AMERICAN ACADEMY OF OTOLARYNGOLOGY–HEAD AND NECK SURGERY FOUNDATION

Supplement

Otolaryngology–Head and Neck Surgery
1–42

DOI: 10.1177/0194599817751030
http://otojournal.org
SAGE

Clinical Practice Guideline: Hoarseness (Dysphonia) (Update)

Robert J. Stachler, MD[1], David O. Francis, MD, MS[2], Seth R. Schwartz, MD, MPH[3], Cecelia C. Damask, DO[4], German P. Digoy, MD[5], Helene J. Krouse, PhD[1], Scott J. McCoy, DMA[6], Daniel R. Ouellette, MD[7], Rita R. Patel, PhD, CCC-SLP[8], Charles (Charlie) W. Reavis[9], Libby J. Smith, DO[10], Marshall Smith, MD[11], Steven W. Strode, MD, MEd, MPH[12], Peak Woo, MD[13], and Lorraine C. Nnacheta, MPH[14]

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

Abstract

Objective. This guideline provides evidence-based recommendations on treating patients who present with dysphonia, which is characterized by altered vocal quality, pitch, loudness, or vocal effort that impairs communication and/or quality of life. Dysphonia affects nearly one-third of the population at some point in its life. This guideline applies to all age groups evaluated in a setting where dysphonia would be identified or managed. It is intended for all clinicians who are likely to diagnose and treat patients with dysphonia.

Purpose. The primary purpose of this guideline is to improve the quality of care for patients with dysphonia, based on current best evidence. Expert consensus to fill evidence gaps, when used, is explicitly stated and supported with a detailed evidence profile for transparency. Specific objectives of the guideline are to reduce inappropriate variations in care, produce optimal health outcomes, and minimize harm.

For this guideline update, the American Academy of Otolaryngology—Head and Neck Surgery Foundation selected a panel representing the fields of advanced practice nursing, bronchoesophagology, consumer advocacy, family medicine, geriatric medicine, internal medicine, laryngology, neurology, otolaryngology–head and neck surgery, pediatrics, professional voice, pulmonology, and speech-language pathology.

Action Statements. The guideline update group made *strong recommendations* for the following key action statements (KASs): (1) Clinicians should assess the patient with dysphonia by history and physical examination to identify factors where expedited laryngeal evaluation is indicated. These include, but are not limited to, recent surgical procedures involving the head, neck, or chest; recent endotracheal intubation; presence of concomitant neck mass; respiratory distress or stridor; history of tobacco abuse; and whether the patient is a professional voice user. (2) Clinicians should advocate voice therapy for patients with dysphonia from a cause amenable to voice therapy.

The guideline update group made *recommendations* for the following KASs: (1) Clinicians should identify dysphonia in a patient with altered voice quality, pitch, loudness, or vocal effort that impairs communication or reduces quality of life (QOL). (2) Clinicians should assess the patient with dysphonia by history and physical examination for underlying causes of dysphonia and factors that modify management. (3) Clinicians should perform laryngoscopy, or refer to a clinician who can perform laryngoscopy, when dysphonia fails to resolve or improve within 4 weeks or irrespective of duration if a serious underlying cause is suspected. (4) Clinicians should perform diagnostic laryngoscopy, or refer to a clinician who can perform diagnostic laryngoscopy, before prescribing voice therapy and document/communicate the results to the speech-language pathologist (SLP). (5) Clinicians should advocate for surgery as a therapeutic option for patients with dysphonia with conditions amenable to surgical intervention, such as suspected malignancy, symptomatic benign vocal fold lesions that do not respond to conservative management, or glottic insufficiency. (6) Clinicians should offer, or refer to someone who can offer, botulinum toxin injections for the treatment of dysphonia caused by spasmodic dysphonia and other types of laryngeal dystonia. (7) Clinicians should inform patients with dysphonia about control/preventive measures. (8) Clinicians should document resolution, improvement or worsened symptoms of dysphonia, or change in QOL of patients with dysphonia after treatment or observation.

The guideline update group made a *strong recommendation against* 1 action: (1) Clinicians should *not* routinely prescribe antibiotics to treat dysphonia. The guideline update group made *recommendations against* other actions: (1) Clinicians should *not* obtain computed tomography (CT) or magnetic resonance imaging (MRI) for patients with a primary voice complaint prior to visualization of the larynx. (2) Clinicians should *not* prescribe antireflux medications to treat isolated dysphonia, based on symptoms alone attributed to suspected

gastroesophageal reflux disease (GERD) or laryngopharyngeal reflux (LPR), without visualization of the larynx. (3) Clinicians should *not* routinely prescribe corticosteroids for patients with dysphonia prior to visualization of the larynx.

The policy level for the following recommendation about laryngoscopy at any time was an *option*: (1) Clinicians may perform diagnostic laryngoscopy at any time in a patient with dysphonia.

Disclaimer. This clinical practice guideline is not intended as an exhaustive source of guidance for managing dysphonia (hoarseness). Rather, it is designed to assist clinicians by providing an evidence-based framework for decision-making strategies. The guideline is not intended to replace clinical judgment or establish a protocol for all individuals with this condition, and it may not provide the only appropriate approach to diagnosing and managing this problem.

Differences from Prior Guideline

(1) Incorporation of new evidence profiles to include the role of patient preferences, confidence in the evidence, differences of opinion, quality improvement opportunities, and any exclusion to which the action statement does not apply
(2) Inclusion of 3 new guidelines, 16 new systematic reviews, and 4 new randomized controlled trials
(3) Inclusion of a consumer advocate on the guideline update group
(4) Changes to 9 KASs from the original guideline
(5) New KAS 3 (escalation of care) and KAS 13 (outcomes)
(6) Addition of an algorithm outlining KASs for patients with dysphonia

Keywords

dysphonia, hoarseness, voice change, voice disturbance, voice disorders, laryngitis, voice, guidelines

Received May 26, 2017; revised August 14, 2017; accepted December 8, 2017.

Dysphonia (impaired voice production) is a very common complaint affecting nearly one-third of the population at some point in its life.[1-3] The term *dysphonia* is often used interchangeably with *hoarseness*; however, this terminology is imprecise, as hoarseness is a symptom of altered voice quality reported by patients, while dysphonia characterizes impaired voice production as recognized by a clinician.[4]

Dysphonia can affect patients of all ages and sex but has an increased prevalence in teachers, older adults, and other persons with significant vocal demands.[5-8] In fact, voice problems affect 1 in 13 adults annually.[9] While patients report a significant impairment of the voice, a relative minority seeks medical care for the voice problem.[9-11] Dysphonia is responsible for frequent health care visits and several billion dollars in lost productivity annually from work absenteeism.[12] Dysphonia is often caused by benign or self-limited conditions, but it may also be the presenting symptom of a more serious or progressive condition requiring prompt diagnosis and management.

This clinical practice guideline (CPG) is as an update of, and replacement for, a guideline published in 2009 by the American Academy of Otolaryngology—Head and Neck Surgery Foundation (AAO-HNSF).[13] An update was necessitated by new primary studies and systematic reviews that suggest a need for modifying clinically important recommendations, as well as by the elapsed time since the original guideline. Changes in content and methodology from the prior guideline include

- Incorporation of new evidence profiles to include the role of patient preferences, confidence in the evidence, differences of opinion, and quality improvement opportunities
- Inclusion of 3 new guidelines, 16 new systematic reviews, and 4 new randomized controlled trials (RCTs)
- Inclusion of a consumer advocate on the guideline update group (GUG)
- Changes to 9 of the key action statements (KAS) from the original guideline
- New KAS 3 (escalation of care) and KAS 13 (outcomes)
- Addition of an algorithm outlining KASs for patients with dysphonia

The working definitions found in **Table 1** were developed by the guideline panel, and they assume that dysphonia affects people differently. The target population for this guideline includes all individuals presenting with dysphonia, regardless of age. The guideline is intended for all clinicians who diagnose and treat patients with dysphonia, and it applies to any

[1]Wayne State University, Detroit, Michigan, USA; [2]University of Wisconsin, Madison, Wisconsin, USA; [3]Virginia Mason Medical Center, Seattle, Washington, USA; [4]Private practice, Lake Mary, Florida, USA; [5]Oklahoma State University, Oklahoma City, Oklahoma, USA; [6]Ohio State University, Columbus, Ohio, USA; [7]Henry Ford Health Systems, Detroit, Michigan, USA; [8]Indiana University, Bloomington, Indiana, USA; [9]National Spasmodic Dysphonia Association, Itasca, Illinois, USA [10]University of Pittsburgh Medical, Pittsburgh, Pennsylvania, USA; [11]University of Utah School of Medicine, Salt Lake City, Utah, USA; [12]Private practice, Sherwood, Arkansas, USA; [13]Icahn School of Medicine at Mt Sinai, New York, New York, USA; [14]Department of Research and Quality, American Academy of Otolaryngology—Head and Neck Surgery Foundation, Alexandria, Virginia, USA.

Corresponding Author:
Robert J. Stachler, MD, Stachler ENT, 33200 West 14 Mile Rd, Suite 240, West Bloomfield, MI 48322, USA.
Email: robstachler@comcast.net

Table 1. Dysphonia-Related Definitions.

Dysphonia	Altered vocal quality, pitch, loudness, or vocal effort that impairs communication as assessed by a clinician and/or affects quality of life
Hoarseness	A symptom of altered voice quality reported by patients
Worsened voice-related quality of life	Self-perceived decrement in function or a decline in economic status as a result of voice-related dysfunction
Dysarthria	A speech disorder due to impaired movement of the structures used for speech production, including the lips, tongue, and complex musculature involved in articulation
Dyspnea	Difficult or labored breathing, shortness of breath
Dysphagia	Disordered or impaired swallowing
Laryngoscopy	Term used to describe visualization of larynx. Unless otherwise specified, its use in this guideline refers to indirect laryngoscopy (visualization of the larynx), which can be done by several methods—including mirror examination, rigid rod-lens telescope examination, rigid rod-lens telescope, flexible fiber optic, or flexible distal chip scopes. Each laryngoscopy technique has specific diagnostic indications.
Stroboscopy	Advanced laryngeal imaging designed to visualize vocal fold vibratory abnormalities that cannot be appreciated with continuous light laryngoscopy. It uses a synchronized flashing light that passes through a laryngoscope.

setting in which dysphonia would be identified, monitored, treated, or managed.

There are a number of patients with modifying factors for whom many of the recommendations of the guideline may provide diagnostic and treatment guidance. There is some, though not comprehensive, discussion of these factors and how they might modify management. A partial list includes prior laryngeal surgery, recent surgical procedures involving the neck or affecting the recurrent laryngeal nerve, recent endotracheal intubation, history of radiation treatment to the neck, direct laryngeal trauma, craniofacial abnormalities, velopharyngeal insufficiency, and dysarthria (impaired articulation).

Guideline Purpose

The primary purpose of this guideline is to improve the quality of care for patients with dysphonia, based on current best evidence. Expert consensus to fill evidence gaps, when used, is explicitly stated and supported with a detailed evidence profile for transparency. Specific objectives of the guideline are to reduce excessive variation in care, produce optimal health outcomes, and minimize harm.[14-17] Additionally, lack of awareness about dysphonia and its causes are potential barriers to appropriate care. For example, while older adults may experience voice changes as a natural part of aging, some dysphonia in this population may represent symptoms of a more serious underlying disease. Additionally, a parent may misperceive hoarseness as being normal for his or her child. Such assumptions may prevent or delay the evaluation, diagnosis, and treatment of a serious underlying condition. Improved education among all health professionals[18] may allow for improved quality of care and minimization of harm.

The guideline focuses on a limited number of quality improvement opportunities, deemed most important by the working group, and is not intended to be a comprehensive, general guide for managing all patients with dysphonia. It is not intended to be a tool to be utilized by third-party payers to define or deny reimbursement for this condition. In this context, the purpose is to define actions that clinicians can take, regardless of discipline, to deliver quality care. Conversely, the statements in this guideline are not intended to limit or restrict care provided by clinicians based on assessment of individual patients.

This guideline addresses the identification, diagnosis, treatment, and prevention of dysphonia. In addition, it highlights and updates the needs and management options in special populations and among patients who have modifying factors. Furthermore, this guideline is intended to enhance the accurate diagnosis of dysphonia and its underlying causes, promote appropriate therapeutic options with outcomes assessment, and improve counseling and education for prevention and management of dysphonia.

Burden of Dysphonia

Prevalence of Dysphonia

Analyses of cross-sectional data from a large nationally representative US medical claims database in 2001 revealed the point prevalence of dysphonia to be 0.98% (536,943 patients with dysphonia per 55,000,000 patients) in a treatment-seeking population.[1] Consistent with prior studies, rates were higher among females (1.2% vs 0.7% for males) and among those >70 years of age (2.5% vs 0.6%-1.8% for all other age groups).[19-22] Of dysphonia-related diagnoses per the *International Classification of Diseases, Ninth Revision*, the most commonly used by physicians were acute laryngitis, nonspecific dysphonia, benign vocal fold lesions (eg, cysts, polyps, nodules), and chronic laryngitis. The true point prevalence of dysphonia-related conditions is likely higher, as most patients with voice changes are not "treatment seeking," particularly if the dysphonia is transient and related to an upper respiratory infection.[19] An earlier study surveyed randomly selected non–treatment seeking adults in Iowa and Utah and reported a 29.9% cumulative lifetime risk of a voice disorder before 65 years of age.[19]

Costs

Costs of treating dysphonia are significant. The direct costs of dysphonia, as estimated from a large administrative database study, were a mean US $577 to US $953 per patient per year. If an estimated 5.2 million patients with dysphonia seek treatment annually, this would translate into total direct health care costs up to US $13.5 billion.[23] For perspective, these costs are comparable to those spent on conditions such as chronic obstructive pulmonary disease (COPD), asthma, diabetes, and allergic rhinitis.

Quality-of-Life Consequences

Dysphonia primarily affects quality of life (QOL), except when it is a harbinger of a more serious condition (eg, associated with increased risk of mortality or morbidity). QOL consequences of dysphonia are substantial and can be debilitating. Affected patients often suffer social isolation, depression, anxiety, missed work, lost wages, and lifestyle changes.[11,19,24,25] Studies of voice disorders report QOL implications and work productivity losses comparable to those of patients with asthma, acute coronary syndrome, depression, and COPD.[10,11] Those with more severe variants (eg, unilateral vocal fold paralysis) have substantially worse QOL and more productivity losses.[10,26]

Dysphonia as Symptom of Underlying Disease

Dysphonia is a symptom common to a multitude of diseases. It is important to recognize that patients with head and neck cancer may present with dysphonia. In this group, failure to evaluate the larynx can delay cancer diagnosis, resulting in higher staging, need for more aggressive treatment, and reduced survival rates.[27] Other conditions that cause dysphonia are neurologic (eg, vocal fold paralysis, spasmodic dysphonia [SD], essential tremor, Parkinson's disease, amyotrophic lateral sclerosis, multiple sclerosis), gastrointestinal (eg, reflux, eosinophilic esophagitis), rheumatologic/autoimmune (eg, rheumatic arthritis, Sjögren's syndrome, sarcoidosis, amyloidosis, granulomatosis with polyangiitis), allergic, pulmonary (eg, COPD), musculoskeletal (eg, muscle tension dysphonia [MTD], fibromyalgia, cervicalgia), psychological (functional voice disorders), traumatic (eg, laryngeal fracture, inhalational injury, iatrogenic injury, blunt/penetrating trauma), and infectious (eg, candidiasis), among others. Prevalence of dysphonia within these conditions varies. For example, patients with SD or other laryngeal dystonia almost universally manifest with dysphonia. In contrast, not all patients with reflux have dysphonia.

Muscle Tension Dysphonia

Current *International Classification of Diseases, Ninth Revision* or *Tenth Revision* codes are imprecise for voice disorders. It is likely that a large proportion of patients with nonspecific dysphonia and chronic laryngitis identified in the aforementioned large administrative database studies ultimately were diagnosed with MTD. This condition is a voice disorder that constitutes 10% to 40% of caseloads in voice centers,[28] and it is characterized by increased laryngeal musculoskeletal tension with excessive recruitment in the larynx and pharynx with concomitant disruption of efficient vibratory parameters.[29] MTD is further classified as primary or secondary. *Primary* occurs in the absence of identifiable fixed laryngeal disorders, while *secondary* refers to MTD that occurs in conjunction with laryngeal disorders.[30] Both types present with variable symptomatology, including voice change, vocal fatigue, effortful voice production, change in habitual pitch, reduced vocal range, pain with voice use, muscular cramping and neck stiffness.

Dysphonia and Age

Voice disorders affect all ages, but some evidence suggests that risks are higher in pediatric and elderly (>65 years of age) populations. An estimated 23.4% of children have dysphonia at some point,[31-34] with increased prevalence among boys and those in the 8- to 14-year age range.[35]

Prevalence is also substantially higher among older adults with presbylarynx (ie, age-related laryngeal changes).[8,20,36-43] In a large nationally representative administrative insurance claims database,[1,22] the prevalence rate of dysphonia in the treatment-seeking elderly population was 1.3% among those aged 60 to 69 years and 2.5% among patients >70 years.[1] The most common diagnoses coded in this cohort were acute and chronic laryngitis, nonspecific dysphonia, and laryngeal lesions. An earlier study that surveyed non–treatment seeking elderly volunteers reported that 47% had a voice disorder during their lifetime and 29% were actively experiencing dysphonia.[44] Another study surveyed 120 elderly occupants of an independent living facility in Atlanta and found a 20–percentage point prevalence of voice disturbance based on voice-related QOL scores.[45]

Dysphonia and Occupation

People in vocations with high vocal demands have increased likelihood of developing dysphonia. This includes, but is not limited to, singers and entertainers,[46,47] legal professionals,[48] teachers,[49,50] telemarketers,[5,51,52] aerobics instructors,[6] clergy,[48] and coaches.[53]

Dysphonia can affect a person's ability to work.[54] An estimated 28 million workers in the United States experience voice problems daily.[48] In the general population, 7.2% of individuals surveyed missed work for ≥1 more days within the preceding year because of a voice problem,[19] and 1 out of 10 individuals with voice disorders file short-term disability claims.[55] In fact, 20% of teachers miss work due to dysphonia,[21] and absenteeism in this occupation alone has associated economic ramifications of $2.5 billion in the United States annually.[48]

Iatrogenic Dysphonia

Vocal fold injury after intubation is common, with estimates ranging widely from 2.3% to 84%, depending on the age range assessed (infants vs adults), injury definition, and ascertainment methodology.[56-59] Estimated rates of dysphonia resulting from injury to the recurrent laryngeal nerve after thyroidectomy and anterior cervical spine surgery also range widely in the literature: 0.85% to 8.5%[60-69] and 1.69% to

24.2%,[70-73] respectively. Cardiothoracic procedures for children and adults represent another source of recurrent laryngeal nerve injury.[74-77] It is important to emphasize that the wide ranges listed are attributed to different assessment criteria, study designs and ascertainment methodology, and patient populations considered and highlight the overall lack of understanding of the population-level burden of iatrogenic voice-related disease.

Medication Side Effects

Medication side effects are another etiology of and contributor to dysphonia. While many medications have dysphonia as a potential side effect, inhaled steroids and drying agents (eg, anticholinergics,[78,79] antihistamines,[80] decongestants,[80] and antihypertensives[81]) are most closely linked to dysphonia. Steroid inhalers may cause fungal and nonspecific laryngitis.[82-85] Drying medications were associated with 2.32- and 4.52-fold increased odds of dysphonia in a recent cross-sectional study.[78]

CPG Outcome Measures

The primary outcome considered in this guideline is measured change in QOL. Secondary outcomes include assessment of harms (eg, complications and adverse events). Economic consequences, adherence to therapy, absenteeism, communication function, and voice-related health care utilization were also considered. The high prevalence, significant individual and societal implications, diversity of interventions, and lack of consensus make this an important condition for an up-to-date evidence-based practice guideline.

Methods

General Methods

In the development of this update of the evidence-based CPG, the methods outlined in the AAO-HNSF's "Clinical Practice Guideline Development Manual, Third Edition" were followed explicitly.[86]

A draft of the original hoarseness guideline[13] was sent to a panel of expert reviewers from the fields of advanced practice nursing, bronchoesophagology, consumer advocacy, family medicine, geriatric medicine, internal medicine, laryngology, neurology, otolaryngology–head and neck surgery, pediatrics, professional voice teachers, pharmacy, and speech-language pathology. Several group members had significant experience in developing CPGs. The reviewers concluded that the original guideline action statements remained valid but should be updated with minor modifications. Suggestions were also made for new KASs.

Literature Search

An information specialist conducted 3 literature searches from December 2015 through April 2016 using a validated filter strategy to identify CPGs, systematic reviews, and RCTs. The search terms used were as follows: ("hoarseness"[MeSH Terms] OR "hoarseness"[tw] OR "hoarse"[tw] OR "aphonia"[MeSH Terms] OR "aphonia"[tw] OR "phonation disorder"[tw] OR "dysphonia"[MeSH Terms] OR "dysphonia"[tw] OR "phonation disorders"[tw] OR "voice disorder"[tw] OR "voice disorders"[tw] OR "vocal disorder"[tw] OR "vocal disorders"[tw] OR laryngitis[tw] OR "laryngeal disorder"[tw] OR "laryngeal disorders"[tw]). These search terms were used to capture all evidence on the population by incorporating all relevant treatments and outcomes.

The English-language searches were performed in multiple databases: HSTAT, AHRQ, BIOSIS Previews, CAB Abstracts, AMED, EMBASE, GIN International Guideline Library, Cochrane Library (Cochrane Database of Systematic Reviews, DARE, HTA Database, NHS EED), Australian National Health and Medical Research Council, New Zealand Guidelines Group, SIGN, TRIP Database, CMA Infobase, National Guideline Clearinghouse, PubMed Search, and CINAHL.

The initial English-language search identified 106 CPGs, 561 systematic reviews, and 516 RCTs published in 2008 or later. CPGs were included if they met quality criteria of (1) an explicit scope and purpose, (2) multidisciplinary stakeholder involvement, (3) systematic literature review, (4) explicit system for ranking evidence, and (5) explicit system for linking evidence to recommendations. Systematic reviews were emphasized and included if they met quality criteria of (1) a clear objective and methodology, (2) an explicit search strategy, and (3) valid data extraction methods. RCTs were included if they met quality criteria as follows: (1) trials involved study randomization; (2) trials were described as double-blind; and (3) trials denoted a clear description of withdrawals and dropouts of study participants. After removal of duplicates, irrelevant references, and non–English language articles, 6 CPGs, 55 systematic reviews, and 24 RCTs were retained. In certain instances, targeted searches were performed by GUG members to address gaps from the systematic searches identified in writing the guideline from June 2016 through February 2017. Therefore, in total, the evidence supporting this guideline includes 3 CPGs, 16 systematic reviews, and 4 RCTs. The recommendations in this CPG are based on systematic reviews identified by a professional information specialist using an explicit search strategy. Additional background evidence included RCTs and observational studies, as needed, to supplement the systematic reviews or to fill gaps when a review was not available.

The AAO-HNSF assembled a GUG representing the disciplines of advanced practice nursing, bronchoesophagology, consumer advocacy, family medicine, geriatric medicine, internal medicine, laryngology, neurology, otolaryngology–head and neck surgery, pediatrics, professional voice, pulmonology, and speech-language pathology. The GUG had several conference calls and 1 in-person meeting during which it defined the scope and objectives of updating the guideline, reviewed comments from the expert panel review for each KAS, identified other quality improvement opportunities, reviewed the literature search results, and drafted the document.

The evidence profile for each statement in the earlier guideline was then converted into an expanded action statement profile for consistency with our current development standards.[86] Information was added to the action statement

Table 2. Aggregate Grades of Evidence by Question Type.[a]

Grade	CEBM Level	Treatment	Harm	Diagnosis	Prognosis
A	1	Systematic review[b] of randomized trials	Systematic review[b] of randomized trials, nested case-control studies, or observational studies with dramatic effect	Systematic review[b] of cross-sectional studies with consistently applied reference standard and blinding	Systematic review[b] of inception cohort studies[c]
B	2	Randomized trials or observational studies with dramatic effects or highly consistent evidence	Randomized trials or observational studies with dramatic effects or highly consistent evidence	Cross-sectional studies with consistently applied reference standard and blinding	Inception cohort studies[c]
C	3-4	Nonrandomized or historically controlled studies, including case-control and observational studies	Nonrandomized controlled cohort or follow-up study (postmarketing surveillance) with sufficient numbers to rule out a common harm; case-series, case-control, or historically controlled studies	Nonconsecutive studies; case-control studies; or studies with poor, nonindependent, or inconsistently applied reference standards	Cohort study, control arm of a randomized trial, case series or case-control studies, or poor-quality prognostic cohort study
D	5	Case reports, mechanism-based reasoning, or reasoning from first principles			
X	N/A	Exceptional situations where validating studies cannot be performed and there is a clear preponderance of benefit over harm			

Abbreviation: CEBM, Oxford Centre for Evidence-Based Medicine; N/A, not applicable.
[a]Adapted from Howick and coworkers.[90]
[b]A systematic review may be downgraded to level B because of study limitations, heterogeneity, or imprecision.
[c]A group of individuals identified for subsequent study at an early uniform point in the course of the specified health condition or before the condition develops.

profiles regarding quality improvement opportunities, level of confidence in the evidence, differences of opinion, role of patient preferences, and any exclusion to which the action statement does not apply. New KASs were developed with an explicit and transparent a priori protocol for creating actionable statements based on supporting evidence and the associated balance of benefit and harm. Electronic decision support software (BRIDGE-Wiz; Yale Center for Medical Informatics, New Haven, Connecticut) was used to facilitate the creation of actionable recommendations and evidence profiles.[87]

The updated guideline underwent GuideLine Implementability Appraisal to appraise adherence to methodologic standards, to improve clarity of recommendations, and to predict potential obstacles to implementation.[88] The GUG received summary appraisals and modified an advanced draft of the guideline based on the appraisal. The final draft of the updated CPG was revised per the comments received during multidisciplinary peer review, open public comment, and journal editorial peer review. A scheduled review process will occur at 5 years from publication or sooner if new compelling evidence warrants earlier consideration.

Classification of Evidence-Based Statements

Guidelines are intended to produce optimal health outcomes for patients, to minimize harm, and to reduce inappropriate variations in clinical care. The evidence-based approach to guideline development requires that evidence supporting a policy be identified, appraised, and summarized and that an explicit link between evidence and statements be defined. Evidence-based statements reflect both the quality of evidence and the balance of benefit and harm that are anticipated when the statement is followed. The definitions for evidence-based statements are listed in **Table 2**[89,90] and **Table 3.**[91]

Guidelines are not intended to supersede professional judgment but rather may be viewed as a relative constraint on individual clinician discretion in a particular clinical circumstance. Less frequent variation in practice is expected for a "strong recommendation" as compared with a "recommendation." "Options" offer the most opportunity for practice variability.[91] Clinicians should always act and decide in a way that they believe will best serve their patients' interests and needs, regardless of guideline recommendations. They must also operate within their scope of practice and according to their training. Guidelines represent the best judgment of a team of experienced clinicians and methodologists addressing the scientific evidence for a particular topic.[91] Making recommendations about health practices involves value judgments on the desirability of various outcomes associated with management options. Values applied by the guideline panel sought to minimize harm and diminish unnecessary and inappropriate

Table 3. Guideline Definitions for Evidence-Based Statements.

Statement	Definition	Implication
Strong recommendation	A strong recommendation means that the benefits of the recommended approach clearly exceed the harms (or that the harms clearly exceed the benefits, in the case of a strong negative recommendation) and that the quality of the supporting evidence is excellent (grade A or B).[a] In some clearly identified circumstances, strong recommendations may be made on the basis of lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A recommendation means that the benefits exceed the harms (or that the harms exceed the benefits, in the case of a negative recommendation) but that the quality of evidence is not as strong (grade B or C).[a] In some clearly identified circumstances, recommendations may be made on the basis of lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits outweigh the harms.	Clinicians should also generally follow a recommendation but should remain alert to new information and sensitive to patient preferences.
Option	An option means either that the quality of evidence that exists is suspect (grade D)[a] or that well-done studies (grade A, B, or C)[a] show little clear advantage to one approach versus another.	Clinicians should be flexible in their decision making regarding appropriate practice, although they may set bounds on alternatives. Patient preference should have a substantial influencing role.

[a]American Academy of Pediatrics classification scheme.[91]

therapy. A major goal of the panel was to be transparent and explicit about how values were applied and to document the process.

Financial Disclosure and Conflicts of Interest

The cost of developing this guideline, including travel expenses of all panel members, was covered in full by the AAO-HNSF. Potential conflicts of interest for all panel members in the past 2 years were compiled and distributed before the first conference call. After review and discussion of these disclosures,[92] the panel concluded that individuals with potential conflicts could remain on the panel if they (1) reminded the panel of potential conflicts before any related discussion, (2) recused themselves from a related discussion if asked by the panel, and (3) agreed not to discuss any aspect of the guideline with industry before publication. Last, panelists were reminded that conflicts of interest extend beyond financial relationships and may include personal experiences, how a participant earns a living, and the participant's previously established "stake" in an issue.[93]

Guideline Key Action Statements

Each evidence-based statement is organized in a similar fashion: an evidence-based KAS in bold, followed by the strength of the recommendation in italics. Each KAS is followed by the "action statement profile," which lists quality improvement opportunities, aggregate evidence quality, level of confidence in the evidence, the risks and costs of carrying out the prescribed action as determined by the panel, and a benefit-harm assessment. Additionally, there is an explicit statement of any value judgments, the role of patient preferences, clarification of any intentional vagueness by the panel, exclusions to the statement, any differences of opinion, and a repeat statement of the strength of the recommendation. Several paragraphs subsequently discuss the evidence base supporting the statement. **Table 4** presents an overview of each evidence-based statement in this guideline.

For the purposes of this guideline, *shared decision making* refers to the exchange of information regarding treatment risks and benefits, as well as the expression of patient preferences and values, which result in mutual responsibility in decisions regarding treatment and care.[94] In cases where evidence is weak or benefits are unclear, the practice of shared decision making is extremely useful, wherein the management decision is made by a collaborative effort between the clinician and an informed patient. Factors related to patient preference include, but are not limited to, absolute benefits (numbers needed to treat), adverse effects (number needed to harm), cost of medications or procedures, and frequency and duration of treatment.

STATEMENT 1. IDENTIFICATION OF ABNORMAL VOICE: Clinicians should identify dysphonia in a patient with altered voice quality, pitch, loudness, or vocal effort that impairs communication or reduces QOL. *Recommendation based on observational studies with a preponderance of benefit over harm*.

Table 4. Summary of Evidence-Based Statements.

Statement	Action	Strength
1. Identification of abnormal voice	Clinicians should identify dysphonia in a patient with altered voice quality, pitch, loudness, or vocal effort that impairs communication or reduces QOL.	Recommendation
2. Identifying underlying cause of dysphonia	Clinicians should assess the patient with dysphonia by history and physical examination for underlying causes of dysphonia and factors that modify management.	Recommendation
3. Escalation of care	Clinicians should assess the patient with dysphonia by history and physical examination to identify factors where expedited laryngeal evaluation is indicated. These include but are not limited to recent surgical procedures involving the head, neck, or chest; recent endotracheal intubation; presence of concomitant neck mass; respiratory distress or stridor; history of tobacco abuse; and whether the patient is a professional voice user.	Strong recommendation
4a. Laryngoscopy and dysphonia	Clinicians may perform diagnostic laryngoscopy at any time in a patient with dysphonia.	Option
4b. Need for laryngoscopy in persistent dysphonia	Clinicians should perform laryngoscopy, or refer to a clinician who can perform laryngoscopy, when dysphonia fails to resolve or improve within 4 weeks or irrespective of duration if a serious underlying cause is suspected.	Recommendation
5. Imaging	Clinicians should *not* obtain computed tomography (CT) or magnetic resonance imaging (MRI) for patients with a primary voice complaint prior to visualization of the larynx.	Recommendation against
6. Antireflux medication and dysphonia	Clinicians should *not* prescribe antireflux medications to treat isolated dysphonia based on symptoms alone attributed to suspected gastroesophageal reflux disease (GERD) or laryngopharyngeal reflux (LPR), without visualization of the larynx.	Recommendation against
7. Corticosteroid therapy	Clinicians should *not* routinely prescribe corticosteroids for patients with dysphonia prior to visualization of the larynx.	Recommendation against
8. Antimicrobial therapy	Clinicians should *not* routinely prescribe antibiotics to treat dysphonia.	Strong recommendation against
9a. Laryngoscopy prior to voice therapy	Clinicians should perform diagnostic laryngoscopy, or refer to a clinician who can perform diagnostic laryngoscopy, before prescribing voice therapy and document/communicate the results to the speech-language pathologist (SLP).	Recommendation
9b. Advocating for voice therapy	Clinicians should advocate voice therapy for patients with dysphonia from a cause amenable to voice therapy.	Strong recommendation
10. Surgery	Clinicians should advocate for surgery as a therapeutic option for patients with dysphonia with conditions amenable to surgical intervention, such as suspected malignancy, symptomatic benign vocal fold lesions that do not respond to conservative management, or glottic insufficiency.	Recommendation
11. Botulinum toxin	Clinicians should offer, or refer to a clinician who can offer, botulinum toxin injections for the treatment of dysphonia caused by spasmodic dysphonia and other types of laryngeal dystonia.	Recommendation
12. Education/prevention	Clinicians should inform patients with dysphonia about control/preventive measures.	Recommendation
13. Outcomes	Clinicians should document resolution, improvement, or worsened symptoms of dysphonia or change in QOL among patients with dysphonia after treatment or observation.	Recommendation

Action Statement Profile: 1

- Quality improvement opportunity: To promote awareness of dysphonia by all clinicians as a condition that may require intervention or additional investigation. National Quality Strategy domain: Prevention and Treatment of Leading Causes of Morbidity and Mortality.
- Aggregate evidence quality: Grade C, observational studies for symptoms, with 1 systematic review of QOL in voice disorders and 2 systematic reviews on medication side effects
- Level of confidence in evidence: High
- Benefit: Timely recognition of the need to search for an underlying etiology; identify patients who may benefit

from treatment; discourage the perception of dysphonia as a trivial condition that does not warrant attention
- Risks, harms, costs: Potential anxiety related to diagnosis; time expended in diagnosis, documentation, and discussion
- Benefits-harm assessment: Preponderance of benefits over harm
- Value judgments: The group believes that this is a critical component to caring for patients with altered voice, but it was constrained from calling this a strong recommendation from a lack of A- or B-level evidence
- Intentional vagueness: None
- Role of patient preferences: Small
- Exclusions: None
- Policy Level: Recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is to promote awareness of dysphonia as a condition that may decrease a patient's QOL or as a harbinger of a serious underlying condition (eg, associated with increased risk of mortality or morbidity). The proposed diagnosis (dysphonia) is based strictly on clinical criteria and does not require testing. Hoarseness is the patient- and/or proxy-reported symptom of altered voice quality. Dysphonia is diagnosed by the clinician for individuals who present with complaints of abnormal voice or voice changes or if a proxy/parent has recognized abnormal voice or voice changes.

The clinician should assess the quality of the voice. For example, a breathy voice may signify vocal fold paralysis or another cause of incomplete vocal fold closure. A strained voice with altered pitch or pitch breaks is common in SD.[95] Changes in voice quality may be limited to the singing voice and not affect the speaking voice. Among infants and young children, an abnormal cry may signify underlying pathology (eg, vocal fold paralysis, laryngeal papilloma).[96]

Clinicians should also solicit input from proxies (when available) when evaluating dysphonia, as patients often discount their symptoms. In 1 study, 52% of patients with vocal fold cancer thought that their dysphonia was harmless and delayed seeing a physician, and 16.7% sought treatment only after encouragement from other people.[97] Another study found that patients routinely delay medical evaluation of hoarseness symptoms for >100 days.[98] Prompt referral by primary care physicians could improve outcomes and QOL.

Furthermore, children, those with cognitive impairments, and patients with severe emotional distress may be unaware or unable to recognize and report on their own dysphonia.[99] QOL studies of older adults required proxy input for approximately 25% of the geriatric population.[100] While many self-report measures for dysphonia are available, patients may be unable to complete them.[101-104] In these cases, proxy judgments by significant others about QOL are a good alternative.[99]

STATEMENT 2. IDENTIFYING UNDERLYING CAUSE OF DYSPHONIA: Clinicians should assess the patient with dysphonia by history and physical examination for underlying causes of dysphonia and factors that modify management. *Recommendation based on observational studies with a preponderance of benefit over harm.*

Action Statement Profile: 2

- Quality improvement opportunity: To guide the expediency and nature of recommended treatments/investigations through identification of potential underlying causes of the dysphonia. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality; Effective Communication and Care Coordination.
- Aggregate evidence quality: Grade C, observational studies
- Level of confidence in evidence: High
- Benefit: To identify potential causative factors of the dysphonia, increase awareness of underlying causes of dysphonia, identify patients at risk for serious underlying conditions, and identify underlying cause to allow for targeted treatment
- Risks, harms, costs: None
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: Further management of dysphonia is completely dependent on the underlying cause. The group believed that while this seems obvious, it was an opportunity to educate clinicians about potential etiologies
- Intentional vagueness: None
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Strong recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is to help clinicians identify the underlying cause of dysphonia. Careful history and physical examination provide important clues to the underlying etiology and can help direct management (**Table 5**).

The larynx is a physiologically complex organ that sits at the intersection of the upper respiratory tract and esophageal inlet. It is therefore exposed to a variety of pathogens and noxious irritants and is at risk for iatrogenic injury. Thus, potential etiologies of dysphonia are very broad and include traumatic, infectious, inflammatory, neurologic, metabolic, neoplastic, congenital, and behavioral factors (**Table 6**).

The history should include, but not be limited to, reviewing the duration of the dysphonia, type of onset (eg, sudden, gradual), potential inciting events, how the condition is affecting the patient, associated symptoms (eg, swallowing, breathing difficulties), modifying factors, current medications, habits (eg, smoking, alcohol use), concurrent medical conditions, and prior surgery (**Tables 5** and **6**). Careful evaluation allows the clinician to (1) categorize dysphonia severity, (2) develop a treatment plan, and (3) prioritize patients who may need escalated care.[105,106]

Table 5. Examples of Pertinent Questions in the Assessment of a Patient with Dysphonia.[301,459,460,a]

Voice-specific questions	Was the onset of your hoarseness abrupt or slowly progressive?
	Does your voice ever return to normal, or is the hoarseness constant?
	Did your voice change at the time or persist after an upper respiratory tract infection?
	Do you have pain, or is there effort when talking?
	Does your voice deteriorate or fatigue with use?What is different about the sound of your voice?
	Do you have a difficult time getting loud or projecting?
	Have you noticed changes in your pitch or range?
	Do you run out of air when talking?
	Does your voice crack or break?
	Were you intubated prior to dysphonia onset?
	Did you have brain, spine, neck, or chest surgery prior to dysphonia onset?
	Did you recently take inhaled medications, antibiotics, or steroids?
	Do you need the voice for your occupation? Do you have significant daily voice use requirements?
	Do you smoke (tobacco, vape, or use recreational drugs)?
	Does your throat feel dry?
	Have you undergone radiation therapy to the head and neck region?
	Do you have any neurologic or arthritic problems?
	Did you have prior trauma (physical, emotional, or psychological) preceding the voice change?
Symptoms	Globus pharyngeus (persisting sensation of lump in throat)
	Dysphagia
	Sore throat
	Chronic throat clearing
	Cough
	Odynophagia (pain with swallowing)
	Nasal drainage
	Postnasal drainage
	Acid reflux
	Regurgitation
	Heartburn
	Hemoptysis
	Nonanginal chest pain
	Waterbrash (sudden appearance of salty liquid in the mouth)
	Halitosis (“bad breath”)
	Weight loss
	Night sweats
	Fever (>101.5°F)
	Otalgia (ear pain)
	Dyspnea (difficulty breathing)
Medical history relevant to dysphonia	Occupation and/or avocation requiring extensive voice use (eg, teacher, singer)
	Absenteeism from occupation due to dysphonia
	Prior episodes of hoarseness
	Relationship of instrumentation (eg, intubation) to onset of dysphonia
	Relationship of prior surgery to neck or chest to onset of dysphonia
	Cognitive impairment (requirement for proxy historian)
	Anxiety, depression, stress
Acute conditions	Infection of the throat and/or larynx: viral, bacterial, fungal
	Foreign body in larynx, trachea, or esophagus
	Neck or laryngeal trauma
Chronic conditions	Stroke
	Diabetes
	Parkinson’s disease
	Parkinson-plus syndromes (eg, progressive supranuclear palsy)
	Myasthenia gravis
	Multiple sclerosis
	Amyotrophic lateral sclerosis
	Essential tremor
	Testosterone deficiency
	Allergic rhinitis
	Chronic rhinitis
	Hypertension (because of certain medications used for this condition)
	Schizophrenia (because of antipsychotics used for mental health problems)

(continued)

Table 5. (continued)

Osteoporosis (because of certain medications used for this condition)
Asthma (because of use of inhaled steroids or effect on respiratory function)
Chronic obstructive pulmonary disease (because of use of inhaled steroids or effect on respiratory function)
Aneurysm of thoracic aorta (rare cause)
Laryngeal cancer
Lung cancer (or metastasis to the lung)
Thyroid cancer
Hypothyroidism and other endocrinopathies
Vocal fold nodules
Vocal fold paralysis
Vocal abuse
Infective laryngitis
Chemical laryngitis
Chronic tobacco use
Sjögren's syndrome
Alcohol (moderate to heavy use or abuse)
Menopause

[a]These are sample considerations, and the list is not comprehensive of all pertinent parameters that may need to be assessed.

Physical examination should include a full head and neck examination with particular attention to listening to the voice (perceptual evaluation), inspection and palpation of the neck for masses or lesions, and, if feasible, indirect mirror laryngoscopy. Observations of swallowing and breathing should be performed to assess for any discomfort or difficulty in either. History and general physical examination can help differentiate which patients may need laryngeal examination.

Note that most dysphonia is self-limited and related to upper respiratory tract infection, which usually resolves in 7 to 10 days regardless of treatment. Thus, clinicians should identify dysphonia and determine its duration and associated symptoms. If other upper respiratory tract infection symptoms are associated with dysphonia (eg, rhinitis, fever [>101.5°F], fatigue) and symptoms in general are of recent onset, then the voice changes will likely resolve spontaneously.

Dysphonia that does not resolve within a few weeks is more challenging to diagnose. Causes may include MTD, voice overuse, allergic laryngitis, tobacco use, head and neck cancer, medication side effects, age-related changes, intubation, and postsurgical injury, among others. Voice overuse is perhaps the most common cause of chronic dysphonia. Many occupations depend on voice use. For instance, >50% of teachers experience dysphonia attributable to voice overuse, and 20% miss work as a result.[107] Clinicians should inquire about an individual's voice use and how the altered voice quality affects the individual professionally and in other areas of life (eg, ability communicate with family). Patient occupation should be elicited during the history. Professional voice users (those who rely on their voices for their livelihood) and those who cannot function adequately to perform required duties can be significantly affected by voice symptoms that may be subclinical for other patients. Early evaluation is warranted for these patient groups, as delay in diagnosis and treatment can have psychological and economic ramifications.

Dysphonia in smokers is of particular concern. Smoking is associated with an increased risk of polypoid vocal fold lesions (Reinke's edema), leukoplakia, erythroplakia, and, most important, head and neck cancer.[108] Thus, dysphonia in smokers should prompt expedient laryngoscopy or referral for laryngoscopy, as described in KAS 3 (escalation of care). An important historical consideration in the evaluation of patients already diagnosed with head and neck cancer is whether they underwent neck radiation, which often leads to decline in voice quality.[109]

Medications (**Table 7**) can also contribute to dysphonia. In particular, patients who use inhaled corticosteroids for the treatment of asthma or COPD may present with dysphonia, which can result from direct mucosal irritation from inhaled particulates or secondary to laryngeal fungal infection.[82-85] Many other types of medications can negatively affect voice production, including drying medications and certain hormonal treatments, among others.

Age of the patient with dysphonia can also help in the differential diagnosis. Voice disorders are common among older adults and significantly affect their QOL.[8,45] Vocal fold atrophy with resulting dysphonia is common among older individuals and is frequently undiagnosed by primary care providers.[37,110] Neurologic conditions are also more common among older individuals (eg, Parkinson's disease, stroke) and can cause voice changes.[38,111-113]

The differential diagnosis of pediatric patients is unique and depends on the age of the child. Premature infants are especially at risk for dysphonia.[114,115] Dysphonia is often recognized by perception of abnormal cry.[96] Suspicion should prompt otolaryngology consultation.[116] Premature infants and neonates are also at risk for iatrogenic injury to their vocal folds due to prolonged intubation.[117] When infants do present with dysphonia, underlying etiologies should be considered—such as birth trauma, surgery (eg, patent ductus arteriosus correction) or intubation, and intracranial process (eg, Arnold-Chiari malformation or posterior fossa mass, congenital laryngeal anomaly, or mediastinal pathology).[118] Chronic dysphonia is quite common among preschool to adolescent children and has an adverse impact on QOL.[119] Additionally, prevalence rates range from 15% to 24% of the

Table 6. Etiologies of Dysphonia and Examples from Each Category.[a]

Etiologic Category	Examples
Surgery	Thyroidectomy or parathyroidectomy
	Anterior spine surgery
	Thoracic and cardiac surgery
	Neurosurgery and skull base surgery
Inflammatory	Tobacco use
	Polypoid corditis
	Allergy
Autoimmune	Granulomatosis with polyangiitis
	Sarcoidosis
	Amyloidosis
	Rheumatoid arthritis
Infectious	Viral upper respiratory infection
	Bacterial infection
	Laryngeal candidiasis
Neurologic	Laryngeal dystonia (eg, spasmodic dysphonia)
	Vocal fold paralysis
	Essential tremor
	Parkinson disease
Endocrinologic	Hypothyroidism
	Diabetes
	Menopause
	Androgen supplementation
Neoplastic	Laryngeal squamous cell carcinoma
	Recurrent respiratory papillomatosis
	Metastatic disease
	Other neoplasms (eg, chondromas, lymphoma)
Congenital	Laryngeal web
	Vocal fold cyst
	Laryngeal cleft
Traumatic	Laryngeal fracture
	Posterior glottic stenosis
	Intubation injury
Behavioral	Vocal fold nodules
	Vocal fold cyst
	Vocal fold polyp
	Vocal fold vascular lesion
Musculoskeletal	Muscle tension dysphonia
	Cervicalgia
Gastrointestinal	Reflux

[a]Not a comprehensive list of etiologic examples.

population.[31,34,120] In 1 study, 77% of hoarse children had vocal fold nodules.[34]

STATEMENT 3. ESCALATION OF CARE: Clinicians should assess the patient with dysphonia by history and physical examination to identify factors where expedited laryngeal evaluation is indicated. These include but are not limited to recent surgical procedures involving the head, neck, or chest; recent endotracheal intubation; presence of concomitant neck mass; respiratory distress or stridor; history of tobacco abuse; and whether the patient is a professional voice user. *Strong recommendation based on observational studies with a preponderance of benefit over harm.*

Action Statement Profile: 3

- Quality improvement opportunity: To encourage early referral of patients with dysphonia whose history, symptoms, or physical examination is concerning for a serious underlying etiology. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality; Effective Communication and Care Coordination; Patient Safety.
- Aggregate evidence quality: Grade B, based on overwhelmingly consistent evidence from observational studies
- Level of confidence in evidence: High
- Benefit: To identify factors early in the course of management that could influence the timing of diagnostic procedures, choice of interventions, or provision of follow-up care; to identify risk factors; to identify populations for whom early or more aggressive intervention may be warranted (ie, professional voice)
- Risks, harms, costs: Time in assessment
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: Importance of history taking and identifying modifying factors as an essential component of providing quality care
- Intentional vagueness: The term *expedited* does not specify exact timing
- Role of patient preferences: Moderate (small: in the setting of a neck mass with dysphonia or concern for malignancy)
- Exclusions: None
- Policy level: Strong recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is to encourage early laryngoscopy and/or referral for specialty care with laryngoscopy for patients with dysphonia whose history, symptoms, or physical examination is concerning for a serious underlying etiology (eg, associated with increased risk of mortality or morbidity). Several conditions exist for which early laryngeal visualization can minimize morbidity and mortality and reduce negative QOL consequences. For example, smokers with new-onset dysphonia with or without lymphadenopathy or neck mass should be referred for laryngeal examination to rule out the potential for head and neck cancer. Early referral to an otolaryngologist or, when available, a laryngologist (otolaryngologists with advanced experience in managing voice disorders) should also be offered for professional voice users and singers or others occupations/positions where a delay may risk extension of injury and/or have a significant effect on QOL and/or professional obligations. Other triggers warranting early referral include new-onset dysphonia after anterior neck, cardiothoracic, or neurologic surgery and symptoms concerning for rapidly progressive neurologic disorders, such as amyotrophic lateral sclerosis. Dysphonia with associated stridor or

Table 7. Medications That May Cause Dysphonia.[a]

Medication	Mechanism of Impact on Voice
Coumadin, thrombolytics, phosphodiesterase-5 inhibitors	Vocal fold hematoma[461-463]
Bisphosphonates	Chemical laryngitis[464]
Angiotensin-converting enzyme inhibitors	Cough[465]
Antihistamines, diuretics, anticholinergics	Drying effect on mucosa[78, 80,345]
Danocrine, testosterone	Sex hormone production/utilization; alteration[466,467]
Antipsychotics, atypical antipsychotics	Laryngeal dystonia[468,469]
Inhaled steroids	Dose dependent mucosal irritation[261,263,470]; fungal laryngitis[264,265]

[a]This is not intended to be an exhaustive list of all medication that could cause dysphonia.

respiratory distress should also trigger immediate escalated care. Clinicians should provide documentation to explain the rationale for escalation of care in the patient's medical record.

Head and Neck Cancer

Delay in head and neck cancer diagnosis can result in higher initial staging, need for more invasive and complex oncologic treatments, and more substantial health and QOL consequences. Despite many historical risk factors that should trigger early referral (eg, smoking, alcohol abuse), patients and clinicians often overlook the potential relationship between dysphonia and head and neck cancer, resulting in delayed referral.[121-126] The strongest risk factor for malignancy is smoking, which increases the odds of head and neck cancer 2- to 3-fold.[127-129] The presence of concurrent lymphadenopathy or a neck mass should increase the level of concern, even more as this could represent more advanced disease. Several observational studies demonstrated that delay in diagnosis can lead to untoward consequences, including reduced survival rates.[27,130-134] Data suggest that delayed referral to otolaryngology may be more evident among those eventually diagnosed with laryngeal cancer.[135] Thus, smokers and patients at risk for head and neck cancer who present with dysphonia, with or without lymphadenopathy or neck mass, should be assessed with a thorough visual examination of the upper aerodigestive tract, including the larynx and pharynx.

Surgery and Dysphonia

Advances in surgical approaches have increased the number of surgical procedures that manipulate the upper aerodigestive tract, with a corresponding increase in relative complication frequency. This is particularly true for thyroidectomy[136] and anterior approaches to the cervical spine.[137] Such procedures put the recurrent laryngeal nerve at risk, which, if injured, can result in severe dysphonia, dysphagia (including aspiration in 15%), and new-onset shortness of breath.[24,138-141] Patients presenting with new-onset postoperative dysphonia should have an expedited laryngeal evaluation according to the AAO-HNSF guidelines, which recommend that this occur between 2 weeks and 2 months following the surgery.[142] Early diagnosis and treatment of vocal fold paralysis can effectively alleviate the significant associated negative health and QOL consequences and resultant work absenteeism.[10,76,143-146] Early evaluation is also recommended for patients with dysphonia after extubation, regardless of duration of intubation, since they are at increased risk of having laryngeal injury, vocal fold paralysis, and aspiration.[147-152] These patients are all more easily treated if identified early. A systematic review of adverse effects from intubation found that dysphonia and vocal cord injuries are clinically relevant complications related to short-term general anesthesia with an endotracheal tube or laryngeal mask.[56]

Neurologic Conditions

Dysphonia may be part of a constellation of symptoms indicative of a severe or progressive neurologic condition. Combined with dysarthria and dysphagia (with or without aspiration) and/or other upper motor neuron signs, dysphonia can be a presenting sign of amyotrophic lateral sclerosis or other serious neurologic condition. Patients presenting with these signs should undergo early laryngeal examination and diagnosis to expedite referral to neurology for definitive management.[153,154]

Professional Voice Users

Many patients rely on their voices for their livelihood or cannot complete critical duties without their voice. These primarily include singers and teachers but also a range of professionals who are dependent on their voices to work, such as call center workers, receptionists, nurses, physicians, and attorneys. Dysphonia can impair a patient's ability to work. In the general population, 7.2% of surveyed individuals missed work for ≥1 days within the preceding year due to a voice problem,[19] and 1 in 10 individuals filed short-term disability claims.[55] It is important to carefully consider the patient's perspective and level of concern in decision making and management. Most obviously, this affects professional musicians.[155] Singers are expectedly more anxious about voice problems[156,157] and often seek health care for symptoms such as vocal fatigue not commonly perceived as dysphonia.[158] However, it cannot be overemphasized that professional voice users form a much broader category that includes any person who relies on her or his voice for an occupation.[159] Furthermore, avocational voice users may have significant voice needs and express heightened concern about their voices that may necessitate early escalation. Referral to a laryngologist may be helpful for professional voice users with dysphonia if the etiology is not clear.

STATEMENT 4A. LARYNGOSCOPY AND DYSPHONIA: Clinicians may perform diagnostic laryngoscopy at any time for a patient with dysphonia. *Option based on observational studies, expert opinion, and a balance of benefit and harm.*

Action Statement Profile: 4A

- Quality improvement opportunity: To highlight the important role of visualizing the larynx and vocal folds in treating a patient with dysphonia. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality; Effective Communication and Care Coordination; Patient Safety.
- Aggregate evidence quality: Grade C, based on observational studies
- Level of confidence in evidence: High
- Benefit: Establishing the underlying diagnosis, possible reduction in cost, improved diagnostic accuracy, appropriate referrals and treatment, avoidance of missed or delayed diagnosis, reduced anxiety by establishing diagnosis
- Risks, harms, costs: Patient discomfort, cost of examination, procedure-related morbidity
- Benefits-harm assessment: Balance of benefit and harm
- Value judgments: Laryngoscopy is an essential tool for diagnosing the cause of dysphonia and should be available to those who can perform it; however, dysphonia is often self-limited and may resolve spontaneously without a diagnosis
- Intentional vagueness: None
- Role of patient preferences: Moderate
- Exclusions: None
- Policy level: Option
- Differences of opinions: None

Supporting Text

The purpose of these statements is to highlight the important role of visualizing the larynx and vocal folds to establish a diagnosis of a patient with dysphonia. Clinicians who are capable of doing so need not withhold this valuable diagnostic tool to wait for resolution before looking for a cause. While dysphonia often resolves spontaneously, it can be a symptom of a serious underlying disorder (eg, associated with increased risk of mortality or morbidity). Immediate laryngoscopy can also help to avoid misdiagnosis or delayed diagnosis. Clinicians may perform laryngoscopy at any time, if appropriate, on the basis of the patient's specific clinical presentation and modifying factors.

Laryngoscopy and Dysphonia

Visualization of the larynx is part of a comprehensive evaluation for voice disorders. Most dysphonia is caused by benign or self-limited conditions, but early identification of some disorders by visualization may increase the likelihood of optimal outcomes. Laryngeal visualization is a safe procedure. More advanced laryngeal visualization equipment (eg, rigid/flexible laryngoscopy, stroboscopy) is not available in all health care settings. Patient preferences, including concerns about neoplasm and professional voice use, may represent important considerations that influence the ideal timing and direct the appropriate type of laryngeal evaluation.

There are a number of conditions where laryngoscopy at the time of initial assessment allows for more timely diagnosis and management (see KAS 2). Laryngoscopy can be used at the bedside for patients with dysphonia after surgery or intubation to identify vocal fold immobility, intubation trauma, or other sources of postsurgical dysphonia. Laryngoscopy plays a critical role in evaluating laryngeal patency after laryngeal trauma, where visualization of the airway allows for assessment of the need for surgical intervention (eg, tracheotomy) and for following patients for whom immediate surgery is not required.[160,161]

Laryngeal cancer is one of the greatest concerns among patients presenting with dysphonia (see KAS 3). Laryngoscopy is routinely used to identify lesions that are concerning for laryngeal cancer. The usefulness of laryngoscopy for laryngeal cancer screening and the benefit of early detection of concerning laryngeal abnormalities led the British medical system to employ fast-track screening clinics for laryngeal cancer that mandate laryngoscopy within 14 days of suspicion of laryngeal cancer.[162,163]

Visualizing the larynx is critical to identify the etiology of the dysphonia. For example, fungal laryngitis from inhalers is best diagnosed with laryngoscopy and must be distinguished from malignancy by response to antifungal medication or biopsy.[164] Unilateral vocal fold paralysis causes breathy dysphonia and is routinely identified, characterized, and followed with laryngoscopy.[165,166] Among patients with cranial nerve deficits or neuromuscular changes, laryngoscopy is useful to identify neurologic causes of vocal dysfunction.[167] Benign vocal fold lesions, such as vocal fold cysts, nodules, and polyps, can be detected with laryngoscopy but are more easily identified and characterized with stroboscopy.[168] Visualization of the larynx may also provide some supporting evidence for the diagnosis of laryngopharyngeal reflux (LPR)[169] but cannot be relied on diagnostically due to poor specificity.[170-174] Dysphonia caused by neurologic or motor neuron disease, such as Parkinson's disease, amyotrophic lateral sclerosis, and SD, may have laryngoscopic findings that help diagnose or prompt early referral and management of the underlying disease.[175] Visualizing the larynx is also critical in the evaluation of the aging voice. Distinguishing the numerous etiologies is beyond the scope of this guideline. Note that there are many etiologies causing dysphonia that can be identified.

Neonates with dysphonia should undergo laryngoscopy to identify vocal fold paralysis,[176] laryngeal webs,[177] or other congenital anomalies that might affect their ability to swallow or breathe.[178] Dysphonia in children is less frequently a sign of a serious underlying condition and is more likely related to laryngitis or benign laryngeal lesions, such as polyps, nodules, or cysts.[179] It is important that persistent dysphonia be evaluated to rule out more serious conditions. For example, determining if laryngeal papilloma is the etiology of dysphonia in a child is particularly important given the high potential for life-threatening airway obstruction and the potential for malignant

transformation.[180] A hoarse child with other symptoms, such as stridor, airway obstruction, or dysphagia, may have a serious underlying problem, including a Chiari malformation,[181] hydrocephalus, skull base tumors, or a compressing neck or mediastinal mass. Persistent dysphonia in children may be a symptom of vocal fold paralysis with underlying etiologies that include neck masses, congenital heart disease, or previous cardiothoracic, esophageal, or neck surgery.[182]

STATEMENT 4B. NEED FOR LARYNGOSCOPY IN PERSISTENT DYSPHONIA: Clinicians should perform laryngoscopy, or refer to a clinician who can perform laryngoscopy, when dysphonia fails to resolve or improve within 4 weeks or irrespective of duration if a serious underlying cause is suspected. *Recommendation based on observational studies, expert opinion, and a preponderance of benefit over harm.*

Action Statement Profile: 4B

- Quality improvement opportunity: To highlight the important role of visualizing the larynx and vocal folds in treating a patient with dysphonia, especially if the dysphonia fails to improve within 4 weeks' onset. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality; Effective Communication and Care Coordination.
- Aggregate evidence quality: Grade C, observational studies on the natural history of benign laryngeal disorders; grade C for observational studies plus expert opinion on defining what constitutes a serious underlying condition
- Level of confidence in evidence: High
- Benefit: Avoid missed or delayed diagnosis of serious conditions among patients without additional signs and/or symptoms to suggest underlying disease; permit prompt assessment of the larynx when serious concern exists
- Risks, harms, costs: Potential for delay in diagnosis; procedure-related morbidity; procedure-related expense; patient discomfort
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: A need exists to balance timely diagnostic intervention with the potential for overutilization and excessive cost. The guideline update panel debated the optimal time for assessment of the larynx with a consensus-based approach and agreed on 4 weeks with the option to proceed more promptly based on clinical circumstances
- Intentional vagueness: The term *serious underlying concern* is subject to the discretion of the clinician. Some conditions are clearly serious, but for other patients, the seriousness of the condition is dependent on the patient. Intentional vagueness was incorporated to allow for clinical judgment in the expediency of evaluation
- Role of patient preferences: If there is a serious underlying concern, then there is a limited role for patient preference; however, among patients without a serious underlying concern, the role for patient preference is moderate
- Exclusions: None
- Policy level: Recommendation
- Differences of opinions: There was some disagreement about whether the time frame should be 4 or 6 weeks. After casting their votes, 10 panel members favored a 4-week time frame, and 5 favored a 6-week time frame.

Supporting Text

The purpose of this statement is to highlight the important role of visualizing the larynx and vocal folds in establishing a diagnosis for a patient with dysphonia that fails to resolve spontaneously. Viral upper respiratory tract infection is among the most common causes of dysphonia. Symptoms from viral laryngitis typically last 1 to 3 weeks and then resolve spontaneously.[183,184] Accordingly, initial observation for most patients with new-onset dysphonia is reasonable. Dysphonia persisting beyond this time raises concerns for other pathologies less likely to resolve spontaneously. Visualization of the larynx is the principal method to refine the differential diagnosis for a patient with dysphonia and allows for appropriately directed treatment. Most important, its expedient performance will prevent delay in diagnosis of malignancy or other morbid conditions. Delay to referral is common. A recent study highlighted that most patients with dysphonia wait between 88.7 and 119.2 days before seeking treatment.[122] A survey of primary care providers found that 64% preferred to treat rather than refer a patient with chronic dysphonia (>6 weeks).[185] Other studies showed several-month delays in presentation to otolaryngology and even longer delays for specialized laryngology care.[76,77] This statement urges referral based on evidence suggesting that referral for careful laryngeal visualization results in shorter time to disease resolution and is more cost-effective than continued treatment without identification of an underlying etiology of the dysphonia.[186]

The term *serious* used in the statement is intended to have 2 meanings. First, it describes an etiology that would shorten the life span of the patient. In this setting, delay in diagnosis could lead to worsened outcomes and should be avoided. Second, it refers to the impact of dysphonia on the patient. For some patients, specifically professional voice users, dysphonia may significantly impair their ability to work or reduce voice-related QOL. Detailed information on how to identify these patients is presented in KAS 3 regarding escalation of care. If the clinician is concerned that dysphonia is caused by a serious underlying condition or may have a disproportionate effect on the patient's work or well-being, more immediate evaluation of the larynx is warranted.

A majority of patients (90%) with a complaint of hoarseness initially present to their primary care physicians.[187,188] Thus, primary care physicians care for most patients with dysphonia while otolaryngologists ultimately see between 3% and 10% of initial dysphonia consultations. Identifying patients in need of

laryngoscopy is important to optimize care of the patient with dysphonia. A large national database study showed that the timing of referral to otolaryngology ranged from <1 month to >3 months.[187] Delaying otolaryngology referral >3 months more than doubled the patient's health care costs ($271 increased to $711). After referral to otolaryngology, the use of advanced laryngeal visualization technology (eg, stroboscopy) resulted in a change of the primary care physician's diagnosis (almost always "acute laryngitis" or "nonspecific dysphonia") to a different and likely more accurate diagnosis in 56% of cases. For example, of the 10,061 cases studied, new diagnoses of benign vocal fold pathology (n = 1384), vocal fold paresis or paralysis (n = 369), and laryngeal cancer (n = 293) were made among patients originally diagnosed with something else (mostly "acute laryngitis" or "nonspecific dysphonia").[187] Additionally, referral to multidisciplinary voice clinics—to include laryngologists and speech-language pathologists (SLPs) with access to and experience interpreting stroboscopy—resulted in changes in the underlying diagnosis of dysphonia in 45% to 70% of cases[189-191] and altered management (eg, voice therapy, surgery, medication changes).

STATEMENT 5. IMAGING: Clinicians should not obtain computed tomography (CT) or magnetic resonance imaging (MRI) among patients with a primary voice complaint prior to visualization of the larynx. *Recommendation against imaging based on observational studies of harm, absence of evidence concerning benefit, and a preponderance of harm over benefit.*

Action Statement Profile: 5

- Quality improvement opportunity: To reduce variations of care and unnecessary expense as well as harm from radiation and/or contrast exposure. National Quality Strategy domain: Making Quality Care More Affordable.
- Aggregate evidence quality: Grade C, observational studies regarding the adverse events of CT and MRI; no evidence identified concerning benefits among patients with dysphonia before laryngoscopy
- Level of confidence in evidence: High
- Benefit: Avoid unnecessary testing and overdiagnosis; minimize cost and adverse events; maximize the diagnostic yield of CT and MRI when indicated; avoid radiation
- Risks, harms, costs: Potential for delayed/missed diagnosis
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: None
- Intentional vagueness: None
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation against
- Differences of opinions: None

Supporting Text

The purpose of this statement is not to discourage the use of imaging in the comprehensive workup of dysphonia but rather to emphasize that it should be appropriately used to assess for specific pathology after the larynx has been visualized. Imaging may be appropriate after a diagnosis has been made with laryngoscopy or if a laryngeal process exists without a clear identifiable cause.

Laryngoscopy is the primary diagnostic modality for evaluating patients with dysphonia. Imaging studies, including CT and MRI, are unnecessary in most patients with dysphonia because most dysphonia is self-limited or caused by pathology that can be identified by laryngoscopy alone. The value of imaging procedures before laryngoscopy is undocumented; no articles were found in the systematic literature review for this guideline regarding the diagnostic yield of imaging studies prior to laryngeal examination. Conversely, the risk of imaging studies is well documented.

The risk of radiation-induced malignancy from CT scans is small but real. More than 62 million CT scans per year are obtained in the United States for all indications, including 4 million performed on children.[192] In a study of 400,000 radiation workers in the nuclear industry who were exposed to an average dose of 20 mSVs (a typical organ dose from a single CT scan for an adult), a significant association was reported between the radiation dose and mortality from cancer in this cohort. These risks were quantitatively similar to those reported for atomic bomb survivors.[192] Children have higher rates of malignancy and a longer life span in which radiation-induced malignancies can develop.[193,194] Approximately 0.4% of all cancers in the United States may be attributable to the radiation from CT studies.[195,196] It is acknowledged that advances in technology and medical physics have helped to reduce the dose of radiation that patients receive from tests such as CT scans. However, depending on a patient's size and imaging needs, the radiation exposure of a CT scan is still equivalent to about 100 to 200 chest x-rays.

There are also risks associated with the intravenous contrast dye used to increase the diagnostic yield of CT scans.[197] Allergies to contrast dye are common (5%-8% of the population). Severe, life-threatening reactions, including anaphylaxis, occur among 0.1% of people receiving iodinated contrast material, with a death rate of up to 1 in 29,500 people.[198,199]

While MRI has no radiation effects, it is not without risk. A review of the safety risks of MRI[200] details 5 main classes of injury: (1) projectile effects (anything metal that gets attracted by the magnetic field), (2) twisting of indwelling metallic objects (cerebral artery clips, cochlear implants, or shrapnel), (3) burning (electrical conductive material in contact with the skin with an applied magnetic field; ie, electrocardiographic electrodes or medication patches), (4) artifacts (radiofrequency effects from the device itself simulating pathology), and (5) device malfunction (pacemakers will fire inappropriately or work at an elevated frequency, thus distorting cardiac conduction).[201]

The small confines of the MRI scanner may lead to claustrophobia and anxiety.[202] Some patients, children in particular, require sedation (with its associated risks). The gadolinium contrast used for MRI rarely induces anaphylactic reactions,[203-205]

but there is evidence of renal toxicity with gadolinium in patients with preexisting renal disease.[205] Transient hearing loss has been reported, but this is usually avoided with hearing protection.[206] The costs of MRI, however, are significantly more than CT scanning. Despite these risks and their considerable cost, cross-sectional imaging studies are being used with increasing frequency.[207-209]

STATEMENT 6. ANTIREFLUX MEDICATION AND DYSPHONIA: Clinicians should not prescribe antireflux medications to treat isolated dysphonia, based on symptoms alone attributed to suspected gastroesophageal reflux disease (GERD) or laryngopharyngeal reflux (LPR), without visualization of the larynx. *Recommendation against prescribing based on randomized trials with limitations and observational studies with a preponderance of harm over benefit*.

Action Statement Profile: 6

- Quality improvement opportunity: To limit widespread use of antireflux medications as empiric therapy for dysphonia without symptoms of GERD or seeing changes in the larynx associated with LPR or laryngitis, given limited evidence of benefit and the potential adverse effects of the medications. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality; Patient Safety; Making Quality Care More Affordable.
- Aggregate evidence quality: Grade B, randomized trials with limitations showing lack of benefits for antireflux therapy among patients with laryngeal symptoms alone, including dysphonia; observational studies with inconsistent or inconclusive results; inconclusive evidence regarding the prevalence of dysphonia as the only manifestation of reflux disease
- Level of confidence in evidence: Medium based on small inconsistent randomized trials with heterogeneous entry criteria and poorly defined outcome measures
- Benefit: Avoidance of unnecessary therapy; reduced cost; avoidance of complications from proton pump inhibitors (PPIs); avoidance of diagnostic and treatment delay due to course of PPI therapy.
- Risks, harms, costs: Potential withholding of therapy from patients who may benefit
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: The committee thought that there is general overuse of these medications and that they have limited usefulness for most patients with dysphonia but that there may be a role for antireflux medications in a subset of hard-to-define cases. We also recognize that there is a role for these medications to treat gastroesophageal reflux
- Intentional vagueness: None
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation against
- Differences of opinions: The panel was divided about whether to include the terms *GERD* and *LPR* in the action statement or to leave it simply as symptoms alone. The majority favored inclusion of these terms in the KAS

Supporting Text

The purpose of the statement is to limit widespread use of antireflux medication as empiric therapy for isolated dysphonia without symptoms of GERD and without visualizing the larynx to evaluate for signs suggesting LPR or other etiologies of dysphonia. LPR should not be diagnosed on the basis of voice symptoms alone, given limited evidence of benefit and the potential adverse effects of the medications. This statement is not intended to limit the use of antireflux medications in managing LPR-attributed symptoms when suspected by history and physical examination that includes laryngoscopy or for the treatment of GERD symptoms.

Antireflux Medications and the Empiric Treatment of Dysphonia

The benefit of antireflux treatment for dysphonia among patients without symptoms of esophageal reflux (heartburn and regurgitation) or evidence for esophagitis is inconclusive. A Cochrane systematic review of 302 eligible studies, including 6 RCTs, that assessed the effectiveness of antireflux therapy for patients with dysphonia did not identify any high-quality trials meeting the inclusion criteria.[210] To date, 11 randomized trials have evaluated the efficacy of PPI treatment for patients with suspected reflux-related dysphonia and/or LPR: 9 were placebo-controlled trials[211-219]; 1 compared PPI with lifestyle modification[220]; and 1 compared PPI with and without voice therapy.[221] Of 9 placebo-controlled trials, 3 reported increased odds of voice improvement with PPI treatment,[213,217,219] while the remainder did not find a difference. It is important to note that these trials were heterogeneous in their inclusion criteria, used different LPR diagnostic algorithms and outcome measures, varied in sample size (range, 15-145), and had conflicting results.

In contrast, benefits of antireflux medication for control of GERD symptoms are well documented. High-quality controlled studies demonstrate that PPIs and H2RA (histamine 2 receptor antagonist) improve important clinical outcomes in esophageal GERD over placebo, with PPIs demonstrating superior response.[222,223] Response rates for esophageal symptoms and esophagitis healing are high (approximately 80% for PPIs).[222,223]

Among patients with dysphonia and a diagnosis of GERD, antireflux treatment is more likely to reduce dysphonia. Antireflux treatment given to patients with GERD (based on positive pH probe, esophagitis on endoscopy, or presence of heartburn or regurgitation) showed improved chronic laryngitis symptoms, including dysphonia, over those without GERD.[224] There is some evidence supporting the pharmacologic treatment of GERD without documented esophagitis, but the number needed to treat tends to be higher.[223] Importantly, these studies have esophageal symptoms and/or mucosal healing as outcomes, not dysphonia.

Although the use of empiric PPI treatment for dysphonia without laryngoscopy is common among primary care clinicians,[185] there are no data showing its superiority over placebo. Moreover, such an approach is often associated with missed/inaccurate diagnosis and delay in appropriate treatment.[191,225-227] Patient and providers should be aware of the lack of supportive evidence for empirical use of PPI in patients presenting with dysphonia alone. Alternative diagnosis and confirmation of laryngeal inflammation should be sought by laryngoscopy.[228]

There are also potential risks to prolonged PPI/H2RA use, including associations with impaired cognition (H2RA,[229,230] PPI[231]), bacterial gastroenteritis (PPI,[232-235] acid-suppressing medications[236]), community-acquired pneumonia (PPI[237]), drug interactions (eg, PPI and clopidogrel[238,239]), hip fractures (PPI[240-244]), decreased vitamin B12 levels (PPI[245]), hypomagnesemia (acid-lowering agents[246]), and chronic kidney disease (PPI[247]). Associated risk and increased attention to cost-effective practice has raised questions about the safety and utility of long-term PPI use.[248,249] In fact, the Food and Drug Administration (FDA) issued a warning related to long-term PPI use in children. Nonetheless, most experts agree that the benefits of short-term PPI treatment outweigh the potential risks in the majority of patients, especially if PPI use is based on a relevant indication (eg, concomitant heartburn, regurgitation).[250]

STATEMENT 7. CORTICOSTEROID THERAPY: Clinicians should not routinely prescribe corticosteroids for patients with dysphonia prior to visualization of the larynx. *Recommendation against prescribing based on randomized trials showing adverse events and absence of clinical trials demonstrating benefits with a preponderance of harm over benefit for steroid use.*

Action Statement Profile: 7

- Quality improvement opportunity: To discourage the empiric use of steroids for dysphonia prior to laryngeal examination. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality; Patient Safety; Making Quality Care More Affordable.
- Aggregate evidence quality: Grade B, randomized trials showing increased incidence of adverse events associated with orally administered steroids; absence of clinical trials demonstrating any benefit of steroid treatment on outcomes
- Level of confidence in evidence: High
- Benefit: Avoid potential adverse events associated with unproven therapy
- Risks, harms, costs: None
- Benefits-harm assessment: Preponderance of harm over benefit for steroid use
- Value judgments: Avoid adverse events of ineffective or unproven therapy
- Intentional vagueness: The word *routine* is used to acknowledge that there may be specific situations, based on laryngoscopy results, or other associated conditions that may justify steroid use on an individualized basis
- Role of patient preferences: Small; there is a role for shared decision making in weighing the harms of steroids against the potential yet unproven benefit in specific circumstances (ie, professional or avocation voice use and acute laryngitis)
- Exclusions: Children with croup
- Policy level: Recommendation against
- Differences of opinions: None

Supporting Text

The purpose of this statement is to discourage the empiric use of steroids for dysphonia prior to examination of the larynx. Oral steroids are commonly prescribed by primary care and urgent care clinicians for empirical treatment of dysphonia and for presumed acute laryngitis, despite an overwhelming lack of supporting data of efficacy. A systematic search of MEDLINE, CINAHL, EMBASE, and the Cochrane Library revealed no studies supporting the use of corticosteroids as empiric therapy for dysphonia except in special circumstances, as discussed later.

Although dysphonia is often attributed to acute inflammation of the larynx, the temptation to prescribe systemic or inhaled steroids for acute or chronic dysphonia or laryngitis should be avoided because of the potential for significant and serious side effects. Side effects from corticosteroids can occur with short- or long-term use, although the frequency increases with longer durations of therapy and higher doses of oral corticosteroids (**Table 8**).[251]

One Cochrane review examining the use of a short course (<21 days) of oral steroids for chronic rhinosinusitis indicated that there may have been an increase in insomnia and gastrointestinal disturbances, but it is not clear whether there was an increase in mood disturbances.[252] Geer et al[253] described the mechanisms of glucocorticoid-induced insulin resistance in a recent study and discussed risks for obesity, metabolic syndrome, lipodystrophy, and increased cardiovascular risks with longer-term use. Furthermore, long-term use of oral glucocorticoids is associated with an increased risk of hip/femur fracture (adjusted odds ratio, 1.43; 95% CI, 0.91-1.27),[254] cataract formation,[255] adrenal insufficiency, diabetes, changes in bone density at higher doses in children.[256-258] In a systematic literature review, Sarnes et al[259] found that corticosteroid-associated adverse events that were reported to occur at an incidence of >30% included sleep disturbances, lipodystrophy, adrenal suppression, metabolic syndrome, weight gain, and hypertension. Vertebral fractures were reported at an incidence of 21% to 30%. Dose-response relationships were documented for fractures, acute myocardial infarction, hypertension, and peptic ulcer. Furthermore, costs associated with these complications are substantial (1-year per-patient cost of $26,471.80 for nonfatal myocardial infarction and per-event costs for fracture as high as $18,357.90). Recent (within 12 months) and prolonged (≥90 days) glucocorticoid use was independently associated with reduced bone mineral density and increased risk of fractures.[260]

The use of inhaled corticosteroids and increasing doses increases the risk of diabetes onset and progression.[261] Inhaled corticosteroids were shown in a meta-analysis to cause oral

Table 8. Documented Side Effects of Short- and Long-term Steroid Therapy.

- Lipodystrophy
- Hypertension
- Cardiovascular disease
- Cerebrovascular disease
- Osteoporosis
- Impaired wound healing
- Myopathy
- Cataracts
- Peptic ulcers
- Infection
- Mood disorder
- Ophthalmologic disorders
- Skin disorders and alopecia
- Menstrual disorders and hormonal changes
- Avascular necrosis (femur, humerus, long bones)
- Pancreatitis
- Diabetogenesis

candidiasis and pharyngitis in a dose-dependent fashion. The higher the dose, the greater the risk of the adverse event.[262] Clearly, there are risks associated with glucocorticoid use, and these should be considered carefully before proceeding with treatment.

Additionally, there are many reports implicating long-term inhaled steroid use as a cause of dysphonia.[82,262-268] A theorized mechanism is mucosal deposition of the inhaled corticosteroids and associated mild myopathy of the thyroarytenoid muscle. Videostroboscopic findings are often subtle if present and do not explain all the symptoms completely. Rinsing the oral cavity, gargling, and drinking water after use and using the lowest possible dose of inhaled corticosteroids is recommended to mitigate these side effects.

Despite these side effects, there are some indications for steroid use in specific disease entities and patients. The diagnosis should be established prior to initiation of therapy. Vocal performers and vocational voice users with dysphonia are often prescribed short courses of steroids,[269,270] although the formulation and doses are not uniform, as there is no strong evidence to support this indication.

The literature does support steroid use for recurrent croup with associated laryngitis in pediatric patients.[271,272] In a Cochrane review of the safety of corticosteroid use in lower respiratory disorders in children with croup, the authors found that steroid use reduced emergency room visit time by 8 hours and reduced the relapse rate when compared with placebo.[273]

In limited cases, systemic steroids were reported to provide quick relief from allergic laryngitis for performers.[274,275] While these are not high-quality trials, they suggest a possible role for steroids in these selected patient populations. Among patients who are acutely dependent on their voices, the balance of benefit and harm may be shifted. The length of treatment for allergy-associated dysphonia with steroids has not been well defined in the literature.

Steroids should also be considered for patients with airway compromise to decrease edema and inflammation. An appropriate evaluation and determination of the cause of the airway compromise is required prior to starting the steroid therapy. Corticosteroids are also helpful in some autoimmune disorders involving the larynx, such as systemic lupus erythematosus, sarcoidosis, and granulomatosis with polyangiitis.[276-278]

There have been reports in the literature concerning hypersensitivity reactions to corticosteroids. These situations are rare but can be seen in high-risk groups of patients, such as those who receive multiple doses of corticosteroids.[279] Steroid hypersensitivity can be either type I (IgE mediated), which can include anaphylaxis (rare, 0.3%-0.5%), or, more commonly, type IV (T cell mediated), which usually follows a topical corticosteroid application.[280-282] Such reactions are usually triggered by preservative or matrix in the steroid preparation rather than the active medication, and a switch to another preparation is often the solution.

Due to the significant risk profile of steroids and the limited evidence of benefit, steroids should not be used empirically. If the diagnosis is known and the treatment is targeted, especially in professional voice users, a shared decision is made between the patient and the clinician about whether to use steroids after the risks and limited evidence for benefit have been discussed.

STATEMENT 8. ANTIMICROBIAL THERAPY: Clinicians should not routinely prescribe antibiotics to treat dysphonia. *Strong recommendation against prescribing based on systematic reviews and randomized trials showing ineffectiveness of antibiotic therapy and a preponderance of harm over benefit.*

Action Statement Profile: 8

- Quality improvement opportunity: To discourage the misuse of antibiotics. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality; Patient Safety; Making Quality Care More Affordable.
- Aggregate evidence quality: Grade A, systematic reviews showing no benefit for antibiotics for acute laryngitis or upper respiratory tract infection; grade A evidence showing potential harms of antibiotic therapy
- Level of confidence in evidence: High
- Benefit: Avoidance of ineffective therapy, unnecessary cost, and antibiotic resistance
- Risks, harms, costs: Potential for failing to treat bacterial, fungal, or mycobacterial causes of dysphonia
- Benefits-harm assessment: Preponderance of harm over benefit if antibiotics are prescribed
- Value judgments: Importance of limiting antimicrobial therapy to treating bacterial or fungal infections
- Intentional vagueness: The word *routine* is used in the KAS to discourage empiric therapy yet to acknowledge there are occasional circumstances where antimicrobial use may be appropriate
- Role of patient preferences: None
- Exclusions: Patients with dysphonia caused by bacterial, fungal, or mycobacterial infection

- Policy level: Strong recommendation against
- Differences of opinions: None

Supporting Text

The purpose of this statement is to discourage the misuse of antibiotics. Dysphonia in most patients is caused by acute viral laryngitis, which is not a bacterial infection. Since antibiotics are effective only in bacterial infections, their routine empiric use in treating patients with dysphonia is unwarranted.

Upper respiratory infections often produce symptoms of sore throat, fever, and globus sensation and may alter voice quality and function. Acute upper respiratory infections caused by parainfluenza, rhinovirus, influenza, and adenovirus have been linked to laryngitis.[283,284] Acute laryngitis is self-limited, with most patients experiencing symptomatic improvement within 7 to 10 days irrespective of treatment.[285] A Cochrane review examining the role of antibiotics in acute laryngitis among adults found that antibiotics do not appear to be effective in treating acute laryngitis in terms of objective outcomes.[184]

Misuse of antibiotics also exposes patients and the health care system to unnecessary costs. Medications account for one-fifth to one-third of total direct costs in management of laryngeal disorders, and 30% of that is attributable to antibiotics.[286] Antibiotics can have side effects, including rash, abdominal pain, diarrhea, and vomiting.[287,288] Moreover, interaction between antibiotics and other medications can have untoward consequences.[289]

Societal implications of antibiotic over- and misuse are also important. Overprescription contributes to bacterial antibiotic resistance. Exemplifying this are recent sinusitis culture studies showing a growing rate of methicillin-resistant *Staphylococcus aureus*.[290] Spread of antibiotic resistance has serious health and cost impacts. Regions with higher antibiotic resistance have 33% higher treatment costs for infectious diseases such as community-acquired pneumonia.[291] Lack of bacterial susceptibility to antibiotics due to resistance increases the complexity of treating routine infectious conditions and negatively affects patient outcomes. Antibiotic use can also increase the risk of or exacerbate laryngeal candidiasis.[292]

Antibiotics for dysphonia may be appropriate in select circumstances. Such cases are often associated with an immunosuppressed patient. For example, laryngeal tuberculosis in patients with renal transplants and human immunodeficiency virus was reported,[293,294] and so was atypical mycobacterial laryngeal infection for a patient on inhaled steroids.[295] Antibiotics may also be warranted for patients with dysphonia secondary to other bacterial infections. Community outbreaks of pertussis attributed to waning immunity in adolescents and adults were reported.[296] Bacterial laryngotracheitis, secondary to *S aureus* (among others), can be associated with severe upper respiratory infection manifesting with mucosal crusting and multiple symptoms, such as cough, stridor, increased work of breathing, and dysphonia.[297] The diagnosis should be established prior to initiation of therapy.

STATEMENT 9A. LARYNGOSCOPY PRIOR TO VOICE THERAPY: Clinicians should perform diagnostic laryngoscopy, or refer to a clinician who can perform diagnostic laryngoscopy, before prescribing voice therapy and document/communicate the results to the speech-language pathologist (SLP). *Recommendation based on observational studies showing benefit and a preponderance of benefit over harm.*

Action Statement Profile: 9A

- Quality improvement opportunity: To encourage the routine use of diagnostic laryngoscopy for patients with dysphonia (hoarseness) before initiation of voice therapy and to promote the most effective treatment practices for patients with dysphonia. National Quality Strategy domains: Effective Communication and Care Coordination; Prevention and Treatment of Leading Causes of Morbidity and Mortality.
- Aggregate evidence quality: Grade C, observational studies of the benefit of laryngoscopy for voice therapy
- Level of confidence in evidence: High
- Benefit: Avoid delay in diagnosing laryngeal conditions not treatable with voice therapy, optimize voice therapy by allowing targeted therapy
- Risks, harms, costs: Delay in initiation of voice therapy; cost of the laryngoscopy and associated clinician visit; patient discomfort
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: To ensure no delay in identifying pathology not treatable with voice therapy. The SLP should not initiate therapy prior to laryngoscopy
- Intentional vagueness: None
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is (1) to encourage the routine use of diagnostic laryngoscopy for patients with dysphonia (hoarseness) before initiation of voice therapy and (2) to promote the most effective treatment of patients with dysphonia.

Laryngoscopy Prior to Voice Therapy. Voice therapy is a well-established treatment modality for some voice disorders, but therapy should not begin until a diagnosis is made. Failure to visualize the larynx and establish a diagnosis can lead to inappropriate therapy or delay in diagnosis of disorders not amenable to voice therapy.[135,298] Many diagnoses can be made with laryngoscopy; however, if the diagnosis is not clear after continuous light laryngoscopy, stroboscopy may help clarify the underlying diagnosis. Information gleaned from visualization of the larynx is helpful in optimizing the therapy regimen.

Evidence-based guidelines from the Royal College of Speech and Language Therapists mandate that an otolaryngologist evaluate each patient prior to initiating voice therapy.[299] While the guideline does not explicitly refer to laryngoscopy, it states that the "evaluation is needed to identify disease, assess structure and contribute to the assessment

of function," and laryngoscopy is the primary tool for this assessment. The American Speech-Language-Hearing Association (ASHA) acknowledges these guidelines and specifies in its practice policy that the clinical process for voice evaluation entails that "all patients/clients with voice disorders are examined by a physician, preferably in a discipline appropriate to the presenting complaint."[300]

An SLP trained in visual imaging may examine the larynx for the purpose of evaluating vocal function and planning an appropriate therapy program for the voice disorder. In some multidisciplinary practices, an SLP may perform laryngoscopy and stroboscopy in conjunction with an otolaryngologist who reviews it for diagnostic purposes.[301,302] Examination or review by the otolaryngologist ensures that diagnoses are managed appropriately when they are less amenable to voice therapy (eg, laryngeal cancer or papilloma). This recommendation is consistent with published ASHA guidelines.[303]

Evidence supports the usefulness of laryngoscopy and stroboscopy in planning voice therapy and in documenting its effectiveness in remediating vocal lesions.[304,305] Accordingly, the results of the laryngeal examination should be documented and communicated to the SLP who will conduct voice therapy. This communication should include a detailed diagnosis/description of the laryngeal pathology and a brief history of the problem. Visual images and video of the pathology are also helpful in treatment planning.[305] Voice clinical fellowships exist for SLPs interested in advanced specialized care of patients with voice disorders.

STATEMENT 9B. ADVOCATING FOR VOICE THERAPY: Clinicians should advocate voice therapy for patients with dysphonia from a cause amenable to voice therapy. *Strong recommendation based on systematic reviews and randomized trials with a preponderance of benefit over harm*.

Action Statement Profile: 9B

- Quality improvement opportunity: To promote effective communication with patients and to promote the most effective prevention and treatment practices for patients with dysphonia. National Quality Strategy domains: Person and Family Centered Care; Prevention and Treatment of Leading Causes of Morbidity and Mortality; Making Quality Care More Affordable.
- Aggregate evidence quality: Grade A, RCTs and systematic reviews
- Level of confidence in evidence: High
- Benefit: Improve voice-related QOL; prevent relapse; potentially prevent need for more invasive therapy
- Risks, harms, costs: No harm reported in controlled trials; cost of treatment
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: Voice therapy is underutilized in managing dysphonia despite efficacy; advocacy is needed
- Intentional vagueness: Deciding which patients will benefit from voice therapy is often determined by the voice therapist (SLP)
- Role of patient preferences: Small
- Exclusions: Patients unable to participate in therapy
- Policy level: Strong recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is to ensure that patients are aware that voice therapy may be an effective treatment for dysphonia.

Advocating for Voice Therapy

The clinician should advocate for voice therapy for patients whose dysphonia has an etiology that may be improved with a voice therapy intervention (eg, primary MTD). Advocacy is important to raise awareness of voice therapy's effectiveness. The clinician should (1) document that voice therapy was discussed, (2) provide educational materials to the patient (see Appendix: Frequently Asked Questions about Voice Therapy), and/or (3) refer to an educational website or an SLP.

Clinicians have several choices for managing dysphonia, including observation, medical therapy, surgical therapy, voice therapy, or a combination of these approaches. Certified and licensed SLPs play a central role in patient education and are critical providers of voice therapy, which addresses the behavioral and muscular issues contributing to dysphonia. Voice therapy is effective for dysphonia across the life span from children to older adults.[11,12,303,306-309] However, children <2 years old may not be able to participate fully and effectively in many forms of voice therapy. In these situations, family education and counseling can be beneficial.

Voice therapy was demonstrated to be effective in the treatment of MTD (abnormal voice quality not attributable to anatomic laryngeal changes) as compared with the control group receiving vocal hygiene alone.[310] Voice therapy is also beneficial when combined with other treatment approaches, including pre- and postoperative therapy or in combination with certain medical treatments (ie, allergy management, asthma therapy, antireflux therapy).[12,306,311] Specialized voice therapy is effective in Parkinson's disease–related dysphonia[312-314] and other conditions involving the larynx, such as paradoxical vocal fold dysfunction/cough.[315-318] Voice therapy can be used in the treatment of glottic insufficiency (eg, presbylarynx),[319] unilateral vocal fold paralysis,[320,321] presbyphonia,[322] and vocal process granuloma[323] and to improve postsurgical outcomes after vocal fold injection medialization[324] and laryngoplasty.[325] Moreover, voice therapy can be a useful adjunct to botulinum toxin in the treatment of SD.[326] Voice therapy may be an important component of any comprehensive surgical treatment for dysphonia.[327]

The efficacy of physiologic approaches is well supported by randomized and other controlled trials.[328-341] Hygienic approaches focus on eliminating behaviors considered to be harmful to the vocal mechanism. Symptomatic approaches target the direct modification of aberrant features of pitch, loudness, and quality. Physiologic methods approach

treatment holistically, as they work to retrain and rebalance the subsystems of respiration, phonation, and resonance.

A systematic review of voice therapy efficacy revealed various levels of support for each approach.[306] Efficacy of physiologic approaches is well supported by randomized and other controlled trials.[310-312,332,342] Hygiene approaches showed mixed results in relatively well-designed controlled trials.[310,328,331,343-345] Interdisciplinary treatment of dysphonia may also include contributions from singing teachers, acting voice coaches, and other medical disciplines in conjunction with voice therapy.[303] This is particularly relevant to singers who may benefit from a singing coach or other professional. Finally, it is recommended and critical that clinicians document response to therapy and voice status at the completion of therapy, including resolution, improvement, deterioration, or no change.

STATEMENT 10. SURGERY: Clinicians should advocate for surgery as a therapeutic option for patients with dysphonia with conditions amenable to surgical intervention, such as suspected malignancy, symptomatic benign vocal fold lesions that do not respond to conservative management, or glottic insufficiency. *Recommendation based on observational studies demonstrating a benefit of surgery in these conditions and a preponderance of benefit over harm*.

Action Statement Profile: 10

- Quality improvement opportunity: To advocate that clinicians discuss and consider surgery as a therapeutic option for patients with dysphonia whose underlying etiology is amenable to surgical intervention. National Quality Strategy domains: Person and Family Centered Care; Prevention and Treatment of Leading Causes of Morbidity and Mortality.
- Aggregate evidence quality: Grade B, in support of surgery to reduce dysphonia and improve voice quality among selected patients based on observational studies overwhelmingly demonstrating the benefit of surgery
- Level of confidence in evidence: High
- Benefit: Potential for improved voice outcomes among carefully selected patients
- Risks, harms, costs: None
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: Surgical options for treating dysphonia are not always recognized
- Intentional vagueness: None
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is to encourage clinicians to discuss surgery as a therapeutic option for patients with dysphonia whose underlying etiology is amenable to surgical intervention. Such conditions can be broadly categorized into (1) malignancy, (2) symptomatic benign vocal fold lesions not responsive to conservative management, (3) recurrent respiratory papillomatosis, and (4) glottic insufficiency. Surgery is not the primary treatment for the majority of patients with dysphonia and should be targeted at specific pathologies.

Suspected Malignancy

Dysphonia may be the presenting symptom in malignancy of the upper aerodigestive tract. Surgical biopsy with histopathologic evaluation is necessary to confirm the diagnosis of malignancy in upper airway lesions. Highly suspicious lesions with increased vasculature, ulceration, or exophytic growth require prompt biopsy. For superficial white lesions (eg, leukoplakia) on otherwise mobile vocal folds, a trial of conservative therapy with avoidance of irritants[346] and treatment of laryngeal candidiasis should be instituted prior to biopsy.[268,347,348] Once a diagnosis of cancer has been established, additional surgical management is 1 possible treatment. Discussion of surgical management of laryngeal cancer is beyond the scope of this guideline.

Benign Soft Tissue Vocal Fold Lesions

A trial of conservative management is typically recommended prior to surgical intervention and may obviate the need for surgery. Many benign phonotraumatic vocal fold lesions are self-limited or reversible (eg, polyps, cysts, nodules).[349-356] Failure to address underlying etiologies may lead to postsurgical recurrence of some lesions.[323,357-359] Surgery is reserved for benign vocal fold lesions when a satisfactory voice result cannot be achieved with conservative management (eg, voice therapy) and the voice may be improved with surgical intervention.[349] Effectiveness of surgical treatment for benign vocal fold lesions is based on observational studies of polyps, cysts, and nodules refractory to conservative management.[360-362] Surgery can improve subjective voice-related QOL and objective vocal parameters among patients with dysphonia that results from benign vocal fold lesions.[361-365]

Nodules are common in the pediatric population and, as with adults, are treated conservatively. Also as with adults, surgery should be reserved for severe cases refractory to conservative treatment.[366] Parents should be counseled that pediatric nodules typically resolve over time during normal developmental process[367] and that voice therapy should be considered the primary treatment.[368] The role of surgery for pediatric vocal nodules is limited. However, a paucity of data from small case series does demonstrate that pediatric nodules may be effectively removed via microsurgical approaches.[369]

Recurrent Respiratory Papillomatosis

Surgery is necessary in the management of recurrent respiratory papillomatosis, a typically benign but aggressive neoplasm of the upper airway more commonly seen in children. Surgical removal with contemporary laryngeal instruments, including laser and microdebrider, can prevent airway obstruction and is effective in reducing the symptoms of dysphonia

but is unlikely to be curative since the causative human papillomavirus is present in adjacent normal-appearing mucosa.[370-372] Because of the recurrent nature of this condition, it is imperative that every effort be made to avoid injury to the underlying vibratory layers of the vocal folds to avoid long-term dysphonia related to scar formation.

Glottic Insufficiency

Glottic insufficiency generally means incomplete closure of the vocal folds. There are several etiologies, including impaired vocal fold mobility (eg, paralysis or paresis), bowing, and vocal fold soft tissue defects. This condition can result in a weak, breathy dysphonia with poor cough, dyspnea, and dysphagia.[24,60,139,140,146] Surgical correction of glottic insufficiency by medialization techniques can be done unilaterally or bilaterally and works by reducing the glottic opening during phonatory tasks to improve vocal efficiency. Vocal fold medialization can be achieved with temporizing injection of bulking agents into the affected vocal fold (injection medialization) or external medialization with open surgery (laryngeal framework surgery). Injection medialization can be safely performed in the office under local anesthesia or in the operating room under general anesthesia,[373-375] which generally provides comparable improvement in voice.[373,376-383] Collagen or lyophilized dermis injections can provide adequate vocal rehabilitation of pediatric patients.[384] The use of polytetrafluoroethylene as a permanent injectable implant is not recommended due to its association with foreign body granulomas that can result in voice deterioration and airway compromise.[385-387]

Open medialization laryngoplasty (ie, type I laryngoplasty or thyroplasty, with or without arytenoid adduction) with a variety of implants demonstrated dysphonia reduction in appropriately selected patients.[388-391] Additionally, laryngeal reinnervation is a treatment option for patients with unilateral and bilateral vocal fold paralysis in addition to static procedures.[392-395] When analyzed by trained blinded listeners, the voices of 15 patients who underwent external laryngoplasty were indistinguishable from controls in loudness and pitch but had higher levels of strain and breathiness.[396] In all, 92% of patients reported satisfaction, but 87% still considered their voices abnormal. In a retrospective study of 117 patients with glottic insufficiency, patients who underwent type I laryngoplasty demonstrated better symptom resolution when compared with patients receiving voice therapy alone.[397] Survey data suggest a 5.4% revision rate for laryngoplasty.[398]

STATEMENT 11. BOTULINUM TOXIN: Clinicians should offer, or refer to someone who can offer, botulinum toxin injections for the treatment of dysphonia caused by SD and other types of laryngeal dystonia. *Recommendation based on RCTs with minor limitations and preponderance of benefit over harm.*

Action Statement Profile: 11

- Quality improvement opportunity: To expedite referral for suspected SD. National Quality Strategy domains: Person and Family Centered Care; Prevention and Treatment of Leading Causes of Morbidity and Mortality.
- Aggregate evidence quality: Grade B, few controlled trials, diagnostic studies with minor limitations, and overwhelmingly consistent evidence from observational studies
- Level of confidence in evidence: High
- Benefit: Improved voice quality and voice-related QOL
- Risks, harms, costs: Dysphagia, airway obstruction, breathy voice, direct costs of treatment, time off work, and indirect costs of repeated treatments
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: Botulinum toxin is beneficial despite the potential need for repeated treatments given the limited availability of other effective interventions for SD
- Intentional vagueness: None
- Role of patient preferences: Large
- Exclusions: Allergy to botulinum toxin
- Policy level: Recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is to expeditiously direct patients with suspected SD/laryngeal dystonia to clinicians who can diagnose the condition and offer treatment with laryngeal botulinum toxin injection.

SD is a focal laryngeal dystonia most commonly characterized by a strained, strangled voice.[399] Patients demonstrate increased tone and voice breaks in the intralaryngeal muscle groups responsible for either opening (abductor SD) or closing (adductor SD) the vocal folds. This results in phonemic task-specific dysphonia; that is, affected patients experience voice breaks from voiceless consonants (abductor) or on vowels and voiced consonants (adductor).[400] The diagnosis can be subtle and masquerade as other forms of dysphonia (eg, MTD), which can cause significant delays in diagnosis, averaging 4.4 years.[401] Intramuscular injection of botulinum toxin into the affected muscles causes transient nondestructive flaccid paralysis of these muscles by inhibiting the release of acetylcholine from nerve terminals, thus reducing the spasm.[402] SD is a disorder of the central nervous system that cannot be cured by botulinum toxin,[403] but excellent symptom control is possible with 3 to 6 months of interval treatment.[404] Injections can be performed on awake ambulatory patients with minimal discomfort.[405]

While this treatment is not currently FDA approved for SD, a large body of evidence supports the efficacy of botulinum toxin (primarily botulinum toxin A) as an off-label use for treating adductor SD. The off-label use of botulinum toxin for SD/laryngeal dystonia is approved by the Center for Medicare and Medicaid Services. Two double-blind randomized placebo-controlled trials of botulinum toxin for adductor SD with self-assessment and expert listeners found improved voice among patients treated with botulinum toxin

injections.[406,407] Botulinum toxin treatment has also been shown to improve self-perceived dysphonia, mental health, and social functioning.[408] A meta-analysis concluded that botulinum toxin treatment of SD results in "moderate overall improvement"; however, it noted concerns of methodological limitations and lack of standardization in assessment of botulinum toxin efficacy and recommended caution when making inferences regarding treatment benefit.[326] Despite these limitations, botulinum toxin is considered the "treatment of choice" for adductor SD.[403-405,409] In the last 7 years since the 2009 publication of this guideline, the use of botulinum toxin for SD has continued and expanded to other indications. Large case series of SD patients followed over several decades documented its safety and effectiveness.[410-413]

Botulinum toxin may be used for other disorders of excessive or inappropriate muscular contraction.[402] There are numerous reports addressing the use of botulinum toxin for spastic dysarthria, nerve section failure, anterior commissure release, adductor breathing dystonia, abductor SD, ventricular dysphonia (also called dysphonia plica ventricularis), essential voice tremor, chronic cough, bilateral vocal fold paralysis,[381,396,397,414-421] and granuloma.[323,422]

Botulinum toxin injections have a good safety record. Blitzer et al[423] reported in 1998 their 13-year experience with 901 patients who underwent 6300 injections and updated this in 2010 to a 24-year experience of 1300 patients.[410] Adverse effects included mild breathiness (25%) and coughing on fluids (10%) for the patients with adductor SD and "mild stridor" for the patients with abductor SD.[423] Many other studies documented similar rates of adverse effects (breathiness and dysphagia, choking on fluids).[424-429] Postinjection dysphagia may be more common among patients with preexisting dysphagia.[430] Exertional wheezing, exercise intolerance, and stridor were more commonly reported for patients with abductor SD.[423,431]

Adverse events may result from diffusion of drug from the target muscle to adjacent muscles ("black box warning" by the FDA).[402] Adjusting the dose, distribution, and timing of injections may decrease the frequency of adverse events.[429,432] Bleeding is rare, and vocal fold edema was documented for only 1 patient receiving saline as a placebo.[406] Reports of sensations of burning, tickling, irritation of the larynx or throat, excessive thick secretions, and dryness also occurred.[433] Systemic effects are rare, with only 2 reports of generalized botulism-like syndromes and 1 report of possible precipitation of biliary colic.[402] Acquired resistance to botulinum toxin can occur.[402,434] This can be successfully managed by changing to another botulinum toxin product or by extending the interval before resuming treatment.[435]

Dedo began surgical treatment of adductor SD with unilateral resection of the recurrent laryngeal nerve.[436] This fell out of favor, as high relapse rates were subsequently reported[437] and botulinum toxin injection began use in the 1980s. Some patients do not like the temporary and variable effect of botulinum toxin or do not tolerate its side effects. For these patients, surgical treatments are available that provide the possibility of a long-lasting and stable result. These include bilateral selective laryngeal adductor denervation/reinnervation (SLADR)[438-440] and type II thyroplasty.[441,442] Medications to treat SD, as used for other forms of dystonia, were described in small series[443,444] and case reports,[445] but clinical trials have not been conducted.

SD is not a life-threatening condition. As described here, several treatment options are available that have various benefits, side effects, and risks. Many patients reasonably choose no treatment. There is a significant role for patient preference and shared decision making in managing this disorder. Patient-oriented informational materials from organizations such as the National Spasmodic Dysphonia Association (www.dysphonia.org) are very helpful in counseling patients regarding the management of SD.

STATEMENT 12. EDUCATION/PREVENTION: Clinicians should inform patients with dysphonia about control/preventive measures. *Recommendation based on observational studies, small-sample RCTs, expert opinion, and a preponderance of benefit over harm*.

Action Statement Profile: 12

- Quality improvement opportunity: To provide guidance to clinicians in educating patients on behavioral strategies and environmental measures that may prevent or decrease the risk of dysphonia. National Quality Strategy domains: Person and Family Centered Care; Prevention and Treatment of Leading Causes of Morbidity and Mortality.
- Aggregate evidence quality: Grade C, evidence based on observational studies, small-sample RCTs, expert opinion, and a preponderance of benefit over harm
- Level of confidence in evidence: High
- Benefit: Possible decreased risk of recurrence of dysphonia; improved vocal hygiene may reduce dysphonia; possible prevention of dysphonia for persons at high risk
- Risks, harms, costs: Time of education; cost of potentially ineffective interventions
- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: None
- Intentional vagueness: None
- Role of patient preferences: Small role in terms of receiving information from clinician; moderate to large role in shared decision making that involves choosing specific preventive and control measures to use
- Exclusions: None
- Policy level: Recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is to provide guidance to clinicians in educating patients on behavioral strategies and environmental measures that may prevent or decrease the risk of

Table 9. Preventive Measures.

What is dysphonia?	Altered vocal quality, pitch, loudness, or vocal effort that impairs communication as assessed by a clinician and affects quality of life
Who is at greatest risk for developing dysphonia (hoarseness)?	Individuals who professionally use their voices, such as singers, teachers, and call center operators, as well as certain age groups, including children and the elderly and smokers
What preventive measures can help reduce voice disorders?	Things to DO 1. Adequately hydrate by drinking water daily. 2. Use of amplification in large noisy spaces can help reduce voice strain. 3. Rest your voice briefly to prevent voice fatigue, straining, and overuse. 4. Provide indoor air humidification in dry, arid environments. Things to AVOID 1. Smoking and secondhand smoke from cigarettes, cigars, and pipes that can irritate your airway, throat, nose, and mouth 2. Overusing or straining your voice by yelling, shouting, speaking over loud noises, and whispering 3. Excessive throat clearing and coughing 4. Alcohol and caffeine consumption, as it can dry the throat resulting in mucous thickening 5. Use of drying medications

developing dysphonia and promoting factors that encourage vocal health. Clinicians should document specific measures discussed in this educational conversation with the patient.

Optimization of vocal health should be encouraged for all individuals but particularly those at greatest risk for developing dysphonia (eg, teachers, singers, elderly). Dysphonia risk factors relate to behavioral, environmental, and lifestyle choices. Voice hygiene measures include behaviors designed to decrease tissue injury and prevent dysphonia while promoting strategies that improve vocal health.[446] Preventive measures, such as adequate hydration, avoidance of irritants, voice training, and amplification, may reduce the risk of developing dysphonia. Behaviors to avoid include yelling or shouting, consumption of alcohol and caffeine products, smoking, use of certain drying medications, and dehydration (**Table 9**). In a study of 422 teachers, absence of water intake was associated with a 60% higher risk of dysphonia,[447] while a study of amateur singers demonstrated less vocal fatigue with hydration and periods of voice rest.[448] Phonatory effort may also be decreased by adequate hydration,[449] and amplification may sustain voice quality during heavy use.[450] One RCT did find benefits of voice hygiene education among healthy student teachers; however, the small sample size prevented any inferential statistical analysis of the data.[446] The relationship of physical activity on the voice was examined in 1 large cross-sectional study of teachers. Researchers found that individuals who do regular physical exercise, ≥3 times a week, had a lower prevalence of dysphonia.[451] These findings clearly warrant further investigation regarding the possible role that routine physical activity plays in voice hygiene.

In addition, environmental conditions can affect the voice, such as background noise, poor air quality, and dryness.[452-454] Exposure to large amounts of environmental or occupational irritants, such as chemicals, smoke, particulates, and pollution, can increase the likelihood of developing dysphonia. One study of 10 symptomatic rescue workers at the World Trade Center disaster site associated the development of vocal cord dysfunction and hoarseness with exposure to large amounts of irritants found at the recovery site.[455] Dry or arid environments may also adversely affect the voice. Environmental humidification had some beneficial effects on superficial laryngeal dehydration, which may help prevent or reduce negative voice changes.[456] On the basis of the report of the surgeon general,[457] the CPG update panel concurred that avoidance of tobacco smoke (primary or secondhand) was beneficial to decrease the risk of dysphonia despite limited direct evidence in the literature.

STATEMENT 13. OUTCOMES: Clinicians should document resolution, improvement, or worsened symptoms of dysphonia or change in QOL among patients with dysphonia after treatment or observation. *Recommendation based on randomized trials and cohort studies with a preponderance of benefit over harm.*

Action Statement Profile: 13

- Quality improvement opportunity: To ensure that patients with dysphonia are followed until the dysphonia has improved or resolved or the underlying condition has been diagnosed and appropriately managed. National Quality Strategy domain: Effective Communication and Care Coordination.
- Aggregate evidence quality: Grade C, recommendation based on randomized trials and cohort studies with a preponderance of benefit over harm
- Level of confidence in evidence: High
- Benefit: Document the final status of dysphonia, communicate with referring clinicians, document favorable outcomes or failures of treatment
- Risks, harms, costs: Cost of follow-up visits

- Benefits-harm assessment: Preponderance of benefit over harm
- Value judgments: None
- Intentional vagueness: The time frame for assessing outcome is not stated
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation
- Differences of opinions: None

Supporting Text

The purpose of this statement is to ensure that patients with dysphonia are followed until the dysphonia has improved or resolved or the underlying condition has been diagnosed and appropriately managed. The responsible primary or specialty clinician to whom the patient has been referred should follow and document resolution of the dysphonia. In the setting of new-onset dysphonia, clinicians should document the status of the voice disorder and its resolution within a few weeks of symptom onset. If there is not resolution, clinicians should perform, or refer to a specialist for, laryngoscopy (KAS 4A/4B). Rationale for referral should be clearly documented. Follow-up on status and outcome of management may be in person or through telephone communication as appropriate. For patients with persistent dysphonia, an underlying diagnosis must be sought, as detailed throughout this guideline.

Management strategies will depend on the underlying cause of the dysphonia and may widely differ. The managing clinician should follow up with patients after any intervention (eg, medications, surgery, voice therapy) and document the outcome of the treatment. Objective tools may be used for this purpose. Several validated patient-reported outcome measures are available to systematically assess voice,[458] but their use is not necessary to document resolution. If the patient has been referred to a provider with more advance training or capabilities, the clinician who ultimately treats the patient should document the outcome of therapy and communicate those results back to the referring clinician.

Implementation Considerations

The complete guideline is published as a supplement to *Otolaryngology–Head and Neck Surgery* to facilitate reference and distribution. The guideline was presented to AAO-HNS members as a miniseminar at the AAO-HNSF 2017 Annual Meeting & OTO Experience prior to publication. Existing brochures and publications by the AAO-HNSF will be updated to reflect the guideline recommendations. A full-text version of the guideline will also be accessible free of charge at www.entnet.org.

An anticipated barrier to diagnosis is distinguishing modifying factors for dysphonia in a busy clinical setting. This barrier may be mitigated through a laminated teaching card or visual aid summarizing important factors that modify management.

Laryngoscopy is an option at any time for patients with dysphonia, but the guideline also recommends that no patient be allowed to wait >4 weeks prior to having his or her larynx examined. It is also clearly recommended that if there is a concern of an underlying serious condition, then laryngoscopy should be immediate. Tables in this guideline regarding causes for concern should help guide clinicians regarding when prompt laryngoscopy is warranted. The cost of the laryngoscopy and the possible wait times to see clinicians trained in the technique may hinder access to care.

While the guideline acknowledges that there may be a significant role for antireflux therapy to treat laryngeal inflammation, empiric use of antireflux medications for dysphonia has minimal support and a growing list of potential risks. Avoidance of empiric use of antireflux therapy represents a significant change in practice for some clinicians. Educational pamphlets describing the risks and benefits of these medications may help facilitate this potential change in practice pattern.

Lack of knowledge about voice therapy by practitioners is a likely barrier to advocacy for its use. This barrier can be overcome by educational materials about voice therapy and its indications.

As a supplement to clinicians, an algorithm of the guidelines action statements is provided in **Figure 1**. The algorithm allows for a more rapid understanding of the guideline's logic and the sequence of the action statements. The GUG hopes that the algorithm can be adopted as a quick reference guide to support the implementation of the guideline's recommendations.

Research Needs

While there is a body of literature from which these recommendations were drawn, significant gaps in our knowledge about dysphonia and its management remain. The guideline committee identified several areas where further research would improve the ability of clinicians to optimally treat patients with dysphonia.

1: Escalation of Care and Laryngoscopy and Dysphonia (KASs 3 and 4)

Little is known about the natural history of voice disorders; thus, research is needed to better understand the normal course of these conditions to determine when and if early referral is helpful and/or if early intervention (eg, voice therapy, medical management, surgery) is effective at increasing the QOL or reducing health consequences related to other underlying conditions.

A need exists to better define what "warning signs" and indications should prompt early referral for laryngoscopy. Moreover, education and dissemination of these "warning signs" and indications are important, and effective approaches should be investigated.

2: Antireflux Medication and Dysphonia (KAS 6)

There is a need for a consistent "gold standard" definition of what constitutes LPR to reduce heterogeneity among comparative studies. This would allow for better estimates of disease burden and the degree of association with dysphonia

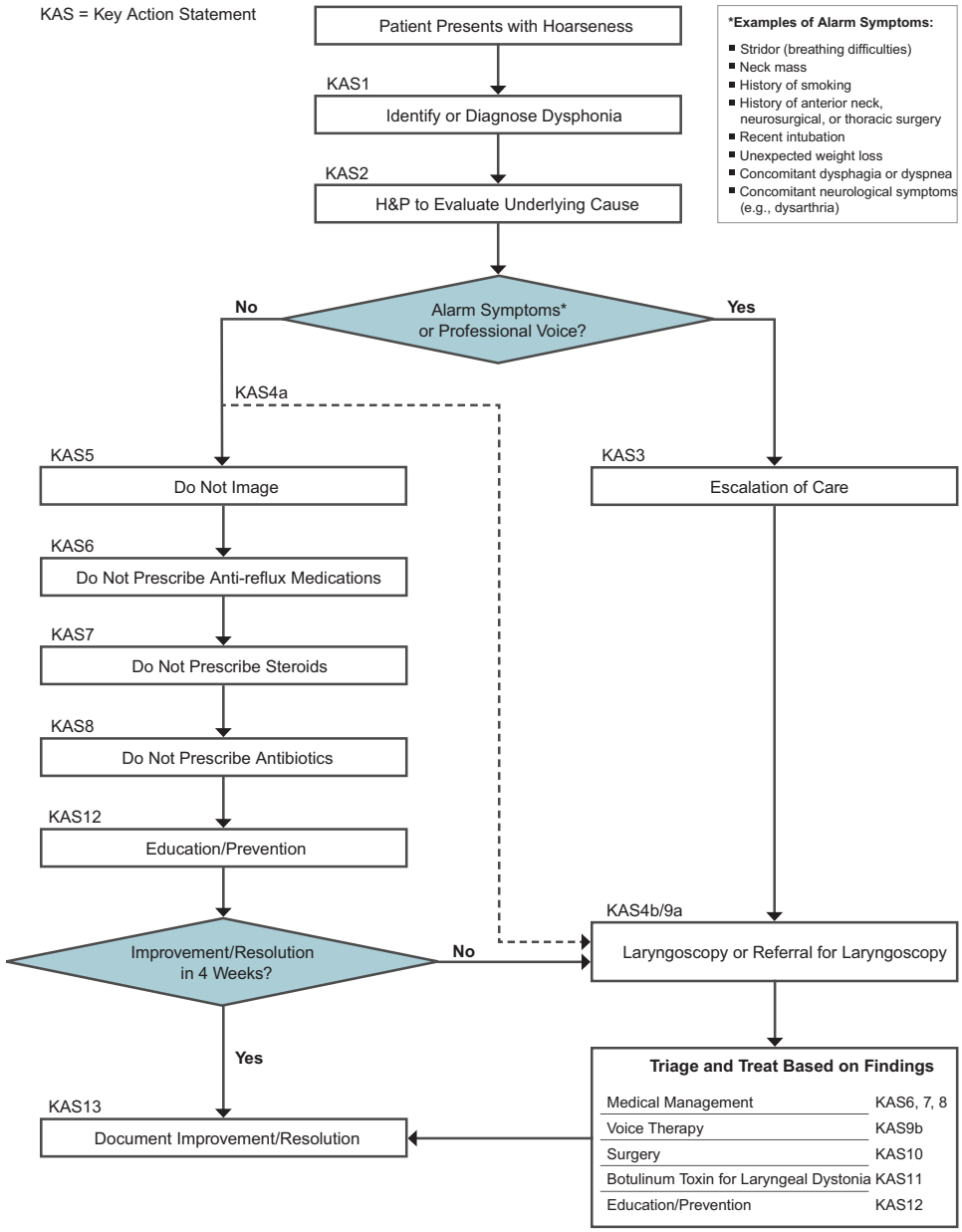

Figure 1. Hoarseness (dysphonia) clinical practice guideline algorithm. H&P, history and physical examination; KAS, key action statement.

and to determine what indications and what interventions are effective at treating this condition. Without an agreed-on definition, it is difficult to design rigorous comparative treatment and outcome studies.

3: Corticosteroids and Antibiotics in Treatment of Dysphonia (KASs 7 and 8)

Research is needed to better understand the variation and overuse of antibiotics and steroids for acute laryngitis. Educational efforts should be directed at reducing their use and promoting conservative management in acute laryngitis. Despite frequency of corticosteroid therapy for acute or chronic laryngitis and for other voice disorders by various clinical specialties, little literature supports its use for these indications. Research is needed to better understand its effectiveness (benefits and harms) in this setting and for which indications they should be considered and/or avoided.

4: Surgery (KAS 10)

Outcomes are difficult to compare for surgery, due to heterogeneity in the number and quality of outcome measures used. This is an issue for patient-centered outcomes and for "objective measures" (eg, cepstral analysis, aerodynamics). A better understanding of and standardization of what benign lesions are amenable to surgery is needed. Furthermore, more research is needed to understand the effectiveness (benefits and harms) of less invasive treatments (office based or medical therapy) for these conditions.

5: Botulinum Toxin (KAS 11)

A need exists to better understand the pathophysiology of laryngeal dystonia to develop more effective treatments. It is also necessary to learn about which patients and factors predict better or worse outcomes with botulinum toxin and what other alterative interventions might be beneficial to this patient population.

6: Education/Prevention (KAS 12)

Prevention and education are paramount to reducing the burden of disease and disease recidivism. This requires a clearer understanding of preventive factors, healthy behaviors, and effective methods to effect and disseminate this information. In addition, it is important to better understand what factors increase the likelihood of developing voice disorders such that these groups can be targeted for educational and preventive interventions.

Further work is needed to better understand the underpinnings of MTD and functional dysphonia to help in prevention, education, and the management of these conditions.

7: Outcomes (KAS 13)

Outcome assessment in voice disorders needs to be better standardized and refined. Patient-centered outcome measures and instrumental assessment need to be carefully and rigorously evaluated to determine their usefulness and reasonableness at the point of care. Better standardization of measurement would allow for better comparison across treatment and to better define disease severity and affect patient QOL and function.

Acknowledgments

We gratefully acknowledge the support provided by Jackie Cole, from the AAO-HNSF, for her assistance with this guideline's graphic designs and Rachel Posey, MS, for her assistance with the literature searches. In addition, we acknowledge the work of the original guideline development group, which includes Seth R. Schwartz, MD, MPH; Seth Cohen, MD, MPH; Seth Dailey, MD; Richard M. Rosenfeld, MD, MPH; Ellen Deutsch, MD; M. Boyd Gillespie, MD, MS; Evelyn Granieri, MD, MPH, MEd; Barbara Messinger-Rapport, MD, PhD; Edie Hapner, PhD; Joseph Stemple, MD; PhD; Eve Kimball, MD; Safdar Medina, MD; J. Scott McMurray, MD; Paul Willging, MD; Helene J. Krouse, PhD; Karen O'Brien, MD; Steven Strode, MD, MEd, MPH; Daniel Ouellette, MD; Robert Stachler, MD; Scott McCoy, DMA; Terrie Crowley; Peter Bernad, MD, MPH; and Dana Thompson, MD, MS.

Disclaimer

This CPG is not intended as an exhaustive source of guidance for managing dysphonia (hoarseness). Rather, it is designed to assist clinicians by providing an evidence-based framework for decision-making strategies. The guideline is not intended to replace clinical judgment or establish a protocol for all individuals with this condition and may not provide the only appropriate approach to diagnosing and managing this program of care. As medical knowledge expands and technology advances, clinical indicators and guidelines are promoted as conditional and provisional proposals of what is recommended under specific conditions, but they are not absolute. Guidelines are not mandates. These do not and should not purport to be a legal standard of care. The responsible physician, in light of all circumstances presented by the individual patient, must determine the appropriate treatment. Adherence to these guidelines will not ensure successful patient outcomes in every situation. The AAO-HNSF emphasizes that these clinical guidelines should not be deemed to include all proper treatment decisions or methods of care or to exclude other treatment decisions or methods of care reasonably directed to obtaining the same results.

Author Contributions

Robert J. Stachler, writer, chair; David O. Francis, writer, assistant chair; Seth R. Schwartz, writer, methodologist; Cecelia C. Damask, writer; German P. Digoy, writer; Helene J. Krouse, writer; Scott J. McCoy, writer; Daniel R. Ouellette, writer; Rita R. Patel, writer; Charles (Charlie) W. Reavis, writer; Libby J. Smith, writer; Marshall Smith, writer; Steven W. Strode, writer; Peak Woo, writer; Lorraine C. Nnacheta, writer, AAO-HNSF staff liaison.

Disclosures

Competing interests: David O. Francis, research funding from the Patient Centered Outcomes Research Institute and National Institute on Deafness and Other Communication Disorders; Seth R. Schwartz, conference travel expenses for Cochlear Americas, Oticon Medical, and Cochlear Corporation (2013); Cecelia C. Damask, consulting fee from Audigy Medical, honoraria from Teva Respiratory, and webinar speaker for ALK; Helene J. Krouse, Society of Otorhinolaryngology and Head-Neck Nurses Research Award (principal investigator, no salary support), AAO-HNSF and Society of Otorhinolaryngology and Head-Neck Nurses editorial boards, and AAO-HNSF editor in chief (self and partner); Daniel R. Ouellette, principal investigator for clinical trial with Cardeas Pharmaceuticals, which examines the treatment of ventilator-associated pneumonia in the intensive care unit with inhaled amikacin/fosfomycin versus placebo; expert witness for law firm of Marynell Maloney for a case involving pulmonary embolism; chair, guideline oversight committee for American College of Chest Physicians; Rita R. Patel, American Speech-Language-Hearing Association Special Interest Group 3 coordinator; Charles (Charlie) W. Reavis, National Spasmodic Dysphonia Association board member and president; Libby J. Smith, Olympus product focus group; Steven W. Strode, American Academy of Family Physicians, federal-level lobbying; Lorraine C. Nnacheta, salaried employee, AAO-HNSF.

Sponsorships: AAO-HNSF.

Funding source: AAO-HNSF.

References

1. Cohen SM, Kim J, Roy N, et al. Prevalence and causes of dysphonia in a large treatment—seeking population. *Laryngoscope*. 2012;122:343-348.
2. Reiter R, Hoffmann TK, Pickhard A, Brosch S. Hoarseness—causes and treatments. *Dtsch Arztebl Int*. 2015;112:329-337.
3. Cohen SM. Self-reported impact of dysphonia in a primary care population. *Laryngoscope*. 2010;120:2022-2032.
4. Johns MM 3rd, Sataloff RT, Merati AL, et al. Shortfalls of the American Academy of Otolaryngology—Head and Neck Surgery's clinical practice guideline: hoarseness (dysphonia). *Otolaryngol Head Neck Surg*. 2010;143:175-180.
5. Jones K, Sigmon J, Hock L, et al. Prevalence and risk factors for voice problems among telemarketers. *Arch Otolaryngol Head Neck Surg*. 2002;128:571-577.

6. Long J, Williford HN, Olson MS, et al. Voice problems and risk factors among aerobics instructors. *J Voice*. 1998;12:197-207.
7. Smith E, Kirchner HL, Taylor M, et al. Voice problems among teachers: differences by gender and teaching characteristics. *J Voice*. 1998;12:328-334.
8. Davids T, Klein AM, Johns MM 3rd. Current dysphonia trends in patients over the age of 65: is vocal atrophy becoming more prevalent? *Laryngoscope*. 2012;122:332-335.
9. Bhattacharyya N. Prevalence of voice problems among US adults. *Laryngoscope*. 2014;124:2359-2362.
10. Cohen SM, Dupont WD, Courey MS. Quality-of-life impact of nonneoplastic voice disorders: a meta-analysis. *Ann Otol Rhinol Laryngol*. 2006;115:128-134.
11. Benninger MS, Ahuja AS, Gardner G, et al. Assessing outcomes for dysphonic patients. *J Voice*. 1998;12:540-550.
12. Ramig LO, Verdolini K. Treatment efficacy: voice disorders. *J Speech Lang Hear Res*. 1998;41:S101-S116.
13. Schwartz SR, Cohen SM, Dailey SH, et al. CPG: dysphonia guideline. *Otolaryngol Head Neck Surg*. 2009;14:S1-S31.
14. Sulica L, Behrman A. Management of benign vocal fold lesions: a survey of current opinion and practice. *Ann Otol Rhinol Laryngol*. 2003;112:827-833.
15. Allen MS, Pettit JM, Sherblom JC. Management of vocal nodules: a regional survey of otolaryngologists and speech-language pathologists. *J Speech Hear Res*. 1991;34:229-235.
16. Behrman A, Sulica L. Voice rest after microlaryngoscopy: current opinion and practice. *Laryngoscope*. 2003;113:2182-2186.
17. Ahmed TF, Khandwala F, Abelson TI, et al. Chronic laryngitis associated with gastroesophageal reflux: prospective assessment of differences in practice patterns between gastroenterologists and ENT physicians. *Am J Gastroenterol* 2006;101:470-478.
18. Hamdan AL, Sibai AM, Srour ZM, Sabra OA, Deeb RA. Voice disorders in teachers: the role of family physicians. *Saudi Med J*. 2007;28:422-428.
19. Roy N, Merrill RM, Gray SD, et al. Voice disorders in the general population: prevalence, risk factors, and occupational impact. *Laryngoscope*. 2005;115:1988-1995.
20. Coyle SM, Weinrich BD, Stemple JC. Shifts in relative prevalence of laryngeal pathology in a treatment-seeking population. *J Voice*. 2001;15:424-440.
21. Titze IR, Lemke J, Montequin D. Populations in the US workforce who rely on voice as a primary tool of trade: a preliminary report. *J Voice*. 1997;11:254-259.
22. Roy N, Kim J, Courey M, et al. Voice disorders in the elderly: a national database study. *Laryngoscope*. 2016;126:421-428.
23. Cohen SM, Kim J, Roy N, et al. Direct health care costs of laryngeal diseases and disorders. *Laryngoscope*. 2012;122:1582-1588.
24. Francis DO, McKiever ME, Garrett CG, et al. Assessment of patient experience with unilateral vocal fold immobility: a preliminary study. *J Voice*. 2014;28:636-643.
25. Mirza, N, Ruiz, C, Baum, ED, et al. The prevalence of major psychiatric pathologies in patients with voice disorders. *Ear, Nose, Throat J*. 2003;82:808-810, 812, 814.
26. Fang TJ, Li HY, Gliklich RE, et al. Quality of life measures and predictors for adults with unilateral vocal cord paralysis. *Laryngoscope*. 2008;118:1837-1841.
27. Chen AY, Schrag NM, Halpern M, et al. Health insurance and stage at diagnosis of laryngeal cancer: does insurance type predict stage at diagnosis? *Arch Otolaryngol Head Neck Surg*. 2007;133:784-790.
28. Van Houtte E, Van Lierde K, Claeys S. Pathophysiology and treatment of muscle tension dysphonia: a review of the current knowledge. *J Voice*. 2011;25:202-207.
29. Morrison MD, Rammage LA. Muscle misuse voice disorders: description and classification. *Acta Otolaryngol*. 1993;113:428-434.
30. Craig J, Tomlinson C, Stevens K, et al. Combining voice therapy and physical therapy: a novel approach to treating muscle tension dysphonia. *J Commun Disord*. 2015;58:169-178.
31. Bhattacharya N. The prevalence of pediatric voice and swallowing problems in the United States. *Laryngoscope*. 2015;125:746-750.
32. Duff MC, Proctor A, Yairi E. Prevalence of voice disorders in African American and European American preschoolers. *J Voice*. 2004;18:348-353.
33. Carding PN, Roulstone S, Northstone K, et al. The prevalence of childhood dysphonia: a cross-sectional study. *J Voice*. 2006;20:623-630.
34. Silverman EM. Incidence of chronic hoarseness among school-age children. *J Speech Hear Disord*. 1975;40:211-215.
35. Angelillo N, Di Costanzo B, Angelillo M, et al. Epidemiological study on vocal disorders in paediatric age. *J Prev Med Hyg*. 2008;49:1-5.
36. Woo P, Casper J, Colton R, et al. Dysphonia in the aging: physiology versus disease. *Laryngoscope*. 1992;102:139-144.
37. Hagen P, Lyons GD, Nuss DW. Dysphonia in the elderly: diagnosis and management of age-related voice changes. *South Med J*. 1996;89:204-207.
38. Lundy DS, Silva C, Casiano RR, et al. Cause of hoarseness in elderly patients. *Otolaryngol Head Neck Surg*. 1998;118:481-485.
39. Takano S, Kimura M, Nito T, et al. Clinical analysis of presbylarynx—vocal fold atrophy in elderly individuals. *Auris Nasus Larynx*. 2010;37:461-464.
40. Pontes P, Brasolotto A, Behlau M. Glottic characteristics and voice complaint in the elderly. *J Voice*. 2005;19:84-94.
41. Gregory ND, Chandran S, Lurie D, et al. Voice disorders in the elderly. *J Voice*. 2012;26:254-258.
42. Yamauchi A, Imagawa H, Sakakaibara K, et al. Vocal fold atrophy in a Japanese tertiary medical institute: status quo of the most aged country. *J Voice*. 2014;28:231-236.
43. Turley R, Cohen S. Impact of voice and swallowing problems in the elderly. *Otolaryngol Head Neck Surg*. 2009;140:33-36.
44. Roy N, Stemple J, Merrill RM, et al. Epidemiology of voice disorders in the elderly: preliminary findings. *Laryngoscope*. 2007;117:628-633.
45. Golub JS, Chen PH, Otto KJ, et al. Prevalence of perceived dysphonia in a geriatric population. *J Am Geriatr Soc*. 2006;54:1736-1739.
46. Rosa M, Behlau M. Mapping of vocal risk in amateur choir. *J Voice*. 2017;31:118.e1-118.e11.
47. Guss J, Sadoughi B, Benson B, et al. Dysphonia in performers: toward a clinical definition of laryngology of the performing voice. *J Voice*. 2014;28:349-355.

48. Verdolini K, Ramig LO. Review: occupational risks for voice problems. *Logoped Phoniatr Vocol*. 2001;26:37-46.
49. Roy N, Merrill RM, Thibeault S, et al. Prevalence of voice disorders in teachers and the general population. *J Speech Lang Hear Res*. 2004;47:281-293.
50. Smith E, Lemke J, Taylor M, et al. Frequency of voice problems among teachers and other occupations. *J Voice*. 1998;12:480-488.
51. Fortes FS, Imamura R, Tsuji DH, et al. Profile of voice professionals seen in a tertiary health center. *Braz J Otorhinolaryngol*. 2007;73:27-31.
52. Oliveira AG, Behlau M, Gouveia N. Vocal symptoms in telemarketers: a random and controlled field trial. *Folia Phoniatr Logop*. 2009;61:76-82.
53. Fellman D, Simberg S. Prevalence and risk factors for voice problems among soccer coaches. *J Voice*. 2017;31:121.e9-121.e15.
54. Isetti D, Meyer T. Workplace productivity and voice disorders: a cognitive interviewing study on presenteeism in individuals with spasmodic dysphonia. *J Voice*. 2014;28:700-710.
55. Cohen SM, Kim J, Roy N, et al. The impact of laryngeal disorders on work-related dysfunction. *Laryngoscope*. 2012;122:1589-1594.
56. Mendels EJ, Brunings JW, Hamaekers AE, et al. Adverse laryngeal effects following short-term general anesthesia: a systematic review. *Arch Otolaryngol Head Neck Surg*. 2012;138:257-264.
57. Lundy DS, Casiano RR, Shatz D, et al. Laryngeal injuries after short- versus long-term intubation. *J Voice*. 1998;12:360-365.
58. Schweiger C, Manica D, Kuhl G, et al. Post-intubation acute laryngeal injuries in infants and children: a new classification system. *Int J Pediatr Otorhinolaryngol*. 2016;86:177-182.
59. De Lima Eda S, de Oliveira, MA, Barone, CR, et al. Incidence and endoscopic characteristics of acute laryngeal lesions in children undergoing endotracheal intubation. *Braz J Otorhinolaryngol*. 2016;82:507-511.
60. Bhattacharyya N, Fried MP. Assessment of the morbidity and complications of total thyroidectomy. *Arch Otolaryngol Head Neck Surg*. 2002;128:389-392.
61. Bergamaschi R, Becouarn G, Ronceray J, et al. Morbidity of thyroid surgery. *Am J Surg*. 1998;176:71-75.
62. Prim MP, de Diego JI, Hardisson D, et al. Factors related to nerve injury and hypocalcemia in thyroid gland surgery. *Otolaryngol Head Neck Surg*. 2001;124:111-114.
63. Dralle H, Sekulla C, Haerting J, et al. Risk factors of paralysis and functional outcome after recurrent laryngeal nerve monitoring in thyroid surgery. *Surgery*. 2004;136:1310-1322.
64. Jeannon JP, Orabi AA, Bruch GA, et al. Diagnosis of recurrent laryngeal nerve palsy after thyroidectomy: a systematic review. *Int J Clin Pract*. 2009;63:624-629.
65. Bergenfelz A, Jansson S, Kristoffersson A, et al. Complications to thyroid surgery: results as reported in a database from a multicenter audit comprising 3,660 patients. *Langenbecks Arch Surg*. 2008;393:667-673.
66. Godballe C, Madsen AR, Sorensen CH, et al. Risk factors for recurrent nerve palsy after thyroid surgery: a national study of patients treated at Danish departments of ENT head and neck surgery. *Eur Arch Otorhinolaryngol*. 2014;271:2267-2276.
67. Rosato L, Avenia N, Bernante P, et al. Complications of thyroid surgery: analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years. *World J Surg*. 2004;28:271-276.
68. Thomusch O, Machens A, Sekulla C, et al. Multivariate analysis of risk factors for postoperative complications in benign goiter surgery: prospective multicenter study in Germany. *World J Surg*. 2000;24:1335-1341.
69. Francis DO, Pearce EC, Ni S, et al. Epidemiology of vocal fold paralyses after total thyroidectomy for well-differentiated thyroid cancer in a Medicare population. *Otolaryngol Head Neck Surg*. 2014;150:548-557.
70. Kriskovich MD, Apfelbaum RI, Haller JR. Vocal fold paralysis after anterior cervical spine surgery: incidence, mechanism, and prevention of injury. *Laryngoscope*. 2000;110:1467-1473.
71. Spanu G, Marchionni M, Adinolfi D, et al. Complications following anterior cervical spine surgery for disc diseases: an analysis of ten years experience. *Chir Organi Mov*. 2005;90:229-240.
72. Li H, Dai LY. A systematic review of complications in cervical spine surgery for ossification of the posterior longitudinal ligament. *Spine J*. 2011;11:1049-1057.
73. Tan TP, Govindarajulu AP, Massicotte EM, et al. Vocal cord palsy after anterior cervical spine surgery: a qualitative systematic review. *Spine J*. 2014;14:1332-1342.
74. Zbar RI, Chen AH, Behrendt DM, et al. Incidence of vocal fold paralysis in infants undergoing ligation of patent ductus arteriosus. *Ann Thorac Surg*. 1996;61:814-816.
75. Smith ME, King JD, Elsherif A, et al. Should all newborns who undergo patent ductus arteriosus ligation be examined for vocal fold mobility? *Laryngoscope*. 2009;119:1606-1609.
76. Francis DO, Williamson K, Hovis K, et al. Effect of injection augmentation on need for framework surgery in unilateral vocal fold paralysis. *Laryngoscope*. 2016;126:128-134.
77. Spataro EA, Grindler DJ, Paniello RC. Etiology and time to presentation of unilateral vocal fold paralysis. *Otolaryngol Head Neck Surg*. 2014;151:286-293.
78. Haft S, Farquhar D, Carey R, et al. Anticholinergic use is a major risk factor for dysphonia. *Ann Otol Rhinol Laryngol*. 2015;124:797-802.
79. Rhoads JM, Lowell SH, Hedgepeth EM. Hoarseness and aphonia as a side effect of tricyclic antidepressants. *Am J Psych*. 1979;136:1599.
80. Abaza MM, Levy S, Hawkshaw MJ, et al. Effects of medications on the voice. *Otolaryngol Clin North Am*. 2007;40:1081-1090.
81. Verdolini K, Min Y, Titze IR, et al. Biological mechanisms underlying voice changes due to dehydration. *J Speech Lang Hear Res*. 2002;45:268-281.
82. Gallivan GJ, Gallivan KH, Gallivan HK. Inhaled corticosteroids: hazardous effects on voice-an update. *J Voice*. 2007;21:101-111.
83. Bhalla RK, Taylor W, Jones AS, et al. The inflammation produced by corticosteroid inhalers in the pharynx in asthmatics. *Clin Otolaryngol*. 2008;33:581-586.
84. Bhalla RK, Jones AS, Roland NJ. Prevalence of pharyngeal and laryngeal complications in adult asthmatics using inhaled corticosteroids. *J Laryngol Otol*. 2008;122:1078-1083.
85. Ihre E, Zetterstrom O, Ihre E, et al. Voice problems as side effects of inhaled corticosteroids in asthma patients—a prevalence study. *J Voice*. 2004;18:403-414.
86. Rosenfeld RM, Shiffman RN, Robertson P. Clinical practice guideline development manual, third edition: a quality-driven approach for translating evidence into action. *Otolaryngol Head Neck Surg*. 2013;148(1):S1-S55.

87. Shiffman RN, Michel G, Rosenfeld RM, et al. Building better guidelines with BRIDGE-Wiz: development and evaluation of a software assistant to promote clarity, transparency, and Implementability. *J Am Med Inform Assoc*. 2012;19:94-101.
88. Shiffman RN, Dixon J, Brandt C, et al. The GuideLine Implementability Appraisal (GLIA): development of an instrument to identify obstacles to guideline implementation. *BMC Med Inform Decis Mak*. 2005;5:23.
89. Oxford Centre for Evidence-Based Medicine. The Oxford 2011 levels of evidence. http://www.cebm.net/index.aspx?o=5653. Published 2011. Accessed June 4, 2016.
90. Howick J, Chalmers I, Glasziou; OCEBM Levels of Evidence Working Group. The Oxford 2011 levels of evidence. http://www.cebm.net/index.aspx?o=5653. Published 2011.
91. AAP Steering Committee on Quality Improvement and Management. Policy statement: classifying recommendations for clinical practice guidelines. *Pediatrics*. 2004;114:874-877.
92. Choudhry NK, Stelfox HT, Detsky AS. Relationships between authors of clinical practice guidelines and the pharmaceutical industry. *JAMA*. 2002;287:612-617.
93. Detsky AS. Sources of bias for authors of clinical practice guidelines. *CMAJ*. 2006;175:1033-1035.
94. Barry, MJ, Edgman-Levitan, S. Shared decision making—the pinnacle of patient-centered care. *N Engl J Med*. 2012;366:780-781.
95. Blitzer A, Brin MF, Fahn S, et al. Clinical and laboratory characteristics of focal laryngeal dystonia: study of 110 cases. *Laryngoscope*. 1998;98:636-640.
96. Golub HL, Corwin MJ. Infant cry: a clue to diagnosis. *Pediatrics*. 1982;69:197-201.
97. Brouha XD, Tromp DM, de Leeuw JR, et al. Laryngeal cancer patients: analysis of patient delay at different tumor stages. *Head Neck*. 2005;27:289-295.
98. Smith MM, Abrol A, Gardner GM. *Laryngoscope*. 2016;126:1612-1615.
99. Sneeuw KC, Sprangers MA, Aaronson NK. The role of health care providers and significant others in evaluating the quality of life of patients with chronic disease. *J Clin Epidemiol*. 2002;55:1130-1143.
100. Hackett ML, Duncan JR, Anderson CS, et al. Health-related quality of life among long-term survivors of stroke: results from the Auckland Stroke Study, 1991-1992. *Stroke*. 2000;31:440-447.
101. Hogikyan ND, Sethuraman G. Validation of an instrument to measure voice-related quality of life (V-RQOL). *J Voice*. 1999;13:557-569.
102. Jacobson BH, Johnson A, Grywalski C, et al. The Voice Handicap Index (VHI): development and validation. *Am J Speech Lang Pathol*. 1997;6:66-70.
103. Deary IJ, Wilson JA, Carding PN, et al. VoiSS: a patient-derived voice symptom scale. *J Psychosom Res*. 2003;54:483-489.
104. Rosen CA, Lee AS, Osborne J, et al. Development and validation of the Voice Handicap Index-10. *Laryngoscope*. 2004;114:1549-1556.
105. Roy N, Gouse M, Mauszycki SC, et al. Task specificity in adductor spasmodic dysphonia versus muscle tension dysphonia. *Laryngoscope*. 2005;115:311-316.
106. Chhetri DK, Merati AL, Blumin JH, et al. Reliability of the perceptual evaluation of adductor spasmodic dysphonia. *Ann Otol Rhinol Laryngol*. 2008;117:159-165.
107. Preciado-López J, Pérez-Fernández C, Calzada-Uriondo M, et al. Epidemiological study of voice disorders among teaching professionals of La Rioja, Spain. *J Voice*. 2008;22:489-508.
108. Matsuo K, Kamimura M, Hirano M. Polypoid vocal folds: a 10-year review of 191 patients. *Auris Nasus Larynx*. 1983;10:S37-S45.
109. Karlsson T, Bergström L, Ward E, Finizia C. A prospective longitudinal study of voice characteristics and health-related quality of life outcomes following laryngeal cancer treatment with radiotherapy. *Acta Oncol*. 2016;55:693-699.
110. Kosztyla-Hojna B, Rogowski M, Pepiński W. The evaluation of voice in elderly patients. *Acta Otorhinolaryngol Belg*. 2003;57:107-112.
111. Kandoğan T, Olgun L, Gültekin G. Causes of dysphonia in patients above 60 years of age. *Kulak Burun Bogaz Ihtis Derg*. 2003;11:139-143.
112. Hartman DE. Neurogenic dysphonia. *Ann Otol Rhinol Laryngol*. 1984;93:57-64.
113. Sewall GK, Jiang J, Ford CN. Clinical evaluation of Parkinson's-related dysphonia. *Laryngoscope*. 2006;116:1740-1744.
114. Reynolds V, Meldrum S, Simmer K, et al. Dysphonia in very preterm children: a review of the evidence. *Neonatology*. 2014;106:69-73.
115. Reynolds V, Meldrum S, Simmer K, et al. Voice problems in school-aged children following very preterm birth. *Arch Dis Child*. 2016;101:556-560.
116. Hirschberg J. Dysphonia in infants. *Int J Pediatr Otorhinolaryngol*. 1999;49:S293-S296.
117. Hengerer AS, Strome M, Jaffe BF. Injuries to the neonatal larynx from long-term endotracheal tube intubation and suggested tube modification for prevention. *Ann Otol Rhinol Laryngol*. 1975;84:764-770.
118. Shankargouda S, Krishnan U, Murali R, et al. Dysphonia: a frequently encountered symptom in the evaluation of infants with unobstructed supracardiac total anomalous pulmonary venous connection. *Pediatr Cardiol*. 2000;21:458-460.
119. Connor NP, Cohen SB, Theis SM, et al. Attitudes of children with dysphonia. *J Voice*. 2008;22:197-209.
120. Sederholm E, McAllister A, Dalkvist J, et al. Aetiologic factors associated with hoarseness in ten-year-old children. *Folia Phoniatr Logop*. 1995;47:262-278.
121. Franco J, Elghouche AN, Harris MS, et al. Diagnostic delays and errors in head and neck cancer patients: opportunities for improvement. *Am J Med Quality*. 2017;32:330-335.
122. Smith MM, Abrol A, Gardner GM. Assessing delays in laryngeal cancer treatment. *Laryngoscope*. 2016;126:1612-1615.
123. Lee JJ, Dhepnorrarat C, Nyhof-Young J, et al. Investigating patient and physician delays in the diagnosis of head and neck cancers: a Canadian perspective. *J Cancer Educ*. 2016;31:8-14.
124. Nash R, Hughes J, Sandison A, et al. Factors associated with delays in head and neck cancer treatment: case-control study. *J Laryngol Otol*. 2015;129:383-385.
125. Tan JY, Otty ZA, Vangaveti VN, et al. A prospective comparison of times to presentation and treatment of regional and remote head and neck patients in North Queensland, Australia. *Intern Med J*. 2016;46:917-924.
126. Christophe V, Leroy T, Seillier M, et al. Determinants of patient delay in doctor consultation in head and neck cancers (Protocol DEREDIA). *BMJ Open*. 2014;4:e005286.

127. Choi SY, Kahyo H. Effect of cigarette smoking and alcohol consumption in the aetiology of cancer of the oral cavity, pharynx and larynx. *Intern J Epidemiol*. 1991;20:878-885.
128. Mashberg A, Boffetta P, Winkelman R, et al. Tobacco smoking, alcohol drinking, and cancer of the oral cavity and oropharynx among US veterans. *Cancer*. 1993;72:1369-1375.
129. Brennan JA, Boyle JO, Koch WM, et al. Association between cigarette smoking and mutation of the p53 gene in squamous-cell carcinoma of the head and neck. *N Engl J Med*. 1995;332:712-717.
130. Seoane J, Takkouche B, Varela-Centelles P, et al. Impact of delay in diagnosis on survival to head and neck carcinomas: a systematic review with meta-analysis. *Clin Otolaryngol*. 2012;37:99-106.
131. Kowalski LP, Carvalho AL. Influence of time delay and clinical upstaging in the prognosis of head and neck cancer. *Oral Oncol*. 2001;37:94-98.
132. Murphy CT, Galloway TJ, Handorf EA, et al. Survival impact of increasing time to treatment initiation for patients with head and neck cancer in the United States. *J Clin Oncol*. 2016;34:169-178.
133. van Harten MC, Hoebers FJ, Kross KW, et al. Determinants of treatment waiting times for head and neck cancer in the Netherlands and their relation to survival. *Oral Oncol*. 2015;51:272-278.
134. Teppo H, Alho OP. Relative importance of diagnostic delays in different head and neck cancers. *Clin Otolaryngol*. 2008;33:325-330.
135. Teppo H, Alho OP. Comorbidity and diagnostic delay in cancer of the larynx, tongue and pharynx. *Oral Oncol*. 2009;45:692-695.
136. Davies L, Welch HG. Increasing incidence of thyroid cancer in the United States, 1973-2002. *JAMA*. 2006;295:2164-2167.
137. Marawar S, Girardi FP, Sama AA, et al. National trends in anterior cervical fusion procedures. *Spine*. 2010;35:1454-1459.
138. Sulica L. The natural history of idiopathic unilateral vocal fold paralysis: evidence and problems. *Laryngoscope*. 2008;118:1303-1307.
139. Leder SB, Ross DA. Incidence of vocal fold immobility in patients with dysphagia. *Dysphagia*. 2005;20:163-167.
140. Brunner E, Friedrich G, Kiesler K, et al. Subjective breathing impairment in unilateral vocal fold paralysis. *Folia Phoniatr Logop*. 2011;63:142-146.
141. Bhattacharyya N, Kotz T, Shapiro J. The effect of bolus consistency on dysphagia in unilateral vocal cord paralysis. *Otolaryngol Head Neck Surg*. 2003;129:632-636.
142. Chandrasekhar SS, Randolph GW, Seidman MD, et al. Clinical practice guideline: improving voice outcomes after thyroid surgery. *Otolaryngol Head Neck Surg*. 2013;148:S1-S37.
143. Young VN, Smith LJ, Rosen C. Voice outcome following acute unilateral vocal fold paralysis. *Ann Otol Rhinol Laryngol*. 2013;122:197-204.
144. Chen X, Wan P, Yu Y, et al. Types and timing of therapy for vocal fold paresis/paralysis after thyroidectomy: a systematic review and meta-analysis. *J Voice*. 2014;28:799-808.
145. Cates DJ, Venkatesan NN, Strong B, et al. Effect of vocal fold medialization on dysphagia in patients with unilateral vocal fold immobility. *Otolaryngol Head Neck Surg*. 2016;155:454-457.
146. Asik MB, Karasimav O, Birkent H, et al. Airway and respiration parameters improve following vocal fold medialization: a prospective study. *Ann Otol Rhinol Laryngol*. 2015;124:972-977.
147. Scheel R, Pisegna JM, McNally E, et al. Endoscopic assessment of swallowing after prolonged intubation in the ICU setting. *Ann Otol Rhinol Laryngol*. 2016;125:43-52.
148. Santos PM, Afrassiabi A, Weymuller EA Jr. Risk factors associated with prolonged intubation and laryngeal injury. *Otolaryngol Head Neck Surg*. 1994;111:453-459.
149. Tadie JM, Behm E, Lecuyer L, et al. Post-intubation laryngeal injuries and extubation failure: a fiberoptic endoscopic study. *Intensive Care Med*. 2010;36:991-998.
150. Venugopal A, Jacob RM, Koshy RC. A randomized control study comparing the pharyngolaryngeal morbidity of laryngeal mask airway versus endotracheal tube. *Anesth Essays Res*. 2016;10:189-194.
151. Xu W, Han D, Hu R, et al. Characteristics of vocal fold immobility following endotracheal intubation. *Ann Otol Rhinol Laryngol*. 2012;121:689-694.
152. Reece GP, Shatney CH. Blunt injuries of the cervical trachea: review of 51 patients. *South Med J*. 1988;81:1542-1548.
153. Paganoni S, Macklin EA, Lee A, et al. Diagnostic timelines and delays in diagnosing amyotrophic lateral sclerosis (ALS). *Amyotroph Lateral Scler Frontotemporal Degener*. 2014;15:453-456.
154. Nzwalo H, de Abreu D, Swash M, et al. Delayed diagnosis in ALS: the problem continues. *J Neurol Sci*. 2014;343:173-175.
155. Petty BE. Health information-seeking behaviors among classically trained singers. *J Voice*. 2012;26:330-335.
156. Kwak PE, Stasney CR, Hathway J, et al. Knowledge, experience, and anxieties of young classical singers in training. *J Voice*. 2014;28:191-195.
157. Salturk Z, Kumral TL, Aydoğdu I, et al. Psychological effects of dysphonia in voice professionals. *Laryngoscope*. 2015;125:1908-1910.
158. Kirsh ER, Van Leer E, Phero HJ, et al. Factors associated with singers' perceptions of choral singing well-being. *J Voice*. 2013;27:786.e725-e732.
159. Behlau M, Zambon F, Madazio G. Managing dysphonia in occupational voice users. *Curr Opin Otolaryngol Head Neck Surg*. 2014;22:188-194.
160. Mace SE. Blunt laryngotracheal trauma. *Ann Emerg Med*. 1986;15:836-842.
161. Schaefer SD. The acute management of external laryngeal trauma: a 27-year experience. *Arch Otolaryngol Head Neck Surg*. 1992;118:598-604.
162. Resouly A, Hope A, Thomas S. A rapid access husky voice clinic: useful in diagnosing laryngeal pathology. *J Laryngol Otol*. 2001;115:978-980.
163. Johnson JT, Newman RK, Olson JE. Persistent hoarseness: an aggressive approach for early detection of laryngeal cancer. *Postgrad Med*. 1980;67:122-126.
164. Ishizuka T, Hisada T, Aoki H, et al. Gender and age risks for hoarseness and dysphonia with use of a dry powder fluticasone propionate inhaler in asthma. *Allergy Asthma Proc*. 2007;28:550-556.

165. Rosenthal LHS, Benninger MS, Deeb RH. Vocal fold immobility: a longitudinal analysis of etiology over 20 years. *Laryngoscope*. 2007;117:1864-1870.
166. Hartl DA, Hans S, Vaissière J, et al. Objective acoustic and aerodynamic measures of breathiness in paralytic dysphonia. *Eur Arch Otorhinolaryngol*. 2003;260:175-182.
167. Mao VH, Abaza M, Spiegel JR, et al. Laryngeal myasthenia gravis: report of 40 cases. *J Voice*. 2001;15:122-130.
168. Rosen CA, Gartner-Schmidt J, Hathaway B, et al. A nomenclature paradigm for benign mid-membranous vocal fold lesions. *Laryngoscope*. 2012;122:1335-1341.
169. Belafsky PC, Rees CJ. Laryngopharyngeal reflux: the value of otolaryngology examination. *Curr Gastroenterol Rep*. 2008;10:278-282.
170. Park KH, Choi SM, Kwon SU, et al. Diagnosis of laryngopharyngeal reflux among globus patients. *Otolaryngol Head Neck Surg*. 2006;134:81-85.
171. Powell J, Cocks HC. Mucosal changes in laryngopharyngeal reflux—prevalence, sensitivity, specificity and assessment. *Laryngoscope*. 2013;123:985-991.
172. Hicks DM, Ours TM, Abelson TI, et al. The prevalence of hypopharynx findings associated with gastroesophageal reflux in normal volunteers. *J Voice*. 2002;16:564-579.
173. Milstein CF, Charbel S, Hicks DM, et al. Prevalence of laryngeal irritation signs associated with reflux in asymptomatic volunteers: impact of endoscopic technique (rigid vs flexible laryngoscope). *Laryngoscope*. 2005;115:2256-2261.
174. Branski RC, Bhattacharyya N, Shapiro J. The reliability of the assessment of endoscopic laryngeal findings associated with laryngopharyngeal reflux disease. *Laryngoscope*. 2002;112:1019-1024.
175. Ludlow CL, Adler CH, Berke GS, et al. Research priorities in spasmodic dysphonia. *Otolaryngol Head Neck Surg*. 2008;139:495-505.
176. De Jong AL, Kuppersmith RB, Sulek M, et al. Vocal cord paralysis in infants and children. *Otolarygol Clin North Am*. 2000;33:131-149.
177. Nicollas R, Triglia JM. The anterior laryngeal webs. *Otolaryngol Clin North Am*. 2008;41:877-888.
178. Thompson DM. Abnormal sensorimotor integrative function of the larynx in congenital laryngomalacia: a new theory of etiology. *Laryngoscope*. 2007;117:1-33.
179. Faust RA. Childhood voice disorders: ambulatory evaluation and operative diagnosis. *Clin Pediatr*. 2003;42:1-9.
180. Rehberg E, Kleinsasser O. Malignant transformation in nonirradiated juvenile laryngeal papillomatosis. *Eur Arch Otorhinolaryngol*. 1999;256:450-454.
181. Portier F, Marianowski R, Morisseau-Durand MP, et al. Respiratory obstruction as a sign of brainstem dysfunction in infants with Chiari malformations. *Int J Pediatr Otorhinolaryngol*. 2001;57:195-202.
182. Truong MT, Messner AH, Kerschner JE, et al. Pediatric vocal fold paralysis after cardiac surgery: rate of recovery and sequelae. *Otolaryngol Head Neck Surg*. 2007;137:780-784.
183. Dworkin JP. Laryngitis: types, causes, and treatments. *Otolaryngol Clin North Am*. 2008;41:419-436.
184. Reveiz L, Cardona Zorrilla AF, Ospina EG. Antibiotics for acute laryngitis in adults. *Cochrane Database Syst Rev*. 2015;(2):CD004783.
185. Ruiz R, Jeswani S, Andrews K, et al. Hoarseness and laryngopharyngeal reflux: a survey of primary care physician practice patterns. *JAMA Otolaryngol Head Neck Surg*. 2014;140:192-196.
186. Cohen SM, Lee HJ, Roy N, Misono S. Chronicity of voice-related health care utilization in the general medicine community. *Otolaryngol Head Neck Surg*. 2017;156:693-701.
187. Cohen SM, Kim J, Roy N, et al. Factors influencing referral of patients with voice disorders from primary care to otolaryngology. *Laryngoscopy*. 2014;124:214-220.
188. Cohen SM, Kim J, Roy N, et al. Delayed otolaryngology referral for voice disorders increases health care costs. *Am J Med*. 2015;128:426.e11-e18.
189. Cohen SM, Kim J, Roy N, et al. Change in diagnosis and treatment following specialty voice evaluation: a national database analysis. *Laryngoscope*. 2015;125:1660-1666.
190. Fritz MA, Persky MJ, Fang Y, et al. The accuracy of the laryngopharyngeal reflux diagnosis: utility of the stroboscopic exam. *Otolaryngol Head Neck Surg*. 2016;155:629-634.
191. Keesecker SE, Murry T, Sulica L. Patterns in the evaluation of hoarseness: time to presentation, laryngeal visualization, and diagnostic accuracy. *Laryngoscope*. 2015;125:667-673.
192. Brenner DJ, Hall EJ. Computed tomography—an increasing source of radiation exposure. *N Engl J Med*. 2007;357:2277-2284.
193. Brenner D, Elliston C, Hall E, et al. Estimated risks of radiation-induced fatal cancer from pediatric CT. *AJR Am J Roentgenol*. 2001;176:289-296.
194. Rice HE, Frush DP, Farmer D, et al. Review of radiation risks from computed tomography: essentials for the pediatric surgeon. *J Pediatr Surg*. 2007;42:603-607.
195. Berrington de Gonzalez A, Darby S. Risk of cancer from diagnostic x-rays: estimates for the UK and 14 other countries. *Lancet*. 2004;363:345-351.
196. United Nations Scientific Committee on the Effects of Atomic Radiation. *Sources and Effects of Ionizing Radiation: UNSCEAR 2000 Report to the General Assembly*. New York, NY: United Nations; 2000.
197. Wang CL, Cohan RH, Ellis JH, et al. Frequency, outcome, and appropriateness of treatment of nonionic iodinated contrast media reactions. *AJR Am J Roentgenol*. 2008;191:409-415.
198. Mortelé KJ, Oliva MR, Ondategui S, et al. Universal use of nonionic iodinated contrast medium for CT: evaluation of safety in a large urban teaching hospital. *AJR Am J Roentgenol*. 2005;184:31-34.
199. Dillman JR, Ellis JH, Cohan RH, et al. Frequency and severity of acute allergic-like reactions to gadolinium-containing IV contrast media in children and adults. *AJR Am J Roentgenol*. 2007;189:1533-1538.
200. Chung SM. Safety issues in magnetic resonance imaging. *J Neuroopthalmol*. 2002;22:35-39.
201. Stecco A, Saponaro A, Carriero A. Patient safety issues in magnetic resonance imaging: state of the art. *Radiol Med*. 2007;112:491-508.
202. Quirk ME, Letendre AJ, Ciottone RA, et al. Anxiety in patients undergoing MR imaging. *Radiology*. 1989;170:463-466.

203. Prince MR, Arnoldus C, Frisoli JK. Nephrotoxicity of high-dose gadolinium compared with iodinated contrast. *J Magn Reson Imaging*. 1996;6:162-166.
204. Tardy B, Guy C, Barral G, et al. Anaphylactic shock induced by intravenous gadopentetate dimeglumine. *Lancet*. 1992;22:494.
205. Perazella MA. Gadolinium-contrast toxicity in patients with kidney disease: nephrotoxicity and nephrogenic systemic fibrosis. *Curr Drug Saf*. 2008;3:67-75.
206. Brummett RE, Talbot JM, Charuhas P. Potential hearing loss resulting from MR imaging. *Radiology*. 1988;169:539-540.
207. Smith-Bindman R, Miglioretti DL, Larson EB. Rising use of diagnostic medical imaging in a large integrated health system. *Health Aff (Millwood)*. 2008;27:1491-1502.
208. Saini S, Sharma R, Levine LA, et al. Technical cost of CT examinations. *Radiology*. 2001;218:172-175.
209. Saini S, Seltzer SE, Bramson RT, et al. Technical cost of radiologic examinations: analysis across imaging modalities. *Radiology*. 2000;216:269-272.
210. Hopkins C, Yousaf U, Pedersen M. Acid reflux treatment for hoarseness. *Cochrane Database Syst Rev*. 2006;(1):CD005054.
211. Fass R, Noelck N, Willis MR, et al. The effect of esomeprazole 20 mg twice daily on acoustic and perception parameters of the voice in laryngopharyngeal reflux. *Neurogastroenterol Motility*. 2010;22:134-141, e44-e45.
212. Vaezi MF, Richter JE, Stasney CR, et al. Treatment of chronic posterior laryngitis with esomeprazole. *Laryngoscope*. 2006;116:254-260.
213. El-Serag HB, Lee P, Buchner A, et al. Lansoprazole treatment of patients with chronic idiopathic laryngitis: a placebo-controlled trial. *Am J Gastroenterol*. 2001;96:979-983.
214. Noordzij JP, Khidr A, Evans BA, et al. Evaluation of omeprazole in the treatment of reflux laryngitis: a prospective, placebo-controlled, randomized, double-blind study. *Laryngoscope*. 2001;111:2147-2151.
215. Eherer AJ, Habermann W, Hammer HF, et al. Effect of pantoprazole on the course of reflux-associated laryngitis: a placebo-controlled double-blind crossover study. *Scand J Gastroenterol*. 2003;38:462-467.
216. Wo JM, Koopman J, Harrell SP, et al. Double-blind, placebo-controlled trial with single-dose pantoprazole for laryngopharyngeal reflux. *Am J Gastroenterol*. 2006;101:1972-1978.
217. Reichel O, Dressel H, Wiederanders K, et al. Double-blind, placebo-controlled trial with esomeprazole for symptoms and signs associated with laryngopharyngeal reflux. *Otolaryngol Head Neck Surg*. 2008;139:414-420.
218. Havas T, Huang S, Levy M, et al. Posterior pharyngolaryngitis: double-blind randomised placebo-controlled trial of proton pump inhibitor therapy. *Australian J Otolaryngol*. 1999;3:243.
219. Lam PK, Ng ML, Cheung TK, et al. Rabeprazole is effective in treating laryngopharyngeal reflux in a randomized placebo-controlled trial. *Clini Gastroenterol Hepatol*. 2010;8:770-776.
220. Steward DL, Wilson KM, Kelly DH, et al. Proton pump inhibitor therapy for chronic laryngo-pharyngitis: a randomized placebo-control trial. *Otolaryngol Head Neck Surg*. 2004;131:342-350.
221. Park JO, Shim MR, Hwang YS, et al. Combination of voice therapy and antireflux therapy rapidly recovers voice-related symptoms in laryngopharyngeal reflux patients. *Otolaryngol Head Neck Surg*. 2012;146:92-97.
222. Kahrilas PJ, Shaheen NJ, Vaezi MF; American Gastroenterological Association Institute; Clinical Practice and Quality Management Committee. American Gastroenterological Association Institute technical review on the management of gastroesophageal reflux disease. *Gastroenterology*. 2008;135:1392-1413, 1413.e1-e5.
223. Kahrilas PJ, Shaheen NJ, Vaezi MF, et al. American Gastroenterological Association medical position statement on the management of gastroesophageal reflux disease. *Gastroenterology*. 2008;135:1383-1391, 1391.e1-e5.
224. Qua CS, Wong CH, Gopala K, et al. Gastro-oesophageal reflux disease in chronic laryngitis: prevalence and response to acid-suppressive therapy. *Aliment Pharmacol Ther*. 2007;25:287-295.
225. Thomas JP, Zubiaur FM. Over-diagnosis of laryngopharyngeal reflux as the cause of hoarseness. *Eur Arch Otorhinolaryngol*. 2013;270:995-999.
226. Rafii B, Taliercio S, Achlatis S, et al. Incidence of underlying laryngeal pathology in patients initially diagnosed with laryngopharyngeal reflux. *Laryngoscope*. 2014;124:1420-1424.
227. Sulica L. Hoarseness misattributed to reflux: sources and patterns of error. *Ann Otol Rhinol Laryngol*. 2014;123:442-445.
228. Wright MR, Sharda R, Vaezi MF. Unmet needs in treating laryngo-pharyngeal reflux disease: where do we go from here? *Expert Rev Gastroenterol Hepatol*. 2016;10:995-1004.
229. Hanlon JT, Landerman LR, Artz MB, et al. Histamine2 receptor antagonist use and decline in cognitive function among community dwelling elderly. *Pharmacoepidemiol Drug Saf*. 2004;13:781-787.
230. Boustani M, Hall KS, Lane KA, et al. The association between cognition and histamine-2 receptor antagonists in African Americans. *J Am Geriatr Soc*. 2007;55:1248-1253.
231. Gomm W, von Holt K, Thomé F, et al. Association of proton pump inhibitors with risk of dementia: a pharmacoepidemiological claims data analysis. *JAMA Neurol*. 2016;73:410-416.
232. Freedberg DE, Abrams JA. *Clostridium difficile* infection in the community: are proton pump inhibitors to blame? *World J Gastroenterol*. 2013;19:6710-6713.
233. Janarthanan S, Ditah I, Adler DG, et al. *Clostridium difficile*–associated diarrhea and proton pump inhibitor therapy: a meta-analysis. *Am J Gastroenterol*. 2012;107:1001-1010.
234. Kim YG, Graham DY, Jang BI. Proton pump inhibitor use and recurrent *Clostridium difficile*–associated disease: a case-control analysis matched by propensity score. *J Clin Gastroenterol*. 2012;46:397-400.
235. Leontiadis GI, Miller MA, Howden CW. How much do PPIs contribute to *C difficile* infections? *Am J Gastroenterol*. 2012;107:1020-1021.
236. Garcia Rodriguez LA, Ruigomez A, Panes J. Use of acid-suppressing drugs and the risk of bacterial gastroenteritis. *Clin Gastroenterol Hepatol*. 2007;5:1418-1423.
237. Ramsay EN, Pratt NL, Ryan P, et al. Proton pump inhibitors and the risk of pneumonia: a comparison of cohort and self-controlled case series designs. *BMC Med Res Methodol*. 2013;13:82.

238. Gerson LB, McMahon D, Olkin I, et al. Lack of significant interactions between clopidogrel and proton pump inhibitor therapy: meta-analysis of existing literature. *Dig Dis Sci*. 2012;57:1304-1313.
239. Chen M, Wei JF, Xu YN, et al. A meta-analysis of impact of proton pump inhibitors on antiplatelet effect of clopidogrel. *Cardiovasc Ther*. 2012;30:e227-e233.
240. Yang YX, Lewis JD, Epstein S, et al. Long-term proton pump inhibitor therapy and risk of hip fracture. *JAMA*. 2006;296:2947-2953.
241. Geller JL, Adams JS. Proton pump inhibitor therapy and hip fracture risk. *JAMA*. 2007;297:1429; author reply, 1429-1430.
242. Targownik LE, Lix LM, Metge CJ, et al. Use of proton pump inhibitors and risk of osteoporosis-related fractures. *CMAJ*. 2008;179:319-326.
243. Gray SL, LaCroix AZ, Larson J, et al. Proton pump inhibitor use, hip fracture, and change in bone mineral density in postmenopausal women: results from the Women's Health Initiative. *Arch Int Med*. 2010;170:765-771.
244. Targownik LE, Leslie WD, Davison KS, et al. The relationship between proton pump inhibitor use and longitudinal change in bone mineral density: a population-based study [corrected] from the Canadian Multicentre Osteoporosis Study (CaMos). *Am J Gastroenterol*. 2012;107:1361-1369.
245. Jung SB, Nagaraja V, Kapur A, et al. Association between vitamin B12 deficiency and long-term use of acid-lowering agents: a systematic review and meta-analysis. *Intern Med J*. 2015;45:409-416.
246. Park CH, Kim EH, Roh YH, et al. The association between the use of proton pump inhibitors and the risk of hypomagnesemia: a systematic review and meta-analysis. *PloS One*. 2014;9:e112558.
247. Lazarus B, Chen Y, Wilson FP, et al. Proton pump inhibitor use and the risk of chronic kidney disease. *JAMA Intern Med*. 2016;176:238-246.
248. Vakil N. Prescribing proton pump inhibitors: is it time to pause and rethink? *Drugs*. 2012;72:437-445.
249. Heidelbaugh JJ, Metz DC, Yang YX. Proton pump inhibitors: are they overutilised in clinical practice and do they pose significant risk? *Int J Clin Pract*. 2012;66:582-591.
250. Reimer C. Safety of long-term PPI therapy. *Best Pract Res Clin Gastroenterol*. 2013;27:443-454.
251. Zazzali JL, Broder MS, Omachi TA, et al. Risk of corticosteroid-related adverse events in asthma patients with high oral corticosteroid use. *Allergy Asthma Proc*. 2015;36:268-274.
252. Head K, Chong LY, Hopkins C, et al. Short-course oral steroids alone for chronic rhinosinusitis. *Cochrane Database Syst Rev*. 2016;(4):CD011991.
253. Geer EB, Islam J, Buettner C. Mechanisms of glucocorticoid-induced insulin resistance: focus on adipose tissue function and lipid metabolism. *Endocrinol Metab Clin North Am*. 2014;43:75-102.
254. deVries F, Pouwels S, Lammers JW, et al. Use of inhaled and oral corticosteroids, severity of inflammatory disease and risk of hip/femur fracture: a population-based case-control study. *J Intern Med*. 2007;261:170-177.
255. Wang JJ, Rochtchina E, Tan AG, et al. Use of inhaled and oral corticosteroids and the long-term risk of cataract. *Ophthalmology*. 2009;116:652-657.
256. Kapadia CR, Nebesio TD, Myers SE, et al; Drugs and Therapeutics Committee of the Pediatric Endocrine Society. Endocrine effects of inhaled corticosteroids in children. *JAMA Pediatrics*. 2016;170:163-170.
257. Weldon D. The effects of corticosteroids on bone growth and bone density. *Ann Allergy Asthma Immunol*. 2009;103:3-11.
258. Kelly HW, Van Natta ML, Covar RA, et al. Effect of long-term corticosteroid use on bone mineral density in children: a prospective longitudinal assessment in the childhood Asthma Management Program (CAMP) study. *Pediatrics*. 2008;122:e53-e61.
259. Sarnes E, Crofford L, Watson M, et al. Incidence and US costs of corticosteroid-associated adverse events: a systematic literature review. *Clin Ther*. 2011;33:1413-1432.
260. Majumdar SR, Morin SN, Lix LM, et al. Influence of recency and duration of glucocorticoid use on bone mineral density and risk of fractures: population-based cohort study. *Osteoporosis Int*. 2013;24:2493-2498.
261. Suissa S, Kezouh A, Ernst P. Inhaled corticosteroids and the risks of diabetes onset and progression. *Am J Med*. 2010;123:1001-1006.
262. Rachelefsky GS, Liao Y, Faruqi R. Impact of inhaled corticosteroid-induced oropharyngeal adverse events: results from a meta-analysis. *Ann Allergy Ashtma Immunol*. 2007;98:225-238.
263. Chmielewska M, Akst LM. Dysphonia associated with the use of inhaled corticosteroids. *Opin Otolaryngol Head Neck Surg*. 2015;23:255-259.
264. Galván CA, Guarderas JC. Practical considerations for dysphonia caused by inhaled corticosteroids. *Mayo Clinic Proc*. 2012;87:901-904.
265. Ozbilen Acar G, Uzun Adatepe N, Kaytaz A, et al. An evaluation of laryngeal findings in users of inhaled steroids. *Eur Arch Otorhinolaryngol*. 2010;267:917-923.
266. Sulica L. Laryngeal thrush. *Ann Otol Rhinol Laryngol*. 2005;114:369-375.
267. Mirza N, Kasper Schwartz S, Antin-Ozerkis D. Laryngeal findings in users of combination corticosteroid and bronchodilator therapy. *Laryngoscope*. 2004;114:1566-1569.
268. Wong KK, Pace-Asciak P, Wu B, et al. Laryngeal candidiasis in the outpatient setting. *J Otolaryngol Head Neck Surg*. 2009;38:624-627.
269. Cohen SM, Kim J, Roy N, et al. Prescribing patterns of primary care physicians and otolaryngologists in the management of laryngeal disorders. *Otolaryngol Head Neck Surg*. 2013;149:118-125.
270. Govil N, Rafii BY, Paul BC, et al. Glucocorticoids for vocal fold disease: a survey of otolaryngologists. *J Voice*. 2014;28:82-87.
271. Petrocheilou A, Tanou K, Kalampouka E, et al. Viral croup: diagnosis and a treatment algorithm. *Pediatr Pulmonol*. 2014;49:421-429.
272. Johnson DW. Croup. *BMJ Clin Evid*. 2014;29:2014.
273. Fernandes RM, Oleszczuk M, Woods CR, et al. The Cochrane Library and safety of systemic corticosteroids for acute respira-

tory conditions in children: an overview of reviews. *Evid Based Child Health*. 2014;9:733-747.
274. Jackson-Menaldi CA, Dzul AI, Holland RW. Allergies and vocal fold edema: a preliminary report. *J Voice*. 1999;13:113-122.
275. Jackson-Menaldi CA, Dzul AI, Holland RW. Hidden respiratory allergies in voice users: treatment strategies. *Logoped Phoniatr Vocol*. 2002;27:74-79.
276. Todic J, Schweizer V, Leuchter I. Bamboo nodes of vocal folds: case report and review of literature [in French]. *Rev Med Suisse*. 2014;10:1811-1812, 1814-1815.
277. Dean CM, Sataloff RT, Hawkshaw MJ, et al. Laryngeal sarcoidosis. *J Voice*. 2002;16:283-288.
278. Ozcan KM, Bahar S, Ozcan I, et al. Laryngeal involvement in systemic lupus erythematosus: report of two cases. *J Clin Rheumatol*. 2007;13:278-279.
279. Vatti RR, Ali F, Teuber S, et al. Hypersensitivity reactions to corticosteroids. *Clin Rev Allergy Immunol*. 2014;47:26-37.
280. Baeck M, Marot L, Nicolas J-F, et al. Allergic hypersensitivity to topical and systemic corticosteroids: a review. *Allergy*. 2009;64:978-994.
281. Baeck M, Chemelle J-A, Terreux R, et al. Delayed hypersensitivity to corticosteroids in a series of 315 patients: clinical data and patch test results. *Contact Dermatitis*. 2009;61:163-175.
282. Basedow S, Eigelshoven S. Immediate and delayed hypersensitivity to corticosteroids. *J Dtsch Dermatol Ges*. 2011;9:885-888.
283. Higgins PB. Viruses associated with acute respiratory infections 1961-71. *J Hyg (Lond)*. 1974;72:425-432.
284. Bove MJ, Kansal S, Rosen CA. Influenza and the vocal performer: update on prevention and treatment. *J Voice*. 2008;22:326-332.
285. Schalén L, Eliasson I, Kamme C, et al. Erythromycin in acute laryngitis in adults. *Ann Otol Rhinol Laryngol*. 1993;102:209-214.
286. Cohen SM, Kim JK, Roy N, et al. Direct health care costs of laryngeal diseases and disorders. *Laryngoscope*. 2012;122:1582-1588.
287. Arroll B, Kenealy T. Antibiotics for the common cold and acute purulent rhinitis. *Cochrane Database Syst Rev*. 2005;(3):CD000247.
288. Glasziou PP, Del Mar C, Sanders S, et al. Antibiotics for acute otitis media in children. *Cochrane Database Syst Rev*. 2004;(1):CD000219.
289. Horn JR, Hansten PD. Drug interactions with antibacterial agents. *J Fam Pract*. 1995;41:81-90.
290. Brook I, Foote PA, Hausfeld JN. Increase in the frequency of recovery of meticillin-resistant *Staphylococcus aureus* in acute and chronic maxillary sinusitis. *J Med Microbiol*. 2008;57:1015-1017.
291. Asche C, McAdam-Marx C, Seal B, et al. Treatment costs associated with community-acquired pneumonia by community level of antimicrobial resistance. *J Antimicrob Chemother*. 2008;61:1162-1168.
292. Chandran SK, Lyons KM, Divi V, et al. Fungal laryngitis. *Ear Nose Throat J*. 2009;88:1026-1028.
293. Singh B, Balwally AN, Nash M, et al. Laryngeal tuberculosis in HIV-infected patients: a difficult diagnosis. *Laryngoscope*. 1996;106:1238-1240.
294. Tato AM, Pascual J, Orofino L, et al. Laryngeal tuberculosis in renal allograft patients. *Am J Kidney Dis*. 1998;31:701-705.
295. Wang BY, Amolat MJ, Woo P, et al. Atypical mycobacteriosis of the larynx: an unusual clinical presentation secondary to steroids inhalation. *Ann Diagn Pathol*. 2008;12:426-429.
296. Sotir MJ, Cappozzo DL, Warshauer DM, et al. A countywide outbreak of pertussis: initial transmission in a high school weight room with subsequent substantial impact on adolescents and adults. *Arch Pediatr Adolesc Med*. 2008;162:79-85.
297. Hopkins A, Lahiri T, Salerno R, et al. Changing epidemiology of life-threatening upper airway infections: the reemergence of bacterial tracheitis. *Pediatrics*. 2006;118:1418-1421.
298. Carvalho AL, Pintos J, Schlecht NF, et al. Predictive factors for diagnosis of advanced-stage squamous cell carcinoma of the head and neck. *Arch Otolaryngol Head Neck Surg*. 2002;128:313-318.
299. Royal College of Speech and Language Therapists. Clinical voice disorders. http://almacengpc.dynalias.org/publico/Clinical_Guidelines%20Speech%20Therapists.pdf. Published 2005. Accessed June 25, 2016.
300. American Speech-Language-Hearing Association. Preferred practice patterns for the profession of speech-language pathology [preferred practice patterns]. http://www.asha.org/policy. Published 2004. Accessed June 25, 2016.
301. Rubin JS, Sataloff RT, Korovin GS. *Diagnosis and Treatment of Voice Disorders*. 3rd ed. San Diego, CA: Plural Publishing Inc; 2006.
302. Bastian RW, Levine LA. Visual methods of office diagnosis of voice disorders. *Ear Nose Throat J*. 1988;67:363-379.
303. American Speech-Language-Hearing Association. The use of voice therapy in the treatment of dysphonia [technical report]. http://www.asha.org/policy. Published 2005. Accessed June 25, 2016.
304. Thomas G, Mathews SS, Chrysolyte SB, et al. Outcome analysis of benign vocal cord lesions by videostroboscopy, acoustic analysis and Voice Handicap Index. *Indian J Otolaryngol Head Neck Surg*. 2007;59:336-340.
305. Woo P, Colton R, Casper J, et al. Diagnostic value of stroboscopic examination in hoarse patients. *J Voice*. 1991;5:231-238.
306. Thomas LB, Stemple JC. Voice therapy: does science support the art*? Communicative Disorders Review*. 2007;1:49-77.
307. Anderson T, Sataloff RT. The power of voice therapy. *Ear Nose Throat J*. 2002;81:433-434.
308. Speyer R, Weineke G, Hosseini EG, et al. Effects of voice therapy as objectively evaluated by digitized laryngeal stroboscopic imaging. *Ann Otol Rhinol Laryngol*. 2002;111:902-908.
309. Misono S, Marmor S, Roy N, et al. Multi-institutional study of voice disorders and voice therapy referral: report from the CHEER Network. *Otolaryngol Head Neck Surg*. 2016;155:33-41.
310. Watts CR, Hamilton A, Toles L, et al. A randomized controlled trial of stretch-and-flow voice therapy for muscle tension dysphonia. *Laryngoscope*. 2015;125:1420-1425.
311. Wenke RJ, Stabler P, Walton C, et al. Is more intensive better? Client and service provider outcomes for intensive versus standard therapy schedules for functional voice disorders. *J Voice*. 2014;28:652.e31-652.e43.
312. Fox CM, Ramig LO, Ciucci MR, et al. The science and practice of LSVT/LOUD: neural plasticity-principled approach to treat-

ing individuals with Parkinson disease and other neurological disorders. *Semin Speech Lang*. 2006;27:283-299.
313. Theodoros DG, Hill AJ, Russel TG. Clinical and quality of life outcomes of speech treatment for Parkinson's disease delivered to the home via telerehabilitation: a noninferiority randomized controlled trial. *Am J Speech Lang Pathol*. 2016;25:214-232.
314. Kalf H, de Swart B, Bonnier-Baars M, et al. *Guidelines for Speech-Language Therapy in Parkinson's Disease*. Nijmegen, Netherlands; ParkinsonNet; 2011.
315. Kim J, Davenport P, Sapienza C. Effect of expiratory muscle strength training on elderly cough function. *Arch Gerontol Geriatr*. 2009;48:361-366.
316. Sullivan MD, Heywood BM, Beukelman DR. A treatment for vocal cord dysfunction in female athletes: an outcome study. *Laryngoscope*. 2001;111:1751-1755.
317. Patel R, Venediktov R, Schooling T, et al. Evidence-based systematic review: effects of speech-language pathology treatment for individuals with paradoxical vocal fold motion. *Am J Speech Lang Pathol*. 2015;24:566-584.
318. Gibson PG, Chang AB, Glasgow NJ, et al; CICADA. Cough in children and adults: diagnosis and assessment. Australian cough guidelines summary statement. *Med J Aust*. 2010;192:265-271.
319. Gorman S, Weinrich B, Lee L, et al. Aerodynamic changes as a result of vocal function exercises in elderly men. *Laryngoscope*. 2008;118:1900-1903.
320. Schindler A, Bottero A, Capaccio P, et al. Vocal improvement after voice therapy in unilateral vocal fold paralysis. *J Voice*. 2008;22:113-118.
321. Miller S. Voice therapy for vocal fold paralysis. *Otolaryngol Clin North Am*. 2004;37:105-119.
322. Ziegler A, Verdolini Abbott K, Johns M, et al. Preliminary data on two voice therapy interventions in the treatment of presbyphonia. *Laryngoscope*. 2014;124:1869-1876.
323. Karkos PD, George M, Van Der Veen J, et al. Vocal process granulomas: a systematic review of treatment. *Ann Otol Rhinol Laryngol*. 2014;123:314-320.
324. Rosen CA. Phonosurgical vocal fold injection: procedures and materials. *Otolaryngol Clin North Am*. 2000;33:1087-1096.
325. Billiante CR, Clary J, Sullivan C, et al. Voice therapy following thyroplasty with long standing vocal fold immobility. *Aurus Narux Larynx*. 2002;29:341-345.
326. Boutsen F, Cannito MP, Taylor M, et al. Botox treatment in adductor spasmodic dysphonia: a meta-analysis. *J Speech Lang Hear Res*. 2002;45:469-481.
327. Branski RC, Murray T. Voice therapy. http://emedicine.medscape.com/article/866712-overview. Published 2008.
328. Pedersen M, Beranova A, Møller S. Dysphonia: medical treatment and a medical voice hygiene advice approach. A prospective randomised pilot study. *Eur Arch Otorhinolaryngol*. 2004;261:312-315.
329. Boone DR, McFarlane SC, Von Berg SL. *The Voice and Voice Therapy*. Boston, MA: Allyn & Bacon; 2005.
330. Stemple JC, Glaze LE, Klaben BG. *Clinical Voice Pathology: Theory and Management*. San Diego, CA: Singular Publishing Group; 2000.
331. Roy N, Gray SD, Simon M, et al. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomized clinical trial. *J Speech Lang Hear Res*. 2001;44:286-296.
332. Verdolini-Marston K, Burke MK, Lessac A, et al. Preliminary study of two methods of treatment for laryngeal nodules. *J Voice*. 1995;9:74-85.
333. Stemple JC, Lee L, D'Amico B, et al. Efficacy of vocal function exercises as a method of improving voice production. *J Voice*. 1994;8:271-278.
334. Pasa G, Oates J, Dacakis G. The relative effectiveness of vocal hygiene training and vocal function exercises in preventing voice disorders in primary school teachers. *Logoped Phoniatr Vocol*. 2007;32:128-140.
335. Sauder C, Roy N, Tanner K, et al. Vocal function exercises for presbylaryngis: a multidimensional assessment of treatment outcomes. *Ann Otol Rhinol Laryngol*. 2010;119:460-467.
336. Pedrosa V, Pontes A, Pontes P, et al. The effectiveness of the comprehensive voice rehabilitation program compared with the vocal function exercises method in behavioral dysphonia: a randomized clinical trial. *J Voice*. 2016;30:377.e11-e19.
337. Sabol J, Lee L, Stemple J. The value of vocal function exercises in the practice regimen of singers. *J Voice*. 1995;9:27-36.
338. Kaneko M, Hirano S, Tateya I, et al. Multidimensional analysis of the effect of vocal function exercises on aged vocal fold atrophy. *J Voice*. 29;5:638-644.
339. Pizolato R, Rehder M, Dias C, et al. Evaluation of the effectiveness of a voice training program for teachers. *J Voice*. 2013;27:603-610.
340. Rodriguez-Parra M, Adrián J, Casado J. Comparing voice-therapy and vocal-hygiene treatments in dysphonia using a limited multidimensional evaluation protocol. *J Commun Disord*. 2011;44:615-630.
341. Gillivan-Murphy P, Drinnan M, O'Dwyer T, et al. The effectiveness of a voice treatment approach for teachers with self-reported voice problems. *J Voice*. 2006;20:423-431.
342. Roy N, Weinrich B, Gray S, et al. Three treatments for teachers with voice disorders: a randomized clinical trial. *J Speech Lang Hear Res*. 2003;46:670-688.
343. Roy N, Weinrich B, Gray S, et al. Voice amplification versus vocal hygiene instruction for teachers with voice disorders: a treatment outcomes study. *J Speech Lang Hear Res*. 2002;45:623-638.
344. Holmberg E, Hillman R, Hammarberg B, et al. Efficacy of a behaviorally based voice therapy protocol for vocal nodules. *J Voice*. 2001;15:395-412.
345. Verdolini-Marston K, Sandage M, Titze I. Effect of hydration treatments on laryngeal nodules and polyps and related voice measures. *J Voice*. 1994;8:30-47.
346. Zeitels SM, Casiano RR, Gardner GM, et al. Management of common voice problems: committee report. *Otolaryngol Head Neck Surg*. 2002;126:333-348.
347. Nunes FP, Bishop T, Prasad ML, et al. Laryngeal candidiasis mimicking malignancy. *Laryngoscope*. 2008;118:1957-1959.
348. Mehanna HM, Kuo T, Chaplin J, et al. Fungal laryngitis in immunocompetent patients. *J Laryngol Otol*. 2004;118:379-381.
349. Johns MM. Update on the etiology, diagnosis, and treatment of vocal fold nodules, polyps, and cysts. *Curr Opin Otolaryngol Head Neck Surg*. 2003;11:456-461.

350. Cohen SM, Garrett CG. Utility of voice therapy in the management of vocal fold polyps and cysts. *Otolaryngol Head Neck Surg*. 2007;136:742-746.
351. Yun YS, Kim MB, Son YI. The effect of vocal hygiene education for patients with vocal polyp. *Otolaryngol Head Neck Surg*. 2007;137:569-575.
352. Klein AM, Lehmann M, Hapner ER, et al. Spontaneous resolution of hemorrhagic polyps of the true vocal fold. *J Voice*. 2009;23:132-135.
353. Cho KJ, Nam IC, Hwang YS, et al. Analysis of factors influencing voice quality and therapeutic approaches in vocal polyp patients. *Eur Arch Otorhinolaryngol*. 2011;268:1321-1327.
354. Nakagawa H, Miyamoto M, Kusuyama T, et al. Resolution of vocal fold polyps with conservative treatment. *J Voice*. 2012;26:e107-e110.
355. Jeong WJ, Lee SJ, Lee WY, et al. Conservative management for vocal fold polyps. *JAMA Otolaryngol Head Neck Surg*. 2014;140:448-452.
356. Lee YS, Lee DH, Jeong GE, et al. Treatment efficacy of voice therapy for vocal fold polyps and factors predictive of its efficacy. *J Voice*. 2016;31:120.e9-120.e13.
357. Havas TE, Priestley J, Lowinger DS. A management strategy for vocal process granulomas. *Laryngoscope*. 1999;109:301-306.
358. Ma L, Xiao Y, Ye J, et al. Analysis of therapeutic methods for treating vocal process granulomas. *Acta Otolaryngol*. 2015;135:277-282.
359. Hillel AT, Lin LM, Samlan R, et al. Inhaled triamcinolone with proton pump inhibitor for treatment of vocal process granulomas: a series of 67 granulomas. *Ann Otol Rhinol Laryngol*. 2010;119:325-330.
360. Zeitels SM, Hillman RE, Desloge R, et al. Phonomicrosurgery in singers and performing artists: treatment outcomes, management theories, and future directions. *Ann Otol Rhinol Laryngol Suppl*. 2002;190:21-40.
361. McCrory E. Voice therapy outcomes in vocal fold nodules: a retrospective audit. *Int J Lang Commun Disord*. 2001;36:19-24.
362. Jensen JB, Rasmussen N. Phonosurgery of vocal fold polyps, cysts and nodules is beneficial. *Dan Med J*. 2013;60:A4577.
363. Zeitels SM, Akst LM, Bums JA, et al. Pulsed angiolytic laser treatment of ectasias and varices in singers. *Ann Otol Rhinol Laryngol*. 2006;115:571-580.
364. Bennett S, Bishop SG, Lumpkin SM. Phonatory characteristics following surgical treatment of severe polypoid degeneration. *Laryngoscope*. 1989;99:525-532.
365. Ragab SM, Elsheikh MN, Saafan ME, et al. Radiophonosurgery of benign superficial vocal fold lesions. *J Laryngol Otol*. 2005;119:961-966.
366. Tezcaner CZ, Karatayli Ozgursoy S, Sati I, et al. Changes after voice therapy in objective and subjective voice measurements of pediatric patients with vocal nodules. *Eur Arch Otorhinolaryngol*. 2009;266:1923-1927.
367. Nardone HC, Recko T, Huang L, et al. A retrospective review of the progression of pediatric vocal fold nodules. *JAMA Otolaryngol Head Neck Surg*. 2014;140:233-236.
368. Ongkasuwan J, Friedman EM. Is voice therapy effective in the management of vocal fold nodules in children? *Laryngoscope*. 2013;123:2930-2931.
369. Benjamin B, Croxson G. Vocal nodules in children. *Ann Otol Rhinol Laryngol*. 1987;96:530-533.
370. Dedo HH, Yu KC. CO(2) laser treatment in 244 patients with respiratory papillomas. *Laryngoscope*. 2001;111:1639-1644.
371. Pasquale K, Wiatrak B, Woolley A, et al. Microdebrider versus CO2 laser removal of recurrent respiratory papillomas: a prospective analysis. *Laryngoscope*. 2003;113:139-143.
372. Steinberg BM, Topp WC, Schneider PS, et al. Laryngeal papillomavirus infection during clinical remission. *N Engl J Med*. 1983;308:1261-1264.
373. Mohammed H, Masterson L, Gendy S, et al. Outpatient-based injection laryngoplasty for the management of unilateral vocal fold paralysis—clinical outcomes from a UK centre. *Clin Otolaryngol*. 2016;41:341-346.
374. O'Leary MA, Grillone GA. Injection laryngoplasty. *Otolaryngol Clin North Am*. 2006;39:43-54.
375. Bové MJ, Jabbour N, Krishna P, et al. Operating room versus office-based injection laryngoplasty: a comparative analysis of reimbursement. *Laryngoscope*. 2007;117:226-230.
376. Morgan JE, Zraick RI, Griffin AW, et al. Injection versus medialization laryngoplasty for the treatment of unilateral vocal fold paralysis. *Laryngoscope*. 2007;117:2068-2074.
377. Hertegard S, Hallen L, Laurent C, et al. Cross-linked hyaluronan versus collagen for injection treatment of glottal insufficiency: 2-year follow-up. *Acta Otolaryngol*. 2004;124:1208-1214.
378. Kimura M, Nito T, Sakakibara K, et al. Clinical experience with collagen injection of the vocal fold: a study of 155 patients. *Auris Nasus Larynx*. 2008;35:67-75.
379. Cantarella G, Mazzola RF, Domenichini E, et al. Vocal fold augmentation by autologous fat injection with lipostructure procedure. *Otolaryngol Head Neck Surg*. 2005;132:239-243.
380. Karpenko AN, Dworkin JP, Meleca RJ, et al. Cymetra injection for unilateral vocal fold paralysis. *Ann Otol Rhinol Laryngol*. 2003;112:927-934.
381. Lee SW, Son YI, Kim CH, et al. Voice outcomes of polyacrylamide hydrogel injection laryngoplasty. *Laryngoscope*. 2007;117:1871-1875.
382. Sittel C, Echternach M, Federspil PA, et al. Polydimethylsiloxane particles for permanent injection laryngoplasty. *Ann Otol Rhinol Laryngol*. 2006;115:103-109.
383. Rosen CA, Gartner-Schmidt J, Casiano R, et al. Vocal fold augmentation with calcium hydroxylapatite (CaHA). *Otolaryngol Head Neck Surg*. 2007;136:198-204.
384. Patel NJ, Kerschner JE, Merati AL. The use of injectable collagen in the management of pediatric vocal unilateral fold paralysis. *Int J Pediatr Otorhinolaryngol*. 2003;67:1355-1360.
385. Kasperbauer JL, Slavit DH, Maragos NE. Teflon granulomas and overinjection of Teflon: a therapeutic challenge for the otorhinolaryngologist. *Ann Otol Rhinol Laryngol*. 1993;102:748-751.
386. Varvares MA, Montgomery WW, Hillman RE. Teflon granuloma of the larynx: etiology, pathophysiology, and management. *Ann Otol Rhinol Laryngol*. 1995;104:511-515.

387. Ossoff RH, Koriwchak MJ, Netterville JL, et al. Difficulties in endoscopic removal of Teflon granulomas of the vocal fold. *Ann Otol Rhinol Laryngol*. 1993;102:405-412.
388. Daniero JJ, Garrett CG, Francis DO. Framework surgery for treatment of unilateral vocal fold paralysis. *Curr Otorhinolaryngol Rep*. 2014;2:119-130.
389. Schneider B, Denk DM, Bigenzahn W. Functional results after external vocal fold medialization thyroplasty with the titanium vocal fold medialization implant. *Laryngoscope*. 2003;113:628-634.
390. Zeitels SM, Mauri M, Dailey SH. Medialization laryngoplasty with Gore-Tex for voice restoration secondary to glottal incompetence: indications and observations. *Ann Otol Rhinol Laryngol*. 2003;112:180-184.
391. Cummings CW, Purcell LL, Flint PW. Hydroxylapatite laryngeal implants for medialization: preliminary report. *Ann Otol Rhinol Laryngol*. 1993;102:843-851.
392. Paniello, RC, Edgar, JD, Kallogjeri, D, et al. Medialization versus reinnervation for unilateral vocal fold paralysis: a multicenter randomized clinical trial. *Laryngoscope*. 2011;121:2172-2179.
393. Zur KB, Carroll LM. Recurrent laryngeal nerve reinnervation in children: acoustic and endoscopic characteristics pre-intervention and post-intervention. A comparison of treatment options. *Laryngoscope*. 2015;125:S1-S15.
394. Smith ME, Houtz DR. Outcomes of laryngeal reinnervation for unilateral vocal fold paralysis in children: associations with age and time since injury. *Ann Otol Rhinol Laryngol*. 2016;125:433-438.
395. Li M, Chen S, Wang W, et al. Effect of duration of denervation on outcomes of ansa-recurrent laryngeal nerve reinnervation. *Laryngoscope*. 2014;124:1900-1905.
396. Gray SD, Barkmeier J, Jones D, et al. Vocal evaluation of thyroplastic surgery in the treatment of unilateral vocal fold paralysis. *Laryngoscope*. 1992;102:415-421.
397. Kelchner LN, Stemple JC, Gerdeman E, et al. Etiology, pathophysiology, treatment choices, and voice results for unilateral adductor vocal fold paralysis: a 3-year retrospective. *J Voice*. 1999;13:592-601.
398. Rosen CA. Complications of phonosurgery: results of a national survey. *Laryngoscope*. 1998;108:1697-1703.
399. Truong DD, Bhidayasiri R. Botulinum toxin therapy of laryngeal muscle hyperactivity syndromes: comparing different botulinum toxin preparations. *Eur J Neurol*. 2006;13:36-41.
400. Roy N. Differential diagnosis of muscle tension dysphonia and spasmodic dysphonia. *Curr Opin Otolaryngol Head Neck Surg*. 2010;18:165-170.
401. Creighton FX, Hapner E, Klein A, et al. Diagnostic delays in spasmodic dysphonia: a call for clinician education. *J Voice*. 2015;29:592-594.
402. Blitzer A, Sulica L. Botulinum toxin: basic science and clinical uses in otolaryngology. *Laryngoscope*. 2001;111:218-226.
403. Sulica L. Contemporary management of spasmodic dysphonia. *Curr Opin Otolaryngol Head Neck Surg*. 2004;12:543-548.
404. Stong BC, DelGaudio JM, Hapner ER, et al. Safety of simultaneous bilateral botulinum toxin injections for abductor spasmodic dysphonia. *Arch Otolaryngol Head Neck Surg*. 2005;131:793-795.
405. Blitzer A, Brin MF, Fahn S, et al. Localized injections of botulinum toxin for the treatment of focal laryngeal dystonia (spastic dysphonia). *Laryngoscope*. 1988;98:193-197.
406. Troung DD, Rontal M, Rolnick M, et al. Double-blind controlled study of botulinum toxin in adductor spasmodic dysphonia. *Laryngoscope*. 1991;101:630-634.
407. Cannito MP, Woodson GE, Murry T, et al. Perceptual analyses of spasmodic dysphonia before and after treatment. *Arch Otolaryngol Head Neck Surg*. 2004;130:1393-1389.
408. Courey MS, Garrett CG, Billante CR, et al. Outcomes assessment following treatment of spasmodic dysphonia with botulinum toxin. *Ann Otol Rhinol Laryngol*. 2000;109:819-822.
409. Watts C, Whurr R, Nye C. Botulinum toxin injections for the treatment of spasmodic dysphonia. *Cochrane Database Syst Rev*. 2004;(3):CD004327.
410. Blitzer A. Spasmodic dysphonia and botulinum toxin: experience from the largest treatment series. *Eur J Neurol*. 2010;17:28-30.
411. Patel AB, Bansberg SF, Adler CH, et al. The Mayo Clinic Arizona spasmodic dysphonia experience: a demographic analysis of 718 patients. *Ann Otol Rhinol Laryngol*. 2015;124:859-863.
412. Namin AW, Christopher KM, Eisenbeis JF. Botulinum toxin dosing trends in spasmodic dysphonia over a 20-year period. *J Voice*. 2017;31:107-110.
413. Tang CG, Novakovic D, Mor N, et al. Onabotulinum toxin A dosage trends over time for adductor spasmodic dysphonia: a 15-year experience. *Laryngoscope*. 2016;126:678-681.
414. Patel NJ, Kerschner JE, Merati AL. The use of injectable collagen in the management of pediatric vocal unilateral fold paralysis. *Int J Pediatr Otorhinolaryngol*. 2003;67:1355-1360.
415. Chester MW, Stewart MG. Arytenoid adduction combined with medialization thyroplasty: an evidence-based review. *Otolaryngol Head Neck Surg*. 2003;129:305-310.
416. Gardner GM, Altman JS, Balakrishnan G. Pediatric vocal fold medialization with silastic implant: intraoperative airway management. *Int J Pediatr Otorhinolaryngol*. 2000;52:37-44.
417. Link DT, Rutter MJ, Liu JH, et al. Pediatric type I thyroplasty: an evolving procedure. *Ann Otol Rhinol Laryngol*. 1999;108:1105-1110.
418. Orbelo DM, Duffy JR, Hughes Borst BJ, et al. Differences in botulinum toxin dosing between patients with adductor spasmodic dysphonia and essential voice tremor. *J Voice*. 2014;28:123-127.
419. Payne S, Tisch S, Cole I, et al. The clinical spectrum of laryngeal dystonia includes dystonic cough: observations of a large series. *Mov Disord*. 2014;29:729-735.
420. Ekbom DC, Garrett CG, Yung KC, et al. Botulinum toxin injections for new onset bilateral vocal fold motion impairment in adults. *Laryngoscope*. 2010;120:758-763.
421. Ongkasuwan J, Courey M. The role of botulinum toxin in the management of airway compromise due to bilateral vocal fold paralysis. *Curr Opin Otolaryngol Head Neck Surg*. 2011;19:444-448.
422. Damrose EJ, Damrose JF. Botulinum toxin as adjunctive therapy in refractory laryngeal granuloma. *J Laryngol Otol*. 2008;122:824-828.
423. Blitzer A, Brin MF, Stewart CF. Botulinum toxin management of spasmodic dysphonia (laryngeal dystonia): a 12-year experi-

ence in more than 900 patients. *Laryngoscope*. 1998;108:1435-1441.
424. Adler CH, Bansberg SF, Krein-Jones K, et al. Safety and efficacy of botulinum toxin type B (Myobloc) in adductor spasmodic dysphonia. *Mov Disord*. 2004;19:1075-1079.
425. Barrow EM, Rosen CA, Hapner ER, et al. Safety and efficacy of multiuse botulinum toxin vials for intralaryngeal injection. *Laryngoscope*. 2015;125:1149-1154.
426. Thomas JP, Siupsinskiene N. Frozen versus fresh reconstituted botox for laryngeal dystonia. *Otolaryngol Head Neck Surg*. 2006;135:204-208.
427. Blitzer A, Brin MF. Laryngeal dystonia: a series with botulinum toxin therapy. *Ann Otol Rhinol Laryngol*. 1991;100:85-89.
428. Inagi K, Ford CN, Bless DM, et al. Analysis of factors affecting botulinum toxin results in spasmodic dysphonia. *J Voice*. 1996;10:306-313.
429. Koriwchak MJ, Netterville JL, Snowden T, et al. Alternating unilateral botulinum toxin type A (BOTOX) injections for spasmodic dysphonia. *Laryngoscope*. 1996;106:1476-1481.
430. Holzer SE, Ludlow CL. The swallowing side effects of botulinum toxin type A injection in spasmodic dysphonia. *Laryngoscope*. 1996;106:86-92.
431. Woodson G, Hochstetler H, Murry T. Botulinum toxin therapy for abductor spasmodic dysphonia. *J Voice*. 2006;20:137-143.
432. Lundy DS, Lu FL, Casiano RR, et al. The effect of patient factors on response outcomes to Botox treatment of spasmodic dysphonia. *J Voice*. 1998;12:460-466.
433. Fisher KV, Giddens CL, Gray SD. Does botulinum toxin alter laryngeal secretions and mucociliary transport? *J Voice*. 1998;12:389-398.
434. Park JB, Simpson LL, Anderson TD, et al. Immunologic characterization of spasmodic dysphonia patients who develop resistance to botulinum toxin. *J Voice*. 2003;14:255-264.
435. Mor N, Tang C, Blitzer A. Botulinum toxin in secondarily nonresponsive patients with spasmodic dysphonia. *Otolaryngol Head Neck Surg*. 2016;155:458-461.
436. Dedo HH. Recurrent laryngeal nerve section for spastic dysphonia. *Ann Otol Rhinol Laryngol*. 1976;85:451-459.
437. Aronson AE, De Santo LW. Adductor spastic dysphonia: three years after recurrent laryngeal nerve resection. *Laryngoscope*. 1983;93:1-8.
438. Mendelsohn AH, Berke GS. Surgery or botulinum toxin for adductor spasmodic dysphonia: a comparative study. *Ann Otol Rhinol Laryngol*. 2012;121:231-238.
439. Chhetri DK, Mendelsohn AH, Blumin JH, et al. Long-term follow-up results of selective laryngeal adductor denervation-reinnervation surgery for adductor spasmodic dysphonia. *Laryngoscope*. 2006;116:635-642.
440. Berke GS, Blackwell KE, Gerratt BR, et al. Selective laryngeal adductor denervation-reinnervation: a new surgical treatment for adductor spasmodic dysphonia. *Ann Otol Rhinol Laryngol*. 1999;108:227-231.
441. Sanuki T, Yumoto E, Minoda R, et al. Effects of type II thyroplasty on adductor spasmodic dysphonia. *Otolaryngol Head Neck Surg*. 2010;142:540-546.
442. Sanuki T, Yumoto E, Kodama N, et al. Long-term voice handicap index after type II thyroplasty using titanium bridges for adductor spasmodic dysphonia. *Auris Nasus Larynx*. 2014;41:285-289.
443. Jankovic J, Ford J. Blepharospasm and orofacial-cervical dystonia: clinical and pharmacological findings in 100 patients. *Ann Neurol*. 1983;13:402-411.
444. Mauriello JA Jr, Dhillon S, Leone T, et al. Treatment selections of 239 patients with blepharospasm and Meige syndrome over 11 years. *Br J Ophthalmol*. 1996;80:1073-1076.
445. Hattori H, Yoshikawa F, Sato H, et al. Spasmodic dysphonia in Meige syndrome responding to clonazepam. *Intern Med*. 2011;50:2061-2062.
446. Nanjundeswaran C, Li NYK, Chan KMK, et al. Preliminary data on prevention and treatment of voice problems in student teachers. *J Voice*. 2012;26, 816.e1-816.e12.
447. Ferreira LP, de Oliveira Latorre MD, Pinto Giannini SP, et al. Influence of abusive vocal habits, hydration, mastication, and sleep in the occurrence of vocal symptoms in teachers. *J Voice*. 2010;24:86-92.
448. Yiu EM, Chan RM. Effect of hydration and vocal rest on the vocal fatigue in amateur karaoke singers. *J Voice*. 2003;17:216-227.
449. Verdolini K, Titze IR, Fennell A. Dependence of phonatory effort on hydration level. *J Speech Hear Res*. 1994;37:1001-1007.
450. Jónsdottir V, Laukkanen AM, Siikki I. Changes in teachers' voice quality during a working day with and without electric sound amplification. *Folia Phoniatr Logop*. 2003;55:267-280.
451. Assuncao AA, de Medeiros MA, Barreto SM, et al. Does regular physical activity reduce the risk of dysphonia? *Prev Med*. 2009;49:487-489.
452. Martins RHG, Pereira ERBN, Hidalgo CB, et al. Voice disorders in teachers: a review. *J Voice*. 2009;28:716-724.
453. Ruotsalainen J, Sellman J, Lic P, et al. Systematic review of the treatment of functional dysphonia and prevention of voice disorders. *Otolaryngol Head Neck Surg*. 2008;138:557-565.
454. Hazlett DE, Duffy M, Moorhead SA. Review of the impact of voice training on the vocal quality of professional voice users: implications for vocal health and recommendations for further research. *J Voice*. 2011;25:181-191.
455. de la Hoz RE, Shohet MR, Bienenfeld LA, et al. Vocal cord dysfunction in former World Trade Center (WTC) rescue and recovery workers and volunteers. *Am J Ind Med*. 2008;51:161-165.
456. Levendoski EE, Sundarrajan A, Sivasankar MP. Reducing the negative vocal effects of superficial laryngeal dehydration with humidification. *Ann Otol Rhinol Laryngol*. 2014;123:475-481.
457. US Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress*. Rockville, MD: US Department of Health and Human Services; 2014.
458. Francis DO, Daniero JJ, Hovis K, et al. Voice-related patient-reported outcome measures: a systematic review of instrument development and validation. *J Speech Lang Hear Res*. 2017;60:62-88.
459. Sataloff RT, Divi V, Heman-Ackah YD, et al. Medical history in voice professionals. *Otolaryngol Clin North Am*. 2007;40:931-951.
460. Sataloff RT. Office evaluation of dysphonia. *Otolaryngol Clin North Am*. 1992;25:843-855.
461. Kerr HD, Kwaselow A. Vocal cord hematomas complicating anticoagulant therapy. *Ann Emerg Med*. 1984;13:552-553.

462. Laing C, Kelly J, Coman S, et al. Vocal cord haematoma after thrombolysis. *Lancet*. 1997;350:1677.
463. Neely JL, Rosen C. Vocal fold hemorrhage associated with coumadin therapy in an opera singer. *J Voice*. 2000;14:272-277.
464. Bhutta MF, Rance M, Gillett D, et al. Alendronate-induced chemical laryngitis. *J Laryngol Otol*. 2005;119:46-47.
465. Dicpinigaitis PV. Angiotensin-converting enzyme inhibitor-induced cough: ACCP evidence-based clinical practice guidelines. *Chest*. 2006;129:169S-173S.
466. Baker J. A report on alterations to the speaking and singing voices of four women following hormonal therapy with virilizing agents. *J Voice*. 1999;13:496-507.
467. Pattie MA, Murdoch BE, Theodoros D, et al. Voice changes in women treated for endometriosis and related conditions: the need for comprehensive vocal assessment. *J Voice*. 1998;12:366-371.
468. Christodoulou C, Kalaitzi C. Antipsychotic drug-induced acute laryngeal dystonia: two case reports and a mini review. *J Psychopharmacol*. 2005;19:307-311.
469. Tsai CS, Lee Y, Chang YY, et al. Ziprasidone-induced tardive laryngeal dystonia: a case report. *Gen Hosp Psychiatry*. 2008;30:277-279.
470. Adams NP, Bestall JC, Lasserson TJ, et al. Fluticasone versus placebo for chronic asthma in adults and children. *Cochrane Database Syst Rev*. 2008;(4):CD003135.

Appendix: Frequently Asked Questions about Voice Therapy

Why Is Voice Therapy Recommended for Dysphonia?

Voice therapy has been demonstrated to be effective for dysphonia across the life span from children to older adults.[A1,A2] Voice therapy is the first line of treatment for vocal fold lesions, such as vocal nodules, polyps, or cysts.[A3,A4] These lesions often occur in people with vocally intense occupations, including teachers, attorneys, and clergy.[A5] Another possible cause of these lesions is vocal overdoing, commonly seen in sports enthusiasts; in socially active, aggressive, or loud children; or in high-energy adults who often speak loudly.[A6-A9] Voice therapy, specifically the Lee Silverman voice therapy method, has been demonstrated to be the most effective method of treating the lower-volume, lower-energy, and rapid-rate voice/speech of individuals with Parkinson's disease.[A10,A11]

Voice therapy has been used to treat dysphonia concurrently with other medical therapies, such as botulinum toxin injections for SD and/or tremor.[A12,A13] Voice therapy has been used alone in the treatment of unilateral vocal fold paralysis,[A14,A15] prebyphonia,[A16] and vocal process granuloma,[A17] and it has been used to improve the outcome of surgical procedures, as in vocal fold augmentation[A18] or thyroplasty.[A19] Voice therapy is an important component of any comprehensive surgical treatment for dysphonia.[A20]

What Happens in Voice Therapy?

Voice therapy is a program designed to reduce dysphonia through guided change in vocal behaviors and lifestyle changes. Voice therapy consists of a variety of tasks designed to eliminate harmful vocal behavior, shape healthy vocal behavior, and assist in vocal fold wound healing after surgery or injury. Voice therapy for dysphonia generally consists of 1 or 2 therapy sessions each week for 4 to 8 weeks.[A21] The duration of therapy is determined by the origin of the dysphonia and severity of the problem, co-occurring medical therapy, and, importantly, patient commitment to the practice and generalization of new vocal behaviors outside the therapy session.[A22]

Who Provides Voice Therapy?

Certified and licensed SLPs are health care professionals with the expertise needed to provide effective behavioral treatment for dysphonia.[A23]

How Do I Find a Qualified SLP Who Has Experience in Voice?

ASHA is an excellent resource for finding a certified SLP by going to the ASHA website (www.asha.org) or by accessing ASHA's online search engine, called ProFind at http://www.asha.org/profind/. You may also contact ASHA's Action Center, Monday through Friday (8:30 AM–5:00 PM) at 800-498-2071; fax, 301-296-8580; TTY (text telephone communication device), 301-296-5650; email, actioncenter@asha.org.

Does Insurance Cover Voice Therapy?

Generally, Medicare, under the guidelines for coverage of speech therapy, will cover voice therapy if provided by a certified and licensed SLP, if ordered by a physician, and if deemed medically necessary for the diagnosis. Medicaid varies from state to state but generally covers voice therapy, under the rules for speech therapy, up to the age of 18 years old. It is best to contact your local Medicaid office, as there are state differences and program differences. Private insurance companies vary, and the consumer is guided to contact her or his insurance company for specific guidelines for the purchased policies.

Are Speech Therapy and Voice Therapy the Same?

Speech therapy is a term that encompasses a variety of therapies, including voice therapy. Most insurance companies refer to *voice therapy* as *speech therapy*, but they are the same thing if provided by a certified and licensed SLP.

Appendix References

A1. Thomas LB, Stemple JC. Voice therapy: does science support the art? *Communicative Disord Rev*. 2007;1:51-79.
A2. Ramig LO, Verdolini K. Treatment efficacy: voice disorders. *J Speech Hear Res*. 1998;41:S101-S116.
A3. Johns MM. Update on the etiology, diagnosis, and treatment of vocal fold nodules, polyps, and cysts. *Curr Opin Otolaryngol Head Neck Surg*. 2003;11:456-461.

A4. Anderson T, Sataloff RT. The power of voice therapy. *Ear Nose Throat J*. 2002;81:433-434.
A5. Roy N, Gray SD, Simon M, et al. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomized clinical trial. *J Speech Hear Res*. 2001;44:286-296.
A6. Trani M, Ghidini A, Bergamini G, et al. Voice therapy in pediatric functional dysphonia: a prospective study. *Int J Pediatr Otorhinolaryngol*. 2007;71:379-384.
A7. Rubin JS, Sataloff RT, Korovin GW. *Diagnosis and Treatment of Voice Disorders*. San Diego, CA: Plural Publishing Group; 2006.
A8. Stemple J, Glaze L, Klaben B. *Clinical Voice Pathology: Theory and Management*. San Diego, CA: Singular Publishing Group. 2000.
A9. Boone DR, McFarlane SC, Von Berg S. *The Voice and Voice Therapy*. Boston, MA: Allyn & Bacon; 2005.
A10. Fox CM, Ramig LO, Ciucci MR, et al. The science and practice of LSVT/LOUD: neural plasticity-principled approach to treating individuals with Parkinson disease and other neurologic disorders. *Semin Speech Lang*. 2006;27:283-299.
A11. Dromey C, Ramig LO, Johnson AB. Phonatory and articulatory changes associated with increased vocal intensity in Parkinson disease: a case study. *J Speech Hear Res*. 1995;38:751-764.
A12. Pearson EJ, Sapienza CM. Historical approaches to the treatment of adductor-type spasmodic dysphonia (ADSD): review and tutorial. *Neuro Rehabilitation*. 2003;18:325-338.
A13. Murry T, Woodson GE. Combined-modality treatment of adductor spasmodic dysphonia with botulinum toxin and voice therapy. *J Voice*. 1995;9:460-465.
A14. Schindler A, Bottero A, Capaccio P, et al. Vocal improvement after voice therapy in unilateral vocal fold paralysis. *J Voice*. 2008;22:113-118.
A15. Miller S. Voice therapy for vocal fold paralysis. *Otolaryngol Clin North Am*. 2004;37:105-119.
A16. Ziegler A, Verdolini Abbott K, Johns M, et al. Preliminary data on two voice therapy interventions in the treatment of presbyphonia. *Laryngoscope*. 2014;124:1869-1876.
A17. Karkos PD, George M, Van Der Veen J, et al. Vocal process granulomas: a systematic review of treatment. *Ann Otol Rhinol Laryngol*. 2014;123:314-320.
A18. Rosen CA. Phonosurgical vocal fold injection: procedures and materials. *Otolaryngol Clin North Am*. 2000;33:1087-1096.
A19. Billiante CR, Clary J, Sullivan C, et al. Voice therapy following thyroplasty with long standing vocal fold immobility. *Aurus Narux Larynx*. 2002;29:341-345.
A20. Branski RC, Murray T. Voice therapy. http://emedicine.medscape.com/article/866712-overview. Published 2008. Accessed May 18, 2009.
A21. Hapner E, Portone-Maira C, Johns MM. A study of voice therapy dropout. *J Voice*. 2009;23:337-340.
A22. Behrman A. Facilitating behavioral change in voice therapy: the relevance of motivational interviewing. *Am J Speech Lang pathol*. 2006;15:215-225.
A23. American Speech-Language-Hearing Association. The use of voice therapy in the treatment of dysphonia [technical report]. http://www.asha.org/policy. Published 2005. Accessed June 25, 2016.