

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Goldstein et al 2012	51	11	15	17	0.77 [0.65, 0.87]	0.61 [0.41, 0.78]
Li et al 2006	50	32	16	131	0.76 [0.64, 0.85]	0.80 [0.73, 0.86]
Spronson et al 2009	26	9	12	14	0.68 [0.51, 0.82]	0.61 [0.39, 0.80]



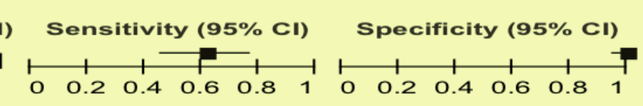
C Questionnaire, physical examination and other test

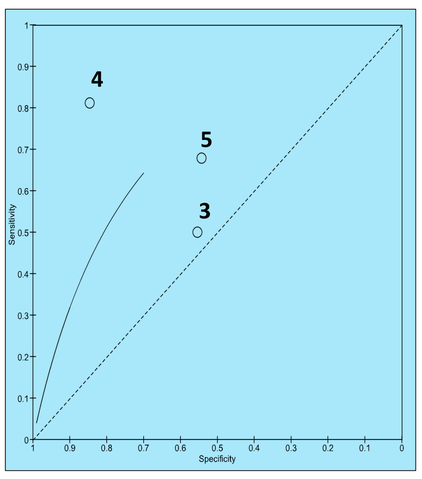
Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Chervin et al 2007	32	18	9	46	0.78 [0.62, 0.89]	0.72 [0.59, 0.82]
Goldstein et al 1994	12	12	1	5	0.92 [0.64, 1.00]	0.29 [0.10, 0.56]
Lamm et al 1999	5	2	6	10	0.45 [0.17, 0.77]	0.83 [0.52, 0.98]
Yang et al 2012	229	34	135	129	0.63 [0.58, 0.68]	0.79 [0.72, 0.85]



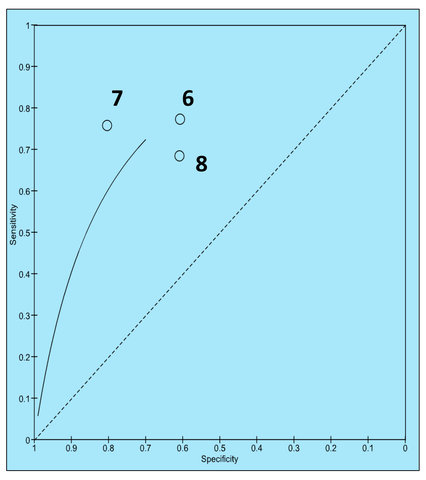
D Physical examination and other test

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Supriyatano et al 2010	26	0	16	68	0.62 [0.46, 0.76]	1.00 [0.95, 1.00]

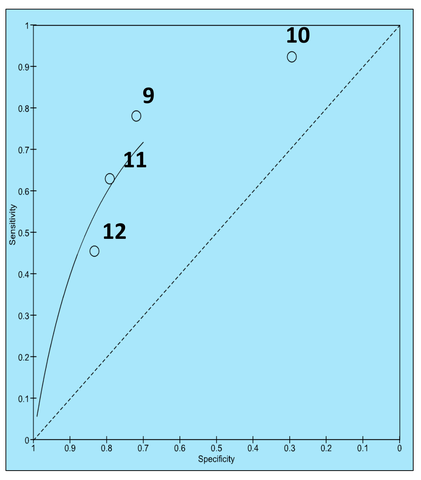




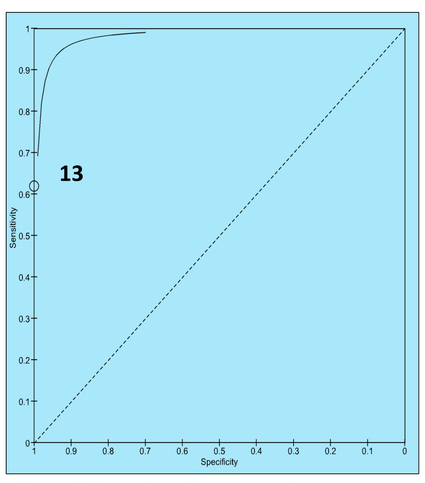
A – Questionnaire



B – Questionnaire and physical examination



C - Questionnaire, physical examination and/or other test



D - Physical examination and other test

CONCLUSION

The PSQ[4] had the best diagnostic accuracy of the evaluated tests. As it does not attain diagnostic values high enough to replace the current gold standard (PSG), it should only be used be used as a screening tool to identify pediatric SDB.

References

1. Whiting P, Rutjes AWS, Reitsma JB. The development of QUADAS: a tool for the quality assessment of studies of diagnostic accuracy included in systematic reviews. BMC Medical Research Methodology. 2003:1-13. Available from "http:/.biomedicentral.com/1471-2288/3/25".
2. Review Manager (Rev Man) [Computer program]. Version 5.2. Copenhagen: The Nordic Cochrane Centre,The Cochrane Collaboration, 2012.
3.Chan CH, Ng DK. Validation of sleep-related breathing disorder scale in Hong Kong Chinese snoring children. Pediatr Pulmonol 2012; 47(8):795-800.
4.Chervin RD, Hedger K, Dillon JE, Pituch KJ. Pediatric Sleep Questionnaire (PSQ): validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness and behavioral problems. Sleep Medicine 2000; 1:21-32.
5.Yang CM, Huang YS, Song YC. Clinical utility of the Chinese version of the pediatric daytime sleepiness scale in children with obstructive sleep apnea syndrome and narcolepsy. Psychiatry Clin Neurosci 2010; 64(2): 134-140.
6.Goldstein NA, Stefanov DG, Graw-Panzer KD, Fahmy SA, Fishkin S, Jackson A, Sarhis JS, Weedon Jeremy. Validation of a clinical assessment score for pediatric sleep-disordered breathing. Laryngoscope 2012; 122:2096-2104.
7.Li AM, Cheung A, Chan D, Wong E, Ho C, Lau J, Wing YK. Validation of a questionnaire instrument for prediction of obstructive sleep apnea in Hong Kong Chinese children. Pediatr Pulmonol 2006; 41:1153-1160.
8.Spronson EL, Hogan AM, Hill CM. Accuracy of clinical assessment of pediatric obstructive sleep apnea in two English centres. J Laryngol Otol 2009; 123(9):1002-1009.
9.Chervin RD, Weatherly RA, Gaertz SL, Ruzicka DL, Giordani BJ, Hodges EK, Dillon JE, Guire KE. Pediatric sleep questionnaire: Prediction of sleep apnea and outcomes. Arch Otolaryngol Head Neck Surg 2007; 133:216-222.
10.Goldstein NA, Sculerati N, Walsleben JA, Bhatia N, Friedman DM, Rapoport DM. Clinical diagnosis of pediatric obstructive sleep apnea validated by polysomnography. Otolaryngol Head Neck Surg 1994; 111(5):611-617.
11.Lamm C, Mandelli J, Kattan M. Evaluation of home audiotapes as an abbreviated test for obstructive sleep apnea syndrome (OSAS) in children. Pediatr Pulmonol 1999; 27(4): 267-272.
12.Yang Y, Xu Z, Chen M, Zhang Y. Exploration of screening scores for pediatric obstructive sleep apnea hypopnea syndrome. Lin Chung Er Bi Yan Hou Tou Jing Wai Ke Za Zhi 2012;26(15): 680-683.
13.Supriyatno B, Said M, Hermani B, Sjarir DR, Sastroasmoro S. Risk factors of obstructive sleep apnea syndrome in obese early adolescents: a prediction model using scoring system. Acta Med Indones 2010; 42(3): 152-157.