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Chronicity of Voice-Related Health Care Utilization in the General Medicine Community

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Abstract

Objectives—To examine voice-related health care utilization of patients in the general medical community without otolaryngology evaluation and explore factors associated with prolonged voice-related health care.

Study Design—Retrospective cohort analysis.

Setting—Large, national administrative US claims database.

Subjects and Methods—Patients with voice disorders per *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes from January 1, 2010, to December 31, 2012, seen by a general medical physician, and who did not see an otolaryngologist in the subsequent year were included. Voice-related health care utilization, patient demographics, comorbid conditions, and index laryngeal diagnosis were collected. Logistic regression with variable selection was performed to evaluate the association between predictors and 30 days of voice-related health care use.

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Disclosures

Competing interests: Seth Cohen, consultant for Fibrocell.

Supplemental Material

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

Results—In total, 46,205 unique voice-disordered patients met inclusion criteria. Of these patients, 8.5%, 10.0%, and 12.5% had voice-related health care use of 90, 60, and 30 days respectively. Of the 30-day subset, 80.3% and 68.5%, respectively, had 60 and 90 days of voice-related health care utilization. The 30-day subset had more general medicine and nonotolaryngology specialty physician visits, more prescriptions and procedures, and 4 times the voice-related health care costs compared with those in the <30-day subset. Age, sex, employment status, initial voice disorder diagnosis, and comorbid conditions were related to 30 days of voice-related health care utilization.

Conclusions—Thirty days of nonotolaryngology-based care for a voice disorder may represent a threshold beyond which patients are more likely to experience prolonged voice-related health care utilization. Specific factors were associated with extended voice-related health care.

Keywords

laryngeal disorders; voice disorders; larynx; management; dysphonia; voice; diagnosis; treatment; otolaryngology

General medicine physicians (GMPs) are frequently involved in managing otolaryngology complaints. Primary care visits for ear/nose/throat-related complaints have risen from 4.5% in 1999–2002 to 8.5% in 2006–2009, with a 7.5% prevalence of current voice problems in a primary care population.^{1,2} Given the negative quality-of-life impact, direct health care cost estimates of roughly \$5 billion annually, and indirect costs related to work absenteeism and presenteeism, voice disorders represent an important and costly public health challenge.^{3–6}

GMPs, along with otolaryngologists, are the 2 most frequent providers treating voice disorders.^{7,8} Yet, most voice-disordered patients who present to GMPs do not receive otolaryngology assessment.⁹ Furthermore, it is unclear what proportion of these patients assessed by GMPs experience self-limited voice disorders vs more protracted difficulties. Delayed or nonreferral to otolaryngology for voice disorders may adversely affect patient outcomes through inaccurate diagnosis and subsequent inappropriate treatment. Currently, little is known regarding the health care utilization of voice-disordered patients in the general medicine community.

The objective of this study is to examine the health care utilization of voice-disordered patients in a general medical patient cohort. Such longitudinal data are needed to characterize the chronicity of voice-related health care utilization and can serve as a foundation for identifying patients at risk for more chronic problems, leading to potential opportunities for timely otolaryngology evaluation or reevaluation. The aims of this study are to (1) measure the voice-related health care utilization; (2) determine the proportion of patients who have voice-related health care use 30, 60, and 90 days; and (3) explore factors associated with having voice-related health care utilization 30 days vs <30 days in a general medicine cohort of voice-disordered patients without otolaryngology evaluation over 12 months.

Methods

This study was approved by the Duke University Medical Center Institutional Review Board. The MarketScan Commercial Claims and Encounters data set and Medicare Supplemental and Coordination of Benefits data set, a large, national administrative US claims database, was retrospectively analyzed for January 1, 2010, to December 31, 2012. Health care claims are representative of typical clinical care.¹⁰ The MarketScan databases (Truven Health Analytics, Ann Arbor, Michigan) encompass the average annual health care claims of roughly 59 million individual employees <65 years of age, Medicare beneficiaries 65 years of age, and their dependents integrated from all care providers and linked to health care utilization at the patient level.⁸

Patients were included for analysis if they had a diagnosis of at least 1 *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* code for a voice disorder (Table 1) as 1 of the 4 diagnoses per outpatient encounter, had 12 months of follow-up data after the initial voice disorder diagnosis by a GMP (index date), had 6 months of pre-index date data, and had no otolaryngology care at any time before the index date or during the 12-month post-index date period. Because patients with a brainstem stroke may have a disordered voice from nucleus ambiguus involvement, 438.10 and 438.19 (late effects of cerebrovascular disease, speech and language deficit unspecified) were included. Patients who did not see a GMP at the index date for a voice disorder, without 12 months of post-index date data, without 6 months of pre-index date data, or with otolaryngologist care at any point during the pre-index date or 12-month post-index date period were excluded. Patients who had a *Current Procedural Terminology (CPT)* code for laryngeal surgery were excluded as a final check to remove patients who received care potentially from an otolaryngologist whose provider type may have been inaccurate or missing in the databases (Figure 1).

Age, sex, index date of laryngeal diagnosis, geographic region (divided into 4 census regions: northeast, north-central, south, and west), urban vs rural status (based on residence in a metropolitan statistical area [MSA]), and employment status (retired, employed, dependent, disabled) were collected. The length of voice-related health care utilization was the time from index date to the last health care claim with a voice disorder diagnosis in the 12-month follow-up period. Comorbid conditions were identified by *ICD-9-CM* and *CPT* codes (see Appendix in the online version of the article) from inpatient, outpatient, and emergency room records during the 6-month pre-index date to 6-month post-index date. A sensitivity analysis was performed comparing cohort demographics, geographic region, urban vs rural status, employment type, pharmacy claim capture, and length of voice disorder for the requirement of 6-month pre-index date data, 3-month pre-index date data, and no pre-index date requirement. As no differences were seen, the 6-month pre-index date to 6-month post-index date time period was selected for assessing comorbid conditions.

Based on the MarketScan database dictionary, *otolaryngologists* were otolaryngology, pediatric otolaryngology, head and neck surgery, or surgeon not elsewhere classified if they had associated same-day *CPT* codes for 31505, 31575, and 31579. *General medicine physicians (GMPs)* were urgent care, osteopathic medicine, internal medicine, emergency

medicine, hospitalist, family practice, geriatric medicine, preventive medicine, pediatrician, nurse practitioners, and physician assistants. Medical doctor not elsewhere classified or multispecialty group was assessed for same-day *CPT* claims for 31505, 31575, or 31579. If there was one of these *CPT* codes on the visit day, the patients were excluded as they potentially could have seen an otolaryngologist. If there was no associated *CPT* code, these 2 provider types were categorized with GMPs. *Specialists* included allergy, neurology, gastroenterology, endocrinology, hematology/oncology, infectious disease, pulmonary, rheumatology, acupuncture/spiritual healer, and psychiatry/psychology. The number of voice disorder encounters for GMPs and specialists was calculated during the 12-month post-index date follow-up period.

MarketScan database management and statistical analysis was completed with R 3.2.1 (R Core Team, Vienna, Austria). To determine the costs related to the care of voice disorders, costs from medical encounters having a voice disorder diagnosis and costs from procedures having a voice disorder diagnosis were tabulated using the gross payment to the provider, which was the amount eligible for payment under the medical plan. The procedures having a voice disorder diagnosis were categorized based on *CPT*, *ICD-9-CM* volume 3 procedure codes, and *Healthcare Common Procedure Coding System (HCPCS)* codes (see Appendix, available online). To temporally link pharmacy claims to a voice disorder, only pharmacy claims occurring within 2 weeks after a medical encounter having a voice disorder diagnosis were included. The therapeutic drug classes and generic identification numbers according to the MarketScan database dictionary were used to identify proton pump inhibitors (PPIs), antibiotics, antihistamines, oral and inhaled steroids, and histamine 2 antagonists. Medication costs were the ingredient cost, which is the discount below the average wholesale price, plus the dispensing fee. Costs were adjusted to the 2012 Consumer Price Index. Patients with negative costs or extremely large costs (>99.9th percentile) were removed from the cost analyses.

We calculated the proportion of patients with 30, 60, and 90 days of voice-related health care utilization and summary statistics for demographics, health care utilization, and comorbid conditions. The χ^2 , Fisher exact, and Mann-Whitney *U* tests were used to compare patients with 30 vs <30 days of voice-related health care utilization. Two-sided statistical tests were used in all analyses, and the level of significance was set at .01.

We examined patient characteristics associated with 30 days of voice-related health care utilization with logistic regression models. Age, sex, employment status, index date diagnosis, and comorbid condition were considered for inclusion in the models. Because not every patient (*n* = 1166) had data for region or urban vs rural status, these variables were excluded from regression analyses to allow for a comparison across the entire sample. Least Absolute Shrinkage and Selection Operator (LASSO)¹¹ with a 10-fold cross-validation and likelihood ratio test-based backward selection were employed to perform variable selection. Regression diagnostics were assessed. Since the backward selection model had a better model fit than the LASSO model and fit equally well as the full model, only the results of the backward selection model were reported. Sensitivity analyses were performed using cut points of 60 days and 90 days with similar results (results not shown). Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were presented.

Results

A yearly mean of 59,400,337 unique patients were enrolled in the MarketScan databases during January 1, 2010, to December 31, 2012, with 628,372 (1.1%) unique patients having utilization consistent with a voice disorder. Cohort selection process is shown in Figure 1.

Patient demographics are shown in Table 2. Of voice-disordered patients, 12.5% (5760) had voice-related health care utilization ≥ 30 days, 10.0% (4626) ≥ 60 days, and 8.5% (3945) ≥ 90 days. Of patients with ≥ 30 days of voice-related health care utilization, 80.3% had ≥ 60 days and 68.5% had ≥ 90 days of voice-related health care utilization. Diagnoses of laryngeal cancer, vocal fold paralysis, and benign laryngeal/vocal fold pathology were more frequent in the ≥ 30 -day group while acute laryngitis and nonspecific dysphonia were more common in the <30 -day group (Table 3). Multiple comorbid conditions were present with greater percentages of comorbid conditions in the ≥ 30 -day group (Table 4). In the ≥ 30 -day subset, median length of voice-related health care utilization was 155 days (interquartile range [IQR], 70–271).

In the overall cohort, 7591 (16.4%) patients had procedure claims, and 34,693 (75.1%) had pharmacy claims captured each year, of whom 48.7% were prescribed at least 1 of the 6 medications of interest. Patients in the ≥ 30 -day subset had more general medicine and specialist visits, procedure claims, and pharmacy claims compared with the <30 -day subset (Table 4). The 5 most frequent specialists were allergists, pulmonary, physical therapy, gastroenterology, and neurology. In the overall cohort, 3210 (6.9%) patients had a laryngoscopy, with family and internal medicine physicians associated with 82.4% of the laryngoscopy claims. After removing patients whose pharmacy claims were not captured and cost outliers, the median cost per person over 12 months for the ≥ 30 -day vs <30 -day group was \$402.50 (IQR, \$238.90–\$809.70) vs \$119.00 (IQR, \$86.20–198.20) (Mann-Whitney test $P < .001$).

To evaluate factors related to having ≥ 30 days of voice-related health care utilization, regression analyses were performed (Table 5). After controlling for explanatory variables, a 1-year increase in age was associated with a 0.3% increase in the odds of ≥ 30 days of voice-related health care utilization. This translates into a 6% increased odds of a chronic voice disorder for a 65-year-old compared with a 45-year-old. Males had 15.0% greater odds of ≥ 30 days of voice-related health care utilization than females. Compared with a diagnosis of acute laryngitis on the index date, chronic laryngitis, malignant and benign laryngeal pathology, vocal fold movement disorders, and laryngeal cancer increased the odds of ≥ 30 days of nonotolaryngology voice-related health care utilization after adjusting for covariates. Last, comorbid conditions involving the upper and lower airway, neurologic diseases, other throat symptoms, and reflux/swallowing increased the odds of having ≥ 30 days of nonotolaryngology voice-related health care utilization.

Discussion

As otolaryngologists and GMPs both care for dysphonic patients, understanding the nature and burden of voice disorders in the general medicine community is essential for improving

the health care of voice-disordered patients. Similar motivation has prompted investigations aimed at the management of sinusitis among nonotolaryngologists.¹² Our study found that 8.5%, 10.0%, and 12.5% of voice-disordered patients presenting to a GMP have voice-related health care utilization of 90, 60, and 30 days, respectively. Compared with the <30-day group, the 30-day subset had more specialist visits, procedures, and pharmacy claims, incurring greater health care costs. How the health care utilization and outcome of the 30-day subset might have changed with otolaryngology evaluation during the 12-month follow-up period is unknown. However, an examination of voice-disordered patients who presented to general medicine or primary care physicians and subsequently to otolaryngologists found incremental health care costs as the time to otolaryngology evaluation increased from 1 month to 3 months.¹³ Identification of patients at risk for chronic voice-related health care utilization could potentially improve individual outcomes, avoid unnecessary tests and medication trials, and reduce societal costs. With 80.3% and 68.5% of the 30-day group having 60 and 90 days, respectively, of voice-related health care utilization, 30 days of nonotolaryngology voice-related health care may indicate someone likely to have prolonged voice-related health care utilization and who could benefit from early otolaryngology evaluation or reevaluation.

Demographic factors were associated with having 30 days compared with <30 days of a voice disorder. Increased age has been shown to be related to increased prevalence of voice disorders, and we observed increased odds of 30 days of voice-related health care utilization for each incremental year of age.^{8,14–16} Interestingly, retirees had greater odds of prolonged voice-related health care utilization than employed individuals. Although data on specific job type were unavailable, employed individuals may have had difficulty leaving work for evaluation or may have accepted their dysphonia as a normal part of their employment, such as in the case of teachers.¹⁷ Although more females than males in the general medical cohort had a voice disorder, similar to prior epidemiologic studies, male sex was an independent predictor of 30 days of health care utilization for a voice disorder (Table 5).^{2,14,16,18,19} Potentially, women may have felt reassured after medical evaluation, or males may have presented later in the disease process, thereby affecting their voice-related health care utilization. While further investigation is needed to determine the reasons for sex differences in voice-related health care utilization, elderly and male patients appear more prone to prolonged voice-related health care utilization.

Although the origin of the index voice disorder diagnosis could not be precisely determined (a presumptive diagnosis by a GMP or potentially a longer term/preexisting carryover diagnosis from an otolaryngologist or other specialist prior to January 1, 2010), greater odds of 30 days of voice-related health care utilization for laryngeal cancer, benign laryngeal/vocal fold pathology, vocal fold paralysis, and multiple diagnoses compared with acute laryngitis diagnosis was found (Table 5). Differentiating between these various etiologies requires experienced laryngeal examination, without which diagnostic accuracy is poor.²⁰ Yet, laryngoscopy occurred in only 6.9% of these patients. The specific voice disorder's impact on the chronicity of the associated health care utilization and the potential for delayed or missed diagnosis highlights the necessity of experienced laryngeal examination to accurately determine the cause and treatment for the voice disorder and improve patient outcome, including quality of life.²¹ Neurologic and structural laryngeal disorders were

more likely associated with 30 days of voice-related health care utilization and could indicate patients needing timely otolaryngology evaluation or reexamination.

Comorbid health conditions may further indicate which voice-disordered patients are at greater risk for chronic voice-related health care utilization. Upper and lower respiratory conditions such as asthma and sinonasal diseases are not only risk factors for dysphonia but should alert providers to the potential for extended voice-related health care utilization.^{2,18,22} Similarly, patients with lung cancer, coexisting throat symptoms, dysphagia, and neurologic diseases such as Parkinson disease or essential tremor also warrant heightened vigilance from providers.^{23,24} Although concern regarding potential overdiagnosis of reflux-related voice disorders has been raised, gastroesophageal reflux was related to 30 days of voice-related health care utilization (Table 5).^{25–27} Whether this association is due to a pathologic link, coprevalence, or presumptive reflux diagnosis cannot be determined. These health conditions may indicate patients who could benefit from early evaluation for new onset and reevaluation with otolaryngologists for more chronic voice disorders.

This study was subject to limitations standard to this type of research method. The accuracy of *ICD-9-CM* coding regarding voice disorder and comorbid disease diagnosis and direct data regarding tobacco and alcohol consumption could not be confirmed. However, GMPs should have a low threshold for referral in patients with these known risk factors for laryngeal malignancy. Differentiating between dysphonia as a chief complaint due to a primary voice disorder, a secondary problem related to other health conditions, or between new, recurrent, and persistent dysphonia was not possible. However, including all these voice disorders patients is important as GMPs must navigate the diverse dysphonic population to determine management, evaluation, and reevaluation. *ICD-9-CM* coding has also shown high specificity and positive predictive value for having the particular condition.^{28–31} Thus, regardless of the cause, the GMP likely felt the voice complaint was an important part of the patient presentation. Pharmacy claims for each year were available for only 75.1% of the overall cohort and could only be linked to diagnosis claims with a temporal relationship. The impact of other factors on duration of voice-related health care utilization such as quality of life, race, ethnicity, and socioeconomic status could not be directly assessed. Patients had commercial health insurance or Medicare and may not be generalizable to patients without health insurance or with Medicaid. No assessment of the appropriateness of care patients received was possible. Despite these limitations, this study provides new insights regarding the natural history and impact of voice disorders and factors related to prolonged voice-related health care utilization disorders in a general medical cohort without otolaryngology evaluation over 12 months.

Conclusions

The general medical community cares for voice-disordered patients beyond those with acute, self-limited disease; those patients with prolonged voice-related health care utilization have more specialist visits, procedures, pharmacy claims, and costs. Thirty days of voice-related health care utilization may be a threshold indicating patients likely to have more prolonged voice disorders. In addition, predictors of 30 days of health care utilization for a voice

disorder (age, sex, employment status, voice disorder diagnosis, comorbid illness) were identified and could be used to inform decisions about otolaryngology referral.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Flowchart for cohort identification. *CPT*, *Current Procedural Terminology*.

Table 1*ICD-9-CM* Code for Voice Disorder Groupings.

Category	<i>ICD-9-CM</i> 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

Abbreviation: *ICD-9-CM*, *International Classification of Diseases, Ninth Revision, Clinical Modification*.

Table 2

Patient Demographics.

Variable	<30 Days Voice-Related Health Care Utilization (n = 40,445)	30 Days Voice-Related Health Care Utilization (n = 5760)	Total (N = 46,205)
Age, y			
Mean (SD)	41.9 (24.2)	45.3 (26.3)	42.3 (24.5)
Median (interquartile range)	46 (21–59)	51 (20–66)	47 (21–60)
Region, %			
Northeast	22.3	23.6	22.5
North-central	20.1	19.8	20.1
South	35.5	32.6	35.1
West	19.5	21.8	19.8
Unknown	2.6	2.3	2.5
Urban vs rural, %			
Yes	14.0	14.0	14.0
No	83.5	83.8	83.6
Unknown	2.5	2.2	2.5
Employment status, %			
Dependent	82.1	83.8	82.3
Disability	0.1	0.2	0.1
Employed	15.0	11.8	14.6
Retired	2.8	4.1	3.0
Sex, %			
Female	61.8	57.0	61.2
Male	38.2	43.0	38.8

Table 3

Patient Index Voice Disorder Diagnosis and Presence of Comorbid Disease during the 6-Month Pre–Index Date to 6-Month Post–Index Date Period.

Variable	<30 Days Voice-Related Health Care Utilization (n = 40,445), %	30 Days Voice-Related Health Care Utilization (n = 5760), %	P Value
Index voice disorder diagnosis			
Unilateral vocal fold paralysis	0.6	2.0	<.001
Bilateral vocal fold paralysis	0.0	0.1	.007
Vocal fold paresis	0.2	0.7	<.001
Nonspecific dysphonia	51.5	43.3	<.001
Acute laryngitis	23.3	15.2	<.001
Benign laryngeal/vocal fold pathology	7.8	14.3	<.001
Other larynx/vagus	0.7	0.9	.33
Chronic laryngitis	6.7	7.6	.013
Laryngeal cancer	1.2	4.7	<.001
Laryngeal spasm	4.8	4.4	.2
Late effect cerebrovascular disease, other speech deficits	5.2	10.1	<.001
Multiple diagnoses	1.9	3.1	<.001
Comorbid condition			
Acute sinusitis	19.5	18.5	.057
Asthma	13.9	19.7	<.001
Chronic obstructive pulmonary disease	7.1	9.8	<.001
Gastroesophageal reflux/esophagitis	20.8	32.1	<.001
Acute pharyngitis/tonsillitis/upper respiratory illness	35.8	32.1	<.001
Acute bronchitis	14.3	15.1	.14
Pneumonia	4.4	6.6	<.001
Allergic rhinitis	19.2	23.3	<.001
Other throat symptoms ^a	26.9	32.0	<.001
Dysphagia	7.3	13.4	<.001
Neck mass	2.7	4.0	<.001
Stroke speech effects	1.6	3.8	<.001
Parkinson/other neurologic disease	1.1	2.6	<.001
Thyroid cancer	0.6	0.9	.055
Thyroidectomy/parathyroidectomy	0.6	0.8	.033
Carotid/chest surgery	0.2	0.5	<.001
Alcohol/tobacco use	5.2	5.9	.023
Esophageal cancer/esophagectomy	0.1	0.5	<.001
Obstructive sleep apnea	5.4	7.0	<.001
Chemotherapy	0.6	1.2	<.001
Lung/mediastinal cancer	0.5	1.4	<.001
Chronic rhinosinusitis	12.2	16.9	<.001
Autoimmune disease	2.6	3.0	.089

Variable	<30 Days Voice-Related Health Care Utilization (n = 40,445), %	30 Days Voice-Related Health Care Utilization (n = 5760), %	P Value
Depression/anxiety	15.9	17.1	.025

^a Other throat symptoms include cough, throat pain, chronic pharyngitis, stridor, or hemoptysis.

Table 4

Comparison of Physician Visits, Pharmacy, and Procedure Claims over the 12-Month Follow-up Period between Patients with <30 Days vs 30 Days of Voice-Related Health Care Utilization.

	<30 Days Voice-Related Health Care Utilization	30 Days Voice-Related Health Care Utilization	<i>P</i> Value
Median (interquartile range) for number of general medical physician visits ^a	1 (1–1)	2 (2–3)	<.001
Number of specialist visits, % ^a			<.001
0	99.8	94.4	
1	0.2	3.1	
2	0.0	1.1	
3	0.0	1.4	
Median (interquartile range) for number of pharmacy claims within 2 weeks of any physician visit over 12-month post-index date follow-up ^a	1 (0–3)	3 (1–6)	<.001
Medication use, %			
Ever ^b antibiotic	33.7	36.8	<.001
Ever proton pump inhibitor	7.9	20.3	<.001
Ever histamine 2 blocker	1.2	3.0	<.001
Ever oral steroid	14.3	16.8	<.001
Ever inhaled steroid	2.0	5.5	<.001
Ever antihistamines	2.6	4.4	<.001
Procedures performed, %			
Any laryngoscopy ^c	5.6	16.4	<.001
Any stroboscopy	0.5	4.5	<.001
Any voice evaluation/treatment	0.9	12.5	<.001
Any radiologic study	2.7	6.0	<.001
Any swallow study	0.8	3.0	<.001
Any reflux study	0.1	0.5	<.001
Any esophagogastroduodenoscopy	0.3	1.5	<.001
Any allergy procedure	0.4	1.8	<.001
Any pulmonary function test	3.4	7.6	<.001

^aN = 40,445 for <30-day and 5760 for 30-day patient groups for physician visits and procedures. Full pharmacy claim data were available for 30,588 and 4105 for <30-day and 30-day patient groups, respectively.

^bEver means having at least 1 pharmacy claim for a given medication within 2 weeks of any physician visit for voice disorder over the 12-month post-index date follow-up.

^cAt least 1 specific procedure with associated voice disorder diagnosis over 12-month post-index date follow-up.

Table 5

Multiple Logistic Regression with Backward Selection Model for Outcome 30 Days Voice-Related Health Care Utilization.

Covariate	OR	95% Confidence Interval	P Value
Age	1.003	1.002–1.004	<.001
Sex			
Female	Reference		
Male	1.15	1.09–1.22	<.001
Employment status			
Retired	Reference		
Dependent	0.81	0.70–0.94	.005
Disability	1.81	0.89–3.47	.086
Employed	0.72	0.60–0.85	<.001
Diagnosis			
Acute laryngitis	Reference		
Benign vocal fold/laryngeal pathology	2.03	1.81–2.26	<.001
Bilateral vocal fold paralysis	7.90	2.23–26.73	<.001
Chronic laryngitis	1.21	1.06–1.38	.005
Laryngeal cancer	4.44	3.72–5.28	<.001
Laryngeal spasm	1.11	0.97–1.30	.162
Nonspecific dysphonia	0.98	0.90–1.07	.603
Other larynx/vagus	1.32	0.95–1.80	.086
Late effect cerebrovascular disease, other speech deficits	1.32	0.95–1.80	<.001
Unilateral vocal fold paralysis	3.61	2.81–4.62	<.001
Vocal fold paresis	3.75	2.35–5.87	<.001
Multiple diagnoses	1.94	1.61–2.32	<.001
Comorbid condition ^a			
Asthma	1.34	1.24–1.45	<.001
Chronic obstructive pulmonary disease	1.11	1.00–1.22	.0546
Gastroesophageal reflux/esophagitis	1.55	1.45–1.66	<.001
Acute pharyngitis	0.91	0.86–1.25	.006
Allergic rhinitis	1.17	1.09–1.25	<.001
Dysphagia	1.33	1.21–1.45	<.001
Other throat symptoms ^b	1.14	1.07–1.22	<.001
Stroke speech effects	1.30	1.09–1.55	.004
Parkinson/other neurologic disease	1.80	1.47–2.18	<.001
Ethanol/tobacco	0.88	0.77–0.99	.04
Lung/mediastinal cancer	1.62	1.22–2.14	<.001
Chronic rhinosinusitis	1.24	1.14–1.34	<.001

^aReferent condition is not having the specific comorbid condition.

^bOther throat symptoms include cough, throat pain, chronic pharyngitis, stridor, or hemoptysis.