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Pharmacologic Management of Voice Disorders by General Medicine Providers and Otolaryngologists

Seth M. Cohen, MD, MPH, Hui-Jie Lee, PhD, Nelson Roy, PhD, CCC-SLP, and Stephanie Misono, MD, MPH

Duke Voice Care Center, Division of Otolaryngology–Head & Neck Surgery (S.M.C.); the Department of Biostatistics and Bioinformatics (H-J.L.), Duke University Medical Center, Durham, North Carolina; the Department of Communication Sciences and Disorders, Division of Otolaryngology–Head & Neck Surgery (Adjunct), University of Utah (N.R.), Salt Lake City, Utah; and the Lions Voice Clinic, Department of Otolaryngology/Head and Neck Surgery, University of Minnesota (S.M.), Minneapolis, Minnesota, U.S.A

Abstract

Objectives—1) To compare laryngeal diagnoses from general medical providers (GMP) to otolaryngologists following GMP-based medication trial, and 2) to evaluate associations between GMP medication trials and pharmacologic treatment by otolaryngologists.

Methods—Retrospective cohort analysis using large, national administrative U.S. claims database. Patients with laryngeal/voice disorders as per the International Classification of Diseases, Ninth Revision, Clinical Modification codes from January 1, 2010, to December 31, 2012, seen by a GMP and then an otolaryngologist between 2 weeks to 3 months after the GMP visit, were included. Patient demographics, comorbid conditions, medication use, and initial GMP and otolaryngology laryngeal diagnoses were collected. Logistic regression was performed to evaluate the association between GMP and otolaryngologist medication trials.

Results—A total of 12,475 unique laryngeal/voice-disordered patients met inclusion criteria. At the initial GMP visit, 15.3% received an antibiotic, 14.0% a proton pump inhibitor (PPI), and 7.7% an oral steroid. After the otolaryngology visit, increased diagnoses of vocal fold paralysis/paresis, benign vocal fold/laryngeal pathology, chronic laryngitis, and multiple diagnoses occurred. The adjusted odds for an otolaryngologist prescribing an antibiotic, PPI, or oral steroid, respectively, given that a GMP prescribed an antibiotic, PPI, or oral steroid, was roughly two to three times higher than that of a GMP not prescribing the given medication.

Conclusion—Patients with structural and neuromuscular laryngeal disorders were treated with medications by GMPs, and similar medications often were repeated after otolaryngology evaluation. These findings suggest potential areas of unnecessary pharmacologic treatment of laryngeal/voice-disordered patients.

Keywords

Laryngeal disorders; pharmacology; dysphonia; voice; treatment

INTRODUCTION

Both general medical providers (GMPs) and otolaryngologists have prominent roles in the evaluation and management of patients with laryngeal/voice disorders. In fact, GMPs and otolaryngologists are the two most frequent providers caring for these patients.^{1,2} With impaired quality of life, lost work productivity, and a conservative estimate of \$5 billion annual direct costs, laryngeal/voice disorders are associated with adverse effects on the individual and society.^{3–6} Treatment of these disorders may involve pharmacologic, behavioral, and surgical intervention. Medications (especially antibiotics, proton pump inhibitors [PPIs], and steroids) represent a significant expense, accounting for almost one-third of all direct costs.⁴

Both GMPs and otolaryngologists routinely prescribe medications for laryngeal/voice-disordered patients with different prescription patterns.^{1,7,8} With regard to GMPs, prescribed medications typically occur prior to completion of laryngoscopy, which is necessary for accurate diagnosis of laryngeal/voice disorders.^{9,10} Furthermore, multiple medication trials by GMPs and otolaryngologists for the same laryngeal diagnosis have been observed, suggesting a level of uncertainty regarding appropriate and effective pharmacologic treatment.^{8,11}

Given the considerable public health burden of laryngeal/voice disorders and the substantial costs associated with pharmacologic treatment, there is a need to better understand prescribing patterns of GMPs and otolaryngologists. This study examines the continuum of care regarding medication use for laryngeal/voice disorders among a cohort of patients who saw both GMPs and otolaryngologists. Such data may provide insights about current treatment patterns and serve as a foundation for studies exploring how various treatment patterns impact patient outcomes. The aims of this study are 1) to determine laryngeal diagnosis change from GMP to otolaryngology by GMP-based medication trial, and 2) to evaluate the association between GMP-based medication trials and the likelihood of otolaryngology-based pharmacologic treatment.

MATERIALS AND METHODS

This study was approved by the Duke University Medical Center Institutional Review Board. The MarketScan Commercial Claims and Encounters dataset (Truven Health Analytics, Ann Arbor, Michigan, U.S.A.) and the Medicare Supplemental and Coordination of Benefits dataset, a large, national administrative U.S. claims database, were retrospectively analyzed from January 1, 2010, to December 31, 2012. Healthcare claims are indicative of routine clinical care.¹² The MarketScan (Truven Health Analytics) databases contain the average annual healthcare claims of roughly 59 million individual employees <65 years of age; Medicare beneficiaries ≥65 years of age; and their dependents, who were integrated from all care providers and linked to healthcare utilization at the patient level.

Patients were included for analysis if 1) they had a diagnosis of at least one International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code for a laryngeal/voice disorder (Table I) as one of the four diagnoses per outpatient encounter; 2) initial laryngeal/voice-disorder diagnosis was by a GMP (index date); 3) they had 3 months of continuous enrollment after the index date; 4) they subsequently saw an otolaryngologist during the time period 2 weeks after index date to 3 months postindex date; and 5) they had prescription data available for the index date and the first otolaryngology visit. Because patients with a brainstem stroke may have a disordered voice from nucleus ambiguous involvement, 438.10 and 438.19 (late effects of cerebrovascular disease, speech and language deficit unspecified) were included. Patients with otolaryngology outpatient visits within 2 weeks of the index date were excluded due to difficulty in determining whether the pharmacy claim was related to the GMP or otolaryngologist.

Each pharmacy claim occurring within 2 weeks of the initial outpatient GMP visit (new or return) and within 2 weeks of the subsequent otolaryngology outpatient visit for a laryngeal diagnosis was collected and assigned to the relevant provider. The therapeutic drug classes and generic identification numbers according to the MarketScan (Truven Health Analytics) database dictionary were used to identify medications, and refill variable was used to determine new prescription.

Age, gender, index date GMP laryngeal diagnosis, initial subsequent otolaryngology laryngeal diagnosis, geographic region (divided in to four census regions: northeast, north central, south, and west), urban versus rural status (based on residence in a metropolitan statistical area), and employment status (retired, employed, dependent, disabled) were collected. The number of stroboscopies, voice therapy claims, and laryngeal surgeries from the initial otolaryngology visit to the 3 months postindex date period also were tabulated based on current procedural terminology (CPT) codes (Table I).

Otolaryngologists were otolaryngology, pediatric otolaryngology, head and neck surgery, or surgeon not elsewhere classified if they had associated same-day CPT code for 31505, 31575, 31579. *General medicine providers* were urgent care, osteopathic medicine, internal medicine, emergency medicine, hospitalist, family practice, geriatric medicine, preventive medicine, pediatrician, pediatric emergency medicine, nurse practitioners, and physician assistants. *Medical doctor not elsewhere classified or multispecialty group* were assessed for same-day CPT claims for 31505, 31575, or 31579. If one of these CPT codes was associated with the visit day, the patients were categorized as otolaryngologists. If there was no associated CPT code, these two provider types were categorized as GMPs.

MarketScan (Truven Health Analytics) database management and statistical analysis were completed with R 3.2.1 (R Core Team, Vienna, Austria, 2015). Summary statistics were tabulated, and the index GMP laryngeal/voice diagnosis was compared to the subsequent initial otolaryngology diagnosis by medication category using the McNemar test or exact binomial test where appropriate. Logistic regression analyses were performed to examine the relationship between otolaryngology and GMP use of antibiotics, PPIs, and oral steroids (the 3 most common medications) while adjusting for initial otolaryngology laryngeal diagnosis, age, gender, region, and urban versus rural status. The impact of comorbid conditions was

adjusted for as well by assessing specific comorbidities: sinusitis (461.x, 473.x), gastroesophageal reflux/esophagitis (530.1x, 530.8t, 787.1), dysphagia (438.82, 787.xx), acute pharyngitis/tonsillitis/upper respiratory illness (462, 463, 465.x), acute bronchitis (466.xx), acute upper respiratory illness (465.x), pneumonia (481, 482.xx, 483.x, 486), chronic obstructive pulmonary disease (490, 491.xx, 492, 492.0, 492.8), cough (786.2), stridor (786.1), chronic pharyngitis (472.1), and sore throat (784.1). Regression diagnostics were performed.

RESULTS

A yearly mean of 59,400,337 unique patients were enrolled in the MarketScan (Truven Health Analytics) databases from January 1, 2010, to December 31, 2012, with 628,372 (1.1%) unique patients having laryngeal/voice-disorder diagnosis codes. Of the 136,607 patients who saw a GMP and had pharmacy data available during the 3 months postindex date period, 65,222 (47.7%) were prescribed an antibiotic, PPI, histamine 2 blocker, oral/inhaled steroid, or antihistamine. Cohort selection process is illustrated in Figure 1.

Patient demographics are displayed in Table II. The median time from index GMP visit to initial otolaryngology visit was 29 days (interquartile range 20–47 days). At the index GMP visit, 15.3% of laryngeal/voice-disordered patients received an antibiotic, 14.0% a PPI, and 7.7% an oral steroid. A total of 94.6% of the antibiotic, 71.0% of the PPI, and 94.1% of the oral steroid prescriptions were new medications. The comparisons of the index GMP laryngeal diagnoses and the initial subsequent otolaryngology laryngeal diagnoses by these three medications are shown in Table III. An increased frequency of unilateral vocal fold paralysis, vocal fold paresis, benign vocal fold/laryngeal pathology, chronic laryngitis, and multiple laryngeal diagnoses was noted among otolaryngologists as compared to GMPs. In the case of patients receiving a GMP-based antibiotic, there was an increased frequency of laryngeal cancer diagnoses by otolaryngologists.

Subsequent treatment among otolaryngologists was evaluated. Among 1,910 laryngeal/voice-disorder patients who first had an antibiotic from their GMP, 17.7% received an antibiotic, 24.5% a PPI, and 8.8% an oral steroid at the initial otolaryngology visit. Those 1,748 and 963 patients who received a PPI or oral steroid from their GMP subsequently had an antibiotic (11.4% and 16.6%), a PPI (33.5% and 23.9%), or an oral steroid (7.5% and 14.7%) from their otolaryngologist, respectively. A total of 90.6% of the antibiotic, 75.6% of the PPI, and 92.0% of the oral steroid otolaryngology-related prescriptions were new medications. In the entire cohort, during the 3-month postindex date period, otolaryngologists utilized voice therapy 11.8% of the time, stroboscopy 17.4% of the time, and laryngeal surgery 11.5% of the time (Table IV).

Three separate multivariable logistic regression models were fit to evaluate the association between GMP medication trial and subsequent otolaryngology medication use while controlling for age, gender, geographic region, urban versus rural status, initial otolaryngology diagnosis, and comorbidity (Table V). The adjusted odds for an otolaryngologist prescribing an antibiotic, PPI, and oral steroid, respectively, was 2.15 times higher if the GMP prescribed an antibiotic versus not prescribing an antibiotic, 2.11 times

higher if the GMP prescribed a PPI versus not prescribing a PPI, and 3.08 time higher if the GMP prescribed an oral steroid versus not prescribing an oral steroid.

DISCUSSION

Laryngeal/voice-disordered patients commonly are treated with medications by GMPs and general otolaryngologists; thus, a real-world examination of pharmacologic practice patterns is needed. Prior investigations have reported that medications often are the first-line treatment for laryngeal/voice disorders, with roughly half of patients receiving antibiotics, PPIs, histamine 2 blockers, oral and inhaled steroids, or antihistamines.^{1,7,8} This investigation confirms that almost half of our patients who saw a GMP for a laryngeal/voice disorder had similar medication trials.

General Medical Provider Evaluation and Treatment

Specific diagnostic trends were noted while laryngeal/voice-disordered patient care changed from GMPs to otolaryngologists. In patients who received an antibiotic from their GMP, otolaryngologists more frequently diagnosed laryngeal structural abnormalities, neuromuscular impairment, laryngeal cancer, or multiple diagnoses than did GMPs (Table III). Similar diagnostic changes were noted among patients who received PPIs or oral steroids at the index GMP visit (Table III). Although the index laryngeal/voice-disorder diagnosis by the GMP could be a presumptive diagnosis by a GMP or a longer term/preexisting carryover diagnosis from an otolaryngologist or other specialist prior to January 1, 2010, these diagnoses changes have important implications. Despite the fact that we cannot determine whether GMPs performed mirror laryngoscopy, no flexible laryngoscopy procedure codes were associated with GMP-based outpatient visits for laryngeal/voice disorders. Without laryngoscopy, the specific diagnoses noted more frequently by the otolaryngologists cannot be made.

Despite the fact that our data do not allow us to determine whether the medication trial was appropriate or indicated, possible inappropriate treatment may have occurred. Although our study does not look at patients who were successfully treated by GMPs, patients with ultimate otolaryngology diagnoses of vocal fold paralysis or laryngeal cancer may have had unnecessary medical treatment, persistent impaired quality of life, work dysfunction, or delayed diagnosis and treatment initiation. The potential for misdiagnosis and inappropriate antibiotic use among primary care and emergency room physicians also has been noted in sinusitis patients.^{13,14} Although many factors can influence prescription choices, such as fear of complications, comorbid disease, patient satisfaction, provider type, and geographic variation, half of antibiotics are inappropriately prescribed for likely viral infections.^{15–19} Continued collaboration between otolaryngologists, GMPs, and patients is needed to develop strategies aimed at improving the appropriate care of laryngeal/voice-disordered patients. Interventions, such as otolaryngology-based cross-training of residents from GMP-related fields, electronic health record decision support, or other educational efforts aimed at GMPs and patients, may be beneficial and need investigation.

Otolaryngology Evaluation and Treatment

Medication trials also were common after subsequent otolaryngology evaluation. Although patients had received an antibiotic, PPI, or oral steroid at the initial GMP visit for a laryngeal/voice disorder, these medications often were repeated after otolaryngology evaluation. Even after adjusting for age, gender, geographic region, initial laryngeal diagnosis from the otolaryngologist, and specific comorbid conditions, the odds of antibiotic, PPI, or oral steroid prescription after otolaryngology evaluation were two to three times that for patients whose GMP already had prescribed the same medication class versus those who did not (Table V). Although whether a different antibiotic, PPI, or steroid was used—or a different dosing regimen or length of treatment was employed—are not precisely known, the vast majority of otolaryngology-related prescriptions were new medications. Possible explanations for repeat pharmacologic treatment, particularly after examining the larynx, are that GMPs and otolaryngologists may both focus on apparent concomitant or comorbid conditions as a guide to pharmacologic treatment. In some cases, otolaryngologists may not want to stop a previously prescribed medication while treating the laryngeal disease. Further studies are needed to determine whether there are opportunities to reduce medication use and associated costs and side effects.

Role of Stroboscopy

Although stroboscopy was used in only 17.4% of our patient cohort, and even less frequently (i.e., 6.2%) within a larger cohort of outpatient otolaryngology visits for laryngeal/voice disorders, evaluation with stroboscopy or in a multidisciplinary fashion with speech-language pathology (SLP) may impact the diagnosis and related treatment of laryngeal/voice-disordered patients.²⁰ Despite low and varied inter- and intrarater reliability for diagnosing laryngopharyngeal reflux (LPR) via laryngeal examination, empiric treatment with PPIs has increased among otolaryngologists.^{21,22} With otolaryngologists reporting being less comfortable when diagnosing laryngeal/voice disorders in the absence of frank structural or mobility abnormalities as compared to vocal fold lesions and vocal fold paralysis, patients may receive inappropriate medications based on a presumed diagnosis, comorbid condition, or concomitant illness.²³ However, after referral to tertiary voice clinics, patients with persistent LPR-type symptoms frequently had diagnostic and treatment changes, with two-thirds of such patients improving with voice therapy provided by an SLP.^{24–26} A multicenter study of patients referred with a presumed LPR diagnosis via laryngoscopy found that stroboscopy commonly identified different diagnoses that instead would benefit from surgical treatment or voice therapy.²⁷ Furthermore, reduced antibiotic use and less frequent reflux evaluation and treatment were noted in a single institution study comparing treatment pre- and postreferral to a tertiary voice clinic, as well as within a national claims database study comparing treatment pre- and postotolaryngology evaluation with stroboscopy with or without SLP evaluation.^{28,29} Further evaluation of the impact of stroboscopy on reducing potential unnecessary medications is warranted.

Role of Speech Language Pathology

Referral to a voice-trained SLP may be an unexplored or underutilized treatment option. Only 11.8% of our patient cohort (and 4.9% of a larger cohort of laryngeal/voice-disordered

patients) with otolaryngology evaluation received SLP evaluation/treatment.²⁰ Voice stimulability testing administered by an SLP has an important role and can shed light on the nature of the patient's voice problem and the patient's potential for improvement with voice therapy as the primary modality.^{30,31} Even after controlling for the use of stroboscopy, as compared with otolaryngology evaluation without SLP, laryngeal/voice-disordered patients who also had SLP evaluation had an 18% greater odds of having a change in laryngeal diagnosis and were more likely to attend voice therapy.²⁰ Further evaluation is needed to examine the impact of multidisciplinary evaluation of laryngeal/voice-disordered patients and the impact on healthcare utilization, especially subsequent pharmacologic treatment. This may be especially germane for patients 1) who already have previously seen a GMP and failed prior medication trials, and/or 2) do not have obvious structural or mobility abnormalities of the vocal folds on laryngoscopy sufficient to account for the degree of dysphonia observed.

Limitations and Implications

Methodologic limitations standard to this type of research must be addressed. The accuracy of ICD-9 coding for the laryngeal/voice disorder and comorbid diseases could not be confirmed. However, the diagnostic trends to more structural laryngeal disorders after otolaryngology evaluation appear logical and consistent with prior literature.² Although we cannot differentiate between a primary voice disorder and a secondary voice disorder related to another health problem—or between new or recurrent—all these patients may present to GMPs and subsequently to otolaryngologists; thus, their experiences are worthy of examination. We chose a 3-month follow-up window after the first laryngeal/voice diagnosis with a GMP to evaluate pharmacologic care likely occurring over the same symptom complex. As a result, stroboscopy, SLP evaluation/treatment, or laryngeal surgery occurring after the 3 months are not represented in these data. Pharmacy claims for each year were available for only 70% of the overall cohort and only could be linked to diagnosis claims by provider with temporal relationship. Patients had commercial health insurance or Medicare and results may not be generalizable to patients without health insurance or with Medicaid. Despite these limitations, our study provides new insights regarding repeated, potentially unnecessary, medication use among GMPs and otolaryngologists in a real-world setting.

CONCLUSION

Medication trials commonly are employed in the treatment of laryngeal/voice-disordered patients. Treatment by GMPs with antibiotics, PPIs, or oral steroids in patients with subsequent otolaryngology-based diagnoses of vocal fold paralysis and paresis, benign vocal fold/laryngeal pathology, laryngeal cancer, or multiple diagnoses may represent opportunities to reduce inappropriate medication use. Laryngeal/voice-disordered patients with prior GMP-based medication trials had higher odds of the same class of medication trial prescribed after otolaryngology evaluation, representing another area warranting further study. Future studies aimed at comparing patient outcomes, healthcare utilization, and pharmacologic treatment for various evaluation strategies for laryngeal/voice-disordered patients are needed and ultimately may help reduce potential unnecessary medication use.

Education and outreach programs for patients, GMPs, and otolaryngologists also may facilitate improved care of laryngeal/voice-disordered patients.

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Fig. 1.
Flow chart for cohort identification.

TABLE I**ICD-9 and CPT Code Diagnostic and Procedural Code Groupings**

Category	ICD-9 Codes
Vocal fold paralysis	478.30, 478.32
Bilateral vocal fold paralysis	478.34
Vocal fold paresis	478.31, 478.33
Nonspecific dysphonia	784.49, 784.42, 784.40, 784.41
Acute laryngitis	464, 464.01, 464.20, 464.21
Benign laryngeal/vocal fold pathology	478.4, 478.5, 478.6, 478.71, 478.79, 212.1, 748.2
Other larynx/vagus	478.70, 352.3
Chronic laryngitis	476.0, 476.1
Laryngeal cancer	161.0, 161.1, 161.2, 161.3, 161.8, 161.9, 231.0, 235.6
Laryngeal spasm	478.75
Late effect cerebrovascular disease, speech and language deficit, unspecified	438.10, 438.19
Laryngoscopy	CPT: 31505, 31575
Stroboscopy	CPT: 31579
Voice evaluation/therapy	CPT: 92506, 92507, 92508, 92520
Laryngeal surgery	CPT: 31300, 31320, 31360, 31365, 31367, 31368, 31370, 31375, 31380, 31382, 31390, 31395, 31400, 31420, 31500, 31502, 31510, 31511, 31512, 31513, 31515, 31520, 31525, 31526, 31527, 31528, 31529, 31530, 31531, 31536, 31540, 31541, 31545, 31546, 31560, 31561, 31570, 31571, 31576, 31577, 31578, 31580, 31582, 31584, 31587, 31588, 31590, 31595, 31599, 64716, or 64886

CPT =current procedural terminology; ICD-9-CM =International Classification of Diseases, Ninth Revision, Clinical Modification.

TABLE II

Demographics of the Patient Cohort

Age	
Mean (SD)	51.8 (18.6)
Median (IQR)	54 (42–63)
Minimum to maximum	0–97
Gender	
Female	7,371 (59.1%)
Male	5,104 (40.9%)
Region	
Northeast	2,560 (20.5%)
North central	3,196 (25.6%)
South	3,712 (29.8%)
West	2,800 (22.4%)
Unknown	207 (1.7%)
MSA	
Rural	1,897 (15.2%)
Urban	10,372 (83.1%)
Missing	206 (1.7%)
Employment Status	
Dependent	111 (0.9%)
Disability	24 (0.2%)
Employed	3,756 (30.1%)
Retired	2,153 (17.3%)
Other/unknown	6,431 (51.5%)

IQR =interquartile range; MSA =metropolitan statistical area; SD =standard deviation.

TABLE III**General Medicine Provider Versus Otolaryngology Diagnoses by Medication Trial**

GMP Antibiotic Trial	First GMP Visit N =1910	First ENT Visit N =1910	P Value (McNemar test)
Paralysis	2.7%	5.2%	<0.001
Bilateral paralysis	0.2%	0.3%	0.48
Paresis	0.7%	1.9%	<0.001
Nonspecific hoarseness	68.0%	64.0%	0.002
Acute laryngitis	7.2%	1.8%	<0.001
Benign lesion	10.8%	26.4%	<0.001
Other larynx/vagus disease	0.5%	0.6%	0.65
Chronic laryngitis	7.9%	14.1%	<0.001
Laryngeal cancer	5.2%	6.5%	<0.001
Laryngeal spasm	1.6%	0.9%	0.03
Other speech and language deficits	0.2%	0%	0.25 *
Multiple diagnoses	4.7%	20.4%	<0.001

GMP PPI Trial	First GMP Visit N =1,748	First ENT Visit N =1,748	P Value
Paralysis	2.4%	4.5%	<0.001
Bilateral paralysis	0.1%	0.2%	0.41
Paresis	0.6%	3.0%	<0.001
Nonspecific hoarseness	72.8%	62.4%	<0.001
Acute laryngitis	2.2%	1.3%	0.03
Benign lesion	13.0%	28.3%	<0.001
Other larynx/vagus disease	0.3%	0.7%	0.11
Chronic laryngitis	7.2%	14.1%	<0.001
Laryngeal cancer	4.0%	4.6%	0.12
Laryngeal spasm	2.0%	2.2%	0.77
Other speech and language deficits	0.1%	0%	1 *
Multiple diagnoses	4.5%	19.6%	<0.001

GMP Oral Steroid Trial	First GMP visit N =963	First ENT visit N =963	P Value
Paralysis	2.4%	5.0%	<0.001
Bilateral paralysis	0.3%	0.3%	1.0
Paresis	0.7%	2.4%	0.001
Nonspecific hoarseness	66.9%	63.9%	0.11
Acute laryngitis	7.8%	2.0%	<0.001
Benign lesion	11.6%	25.1%	<0.001
Other larynx/vagus disease	0.6%	0.7%	0.74
Chronic laryngitis	9.3%	15.4%	<0.001
Laryngeal cancer	3.9%	4.9%	0.11

GMP Antibiotic Trial	First GMP Visit N =1910	First ENT Visit N =1910	P Value (McNemar test)
Laryngeal spasm	2.9%	1.9%	0.10
Other speech and language deficits	0.2%	0.1%	0.32
Multiple diagnoses	6.4%	19.8%	<0.001

*
Exact binomial tests were used instead of McNemar test.

ENT =otolaryngology; GMP =general medicine provider; PPI =proton pump inhibitor.

TABLE IV

Number of Patients With Voice Therapy, Stroboscopy, and Laryngeal Surgery From the First ENT Visit (Inclusive) to 3 Months Postindex Date

Cohort	Voice Therapy	Stroboscopy	Laryngeal Surgery	Total Sample Size
Overall patients	1,468 (11.8%)	2,173 (17.4%)	1,437 (11.5%)	12,475
Patients with GMP prescribing antibiotics	190 (9.9%)	313 (16.4%)	248 (13%)	1,910
Patients with ENT prescribing antibiotics	112 (9.1%)	180 (14.6%)	252 (20.4%)	1,233
Patients with GMP prescribing PPI	222 (12.7%)	348 (19.9%)	186 (10.6%)	1,748
Patients with ENT prescribing PPI	298 (11.7%)	469 (19.5%)	224 (8.8%)	2,549
Patients with GMP prescribing oral steroid	110 (11.4%)	177 (18.4%)	117 (12.1%)	963
Patients with ENT prescribing oral steroid	76 (10.5%)	120 (16.6%)	104 (14.4%)	721
Patients without any medication prescription from ENT	986 (12%)	1,449 (17.6%)	938 (11.4%)	8,223

ENT =otolaryngology; GMP =general medicine provider; PPI =proton pump inhibitor.

TABLE V

Logistic Regression of Otolaryngology Prescription by General Medicine Provider Prescription Adjusted for Age, Gender, Geographic Region, Urban Versus Rural Status, Initial Otolaryngology Diagnosis, and Comorbid Condition.*

	95% Confidence Interval		P Value
Adjusted OR for Otolaryngologist Prescribing Antibiotic			
GMP-prescribed antibiotic	2.15	1.87–2.48	<0.001
Adjusted OR for otolaryngologist prescribing PPI			
GMP-prescribed PPI	2.11	1.88–2.37	<0.001
Adjusted OR for otolaryngologist prescribing oral steroid			
GMP-prescribed oral steroid	3.08	2.51–3.76	<0.001

* For antibiotics, adjusted comorbid conditions included acute sinusitis, chronic sinusitis, acute pharyngitis, acute and chronic tonsillitis, upper respiratory infection, stridor, cough, sore throat, chronic pharyngitis, chronic obstructive pulmonary disease, pneumonia, and acute bronchitis.

For PPI, adjusted comorbid conditions included gastroesophageal reflux, esophagitis, and dysphagia.

For oral steroid, adjusted comorbid conditions included acute sinusitis, chronic sinusitis, acute pharyngitis, acute and chronic tonsillitis, upper respiratory infection, asthma, chronic obstructive pulmonary disease, pneumonia, and acute bronchitis.

GMP =general medicine provider; OR =odds ratio; PPI =proton pump inhibitor.