

Epidemiology of Voice Disorders in the Elderly: Preliminary Findings

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Objectives: Epidemiologic studies of the prevalence and risk factors of voice disorders in the elderly, nontreatment seeking population are nonexistent. The purpose of this preliminary investigation was to 1) estimate the prevalence of voice disorders, 2) identify variables associated with increased risk of voice disorders, and 3) measure the socioemotional impact of voice disorders on the elderly who live independently. **Study Design:** Prospective, cross-sectional survey. **Methods:** One hundred seventeen seniors (39 males and 78 females; mean age, 76.1 yr; SD, 8.5 yr; range, 65–94 yr), residing in Utah and Kentucky, were interviewed using a questionnaire that addressed three areas related to voice disorders: prevalence, potential risk factors, and socioemotional consequences/effects. **Results:** The lifetime prevalence of a voice disorder was 47%, with 29.1% of participants reporting a current voice disorder. The majority of respondents (60%) reported chronic voice problems persisting for at least 4 weeks. Seniors who had experienced esophageal reflux, severe neck/back injury, and chronic pain were at increased risk. Voice-related effort and discomfort, combined with increased anxiety and frustration and the need to repeat oneself, were specific areas that adversely affected quality of life. **Conclusions:** This preliminary epidemiologic study confirmed that voice disorders are common among the elderly, and further research is needed to identify additional risk factors contributing to voice disorder vulnerability. **Key Words:** Voice disorders, prevalence, risks, quality of life.

Laryngoscope, 117:●●●–●●●, 2007

INTRODUCTION

Epidemiologic studies of the prevalence, risk factors, and socioemotional impact of disordered voice in the el-

derly are rare. Studies of the epidemiology of voice problems in the 65+ population have been restricted solely to investigations of treatment-seeking populations,^{1–4} and no data exist estimating the true prevalence of voice disorders in the general elderly population. Although age-related changes in pitch, pitch range, loudness, and quality^{5–7} can alter quality of life and limit social interaction in the elderly,^{8,9} older adults may also be at increased risk for disordered voice because of possible alteration of voice use patterns, the presence of vocal fold lesions (e.g., carcinoma, Reinke's edema, and paralysis), development of systemic diseases known to be associated with alterations in laryngeal function and voice production (e.g., stroke, respiratory disease, and arthritis), and degenerative changes in the structure and function of the vocal fold mucosa, musculature, and peripheral nerve supply.¹⁰ Regrettably, however, the actual prevalence of voice disorders in this population is not known, and risk factors as well as consequences of voice disorders have not been delineated. Thus, the purpose of this study was to provide preliminary evidence of the epidemiology of voice disorders in a group of nontreatment seeking individuals over age 65. Information related to the prevalence of self-reported voice concerns, key risk factors, and the socioemotional impact of voice disorders is presented.

METHODS

Sampling Procedures

Data related to voice disorders were acquired during face-to-face interviews of elderly individuals (65+) in Utah and Kentucky who were recruited through senior citizen centers or personal contacts. After university and state institutional review board approval, a total of 16 senior centers in the Salt Lake City, UT and in the Lexington, KY areas agreed to permit recruitment of participants. Recruitment advertisements were posted, and research assistants visited senior centers periodically to recruit and schedule eligible participants. Seniors were eligible to participate if they were 1) living independently (i.e., not living in a residential facility such as an assisted living or skilled nursing facility), 2) free of dementia, as assessed by the MiniCog,¹¹ a brief screening test of cognitive performance with proven psychometric properties (i.e., pass cutoff score [$>$ or = 3 of 5 points]), and 3) had no significant hearing loss sufficient to interfere with completion of the oral questionnaire. In both states, all participants were interviewed by the investigators or research assistants trained in

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Editor's Note: This Manuscript was accepted for publication December 1, 2006.

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DOI: 10.1097/MLG.0b013e3180306da1

the administration of the questionnaire. The interview took each participant approximately 50 minutes to complete.

Description of the Interview/Questionnaire

The survey instrument was developed from a model instrument used in a series of previously published voice prevalence studies aimed at a variety of nonelderly populations (<65).¹²⁻¹⁴ The original instrument was modified and extended for use with the elderly. The survey tool evaluated both current and past problems in the area of voice. To allow for conclusions related to risk factors, protective factors, familial trends, and functional impact, the survey probed the domains of voice history (symptoms and signs, voice use practices and patterns), medical history, psychosocial history, occupational history, and social/lifestyle history. Voice disorders and their prevalence were defined on the basis of the responses elicited from the interviewee regarding voice symptoms or voice disorders. For the purpose of this study, we considered a voice disorder to be any time the voice did not work, perform, or sound as it normally should so that it interfered with communication.

Statistical Analyses

The prevalence of ever having had a voice disorder and selected voice activities, voice symptoms, general health conditions, and diet, tobacco, and alcohol were evaluated using contingency tables, analysis of variance, and logistic regression. Bivariate analyses of associations were evaluated for statistical significance using the chi-square and *t* test. Multiple logistic regression allowed us to estimate odds ratios (ORs) and corresponding confidence intervals (CIs). Note that ORs can range from 0 to infinity. An OR less than 1 indicates a negative association, an OR equal to 1 indicates no association, and an OR more than 1 indicates a positive association between two variables. If both the lower and upper limits of the CI are less than 1, there is a significant negative association, whereas if both the lower and upper limits of the CI are greater than 1, there is a significant positive association. Two-tailed tests of significance and CIs were based on the .05 level.

RESULTS

Demographic Characteristics and Voice Disorders

Participants ranged in age from 65 to 94 (mean, 76.1; SD, 8.5) years. The distribution of participants according to age category is shown in Figure 1. There were 33.3% (n = 39) males, 66.7% (n = 78) females; 12.0% (n = 14)

with less than a high school education, 41.0% (n = 48) with a high school degree, 15.4% (n = 18) with an associate degree, 16.2% (n = 19) with a college degree, and 15.4% (n = 18) with a masters degree; 96.6% (n = 113) were white, nonHispanic; 34.6% (n = 37) with income less than 20 K, 41.1% (n = 44) with income 20 K to less than 40 K, 12.2% (n = 13) with income 40 K to less than 60 K, and 12.2% (n = 13) with income more than 60 K; 56.4% (n = 66) from Utah and 43.4% (n = 51) from Kentucky. The percentage with a family history of voice problems was 8.6% (n = 10). The percentage of individuals who had ever experienced a voice disorder was not significantly different among age groups, education levels, income levels, or between sexes, racial groups, survey sites, or according to whether there was a family history of voice problems.

With use of a stepwise procedure with logistic regression, ever having had a voice disorder (yes vs. no) was regressed on sex, age, race, income, education, family history, and site. The selected entry and exit level of significance was .2. None of these variables entered the model.

Prevalence of Voice Disorders

Voice disorders, defined as any time the voice does not work, perform, or sound as it normally should, or interferes with communication, occurred in 47.0% (n = 55) of the participants during their lifetime, with 29.1% (n = 34) indicating that they currently have a voice disorder. Of the participants having experienced a voice disorder, 43.6% (n = 24) said the voice problem began suddenly; 60.0% (n = 33) reported chronic problems (i.e., duration at least 4 wk); and 40% (n = 22) were acute (i.e., duration <4 wk). There were 14.6% (n = 8) who had previously sought professional help to improve their voice, with 75% seeing a physician only, 12.5% seeing a speech pathologist and a physician, and 12.5% seeing a singing teacher. Half of those people seeking professional help indicated that the assistance they received contributed to voice improvement.

Voice Symptoms and Signs

To assess the association of specific voice symptoms or signs and the occurrence of voice disorders, participants were asked to report whether they had experienced any of a variety of commonly reported voice-related problems. The results are displayed in Table I. As expected, those respondents with a voice disorder history reported many more voice-related signs and symptoms. It is interesting to note, however, that several complaints such as loss of singing range, chronic sore throat, monotone voice, wet/gurgly voice, and bitter or acid taste did not distinguish those respondents with voice disorders from those without. With use of a stepwise procedure with logistic regression, ever having had a voice disorder (yes vs. no) is regressed on those variables in the table involving symptoms. The selected entry and exit level of significance was .2. The final model included discomfort while using your voice (OR, 4.2; 95% CI, 1.3-14.1), trouble speaking or singing softly (OR, 6.1; 1.8-21.1), and talking requires effort (OR, 10.1; 2.0-50.3).

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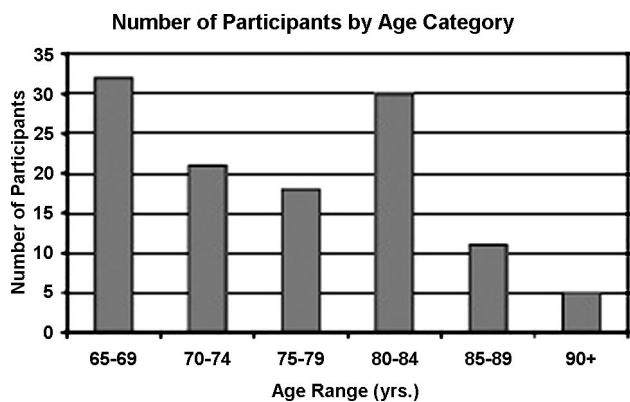


Fig. 1. Distribution of participants surveyed according to age range/category.

TABLE I.

Frequency of Specific Voice Signs and Symptoms According to Whether a Voice Disorder Had Been Previously Identified.

Symptoms	Voice Disorder (%)	No Voice Disorder (%)	χ^2 P Value
Hoarseness	43 (78.2)	35 (56.4)	.0128
Voice tires or changes quality	22 (40.0)	8 (12.9)	.0008
Trouble speaking or singing softly	18 (32.7)	5 (8.1)	.0008
Difficulty projecting	17 (30.9)	6 (9.7)	.0039
Loss of singing range	24 (43.6)	25 (40.3)	.7169
Discomfort using voice	24 (43.6)	4 (6.4)	<.0001
Monotone voice	1 (1.8)	1 (1.6)	.9319
Effort to talk	20 (36.4)	2 (3.2)	<.0001
Chronic dryness of throat	22 (40.0)	15 (24.2)	.0665
Wet, gurgley voice quality	3 (5.4)	2 (3.2)	.5519
Chronic sore throat	4 (7.3)	2 (3.2)	.3219
Frequently clear throat	34 (61.8)	27 (43.6)	.0483
Bitter or acid taste	17 (30.9)	12 (19.4)	.1485
Wobbly or shaky voice	10 (18.2)	2 (3.2)	.0078
Breathy voice	6 (10.9)	0 (0.0)	.0076

Voice Use Patterns and Voice Disorders

To assess the association between specific voice use patterns and the occurrence of voice disorders, participants were asked to report the frequency of specific vocal behaviors (1 = never and 4 = often) during an average day. Mean frequencies for the selected voice activities are shown in Table II according to whether a voice disorder had ever been experienced. Inspection of Table II reveals that voice use patterns and activities did not distinguish those with or without a history of voice disorders. Interestingly, throat clearing behavior was more frequent in those with voice disorders; however, this did not reach significance ($P = .12$).

General Health and Voice Disorders

Frequencies (0 = never to 3 = at least 3 times) of specific acute upper respiratory conditions occurring, on average per year, are presented in Table III. Mean frequencies for the selected illnesses are also shown according to whether a voice disorder had ever been experienced (i.e., lifetime prevalence). Significantly higher mean frequencies for colds and sore throats were observed among those having experienced a voice disorder.

Percentage of those having experienced a voice disorder according to whether a selected health condition was experienced are presented in Table IV. Individuals who had experienced esophageal reflux, severe neck/back injury, and chronic pain were at increased risk of having experienced a voice disorder. Medical conditions, which approached significance (i.e., all P values $<.15$), and might be considered possible risk factors included arthritis, thyroid problems, bronchitis, and sleep disorder. With use of the stepwise procedure with logistic regression, ever having had a voice disorder (yes vs. no) was regressed on the variables shown in Table IV. The selected entry and exit level of significance was .2. Only esophageal reflux entered and remained in the model (OR, 3.1; 1.5–6.9). As an aside, taking estrogen replacement therapy was not significantly associated with having ever had a voice disorder. Also, among those who have taken estrogen replacement therapy, there was no association between time taking replacement therapy and having ever had a voice disorder.

Lifestyle and Voice Disorders

To assess the association between lifestyle factors and voice disorders, respondents were surveyed regarding diet, activity levels, interpersonal styles, and tobacco and alcohol consumption. There were no statistical associations between ever having had a voice disorder and frequency of use of coffee, tea, colas, chocolate, dairy products, mint products, acidic foods, or spicy foods. The responses were also added for each of these items. The average response did not significantly differ between those ever having had a voice disorder and those who have not ever had a voice disorder. Similarly, frequency of exercise, self assessments of overall health (excellent, good,

TABLE II.

Frequency of Selected Voice Activities During an Average Day and Mean Level of Voice Activities According to Whether a Voice Disorder Had Been Previously Identified.

Activity	Relative Frequency on Average per Day				Mean		t Statistic P Value
	Never (1)	Rarely (2)	Occasionally (3)	Often (4)	Voice Disorder, n = 55	No Voice Disorder, n = 62	
Talk	0	0	18.0	82.0	3.80	3.83	.5898
Talk quietly	14.5	16.2	29.1	40.2	2.96	2.94	.8881
Whisper	45.3	40.2	12.0	2.6	1.70	1.72	.9079
Talk loudly	16.2	28.2	28.2	27.4	2.60	2.72	.5203
Sing	24.8	26.5	25.6	23.1	2.40	2.53	.5198
Shout, yell, or cheer	35.9	44.4	14.5	5.1	1.87	1.90	.8453
Clear your throat	22.2	27.4	24.8	25.6	2.71	2.39	.1154
Cough	23.1	35.0	29.9	12.0	2.38	2.24	.4339

TABLE III.

Frequency of Selected Acute Health Conditions and Mean Level of These Conditions According to Whether a Voice Disorder Had Been Previously Identified.

Acute Conditions	Relative Frequency on Average per Year				Mean		t Statistic P Value
	Never	1	2	3+	Voice Disorder, n = 55	No Voice Disorder, n = 62	
Colds	21.4	30.8	40.2	7.7	1.6 (0.8)	1.1 (0.9)	.0116
Sinus infections	62.1	17.2	11.2	9.5	0.8 (1.1)	0.6 (0.9)	.1657
Sore throats	50.9	24.1	14.7	10.3	1.2 (1.1)	0.6 (0.9)	.0012

fair, poor), talkativeness (quiet vs. talkative), well-being (happy vs. sad; easy-going vs. worrier) did not reveal any significant differences between those participants with a history of voice problems versus those who did not. However, 83% of participants who described themselves as "inactive" reported a history of voice disorders, as compared with only 43% of those who described themselves as "active" ($P = .007$).

The percentage of seniors who had ever used any tobacco products for a year or longer was 32.8% ($n = 38$). Interestingly, of those with a history of tobacco use, only 34.2% had ever experienced a voice disorder as compared with 52.6% for those without a history of tobacco use ($\chi^2(1) = 3.46, P = .0629$). The percentage with a current voice problem among these two groups was 34.6% and

18.4%, respectively ($\chi^2(1) = 3.23, P = .0721$). The mean duration of tobacco use was significantly lower for those having ever had a voice disorder (mean, 21.2; SD, 12.1 vs. mean, 32.3; SD, 12.2; $t(36) = 2.22, P = .0328$). The mean duration of tobacco use is also significantly lower for those with a current voice problem (mean, 17.8; SD, 9.1 vs. mean, 30.9, SD, 15.5, $t(36) = 2.13, P = .0399$).

The percentage of participants who at any time in their life drank an average of one or more alcoholic beverages a week was 38.5% ($n = 45$). There was no significant association between having drunk an average of one or more alcoholic beverages a week in their life and ever having experienced a voice disorder. For those who currently consume alcohol, the mean average number of drinks per week is 4.4 (SD, 4.8) for those ever having had a voice disorder compared with 4.5 (SD, 3.6) for those never having experienced a voice disorder. For those with a history of alcohol consumption who are not current drinkers, the mean average number of drinks per week was 19.1 (SD, 17.5) for those ever having had a voice disorder compared with 7.3 (SD, 6.2) for those never having had a voice disorder ($t(10.4) = -2.04, P = .0669$), using the Satterthwaite method for unequal variances).

TABLE IV.

Frequency of Specific Medical Conditions (ever had) According to Whether a Voice Disorder Had Been Previously Identified.

Medical Condition	Voice Disorder, n = 55 (%)	No Voice Disorder, n = 62 (%)	χ^2 P Value
Arthritis	39 (70.9)	35 (56.4)	.1055
Immune disorder	3 (5.4)	3 (4.8)	.8802
Heart disease	21 (38.2%)	20 (32.3)	.5027
Hypertension	37 (67.3)	40 (64.5)	.7537
Circulatory problems	16 (29.1)	12 (19.4)	.2180
Kidney problems	5 (9.3)	8 (12.9)	.5349
Thyroid problems	18 (32.7)	13 (21.0)	.1503
Stomach or duodenal ulcers	11 (20.0)	10 (16.1)	.5861
Esophageal reflux	32 (58.2)	19 (30.6)	.0027
Stroke	8 (14.6)	6 (9.7)	.4181
Respiratory allergies	11 (20.0)	12 (19.4)	.9302
Pneumonia	26 (47.3)	31 (50.0)	.7683
Emphysema	2 (3.6)	2 (3.2)	.9029
Chronic obstructive pulmonary disease	3 (5.4)	2 (3.2)	.5519
Bronchitis	21 (38.2)	16 (25.8)	.1508
Asthma	7 (12.7)	6 (9.7)	.6003
Severe neck, back, or head injury	15 (27.3)	7 (11.3)	.0272
Chronic pain	26 (47.3)	18 (29.0)	.0421
Cancer	15 (27.3)	14 (23.0)	.5914
Depression or anxiety	20 (36.4)	16 (25.8)	0.2169
Sleep disorder	13 (23.6)	7 (11.3)	.0766

Voice Disorders and Voice-Related Quality of Life

To assess the functional impact of a current voice disorder on the elderly, the Voice-Related Quality of Life (V-RQOL) instrument was also administered as part of the interview.¹⁵ The V-RQOL is a 10-item, psychometrically validated self-report instrument that is designed to assess the functional impact of a voice disorder over the previous 2 week period. Severity ratings are assigned for each question, with 1 = "None, not a problem" to 5 = "As bad as it can be." Table V compares seniors who reported a current voice disorder against those who did not for each question. For all questions the seniors with voice disorders reported significantly more voice-related effects. Interestingly, however, these voice problems did not necessarily lead to avoidance of social activities. The scores of participants were also summed across the items listed in the table. The mean score for those with a current voice disorder was 14.6 (SD, 5.5) and for those without a voice disorder was 10.1 (SD, 3.2). The means were significantly different ($t(42.4) = -4.48, P < .0001$, with the Satterthwaite method used because of unequal variances).

With use of the stepwise procedure with logistic regression, a current voice disorder (yes vs. no) is regressed

TABLE V.
Mean Ratings for Items From the Voice-Related Quality of Life (V-RQOL) According to Whether There Is a Current Voice Disorder.

Problems with Voice	Relative Frequency on Average Over Past 2 Weeks				Mean		t Statistic P Value
	None (1)	Small Amount (2)	Moderate Amount (3)	Frequent (4)	Current Voice Disorder, n = 34	No Current Voice Disorder, n = 83	
Difficulty speaking loudly/heard in noise	44.1	23.5	5.9	26.5	2.1	1.2	.0002
Run out of air when talking	55.9	8.8	20.6	14.7	1.9	1.3	.0071
Unpredictable voice	64.7	14.7	5.9	14.7	1.7	1.1	.0070
Get anxious/frustrated	52.9	29.4	11.8	5.9	1.7	1.1	.0010
Get depressed	82.4	17.6	0	0	1.2	1.0	.0493
Trouble using telephone	70.6	8.8	11.8	8.8	1.9	1.1	.0038
Avoid social activities	94.1	2.9	2.9	0	1.2	1.1	.4589
Need to repeat yourself	35.3	44.1	11.8	8.8	1.9	1.1	<.0001
Less outgoing	82.4	8.8	5.9	2.9	1.3	1.1	.1212

on the variables shown in Table V. The selected entry and exit level of significance was .2. Two variables entered into the model: getting anxious or frustrated because of your voice (yes vs. no) (OR, 6.1; 1.2–32.0) and having to repeat yourself to be understood (yes vs. no) (OR, 10.5; 2.7–40.2).

DISCUSSION

Epidemiologic studies of voice disorders of nontreatment seeking elderly populations are nonexistent. In this regard, this preliminary investigation represents the first attempt to establish epidemiologic data of voice disorders in a nonclinical, elderly population. The results suggest that voice disorders are common among the elderly, with 29% of respondents reporting a current voice disorder, and almost half of all seniors reporting a previous history of voice problems. Although some of these voice disorders are likely related to acute and self-limiting infectious processes, the majority (60%) appear to be chronic and linked to certain predisposing factors and medical conditions, which increase vulnerability for experiencing a voice disorder. The results confirmed that “self-reported” esophageal reflux, recurrent upper respiratory infections, sore throats, severe neck/back injury, chronic pain, and low activity levels were associated with increased likelihood of reporting a previous voice disorder. However, what is striking from these data are the fact that other factors traditionally considered to be potential laryngeal irritants, such as frequent phonotraumatic behaviors (such as prolonged speaking, shouting, throat clearing, etc.), refluxogenic foods (e.g., caffeine, mint, spicy foods), as well as smoking and alcohol use were not independently associated with increased reporting of voice disorders. The findings regarding smoking and alcohol consumption replicate previous reports from a larger study of the general (nonelderly) population that failed to identify these factors as independent risk factors for voice disorder reporting.¹⁴ However, these preliminary results need to be confirmed with a larger, randomly selected sample of seniors. It may also be that any voice change purely associated with smoking or alcohol use may be either so gradual or subtle that it does not garner the attention/concern of the individual.

Another interesting finding is the apparent lack of increased frequency of voice disorders with increasing age. Age was not a significant risk factor in this cohort of elderly people. This may be explained in part by the uneven distribution of participants in each age stratum. In this preliminary investigation, we did not intentionally sample to create equal numbers of seniors in each age group. Although we sampled across the 65+ age spectrum, and our median age was 77 years, the number of “very old (i.e., 90+)” was under-represented. This is not to say that age is not an important factor influencing voice disorder reporting, however. To the contrary, in the largest epidemiologic study undertaken of voice disorders in the general population (<65), lifetime prevalence of a voice disorder was 29.9%, with only 6.6% of participants reporting a current voice disorder.¹⁴ By comparison, our prevalence estimates for the 65+ population clearly point to substantially higher rates for both lifetime (47%) and current voice disorders (29%). Thus, although age appears to be a general risk factor for reporting voice disorders, a larger epidemiologic study using stratified block sampling procedures is warranted to ensure more even distribution across age categories, including the very old.

Finally, as expected, the participants with a previous history of voice disorders reported a variety of voice-related complaints; however, the logistic regression analysis shed light on which factors appeared to contribute most to voice disorder reporting. Interestingly, rather than a perceptual change in voice quality (such as hoarseness, breathiness), physical sensations such as discomfort and increased effort associated with voice production appeared to be particularly relevant features among those with voice disorders. Specifically, ORs revealed that participants who reported voice disorders were 10 times more likely to report that talking required effort. Such increased effort and discomfort associated with voice production may help to explain some of the untoward effects on quality of life reported by those elderly with voice disorders. For instance, seniors with voice problems reported a wide array of undesirable voice effects on quality of life, but “getting anxious or frustrated because of their voice, and having to repeat themselves frequently” were

two specific areas that were particularly salient, as identified by the regression analysis. These two findings of increased effort and discomfort, combined with increased anxiety and frustration, and the frequent need to repeat are areas that adversely affect quality of life. To be successful, therefore, treatment programs will need to attend to these factors before any substantial gains in quality of life can be expected.

CONCLUSIONS

These preliminary results confirm that a large segment of the elderly population has experienced a past or present voice disorder, often chronic, with detrimental effects on quality of life. In the future, a larger sample of seniors should be surveyed to ensure equal representation across both age and sex strata and to assess additional risk factors that might contribute to voice disorder vulnerability. Until then, this study provides important preliminary evidence to support that voice disorders are common among the elderly and that these voice disorders negatively impact quality of life.

Acknowledgments

The authors gratefully acknowledge the contributions of Rebekah Barlow, Kassi Harris, and Camilya Siever, who served as research assistants on this project. The authors also acknowledge the contribution of Elaine Smith, PhD, University of Iowa, whose voice disorder questionnaire served as the basis for this study.

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AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES

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