

# Treatment Receipt and Outcomes of Self-Reported Voice Problems in the US Population Aged $\geq 65$ Years

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

## Abstract

**Objectives.** (1) Characterize the US population aged  $\geq 65$  years with self-reported voice problems, (2) describe voice treatment characteristics in this group, and (3) identify factors associated with self-reported voice improvement.

**Study Design.** Retrospective cohort study.

**Setting.** Population-based cross-sectional US national survey sample.

**Subjects and Methods.** We identified a cohort of adults aged  $\geq 65$  years from the 2012 National Health Interview Survey, a population-based US national survey. Descriptive and multivariable regression analyses were performed.

**Results.** The prevalence of self-reported voice problems in this cohort was 10%. Of those, 44% reported voice problems for  $>1$  month. The strongest predictor of reporting voice improvement was receipt of voice treatment (odds ratio, 3.50; 95% confidence interval, 1.36-9.00), after adjusting for sex, age, race, education, and health status. Eleven percent reported voice treatment, which included 20% of those with moderate or worse voice problem severity. Female sex and worse health status were associated with reporting voice treatment. Among those with voice treatment, 38% reported "better," 33% "same," and 29% "worse" voice symptoms over the past year, compared to 17%, 67%, and 16%, respectively, among those without treatment. Health status influenced likelihood of reporting voice improvement but not universally.

**Conclusions.** We observed a significant self-reported burden of voice problems in the US population aged  $\geq 65$  years. Most are untreated and thus not well represented in the current literature. Vocal improvement was strongly associated with treatment. Further investigation is needed to clarify patient and treatment characteristics most associated with vocal improvement.

## Keywords

voice, dysphonia, elderly, aging, population based

Received February 28, 2018; revised March 6, 2018; accepted April 10, 2018.

Voice problems have a prevalence of 5% to 29% in the elderly and increase with advancing age, consistent with known age-associated changes in laryngeal anatomy and physiology.<sup>1-4</sup> Communication disorders affect social interactions as well as other functions such as care utilization.<sup>5,6</sup> Voice problems in the elderly are associated with social withdrawal, depression symptoms, and a tendency to be resigned to having the problems as a result of aging.<sup>7,8</sup>

Voice problems in the elderly co-occur with other medical conditions, including hearing loss, neurological diseases, dysphagia, and polypharmacy,<sup>9</sup> suggesting that they may have unique needs in voice treatment. Treatment of voice problems in the elderly can be beneficial for both voice outcomes and voice-related quality of life.<sup>8,10-13</sup> Optimizing management of voice problems in this patient population has important quality-of-life and health implications. Most studies have focused on patients identified through specialized otolaryngology or voice clinics and do not include self-reported voice improvement. There is a need to understand the broader impact of voice problems and treatment among the elderly.

The National Health Interview Survey (NHIS) provides valuable information on health-related issues from the

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noninstitutionalized civilian general population in the United States.<sup>14</sup> In a study by Bhattacharyya<sup>15</sup> using NHIS data to establish a basic current prevalence of voice problems in US adults, 18 million adults (1 in 13) reported a recent voice problem, of whom 33% rated the problem at least moderate in severity. Older respondents were more likely to report a voice problem than younger respondents, with an increase of nearly 10% per decade.

The objectives of this study were to (1) describe the elderly population with voice problems in the NHIS, (2) describe characteristics of voice treatment in these respondents, and (3) identify factors associated with self-reported voice improvement both among this cohort of patients  $\geq 65$  years of age and among the subset of those reporting voice treatment.

## Methods

### Data Source

We used population-based cross-sectional survey data for adults in the United States in the NHIS and restricted the cohort to adults  $\geq 65$  years old. The 2012 NHIS included a supplement on adult voice, speech, and language disorders. The NHIS data were obtained from the Integrated Health Interview Series (IHIS), a publicly available web-based data resource containing NHIS data, and were integrated as previously described.<sup>14,16-18</sup> The unweighted sample size for this study was 6651 persons, representing a total weighted sample of 38,058,492. These publicly available de-identified data were exempt from institutional review board review.

### Measures

Responses to the question, “During the past 12 months, have you had any problems or difficulties with your voice?” identified NHIS respondents who reported having a voice problem or difficulties with voice in the past year. The temporal burden of voice problems was assessed using the question, “How many days in the past year did you have voice problems?” For analysis, duration responses were subdivided between  $<1$  month and  $>1$  month given the Clinical Practice Guideline on Dysphonia Update recommendation for further assessment for any voice problem persisting beyond 4 weeks.<sup>19</sup> The severity of voice problem was gathered from the following item: “During the past 12 months, how much of a problem did you have with your voice?” For changes in voice problems over time, we used the following item: “Compared to 12 months ago, would you say your voice problems are now better, worse, or about the same?” Responses to the item, “Have you received treatments, therapy, or other rehabilitation services for voice problems in the past 12 months?” were used to identify self-reported treatment. Patients who reported receiving a diagnosis for a voice problem that lasted a week or longer were asked, “What diagnoses or reasons were you told caused your voice problems?” They were presented with a list of potential diagnoses and asked to “enter all that apply.” The full list of potential diagnoses was published previously.<sup>15</sup>

Overall health status was assessed with the question, “Would you say your health in general is excellent, very good, good, fair, or poor?” A single-item perceived health scale has been shown to be valid<sup>20</sup> and predictive of mortality,<sup>21</sup> supporting its use as an indicator of health status when detailed comorbidity data are unavailable. Additional covariates were defined as previously described<sup>16</sup>; poverty levels were defined using the NHIS income variable, and responses were categorized as  $<100\%$  to  $199\%$  of the federal poverty level (FPL),  $200\%$  to  $399\%$  of the FPL, and  $\geq 400\%$  of the FPL.<sup>22,23</sup>

### Analytic Methods

We evaluated the distribution of sociodemographic and patient-reported factors among patients treated for voice problems. We then assessed the extent to which self-report of voice problems was associated with the improvement variable, controlling for age, sex, race, educational attainment, and overall health status using multivariable logistic regression. Voice problem duration and severity were not included in multivariable regression due to sampling patterns that did not evaluate these factors concurrently with the improvement variable. We assessed improvement in all patients reporting a voice problem and then specifically focused on patients who reported receiving voice treatment. All analyses were conducted with SAS version 9.3 (SAS Institute, Cary, North Carolina). Variance estimates were produced using Taylor series linearization (SAS/STAT User’s Guide Version 9.3; SAS Institute).

## Results

### Sociodemographic and Clinical Characteristics of Cohort

The cohort represented approximately 38 million US adults  $\geq 65$  years old. Nearly 10% of the cohort (3,726,349) reported a voice problem within the prior 12 months. Most sampled adults reporting a voice problem were female (62%) and white non-Hispanic (83%), and they had some college or completed college education (53%) (**Table 1**). The mean cohort age was 73 years (95% confidence interval [CI], 72.9-73.4). Overall self-reported health status was excellent/good for the majority of respondents (66%) with a voice problem. Thirteen percent described their voice problem as “no problem,” 52% as a “small problem,” and 35% as a “moderate/big problem.” Nearly one-third (32%) reported that their voice problem had been present for at least 3 months and 44% for at least 1 month.

The voice problem severity groups were then subdivided by overall health status. Among those reporting a moderate/big problem, 48% reported excellent/good overall health status, and 52% reported fair/poor health status. Among those reporting a small problem, those proportions were respectively 68% and 32%; among those reporting that their voice problem was “no problem,” those proportions were 81% and 19%. The most common self-reported diagnoses related to voice problems were “something else” (49%),

**Table 1.** Selected Characteristics of US Civilian, Noninstitutionalized Adults Aged  $\geq 65$  Years Reporting Voice Problem in the Past 12 Months, 2012 National Health Interview Survey.<sup>a</sup>

Characteristic	Voice Problem Past 12 Months?			P Value
	Yes (%)	No (%)	SE	
Sex				.001
Male	38	46	0.74	
Female	62	54	0.60	
Age categories				.44
65-74	53	59	0.85	
75+	47	41	0.62	
Race				.04
White non-Hispanic	83	79	0.66	
Black non-Hispanic	7	9	0.39	
Other	10	12	0.58	
Education level				.68
Less than high school and high school graduate	47	46	0.77	
Some college and college graduate	53	54	0.61	
Income level				.001
<100%-199% of FPL	23	24	0.68	
200%-399% of FPL	46	40	0.85	
$\geq 400\%$ of FPL	32	36	0.88	
Health status				.001
Fair/poor	34	19	0.38	
Good/excellent	66	81	0.24	
Severity of voice problem				
No problem	13	NA		
Small problem	52	NA		
Moderate/big problem	35	NA		
Duration of voice problem				
<1 month	56	NA		
1 month to 1 year	44	NA		
Total weighted sample	38,058,492	3,726,349	34,332,143	

Abbreviations: FPL, federal poverty level; SE, standard error; NA, not applicable.

<sup>a</sup>Total weighted sample = 38,058,492, 3,726,349, and 34,332,143. Note: Column percentages total 100% for each section of the table.

followed by vocal nodules/polyps (10%), allergies (9%), and gastroesophageal reflux (9%) (**Table 2**).

### Factors Associated with Self-Reported Voice Improvement in the Whole Cohort Aged $\geq 65$ Years

In response to the question “Compared to 12 months ago, would you say your voice problems are now better, worse, or about the same?” 20% indicated their voice problems were better, 17% worse, and 63% about the same. We then subdivided these responses by various patient characteristics (**Table 3**). Among all patients that reported having a voice problem, male sex, younger age (65-74 years old), and <1 month of a voice problem were associated with greater likelihood of reporting improvement.

Using multivariable logistic regression, we evaluated the effects of patient and sociodemographic characteristics on the odds of improvement (responding “better” to the question “Compared to 12 months ago, would you say your voice problems are now better, worse, or about the same?”) for voice problems in this cohort (**Table 4**). When

controlling for all other patient factors, respondents who reported their voice to be “better” were significantly more likely to report receiving treatment (odds ratio [OR], 3.50; 95% CI, 1.36-9.00) than those who did not report improvement. Other significant factors for improvement included younger age (65-74 years), higher education, and better health status.

### Characteristics of Voice Treatment

Of those reporting a voice problem, 11% reported receiving treatment. When subdivided by severity, 5% of those who considered their voice problem to be “no” or a “small” problem reported treatment; 20% of those with a “moderate/big” voice problem reported treatment. Using multivariable logistic regression, we evaluated the effects of patient and sociodemographic characteristics on the odds of receipt of treatment for voice problems among the cohort of US adults aged  $\geq 65$  years. Female sex and worse overall health status were associated with greater likelihood of reporting receipt of treatment (**Table 5**).

**Table 2.** Self-Reported Voice Problem Diagnosis among US Adults Aged  $\geq 65$  Years Reporting Voice Problem Lasting a Week or Longer, National Health Interview Survey 2012.

Diagnosis	Mentioned (%) <sup>a</sup>	SE
Laryngitis (voice misuse, abuse, overuse)	2	0.82
Laryngitis caused by colds/strep	6	2.46
Vocal nodules or polyps	10	3.18
Gastroesophageal reflux disease	9	2.62
Allergies	9	2.64
Airborne irritants or environmental pollutants	1	0.55
Head/neck injury	0	NA
Cancer anywhere in the head, neck, or throat	7	1.96
Neurological cause	6	1.89
Prescription medication or drugs	8	2.65
Something else	49	2.98

Abbreviation: SE, standard error; NA, not applicable.

<sup>a</sup>Total exceeds 100% because more than 1 reported diagnosis was permitted per case.

**Table 3.** Selected Characteristics of US Adults Aged  $\geq 65$  Years Responding to the Question “Compared to 12 Months Ago, Would You Say Your Voice Problems Are Now Better, Worse, or about the Same?” 2012 National Health Interview Survey.

Characteristic	Better (%)	Worse (%)	Same (%)	P Value
Whole cohort (total)	20	17	63	NA
Sex				.004
Male	22	20	58	
Female	18	15	67	
Race				.82
White non-Hispanic	19	18	63	
Other	21	12	67	
Age				.0004
65-74	24	16	60	
75+	11	21	68	
Education				.05
Less than high school and high school graduate	12	21	66	
Some college and college graduate	25	14	61	
Health status				.60
Fair/poor	12	27	61	
Good/excellent	24	11	65	
Voice problem severity				.13
No problem	23	7	70	
Small problem	18	18	64	
Moderate/big problem	21	19	60	
Duration of voice problem				.04
<1 month	28	18	54	
1 month to 1 year	12	16	72	

Abbreviations: SE, standard error; NA, not applicable.

Among patients who received treatment, 36% reported seeing a family physician, general practitioner, and/or osteopath; 24% otolaryngology; and 20% speech-language pathology. The relationship between self-reported voice treatment and voice symptom change is shown in **Figure 1**.

Among those who received voice-related treatment, 38% reported their voice problem was “better,” 33% “about the same,” and 29% “worse,” compared to 17%, 67%, and 16%, respectively, among those who did not receive treatment (**Figure 1**).

**Table 4.** Odds of US Adults Aged  $\geq 65$  Years Responding “Better” to the Question “Compared to 12 Months Ago, Would You Say Your Voice Problems Are Now Better, Worse, or about the Same?” 2012 National Health Interview Survey.<sup>a</sup>

Characteristic	Odds Ratio	95% CI
Sex		
Female	1.00 [reference]	
Male	1.15	0.62-2.12
Age categories		
65-74	1.00 [reference]	
75+	<b>0.44</b>	<b>0.24-0.82</b>
Race		
White non-Hispanic	1.00 [reference]	
Other	1.38	0.61-3.15
Education		
Less than high school and high school graduate	<b>0.44</b>	<b>0.24-0.80</b>
Some college and college graduate	1.00 [reference]	
Receipt of treatment		
No	1.00 [reference]	
Yes	<b>3.50</b>	<b>1.36-9.00</b>
Health status		
Fair/poor	1.00 [reference]	
Excellent/good	<b>2.34</b>	<b>1.16-4.71</b>

Abbreviation: CI, confidence interval.

<sup>a</sup>Bold values indicate significant findings.

### Factors Associated with Self-Reported Voice Improvement in Those Who Received Treatment

Factors associated with improvement among those who reported treatment were examined categorically to allow comparisons across the better/worse/same categories. Those of male sex, of white race, of younger age, with higher education, and of excellent/good health status were proportionately more likely to report improvement (**Table 5**). Among respondents who reported treatment, the duration of the voice problem was not associated with differences in self-reported improvement. Older patients (age  $\geq 75$  years) were more likely to report that their voice problem was “the same” despite treatment (42%) than those aged 65 to 74 years (7%). Among those reporting both voice problem duration  $>1$  month and treatment receipt, 44% reported improvement, 30% reported worsening, and 26% reported stability. The impact of provider type, problem severity, and voice-related diagnosis could not be reliably assessed in this analysis due to sampling limitations. All other characteristics are listed in **Table 6**.

## Discussion

This article presents the first national assessment of patient-reported outcomes in the context of voice treatment in the elderly US general population. We also evaluated the impact of health status on the likelihood of receiving voice treatment on a national level. This population-based sampling methodology reduces sampling bias, increasing generalizability. In this cohort, the 1-year prevalence of self-reported voice problems in the US elderly was 10%,

and of those, 44% reported voice problem duration  $>1$  month. The strongest predictor of voice improvement was reported voice treatment. However, only 11% reported receiving voice treatment in the past year, and only 20% of those reporting a moderate/big voice problem reported receiving voice treatment. Health status influenced the likelihood of reporting improvement in response to voice treatment.

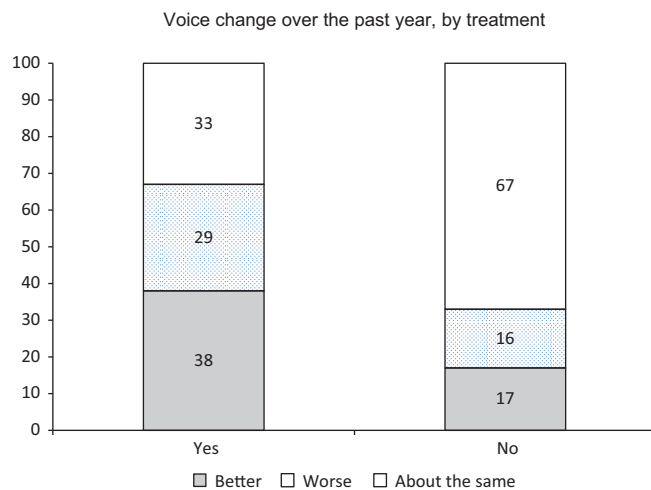
The prevalence of voice problems reported by elderly participants in this study was toward the lower end of previously reported figures (5%-29%).<sup>1,4,24</sup> This may be due to differences in context or question wording. For example, the NHIS asked if the respondent had a voice problem in the past year. However, other studies have asked about “any time the voice does not work, perform, or sound as it normally should.”<sup>4</sup> This difference in wording may lead to different estimates of prevalence. Consistent with this, the prevalence reported here based on 6651 responses (representing 38 million people) is most similar to those reported in population-based studies by Hannaford et al,<sup>25</sup> up to 8.8% in 3413 participants in Scotland, and by Ryu et al,<sup>26</sup> 8.5% in a study of 3759 participants in Korea. It also may be that competing medical demands, lack of occupational vocal demand, and/or other factors made respondents less likely to report a “voice problem” in this study.

The most common voice-related diagnoses and voice-related care providers observed in this study were similar to those previously described in NHIS and other data sources.<sup>1,15,27</sup> Only a small proportion (11%) of those who reported a voice problem reported receiving treatment for the voice problem. Although some problems may have been

**Table 5.** Odds of the US Adults Aged  $\geq 65$  Years Responding “Yes” to “Have You Received Treatments, Therapy, or Other Rehabilitation Services for Voice Problems in Past 12 Months?” 2012 National Health Interview Survey.<sup>a</sup>

Characteristic	Odds Ratio	95% CI
Sex		
Female	1.00 [reference]	
Male	<b>0.36</b>	<b>0.16-0.79</b>
Age categories		
65-74	1.00 [reference]	
75+	1.12	0.58-2.15
Race		
White non-Hispanic	1.00 [reference]	
Other	1.66	0.55-5.07
Education		
Less than high school and high school graduate	0.84	0.36-1.95
Some college and college graduate	1.00 [reference]	
Health status		
Fair/poor	<b>2.23</b>	<b>1.01-5.19</b>
Good/excellent	1.00 [reference]	
Duration of voice problem		
<1 month	1.00 [reference]	
1 month to 1 year	0.84	0.36-1.95

<sup>a</sup>Bold values indicate significant findings.

**Figure 1.** Voice change over the past year, by treatment.

Proportions of respondents reporting their voice problem was “better,” “worse,” or “about the same,” among those who did and did not report voice treatment (in percentages, with columns totaling 100% in each section), National Health Interview Survey 2012.

self-limited or mild, only 20% of those reporting a moderate/big voice problem received treatment, suggesting significant unmet needs. This may be related to factors such as financial limitations, transportation, access to specialty care, referral patterns, and/or patient assumptions that age-related changes are normal.<sup>28-30</sup> The 80% of elderly people who did not receive treatment for a moderate/big voice problem are not well represented in the current literature, which has largely focused on those who seek care.

A larger proportion of the elderly who received voice treatment reported improvement compared to that published for the general adult population in this data source,<sup>15</sup> suggesting that targeted treatment may have a significant benefit in this patient population. It was particularly striking that even among those with a problem duration  $>1$  month, the addition of treatment was associated with a much larger proportion reporting improvement.

This study does have important limitations. Perhaps its greatest limitation is also its greatest strength, which is that data were by patient self-report. This provides a broad sample of respondents and gives us insight into patient perspectives. Self-report does inherently invoke potential recall bias. In this data source, we cannot corroborate self-reported data with external measures of potentially relevant factors such as patient-reported voice-related quality-of-life changes, laryngeal diagnosis, and relevant health care utilization. Seniors have been shown to potentially underreport interactions with specialists,<sup>31</sup> for example, although it is unlikely that this would entirely account for what appears to be a significant gap in care. It is also not discernible from the data whether change in symptoms can be entirely attributed to treatment; it is possible that, as in any typical clinical care setting, other factors such as expectancy effects, patient motivation, or natural history of disease may also have influenced outcomes. Finally, because NHIS collects cross-sectional survey data, we cannot examine trajectories over time. Nonetheless, this data source represents a unique window into the self-described experiences of elderly individuals with voice problems, which have not been previously reported.

**Table 6.** Selected Characteristics of US Adults Aged  $\geq 65$  Years Responding to the Question, “Compared to 12 Months Ago, Would You Say Your Voice Problems Are Now Better, Worse, or about the Same?” Who Received Treatment, 2012 National Health Interview Survey.

Characteristic	Better (%)	Worse (%)	Same (%)	P Value
Total	38	29	33	NA
Sex				<.0001
Male	40	20	40	
Female	30	43	27	
Race				<.0001
White non-Hispanic	42	35	23	
Other	29	15	56	
Age				.002
65-74	54	39	7	
75+	32	26	42	
Education				.003
Less than high school and high school graduate	26	43	32	
Some college and college graduate	50	16	34	
Health status				.04
Fair/poor	20	42	38	
Good/excellent	63	11	26	
Duration of voice problem				.06
<1 month	30	28	42	
1 month to 1 year	44	30	26	

Abbreviation: NA, not applicable.

Findings from this large representative data source indicate that the elderly US population has a significant burden of voice problems. Although voice treatment was associated with voice improvement, only a small minority of elderly patients received treatment, even when symptoms lasted over a month or were severe. The patient-reported responses in this study suggest opportunities to provide more effective treatment for more patients. Future studies incorporating self-reported with longitudinal data may allow for further insights, leading to improved care for the rapidly growing elderly population.

## Conclusions

This is the first population-based report of patient perspectives on voice problems and treatment in the US population  $\geq 65$  years old. The prevalence of self-reported voice problems in the past year among the US population  $\geq 65$  years old was 10%. Of these respondents, 44% reported being affected for  $>1$  month, and 11% reported receiving voice treatment. Only 20% of those with a moderate/big voice problem reported receiving treatment. The strongest predictor of reporting voice improvement was receipt of voice treatment, and health status dramatically influenced likelihood of perceived improvement. Further investigation with additional data sources is needed to clarify patient and treatment characteristics most associated with vocal improvement, but these findings suggest that raising awareness among the medical and general community about the availability and value of voice care for the elderly could lead to better voice and communication outcomes.

## Acknowledgment

We appreciate thoughtful input and feedback from Beth A. Virnig, PhD, MPH, and Tetyana Shippee, PhD, on this study.

## Author Contributions

**Schelomo Marmor**, study design, analysis and interpretation of data for the work; drafting the work and revising it critically; final approval of submitted manuscript; and agreement to be accountable for all aspects of the work; **Stephanie Misono**, study conception and design, interpretation of data for the work; drafting the work and revising it critically; final approval of submitted manuscript; and agreement to be accountable for all aspects of the work.

## Disclosures

**Competing interests:** None.

**Sponsorships:** None.

**Funding source:** NIH (NIDCD). Research reported in this publication was supported by the National Institute on Deafness and Other Communication Disorders of the National Institutes of Health under award number K23DC016335 (Misono). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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