Diagnostic capability of questionnaires and clinical examinations to assess sleep-disordered breathing in children

A systematic review and meta-analysis

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ABSTRACT

Background. The reference standard for the diagnosis of pediatric sleep-disorder breathing (SDB) is a full polysomnography (PSG) (an overnight sleep study). There are many obstacles to children being able to undergo a full PSG; therefore, the authors evaluated the diagnostic value of alternative diagnostic methods (clinical history and physical examination) for pediatric SDB.

Types of Studies Reviewed. The authors selected articles in which the investigators' primary objective was to evaluate the diagnostic capability of physical evaluations and questionnaires compared with the current reference standard (that is, a full PSG) to diagnose SDB in children younger than 18 years. The authors searched several electronic databases without limitations.

Results. Using a two-step selection process, the authors identified 24 articles and used them to conduct a qualitative analysis. They conducted a meta-analysis on 11 of these articles. Among these articles, only one involved a test that had diagnostic accuracy good enough to warrant its use as a screening method for pediatric SDB, but its diagnostic accuracy was not sufficient to be considered a true diagnostic tool (that is, a replacement for full PSG) for pediatric SDB.

Practical Implications. The involvement of dentists in the screening process for pediatric SDB can contribute significantly to children's health. The identified questionnaire could be considered an acceptable screening test to determine which children to refer to a sleep medicine specialist.

Key Words. Obstructive sleep apnea; sleep apnea syndrome; decision making; evidence-based dentistry.
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Pediatric sleep-disordered breathing (SDB) is a diagnosis that reflects a spectrum of symptoms and conditions, ranging from snoring to upper airway resistance syndrome to obstructive sleep apnea (OSA).[1] The prevalence of snoring in children has been reported to be at least 34 percent,[2,3] and it is the most prevalent symptom of pediatric obstructive sleep apnea (POSA).[4] In contrast, the prevalence of POSA is reported to be from 1 through 4 percent.[5-7]

Pediatric SDB symptoms include habitual snoring, excessive daytime sleepiness, disturbed sleep and daytime neurobehavioral problems.[8,9] Although tonsil and adenoid hypertrophy is acknowledged generally as the most common etiology of SDB,[10] evidence indicates that a growing number of other risk factors contribute to SDB such as obesity,[9] craniofacial anomalies,[9] neuromuscular disorders,[9] nasal abnormalities,[7] waist circumference,[7] metabolic factors,[7] neck circumference,[10] ethnicity,[11] asthma,[12] local environmental irritants[13] and preterm birth.[6] If SDB is left untreated, it can be a cause of significant morbidity in children and could lead to growth failure, neurocognitive and behavioral abnormalities, and cardiovascular effects, including cor pulmonale, ventricular dysfunction and systemic hypertension.[1]

SDB is of significant relevance to practicing dentists as it has been associated with a variety of oral and craniofacial problems, such as a retrusive chin,[14] Class II malocclusion,[14] vertical growth direction[14] and sleep bruxism.[15-20]

Sleep laboratory–based polysomnography (PSG) is considered the reference standard for the diagnosis and

assessment of SDB in children.[21] However, conducting PSG sleep studies is onerous and labor-intensive, leads to substantial discomfort for children and their families, and is relatively inaccessible to children. Waiting times between referral for evaluation and diagnosis commonly are five to six months worldwide.[22] The relative complexity and costs associated with PSG for diagnosing most sleep disorders has spurred the quest for alternative diagnostic methods, particularly for children.[22] The alternative diagnostic methods that have been evaluated include medical history and physical examination,[1,23] audiotaping,[24] videotaping,[25] pulse oximetry[26] and abbreviated PSG.[27]

Investigators in numerous studies have assessed the accuracy of clinical symptoms and signs in indicating the presence of POSA, but they found that the accuracy varied significantly for different symptoms and signs, as well as across studies.[28] This scenario supports the execution of systematic reviews and meta-analyses to determine which signs and symptoms can be used in the diagnosis of SDB. Authors of systematic reviews have evaluated the diagnostic value of questionnaires, clinical assessments or both as related to the use of PSG to diagnose SDB in children.[28-30] However, these reviews focused on the physician's use of these methods, ignoring the growing role of dentists.[31-34] We have identified potentially pertinent studies[21,35-43] that were not included in the previous systematic reviews for different reasons.

Because dentists commonly are not able to make referrals for PSG, we conducted a systematic review to evaluate the diagnostic value of alternative tests that are available in dental practice—specifically, clinical history, physical examination or both—to diagnose SDB in children.

METHODS

We conducted this systematic review by following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist.[44] We did not register the systematic review protocol.

Eligibility criteria. We selected only articles in which the primary objective was to evaluate the diagnostic capability of a clinical evaluation (that is, clinical history, physical examination or both), questionnaire or both to diagnose pediatric SDB. Full PSG had to be used as the reference test. The evaluated population had to be children from 0 to 18 years of age. We considered studies that were published in any language. We excluded published reviews, letters and personal opinions.

Information sources and search strategies. We developed detailed individual search strategies for each of the following bibliographic electronic databases: MEDLINE, PubMed, Embase, Cochrane Library and LILACS. (More information on the search strategies is provided in Appendix 1, which can be found in the supplemental data to the online version of this article [found at http://jada.ada.org/content/145/2/165/suppl/DC1].) We also hand searched the reference lists in the selected articles for any additional references that might have been missed in the electronic database searches. We undertook a gray literature search by using Google Scholar. We limited this search to the 100 most recent hits. We conducted all searches from beginning dates through Aug. 19, 2013, across all databases. We managed the references by using software (RefWorks-COS, ProQuest, Bethesda, Md.) and removed duplicate hits.

Study selection. We selected articles in two phases. In phase 1, two authors (G.L.C., V.S.) independently reviewed the titles and abstracts for all of the references. They excluded any articles that did not appear to meet the inclusion criteria from further evaluation. In phase 2, they applied the same selection criteria to the full text of the articles to determine which ones to include, as some abstracts may have presented study details incorrectly or only partially. The same two authors independently reviewed all full-text articles. Any disagreement in the first or second phase was resolved by means of discussion and mutual agreement between the two authors. A third author (C.F.-M.) became involved, when required, to make a final decision.

Data collection process. One author (G.L.C.) collected the required information (authors, year of publication, country, sample size, ages of participants, methods, index test, reference standard and findings) from the selected articles. A second author (V.S.) cross-checked all the retrieved information. Again, any disagreement was resolved by means of discussion and mutual agreement between the two authors. The third author (C.F.-M.) was involved, when required, to make a final decision.

Data items. For each of the included studies, we recorded the author, year of publication, country, size and demographic features of the sample (age range and mean), type of diagnostic approach (questionnaire, clinical, PSG) and the results related to diagnostic capabilities of the tests.

Risk of bias in individual studies. We evaluated the methodology of selected studies by using the 14-item Quality Assessment Tool for Diagnostic Accuracy Studies (QUADAS).[45] Two authors (G.L.C., V.S.) scored each data item as "yes," "no" or "unclear" and assessed independently the quality of each included study. The third author (C.F.-M.) resolved any disagreement between the authors.

ABBREVIATION KEY. **OSA:** Obstructive sleep apnea. **OSA-18:** Obstructive Sleep Apnea-18. **OSAS:** Obstructive sleep apnea syndrome. **PDSS:** Pediatric Daytime Sleepiness Scale. **POSA:** Pediatric obstructive sleep apnea. **PRISMA:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses. **PSG:** Polysomnography. **PSQ:** Pediatric Sleep Questionnaire. **QUADAS:** Quality Assessment Tool for Diagnostic Accuracy Studies. **SDB:** Sleep-disordered breathing. **SDSC:** Sleep Disturbance Scale for Children. **SRBD:** Sleep-Related Breathing Disorder.