Research Article

Epidemiology of Vocal Health in Young Adults Attending College in the United States

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Purpose: The purpose of this study was to document typical vocal health characteristics (including voice-related activities, behaviors, and symptomatology) of young adults attending college and to determine lifetime and point prevalence rates of voice disorders.

Method: Undergraduates at University of Wisconsin–Madison completed an anonymous online survey detailing vocal use, symptomatology, impact, sociodemographics, and voice-related quality of life. Univariate analyses and multivariate regression models isolated risk factors for lifetime and point prevalence rates of a voice disorder.

Results: Vocal health and associated factors were analyzed for 652 students (predominantly 18–25 years of age). Lifetime prevalence rate of a voice disorder was 33.9% (point

prevalence = 4.45%). Change in voice function (odds ratio [OR] = 2.77), seasonal or chronic postnasal drip (OR = 2.11), hoarseness (OR = 2.08), and restrictions to social activity (OR = 2.07; all $p < .05$) were identified as the strongest predictors of disorder. A total of 46% of students reported some form of voice problem in the past year, most frequently lasting between 1 and 6 days (39%). Voice usage in social and work settings exceeded demands in the classroom.

Conclusions: Young adults in college frequently experience disturbances to vocal health; however, this is not usually perceived to interfere with communication. Relative weighting of risk factors appears to differ from older adults, highlighting the need for individualized evaluation and management, with reference to age-appropriate normative reference points.

Voice is more than its basic definition—an audible sound produced by the larynx; it represents an individual's identity through the complex interplay of pitch, resonance, loudness, and quality. Voice is shaped by numerous factors, including age, sex, education, and cultural standards. Vocal health provides a powerful mode of communication, allowing the expression of paralinguistic features across personal, social, and occupational needs (Cohen, Kim, Roy, Asche, & Courey, 2012a). This interaction between the physical and functional is reflected in widely accepted characteristics of what represents a healthy voice, with criteria including discrete measures of pitch, loudness, and quality; self-perceived flexibility and sustainability; and listener perceptions of pleasantness, appropriateness, and intelligibility (Ma & Yiu, 2001). When individuals present to health care providers with vocal complaints, the differential diagnostic process involves comparing these vocal features with normative standards as well

as questioning to identify established risk factors associated with dysphonia. These comparisons can be somewhat problematic because less is known regarding vocal use patterns, prevalence of vocal symptoms, and the impact of voice on quality of life in young adults than in children or older adults.

Epidemiological studies of the general population and specific occupations have revealed a range of sociodemographic (e.g., age, sex, occupation) and health (e.g., frequency of respiratory illnesses, allergies, family history of a voice disorder, thyroid disease, arthritis, gastroesophageal reflux disease, medications) variables that appear to be associated with individuals experiencing vocal problems (Behlau, Zambon, Guerrieri, & Roy, 2012; Bhattacharyya, 2014; Roy, Merrill, Gray, & Smith, 2005; Roy, Merrill, Thibeault, Gray, & Smith, 2004; Roy, Merrill, Thibeault, Parsa, et al., 2004; Roy, Stemple, Merrill, & Thomas, 2007; Thibeault, Merrill, Roy, Gray, & Smith, 2004). However, a recent examination of dysphonia in the primary care population cast doubt on the relative weight of widely accepted factors such as sex, vocal demands at work, smoking status, caffeine intake, and overall voice usage; multivariate analysis identified a college education as the only sociodemographic variable predictive of a lifetime prevalence of voice disorder (Cohen, 2010).

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Editor: Jody Kreiman

Associate Editor: Eric Hunter

Received June 12, 2015

Revision received December 28, 2015

Accepted February 19, 2016

DOI: 10.1044/2016_JSLHR-S-15-0214

Disclosure: The authors have declared that no competing interests existed at the time of publication.

Adding weight to the influence of college on voice is a recent examination of voice disorders among a predominantly Latter-Day Saints cohort of college students in Utah (Merrill et al., 2013). In this study, lifetime prevalence rates exceeded previously published values for individuals in the 20- to 29-year age range and matched Roy et al.'s (2005) investigation of the general population at 29% (mean age = 43.2 years). Students reported a range of symptoms, including hoarseness, vocal fatigue, a wobbly or shaky voice, and throat dryness, found to be linked to detriments in emotional and physical health. These symptoms were reported despite presumed lesser prevalence of use of alcohol, caffeine, and inhaled substances among the Latter-Day Saints population compared with U.S. population norms. Although its use as a valid normative reference for broad clinical application is restricted, the examination of voice in this population questions existing notions of sociodemographic attributes associated with voice disorders, highlighting the need to further examine the specifics of college attendance and how they influence vocal health.

Investigation of the prevalence of vocal symptoms and voice disorders among undergraduate students in countries other than the United States has been scarce. In a survey study of the prevalence of vocal symptoms in 220 undergraduate students in Finland (whose average age [23.46 years; range = 19–46 years] was greater than that in the United States), 25% of the students reported one or more vocal symptoms occurring weekly (Simberg, Sala, & Ronnema, 2004). Symptoms included throat clearing or coughing, voice becoming low or hoarse, voice becoming strained or tired, voice breaking, sensations of pain or a lump in the throat, difficulty being heard, and loss of voice. Although only a small number of undergraduate students were surveyed in this investigation in Finland, these numbers appear to better match a general adult population (Roy et al., 2005) than those published by Merrill et al. (2013) from an undergraduate Latter-Day Saints population in the United States, further necessitating a larger U.S.-based public undergraduate population.

Determining the factors associated with vocal health is a recognized area of need in the literature (Cohen, Kim, Roy, Asche, & Courey, 2012b; Merrill et al., 2013) and is key to the provision of optimum, evidence-based clinical care. Individuals attending college appear to be at an increased risk of a lifetime prevalence of a voice disorder (Cohen, 2010; Merrill et al., 2013). However, it remains unclear whether voice problems that occur while attending college stem from behaviors at college or are related to other external factors. The objective of the current study was to document typical vocal health characteristics of individuals obtaining an undergraduate education at a large public university in the United States, with particular reference to voice-related activities, behaviors, symptomatology, and prevalence of voice disorders. Alongside the provision of a normative reference, the examination of sociodemographic, voice use, and medical factors was designed to elucidate risk factors associated with voice disorders in

order to assist in the prevention and management of impaired vocal health.

Method

Undergraduate students at the University of Wisconsin–Madison (UW–Madison) were invited to complete an anonymous online survey (UW–Madison Qualtrics Survey Hosting Service) regarding (a) voice usage and symptomatology across class, work, and social settings; (b) sociodemographics (age, sex, race, enrollment information, employment, social and extracurricular activities); (c) substance use (tobacco, alcohol, marijuana, other); (d) medical history (family history of voice problems; general health; medications; frequency of colds, sinus infections, or laryngitis; previous services for voice or speech-language problems < age 18 years); and (e) use of the Internet to access health information (general health, voice-specific information; see Appendix). Participants were recruited through a mass e-mail (29,039 random students), posters, flyers, and social media and in person. To be eligible for the study, students were required to be currently enrolled in a UW–Madison undergraduate program, be proficient in English, and be age 18 years or older. Participation was voluntary and was encouraged through the chance to win one of five small cash prizes. Responses were required to be complete in order to be included in the study; surveys that remained incomplete 1 month after the close of the survey were excluded from the study (per consent information). On the basis of the size of the 2014 undergraduate population at UW–Madison (29,302), 649 or 380 students needed to respond to the survey in order to obtain a 5% margin of error and a 95% or 99% confidence interval (CI), respectively. The study was approved by the UW–Madison Education and Social/Behavioral Science Institutional Review Board.

To facilitate comparison with published epidemiological investigations of voice, the survey was developed as a modification of the original phone-based questionnaire used by Roy and colleagues (Roy et al., 2005; Roy, Merrill, Thibeault, Gray, et al., 2004; Roy, Merrill, Thibeault, Parsa, et al., 2004; Thibeault et al., 2004). Additional questions were sourced from the Voice, Speech, and Language supplement of the National Health Interview Survey (2012) and the Voice Handicap Index (VHI; Jacobson et al., 1997). The 2012 National Health Interview Survey questions focused on (a) type, duration, and impact of voice-related symptoms over the past 12 months; (b) utilization of health care services for voice problems prior to age 18 years and within the past 12 months; (c) age at which voice problems first began; and (d) use of the Internet to gain health-related information. In line with a series of previous studies (Roy et al., 2005; Roy, Merrill, Thibeault, Gray, et al., 2004; Roy, Merrill, Thibeault, Parsa, et al., 2004; Thibeault et al., 2004), the presence of a voice disorder was defined as “any time your voice does not work, perform, or sound as you feel it normally should so that it interfered with communication.” A chronic condition was defined as lasting for 4 weeks or more (yes/no question). This procedure allowed

statistical comparisons between groups according to life-time prevalence of a voice disorder as well as the sub-categories of current or past voice disorder and chronic or acute voice disorder.

To best characterize voice in this population, a range of quantitative analysis procedures were used (SAS Version 9.2; SAS Institute, Cary, NC). First, whole-group data were analyzed using descriptive statistics (frequency counts, percentages, means, and standard deviations) to document voice usage, voice-related symptoms, and impact on daily living (VHI) for undergraduate scholars. Chi-square statistics were completed to compare the respondent demographics with the demographics of the entire UW–Madison undergraduate population ($p < .05$ was considered statistically significant). Univariate and multivariate analyses were then conducted to compare characteristics associated with three categories of voice disorder: (a) ever and (b) never across all participants and (c) chronic versus acute and current versus past for those with a positive history of voice disorder. Initial multivariate regression models were developed using specifically isolated variables of interest in college students (use of cigarettes and marijuana and alcohol consumption; Merrill et al., 2013) alongside any variable found to be significantly different ($p < .05$) on 2×2 cross-tabulation (Fisher's exact test) between groups. Pearson's correlation coefficients were determined, and all variables found to have an association greater than .30 were inspected and were condensed where possible prior to inclusion in the regression model. A subsequent stepwise regression was performed to isolate only those variables that were significant at the $p < .05$ level.

Results

Complete survey responses were obtained from 652 undergraduate university scholars (463 women, 71.01%; 189 men, 28.99%), of which more than 97% were younger than 26 years of age (<20 , $n = 344$, 52.76%; $20\text{--}25$, $n = 293$, 44.93%; $26\text{--}29$, $n = 9$, 1.38%; $30\text{--}40$, $n = 5$, 0.07%; $40+$, $n = 1$, 0.01%). Table 1 compares the demographics of respondents with those of the greater UW–Madison undergraduate population ($n = 29,302$; University of Wisconsin–Madison, 2014). Although overall percentages were similar for most categories, significant differences were noted. Respondents identified primarily as White ($n = 533$, 81.75%), with less than 10% identifying as Asian or Pacific Islander ($n = 62$, 9.51%), Hispanic or Latino ($n = 14$, 2.15%), Black or African American ($n = 9$, 1.38%), Native American or Alaska Native ($n = 8$, 1.23%), or other ($n = 26$, 3.99%). Enrollment was typically full time (12 to 18 credits, $n = 616$, 84.48%; six to 12 credits, $n = 26$, 3.99%; one to five credits, $n = 10$, 1.53%), and each of the five year levels were represented (freshman, $n = 249$, 38.19%; sophomore, $n = 126$, 19.33%; junior, $n = 112$, 17.18%; senior, $n = 132$, 20.25%; fifth year, $n = 33$, 5.06%). Approximately one half of respondents were associated with programs in the College of Letters and Sciences ($n = 344$, 52.76%; UW–Madison, 51.17%); the remainder were spread across agriculture and

life sciences ($n = 98$, 15.03%; UW–Madison, 12.47%), engineering ($n = 89$, 13.65%; UW–Madison, 17.04%), business ($n = 41$, 6.29%; UW–Madison, 8.00%), education ($n = 28$, 4.29%; UW–Madison, 5.49%), nursing ($n = 28$, 4.29%; UW–Madison, 2.69%), human ecology ($n = 20$, 3.07%; UW–Madison, 2.99%), and pharmacy ($n = 4$, 0.61%; UW–Madison, 0.15%).

Just more than one half ($n = 367$, 56%) of respondents were currently employed, working on average 13.26 hr/week ($SD = 8.07$, range = 0–45) across a range of settings (tutor, $n = 27$, 4.14%; resident assistant, $n = 7$, 1.07%; retail, $n = 27$, 4.14%; food industry, $n = 88$, 13.50%; clerical and administrative work, $n = 82$, 12.58%; child care, $n = 16$, 2.45%; other, $n = 177$, 27.15%). Recreational activities in order of frequency were student organizations ($n = 467$, 71.63%), attending sports events as a spectator ($n = 306$, 46.93%), sports ($n = 206$, 31.60%), live music events ($n = 193$, 29.60%), bars and clubs ($n = 146$, 22.39%), religious groups ($n = 112$, 17.18%), other unspecified activities ($n = 95$, 14.57%), performing arts ($n = 73$, 11.20%), Greek life ($n = 48$, 7.36%), karaoke ($n = 8$, 1.23%), and marching band ($n = 5$, 0.77%). On average, students reported spending 8.27 hr/week in social and/or extracurricular activities ($SD = 6.54$, range = 0–60).

Less than 20% of students reported current or previous use of cigarettes (current, $n = 12$, 1.84%; past, $n = 78$, 11.96%; never, $n = 562$, 86.2%), cigars (current, $n = 8$, 1.23%; past, $n = 106$, 16.26%; never, $n = 538$, 82.52%), pipes (current, $n = 1$, 0.15%; past, $n = 34$, 5.21%; never, $n = 617$, 94.63%), e-cigarettes (current, $n = 8$, 1.23%; past, $n = 70$, 10.74%; never, $n = 574$, 88.04%), chewing tobacco (current, $n = 1$, 0.15%; past, $n = 12$, 1.84%; never, $n = 639$, 98.01%), or other unspecified recreational drugs (current, $n = 11$, 1.69%; past, $n = 19$, 2.91%; never, $n = 622$, 95.4%). Alcoholic beverages were consumed regularly by 55.67% ($n = 363$) of students (< 1 year, $n = 18$, 2.75%; 1–4 years, $n = 310$, 47.64%; 5+ years, $n = 35$, 5.35%), and 34.66% (current, $n = 69$, 10.58%; past, $n = 157$, 24.08%; never, $n = 426$, 65.34%) reported using marijuana.

Respiratory allergies were the most frequently reported health problem ($n = 149$, 22.85%). Less than 10% of college students reported other current (or within the past 12 months) problems (reflux, $n = 41$, 6.28%; thyroid, $n = 26$, 3.99%; arthritis, $n = 17$, 2.61%; severe head or neck injury, $n = 17$, 2.61%; neurological disorder, $n = 15$, 2.30%; pneumonia, $n = 15$, 2.30%; immune disorder, $n = 13$, 1.99%; intestinal ulcers, $n = 10$, 1.54%; hypertension, $n = 7$, 1.07%; stroke, $n = 3$, 0.46%; heart disease, $n = 3$, 0.46%; diabetes, $n = 3$, 0.46%; cancer, $n = 2$, 0.31%; multiple sclerosis, $n = 2$, 0.31%; Parkinson's disease, $n = 1$, 0.15%). Steroids, oral contraceptives, or hormones were used by 23.93% of students ($n = 156$), decongestants or antihistamines were used by 12.42% ($n = 81$), depression and anxiety medications were used by 9.97% ($n = 65$), and medication for high blood pressure was used by 0.31% ($n = 2$); no participants reported use of chemotherapy medication. For those who experienced postnasal drip ($n = 470$, 72.09%), it was most frequently reported to occur occasionally with colds ($n = 313$, 48.01%), whereas

Table 1. Demographics of respondents compared with the University of Wisconsin (UW)–Madison undergraduate population.

Variable	Respondents	UW–Madison	<i>p</i> value
Total number	652	29,302	
Gender			<.00010
Female	463 (71.01%)	14,980 (51.10%)	
Male	189 (28.99%)	14,322 (48.90%)	
Race/ethnicity			<.00001
Hispanic	14 (2.15%)	1,403 (4.90%)	
African American	9 (1.38%)	620 (2.10%)	
American Indian	8 (1.23%)	65 (0.20%)	
Asian	62 (9.51%)	1,609 (5.50%)	
White	533 (81.75%)	22,578 (77.00%)	
Other	26 (3.99%)	3,027 (10.30%)	
Age (years)			<.00010
<20	344 (52.76%)	18,796 (64.20%)	
20–25	293 (44.93%)	9,547 (32.60%)	
26–29	9 (1.38%)	454 (1.60%)	
30–40	5 (0.07%)	389 (1.30%)	
40+	1 (0.01%)	116 (0.30%)	
Student level			<.00010
Freshman	249 (38.19%)	4,946 (16.80%)	
Sophomore	126 (19.33%)	6,248 (21.30%)	
Junior	112 (17.18%)	7,580 (25.90%)	
Senior	132 (20.25%)	10,528 (36.00%)	
Enrollment			.03000
Full time	616 (94.48%)	28,197 (96.20%)	
Part time	36 (5.52%)	1,105 (3.80%)	
College or school			<.00010
Letters and Science	344 (52.76%)	14,994 (51.20%)	
Agriculture and Life Science	98 (15.03%)	3,653 (12.50%)	
Engineering	89 (13.65%)	4,992 (17.00%)	
Business	41 (6.29%)	2,344 (8.00%)	
Education	28 (4.29%)	1,610 (5.50%)	
Nursing	28 (4.29%)	789 (2.70%)	
Human Ecology	20 (3.07%)	876 (3.00%)	
Pharmacy	4 (0.61%)	44 (0.10%)	

seasonal ($n = 123$, 18.87%) and chronic ($n = 34$, 5.21%) concerns were less common. In a typical 12-month period, 81.29% of students had between one and five colds ($n = 530$), 48.77% had up to two sinus infections ($n = 318$), and 78.99% reported never having laryngitis ($n = 515$).

Respondents reported missing an average of 2.96 days of school ($SD = 5.20$, range = 0–68), 1.22 days of work ($SD = 2.92$, range = 0–40), and 2.75 days of social or extracurricular activities ($SD = 24.83$, range = 0–45) during the past 12 months due to any illness or injury (not including maternity leave). A total of 11.66% of respondents ($n = 76$) indicated receiving special services or instruction for a problem with voice, speech, or language prior to 18 years of age, of which speech ($n = 67$, 10.28%) was the most frequently reported (voice, $n = 4$, 0.61%; language, $n = 15$, 2.30%). Few participants reported a family history of a voice problem ($n = 13$, 1.99%). A total of 40.18% ($n = 262$) of students had accessed health information on the Internet during the past 12 months, but few had gained information specifically about voice problems ($n = 23$, 3.53%).

Hoarseness was the only voice-related symptom reported to occur yearly or more by the majority of respondents ($n = 475$, 72.85%); the next most frequent symptoms were voice tiring or changing quality ($n = 298$, 45.71%) and

frequent throat clearing ($n = 285$, 43.71%; see Table 2).

One third of college students reported trouble speaking or singing softly ($n = 210$, 32.21%), difficulty projecting ($n = 246$, 37.73%), loss of singing range ($n = 210$, 32.21%), discomfort using voice ($n = 217$, 33.28%), chronic sore throat ($n = 204$, 31.29%), and chronic dryness of the throat ($n = 203$, 31.13%) at least once a year. One in five respondents noted requiring effort to talk ($n = 149$, 22.85%), whereas a wet or gurgly voice ($n = 89$, 13.65%), breathy voice ($n = 88$, 13.50%), bitter acidic taste ($n = 102$, 15.64%), and monotone voice ($n = 98$, 15.03%) were experienced by 15% or less of participants. Social or extracurricular activities were perceived to be the most likely cause for each symptom except for a wobbly or shaky (62.22% class, 29.44% work, 53.33% social) or monotone (69.39% class, 25.51% work, 43.88% social) voice, which were more frequently attributed to class. The influence of work on voice was perceived to be most evident for a chronic sore throat ($n = 66$, 32.35%) and requiring effort to talk ($n = 48$, 32.21%), and social activities were perceived to result in hoarseness ($n = 151$, 82.74%).

Social and extracurricular activities accounted for the heaviest voice usage, with the majority of college students talking (79.60%) and laughing (73.93%) often or all the time and talking loudly (50.92%), shouting/yelling/cheering

Table 2. Frequency of voice-related symptoms and perceived source as reported by college students ($n = 652$).

Symptom	Frequency (%)						Source ^a (%)		
	Never	Daily	Weekly	Monthly	Several per year	Yearly	Class/school	Work	Social or extracurricular activities
Hoarseness	27.15	0.92	2.76	8.74	34.66	25.77	31.79	19.58	82.74
Voice tires or changes quality	54.29	2.30	6.75	10.43	17.02	9.20	45.74	29.46	77.91
Trouble speaking or singing softly	67.79	2.61	3.37	4.91	11.20	10.12	48.57	20.00	74.29
Difficulty projecting	62.27	5.06	4.29	5.21	13.04	10.12	48.37	25.61	67.48
Loss of singing range	67.79	2.15	2.15	5.21	13.50	9.20	36.67	17.14	75.24
Discomfort using voice	66.72	1.53	2.91	4.91	14.26	9.66	51.15	24.88	67.28
Monotone voice	84.97	2.61	3.37	2.76	3.83	2.45	69.39	25.51	43.88
Effort to talk	77.15	2.45	3.07	4.75	7.52	5.06	54.36	32.21	64.43
Chronic dryness of throat	68.87	1.84	4.91	6.13	11.81	6.44	54.68	28.08	72.91
Wet, gurgly voice quality	86.35	1.07	1.53	3.22	4.91	2.91	46.07	22.47	67.42
Chronic sore throat	68.71	1.07	0.92	4.29	14.26	10.74	61.76	32.35	66.67
Frequently clear throat	56.29	10.89	7.82	7.82	12.27	4.91	60.70	29.12	68.42
Bitter or acidic taste	84.36	92.00	2.61	4.14	4.14	3.83	56.86	21.57	66.67
Wobbly or shaky voice	72.39	2.30	4.60	8.59	8.59	3.53	62.22	29.44	53.33
Breathy voice	86.50	0.61	2.61	3.68	3.99	2.61	51.14	28.41	67.05

^aValues were calculated as a percentage of those experiencing the symptom, not total respondents. Respondents could choose more than one source.

(36.35%), and singing (27.61%) most frequently within this setting. Talking quietly was most often done in class (49.70%), whereas coughing and throat clearing were typically reported as occurring only rarely or sometimes regardless of the setting. In all students surveyed, work typically involved less frequent voice usage. For those who were employed, however, voice usage was substantial for the majority of participants, with more than 90% talking often or all the time at work (91.55%). Just less than one half reported talking loudly (44.96%) and laughing (48.23%) often or all the time at work, whereas singing (8.45%), shouting/yelling/cheering (8.17%), and coughing (8.72%) were reported by less than 10% of employed students (see Table 3).

One third ($n = 221$, 33.90%) of survey respondents indicated they had experienced a problem with their voice so that it interfered with communication (classified as a voice disorder for the purposes of this study). Forty-six (7.06%) college students reported a voice problem lasting 4 weeks or more (classified as chronic), whereas 175 (26.84%) reported acute concerns only. Less than 5% ($n = 29$, 4.45%) of the cohort had a current voice problem. For those identifying voice problems, gradual ($n = 108$, 48.87%) and sudden ($n = 113$, 51.13%) onset were reported evenly, whereas most considered their problems to be “off and on” ($n = 204$, 92.31%) rather than continual ($n = 17$, 7.69%). When asked to identify the age at which voice problems first began, the most frequent response for those who could recall (*I don't know* was selected by 28.96%, $n = 64$) was between 15 and 19 years of age ($n = 67$, 30.32%). Other responses in order of frequency were 10 to 14 years ($n = 42$, 19.00%), 5 to 9 years ($n = 26$, 11.76%), 0 to 4 years ($n = 6$, 2.71%), 20 to 29 years ($n = 9$, 4.07%), and 40 to 49 years ($n = 1$, 0.45%). Having responded *yes* to the initial question, six participants (2.71%) selected “I have never had a problem with my voice.”

Less than 15% of those with a voice disorder had previously sought help ($n = 29$, 13.12%). Of those who had, a speech-language pathologist ($n = 11$, 37.93%) and primary care provider ($n = 11$, 37.93%) were most frequently reported, followed by otolaryngologist ($n = 9$, 31.03%) and the university health service ($n = 4$, 13.79%). Just more than one half ($n = 16$, 55.17%) were able to recall a diagnosis or reason being provided (laryngitis due to colds or strep, $n = 10$; laryngitis due to usage, $n = 7$; nodules, $n = 2$; gastroesophageal reflux disease, $n = 2$; allergies, $n = 4$; air irritants, $n = 1$; injury, $n = 1$; other, $n = 14$).

When asked to reflect specifically on vocal health over the prior 12-month period, 300 students (46.01%) answered *yes* to having “problems or difficulties with your voice, such as having a hoarse, raspy, or strained voice, or difficulty speaking loud enough to be heard.” Of those, less than 1% ($n = 6$, 0.92%) had seen a speech-language pathologist or other health care professional regarding their voice problems or had received treatment, therapy, or other rehabilitation services ($n = 6$, 0.92%). When asked how much of a problem they had with their voice over the past 12 months, 340 students (52.15%) selected *no problem*, 248 (38.04%) selected *a small problem*, 50 (7.67%) selected *a moderate problem*, five (0.77%) selected *a big problem*, two (0.31%) selected *a very big problem*, and seven (1.07%) selected *I don't know*. The majority of respondents considered their voice to be the same as it was 12 months ago ($n = 518$, 79.45%). Of the remainder, 39 (5.98%) did not know, 15 (2.30%) thought their voice was worse, and 78 (11.96%) thought it was better; two (0.31%) refused to answer the question. Most often, students reported having voice problems for between 1 and 6 days in the past year ($n = 255$, 39.11%) or not having a problem at all ($n = 182$, 27.91%). Less than 10% of participants had voice problems

Table 3. Undergraduate voice use patterns (%) in college, work, and social or extracurricular activities.

Voice use	Never	Rarely	Sometimes	Often	All the time
Talk					
Class	0.46	5.67	24.69	36.35	32.82
Social	1.23	1.84	17.33	34.51	45.09
Work ^a	2.91	2.61	10.12	20.86	30.67
Work ^b	5.18	4.63	4.36	37.06	54.50
Talk quietly					
Class	2.61	6.75	40.95	37.58	12.12
Social	5.83	18.40	42.94	20.71	12.12
Work ^a	7.52	14.26	21.47	17.18	7.36
Work ^b	13.35	25.34	38.15	30.52	13.08
Talk loudly					
Class	9.97	33.28	33.90	17.18	5.67
Social	3.68	9.66	35.74	32.36	18.56
Work ^a	9.20	15.34	18.10	16.26	9.05
Work ^b	16.35	27.25	32.15	28.88	16.08
Sing					
Class	55.83	25.15	9.66	5.67	3.68
Social	23.16	21.17	28.07	18.71	8.90
Work ^a	40.80	14.42	7.98	3.37	1.38
Work ^b	72.48	25.61	14.17	5.99	2.45
Shout/yell/cheer					
Class	51.69	28.37	13.50	4.60	1.84
Social	13.34	16.26	34.05	24.69	11.66
Work ^a	43.87	11.81	7.67	2.45	2.15
Work ^b	77.93	20.98	13.62	4.36	3.81
Clear throat					
Class	10.28	31.75	36.96	15.18	5.83
Social	13.04	27.61	38.34	15.03	5.98
Work ^a	13.34	19.63	23.31	8.90	2.30
Work ^b	23.71	34.88	41.42	15.80	4.09
Laugh					
Class	1.99	9.36	39.72	32.06	16.87
Social	2.76	4.45	18.87	45.71	28.22
Work ^a	5.21	8.90	24.69	19.33	7.82
Work ^b	9.26	15.80	43.87	34.33	13.90
Cough					
Class	3.99	42.18	43.10	8.44	2.30
Social	7.98	38.34	39.88	9.05	4.75
Work ^a	9.51	28.68	24.39	3.68	1.23
Work ^b	16.89	50.95	43.32	6.54	2.18

Note. Not all participants were employed.

^aPercentage calculated from total participants ($n = 652$) to provide overall usage value. ^bCalculated as a percentage of those employed ($n = 367$) to demonstrate voice usage at work.

for 7 to 12 days ($n = 65$, 9.97%) or 13 to 20 days ($n = 35$, 5.37%), and longer durations of problems were present in less than 2% of students (21–15 days, $n = 7$, 1.07%; 26–30 days, $n = 9$, 1.38%; 31–60 days, $n = 5$, 0.77%; 61–90 days, $n = 2$, 0.31%; 91–180 days, $n = 2$, 0.31%; 181–270 days, $n = 3$, 0.46%; 271–365 days, $n = 6$, 0.92%). *I don't know* was selected by 81 (12.42%) respondents.

Voice-related symptoms were reported to restrict educational and social activities by 22% of students ($n = 149$ and 147, respectively); however, few reported a voice-related absence of 1 to 3 days (class, $n = 55$, 8.44%; social, $n = 41$, 6.29%) or longer (class, $n = 5$, 0.77%; social, $n = 9$, 1.38%) in either setting. Frequency of voice-related limitations in the work setting were similar (when calculated as a percentage

of employed students, $n = 367$). Eighty-eight (23.98%) students noted limitations at work due to voice problems; such problems resulted in an absence of 1 to 3 days for 24 respondents (6.54%) and an absence of 4 days or more for two respondents (0.54%). Average total VHI score for the 652 students was 9.54 ($SD = 12.96$, range = 0–79; see Table 4), with 94.02% of scores falling within normal limits (1.99% mild, 2.92% moderate, 1.07% severe; 5.98% total). Subscores were highest for functional questions ($M = 4.39$, $SD = 5.37$, range = 0–30), with 11.66% ($n = 76$) of scores in the *mild* ($n = 18$, 2.76%), *moderate* ($n = 36$, 5.52%), and *severe* ($n = 22$, 3.37%) categories, whereas 96.17% ($n = 627$) of physical scores and 92.33% ($n = 602$) of emotional scores were within normal limits.

Statistically significant differences ($p < .05$) were found between students with a positive history of a voice disorder and those without across selected sociodemographic and voice-related variables (see Table 5). Those in the group with voice disorder were more frequently involved in religious groups and the performing arts; reported more health concerns (e.g., esophageal reflux, respiratory allergies, asthma, laryngitis, seasonal or chronic postnasal drip), voice-related symptoms (e.g., hoarseness, chronic sore throat, wobbly or shaky voice), and a change in their voice over the past 12 months (better or worse); and had experienced more voice-related restrictions and absences. The strongest predictors of having had a voice disorder during the lifetime were voice change in the past 12 months (OR = 2.77, CI [1.62, 4.74]), postnasal drip (OR = 2.11, CI [1.35, 3.31]), hoarseness yearly or more (OR = 2.08, CI [1.21, 3.58]), limitations in social or extracurricular activities (OR = 2.07, CI [1.32, 3.27]), coughing often or all the time in a social setting (OR = 1.79, CI [1.03, 3.11]), vocal discomfort (OR = 1.67, CI [1.07, 2.59]), loss of singing range (OR = 1.59, CI [1.03, 2.45]), and VHI total score (for which each 1-point increase amplified the odds by 1.04, CI [1.02, 1.06], meaning that an 18-point increase would increase the odds by 2.03).

Those with a history of chronic voice problems had significantly higher VHI scores ($M = 25.28$, $SD = 21.22$) than those with acute episodes ($M = 12.47$, $SD = 14.14$) and were more likely to report esophageal reflux (13% vs. 9%; see Table 6). The strongest predictors of chronic versus acute disorders, however, were found to be current employment in the retail sector (10% chronic vs. 1% acute, OR = 9.68) and hoarseness (69% chronic vs. 89% acute, OR = 0.19). Arthritis (10% current vs. 2% previous, OR = 13.91), voice-related limitations at work (41% current vs. 21% previous, OR = 2.95), and hoarseness (72% current vs. 87% previous, OR = 0.25) were the strongest risk factors associated with a current voice disorder (see Table 7) along with VHI score, which was significantly lower for those without current difficulties (current: $M = 31.72$, $SD = 23.43$; previous: $M = 12.63$, $SD = 15.39$; OR for each point increase = 1.05).

Discussion

Determining the true prevalence of voice disorders in the non-treatment-seeking population has long been recognized

Table 4. Mean scores on the Voice Handicap Index for all students and statistical comparison between groups with a voice disorder.

Variable	All students		Voice disorder														
			Ever		Never		<i>p</i> value	Chronic		Acute		<i>p</i> value	Current		Past		<i>p</i> value
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Functional	4.39	5.37	5.99	6.55	3.56	4.43	<.0001	9.67	8.81	5.02	5.45	.0010	12.03	9.45	5.08	5.47	<.0010
Physical	3.06	4.68	5.45	5.80	1.84	3.40	<.0001	8.17	6.32	4.74	5.45	<.0010	9.90	7.09	4.78	5.28	<.0010
Emotional	2.10	4.57	3.69	6.34	1.28	3.00	<.0001	7.43	9.10	2.71	4.98	.0010	9.79	10.09	2.77	4.99	<.0010
Total	9.54	12.96	15.14	16.66	6.68	9.38	<.0001	25.28	21.22	12.47	14.14	<.0010	31.72	23.43	12.63	13.82	<.0010

Note. Differences between groups with a voice disorder were calculated using *t* tests with Satterthwaite unequal variances *p* values.

as problematic (Behlau et al., 2012; Bhattacharyya, 2014; Roy et al., 2005, 2007; Roy, Merrill, Thibeault, Gray, et al., 2004; Roy, Merrill, Thibeault, Parsa, et al., 2004; Simberg et al., 2004; Thibeault et al., 2004). Associated with this is the tendency for the terms *voice disorder*, *dysphonia*, and *hoarseness* to be used synonymously in the research literature and clinical settings, with apparent disagreement on how to best define impaired vocal health (Rosen & Murry, 2000). To enable direct comparison with previous epidemiological studies (Roy et al., 2005; Roy, Merrill, Thibeault, Gray, et al., 2004; Roy, Merrill, Thibeault, Parsa, et al., 2004; Simberg et al., 2004; Thibeault et al., 2004), the current investigation categorized a voice disorder according to whether participants had perceived their voice to negatively affect communication but also included an alternative question used in a recent National Institutes of Health investigation regarding vocal difficulties over the past 12 months (Bhattacharyya, 2014). The two questions yielded markedly different results (33% vs. 46%)—a clear indication that not all changes to voice function are perceived to be problematic or interfere with communication. If the presence of hoarseness alone is defined as dysphonia, then 73% of college students in the current study experienced dysphonia on at least a yearly basis. Regardless of the definition, these results suggest that young adults in college experience frequent impairments to vocal health—likely greater than previous estimates on the basis of age from general population figures.

Lifetime prevalence rates of a voice disorder (defined as having an impact on communication) were slightly higher for students in Wisconsin than previously reported in Utah (33.9% vs. 29.0%; Merrill et al., 2013). Examination of previously isolated risk factors from the general population would point toward greater use of alcohol and inhaled substances. However, even though rates of alcohol (68.56% vs. 59.60%) and marijuana (34.67% vs. 19.10%) use among the current cohort exceeded national estimates for individuals aged 18 to 25 years in the United States (National Center for Health Statistics, 2015), univariate and multivariate analyses revealed no apparent influence. Indeed, the relative weight of risk factors to vocal health in young adults attending college appears to differ from that of the general population. No significant impact of age, sex, or family history of a voice disorder was found in either cohort for ever having a voice disorder or for the type (chronic vs. acute). Instead, key factors spanned a range of sociodemographic (retail

employment, social activities), medical (reflux, sinus infections, postnasal drip, neurological symptoms), voice usage (shout/yell/cheer or cough socially), and symptomatology (hoarseness, monotone pitch, wobbly or shaky voice, loss of singing range, discomfort using voice, change over the past 12 months) parameters associated with voice-related limitations outside of class and work and general negative influence on voice-related quality of life (VHI).

In general, young adults in college in this investigation tended to use their voice more during social or extracurricular activities than during class or work, particularly for more vocally demanding activities, such as shouting, yelling, cheering, and singing. For employed students, however, substantial voice-related requirements were present, with more than 90% talking often or all the time and 45% reporting a frequent need to talk loudly. Indeed, comparing data from employed students with previous accounts of the general working population (Roy et al., 2005), college students report substantially elevated voice activity requirements at work as well as more high-risk behaviors such as throat clearing (19.89% vs. 14.00% often or all the time). Student perceptions of the likely source of vocal health concerns largely mirrored activity patterns, with the majority identifying social or extracurricular activities as the likely source. Although talking loudly in class often or all the time was more frequently reported by those ever experiencing a voice disorder, it appears likely that attending class during college is not a major source of vocal load, and it is unlikely that attending class is detrimental to vocal health. Rather, environmental factors related to employment and social or extracurricular activities are likely major contributors.

Compared with previous accounts of nonprofessional voice users (“nonteachers”; Roy, Merrill, Thibeault, Gray, et al., 2004), the prevalence of voice symptomatology (except hoarseness, equivalent, and a bitter taste in the mouth, fewer) was greater among the current cohort. More than double the percentage of college students reported that their voices tire or change quality or that they have difficulty speaking softly and projecting their voice, a monotone quality, a chronic dry and/or sore throat, and a wobbly or shaky voice. Indeed, the frequency of vocal health complaints in this cohort suggests that experiencing voice-related symptoms (particularly hoarseness; 72.85%) on a yearly basis or more could be considered typical for young adults attending college, particularly given that vocal problems generally

Table 5. Univariate and multivariate regression model for respondents who ever had a voice disorder ($n = 221$) versus those who never had a voice disorder ($n = 431$).

Variable	Ever		Never		<i>p</i> value	Multivariate regression		Stepwise regression	
	<i>n</i>	%	<i>n</i>	%		OR	95% CI	OR	95% CI
Medical history									
Speech-language pathologist services < 18 years of age	36	16.29	40	9.28	.010	1.48	[0.78, 2.80]		
Esophageal reflux	23	10.41	18	4.18	.006	1.45	[0.59, 3.51]		
Respiratory allergies	74	33.48	75	17.40	.000	1.17	[0.69, 1.99]		
Asthma	38	17.19	45	10.44	.047	1.14	[0.59, 2.23]		
Laryngitis	71	32.13	66	15.31	.000	1.50	[0.88, 2.56]		
Postnasal drip (seasonal or chronic)	73	33.03	84	19.49	.001	1.97	[1.19, 3.26]	2.11	[1.35, 3.31]
Decongestants or antihistamines	42	19.00	39	9.05	.000	1.42	[0.74, 2.73]		
Social and extracurricular activities									
Religious groups	47	21.27	65	15.08	.049	1.50	[0.86, 2.62]		
Performing arts	34	15.38	39	9.05	.018	1.07	[0.55, 2.10]		
Substance use									
Cigarettes	31	14.03	59	13.69	.107	1.13	[0.58, 2.21]		
Marijuana	78	35.29	148	34.34	.889	1.13	[0.68, 1.89]		
Alcohol	156	70.59	291	67.52	.476	1.17	[0.70, 1.95]		
Voice use									
Talk loudly in class often or all the time	159	71.95	292	67.75	.030	1.23	[0.74, 2.04]		
Sing at work	16	7.24	15	3.48	.050	1.66	[0.60, 4.60]		
Cough socially	40	18.10	50	11.60	.030	2.04	[1.11, 3.74]	1.79	[1.03, 3.11]
Symptoms ^a									
Hoarseness	189	85.52	286	66.36	.000	1.95	[1.09, 3.50]	2.08	[1.21, 3.58]
Voice tires or changes quality	146	66.06	152	35.27	.000	1.71	[1.06, 2.76]		
Trouble speaking or singing softly	103	46.61	107	24.83	.000	0.85	[0.51, 1.41]		
Difficulty projecting	124	56.11	122	28.31	.000	1.34	[0.83, 2.15]		
Loss of singing range	111	50.23	99	22.97	.000	1.71	[1.04, 2.79]	1.59	[1.03, 2.45]
Discomfort using voice	117	52.94	100	23.20	.000	1.78	[1.09, 2.92]	1.67	[1.07, 2.59]
Monotone voice	47	21.27	51	11.83	.002	0.63	[0.33, 1.20]		
Effort to talk	86	38.91	63	14.62	.000	1.35	[0.76, 2.40]		
Chronic dryness of throat	91	41.18	112	25.99	.000	1.06	[0.65, 1.74]		
Wet, gurgly voice quality	44	19.91	45	10.44	.001	0.86	[0.46, 1.62]		
Chronic sore throat	90	40.72	114	26.45	.000	1.16	[0.70, 1.91]		
Frequently clear throat	117	52.94	168	38.98	.000	0.65	[0.40, 1.04]		
Bitter or acidic taste	50	22.62	52	12.06	.001	0.59	[0.31, 1.14]		
Wobbly or shaky voice	93	42.08	87	20.19	.000	1.87	[1.08, 3.24]		
Breathy voice	49	22.17	39	9.05	.000	0.72	[0.37, 1.42]		
Past 12 months									
Voice change	56	25.34	37	8.58	.000	3.02	[1.69, 5.38]	2.77	[1.62, 4.74]
Class absence due to illness or injury (days)	$M = 3.62$	$SD = 6.28$	$M = 2.62$	$SD = 2.62$	.037	0.97	[0.93, 1.01]		
Impact of voice on daily living									
Limitations at school	85	38.46	64	14.85	.000	1.19	[0.64, 2.20]		
Limitations at work	54	24.43	34	7.89	.000	1.23	[0.60, 2.51]		
Social limitations	88	39.82	59	13.69	.000	1.94	[1.09, 3.46]	2.07	[1.32, 3.27]
Absence from school	29	13.12	28	6.50	.007	1.41	[0.51, 3.89]		
Absence from work	12	5.43	12	2.78	.122	0.57	[0.16, 1.96]		
Social absence	23	10.41	20	4.64	.010	0.57	[0.17, 1.90]		
Voice Handicap Index total ^b	$M = 15.14$	$SD = 16.66$	$M = 6.68$	$SD = 9.38$	<.001	1.03	[1.01, 1.05]	1.04	[1.02, 1.06]

Note. Odds ratio is for each 1-point increase in score. OR = odds ratio; CI = confidence interval.

^aSymptoms were reported to occur at least once per year. ^bTreated as a continuous variable.

were deemed to represent only a minor, if any, concern (< 10% considered it more than a small problem and < 1% had sought medical advice). Examining the impact on communication rather than discrete vocal symptomatology would seem particularly valuable in determining which individuals would benefit from professional assistance. Although few students reported voice-related absences, one in five considered voice symptoms to have imposed restrictions

on educational, work, and social activities. The degree of impact and frequency of restriction were associated with a lifetime prevalence of a voice disorder, with current VHI score distinguishing both students who had ever had a voice disorder and those with chronic versus acute concerns.

The current findings have far-reaching clinical application. Along with providing a normative reference point for differential diagnosis, the identification of a novel set of

Table 6. Univariate and multivariate regression model for respondents who had chronic voice disorders ($n = 46$) versus those who had acute voice disorders ($n = 176$).

Variable	Voice disorder					Chronic voice disorder			
	Chronic		Acute		<i>p</i> value	Multivariate regression		Stepwise regression	
	<i>n</i>	%	<i>n</i>	%		OR	95% CI	OR	95% CI
Demographics									
Current retail employment	5	10.87	3	1.70	.0110	9.03	[1.31, 62.39]	9.68	[1.77, 53.06]
Medical history ^a									
Esophageal reflux	6	13.04	17	9.66	.0100	0.60	[0.15, 2.45]		
Neurological symptoms	3	6.52	1	0.57	.0290	4.35	[0.28, 67.39]		
No history of sinus infections	23	50.00	64	36.36	.0110	0.48	[0.20, 1.14]		
Social and extracurricular activities									
Spectator at sports events	12	26.09	83	47.16	.0120	0.56	[0.21, 1.49]		
Other not-specified activities	11	23.91	16	9.09	.0110	2.80	[0.85, 9.24]	2.97	[1.03, 8.54]
Shout/yell/cheer often or all the time	11	23.91	71	40.34	.0410	1.06	[0.37, 3.06]		
Substance use									
Alcohol	26	56.52	130	73.86	.0280	0.68	[0.26, 1.77]		
Symptoms ^b									
Hoarseness	32	69.57	157	89.20	.0020	0.16	[0.06, 0.43]	0.19	[0.08, 0.49]
Monotone voice	15	32.61	32	18.18	.0430	1.32	[0.48, 3.61]		
Wobbly or shaky voice	27	58.70	66	37.50	.0120	1.01	[0.39, 2.56]		
Past 12 months									
Problem with voice	38	82.61	136	77.27	.0090	0.73	[0.22, 2.45]		
Voice problems for > 7 days	35	76.09	74	42.05	<.0001	2.06	[0.93, 4.56]		
Impact of voice on daily living									
Voice Handicap Index total ^c	<i>M</i> = 25.28	<i>SD</i> = 21.22	<i>M</i> = 12.47	<i>SD</i> = 14.14	.0000	1.04	[1.01, 1.06]	1.04	[1.02, 1.07]

Note. Odds ratio is for each 1-point increase in score. OR = odds ratio; CI = confidence interval.

^aSelf-reported medical history, current and past 6 months. ^bSymptoms were reported to occur at least once per year. ^cTreated as a continuous variable.

sociodemographic, medical, and voice use risk factors can help shape evaluation and management approaches. One potential application is the development of a targeted screening evaluation for young adults that includes specific questions regarding vocal usage in work, social, and extracurricular environments; frequency of vocal symptoms; and associated medical factors. Identification of individuals at risk for a voice disorder—particularly of a chronic nature—during young adulthood presents a valuable preventative opportunity in light of the widely documented increase in vocal disturbances with age. For both clinical and research purposes, consensus on what constitutes a voice disorder, dysphonia, and/or impaired vocal health—particularly on whether an individual must perceive a problem for a voice disorder to exist and whether it must interfere with communication—is required. For example, the recent trend toward the adoption of glottal fry as a desired vocal quality (Wolk, Abdelli-Beruh, & Slavin, 2012) highlights a potential area for discrepancy between established reference values for noise within an acoustic signal, an individual's perception, and cultural norms. Using the terms *hoarseness* and *dysphonia* interchangeably would seem particularly problematic because although hoarseness is both a sign and a symptom of dysphonia, it was one of 15 voice symptoms found to be significantly more prevalent on univariate analysis, reminiscent of Best and Fakhry's (2011, p. 150) description of vocal disorders as a "heterogeneous grouping of symptom-based complaints."

Through thorough description of self-perceived vocal function and sociodemographic and medical characteristics, the current investigation provides a much-needed normative reference for young adults attending college and identifies risk factors associated with impaired voice function. These results should be interpreted with clear understanding of the inherent limitations to epidemiological methodology, including the ability to determine only association and not causation. Results may be subject to recall bias given the nature of the survey, and no objective measures of voice function were performed to document the presence or absence of atypical voice characteristics. Participation in the study was voluntary, and significantly more women than men completed the survey than those representative of the general undergraduate population at UW–Madison. This may have influenced the results, with voice problems reported to be more common among women (Bhattacharyya, 2014). Other significant differences noted between the surveyed group and the general undergraduate population represent small percentage differences, with the exception of age: A larger number of students between the ages of 20 and 25 years and a smaller number of those younger than 20 years responded. Nonetheless, this investigation reports a larger impact of dysphonia in those between 20 and 25 years of age compared with similarly aged undergraduate students in Finland (Simberg et al., 2004).

Results were obtained from a sample of a large public university in the United States. Given the influence of

Table 7. Univariate and multivariate regression model for respondents with current voice disorders ($n = 29$) versus those with previous voice disorders ($n = 192$).

Variable	Current		Previous		<i>p</i> value	Multivariate regression		Stepwise regression	
	<i>n</i>	%	<i>n</i>	%		OR	95% CI	OR	95% CI
Demographics									
Age (years)	$M = 19.34$	$SD = 1.45$	$M = 20.09$	$SD = 2.75$	.030	0.75	[0.47, 1.19]		
Medical history ^a									
Arthritis	3	10.34	4	2.08	.050	8.12	[0.87, 75.84]	13.91	[2.05, 94.43]
Social and extracurricular activities									
Spectator	7	24.14	88	45.83	.043	0.56	[0.16, 1.88]		
Substance use									
Alcohol use (years)	$M = 0.79$	$SD = 1.23$	$M = 1.50$	$SD = 2.45$	.017	0.99	[0.62, 1.57]		
Symptoms ^b									
Hoarseness	21	72.41	168	87.50	.045	0.23	[0.06, 0.83]	0.25	[0.08, 0.81]
Trouble speaking softly	19	65.52	84	43.75	.044	1.59	[0.49, 5.15]		
Effort	17	58.62	69	35.94	.025	0.80	[0.22, 2.86]		
Wet voice	12	41.38	32	16.67	.005	2.47	[0.70, 8.74]		
Clear throat	21	72.41	96	50.00	.028	1.58	[0.42, 5.94]		
Breathy voice	12	41.38	37	19.27	.014	0.83	[0.20, 3.36]		
Past 12 months									
Problem with voice	25	86.21	149	77.60	.000	0.25	[0.04, 1.54]		
Voice problems for > 7 days	22	75.86	87	45.31	.000	2.74	[0.91, 8.26]		
Health information from the Internet	4	13.79	77	40.10	.007	0.37	[0.08, 1.64]		
Impact of voice on daily living									
Limitations at work	12	41.38	42	21.88	.035	3.31	[0.96, 11.36]	2.95	[1.02, 8.51]
Voice Handicap Index total ^c	$M = 31.72$	$SD = 23.43$	$M = 12.63$	$SD = 15.39$	.000	1.04	[1.01, 1.07]	1.05	[1.03, 1.08]

Note. Odds ratio is for each 1-point increase in score. OR = odds ratio; CI = confidence interval.

^aSelf-reported medical history, current and past 6 months. ^bSymptoms were reported to occur at least once per year. ^cTreated as a continuous variable.

sociodemographic factors on vocal health in the current cohort, some degree of variation could be expected in other locations. To further investigate the influence of college education on voice function, comparative investigations involving participants of a similar age who are not involved in college would be of benefit. In this way, the relative influence of age on vocal health, as separate from cultural and educational factors, could be determined.

Conclusions

In the most comprehensive investigation to date, this large-scale study documented typical vocal health, usage patterns, and impact of voice on daily living for individuals attending college in the United States. The results indicate that the prevalence of vocal health concerns in a young adult population is likely higher than previously estimated, with one third of college students indicating that voice-related symptoms interfered with communication at some point and almost one half reporting problems or difficulties with voice within the past 12 months. Univariate and multivariate analyses identified the strongest risk factors to be change in voice over the past 12 months (OR = 2.77), seasonal or chronic postnasal drip (OR = 2.11), hoarseness (OR = 2.08), and social limitations (OR = 2.07) rather than age, sex, or substance use. If differential diagnosis of dysphonia is to require a departure from normative standards

for age, sex, education, and culture, then the current study suggests that for young adults in college, clinicians must look beyond vocal symptoms such as hoarseness and instead inquire about perceived change in voice function over time and voice-related limitations experienced both at work and socially.

Acknowledgments

This research was supported by funding from the Diane M. Bless Endowed Chair in Otolaryngology Head and Neck Surgery and NIH R01 4336, 12773 and 13508. We thank Glen Levenson, biostatistician in the School of Medicine and Public Health at University of Wisconsin–Madison, for his invaluable statistical advice.

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Eligibility Questions

Q1 I am 18 years or older.

- ☐ Yes
- ☐ No

Q2 I am currently enrolled at University of Wisconsin–Madison as a:

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Fifth year
- ☐ Graduate student
- ☐ I'm not currently enrolled at University of Wisconsin–Madison.

Q3 I have trouble understanding written English.

- ☐ Yes
- ☐ No

Main Survey

Demographics

Q4 I am:

- ☐ Male
- ☐ Female

Q5 What is your age?

Q6 I am (if you would like to indicate more than one option, please choose the “other” box and enter details):

- ☐ White
- ☐ Native American or Alaska Native
- ☐ Black or African American
- ☐ Asian or Pacific Islander
- ☐ Hispanic or Latino
- ☐ Other _____

Q7 What is your school or college of enrollment?

- ☐ Agriculture and Life Sciences
- ☐ Business
- ☐ Education
- ☐ Engineering
- ☐ Human Ecology
- ☐ Letters and Sciences
- ☐ Nursing
- ☐ Pharmacy

Q8 How many credits are you currently taking?

- ☐ 12–18 credits
- ☐ 6–12 credits
- ☐ 1–5 credits

Q9 Are you currently employed?

- ☐ Yes
- ☐ No (Go to Q12)

Answer only if yes is selected for Q9

Q10 What type of job do you currently have? Select those that most accurately represent your employment.

- ☐ Tutor
- ☐ Resident assistant
- ☐ Retail
- ☐ Food industry
- ☐ Clerical and administrative work
- ☐ Child care provider
- ☐ Other (please list) _____

Answer only if yes is selected for Q9

Q11 On average, how many hours per week do you work?

Q12 On average, how many hours per week are you involved in social or extracurricular activities?

Q13 What type(s) of social and extracurricular activities do you actively participate in? You may select more than one.

- ☐ Sporting activities (e.g., cycling, hockey, athletics)
- ☐ Student organizations
- ☐ Religious groups
- ☐ Greek life
- ☐ Performing arts
- ☐ Attending sports events as a spectator
- ☐ Live music events
- ☐ Bars and clubs
- ☐ Karaoke
- ☐ Marching band
- ☐ Other (please provide details)

Voice Problems

Q14 For the purposes of this study, we consider a voice problem to be “any time your voice does not work, perform, or sound as you feel it normally should so that it interferes with communication.” Have you ever had a voice problem like this?

- ☐ Yes
- ☐ No

Answer only if yes is selected for Q14

Q15 At what age (in years) did you first begin to have any voice problems?

- ☐ 0–4
- ☐ 5–9
- ☐ 10–14
- ☐ 15–19
- ☐ 20–29
- ☐ 30–39
- ☐ 40–49
- ☐ 50–59
- ☐ 60–69
- ☐ 70–79
- ☐ 80–89
- ☐ 90–99
- ☐ I don’t know.
- ☐ I have never had a problem with my voice. (Go to Q24)

Answer only if yes is selected for Q14

Q16 Have you had any voice problems since that time?

- ☐ Yes
- ☐ No

Answer only if yes is selected for Q14

Q17 Did this problem last for 4 weeks or more?

- ☐ Yes
- ☐ No

Answer only if yes is selected for Q14

Q18 Did the problem begin gradually or suddenly?

- ☐ Gradually
- ☐ Suddenly

Answer only if yes is selected for Q14

Q19 Have your voice problems been continual or off and on?

- ☐ Continual
- ☐ Off and on

Answer only if yes is selected for Q14

Q20 Do you currently have a voice problem?

- ☐ Yes
- ☐ No

Answer only if yes is selected for Q14

Q21 Have you ever sought out help for your voice?

- ☐ Yes
- ☐ No (Go to Q24)

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Survey Investigating the Epidemiology of Vocal Health in Young Adults Attending College in the United States

Answer only if yes is selected for both Q14 and Q21

Q22 From whom did you seek help? You may select more than one response.

- ☐ Speech pathologist
- ☐ Ear, nose, and throat doctor
- ☐ Primary care provider
- ☐ University health services
- ☐ Other _____

Answer only if yes is selected for both Q14 and Q21

Q23 Did a doctor or other health professional ever give you a diagnosis or reason for your voice problem?

- ☐ Yes
- ☐ No (Go to Q24)
- ☐ I don't know. (Go to Q24)

Answer only if yes is selected for Q14, Q21, and Q23

Q24 What diagnoses or reasons were you told caused your voice problems?

- ☐ Laryngitis caused by voice misuse, abuse, or overuse
- ☐ Laryngitis caused by colds or strep
- ☐ Vocal nodules or polyps
- ☐ Gastroesophageal reflux disease
- ☐ Allergies
- ☐ Airborne irritants or environmental pollutants
- ☐ Head or neck injury
- ☐ Cancer anywhere in the head, neck, or throat
- ☐ Neurological cause (e.g., Alzheimer's, Parkinson's, dementia)
- ☐ Prescription medication or drugs
- ☐ Other _____

Everyone to Answer

Q25 Do you have a family history of any type of voice problem?

- ☐ Yes
- ☐ No (Go to Q27)

Answer only if yes is selected for Q25

Q26 Who in your family had a voice problem? You may select more than one.

- ☐ Mother
- ☐ Father
- ☐ Sister
- ☐ Brother
- ☐ Cousin
- ☐ Aunt
- ☐ Uncle
- ☐ Grandmother
- ☐ Grandfather
- ☐ Other

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Voice Use

Q27 Have you ever had any of the following voice symptoms? Where do you think they resulted from?

	How often?						The symptom resulted from (you may select more than one):		
	Never	Daily	Weekly	Monthly	Several times a year	Yearly	Class/school	Work	Extracurricular and social activities
Hoarseness	☐	☐	☐	☐	☐	☐	☐	☐	☐
Voice tires or changes quality	☐	☐	☐	☐	☐	☐	☐	☐	☐
Trouble speaking or singing softly	☐	☐	☐	☐	☐	☐	☐	☐	☐
Difficulty projecting	☐	☐	☐	☐	☐	☐	☐	☐	☐
Loss of singing range	☐	☐	☐	☐	☐	☐	☐	☐	☐
Discomfort using voice	☐	☐	☐	☐	☐	☐	☐	☐	☐
Monotone voice	☐	☐	☐	☐	☐	☐	☐	☐	☐
Effort to talk	☐	☐	☐	☐	☐	☐	☐	☐	☐
Chronic dryness of throat	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wet, gurgly voice quality	☐	☐	☐	☐	☐	☐	☐	☐	☐
Chronic sore throat	☐	☐	☐	☐	☐	☐	☐	☐	☐
Frequently clear throat	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bitter or acidic taste	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wobbly or shaky voice	☐	☐	☐	☐	☐	☐	☐	☐	☐
Breathy voice	☐	☐	☐	☐	☐	☐	☐	☐	☐

Survey Investigating the Epidemiology of Vocal Health in Young Adults Attending College in the United States

	Class/school					Work						Extracurricular and social activities				
	Never	Rarely	Sometimes	Often	All the time	Never	Rarely	Sometimes	Often	All the time	Unemployed	Never	Rarely	Sometimes	Often	All the time
Talk	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Talk quietly	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Talk loudly	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shout, yell, or cheer	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Clear throat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Laugh	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cough	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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Survey Investigating the Epidemiology of Vocal Health in Young Adults Attending College in the United States

Vocal Health

Q29 Has your voice ever caused the following?

	Class/school		Work		Extracurricular and social activities	
	Yes	No	Yes	No	Yes	No
Limitations or inability to do certain tasks	☐	☐	☐	☐	☐	☐
An absence of 1–3 days	☐	☐	☐	☐	☐	☐
An absence of 4 days or more	☐	☐	☐	☐	☐	☐

Q30 How many days in the past year did you have voice problems?

- ☐ 1–6 (Go to Q32)
- ☐ 7–12 (Go to Q32)
- ☐ 13–20 (Go to Q32)
- ☐ 21–25 (Go to Q32)
- ☐ 26–30 (Go to Q32)
- ☐ 1–60 (Go to Q32)
- ☐ 61–90 (Go to Q32)
- ☐ 91–180 (Go to Q32)
- ☐ 181–270 (Go to Q32)
- ☐ 271–365 (Go to Q32)
- ☐ I don't know.
- ☐ I haven't had problems this year. (Go to Q32)

Answer only if I don't know is selected for Q30

Q31 Altogether, did your voice problems last a week or longer?

- ☐ Yes
- ☐ No
- ☐ I don't know.

Q32 During the past 12 months, approximately how many days did you miss because of illness or injury (do not include maternity leave)?

School/class _____

Work _____

Extracurricular and social activities _____

General Health

Q33 Do you have any of the following health conditions?

	Currently	Never	Within the past 6 months
Arthritis	☐	☐	☐
Thyroid problems	☐	☐	☐
Esophageal reflux	☐	☐	☐
Stomach or duodenal ulcers	☐	☐	☐
Respiratory allergies	☐	☐	☐
Diabetes	☐	☐	☐
Parkinson's disease	☐	☐	☐
Multiple sclerosis	☐	☐	☐
Heart disease	☐	☐	☐
Hypertension or high blood pressure	☐	☐	☐
Stroke	☐	☐	☐
Asthma	☐	☐	☐
Pneumonia	☐	☐	☐
Any immune disorder	☐	☐	☐
Neurological disorder with symptoms such as numbness, fainting, seizures, epilepsy, tremors, or weakness	☐	☐	☐
Severe head or neck injury	☐	☐	☐
Cancer of any kind	☐	☐	☐

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Survey Investigating the Epidemiology of Vocal Health in Young Adults Attending College in the United States

Q34 On average, how many times a year do you get the following?

	Never	Less than 1	1–2	3–5	6–8	More than 8
Colds	☐	☐	☐	☐	☐	☐
Sinus infections	☐	☐	☐	☐	☐	☐
Laryngitis	☐	☐	☐	☐	☐	☐

Q35 Do you have postnasal drip?

- ☐ Not at all
- ☐ Occasionally with colds
- ☐ Seasonally
- ☐ Chronically

Q36 Are you currently on any of the following medications?

	Yes	No
Decongestants or antihistamines	☐	☐
Depression or anxiety medication	☐	☐
High blood pressure medication	☐	☐
Steroids, oral contraceptives, or hormones	☐	☐
Chemotherapy	☐	☐

Q37 Have you ever used any tobacco product for a year or longer?

- ☐ Yes
- ☐ No

Q38 Have you ever smoked or used any of the following?

	Currently	Past	Never
Cigarettes	☐	☐	☐
Cigars	☐	☐	☐
Pipes	☐	☐	☐
Chewing tobacco	☐	☐	☐
Marijuana	☐	☐	☐
E-cigarettes	☐	☐	☐
Other recreational drugs	☐	☐	☐

Q39 Have you ever drank an average of one or more alcoholic beverages per week for 1 year or longer?

- ☐ Yes
- ☐ No

Q40 For how many years have you been drinking alcoholic beverages regularly?

Q41 Do you still drink alcoholic beverages?

- ☐ Yes
- ☐ No (Go to Q43)

Answer only if yes is selected for Q41

Q42 On average, how many alcoholic beverages do you consume per week?

- ☐ 1
- ☐ 2–4
- ☐ 5–8
- ☐ 8 or more

Vocal Health in the Past 12 Months

Q43 During the past 12 months, have you had any problems or difficulties with your voice, such as having a hoarse, raspy, or strained voice, or with difficulty speaking loud enough to be heard?

- ☐ Yes
- ☐ No (Go to Q45)

Answer only if yes is selected for Q43

Q44 During the past 12 months, have you seen a speech-language pathologist or other health care professional about your voice problems?

- ☐ Yes
- ☐ No
- ☐ I don't know.

Q45 During the past 12 months, how much of a problem did you have with your voice?

- ☐ No problem
- ☐ A small problem
- ☐ A moderate problem
- ☐ A big problem
- ☐ A very big problem
- ☐ I don't know.

Answer only if yes is selected for Q43

Q46 During the past 12 months, have you received treatments, therapy, or other rehabilitation services for your voice problems?

- ☐ Yes
- ☐ No
- ☐ I don't know.

Answer only if yes is selected for Q46

Q47 Who provided the services for your voice problems in the past 12 months? Please select all that apply.

- ☐ Speech-language pathologist
- ☐ Family physician, general practitioner, or osteopath
- ☐ Rehabilitation specialist (occupational or physical therapist)
- ☐ Ear, nose, and throat doctor (otolaryngologist)
- ☐ Audiologist, hearing specialist, or hearing aid technician
- ☐ Specialty doctor in internal medicine, geriatrics, neurology, and so on
- ☐ Nutritionist or dietician
- ☐ Psychiatrist or psychologist
- ☐ Nurse or nurse practitioner
- ☐ Dentist, orthodontist, or oral surgeon
- ☐ Other
- ☐ I don't know.

Answer only if yes is selected for Q46

Q48 Did the treatments or other rehabilitation services for your voice problems make your personal or social life better?

- ☐ Yes
- ☐ No
- ☐ I don't know.

Answer only if yes is selected for Q46

Q49 Did the treatments or other rehabilitation services for your voice problems make your life at school or work better?

- ☐ Yes
- ☐ No
- ☐ I don't know.

Q50 Compared with 12 months ago, would you say your voice is now better, worse, or about the same?

- ☐ Better
- ☐ Worse
- ☐ About the same
- ☐ Refused
- ☐ I don't know.

Q51 Before age 18 years, did you ever receive special services or instruction for a problem with your voice, speech, or language (e.g., pronunciation, using or understanding words or sentences) or in reading?

- ☐ Yes
- ☐ No (Go to Q54)

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Answer only if yes is selected for Q51

Q52 Was this for problems with your voice, swallowing, speech, or language? Select all that apply.

- ☐ Voice problem
☐ Swallowing problem
☐ Speech problem
☐ Language problem

Answer only if yes is selected for Q51

Q53 Do you still have problems with speech, language, swallowing, or voice? Select all that apply.

- ☐ No
☐ Yes, speech
☐ Yes, language
☐ Yes, swallowing
☐ Yes, voice

How Voice Affects Daily Living

Q54 These are statements that many people have used to describe their voices and the effects of their voices on their lives. Select the response that indicates how frequently you have the same experience.

0 = never; 1 = almost never; 2 = sometimes; 3 = almost always; 4 = always

Part I-F

	0	1	2	3	4
My voice makes it difficult for people to hear me.	☐	☐	☐	☐	☐
People have difficulty understanding me in a noisy room.	☐	☐	☐	☐	☐
My family has difficulty hearing me when I call them throughout the house.	☐	☐	☐	☐	☐
I use the phone less often than I would like to.	☐	☐	☐	☐	☐
I tend to avoid groups of people because of my voice.	☐	☐	☐	☐	☐
I speak with friends, neighbors, or relatives less often because of my voice.	☐	☐	☐	☐	☐
People ask me to repeat myself when speaking face to face.	☐	☐	☐	☐	☐
My voice difficulties restrict my personal and social life.	☐	☐	☐	☐	☐
I feel left out of conversations because of my voice.	☐	☐	☐	☐	☐
My voice problem causes me to lose income.	☐	☐	☐	☐	☐

Q55 These are statements that many people have used to describe their voices and the effects of their voices on their lives. Select the response that indicates how frequently you have the same experience.

0 = never; 1 = almost never; 2 = sometimes; 3 = almost always; 4 = always

Part II-P

	0	1	2	3	4
I run out of air when I talk.	☐	☐	☐	☐	☐
The sound of my voice varies throughout the day.	☐	☐	☐	☐	☐
People ask, "What's wrong with your voice?"	☐	☐	☐	☐	☐
My voice sounds creaky and dry.	☐	☐	☐	☐	☐
I feel as though I have to strain to produce voice.	☐	☐	☐	☐	☐
The clarity of my voice is unpredictable.	☐	☐	☐	☐	☐
I try to change my voice to sound different.	☐	☐	☐	☐	☐
I use a great deal of effort to speak.	☐	☐	☐	☐	☐
My voice is worse in the evening.	☐	☐	☐	☐	☐
My voice "gives out" on me in the middle of speaking.	☐	☐	☐	☐	☐

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Q56 These are statements that many people have used to describe their voices and the effects of their voices on their lives. Select the response that indicates how frequently you have the same experience.

0 = never; 1 = almost never; 2 = sometimes; 3 = almost always; 4 = always

Part III-E

	0	1	2	3	4
I am tense when talking to others because of my voice.	☐	☐	☐	☐	☐
People seem irritated with my voice.	☐	☐	☐	☐	☐
I find that other people don't understand my voice problem.	☐	☐	☐	☐	☐
My voice problem upsets me.	☐	☐	☐	☐	☐
I am less outgoing because of my voice problem.	☐	☐	☐	☐	☐
My voice makes me feel handicapped.	☐	☐	☐	☐	☐
I feel annoyed when people ask me to repeat.	☐	☐	☐	☐	☐
I feel embarrassed when people ask me to repeat.	☐	☐	☐	☐	☐
My voice makes me feel incompetent.	☐	☐	☐	☐	☐
I am ashamed of my voice problem.	☐	☐	☐	☐	☐

Accessing Health Information on the Internet

Q57 During the past 12 months, did you get information from the Internet about your health, medical treatments, or rehabilitation services?

- ☐ Yes
☐ No

Q58 During the past 12 months, did you get information from the Internet on voice problems?

- ☐ Yes
☐ No

Q59 Was any of this information written by a doctor, other health professionals, medical associations, or other health-related organizations?

- ☐ Yes
☐ No
☐ I don't know.

Answer only if yes is selected for Q57

Q60 Overall, how helpful was the health information found on the Internet?

- ☐ Very helpful
☐ Somewhat helpful
☐ Not helpful
☐ Refused

End of Survey