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Identification and evaluation of obstructive sleep apnea prior to adenotonsillectomy in children: a survey of practice patterns

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Abstract

Objectives: Some data suggest that the clinical diagnosis of obstructive sleep apnea (OSA) in a child should be confirmed by polysomnography before adenotonsillectomy (AT), but otolaryngology literature generally does not agree and few studies have examined surgical practice patterns.

Methods: We mailed, to 603 members of two North American otolaryngology societies, surveys about children aged 5.0–12.9 years upon whom they performed ATs in the previous year.

Results: A total of 183 otolaryngologists estimated that they had performed 24,000 ATs. Reported major surgical indications, not mutually exclusive, included recurrent throat infections (for 42% of procedures), obstructed breathing of any type (59%), OSA (39%), poor school performance (17%), and poor attention (11%). Pre-operative evaluations included an office-based, sleep-related history in 93% of children, any objective testing for OSA in $<10\%$, and laboratory-based polysomnography in $<5\%$. Surgeons with academic affiliations, higher volumes of ATs, and pediatric specialization reported lower percentages of ATs performed for recurrent tonsillitis as opposed to other indications.

Conclusions: As a common indication for AT, OSA now rivals recurrent throat infection. No more than 12% of school-aged children who undergo AT for OSA have polysomnography prior to the procedure. Indications for AT may depend, in part, on practice settings and otolaryngologists' backgrounds.

Keywords: Otorhinolaryngologic diseases; Physician's practice patterns; Tonsillectomy; Sleep apnea syndromes; Sleep disorders; Polysomnography; Attention deficit disorder with hyperactivity; Child

1. Introduction

Adenotonsillectomy (AT) remains one of the most commonly performed procedures in children despite a declining frequency during the past several decades [1,2]. Much of the decline has resulted from conservative management of recurrent tonsillitis. The number of children operated for obstructed breathing, and especially obstructive sleep apnea (OSA), has increased as a proportion of the total number of procedures [3]. However, interdisciplinary consensus does not exist on whether polysomnography is necessary to confirm a clinical diagnosis of OSA prior to AT [4]. The American Academy of Pediatrics recommends objective testing prior to AT [5]. Otolaryngology textbooks do not recommend such testing except under specific circumstances [6]. Some studies suggest that diagnosis is inaccurate without polysomnography, but the extent to which laboratory findings improve prediction of impact or outcome in pediatric OSA is not well known. Similarly, increasing data suggest that one of the most common consequences of OSA may be cognitive and behavioral morbidity [7,8], but whether pre-operative identification of these problems is best accomplished by

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behavioral specialists or specific testing is also not known.

To explore current AT indications, pre-operative evaluations, and outcomes, we surveyed a large number of North American otolaryngologists about their practices and the number of ATs they performed on children in the previous year. We used the data to characterize the experience of the children, and the relation of that experience to several practice-specific characteristics.

2. Methods

2.1. Subjects

In July, 2000, we mailed Institutional Review Board-approved practice pattern surveys to 603 members of two national otolaryngology societies: all 111 North American members of the American Society of Pediatric Otolaryngology, and a random sample of 492 members of the American Academy of Otolaryngology, Head and Neck Surgery (total membership = 12,000). The respective society offices provided names and addresses. Surveys were anonymous, but were accompanied by coded postcards to be mailed separately and simultaneously with the completed questionnaire. Physicians whose postcards were not received initially were sent an additional reminder about 1 month later. By November 2000, 208 questionnaires had been returned, and 183 contained sufficient responses to allow inclusion in the current analysis.

2.2. Survey

We designed a three-page survey (see Appendix A) that asked about ATs performed during the previous 12 months in children aged 5.0–12.9 years. This age range was chosen in part because disruptive behavior disorders, among the important outcomes of sleep-disordered breathing, are difficult to diagnose at younger ages. The survey asked for (i) an estimate of the number of such ATs performed, (ii) the percent of cases in which each of several problems were important indications for surgery, (iii) the percent of children who had each of several pre-operative evaluations, (iv) specific methods of such evaluation, and (v) the percent of children with each of several pre-operative symptoms who exhibited significant improvement of that symptom. Respondents circled 0, 20, 40, 60, 80, or 100% for questions (ii) and (v), and wrote the numbers of their choice into blank spaces for responses to the other items. Finally, the instrument collected limited data about respondents' practice setting and training. The survey was pilot-tested and ambiguities were corrected before this study, based on responses from members of the state-wide Michigan Otolaryngologic Society.

2.3. Analysis

The number of ATs reported by individual otolaryngologists were used to weight their responses and generate estimates about the experience of operated children. Although this technique did not permit statistical comparisons between children, chi-square tests were used to examine associations between practice patterns and specific otolaryngologist characteristics. Logistic regression models were used to determine whether practice patterns were associated independently with specific practitioner characteristics. Analyses were performed with SAS®, version 6.12 (SAS Institute Inc., Cary, NC). The level of significance was set at $p < 0.01$.

3. Results

The 183 respondents practiced in 39 different states in the US and three provinces in Canada. Respondents estimated that during the past 12 months they were primary surgeons for a total of 23,981 ATs, which form the basis for this report. The average number of ATs per surgeon was 131 ± 96 (s.d.); the range was 12–700.

3.1. Children's experience

The estimated number and percent of children who had each of several important indications for surgery are listed in Table 1. OSA and recurrent tonsillitis were considered important indications for surgery in about the same proportions of patients. Cognitive and behavioral concerns were important considerations in substantial minorities of the children.

Pre-operative evaluations included an office-based sleep-related history in 93% of the children, but fewer than 10% received formal testing with oximetry, cardiorespiratory home sleep studies, or laboratory-based polysomnography (Table 2). If all reported polysomnography was performed only in those children operated for OSA, still no more than 12% of children who had AT for OSA had had prior polysomnography (4.5% studied/39% with indication = 0.115). Otolaryngologists reported that they performed an office-based behavioral evaluation in 36% of the children, but virtually no patients received evaluations by a child psychiatrist, assessment by a child psychologist, or neuropsychometric or behavioral testing.

Surgeons generally described good surgical outcomes (Table 3). In nearly all cases, throat infections, obstructed breathing patterns, and OSA improved post-operatively. When present pre-operatively, cognitive and behavioral symptoms, except for depression, improved in 20–48% of the cases.

Table 1
Estimated number and percent of children with each specified indication for AT

Indication	Number with indication	Out of total possible[a]	Percent with indication
Recurrent throat infections	9859	23559	42
Obstructed breathing of any type	13713	23059	59
OSA	9110	23073	39
Poor school performance	3385	20512	17
Poor attention	2269	20412	11
Memory deficits	942	20012	5
Learning disabilities	1630	20262	8
Hyperactive behavior	1900	20112	9
Aggressive behavior	931	19462	5
Conduct problems	1455	20162	7
Depression	493	19612	3

Data aggregated from clinician estimates, and individual patients could have had more than one 'important indication' for surgery.
[a] Total possible varied because not all respondents answered every item.

3.2. Otolaryngologist characteristics and indications for surgery

Most respondents (73%) worked in a private group, or hospital-based practice, whereas a smaller group with partial overlap (37%) reported that they worked in academic medicine. Most (69%) were board-eligible or certified in otolaryngology, some (23%) had subspecialty training in pediatric otolaryngology, and none were board-eligible or certified in sleep medicine. Reported frequencies of major AT indications, averaged across respondents, are shown in Table 4.

Each surgeon was classified as using each indication 'relatively frequently' or 'infrequently': for the three most common indications, 'frequently' was arbitrarily defined as $\geq 60\%$ of reported cases, and for all other symptoms 'frequently' was defined as $\geq 20\%$. Frequent use of each indication was then tested for association with each of three respondent characteristics: practice volume, pediatric otolaryngology subspecialty training, and practice setting (Table 5). Higher than average practice volume, subspecialty training, and academic practice settings each predicted less frequent use of recurrent throat infection as an indication for AT ($p < 0.01$). High practice volume also predicted more frequent use of four other indications for surgery: poor attention, learning disabilities, hyperactive behavior, and conduct problems ($p < 0.01$ for each). Other associations did not reach statistical significance, though high practice volume, subspecialty training, and academic settings almost always tended to predict slightly higher rates of non-infectious indications.

High practice volume, academic setting, and pediatric subspecialty training were each associated with the other two variables (Chi-square $p < 0.01$ for each comparison). However, logistic regression models of significant (Table 5) associations between AT indications and respondent characteristics confirmed that each association was still significant after accounting for the two remaining respondent characteristics, with only two exceptions. The association between subspecialty training and recurrent infection became marginally insignificant ($p = 0.03$), as did that between practice volume and conduct problems ($p = 0.01$).

Table 2
Estimated number and percent of children who received each pre-operative evaluation

Evaluation	Number who received evaluation	Out of total possible[a]	Percent who received evaluation
Sleep-related history as part of H and P	21575	23229	92.9
Nocturnal oximetry	677	21389	3.2
Cardiorespiratory sleep study at home	472	21255	2.2
Laboratory-based polysomnography	1045	23120	4.5
Behavioral evaluation as part of H and P	7716	21472	35.9
Evaluation by a child psychiatrist	147	20529	0.7
Evaluation by a child psychologist	177	20504	0.9
Neuropsychometric or behavioral testing	160	20069	0.8

[a] Total possible varied because not all respondents answered every item.

Table 3
Estimated percentage of children with each symptom who showed significant improvement after surgery

Symptom	Number of surgeons who answered question[a]	Percentage of children improved
Recurrent throat infections	173	93
Obstructed breathing of any type	177	93
OSA	170	91
Poor school performance	94	48
Poor attention	90	43
Memory deficits	71	18
Learning disabilities	81	24
Hyperactive behavior	82	28
Aggressive behavior	75	20
Conduct problems	78	24
Depression	65	9

Percentage improvement provided by each physician was weighted by the relative proportion of adenotonsillectomies reported by that physician.
[a] Lack of response would have arisen when surgeons had no patients with the given symptom, but also if surgeons simply failed to complete the questionnaire.

3.3. Otolaryngologist characteristics and pre-operative evaluations

Each of eight pre-operative sleep and behavior evaluation methods were reported to have been used in highly variable proportions of the otolaryngologists' patients (Table 6). Surgeons who performed more than the average number of ATs, in comparison to remaining surgeons, were significantly more likely to use pre-operative polysomnography, nocturnal oximetry, neuropsychometric or behavioral testing, and an office-based behavioral evaluation ($p < 0.01$ for each). Surgeons with subspecialty training in pediatric otolaryngology were more likely than others to use polysomnography ($p < 0.01$). Surgeons in an academic practice setting were more likely than others to use polysomnography or nocturnal oximetry ($p < 0.01$). After controlling for covariation between practice volume, board status, and practice setting, surgeons in high volume or academic practices were still more likely to use full polysomnography ($p < 0.01$), and surgeons in high volume practices were still more likely to use nocturnal oximetry and behavioral evaluation in their offices ($p < 0.01$). However, other associations between practice characteristics and pre-operative evaluations lost significance.

Surgeons reported widely disparate practices: full polysomnography was obtained in 0–50% (median 2%) of each surgeon's patients prior to AT, cardiorespiratory sleep studies in 0–95% (median 0), nocturnal oximetry in 0–100% (median 0), and a sleep-related history in 0–100% (median 100). Evaluation by a child psychiatrist was obtained in 0–20% (median 0), by a child psychologist in 0–20% (median 0), by neuropsychometric or behavioral testing in 0–20% (median 0), and by behavioral evaluation as part of a history and physical examination in 0–100% (median 5).

When polysomnography was used for any of a respondent's patients ($n = 123$ surgeons), acknowledged reasons included clinical evidence of sleep-disordered breathing but no other active medical problems (27% of respondents), clinical uncertainty regarding the presence of

Table 4
Responses of otolaryngologists; percent of operated patients for whom each symptom was considered an important indication for adenotonsillectomy

Indication	Number of otolaryngologists who listed any response	Mean ± s.d. (%)
Recurrent throat infections	181	45 ± 21
Obstructed breathing of any type	177	57 ± 21
OSA	175	38 ± 22
Poor school performance	146	14 ± 15
Poor attention	146	10 ± 13
Memory deficits	144	3 ± 8
Learning disabilities	145	6 ± 10
Hyperactive behavior	144	7 ± 11
Aggressive behavior	141	4 ± 9
Conduct problems	144	6 ± 10
Depression	141	2 ± 6

Table 5
Does practice volume, subspecialty training, or practice setting predict use of specific symptoms as important surgical indications? Percent of otolaryngologists who listed each indication as important in a high proportion of ATs performed:

Indication	All surgeons	Practice volume[a]		Subspecialty training in pediatric otolaryngology		Practice setting	
		>Average ($n = 76$)	≤Average ($n = 107$)	Yes ($n = 42$)	No ($n = 138$)	Academic ($n = 67$)	Not academic ($n = 113$)
Recurrent throat infections	34	***23***	***42***	***12***	***41***	***15***	***46***
Obstructed breathing of any type	67	75	62	75	65	75	63
OSA	30	34	29	39	27	33	28
Poor school performance	55	63	50	67	53	65	52
Poor attention	42	***56***	***30***	48	40	53	35
Memory deficits	17	26	10	22	15	24	13
Learning disabilities	30	***44***	***20***	28	32	34	29
Hyperactive behavior	33	***51***	***20***	39	32	45	26
Aggressive behavior	20	27	15	20	20	28	16
Conduct problems	28	***40***	***20***	34	27	38	24
Depression	10	15	6	13	9	18	6

Bold/italicized values indicate Chi-square $p < 0.01$ for difference between 'yes' and 'no'. A 'high proportion of ATs performed' was arbitrarily defined as ≥60% (for recurrent infections, obstructed breathing, OSA) or ≥20% (for all other symptoms). OSA = olostructive sleep apnea.
[a] Average = 131 procedures/year.

sleep-disordered breathing (78%), need to assess the severity of sleep-disordered breathing (71%), neuromuscular compromise (52%), craniofacial (structural) abnormalities (59%), and the presence of named syndromes (e.g. Down's syndrome; 59%). Formal behavioral testing was used by only four respondents, in these cases because of clinical evidence of behavioral abnormalities (all four), concern about attention-deficit/hyperactivity disorder (ADHD) (three), and problems with behavior or learning at school (four).

3.4. Otolaryngologist characteristics and surgical outcomes

When otolaryngologists were asked what percent of patients with a specified pre-operative symptom experienced significant improvement in that symptom after AT, responses exhibited wide ranges. For example, improvement occurred in 40–100% for recurrent throat infections, 10–100% for OSA, 0–100% for poor school performance, 0–100% for poor attention, and 0–100% for hyperactive behavior. However, practice volume, academic setting, and

Table 6
Does practice volume, board certification, or practice setting predict methods of pre-operative evaluation? Percent of otolaryngologists who used each method before AT in any of their patients, or (for sleep-related history only) in all of their patients:

Evaluation method	All surgeons	Practice volume[a]		Subspecialty training in pediatric otolaryngology		Practice setting	
		>Average ($n = 76$)	≤Average ($n = 107$)	Yes ($n = 42$)	No ($n = 138$)	Academic ($n = 67$)	Not academic ($n = 113$)
Full polysomnography in a sleep laboratory	70	***90***	***56***	***93***	***62***	***90***	***57***
Cardiorespiratory sleep study at home	26	35	20	24	26	36	20
Nocturnal oximetry	35	***54***	***22***	51	29	***49***	***25***
Sleep-related history as part of H and P	80	81	79	85	78	79	79
Evaluation by a child psychiatrist	12	20	7	17	10	20	7
Evaluation by a child psychologist	14	20	9	19	11	21	8
Neuropsychometric or behavioral testing	11	***19***	***4***	17	8	16	6
Behavioral evaluation as part of H and P	52	***66***	***43***	56	51	53	51

Bold/italicized values indicate Chi-square $p < 0.01$ for difference between 'yes' and 'no'. H = history; P = physical examination.
[a] Average = 131 procedures/year.

subspecialty training showed no significant associations with responses (all $p > 0.01$).

4. Discussion

This survey of two national otolaryngology societies suggests that OSA is used as an important indication for surgery in nearly 40% of ATs, but fewer than 5% of school-aged children who receive AT, and no more than 12% of patients operated for OSA, undergo polysomnography before their procedures. For substantial minorities of children, cognitive or behavioral problems were important indications for surgery, but virtually no surgeon used formal behavioral evaluations prior to AT. Indications for surgery and the extent to which polysomnography was used prior to AT did show some relation to practice volume, subspecialty training, and practice setting. Surgeons believed not only that most recurrent infections and OSA improved after surgery, but also that substantial proportions of behavioral problems improved. Although the retrospective study design and a 30% response rate may have limited precision and generalizability of results, the findings were sufficiently robust to suggest that these largely unexplored practice patterns have important clinical implications.

Indications for AT have changed in recent decades [1]. A review of 1722 procedures performed at a New York medical center between 1978 and 1986 found that use of OSA as the predominant indication increased from 0 to 19% [3]. The trend appears to have continued in subsequent years. Our survey of surgeons at many different medical centers suggested that OSA now rivals recurrent infection in frequency of use as an important indication for AT in children. Reduction in recurrent infection as an indication may have occurred due to improvements in conservative management, including antibiotic therapy, recognition that infections tend to abate with age, and acceptance that preserved pharyngeal lymphoid tissue plays some role in normal defense mechanisms. During the same period, clinicians have increasingly realized that OSA affects 1–3% of children [9–11], and that AT effectively treats OSA in about 80% of affected patients [12]. The current observation that otolaryngologists with higher AT volumes, pediatric subspecialty training, or academic practices all perform fewer ATs for tonsillitis, as a proportion of all ATs, suggests that these trends are not the result of misinformation, cost-containment policies, or suboptimal care.

Despite the high frequency of AT for OSA, our data suggest that fewer than 10% of operated children have any formal test for sleep-disordered breathing before their procedures. This practice does not conform with recent American Academy of Pediatrics recommendations [5], or with American Thoracic Society guidelines published 6 years earlier [13]. Both of these groups state that polysomnography—or at least a positive result on some other objective measure such as a cardiopulmonary nocturnal study—is required to avoid misdiagnosis. A bedside diagnosis may not 'miss' significant OSA often [5], but several studies, recently summarized [4], have reported that clinical diagnoses of OSA can be confirmed by polysomnography in only 30 [14], 37 [15], 37 [16], 42 [17], and 51% [12] of children studied. This rate may increase to 56% [18] if a tape recording of breathing during sleep is also used. Pre-operative polysomnographic data on an unselected community sample of children who receive AT for OSA have not been published, but the above studies in combination with our data suggest that in at least 50% of such cases, no OSA would be found by gold-standard laboratory measures.

On the other hand, current otolaryngology textbooks state that polysomnography is necessary before AT only under unusual circumstances [6]. Some studies that were not able to confirm bedside diagnoses of OSA with polysomnography used only a small number of question-items to define the bedside diagnosis, and none of these studies used equipment necessary to detect upper airway resistance syndrome [19], a form of obstructive sleep-disordered breathing that may affect many children [4,20]. The American Academy of Pediatrics acknowledges that whether or not 'primary snoring' (habitual snoring in the absence of clinical consequence) exists in children remains unknown [5]. If primary snoring is rare in children, pre-operative polysomnography may not always be necessary. Furthermore, outcomes of different approaches to childhood OSA, with and without pre-operative polysomnography, have not been studied. The cost of adding polysomnographic studies prior to AT—among the most common procedures performed in children—could more than double the cost of treating each child with OSA, and cost-effectiveness remains unknown [14].

Few data and no recommendations have been published about assessment of behavior or cognition prior to AT. Increasing evidence suggests that poor school performance and disruptive behavior, such as attention deficit and hyperactivity, are associated with untreated sleep-disordered breathing [7,8,21–23]. Preliminary data indicate that more than 40% of children scheduled for AT, regardless of the indication, may qualify for DSM-IV-based diagnoses of attention-deficit/hyperactivity disorder or oppositional-defiant disorder [24]. Nonetheless, our data suggest that formal evalu-

ation by psychologists, psychiatrists, or neuropsychometric studies is exceedingly rare prior to AT. About one-third of the children in our study did have some form of behavioral evaluation in their otolaryngologists' offices, perhaps leading to the many instances in which poor school performance, inattention, or hyperactivity were considered to be important indications for surgery. The frequency of surgery for these reasons—particularly among surgeons who are most experienced with AT—provides some clinical support for a causal relationship, as yet unproven, between OSA and symptoms of attention-deficit/hyperactivity disorder [25]. In the absence of randomized, controlled trials of AT for childhood OSA, the impression of our respondents that behavior often improves after surgery is consistent with previous reports from parents [26]. If the frequency of these behavioral problems and a causal effect of OSA are confirmed, formal behavioral evaluation may prove valuable in selection of appropriate candidates for AT.

Methodological limitations of the current study include reliance on clinician reports, which may be subject to memory bias and inaccuracy. Collection of information about clinician experience rather than specific subjects prevented analyses of some important questions, such as how often children with OSA also had additional indications for surgery. The advantage of the study design used, however, was the participation of 183 surgeons, most of whom would not have participated in a more time-consuming prospective study. Furthermore, a prospective research design might have altered the practice patterns under study. The response rate of 30% raises the possibility of significant selection bias. We were not able to sample non-responders and compare them to responders because the survey was anonymous. Advantages of anonymity included much shorter consent procedures and less motivation to modify answers for the sake of appearance or medico-legal concerns. Furthermore, a 30% response rate is not unusual when surveys are mailed to physicians [27]. We asked clinicians about children aged 5.0–12.9 years, and our results are difficult to generalize to children who are younger or older. Our study was directed at ages that include the large majority of children who undergo ATs [6], but did not include younger children who may receive polysomnograms more often than older children because of otolaryngologists' concern about postoperative morbidity in early AT. Our sample was geographically broad-based, drawn from national professional societies, and inclusive of a large number of ATs.

Despite these limitations, the current data begin to characterize for the first time some important practice patterns of otolaryngologists and referring pediatricians who guide their patients toward a final common endpoint, namely AT. Outcomes of childhood OSA and its treatment are not well known. Few cost-effectiveness studies have been performed. Children with OSA, during the year before diagnosis, consume more than twice as many health care dollars as controls matched for age, gender, and location [28]. Among adults, models suggest that polysomnography is more cost-effective in the diagnosis of OSA than home studies or no studies [29]. Many sleep medicine specialists believe that children—in whom the diagnosis of OSA can be more challenging than in adults—at least deserve pre-operative polysomnography [30]. No evidence-based explanation can be provided for why current practice of otolaryngologists, with respect to pre-operative polysomnography, differs substantially from that recommended by the American Academy of Pediatrics and American Thoracic Society. Possibilities raised by current data include inadequate availability of pediatric sleep laboratory beds outside large academic centers, insufficient training in pediatric otolaryngology, and relative lack of experience in practice. However, research has yet to prove that diagnoses based on polysomnography, as opposed to a bedside history and physical examination, better predict outcomes of AT. In addition, pre-operative polysomnography could add considerable costs or delay to effective treatment. Many children who receive AT for OSA also have other indications sufficient to warrant surgery. More data will be needed to establish optimal approaches to a highly prevalent sleep disorder and one of the most common surgical procedures in children.

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Appendix A

The otolaryngology questionnaire used to collect data for this study.

Research Questionnaire for Otolaryngologists regarding

Adenotonsillar Disease in Pediatric Patients

Directions:

Your answers to the following questions will provide data on current practice patterns for adentonsillectomy. Please follow the specific directions for each section. Thank you very much for sharing information about your practice.

I. Number of Procedures Performed

Please indicate the *number of adenotonsillectomies* you performed as the primary surgeon during the past 12 months in children aged 5.0 through 12.9 years:

_____

II. Surgical Indications

Among the adenotonsillectomies you performed as the primary surgeon in the last 12 months for children aged 5.0 to 12.9 years, please indicate the *percent of cases* in which you found each of the following choices to be an *important indication* for surgery. For each item, please circle the response that most closely approximates this number. (Note: Your responses may exceed 100% if some children had multiple indications for surgery.)

Indications for Surgery	**% of Patients with Indication**					
1. Recurrent throat infections	**0**	**20**	**40**	**60**	**80**	**100**
2. Obstructed breathing of any type	**0**	**20**	**40**	**60**	**80**	**100**
3. Obstructive sleep apnea	**0**	**20**	**40**	**60**	**80**	**100**
4. Poor school performance	**0**	**20**	**40**	**60**	**80**	**100**
5. Poor attention	**0**	**20**	**40**	**60**	**80**	**100**
6. Memory deficits	**0**	**20**	**40**	**60**	**80**	**100**
7. Learning disabilities	**0**	**20**	**40**	**60**	**80**	**100**
8. Hyperactive behavior	**0**	**20**	**40**	**60**	**80**	**100**
9. Aggressive behavior	**0**	**20**	**40**	**60**	**80**	**100**
10. Conduct problems	**0**	**20**	**40**	**60**	**80**	**100**
11. Depression	**0**	**20**	**40**	**60**	**80**	**100**

III. Pre-Operative Patient Evaluation

During the last 12 months, what *percent* of your 5.0 through 12.9 year-old adenotonsillectomy patients for whom you were the primary surgeon had each following assessments as part of their *pre-operative evaluation*?

Evaluation Method	**% of Patients Studied**
1. Full polysomnography in a sleep laboratory	_____%
2. Cardiorespiratory sleep study at home	_____%
3. Nocturnal oximetry	_____%
4. Sleep-related history as part of your H & P	_____%
5. Evaluation by a child psychiatrist	_____%
6. Evaluation by a child psychologist	_____%
7. Neuropsychometric or behavioral testing	_____%
8. Behavioral evaluation as part of your H & P	_____%

IV. Methods of Pre-Operative Patient Evaluation

A. Did you employ polysomnography as part of your pre-operative patient evaluation in any of your patients? Please check "Yes" or "No":

Yes _____ No _____

If you answered "Yes," please check the specific indication(s) from the following list that prompted you to request such testing:

1. Clinical evidence of sleep disordered breathing, but no other active medical probems
2. Clinical uncertainty regarding the presence of sleep disordered breathing ____
3. Need to assess the severity of sleep disordered breathing ____
4. Neuromuscular compromise ____
5. Craniofacial (structural) abnormalities ____
6. Named syndromes (e.g., Down's syndrome) ____

B. Did you employ formal behavioral testing as part of your pre-operative patient evaluation? Please check "Yes" or "No":

Yes _____ No _____

If you answered "Yes," please check the specific indication(s) from the following list that prompted you to request such testing:

1. Clinical evidence of behavioral abnormalities ____
2. Clinical diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) ____
3. Suspected Attention Deficit Hyperactivity Disorder (ADHD) ____
4. Problem with behavior and/or learning at school

V. Effects of Surgery

For each symptom listed below, please indicate the *percent of cases* in which your pediatric adenotonsillectomy patients exhibited *significant improvement* following surgery. Consider only those patients who had the symptom pre-operatively, whether or not the symptom was the primary indication for surgery. Please circle the response that most closely approximates this number.

Symptoms	**% of Patients Exhibiting Improvement**					
1. Recurrent throat infections	**0**	**20**	**40**	**60**	**80**	**100**
2. Obstructed breathing of any type	**0**	**20**	**40**	**60**	**80**	**100**
3. Obstructive sleep apnea	**0**	**20**	**40**	**60**	**80**	**100**
4. Poor school performance	**0**	**20**	**40**	**60**	**80**	**100**
5. Poor attention	**0**	**20**	**40**	**60**	**80**	**100**
6. Memory deficits	**0**	**20**	**40**	**60**	**80**	**100**
7. Learning disabilities	**0**	**20**	**40**	**60**	**80**	**100**
8. Hyperactive behavior	**0**	**20**	**40**	**60**	**80**	**100**
9. Aggressive behavior	**0**	**20**	**40**	**60**	**80**	**100**
10. Conduct problems	**0**	**20**	**40**	**60**	**80**	**100**
11. Depression	**0**	**20**	**40**	**60**	**80**	**100**

Date:_____

Location (State) in which you see patients:_____

Are you: (Please circle all applicable terms)
A. in private, group, or hospital based practice
B. in academic medicine
C. board-eligible or board-certified in otolaryngology
D. board-eligible or board-certified in pediatric otolaryngology
E. board-eligible or board-certified in sleep medicine

Thank you for your help.

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