Published in final edited form as:

Laryngoscope. 2014 January ; 124(1): . doi:10.1002/lary.24280.

Factors Influencing Referral of Patients with Voice Disorders from Primary Care to Otolaryngology

SM Cohen^{a,*}, J Kim^b, N Roy^c, and M Courey^d

^aSeth M. Cohen, MD, MPH, Duke Voice Care Center, Division of Otolaryngology – Head & Neck Surgery, Duke University Medical Center, Durham, NC

^bJaewhan Kim, PhD, Division of Public Health & Study Design and Biostatistics Center, University of Utah, Salt Lake City, UT

^cNelson Roy, PhD, CCC-SLP, Department of Communication Sciences and Disorders, Division of Otolaryngology-Head & Neck Surgery (Adjunct), University of Utah, Salt Lake City, UT

^dMark Courey, MD, Department of Otolaryngology – Head & Neck Surgery, University of California - San Francisco

Abstract

Objective—To evaluate the frequency, timing, and factors that influence referral of patients with laryngeal/voice disorders to otolaryngology following initial evaluation by a primary care physician (PCP).

Study Design—Retrospective analysis of a large, national administrative U.S. claims database.

Methods—Patients with a laryngeal disorder based on ICD-9-CM codes from January 1, 2004 to December 31, 2008, seen by a PCP as an outpatient (with or without otolaryngology involvement), and continuously enrolled for 12 months were included. Patient age, gender, geographic region, last PCP laryngeal diagnosis, comorbid conditions, time from first PCP visit to first otolaryngology visit, number of PCP outpatient visits, and number of PCP laryngeal diagnoses were collected. Cox and generalized linear regressions were performed.

Results—149,653 unique patients saw a PCP as an outpatient for a laryngeal/voice disorder with 136,152 (90.9%) only seeing a PCP, 6013 (4.0%) referred by PCP to an otolaryngologist, and 3820 (2.6%) self-referred to an otolaryngologist. Acute laryngitis had a lower hazard ratio (HR) for otolaryngology referral than chronic laryngitis, non-specific dysphonia, and laryngeal cancer. Multiple comorbid conditions had a greater HR for otolaryngology referral than having no comorbidities. Patient age, gender, and geographic region also affected otolaryngology referral. The time to otolaryngology evaluation ranged from < 1 month to > 3 months. PCP referred patients had less time to the otolaryngology evaluation than self-referred patients.

Conclusions—Multiple factors affected otolaryngology referral for patients with laryngeal/voice disorders. Further education of PCPs regarding appropriate otolaryngology referral for laryngeal/voice disorders is needed.

Keywords

laryngeal disorders; voice disorders; referral; dysphonia; voice

*Corresponding Author: Seth Cohen, MD, MPH, DUMC Box 3805, Durham, NC, 27710, seth.cohen@duke.edu, 919-681-7350 phone, 919-668-6036 fax.

No conflicts of interest

Introduction

Otolaryngologists have recognized the important role primary care physicians (PCPs) play in the evaluation and management of dysphonic patients. PCPs and otolaryngologists are the two most common specialties who evaluate and treat dysphonic patients.¹ Several articles aimed at PCPs describing the symptoms, treatment, role of laryngoscopy, timing of referral, and even audiotapes demonstrating abnormal voices have been published by otolaryngologists.^{2,3} One cross-sectional primary care based study of adults found point and lifetime prevalence rates of dysphonia of 7.5% and 29.1%, respectively.⁴ With the negative impact on patient quality of life (QOL), health care costs associated with evaluating and managing dysphonic patients, and adverse impact on work productivity, PCPs have a vital role in managing the public health impact of laryngeal/voice disorders.⁵⁻⁷

PCPs are often the first physician to evaluate patient symptoms and initiate treatment, thus determining and coordinating referrals is an essential aspect of primary care.⁸ Otolaryngologists have been found to be the third most common specialty to which family physicians referred patients.⁹ Otitis media, sinusitis, and hearing loss were the most common reasons for otolaryngology referral.⁹ Despite the prevalence of dysphonia in primary care patients, data regarding the referral patterns of patients with laryngeal/voice disorders are limited. Survey data found that 36.5% of PCPs routinely evaluated their patients for dysphonia, but 18.1% of PCPs never evaluated their patients for voice problems.¹⁰

Understanding the frequency with which PCPs refer these patients to otolaryngologists and the factors that affect the referral decision is essential. Because PCPs do not routinely examine the larynx, the cornerstone to diagnosing the cause for the dysphonia, late or non-referral could lead to delayed diagnosis, inappropriate initial management, and progression of the laryngeal/voice disorder. The purpose of this study was to examine the frequency of PCP to otolaryngology referral among patients with laryngeal/voice disorders, the factors that influence whether a referral was obtained, and the factors that influence the timing of the referral.

Methods

This study was approved by the Duke University Medical Center Institutional Review Board. A large, national administrative U.S. claims database, the MarketScan[®] Commercial Claims and Encounters dataset and Medicare Supplemental and Coordination of Benefits dataset, was retrospectively analyzed for January 1, 2004 to December 31, 2008. The MarketScan[®] databases (Thomson Reuters Healthcare, Ann Arbor, MI) contain the annual health care claims of approximately 55 million individuals including 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 and cost records at the patient level.¹

Patients with a primary or non-primary diagnosis of at least one of the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes (Table I), seen as an outpatient by a PCP, and continuously enrolled for at least 12 months after the first day of laryngeal diagnosis (i.e. the index date) during January 1, 2004 to December 31, 2008 were included. The assumption is that patients with these ICD-9-CM codes had complaints of voice problems that likely drove the PCP visit and otolaryngology referral decision. Since patients with a brainstem stroke may have a disordered voice from nucleus ambiguus involvement, 438.10 and 438.19 (late effects of cerebrovascular disease) were included. The Evaluation and Management (E & M) Current Procedural Terminology (CPT) codes of 99201, 99202, 99203, 99204, 99205, 99211, 99212, 99213, 99214, 99215, 99241,

99242, 99243, 99244, 99245, 99354, 99355 and internal MarketScan® database codes identified outpatient visits. Patients who did not see a PCP, were not seen as an outpatient, who only saw an otolaryngologist, and who did not have 12 months post-index date data were excluded.

Age, gender, geographic region (divided into four census regions: northeast, north central, south, and west), comorbid conditions, time between the first outpatient PCP encounter to the first otolaryngology outpatient encounter, number of outpatient visits to a PCP, and number of laryngeal diagnoses given by a PCP were collected. Patients' were classified as being employed in a metropolitan statistical area (MSA) to determine urban versus rural status. PCPs were classified as urgent care, medical doctor (not elsewhere classified), osteopathic medicine, internal medicine, multispecialty group, emergency medicine, hospitalist, family practice, geriatric medicine, preventive medicine, pediatrician, nurse practitioner, or physician assistant; *otolaryngologists* were classified as otolaryngology, pediatric otolaryngology, or head & neck surgery based on the MarketScan® database dictionary.

Whether patients had an otolaryngology outpatient evaluation occurring after an outpatient PCP visit determined otolaryngology referral or not. Referrals were further divided into self-referral (first otolaryngology E & M CPT codes of 99201, 99202, 99203, 99204, 99205, and internal MarketScan® codes) and PCP referred (first otolaryngology E & M codes of 99241, 99242, 99243, 99244, 99245 and internal MarketScan® codes).

The impact of comorbid conditions on otolaryngology referral was assessed by tabulating specific comorbidities: sinusitis (461.x, 473.x), asthma (493.x), chronic obstructive pulmonary disease (490, 491.xx, 492), gastro-esophageal reflux (530.81), acute pharyngitis (462), acute bronchitis (466.xx), acute upper respiratory illness (465.x), pneumonia (481, 482.xx, 483.x, 486), and allergic rhinitis (477.x).

To assess the impact of laryngeal diagnosis on otolaryngology referral, the last laryngeal diagnosis provided during an outpatient PCP evaluation was recorded. While laryngeal diagnoses may change over time, the last laryngeal diagnosis was felt to represent the PCPs' impressions at the time when referral decisions were likely made. Patients with more than one laryngeal diagnosis at the last PCP outpatient visit were classified as "multiple diagnoses".

MarketScan® database management and statistical analysis was completed with Stata Version 12 (Stata Corp., TX, USA). Summary statistics were tabulated. Cox proportional hazards modeling was used to assess the impact of specific factors (i.e. age, gender, last PCP laryngeal diagnosis, comorbidity, geographic region, MSA status, number of PCP outpatient visits, and number of PCP given laryngeal diagnoses on whether an otolaryngology referral occurred). The Cox regression estimates the probability of leaving a state (seeing a PCP only) to another state (referral to otolaryngology) over the 12 months post-index date time period. The effects of these independent variables are reported as hazard ratios (HR). For example, with respect to gender, a HR of 1.0 means no association between gender and otolaryngology referral; a HR greater than 1.0 means a greater chance of otolaryngology referral for males; and a HR less than 1.0 means that females have a greater chance of referral. A subset analysis of the patients who had an otolaryngology referral was conducted to assess how the above factors influenced the mean time to otolaryngology referral. A generalized linear regression was conducted because of the positive skewness in the outcome variable (i.e. days) and the range of the outcome variable (0). The Wald test was used to compare the impact of different laryngeal diagnoses and comorbid conditions on otolaryngology referral.

Results

54,600,465 unique patients were in the MarketScan[®] databases during January 1, 2004 to December 31, 2008 with 536,943 (1%) unique patients having a diagnosis of laryngeal disease. 149,653 unique patients with 12 months post-index date data saw a PCP as an outpatient for a laryngeal/voice disorder with 136,152 (90.9%) only seeing a PCP, 6013 (4.0%) referred by a PCP to an otolaryngologist, 3820 (2.6%) self-referred to an otolaryngologist, and 3668 (2.4%) excluded due to an ambiguous referral source (i.e. PCP versus self-referred). 104,582 patients who only saw an otolaryngologist were excluded.

The characteristics of the PCP only, PCP referred, and self-referred groups are displayed in Table II. Older patients more commonly had an otolaryngology referral: mean age 42.8 years (21.7 years standard deviation (SD)) for the PCP only group, 50.7 years (18.9) for the PCP referred group, and 53.6 years (18.4) for the self-referred group. The two most common diagnoses across referral categories were acute laryngitis and non-specific dysphonia. Patients with laryngeal cancer and vocal fold paralysis were more commonly self-referred than PCP referred (Table II).

For patients who received an otolaryngology referral, the time from first PCP visit to first otolaryngology visit varied. While most otolaryngology referrals occurred within 1 month, the time to seeing an otolaryngologist exceeded 3 months for other patients (Table III). Self-referred patients had longer times to seeing the otolaryngologist compared to patients who were PCP referred ($p < 0.001$, Chi-square test).

To determine how patient age, gender, geographic region, MSA status, number of PCP visits, number of PCP provided laryngeal diagnoses, and last PCP laryngeal diagnosis influenced otolaryngology referral, a Cox regression was performed. The adjusted hazard ratio (HR) for each variable (i.e. adjusting for the remaining variables in the model) is shown in Table IV. Compared to patients 65 years of age, patients younger than 35 years of age had a lower HR for otolaryngology referral. Women had a lower HR for otolaryngology referral compared to men. Geographic variation in otolaryngology referral patterns was identified with a lower HR in the west region compared to the south and a slight increased HR for otolaryngology referral for patients in an MSA. The greater number of PCP visits the lower the HR for otolaryngology referral. Patients with acute laryngitis had a lower HR for otolaryngology referral compared to patients with multiple diagnoses, laryngeal cancer, non-specific dysphonia, and chronic laryngitis (Table IV; $p < 0.05$, Wald test). Patients with multiple comorbidities had a greater HR for referral than patients without comorbid disease and gastro-esophageal reflux had a higher HR than acute bronchitis ($p < 0.05$, Wald test).

A subset analysis was conducted to evaluate factors affecting the time to seeing an otolaryngologist (Table V). Patients in the PCP referral group saw an otolaryngologist roughly 30 days quicker than patients in the self-referred group. Age affected the time to specialist with shorter times in patients between 18 and 64 years of age compared to those 65. Patients whose last PCP diagnosis was laryngeal cancer had a greater time to otolaryngology evaluation than patients whose last PCP diagnosis was acute laryngitis ($p < 0.05$, Wald test). Patients with multiple comorbidities had a delay of 16 days to seeing an otolaryngologist compared to patients with no comorbid conditions. An increase in the number of PCP outpatient visits and number of PCP laryngeal diagnoses increased the days to otolaryngology specialist.

Discussion

With one-third of primary care patients experiencing voice problems at some point in their lifetime, PCPs are frequently engaged in evaluating and treating dysphonic patients.⁴ However, of patients who saw a PCP and/or otolaryngologist as an outpatient for a laryngeal/voice disorder, 45% directly saw an otolaryngologist with only 10% of PCP encounters resulting in an otolaryngology referral. Because laryngeal examination is critical for accurate diagnosis and determines the next step in management, referral patterns could impact subsequent treatment.¹¹ Future studies are needed to assess the relationship between referral patterns and health care utilization.

A relationship between the PCPs' last laryngeal diagnosis and otolaryngology referral was observed. Patients with acute laryngitis had a lower HR for otolaryngology referral than patients with multiple diagnoses, laryngeal cancer, and non-specific dysphonia (Table IV). Prior reports have suggested that a greater prevalence of a disorder within a primary care practice is associated with a lower likelihood of referral.¹² While laryngeal pathology was more commonly diagnosed by otolaryngologists, acute laryngitis was more commonly diagnosed by PCPs.¹ Thus, given the frequency of acute laryngitis presenting to the PCP and its self-limited nature, PCPs may be more comfortable treating this patient population compared to patients suspected of having laryngeal cancer or multiple, unknown causes for their laryngeal/voice disorder. Surprisingly, patients whose last PCP diagnosis was laryngeal cancer had greater delays in otolaryngology evaluation compared to those with acute laryngitis (Table V). While the reasons for this observation are unknown, diagnostic imprecision may play a role. Because laryngeal examination is crucial for determining the diagnosis, our PCP diagnoses may not accurately describe patients' ultimate diagnosis. Even among laryngologists, history and physical examination alone led to inaccurate diagnoses with subsequent increased accuracy following laryngeal examination.¹³ For each increase in number of PCP visits and PCP-based laryngeal diagnoses, an increased time to otolaryngology evaluation was seen, possibly reflecting uncertainty in appropriate management (Table V). Examining how laryngeal diagnosis changes during PCP to otolaryngology evaluation may provide insights about diagnostic inaccuracies in patients with laryngeal/voice disorders.

Patient comorbid conditions also influenced otolaryngology referral patterns. Compared to patients with no comorbidities, those with multiple comorbid disorders had an increased HR for referral but a relative increase of 16 days to the otolaryngology evaluation (Tables IV and V). Also, patients with GER had a greater HR for otolaryngology referral compared to those with acute bronchitis, potentially due to the more chronic nature of the patients' presentation (Table IV). Even for common health problems, patient comorbidity has been shown to increase the likelihood of specialty referral.¹¹ Although unable to be assessed in this database, smoking and alcohol increase the risk for laryngeal cancer.¹⁴ A Korean community based general population study found that smoking also increased the odds ratio for having various laryngeal pathologies.¹⁵ Additionally, vocally demanding occupations, such as teachers, have increased voice problems and consequent work absenteeism.¹⁶ Thus, smoking, alcohol, and occupation are important considerations for expeditious otolaryngology referral.

Demographic factors and geography accounted for some of the variable otolaryngology referral patterns. Younger patients had a lower HR for otolaryngology referral and slightly reduced days to seeing the otolaryngologist compared to elderly patients (Tables IV and V). Less concern for life-threatening etiologies such as laryngeal cancer and reduced awareness about laryngeal/voice disorders among pediatricians may explain the reduced otolaryngology referral. Similar to prior reports, even after adjusting for diagnosis and

comorbidity, men had a greater HR for otolaryngology referral than women.¹¹ While women have more office visits than men, a bias among practitioners to regard medical problems among men as more serious may foster more frequent referral.¹⁷ Geographic variation with an increased HR for otolaryngology referral for patients in an MSA may reflect access to an otolaryngologist (Table IV). Additionally, type of PCP, patient preference, and PCP training may influence otolaryngology referral decisions and require further investigation.¹⁸

Ongoing educational collaborations between otolaryngologists and PCPs are essential for fostering appropriate and expeditious patient referrals. Roughly two-thirds of PCPs have stated they wanted more information regarding voice disorders.¹⁰ Although laryngeal/voice disorders were not included, referral guidelines regarding otolaryngologic disorders improved the ratio of appropriate to unnecessary referrals, earlier referrals, and improved patient satisfaction.¹⁹ The Clinical Practice Guideline on Hoarseness/Dysphonia described the need for laryngeal examination or referral for such examination by a maximum of 3 months in patients with unresolving hoarseness/dysphonia.²⁰ This safety net of 3 months could allow for patients with serious laryngeal pathology to have delayed diagnosis and thus treatment. In fact, as previously noted, our time to seeing an otolaryngologist varied from < 1 month to > 3 months, and patients with PCP diagnosed laryngeal cancer and multiple comorbidities had an increased time to otolaryngology evaluation compared to those with acute laryngitis and no comorbidities, respectively. In addition to reexamining the appropriate time for otolaryngology referral, further PCP education regarding the risk factors for and negative QOL impact of laryngeal/voice disorders including populations at risk for life threatening and functionally impairing laryngeal pathology are important.

Certain methodological issues must be addressed. The accuracy of ICD-9 coding could not be confirmed. However, as discussed, inherent uncertainty exists in PCP driven laryngeal diagnoses which may influence otolaryngology referral decisions. By evaluating the last PCP laryngeal diagnosis, the PCPs' thought process prior to the referral was evaluated. Patients who saw more than one otolaryngologist could not be specifically identified. Potentially, an otolaryngologist may have coded a visit as a new patient instead of a consult which could impact our PCP and self-referred counts. Direct measures of disease severity and ethnicity were not available. Since patients had Medicare and commercial employee-sponsored plans, results may not be generalizable to the Medicaid population. Despite these limitations of database research, the MarketScan[®] database has been similarly used to examine health care provider referral patterns.²¹ While the appropriateness of otolaryngology referral decisions cannot be assessed, this study provides insights regarding the nature of PCP to otolaryngology referral for patients with laryngeal/voice disorders.

Conclusions

Roughly 10% of patients evaluated as an outpatient by a PCP with a laryngeal/voice disorder were referred to an otolaryngologist. Older patients and males had greater HRs for otolaryngology referral. Geographic variation was noted with an increased HR for otolaryngology referral for patients living in a MSA. Laryngeal diagnosis and comorbid conditions also influenced otolaryngology referral. PCP versus self-referred patients had a quicker time to otolaryngology evaluation. Futures studies should examine how the time to otolaryngology evaluation affects health care utilization and costs and how laryngeal diagnosis changes upon otolaryngology referral.

Acknowledgments

This study was funded by the American Academy of Otolaryngology – Head & Neck Surgery and supported in part by funding from the National Institutes of Health grant 1K11CA156723 (JK).

References

1. Cohen SM, Kim J, Roy N, Asche C, Courey M. Prevalence and causes of dysphonia in a large treatment-seeking population. *Laryngoscope*. 2012; 122:343–348. [PubMed: 22271658]
2. Rosen CA, Anderson D, Murry T. Evaluating hoarseness: keeping your patient's voice health. *Am Fam Physician*. 1998; 57:2775–2782. [PubMed: 9636340]
3. Maragos NE. Vocal abnormalities: what listening can tell you. *Postgrad Med*. 1984; 76:25–34. [PubMed: 6473223]
4. Cohen SM. Self-reported impact of dysphonia in a primary care population: an epidemiological study. *Laryngoscope*. 2010; 120:2022–2032. [PubMed: 20830762]
5. Cohen SM, Dupont WD, Courey MS. Quality of life impact of non-neoplastic voice disorders: a meta-analysis. *Ann Otol Rhinol Laryngol*. 2006; 115:128–134. [PubMed: 16514796]
6. Cohen SM, Kim J, Roy N, Asche C, Courey M. Direct health care costs of laryngeal diseases and disorders. *Laryngoscope*. 2012; 122:1582–1588. [PubMed: 22544473]
7. Cohen SM, Kim J, Roy N, Asche C, Courey M. The impact of laryngeal disorders on work-related dysfunction. *Laryngoscope*. 2012; 122:1589–1594. [PubMed: 22549455]
8. Grumbach K, Selby JV, Damberg C, et al. Resolving the gatekeeper conundrum: what patients value in primary care and referrals to specialists. *JAMA*. 1999; 281:261–266. [PubMed: 9918482]
9. Forrest CB, Nutting PA, Starfield B, von Schrader S. Family physicians' referral decisions: results from the ASPN referral study. *J Fam Pract*. 2002; 51:215–222. [PubMed: 11978231]
10. Turley R, Cohen SM. Primary care approach to dysphonia. *Otolaryngol Head Neck Surg*. 2010; 142:310–314. [PubMed: 20172372]
11. Paul BC, Branski RC, Amin MR. Diagnosis and management of new-onset hoarseness: a survey of the American Broncho-Esophagological Association. *Ann Otol Rhinol Laryngol*. 2012; 121:629–634. [PubMed: 23130535]
12. Forrest CB, Reid RJ. Prevalence of health problems and primary care physicians' specialty referral decisions. *J Fam Pract*. 2001; 50:427–432. [PubMed: 11350708]
13. Paul BC, Chen S, Sridharan S, Fang Y, Amin MR, Branski RC. Diagnostic accuracy of history, laryngoscopy, and stroboscopy. *Laryngoscope*. 2012; 123:215–219. [PubMed: 23070976]
14. Talamo R, Bosetti C, La Vecchia C, et al. Combined effect of tobacco and alcohol on laryngeal cancer risk: a case-control study. *Cancer Causes Control*. 2002; 13:957–964. [PubMed: 12588092]
15. Byeon, Lee Y. Laryngeal pathologies in older Korean adults and their association with smoking and alcohol consumption. *Laryngoscope*. 2013; 123:429–433. [PubMed: 22991190]
16. Roy N, Merrill RM, Thibeault S, Gray SD, Smith EM. Voice disorders in teachers and the general population : effects on work performance, attendance, and future career choices. *J Speech Lang Hear Res*. 2004; 47:542–551. [PubMed: 15212567]
17. Bertakis K, Azari R, Helms LJ, Callahan EJ, Robbins JA. Gender Differences in the Utilization of Health Care Services. *J Fam Pract*. 2000; 49(2):147–152. [PubMed: 10718692]
18. Franks P, Williams GC, Zwanziger J, Mooney C, Sorbero M. Why do physicians vary so widely in their referral rates? *J Gen Intern Med*. 2000; 15:163–168. [PubMed: 10718896]
19. Benninger, Ms; King, F.; Nichols, RD. Management guidelines for improvement of otolaryngology referrals from primary care physicians. *Otolaryngol Head Neck Surg*. 113:446–452. [PubMed: 7567019]
20. Schwartz SR, Cohen SM, Dailey SH, et al. Clinical practice guideline: hoarseness (dysphonia). *Otolaryngol Head Neck Surg*. 2009; 141:S1–S31. [PubMed: 19729111]
21. Sanyal A, Poklepovic A, Moyneur E, Barghout V. Population-based risk factors and resource utilization for HCC: U.S. perspective. *Cur Med Res Opin*. 2010; 26:2183–2191.

Table I

ICD-9 code groupings.

Category	CPT Codes
Vocal fold paralysis	478.30, 478.32
Bilateral vocal fold paralysis	478.34
Vocal fold paresis	478.31, 478.33
Non-specific 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
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
Laryngeal spasm	478.75
Late effect cerebrovascular disease, other speech deficits	438.10, 438.19

Table II

Characteristics of patient with laryngeal disorders treated by primary care physician (PCP) only, PCP referred to an otolaryngologist, or self-referred to an otolaryngologist.

Variable	PCP only	PCP referred	Self-referred	p-value
Age at first diagnosis				< 0.001
<18	17.1%	7.2%	4.6%	
18–35	16.7%	10.6%	10.6%	
36–64	51.7%	60.2%	57.0%	
> 65	14.5%	21.9%	27.8%	
Gender				< 0.001
Male	32.0%	38.5%	41.3%	
Female	68.0%	61.5%	58.7%	
Geographic location				< 0.001
Northeast	9.7%	10.0%	9.0%	
North Central	23.4%	26.8%	33.9%	
South	45.9%	44.8%	41.2%	
West	20.1%	17.9%	15.4%	
Live in Metropolitan Statistical Area				0.6
Yes	82.6%	83.0%	83.0%	
No	17.4%	17.0%	17.0%	
Mean (SD) number of PCP visits	1.3 (1.7)	1.1 (0.5)	1.3 (1.9)	0.017
Mean (SD) number of PCP given laryngeal diagnoses	1.0 (0.3)	1.1 (0.3)	1.1 (0.4)	< 0.001
Laryngeal disorder				< 0.001
Unilateral vocal fold paralysis	0.66%	0.60%	1.96%	
Bilateral vocal fold paralysis	0.02%	0.02%	0.21%	
Vocal fold paresis	0.15%	0.12%	0.34%	
Non-specific dysphonia	16.49%	53.92%	40.93%	
Acute laryngitis	70.08%	34.82%	34.0%	
Benign laryngeal/vocal fold pathology	3.62%	2.21%	5.52%	
Other larynx/vagus	0.25%	0.03%	0.10%	
Chronic laryngitis	3.99%	3.99%	5.31%	
Laryngeal cancer	1.22%	0.7%	7.25%	
Laryngeal spasm	2.07%	1.01%	1.52%	
Late effect cerebrovascular disease, other speech deficits	0.71%	0.05%	0%	
Multiple diagnoses	0.75%	2.53%	2.85%	
Comorbidity				< 0.001
None	61.38%	57.38%	53.15%	
Sinusitis	1.92%	1.21%	2.15%	
Asthma	0.58%	0.68%	0.65%	
Chronic obstructive pulmonary disease	1.89%	1.40%	1.73%	

Variable	PCP only	PCP referred	Self-referred	p-value
Gastro-esophageal reflux	5.10%	13.95%	14.11%	
Acute pharyngitis	9.97%	5.62%	5.84%	
Acute bronchitis	6.70%	4.67%	4.11%	
Acute upper respiratory infection	0.25%	0.23%	0.24%	
Pneumonia	1.19%	1.33%	1.52%	
Allergic rhinitis	3.7%	5.3%		

* P- value is based on multiple comparisons.

Table III

Time from first primary care physician (PCP) outpatient encounter to first otolaryngology outpatient encounter among patients referred by PCP and self-referred to an otolaryngologist.

Time from PCP to otolaryngology outpatient visit	PCP referred	Self-referred
1 month	71.5%	49.3%
> 1 month 2 months	14.5%	14.7%
> 2 months 3 months	3.9%	7.8%
> 3 months	10.1%	28.2%

Table IV

Adjusted Cox regression for otolaryngology referral. N=145,985

Covariate	Hazard Ratio (HR)	95% Confidence Interval	p-value
Age			
< 18	0.46	0.42 – 0.51	< 0.001
18–35	0.80	0.74 – 0.87	< 0.001
36–64	1.11	1.05 – 1.17	< 0.001
> 65	reference		
Gender			< 0.001
Male	reference		
Female	0.78	0.74 – 0.81	< 0.001
Geographic region			
South	reference		
Northeast	0.98	0.91 – 1.05	0.5
North central	1.16	1.10 – 1.22	< 0.001
West	0.67	0.63 – 0.71	< 0.001
Metropolitan statistical area			< 0.001
Yes	1.10	1.05 – 1.17	< 0.001
No	reference		
# of PCP outpatient visits	0.88	0.86 – 0.91	< 0.001
# of PCP given laryngeal diagnoses	0.99	0.90 – 1.10	0.9
Laryngeal disorder			
Late effect cerebrovascular disease, other speech deficits	0.03	0.01 – 0.13	< 0.001
Unilateral vocal fold paralysis	1.25	0.93 – 1.68	0.14
Bilateral vocal fold paralysis	3.02	1.40 – 6.53	0.005
Vocal fold paresis	1.08	0.66 – 1.76	0.8
Non-specific dysphonia	1.98	1.58 – 2.49	< 0.001
Acute laryngitis	0.43	0.34 – 0.54	< 0.001
Benign laryngeal/vocal fold pathology	0.68	0.53 – 0.87	0.002
Other larynx/vagus	0.16	0.07 – 0.40	< 0.001
Chronic laryngitis	0.71	0.55 – 0.90	0.005
Laryngeal cancer	1.94	1.50 – 2.50	< 0.001
Laryngeal spasm	0.56	0.42 – 0.75	< 0.001
Multiple diagnoses	reference		
Comorbid condition			
None	reference		
Sinusitis	0.92	0.78 – 1.08	0.3
Asthma	1.22	0.95 – 1.58	0.1
Chronic obstructive pulmonary disease	0.96	0.81 – 1.13	0.6

Covariate	Hazard Ratio (HR)	95% Confidence Interval	p-value
Gastro-esophageal disease	1.84	1.72 – 1.95	< 0.001
Acute pharyngitis	0.92	0.84 – 1.01	0.06
Acute bronchitis	0.84	0.76 – 0.93	0.001
Acute upper respiratory infection	1.28	0.85 – 1.92	0.2
Pneumonia	1.02	0.86 – 1.22	0.8
Allergic rhinitis	1.20	1.03 – 1.40	0.02
Multiple	1.50	1.40 – 1.60	< 0.001

Table V

Generalized linear regression for patients who had an otolaryngology referral. N=9833

Covariate	Coefficient*	95% Confidence Interval	p-value
Age			
< 18	-5.4	-10.9 to 0.1	0.05
18-35	-6.8	-11.2 to -2.3	0.003
36-64	-9.5	-12.9 to -6.0	< 0.001
> 65	reference		
Gender			
Male	reference		
Female	2.0	-0.8 to 4.7	0.2
Geographic region			
South	reference		
Northeast	-1.0	-5.6 to 3.6	0.7
North central	2.0	-1.2 to 2.3	0.2
West	-0.6	-4.5 to 3.3	0.8
Metropolitan statistical area			
Yes	-2.1	-5.7 to 1.5	0.3
No	reference		
# of PCP outpatient visits	15.7	12.9 to 18.4	< 0.001
# of PCP given laryngeal diagnoses	16.7	9.9 to 23.5	< 0.001
Laryngeal disorder			
Late effect cerebrovascular disease, other speech deficits	60.9	-151.6 to 273.4	0.6
Unilateral vocal fold paralysis	102.5	46.1 to 158.8	< 0.001
Bilateral vocal fold paralysis	57.7	-48.8 to 164.2	0.3
Vocal fold paresis	37.2	-18.6 to 93.0	0.2
Non-specific dysphonia	25.4	12.2 to 38.6	< 0.001
Acute laryngitis	42.6	25.2 to 59.9	< 0.001
Benign laryngeal/vocal fold pathology	58.3	27.6 to 89.0	< 0.001
Other larynx/vagus	45.8	-43.4 to 134.9	0.3
Chronic laryngitis	47.7	20.8 to 74.6	0.001
Laryngeal cancer	122.4	71.1 to 173.8	< 0.001
Laryngeal spasm	54.4	17.1 to 91.7	0.004
Multiple diagnoses	reference		
Comorbid condition			
None	reference		
Sinusitis	4.5	-7.0 to 16.0	0.4
Asthma	7.6	-10.9 to 26.2	0.4
Chronic obstructive pulmonary disease	8.7	-3.9 to 21.3	0.2
Gastro-esophageal disease	5.6	1.3 to 10.0	0.01

Covariate	Coefficient*	95% Confidence Interval	p-value
Acute pharyngitis	9.0	2.1 to 15.9	0.01
Acute bronchitis	11.5	3.5 to 19.4	0.005
Acute upper respiratory infection	0.7	−26.6 to 28.1	0.9
Pneumonia	3.9	−8.1 to 15.8	0.5
Allergic rhinitis	10.6	−1.7 to 22.9	0.09
Multiple	16.0	10.8 to 21.2	< 0.001

* Coefficient is relative days increase or decrease in time from first primary care physician outpatient visit to first outpatient otolaryngology visit compared to the within category referent group.