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Voice Disorders and Associated Risk Markers Among Young Adults in the United States

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Abstract

Objective—To examine the prevalence of voice disorders in young adults and identify socio-demographic factors, health conditions, and behaviors associated with voice disorder prevalence.

Study Design—Cross-sectional analysis of data from the National Longitudinal Study of Adolescent to Adult Health

Methods—During home interviews, 14,794 young adults, aged 24–34 years, reported their health conditions and behaviors. Presence and duration of voice disorders were reported over the past 12 months. We computed overall and stratified prevalence estimates by age, gender, race/ethnicity, medical conditions, smoking and alcohol use. Multiple logistic regression was used to identify independent risk factors for a voice disorder while accounting for the complex sample design.

Results—Six percent of participants reported a voice disorder lasting at least 3 days. Females had 56% greater odds of voice disorders than males. Number of days drinking alcohol was associated with voice disorders, but number of smoking days was not. Conditions which increased the likelihood of voice disorders included hypertension (OR=1.42 (1.07, 1.89)), tinnitus (OR=1.53(1.06, 2.20)), and anxiety/panic disorder (OR=1.26 (1.00, 1.60)). Results were independent of gender, alcohol consumption, upper respiratory symptoms, lower respiratory conditions including asthma, bronchitis/emphysema, and gastrointestinal symptoms (diarrhea/nausea/vomiting).

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Conclusion—Voice disorders in young adulthood were associated with hypertension, tinnitus, and anxiety. Greater awareness of these relationships may facilitate voice evaluation among people who seek health care for these chronic conditions.

INTRODUCTION

Recent estimates suggest 7–8% of adults in the United States report a voice disorder that interferes with communication, currently or within the last 12 months.^{1,2} Annual direct health care costs have been estimated as up to \$5 billion,³ with additional indirect costs due to absenteeism, short term disability claims, and lost productivity.^{4–6} The prevalence of reported⁷ or diagnosed⁸ voice disorders among adults increases with age, and among those 65 years and older, point prevalence estimates range from 20% to 29%.^{9–11} Young- to middle-aged adults are least likely to experience voice disorders, but the 12-month period prevalence was estimated to be 6–7% among those 18–44 years.⁷ No population-based study of voice disorders has focused solely on young adults.

Only ten percent of adults of any age with voice disorders visited a healthcare professional for their voice disorder.² Identifying health conditions that co-occur with voice disorders and for which people more readily seek health care may be important to improving rates of voice evaluation and treatment. Epidemiologic studies have identified chronic health conditions including gastroesophageal reflux disease,¹¹ hearing loss,^{12,13} depression,¹⁴ asthma,¹³ and respiratory allergies¹³ as associated with voice disorders. If replicated among younger populations, opportunities for earlier evaluation and treatment may become evident. Voice complaints were recently found to be more frequent among a small group of patients with type 2 diabetes.¹⁵ This observation has not been corroborated in population-based studies. If medical conditions associated with voice vulnerability are identified in younger populations, strategies for early, targeted prevention may reduce the public health burden of voice disorders. Our aims were to: (1) estimate the prevalence of voice disorders in a nationally-representative sample of adults aged 24 – 34 years and (2) identify socio-demographic factors, health conditions and health behaviors associated with voice disorders in young adulthood.

MATERIALS AND METHODS

Participants

Data are from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a survey of adolescents followed into early adulthood.¹⁶ In 1994, Add Health used a stratified, clustered, probability sampling design that produced a nationally-representative sample of 20,745 students in grades 7–12. In 2007–2008, in-home follow-up questionnaires administered to 15,701 participants aged 24–34 years (75.6% response rate after 13 years) included questions pertaining to voice. Data on voice were available on 14,794 participants (71.3%). Participants provided informed consent.

Measures

Voice disorders arise when the quality, pitch, or loudness differs from typical voice characteristics.¹⁷ Voice disorder ascertainment consisted of the question: “In the past 12

months, have you had any problem with your voice, that is any time when your voice was hoarse, raspy, breathy, weak or did not work, perform or sound as you feel it normally would?" Positive responses were classified as a disorder if the voice problem lasted three days or more.

Socio-demographic data included age, gender, race/ethnicity, level of education, annual household income, and receipt of public assistance were collected. Self-reported health was assessed as: "In general, how is your health?" Frequency of cigarette smoking among the past 30 days and frequency of alcohol consumption in the past 12 months were asked. Body mass index (BMI (kg/m^2)) was calculated from standing height measured with a steel tape and weight measured with a high capacity digital bathroom scale.¹⁸ Normal weight status was defined as BMI $< 25.0 \text{ kg}/\text{m}^2$ and overweight as BMI between $25.0\text{--}29.9 \text{ kg}/\text{m}^2$. Class 1 obesity was defined as BMI between $30\text{--}34.9 \text{ kg}/\text{m}^2$; class 2 obesity as BMI $35.0\text{--}39.9 \text{ kg}/\text{m}^2$; and class 3 obesity as BMI $\geq 40.0 \text{ kg}/\text{m}^2$. Abdominal adiposity was defined as a waist circumference $> 88 \text{ cm}$ for women and $> 102 \text{ cm}$ for men.

Other health conditions were asked in the format: "Has a doctor, nurse, or other health care provider ever told you that you have high blood sugar or diabetes?" Other conditions included hypertension, asthma/chronic bronchitis/emphysema, migraine headaches, anxiety/panic disorder, depression, and post-traumatic stress disorder (PTSD). Obstructive sleep apnea (OSA) symptoms were assessed by asking if participants snored or stopped breathing during sleep. Participants described their hearing ability without a hearing aid. Tinnitus was based on the question "In the past 12 months, have you been bothered by ringing, roaring, or buzzing in your ears or head that lasts for 5 minutes or more?" Participants were queried about serious injuries in the past 12 months. Conditions assessed over the past four weeks included active infection, surgery, acute illness, and seasonal allergies. Conditions assessed over the past two weeks included flu-like symptoms, fever, and diarrhea/nausea/vomiting.

Statistical analysis

We computed overall and stratified prevalence estimates and 95% confidence limits for voice problems lasting three days or more. Statistical tests of bivariable associations used a Chi-square test for general association. Using parsimonious multiple logistic regression models, characteristics independently associated with voice disorders were estimated as odds ratios (ORs) and 95% confidence limits. Analyses were performed using SUDAAN version 11.0.0 (Research Triangle Institute, Research Triangle Park, NC) incorporating sample weights to account for the complex sample design.

RESULTS

Frequency distributions of socio-demographic characteristics of the study population are presented in Table 1 along with prevalence estimates of having voice disorders. We estimated a 6% prevalence of voice disorders with no significant difference by age group, race/ethnicity, or educational attainment. Females had a greater prevalence of voice disorders than males (7.4% versus 4.6%). Having voice disorders was inversely associated with income and positively associated with receiving public assistance. Table 2 presents frequency distributions of self-reported health and health behaviors and the corresponding

prevalence of voice disorders. Of the 9% of young adults who reported fair or poor health, the prevalence of voice disorders exceeded 11%. The prevalence did not vary by smoking frequency. Over 7% of adults who drank 0–3 days per month reported a voice disorder which was significantly greater than 4.4% among non-drinkers.

Table 3 provides the prevalence of voice disorders stratified by current or recent comorbid conditions. Eleven percent of participants reported hypertension among whom the prevalence of voice disorders was greater than that among those without hypertension (8.9% versus 5.6%). No significant difference was observed by reported high cholesterol. People with diabetes had a 12.5% prevalence of voice disorders, over twice that among those without diabetes. We observed an increase in the prevalence of voice disorders by increasing weight status, but no difference by central adiposity. Adults with a history of mood disorders reported more voice disorders than the overall population: 9.9% and 9.2% for anxiety/panic disorder and depression, respectively. No significant difference was observed by history of PTSD. Participants with asthma/chronic bronchitis/emphysema had over twice the prevalence of voice disorders as those without these conditions (10.6% versus 5.1%). People with OSA symptoms had a greater prevalence of voice disorders than those without these symptoms (6.7% versus 4.7%). Individuals experiencing tinnitus in the past 12 months reported voice disorders twice as often as those without (11.0% versus 5.6%), but there was no significant difference by hearing ability. Almost 10% of people reporting migraine headaches experienced voice disorders compared to 5.3% of those who do not. People reporting a serious injury within the past 12 months had greater prevalence of voice disorders than those who did not. Surgery was not associated with voice disorders. Acute or inflammatory conditions experienced over the last 4 weeks, including active infection, acute illness, or seasonal allergies were associated with voice disorders as were fever, flu symptoms and diarrhea/nausea/vomiting experienced over the last 2 weeks.

Independent associations for voice disorders are presented as odds ratios with corresponding confidence intervals in Table 4. Females had a 56% increased odds of voice disorders relative to males. Compared to the non-drinking group, those who consumed alcohol up to three days per month, had a 57% increased odds of a voice disorder. Individuals who drank alcohol 1–5 days per week had a borderline significant 33% increased likelihood of a voice disorder (OR=1.33 (0.95, 1.86)). Participants with hypertension were 42% more likely to report voice disorders. We detected independent associations of voice disorders with respiratory conditions, including asthma/chronic bronchitis/emphysema (OR=1.64 (1.27, 2.12)) and snoring or the stopping of breathing (OR=1.34 (1.12, 1.61)). Young adults with tinnitus were over 50% more likely to experience voice disorders than those without. We observed a weak association between anxiety/panic disorder and voice disorders (OR=1.26 (1.00, 1.60)). Voice disorders were not independently associated with obesity, diabetes, depression, or migraines.

Voice disorders were associated with symptoms of acute illness including fever (OR=2.38 (1.55, 3.64)) and diarrhea/nausea/vomiting (OR=1.78 (1.34, 2.37)). Upper respiratory symptoms (seasonal allergies or flu symptoms) and active infection (non-specified) were associated with a 49–75% increased odds of voice disorders.

DISCUSSION

We found 6% of adults aged 24–34 years in the United States experienced a voice disorder of at least three days' duration over a 12-month period. As expected, voice disorders were associated with acute, probably self-limiting infectious or inflammatory processes including flu symptoms and seasonal allergies. Importantly, however, we observed voice disorders were independently associated with several chronic medical conditions, including asthma/chronic bronchitis/emphysema, obstructive sleep apnea, anxiety/panic disorder, tinnitus, and hypertension in these young adults.

Our prevalence estimate is consistent with the 6.4% prevalence found in another nationally-representative sample among those aged 25–44 years although this estimate encompasses a voice disorder not limited in duration.⁷ In contrast, our estimate exceeds the 4.2% prevalence of current voice disorders observed for community-dwelling adults aged 20–29 years,¹ a difference likely due to a socio-economically more diverse population and the 12-month period of recall. We found a monotonic increase in voice disorder prevalence as income declined, but after adjustment for the differential prevalence of hypertension and other chronic conditions, no socio-economic difference remained.

Young adult females had a higher prevalence than males of voice disorders. The finding that women are more likely to report and seek help for voice-related problems is well documented,^{1,8,19} but we demonstrated gender-specific vulnerability for voice disorders is established by early adulthood corroborating evidence from Brazil.²⁰ In addition to differences in laryngeal anatomy such as shorter and thinner vocal folds, the higher prevalence of voice disorders among females may reflect physiological differences in the respiratory and digestive systems or a tendency for women to report vocal problems (and other illness) more readily.²¹ The gender difference we observed, however, was independent of reported respiratory and gastrointestinal symptoms.

Despite reported acoustical differences between smokers and non-smokers,^{22,23} we found no evidence that intensity of tobacco use is associated with reported voice disorders. Our finding is in contrast with evidence from Korea where current smokers had a 77% increased odds of self-reported voice problems.²⁴ The Korean data revealed inconsistencies between smoking intensity and its association between self-report and laryngeal disease found by examination, whereby very heavy smoking was associated with laryngeal disease but not with self-reported vocal complaints. Roy and colleagues¹ hypothesized that smoking may contribute to gradual changes in voice quality that the smoker does not recognize as a voice disorder. Further research is necessary to understand the relationship between tobacco use intensity, and voice disorder development and reporting.

Recent data from a Greek population has suggested that intensity of alcohol consumption rather than duration of alcohol consumption may be correlated with hoarseness.²⁵ We also observed that, compared to abstaining, consuming alcohol occasionally or in moderation (i.e., less than 5 days a week) increased the likelihood of a voice disorder. This observation is in contrast to other epidemiology studies that have failed to establish a strong link between alcohol consumption and voice disorders.^{1,26} The putative role and extent of

alcohol consumption in the development of voice disorders is not well understood. Given that we observed an association between alcohol consumption in a relatively young sample, replication of these results might suggest an opportunity for behavioral intervention.

In 2012, asthma and chronic obstructive pulmonary disease were reported by approximately 21.1 million and 15.3 million United States adults, respectively.²⁷ Negative phonatory effects that have been reported in patients who use prescribed inhaled treatments to control these conditions may result from the drugs' effect on the vocal folds.^{28,29} The association we found between voice disorders and asthma/emphysema/chronic bronchitis in young adults adds to evidence that respiratory conditions or their treatments are deleterious to vocal function.^{11,30}

In the current cohort, 49% of young adults reported frequent snoring or dyspnea during sleep. We found increased frequency of voice disorders among participants with these OSA symptoms. This observation is compatible with studies reporting abnormal voice features among adults with OSA, the presence of which might represent potential markers for earlier detection of voice dysfunction.^{31–33} Likewise, a recent study comparing individuals who snore to those who do not snore showed degraded voice quality among the former group, possibly due to vocal fold inflammation.³⁴ Others have suggested that altered structure or function of the upper airway contributes to changes in phonation and vocal fatigue due to extra expiratory effort to overcome upper airway resistance. Alternatively, treatment with nasal continuous positive airway pressure may contribute to disordered voice due to drying of vocal fold mucosa.³⁵ Regardless of mechanism, the association between OSA symptoms and voice disorders is evident in young adulthood and is independent of the potentially confounding effects of alcohol consumption and asthma.³⁶

Individuals with diabetes had a 12.5% prevalence of voice disorders, over twice the prevalence of those without diabetes. A recent investigation identified significant differences in the prevalence of hoarseness and vocal strain in a cohort of individuals with type 2 diabetes mellitus as compared to non-diabetic controls.^{15,37} Although our analysis suggests the association between diagnosed diabetes and vocal disorders is explained by the greater prevalence of OSA symptoms with diabetes, recognizing that voice problems may accompany diabetes could provide an opportunity to get diabetic patients with voice complaints into treatments that may preserve their voice quality.

Young adults with hypertension had a greater likelihood of reporting voice disorders. We know of no other population-based study that has described this association. Hypertension may be associated with voice disorders through reactivity to chronic stress exposure that leads to both laryngeal involvement³⁸ and to hypertension.³⁹ We did not examine whether the hypertension was being treated or was well-controlled, but voice disorders may also be related to medications such as angiotensin-converting enzyme inhibitors⁴⁰ or diuretics.⁴¹ Hypertension in young adults may be a risk marker for voice disorders in the longer term.

Evidence suggests that hearing impairment and dysphonia co-occur in the elderly,¹² but we observed no association between voice disorders and reported hearing trouble. Without audiometric testing or validated hearing screening instruments, poor self-perception of voice

disorders among young hearing impaired adults may explain our results. Recent national data described associations between voice disorders and depression.¹⁴ Although our data suggest that voice disorders are reported 80% more frequently among young adults reporting depression than among those who do not, the association between depressive symptoms and voice problems was not independent of reported anxiety.

Recent flu, fever, infection, allergies, and/or nausea, diarrhea, and vomiting were all independently related to voice disorders. Collectively, these findings support prior epidemiologic evidence identifying frequent sinus, cold, flu-like symptoms among those who report voice disorders.^{1,20}

Finally, we identified a novel association between tinnitus and voice disorders. Elevated levels of depression, anxiety, and somatoform disorders have been noted in patients with tinnitus.^{42,43} Yet, the association we observe is independent of reported anxiety/panic disorder and depression. While further study is needed to elucidate biological mechanisms to explain relationships between voice disorders, tinnitus, psychiatric conditions, and possibly migraine headache, greater awareness of voice complaints in people with these conditions may aid in getting people to seek health care.

We acknowledge several limitations. Our classification of voice disorders was based on self-reported duration and is not validated with respect to presence of dysphonia or diagnosed laryngeal pathology. Likewise, classification of many of our acute health conditions was based on self-report over varying two- and four-week time periods which may or may not correspond to the time period over which the voice disorder was noted. Our cross-sectional analysis does not allow for temporal considerations for the observed associations. Last, because Add Health participants did not report on symptoms of reflux, we were not able to control for the effects of this condition on voice symptoms.

CONCLUSION

This investigation represents the largest epidemiology study to estimate the prevalence of voice disorders among a nationally-representative sample of young adults in the United States. Six percent of young adults experienced a voice disorder of at least 3 days' duration over the previous 12 months. In addition to better known factors such as being female and having respiratory symptoms, we found voice disorders were associated with chronic conditions such as snoring and/or dyspnea during sleep, anxiety/panic disorder, tinnitus, and hypertension. Raising awareness of these chronic disease risk markers among health care providers may facilitate voice disorder evaluation, diagnosis, and treatment.

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Table 1

Prevalence (95% confidence interval) of a voice disorder of at least three days' duration, over the past 12 months, by socio-demographic characteristics among U.S. adults 24–34 years – Add Health (n=14,794).

	n	Weighted %	Prevalence (95% CI) [†] (n=868)
Overall	14,794	100	6.0 (5.4,6.6)
Age, years			
24–26	2,281	19.6	6.7 (5.3,8.3)
27–29	7,589	49.3	5.7 (5.0,6.5)
30–34	4,924	31.1	5.9 (4.9,7.1)
Gender			
Male	6,927	50.7	4.6 (3.9,5.4) *
Female	7,867	49.3	7.4 (6.6,8.3)
Race/ethnicity			
Non-Hispanic White	7,745	64.0	6.0 (5.3,6.8)
Non-Hispanic Black	2,578	13.3	6.5 (5.3,7.9)
Hispanic	2,055	8.7	4.8 (3.3,6.8)
Other race	2,408	14.0	6.0 (4.8,7.5)
Educational attainment			
High school level	3,536	27.1	6.5 (5.5,7.6)
Vocational/technical training	1,458	9.4	5.9 (4.5,7.8)
College level	7,972	52.2	6.0 (5.3,6.7)
Graduate level	1,825	11.2	4.7 (3.6,6.1)
Household income, \$			
<25,000	2,253	17.6	7.4 (5.7,9.5) *
25,000–<50,000	3,837	28.0	6.9 (5.9,8.0)
50,000–<100,000	5,516	39.4	5.4 (4.6,6.2)
100,000	2,215	15.0	5.2 (4.1,6.6)
Received welfare/public assistance			
Yes	3,433	24.6	8.2 (6.8,9.8) *
No	11,330	75.4	5.3 (4.7,5.9)

[†] 95% CI=95% confidence interval

* p<0.05 chi square test for general 2×2, 3×2 or 4×2 association

Table 2

Prevalence (95% confidence interval) of a voice disorder of at least three days' duration, over the past 12 months) by general health and behavioral characteristics among U.S. adults 24–34 years – Add Health (n=14,794).

	n	Weighted %	Prevalence (95% CI) [†]
Self-reported health			
Excellent	2,848	19.1	4.5 (3.5,5.7) *
Very Good	5,641	38.1	4.8 (4.1,5.6)
Good	4,904	33.6	6.8 (5.8,7.9)
Fair/poor	1,401	9.3	11.0 (9.0,13.5)
Number of smoking days, past 30 days			
0	9,464	61.2	6.0 (5.4,6.7)
1–14	1,351	9.1	4.8 (3.5,6.5)
15–29	711	5.2	6.2 (4.1,9.1)
30	3,144	24.6	6.1 (5.1,7.4)
Frequency of alcohol consumption, past 12 months			
Non-drinker	3,018	19.5	4.4 (3.4,5.7) *
0–3 days/month	7,262	49.0	7.1 (6.2,8.1)
1–5 days/week	4,030	28.7	5.3 (4.5,6.3)
Almost every day/every day	398	2.8	4.6 (2.5,8.1)

[†]95% CI=95% confidence interval

*p<0.05 chi square test for the general 4×2 association

Table 3

Prevalence (95% confidence interval) of a voice disorder of at least three days' duration, over the past 12 months, by current or recent comorbid conditions among U.S. adults 24–34 years – Add Health (n=14,794).

	n	Weighted %	Prevalence (95% CI) [†]
Hypertension, ever			
Yes	1,560	11.1	8.9 (7.0,11.2) *
No	13,232	88.9	5.6 (5.0,6.3)
High cholesterol, ever			
Yes	867	8.1	7.8 (5.9,10.2)
No	13,925	91.9	5.8 (5.2,6.4)
Diabetes, ever			
Yes	417	2.6	12.5 (8.1,18.8) *
No	14,376	97.4	5.8 (5.2,6.4)
Weight status, current [§]			
Normal	4,786	33.3	5.2 (4.4–6.2)
Overweight	4,383	29.8	5.8 (4.9–6.9)
Class I Obese	2,688	18.7	5.6 (4.5–7.0)
Class II Obese	1,383	9.5	7.2 (5.5–9.2)
Class III Obese	1,321	8.8	9.0 (7.0–11.5)
Abdominal adiposity, current			
Yes	8,051	57.7	6.0 (5.2,6.8)
No	6,600	42.3	6.0 (5.3,6.9)
Anxiety/panic disorder, ever			
Yes	1,729	13.0	9.9 (8.1,12.1) *
No	13,064	87.0	5.4 (4.9,6.0)
Depression, ever			
Yes	2,262	16.4	9.2 (7.6, 11.1) *
No	12,530	83.6	5.4 (4.8,6.0)
PTSD, ever			
Yes	427	3.0	8.6 (5.9,12.3)
No	14,365	97.0	5.9 (5.3,6.54)
Asthma/chronic bronchitis/emphysema, ever			
Yes	2,190	15.1	10.7 (8.8, 12.8) *
No	12,603	84.9	5.1 (4.6,5.7)
Obstructive sleep apnea symptoms, current			
Yes	7,081	49.1	6.7 (5.8,7.6) *
No	7,486	50.1	4.7 (4.1,5.3)
Hearing ability, current			
Excellent	8,518	55.2	5.7 (5.0,6.4)
Good	5,245	37.2	5.8 (5.0,6.9)

	n	Weighted %	Prevalence (95% CI) [†]
A little trouble or worse	1,031	7.6	8.8 (6.5,11.8)
Tinnitus, past 12 months			
Yes	932	6.7	11.0 (8.4,14.4) *
No	13,861	93.3	5.6 (5.0,6.2)
Migraine headaches, ever			
Yes	2,110	14.8	9.6 (7.9,11.6) *
No	12,683	85.2	5.3 (4.8,6.0)
Serious injury, past 12 months			
Yes	1,926	13.5	8.3 (6.5,10.5) *
No	12,867	86.5	5.6 (5.0,6.3)
Active (non-specified) infection, last 4 weeks			
Yes	487	3.4	14.3 (10.5,19.2) *
No	14,306	96.6	5.6 (5.1,6.3)
Surgery, last 4 weeks			
Yes	298	2.0	8.9 (5.5, 14.3)
No	14,495	98.0	5.9 (5.3, 6.5)
Acute illness, last 4 weeks			
Yes	254	1.9	10.8 (7.1,16.1) *
No	14,539	98.1	5.9 (5.3,6.5)
Seasonal allergies, last 4 weeks			
Yes	2,265	16.5	10.6 (8.6,13.1) *
No	12,528	83.5	5.1 (4.5,5.7)
Flu symptoms, last 2 weeks			
Yes	3,303	22.1	11.0 (9.6,12.7) *
No	11,491	77.9	4.5 (4.0,5.1)
Fever, last 2 weeks			
Yes	621	4.6	20.0 (15.1,26.0) *
No	14,173	95.4	5.3 (4.8,5.9)
Diarrhea/nausea/vomiting, last 2 weeks			
Yes	1,197	8.4	14.4 (12.1,17.2) *
No	13,597	91.6	5.2 (4.6,5.8)

[†] 95% CI=95% confidence interval

* p<0.05 chi square test for general 2×2, 3×2 or 5×2 association

[§] Normal weight BMI < 25.0 kg/m², overweight BMI 25.0–29.9 kg/m², class 1 obesity BMI 30–34.9 kg/m²; class 2 obesity BMI 35.0–39.9 kg/m², class 3 obesity BMI 40.0 kg/m²

Table 4

Independent odds ratios (95% CI)[†] between correlates for a voice disorder of at least 3 days' duration, over the past 12 months, among U.S. adults 24–34 years – Add Health (n=14,794).

	<u>Odds Ratio (95% CI) [†]</u>
Female gender	1.56 (1.25, 1.94)
Frequency of alcohol consumption, past year	
Non-drinker	Ref
0–3 days/month	1.57 (1.14, 2.15)
1–5 days/week	1.33 (0.95, 1.86)
Every day, almost every day	1.05 (0.51, 2.17)
Hypertension, ever	1.42 (1.07, 1.89)
Asthma/chronic bronchitis/emphysema, ever	1.64 (1.27, 2.12)
Snore or stop breathing during sleep	1.34 (1.12, 1.61)
Tinnitus, past 12 months	1.53 (1.06, 2.20)
Anxiety/panic disorder, ever	1.26 (1.00, 1.60)
Active infection, last 4 weeks	1.67 (1.13, 2.46)
Seasonal allergies, last 4 weeks	1.49 (1.14, 1.96)
Flu symptoms, last 2 weeks	1.75 (1.42, 2.16)
Fever, last 2 weeks	2.38 (1.55, 3.64)
Diarrhea/nausea/vomiting, last 2 weeks	1.78 (1.34, 2.37)

[†]95% CI=95% confidence interval