

# Adherence to American Academy of Otolaryngology–Head and Neck Surgery Clinical Practice Guidelines: A Systematic Review

Otolaryngology–  
 Head and Neck Surgery  
 2020, Vol. 163(4) 626–644  
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 Surgery Foundation 2020  
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 DOI: 10.1177/0194599820922155  
<http://otojournal.org>



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## Abstract

**Objective.** Clinical practice guidelines synthesize and disseminate the best available evidence to guide clinical decisions and increase high-quality care. Since 2004, the American Academy of Otolaryngology–Head and Neck Surgery Foundation (AAO-HNSF) has published 16 guidelines. The objective of this review was to evaluate clinicians' adherence to these guidelines' recommendations as measured in the literature.

**Data Sources.** We searched PubMed, Embase, and Web of Science on August 29, 2019, for studies published after June 1, 2004.

**Review Methods.** We systematically identified peer-reviewed studies in English that reported clinician adherence to AAO-HNSF guideline recommendations. Two authors independently reviewed and abstracted study characteristics, including publication date, population, sample size, guideline adherence, and risk of bias.

**Results.** The search yielded 385 studies. We excluded 331 studies during title/abstract screening and 32 more after full-text review. The remaining 22 studies evaluated recommendations from 8 of the 16 guidelines. The Otitis Media with Effusion, Polysomnography, Tonsillectomy, and Sinusitis guidelines were studied most. Study designs included retrospective chart reviews (7, 32%), clinician surveys (7, 32%), and health care database analyses (8, 36%). Studies reported adherence ranging from 0% to 99.8% with a mean of 56%. Adherence varied depending on the recommendation evaluated, type of recommendation, clinician type, and clinical setting. Adherence to the polysomnography recommendations was low (8%-65.3%). Adherence was higher for the otitis media with effusion (76%-90%) and tonsillectomy (43%-98.9%) recommendations.

**Conclusions.** Adherence to recommendations in the AAO-HNSF guidelines varies widely. These findings highlight areas for further guideline dissemination, research about guideline adoption, and quality improvement.

## Keywords

clinical practice guidelines, quality improvement, implementation, quality metrics, otolaryngology

Received December 6, 2019; accepted April 6, 2020.

Clinical practice guidelines synthesize and disseminate the best available research into recommendations to guide clinical practice, including referral, diagnostic, and treatment decisions. Their goal is to increase high-quality care while reducing inappropriate interventions, unnecessary variation, and avoidable costs. Studies have shown that clinical practice guidelines achieve this goal in general.<sup>1-3</sup> This potential for quality improvement has also been shown within otolaryngology, although there have been limited studies so far.<sup>4,5</sup> Since 2004, the American Academy of Otolaryngology–Head and Neck Surgery Foundation (AAO-HNSF) has published 16 guidelines as well as 8 interval updates. These are openly accessible online and are promoted through various medical societies. The guidelines include key action statements with recommendations to guide practice. Each guideline has about 10 key action statements as well as a supporting text. The key action statement policy level can be a strong recommendation for (or against), a recommendation for (or against), or an option, each with different obligations to the clinician. The additional supporting text describes the strength of and rationale for the recommendation. Extensive efforts go into the creation, evaluation, and dissemination of these guidelines. Previous studies have shown that in general within medicine, the adoption of guidelines is slow and often incomplete.<sup>6-8</sup> The pace and the level of adoption of the AAO-HNSF guidelines have not been previously evaluated. Therefore, the objective of this

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This research was presented at the AAO-HNS Annual Meeting; September 16, 2019; New Orleans, Louisiana.

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review was to analyze the literature to understand clinicians' adherence to AAO-HNSF guideline recommendations.

## Methods

Institutional review board approval was not required for this literature review since there was no data collection from human subjects. The methodology and reporting followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines.<sup>9</sup> A written protocol for study exclusion and data extraction was established prior to the review process. The review protocol was registered with Prospero, an international prospective register of systematic reviews.

### Study Eligibility Criteria

We systematically reviewed the peer-reviewed English literature that evaluated adherence by any type of clinician to an AAO-HNSF guideline recommendation. Therefore, studies that only evaluated awareness of or the clinical effectiveness of the guidelines were excluded. We excluded studies if they evaluated adherence to clinical practice guidelines that were not created by AAO-HNSF, only evaluated practices prior to the respective guideline publication, or did not contain enough information to determine if the guideline recommendation applied to the clinical situation. We excluded studies that only evaluated recommendations that presented options rather than a recommendation, because option recommendations are not intended for universal adherence but rather are intended for clinicians to "be flexible in their decision making regarding appropriate practice, although they may set bounds on alternatives; patient preference should have a substantial influencing role."<sup>10</sup> We excluded editorials, reviews, published meeting abstracts, and non-peer-reviewed studies. The criteria for inclusion limited the study design to nonrandomized studies, and therefore no randomized controlled trials were included.

### Search and Study Selection

We performed a systematic literature search in PubMed, Embase, and Web of Science starting with studies published after June 1, 2004, since the first AAO-HNSF clinical practice guideline was published in May 2004 on otitis media with effusion.<sup>11</sup> We completed the searches initially on January 14, 2019, and then updated them on August 29, 2019. The search terms for each database were as follows:

#### PubMed:

("otolaryngology"[MeSH Terms] OR "otolaryngology"[tiab]) AND ("guidelines as topic"[MeSH Terms] OR "guideline\*" [tiab]) AND ("academy"[tiab] OR "AAOHNS"[tiab]) AND ("2004/06/01"[PDAT]: "3000/12/31"[PDAT]) AND English[lang]

#### Embase:

('otorhinolaryngology'/exp AND 'practice guideline'/exp AND (academy OR aahns) AND english:la AND [2004-2019]/py;

#### Web of Science:

(Topic = otolaryngology) AND (Topic = guideline\*) AND (Topic = academy OR AAOHNS) AND LANGUAGE: (English) Timespan: 2004-2019.

Results were compiled and de-duplicated. We also performed hand searches of references from relevant studies to identify additional studies for screening. Abstract/title screening and full-text reviews for inclusion were completed by 2 authors independently (M.A.R. and J.M.W.) according to the predetermined eligibility criteria. Disparities were settled by consensus.

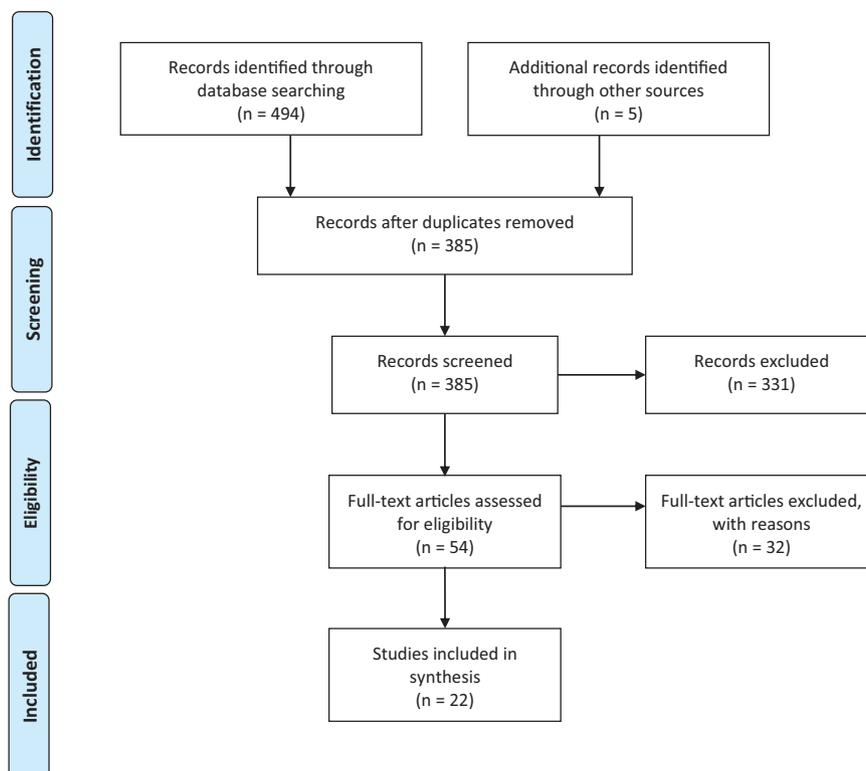
### Data Extraction and Analysis

We reviewed the full text of the included studies for the following data: time between data collection of the study and publication of the referenced guideline, study type, study population, sample size, measurements of adherence to recommendations, strength of the relevant recommendation, and risk of bias. We assigned a level of evidence for each study based on the 2009 Oxford Centre for Evidence-Based Medicine (OCEBM) levels of evidence.<sup>12</sup> Data extraction and assessment of bias were completed by 2 authors independently (M.A.R. and G.R.L.). Disparities were settled by consensus. Because of the heterogeneity in study designs and reporting, we did not complete a meta-analysis.

## Results

### Study Selection

The combined electronic and manual search yielded 499 eligible studies. There were 385 studies after duplicates were removed. **Figure 1** depicts the PRISMA flow diagram of the study selection process. Initial screening of titles/abstracts excluded 331 studies, and full-text review excluded 32 studies with reasons (see Supplemental Table S1 in the online version of the article). Reasons identified to exclude a study after full-text review were as follows: does not directly assess adherence to a recommendation (9 studies), review or editorial without original data (7), data collection before publication of the guideline (6), published meeting abstract (4), assesses adherence to a non-AAO-HNSF guideline (3), not enough clinical information to determine applicability of the recommendation (2), and not peer reviewed (1). We identified 22 studies that met criteria for inclusion. The included studies evaluated adherence to recommendations from 8 of the 16 published guidelines (**Table 1**). Two of the 22 studies (9%) evaluated adherence to recommendations from more than 1 guideline.<sup>13,14</sup> No studies evaluated adherence to any of the recommendations within the following 8 guidelines: Bell's Palsy, Benign Paroxysmal Positional Vertigo (BPPV), Earwax (Cerumen Impaction), Evaluation of the Neck Mass in Adults, Hoarseness (Dysphonia), Improving Nasal Form and Function after Rhinoplasty, Improving Voice Outcomes after Thyroid Surgery, and Tinnitus.



**Figure 1.** PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram detailing selection of studies through systematic review.

### Levels of Evidence and Risk of Bias

**Tables 2** through **6** describe the characteristics of the 22 included studies. The studies were evenly distributed in 3 broad study design categories: 7 retrospective chart reviews (32%), 7 clinician surveys (32%), and 8 health care database analyses (36%). Quality of evidence ranged from levels 2b to 4 according to the 2009 OCEBM levels. All 14 cross-sectional surveys and retrospective chart reviews were level 4 evidence. Most of the health care database analyses were level 2b evidence. Overall, risk of bias was moderate to high in the included studies.

### Overall Adherence to Guideline Recommendations

Within the 22 studies, the mean reported proportion of adherence to guideline recommendations was 56% with a range of 0% to 99.8% (**Tables 2-6**). Only 1 study evaluated adherence to the Acute Otitis Externa guideline recommendations, and adherence was high, ranging from 87% to 98% (**Table 2**). Adherence to the Otitis Media with Effusion guideline was high when otolaryngologists alone were evaluated (76%-90%) (**Table 2**). An audiogram was obtained prior to placement of tympanostomy tubes 47.2% of the time when looking at the practices of North American pediatric otolaryngologists and 72.7% of the time in the Canadian province of Ontario (**Table 3**). The reported adherence to the Tonsillectomy in Children guideline is in the higher end of the overall range of adherence (43%-98.9%) (**Table 4**). The reported adherence to the Polysomnography for Sleep-Disordered Breathing Prior to Tonsillectomy in Children

guideline was in the lower end of the range (8%-65.3%) (**Table 4**). Specifically, many clinicians do not obtain a polysomnogram (PSG) prior to tonsillectomy even in situations where PSG is recommended by the guideline. Both of the extremes of the overall 0% to 99.8% range of adherence were for the Adult Sinusitis guideline (**Table 5**). Darrat and colleagues<sup>15</sup> reported that none of the otolaryngologists in their academic practice adhered to the following adult sinusitis recommendations: statement 1a (“distinguish presumed acute bacterial rhinosinusitis from acute rhinosinusitis caused by viral upper respiratory infections and noninfectious conditions”), recommendation 2 (“prescribe symptomatic relief in managing viral rhinosinusitis”), and recommendation 5 (“if a decision is made to treat acute bacterial rhinosinusitis with an antibiotic agent, the clinician should prescribe amoxicillin as first-line therapy for most adults”). Xiao and colleagues<sup>16</sup> found that 97.7% of otolaryngologists and 99.8% of nonotolaryngology clinicians appropriately avoided a computed tomography (CT) scan for acute rhinosinusitis. **Table 7** demonstrates little variation in adherence based on strength and direction of the recommendation except that adherence was higher for *strong* recommendations *against* an action.

### Changes in Practice after Guideline Publication

Five of 22 studies (23%) evaluated clinician practices both before and after publication of a guideline.<sup>17-21</sup> In almost all instances, practices recommended by guidelines were more common after guideline publication. In the 1 exception,

**Table 1.** American Academy of Otolaryngology–Head and Neck Surgery Foundation Clinical Practice Guidelines and Respective Recommendation That Have Had Clinician Adherence Evaluated by a Published Study.

Studies Evaluating Adherence to a Guideline Recommendation		
First Author, Year	Title	Recommendation Evaluated from Guideline
<b>Otitis Media with Effusion, May 2004</b>		
1. Patel, 2008 <sup>14</sup>	Assessment of Acute Otitis Externa and Otitis Media with Effusion Performance Measures in Otolaryngology Practices	Statement 1A (Strong Recommendation). PNEUMATIC OTOSCOPY
2. Prince, 2015 <sup>22</sup>	Antihistamine Use for Otitis Media with Effusion: Ongoing Opportunities for Quality Improvement	Statement 5 (Recommendation). MEDICATION
3. Bellmunt, 2016 <sup>23</sup>	Oral Steroid Usage for Otitis Media with Effusion, Eustachian Tube Dysfunction, and Tympanic Membrane Retraction	
4. Harvey, 2016 <sup>34</sup>	Clinical Practice Guidelines: Whose Practice Are We Guiding?	
5. Roditi, 2016 <sup>24</sup>	Oral Antibiotic Use for Otitis Media with Effusion: Ongoing Opportunities for Quality Improvement	
6. Wang, 2017 <sup>25</sup>	Intranasal Steroid Use for Otitis Media with Effusion: Ongoing Opportunities for Quality Improvement	
<b>Otitis Media with Effusion (Update), February 2016</b>		
None		
<b>Acute Otitis Externa, April 2006</b>		
1. Patel, 2008 <sup>14</sup>	Assessment of Acute Otitis Externa and Otitis Media with Effusion Performance Measures in Otolaryngology Practices	Statement 2 (Strong Recommendation). PAIN MANAGEMENT Statement 3 (Recommendation). INITIAL THERAPY
<b>Acute Otitis Externa (Update), February 2014</b>		
None		
<b>Adult Sinusitis, September 2007</b>		
1. Bhattacharyya, 2013 <sup>21</sup>	Patterns of Care before and after the Adult Sinusitis Clinical Practice Guideline	All 9 Statements
2. Darrat, 2014 <sup>15</sup>	A Study of Adherence to the AAO-HNS “Clinical Practice Guideline: Adult Sinusitis”	
3. Xiao, 2018 <sup>26</sup>	Shortcomings in the Diagnosis of Chronic Rhinosinusitis: Evaluating Diagnosis by Otolaryngologists and Primary Care Physicians	
4. Xiao, 2019 <sup>16</sup>	Antibiotic Use and Computed Tomography Imaging for Rhinosinusitis as Quality Metrics in Modern Health Care	
<b>Adult Sinusitis (Update), April 2015</b>		
1. Xiao, 2018 <sup>26</sup>	Shortcomings in the Diagnosis of Chronic Rhinosinusitis: Evaluating Diagnosis by Otolaryngologists and Primary Care Physicians	Statement 1B (Recommendation Against). RADIOGRAPHIC IMAGING AND ACUTE RHINOSINUSITIS
2. Xiao, 2019 <sup>16</sup>	Antibiotic Use and Computed Tomography Imaging for Rhinosinusitis as Quality Metrics in Modern Health Care	Statement 4 (Recommendation). INITIAL MANAGEMENT OF ACUTE BACTERIAL RHINOSINUSITIS Statement 5 (Recommendation). CHOICE OF ANTIBIOTIC FOR ACUTE BACTERIAL RHINOSINUSITIS Statement 7B (Strong Recommendation). OBJECTIVE CONFIRMATION OF A DIAGNOSIS OF CHRONIC RHINOSINUSITIS

(continued)

**Table 1.** (continued)

## Studies Evaluating Adherence to a Guideline Recommendation

First Author, Year	Title	Recommendation Evaluated from Guideline
<b>Cerumen Impaction, September 2008</b>		
None		
<b>Cerumen Impaction (Update), January 2017</b>		
None		
<b>Benign Paroxysmal Positional Vertigo, November 2008</b>		
None		
<b>Benign Paroxysmal Positional Vertigo (Update), March 2017</b>		
None		
<b>Hoarseness (Dysphonia), September 2009</b>		
None		
<b>Hoarseness (Dysphonia) (Update), March 2018</b>		
None		
<b>Polysomnography for Sleep-Disordered Breathing Prior to Tonsillectomy in Children, July 2011</b>		
1. Setabutr, 2014 <sup>13</sup>	Impact of the Pediatric Tonsillectomy and Polysomnography Clinical Practice Guidelines	Statement 1 (Recommendation). INDICATIONS FOR POLYSOMNOGRAM
2. Nardone, 2016 <sup>41</sup>	Current Pediatric Tertiary Care Admission Practices following Adenotonsillectomy	Statement 2 (Recommendation). ADVOCATING FOR POLYSOMNOGRAM
3. Lam, 2018 <sup>42</sup>	Predictors of Obtaining Polysomnography among Otolaryngologists Prior to Adenotonsillectomy for Childhood Sleep-Disordered Breathing	Statement 3 (Recommendation). COMMUNICATION WITH ANESTHESIOLOGIST
4. Friedman, 2019 <sup>29</sup>	Pediatric Obstructive Sleep-Disordered Breathing: Updated Polysomnography Practice Patterns	Statement 4 (Recommendation). INPATIENT ADMISSION FOR CHILDREN WITH OBSTRUCTIVE SLEEP APNEA DOCUMENTED IN RESULTS OF POLYSOMNOGRAM
<b>Tonsillectomy in Children, January 2011</b>		
1. Setabutr, 2014 <sup>13</sup>	Impact of the Pediatric Tonsillectomy and Polysomnography Clinical Practice Guidelines	Statement 7 (Strong Recommendation). INTRAOPERATIVE STEROIDS
2. Mahant, 2015 <sup>18</sup>	Association of National Guidelines with Tonsillectomy Perioperative Care and Outcomes	Statement 8 (Strong Recommendation). PERIOPERATIVE ANTIBIOTICS
3. Milder, 2015 <sup>19</sup>	Impact of a New Practice Guideline on Antibiotic Use with Pediatric Tonsillectomy	
4. Padia, 2015 <sup>20</sup>	Hospital and Surgeon Adherence to Pediatric Tonsillectomy Guidelines Regarding Perioperative Dexamethasone and Antibiotic Administration	
<b>Tonsillectomy in Children (Update), February 2019</b>		
None		
<b>Sudden Hearing Loss, March 2012</b>		
1. Witsell, 2016 <sup>27</sup>	Evaluation of Compliance for Treatment of Sudden Hearing Loss: A CHEER Network Study	Statement 1 (Strong Statement). EXCLUSION OF CONDUCTIVE HEARING LOSS
2. Hughes, 2018 <sup>43</sup>	Sudden Sensorineural Hearing Loss in the Department of Defense	Statement 3 (Strong Recommendation Against). COMPUTED TOMOGRAPHY (CT) Statement 4 (Recommendation). AUDIOMETRIC CONFIRMATION OF IDIOPATHIC SUDDEN SENSORINEURAL HEARING LOSS

(continued)

**Table 1.** (continued)

## Studies Evaluating Adherence to a Guideline Recommendation

First Author, Year	Title	Recommendation Evaluated from Guideline
		Statement 5 (Strong Recommendation Against). LABORATORY TESTING
		Statement 6 (Recommendation). RETROCOCHLEAR PATHOLOGY
		Statement 7 (Strong Recommendation). PATIENT EDUCATION
		Statement 10 (Recommendation Against). OTHER PHARMACOLOGIC THERAPY
		Statement 11 (Recommendation). SALVAGE THERAPY
		Statement 13 (Strong Recommendation). REHABILITATION
<b>Sudden Hearing Loss (Update), August 2019</b>		
None		
<b>Tympanostomy Tubes in Children, July 2013</b>		
1. Raol, 2016 <sup>33</sup>	Should Obtaining a Preoperative Audiogram before Tympanostomy Tube Placement Be Used as a Quality Metric? A Survey of Pediatric Otolaryngologists	Statement 2 (Recommendation). HEARING TESTING
2. Beyea, 2018 <sup>17</sup>	Audiometric Testing Guideline Adherence in Children Undergoing Tympanostomy Tubes: A Population-Based Study	
<b>Improving Voice Outcomes after Thyroid Surgery, June 2013</b>		
None		
<b>Bell's Palsy, November 2013</b>		
None		
<b>Tinnitus, October 2014</b>		
None		
<b>Allergic Rhinitis, February 2015</b>		
1. Honeybrook, 2018 <sup>28</sup>	Otolaryngologist Adherence to the AAO-HNSF Allergic Rhinitis Clinical Practice Guideline	All 14 Statements
<b>Evaluation of the Neck Mass in Adults, September 2017</b>		
None		
<b>Improving Nasal Form and Function after Rhinoplasty, February 2017</b>		
None		

Abbreviation: AAO-HNSF, American Academy of Otolaryngology–Head and Neck Surgery Foundation.

Bhattacharyya and Kepnes<sup>21</sup> found similar proportions of diagnostic imaging for acute rhinosinusitis before (97.7%) and after (96.5%) the guideline publication.

In some instances where adherence to a guideline recommendation seemed strong, the practice was already common prior to the guideline publication. For example, the strong recommendation in the Tonsillectomy in Children statement 7 to “administer a single, intraoperative dose of intravenous dexamethasone to children undergoing tonsillectomy” had adherence ranging from 77.4% to 98.9% after the guideline, but this was similar to the 74.6% to 98.4% before the

guideline (**Table 4**). In contrast, the same guideline’s strong recommendation (statement 8) against routine perioperative antibiotics produced substantial changes from 3% to 83.9% adherence before to 64% to 94% after guideline publication (**Table 4**).

### Comparison of Clinician and Setting Type

In the studies that compared the practices of different types of clinicians, substantially higher adherence to guideline recommendations was displayed by otolaryngologists when compared to nonotolaryngologists, particularly for the

(text continues on p. 641)

**Table 2.** Characteristics and Findings of Published Studies That Assess Provider Adherence to Recommendations in Otitis Media with Effusion and Acute Otitis Externa AAO-HNSF Clinical Practice Guidelines.

First Author, Year	Title	Time between Publication and Data Collection	Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
<b>Otitis Media with Effusion, May 2004; Acute Otitis Externa, April 2006</b> Patel, 2008 <sup>14</sup>	Assessment of Acute Otitis Externa and Otitis Media with Effusion Performance Measures in Otolaryngology Practices	14-18 months <b>AOE</b> 37-41 months	Cross-sectional analysis of physicians' practices for PQRI measures	55 patient visits for AOE and 29 patient visits for OME at 5 sites of a large private otolaryngology and allergy group	<b>AOE</b> <b>Strong recommendation:</b> <ul style="list-style-type: none"> <li>98% assessed periauricular pain</li> </ul> <b>Recommendations:</b> <ul style="list-style-type: none"> <li>98% prescribed topical antibiotic</li> </ul> <b>Recommendations against:</b> <ul style="list-style-type: none"> <li>87% did not prescribe systemic antimicrobials</li> </ul> <b>OME</b> <b>Strong recommendation:</b> <ul style="list-style-type: none"> <li>76% used pneumatic otoscopy</li> </ul> <b>Recommendations against:</b> <ul style="list-style-type: none"> <li>86% did not recommend antihistamines or decongestants</li> <li>93% did not prescribe antimicrobials</li> <li>90% did not prescribe systemic steroids</li> </ul>	<b>Participant bias:</b> Physicians aware that the sheets being completed were designed for performance evaluation and may have changed their standard practice <b>Level 4</b>
<b>Otitis Media with Effusion, May 2004 and Updated February 2016</b> Prince, 2015 <sup>22</sup>	Antihistamine Use for Otitis Media with Effusion: Ongoing Opportunities for Quality Improvement	7-79 months	Cross-sectional analysis of a national database	1,491,045,375 weighted pediatric visits in the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey, 2005-2010	<b>Recommendation against: OME</b> associated with a significant increase in nonsedating antihistamine usage (OR, 3.53; 95% CI, 1.62-7.71; $P = .002$ ), when adjusted for age, sex, race/ethnicity, allergic, and nasal conditions  This increase was seen in the ED and nonotolaryngology visits but not in otolaryngology	<b>Information bias:</b> Miscoding of OME with ICD-9 codes <b>Level 2b</b>
Bellmunt, 2016 <sup>23</sup>	Oral Steroid Usage for Otitis Media with Effusion, Eustachian Tube Dysfunction, and Tympanic Membrane Retraction	7-79 months	Cross-sectional analysis of a national database	7,191,711,480 pediatric and adult visits for OME/ETD/TMR in the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey, 2005-2010	<b>Recommendation against:</b> Oral steroid administered at 2.3% of pediatric visits where OME/ETD/TMR was diagnosed vs 1.9% of visits where it was not ( $P = .660$ ) Adults more likely to receive steroids (OR, 3.50; $P < .001$ ) than those with other diagnoses, but similar association not found for children  There was a higher risk of oral steroid prescription outside of the ED and by nonotolaryngologists	<b>Information bias:</b> Miscoding of OME with ICD-9 codes; database limitations for medication reporting; ETD/TMR diagnoses included in addition to OME <b>Level 2b</b>

(continued)

**Table 2.** (continued)

First Author, Year	Title	Time between Guideline Publication and Data Collection	Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
Harvey, 2016 <sup>34</sup>	Clinical Practice Guidelines: Whose Practice Are We Guiding?	0 months after CPG update; 144 months after initial CPG	Cross-sectional survey	52 pediatric and family medicine clinicians within a military health system	53.8% use any CPG to guide for OME management 1.9% use the AAO-HNSF guidelines <i>Strong recommendation: 38.5% use pneumatic otoscopy</i>	Response bias <b>Level 4</b>
Roditi, 2016 <sup>24</sup>	Oral Antibiotic Use for Otitis Media with Effusion: Ongoing Opportunities for Quality Improvement	7-79 months	Cross-sectional analysis of a national database	1,390,404,196 weighted ambulatory pediatric visits for OME in the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey, 2005-2010	<i>Recommendation against: Oral antibiotic administration associated with OME diagnosis (OR, 6.24; 95% CI: 4.17-9.39; P &lt; .001) when adjusted for age, sex, race/ethnicity, infections at nonotologic sites, visit location, and immunodeficiency</i> <b>For all visits:</b> Antibiotics administered in 32% of visits where OME was diagnosed vs 13.2% of visits where OME was not diagnosed (P < .001) <b>For ED visits:</b> Antibiotic administered in 49.7% in the ED compared with 29.1% at other visit sites (P = .0135) <b>For otolaryngology visits:</b> Antibiotics administered in 12.2% of visits where OME was diagnosed vs 7.8% of visits where OME was not diagnosed (P = .0924)	<i>Information bias: Miscoding of OME with ICD-9 codes; database limitations for medication reporting</i> <b>Level 2b</b>

(continued)

Table 2. (continued)

First Author, Year	Title	Time between Guideline Publication and Data Collection	Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
Wang, 2017 <sup>25</sup>	Intranasal Steroid Use for Otitis Media with Effusion: Ongoing Opportunities for Quality Improvement	7-91 months	Cross-sectional analysis of a national database	1,943,177,903 weighted pediatric visits in the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey, 2005-2010	<p><i>Recommendation against:</i> Intranasal steroid administration associated with OME (OR, 3.58; 95% CI, 1.60-8.01; <math>P = .002</math>) adjusted for age, sex, race/ethnicity, and confounding conditions</p> <p><b>For all visits:</b> Intranasal steroids administered in 10% of visits where OME was diagnosed vs 3.5% of visits where OME was not diagnosed (<math>P &lt; .001</math>)</p> <p><b>For otolaryngologist visits:</b> Visits to otolaryngology not associated with a significant increase in intranasal steroid administration Intranasal steroids administered at 5.7% of visits where OME was diagnosed vs 4.1% of visits where OME was not diagnosed (<math>P = .390</math>)</p>	<p><i>Information bias:</i> Miscoding of OME with ICD-9 codes; database limitations for medication reporting</p> <p><b>Level 2b</b></p>

Abbreviations: AAO-HNSF, American Academy of Otolaryngology–Head and Neck Surgery Foundation; AOE, acute otitis externa; CI, confidence interval; CPG, clinical practice guideline; ED, emergency department; ETD, eustachian tube dysfunction; ICD-9, *International Classification of Diseases, Ninth Revision*; OCEBM, Oxford Centre for Evidence-Based Medicine; OME, otitis media with effusion; OR, odds ratio; PQRI, Physician Quality Reporting Initiative; TMR, tympanic membrane retraction.

**Table 3.** Characteristics and Findings of Published Studies That Assess Provider Adherence to Recommendations in Tympanostomy Tubes in Children AAO-HNSF Clinical Practice Guideline.

First Author, Year	Title	Time between Guideline Publication and Data Collection	Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
Raoi, 2016 <sup>33</sup>	<b>Tympanostomy Tubes in Children, July 2013</b> Should Obtaining a Preoperative Audiogram before Tympanostomy Tube Placement Be Used as a Quality Metric? A Survey of Pediatric Otolaryngologists	20 months	Cross-sectional survey	127 of 471 American Society of Pediatric Otolaryngology members	<b>Recommendation:</b> 47.2% of respondents “always” obtain an audiogram prior to surgery for COME 76% agreed that a preoperative audiogram was of high quality for COME	Response bias <b>Level 4</b>
Beyea, 2018 <sup>17</sup>	Audiometric Testing Guideline Adherence in Children Undergoing Tympanostomy Tubes: A Population-Based Study	<b>Comparison</b> <b>Before:</b> 0-36 months <b>After:</b> 1-36 months	Retrospective population-based cohort study using administrative data	316,599 children ≤ 12 years of age who underwent at least 1 bilateral tympanostomy tube placement between January 1, 1995, and June 30, 2016, in Ontario, Canada	<b>Recommendation:</b> 69% of children who underwent bilateral tympanostomy tube placement during the 3 years <b>before</b> CPG publication received preoperative audiometric testing vs 72.7% <b>after</b> CPG publication No significant change following CPG publication (RR, 1.12; 95% CI, 0.85-1.47; P = .432), but the proportion of patients with preoperative audiometric testing increased gradually from 1993 to 2016	<b>Information bias:</b> Administrative data unable to indicate reason for audiometric testing and any audiometric test performed in the 1 year preoperatively included Nonbillable infant hearing tests could not be captured through the database <b>Level 2b</b>

Abbreviations: AAO-HNSF, American Academy of Otolaryngology–Head and Neck Surgery Foundation; CI, confidence interval; COME, chronic otitis media with effusion; CPG, clinical practice guideline; OCEBM, Oxford Centre for Evidence-Based Medicine; RR, risk ratio.

**Table 4.** Characteristics and Findings of Published Studies That Assess Provider Adherence to Recommendations from Polysomnography for Sleep-Disordered Breathing Prior to Tonsillectomy in Children and Tonsillectomy in Children AAO-HNSF Clinical Practice Guidelines.

First Author, Year	Title	Time between Guideline Publication and Data Collection		Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
		Publication	Data				
Setabutr, 2014 <sup>13</sup>	Impact of the Pediatric Tonsillectomy and Polysomnography Clinical Practice Guidelines	Tonsillectomy 11-23 months	Cross-sectional survey	280 of 671 invited AAO-HNSF members	93% had read at least one of the CPGs	Response bias <b>Level 4</b>	
Mahant, 2015 <sup>18</sup>	Association of National Guidelines with Tonsillectomy Perioperative Care and Outcomes	Comparison Before: 24 months After: 24 months	Retrospective cohort study	54,043 pre-CPG and 57,770 post-CPG elective tonsillectomies in children at 29 US children's hospitals	Strong recommendation: Steroid use increased from 74.6% to 77.4% after CPG publication ( $P < .001$ ) Strong recommendation against: Avoiding antibiotics increased from 6% to 97% after CPG ( $P < .001$ ) Avoiding antibiotics increased from 65.3% to 78.2% after CPG ( $P < .001$ )	Information bias <b>Level 2b</b>	
Milder, 2015 <sup>19</sup>	Impact of a New Practice Guideline on Antibiotic Use with Pediatric Tonsillectomy	Comparison Before: 24 months After: 20 months	Retrospective case series with chart review	5359 outpatient tonsillectomies in inpatient and ambulatory surgical facilities of a large health care network	Strong recommendation against: Avoiding antibiotics increased from 6% to 97% after CPG ( $P < .001$ )	Information bias: Retrospective chart review; codes may not accurately capture patient presentation <b>Level 4</b>	
Padia, 2015 <sup>20</sup>	Hospital and Surgeon Adherence to Pediatric Tonsillectomy Guidelines Regarding Perioperative	Comparison Before: 0-36 months After: 0-42 months	Retrospective case series with chart review	7432 pre-CPG and 8518 post-CPG children who underwent outpatient T&A in a multihospital network with 74 surgeons who performed the T&As	<b>Patient-level data:</b> Strong recommendation: Receiving steroids increased from 98.4% to 98.9% after CPG publication Strong recommendation against: Not receiving antibiotics increased from 83.9% to 86.2%	Information bias: Postdischarge antibiotics not included; retrospective chart review <b>Level 4</b>	

(continued)

**Table 4.** (continued)

First Author, Year	Title	Time between Guideline Publication and Data Collection	Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
	Dexamethasone and Antibiotic Administration				<b>Surgeon-level data:</b> Strong recommendation: Giving steroids increased from 82.4% to 94.6% Strong recommendation against: Not giving antibiotics increased from 67.6% to 74.3%	
Nardone, 2016 <sup>41</sup>	Current Pediatric Tertiary Care Admission Practices following Adenotonsillectomy	33-34 months	Cross-sectional survey	48 of 72 pediatric otolaryngology chiefs responding about groups at tertiary children's hospitals in the United States and Canada	Recommendations: 90% admit after if age <3 years 60% admit if AHI >10 67% admit if oxygen saturation nadir <80% on PSG	Surveys reflect entire group instead of individual surgeons Response bias <b>Level 4</b>
Lam, 2018 <sup>42</sup>	Predictors of Obtaining Polysomnography among Otolaryngologists Prior to Adenotonsillectomy for Childhood Sleep-Disordered Breathing	2-15 months	Retrospective case series with chart review	324 children who underwent T&A at an academic children's hospital for SDB or OSA	Recommendation: 20% of patients who met the CPG criteria for pre-T&A PSG had one before T&A	Selection bias: PSG prior to otolaryngology referral so patients without OSA on PSG were excluded Information bias: Retrospective chart review <b>Level 4</b>
Friedman, 2019 <sup>29</sup>	Pediatric Obstructive Sleep-Disordered Breathing: Updated Polysomnography Practice Patterns	68-70 months	Cross-sectional survey	170 of 427 American Society of Pediatric Otolaryngology members	Recommendations: % of respondents who requested PSG prior to T&A 100% of the time • Obesity: 8% • Down syndrome: 27% • Child <2 years: 16% 58% request PSG prior to T&A for children with inconsistent history and exam 92% routinely communicate PSG results to anesthesiologist 37% adhere to inpatient admission recommendations for documented OSA	Response bias <b>Level 4</b>

Abbreviations: AAO-HNSF, American Academy of Otolaryngology-Head and Neck Surgery Foundation; AHI, apnea-hypopnea index; CPG, clinical practice guideline; OCEBM, Oxford Centre for Evidence-Based Medicine; OSA, obstructive sleep apnea; PSG, polysomnogram; SDB, sleep-disordered breathing; T&A, tonsillectomy with adenoidectomy.

**Table 5.** Characteristics and Findings of Published Studies That Assess Provider Adherence to Recommendations in Adult Sinusitis and Allergic Rhinitis AAO-HNSF Clinical Practice Guidelines.

First Author, Year	Title	Time between Guideline Publication and Data Collection	Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
	<b>Adult Sinusitis, September 2007 and Updated April 2015</b>					
Bhattacharyya, 2013 <sup>21</sup>	Patterns of Care before and after the Adult Sinusitis Clinical Practice Guideline	<b>Before:</b> 9-21 months <b>After:</b> 16-28 months	Retrospective cross-sectional study with historical controls	All clinical encounters for adult sinusitis from the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Care Survey 2005-2006 (7.9 million cases) and 2009-2010 (10.2 million cases)	<b>Strong recommendation:</b> 18.9% before and 23% after CPG had analgesia treatment recommended for ARS ( $P = .47$ ) <b>Recommendation:</b> 8.1% before and 29.4% after received amoxicillin for acute sinusitis ( $P = .021$ ) <b>Recommendation against:</b> 97.7% before and 96.5% after did not have diagnostic imaging for ARS; statistical comparison not conducted due to large relative standard error	Clinical criteria and severity of sinusitis cannot be determined from database <b>Level 2b</b>
Darrat, 2014 <sup>15</sup>	A Study of Adherence to the AAO-HNS "Clinical Practice Guideline: Adult Sinusitis"	0-34 months	Retrospective case series with chart review	90 patients > 18 years old seen for CRS, ABRs, or AVRS by 1 of 10 otolaryngologists at an academic outpatient department from June 2007 through June 2010	<b>CRS</b> Mean adherence to KASS ranged from 4% to 88% <b>ABRS</b> Mean adherence to KASS ranged from 0% to 41%	<b>Sample size:</b> Sometimes based on 1 case <b>Information bias:</b> Chart review of retrospective data, documentation, procedure, and diagnosis codes may not accurately capture patient presentation <b>Level 4</b>
Xiao, 2018 <sup>26</sup>	Shortcomings in the Diagnosis of Chronic Rhinosinusitis: Evaluating Diagnosis by Otolaryngologists and Primary Care Physicians	99-111 months after 2007 CPG 8-20 months after 2015 update	Retrospective case series with chart review	Random sample of 502 adult patients newly diagnosed with CRS in an ambulatory visit with a primary care or otolaryngology physician	<b>Strong recommendation:</b> The % of diagnoses meeting the criteria for CRS was 28.9% for otolaryngologists vs 0.97% for primary care ( $P < .0001$ ) Lack of documentation of enough symptoms and of sinonasal inflammation were the most common reasons for nonadherence	<b>Selection bias:</b> Only patients with a new and primary diagnosis of CRS were included <b>Information bias:</b> Chart review of retrospective data, documentation, procedure, and diagnosis codes may not accurately capture patient presentation <b>Level 4</b>

(continued)

**Table 5.** (continued)

First Author, Year	Title	Time between Guideline Publication and Data Collection	Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
Xiao, 2019 <sup>16</sup>	Antibiotic Use and Computed Tomography Imaging for Rhinosinusitis as Quality Metrics in Modern Health Care	96-108 months after 2007 CPG 4 months before to 20 months after 2015 update	Cross-sectional analysis of administrative database	726 clinicians participating in the Centers for Medicare & Medicaid Services Physician Quality Reporting System during 2015-2016	Recommendation: 43% of patients received antibiotics within 7 days of diagnosis or within 10 days after onset from otolaryngology vs 10.6% by other clinicians Recommendation: 90.2% were prescribed amoxicillin as first-line treatment for ABRs at time of diagnosis from otolaryngology vs 35.2% by other clinicians Recommendations against: 97.7% avoided a CT for ARS from otolaryngology vs 99.8% from other clinicians	Sample size: Fewer than 50 otolaryngologists reported any one measure Information bias: Clinician adherence could not be determined from data extraction Possible misclassification of ABRs diagnosis <b>Level 3b</b>
<b>Allergic Rhinitis, February 2015</b> Honeybrook, 2018 <sup>28</sup>	Otolaryngologist Adherence to the AAO-HNSF Allergic Rhinitis Clinical Practice Guideline	13-21 months	Cross-sectional survey	82 of 423 AAOA fellows and 519 of 8650 AAO-HNSF members	“Always” or “never” responses ranged from 7.9% to 59.3% for the 8 KASs with recommendations for or against an action <b>Strong recommendations:</b> 59.3% “always” recommend intranasal steroids; 26.8% “always” recommend oral second-generation oral antihistamines <b>Recommendations against:</b> 16.1% “never” obtain sinonasal imaging; 23.1% “never” recommend oral leukotriene receptor antagonists as first-line therapy	Response bias <b>Level 4</b>

Abbreviations: AAOA, American Academy of Otolaryngic Allergy; AAO-HNSF, American Academy of Otolaryngology-Head and Neck Surgery Foundation; ABRs, acute bacterial rhinosinusitis; ARS, acute rhinosinusitis; AVRS, acute viral rhinosinusitis; CPG, clinical practice guideline; CRS, chronic rhinosinusitis; CT, computed tomography; KAS, key action statement; OCEBM, Oxford Centre for Evidence-Based Medicine.

**Table 6.** Characteristics and Findings of Published Studies That Assess Provider Adherence to Recommendations in 2012 Sudden Hearing Loss AAO-HNSF Clinical Practice Guideline.

First Author, Year	Title	Time between Guideline Publication and Data Collection	Study Type	Study Population	Adherence, Strength of Recommendation	Risks of Bias, OCEBM 2009 Level of Evidence
Witsell, 2016 <sup>27</sup>	<b>Sudden Hearing Loss, March 2012</b> Evaluation of Compliance for Treatment of Sudden Hearing Loss: A CHEER Network Study	15-33 months	Cross-sectional survey with chart review	142 patients with sudden sensorineural hearing loss in the Creating Healthcare Excellence through Education and Research (CHEER) Network	Overall KAS compliance for otolaryngologists was >89%, except for 3.5% for KAS regarding rehabilitative services Overall KAS compliance for nonotolaryngologists was <45%	Response bias Information bias: Chart review of retrospective data, documentation, procedure, and diagnosis codes may not accurately capture patient presentation <b>Level 4</b>
Hughes, 2018 <sup>43</sup>	Sudden Sensorineural Hearing Loss in the Department of Defense	0-42 months	Case series with chart review	204 patients with sudden sensorineural hearing loss from all Department of Defense medical treatment facilities	Recommendations: 73.5% had an MRI to evaluate for retrocochlear pathology 12.3% received a recommended intratympanic steroid dose <i>Strong recommendations against:</i> 86.3% did not receive a head CT at diagnosis 75.5% did not have additional laboratory tests	Information bias: Chart review of retrospective data, documentation, procedure, and diagnosis codes may not accurately capture patient presentation Selection bias: High incidence of loss to follow-up <b>Level 4</b>

Abbreviations: AAO-HNSF, American Academy of Otolaryngology–Head and Neck Surgery Foundation; CT, computed tomography; KAS, key action statement; MRI, magnetic resonance imaging; OCEBM, Oxford Centre for Evidence-Based Medicine.

**Table 7.** Adherence to AAO-HNSF Clinical Practice Guidelines Recommendations Stratified by Type of Recommendation.

Type of Recommendation	Adherence to Recommendations, Mean (Range), %
Recommendation	51 (0-98.9)
Strong recommendation	48 (0-98)
Recommendation against	51 (0-98.9)
Strong recommendation against	80 (64-97)

Abbreviation: AAO-HNSF, American Academy of Otolaryngology–Head and Neck Surgery Foundation.

recommendations in the Otitis Media with Effusion, Adult Sinusitis, and Sudden Hearing Loss guidelines (**Tables 2, 5, and 6**).<sup>16,22-27</sup> **Table 2** shows that adherence to the Otitis Media with Effusion guideline is high for otolaryngologists and low for nonotolaryngology clinicians. The potentially inappropriate (and not recommended) use of medical treatments such as intranasal steroids (odds ratio [OR], 3.58; 95% confidence interval [CI], 1.60-8.01), oral antihistamines (OR, 3.53; 95% CI, 1.62-7.71), and oral antibiotics (OR, 6.24; 95% CI: 4.17-9.39) was associated with encounters with nonotolaryngologists but not with otolaryngologists.<sup>22,24,25</sup> Potentially unindicated prescriptions were especially common in the emergency department setting.<sup>22,24</sup>

## Discussion

Adherence to the recommendations of the studied AAO-HNSF clinical practice guidelines varies widely, with a mean adherence to the recommendations of 56%. Aarts and colleagues<sup>7</sup> also evaluated adherence to their otolaryngology guidelines in the Netherlands and reported a similar mean adherence of 55%. These authors found no difference in adherence to guidelines between academic and private otolaryngologists.<sup>7</sup> A study by Honeybrook and colleagues<sup>28</sup> that was included in this review also found no differences between academic and private otolaryngologists for adherence to the Allergic Rhinitis guideline. Also consistent with findings in the Aarts et al<sup>7</sup> study, several studies included in this review found that older otolaryngologists who were in practice longer were less likely to adhere to the AAO-HNSF guidelines.<sup>28-30</sup> This may be a result of inertia to change established practices in more senior clinicians, experiential evidence, lack of awareness of new guidelines, or disagreement with the guideline.

This review highlights several areas where adherence to AAO-HNSF guideline recommendations is high. Examples are avoidance of oral steroids to treat children with otitis media with effusion, the use of a single intraoperative dose of steroids at tonsillectomy, not prescribing perioperative antibiotics for tonsillectomy, and not ordering a CT for uncomplicated acute rhinosinusitis. Ongoing assessment and quality improvement efforts for these specific practices would likely have a low yield for further performance improvements. In contrast, we identified several areas with low adherence, including obtaining a preoperative PSG for specific indications before pediatric tonsillectomy, providing analgesia treatment for adults with acute rhinosinusitis, fulfilling diagnostic criteria for chronic rhinosinusitis, and

counseling about hearing rehabilitation after sudden hearing loss. Interventions to increase awareness and uptake of these guideline recommendations could have a substantial impact on adherence with resultant quality improvement intended by the guideline developers.

Large opportunities for quality improvement and guideline adherence may focus on clinicians who are not otolaryngologists. Otitis media with effusion, adult sinusitis, and sudden hearing loss are 3 conditions that are frequently managed by primary care and other nonotolaryngology clinicians, and adherence to related guideline recommendations could be improved. Wide dissemination, education, and incorporation of the AAO-HNSF guidelines into primary care, urgent care, and emergency medicine forums could help to improve the quality of care and decrease inappropriate interventions for otolaryngic conditions.

Adherence to half of the published AAO-HNSF clinical practice guidelines has not been formally studied. Prior and colleagues<sup>31</sup> have evaluated the effectiveness of clinical guideline implementation strategies and report that “after implementation and hopefully clinical adoption, measurement of guideline adherence becomes the next natural step in the guideline cycle.” The overall low and variable adherence to the guidelines as well as the unstudied guidelines suggests that ongoing efforts are needed to enhance guideline dissemination, implementation, and assessment of adherence.

## Reasons for Nonadherence

There are many potential reasons that prevent guideline uptake.<sup>32</sup> The clinician may be uninformed about guidelines in general or specific recommendations or perhaps may not agree with the recommendations. Guideline recommendations are not always applicable to every clinical situation and every patient. Finally, systematic obstacles may preclude guideline adherence even when the clinician is informed and agrees with the recommendation. Several specific reasons for nonadherence are reported and discussed in the studies included in this review. Sometimes an intervention that contradicts a guideline recommendation is indicated for a certain clinical scenario. For instance, some patients require perioperative antibiotics after cardiac surgery or implant placement, and these would be appropriate even when a patient is undergoing tonsillectomy, for which antibiotics are not usually indicated.<sup>18,20</sup> Sometimes conflicting research exists. There are conflicting data about the safety and risk of bleeding with dexamethasone during tonsillectomy, which may prevent some clinicians from giving the recommended single intraoperative dose.<sup>18</sup>

Some clinicians disagree with the importance of adherence to guidelines to provide high-quality care. Raol and colleagues<sup>33</sup> found only 12% of responding American Society of Pediatric Otolaryngology (ASPO) members completely agreed, while 68.8% somewhat agreed, 16.8% somewhat disagreed, and 2.4% completely disagreed that total adherence to guidelines actually represents high-quality care. Raol and colleagues<sup>33</sup> also reported that among those who “rarely” or “never” obtained audiograms before treating otitis media with effusion with tympanostomy tubes, 54% cited cost of the audiogram as the reason. Guidelines are intended to minimize inappropriate interventions and therefore unnecessary health care costs, but following a guideline recommendation may increase cost. Lack of accessibility to specialists and testing, such as audiologists and their equipment as well as sleep laboratories, may impair adherence to a guideline. Beyea and colleagues<sup>30</sup> noted geographic variability in obtaining audiograms before tympanostomy tube placement and attributed it at least partially to geographic variation in access to audiologists. Harvey and colleagues<sup>34</sup> reported that only 67.3% of the primary care providers they surveyed actually had pneumatic otoscopes in their clinics for evaluating otitis media in line with the Otitis Media with Effusion guideline recommendation.

External barriers may also prevent adherence to guideline recommendations. In some instances, health insurance requirements directly contradict guidelines. For example, despite the recommendation against imaging in the Allergic Rhinitis guideline, some third-party payers require imaging to rule out concomitant chronic rhinosinusitis before patients with documented allergic rhinitis can be treated with immunotherapy.<sup>28</sup>

### Reasons for Adherence

The studies included in this review highlight areas where adherence to guideline recommendations is high. *Strong* recommendations *against* an intervention had higher adherence compared to other types of recommendations, including that clinicians should not “routinely administer or prescribe perioperative antibiotics to children undergoing tonsillectomy,” “order computerized tomography of the head/brain in the initial evaluation of a patient with presumptive sudden sensorineural hearing loss,” or “obtain routine laboratory tests in patients with idiopathic sudden sensorineural hearing loss.”<sup>35,36</sup> It may be easier for clinicians to abstain from a low-yield action than it is for them to change or add to clinical practice. In this review, simple recommendations with high adherence include giving a single intraoperative dose of steroids during tonsillectomy and obtaining magnetic resonance imaging for sudden hearing loss. In contrast, recommendations that require more counseling, education, or coordination of outside testing had lower adherence. These include assessing for and treating pain in acute rhinosinusitis, counseling patients with incomplete recovery of hearing after sudden hearing loss about hearing rehabilitation, and obtaining a preoperative PSG before tonsillectomy. These more complex actions can be time-intensive as well as limited by resources and systems barriers.

### Increasing Adherence

The greatest improvements to recommendation adherence were seen when a clinical group intentionally standardized their practices according to the guideline.<sup>19</sup> Milder and colleagues<sup>19</sup> showed that this approach led to an improvement from 6% to 97% for avoiding perioperative antibiotics in tonsillectomy. Electronic health records (EHRs) can be employed to increase guideline adherence. EHRs can both remind and support clinicians to follow guideline recommendations through order sets and care pathways.<sup>37</sup> They can also generate performance dashboards that clinicians can check on a regular basis to monitor their own practices and quality of care provided.<sup>38</sup> Lugtenberg and colleagues<sup>39</sup> surveyed general practitioners in the Netherlands to determine ways that would most likely promote their adherence to guidelines. The most preferred method was to have interactive small group meetings (84%) and second was to have audit and feedback (53%). Honeybrook and colleagues<sup>28</sup> also queried their survey respondents about preferred educational resources to help in applying the Allergic Rhinitis guideline and found that online education courses were most desired (32.8%), followed by AAO-HNSF annual meeting sessions (21.1%), home study course modules (18.0%), and patient management perspective self-assessment courses (15.0%). A combination of these different approaches may be most effective. Prior and colleagues<sup>31</sup> argue that “successful guideline implementation strategies should be multifaceted, and actively engage clinicians throughout the process.” Improving implementation of guidelines requires an education plan, a system plan, leadership commitment, and incentives.<sup>38,40</sup>

### Quality Metrics

Quality metrics may also enhance adherence to guidelines through performance or financial incentives. They are intended to evaluate clinician performance by comparing actual clinical practices to recommended practices to reward high-quality practice and identify areas for improvement. In 2013, Bhattacharyya and Kepnes<sup>21</sup> noted that guidelines “have recently attracted the focus of governmental agencies, third-party payers, medical societies, and patients as one of the main potential vehicles for improving the quality of health care rendered in the United States.” Several recommendations from AAO-HNSF guidelines have been incorporated into the Merit-Based Incentive Payment System (MIPS) for otolaryngology. These include prescribing topical antibiotics for acute otitis externa, avoiding systemic antibiotics for acute otitis externa, prescribing amoxicillin as first-line therapy for acute bacterial rhinosinusitis, and avoiding a CT for uncomplicated acute rhinosinusitis.

Not all of the recommendations in guidelines are appropriate for incorporation into quality metrics. Lack of consensus in support of a recommendation indicates that more evaluation of a clinical topic is necessary before a quality metric is developed. For example, Raol and colleagues<sup>33</sup> found no consensus among pediatric otolaryngologists regarding the necessity of a preoperative audiogram in

tympanostomy tube placement, suggesting the need for additional evidence demonstrating the benefit of getting a preoperative audiogram prior to use of this recommendation as a quality metric. This lack of consensus should also be considered when working on an update of a guideline. Areas of inconsistency or low adherence may need more evaluation of contradictory research as well as real-world patient, clinician, and systems factors.

### Risk of Bias and Limitations

By nature of the eligibility for inclusion in this review, the included studies could not be a randomized controlled trial. The OCEBM levels of evidence and risk of bias of the included studies are moderate to high. Each type of study design included in this review has relative limitations and strengths for addressing the question of guideline adherence. The single-center retrospective chart reviews have limited generalizability but can provide detailed clinical information that may help the understanding of reasons for nonadherence. Once identified, those reasons can be further evaluated and addressed. Clinician surveys reach a broader population but rely on accurate recall and self-reporting. Bias can also occur since clinicians who respond to surveys are often different from those who do not. However, targeted questions can be posed in surveys to better understand reasons for nonadherence and adherence. Database analyses that are well designed to minimize introduction of bias can efficiently assess practice impacts and change from guidelines as well as larger-scale levels of adherence.

### Conclusion

There is wide variation in incorporation of the AAO-HNSF clinical practice guideline recommendations into practice, and this variation appears to be influenced by the individual recommendation, the type of recommendation, clinician factors, and setting of care. This review highlights several areas where quality improvement and implementation efforts can be focused to understand obstacles and improve adherence to the clinical practice guideline recommendations.

### Acknowledgments

We thank Dr David Tunkel for critically reviewing the manuscript.

### Author Contributions

**Marisa A. Ryan**, conception and design of the work; acquisition, analysis, and interpretation of data for the work; drafting the work; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Grace R. Leu**, analysis and interpretation of data for the work; drafting the work; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Emily F. Boss**, interpretation of data for the work; revising it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions

related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Eileen M. Raynor**, interpretation of data for the work; revising it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Jonathan M. Walsh**, acquisition, analysis, and interpretation of data for the work; revising it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

### Disclosures

**Competing interests:** Emily F. Boss is an editorial board member for tonsillectomy decision aids for Option Grid/EBSCO Health.

**Sponsorships:** None.

**Funding source:** None.

### Supplemental Material

Additional supporting information is available in the online version of the article.

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