

Prevalence and Characteristics of Voice Disorders in a Sample of University Teaching Faculty

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any individuals rely on their voice in their employment setting (e.g., Verdolini & Ramig, 2001). Titze, Lemke, and Montequin

ABSTRACT: Purpose: This study examined the prevalence of voice disorders in university teaching faculty as well as demographic and behavioral variables linked with voice disorders in past research.

Method: One hundred participants completed a survey. **Results:** Of the 100 participants, 45 reported vocal difficulties that were substantial enough to interfere with normal communication. Symptoms were consistent with vocal overuse, including increased effort, hoarseness, decreased loudness, and vocal discomfort. Demographic and health/behavioral risk factors (e.g., age, gender, allergies, acid reflux, use of tobacco/alcohol) had little apparent effect on the prevalence of a voice disorder. A comparison with past data suggested that this sample of university faculty had a higher than average prevalence of voice disorder, although it was lower than levels reported for kindergarten through high school teachers.

Conclusion: Voice disorder is a considerable problem among university teaching faculty members. The demographic and behavioral factors associated with voice disorder in past studies were not significantly related to voice disorder in the present study. The results suggest that the demands of teaching, and not other demographic and behavioral factors, underlie voice disorder for the faculty participants.

KEY WORDS: voice, teaching, university, college

(1997) described a subset of these individuals as heavy occupational voice users. Included in this subset are clergy, therapists, singers, telemarketers, and teachers. Heavy vocal use (i.e., long duration of vocal use at high intensity) is often associated with voice problems, including physiological changes in the larynx, such as muscle tension and muscle fatigue, and vocal pathologies such as nodules or polyps (Colton & Casper, 1990). A variety of symptoms are associated with heavy vocal use, including hoarseness, decreased pitch control, decreased loudness control, breathiness, increased effort, and/or discomfort (Stemple, Glaze, & Klaben, 2000). For heavy occupational voice users, these problems can impede their work performance.

Defining Voice Disorder

In past research, there has been remarkable inconsistency in defining what exactly constitutes a voice disorder. Stemple (2000) provided three possible definitions, each with its own criteria. One definition described the speaker's voice differing from the voices of others within the same culture, age range, and so forth. The second stated that a voice disorder may be present when deviant characteristics of voice draw attention to the speaker. The third definition described both physical and functional aspects of voice, suggesting that a voice disorder may be present when there are problems with the structure and function of the larynx, or both.

It is not difficult to find several examples of how researchers vary in their definitions. Verdolini and Ramig

(2001), for example, defined voice disorder as “a condition of sufficient concern for the bearer to report it, register functional disruption because of it, and/or seek treatment because of it” (p. 37). Roy, Merrill, Thibeault, Parsa, et al. (2004) defined voice disorder as “any time the voice does not work, perform, or sound as it normally should, so that it interferes with communication” (p. 283). Other studies diagnosed individuals through the use of videoendoscopy and videolaryngostroboscopy (Kosztyla-Hojna, Rogowski, Ruczaj, Pepinski, & Lobaczuk-Sitnink, 2004). In the present study, our definition of a voice disorder is consistent with that of Verdolini and Ramig, and in particular, Roy, Merrill, Thibeault, Parsa, et al., in which the participant’s self-report of a voice problem that is sufficient enough to interfere with communication warrants the identification of a voice disorder.

Issues and Risk Factors for Voice Disorders

Speakers tend to increase the intensity (i.e., the acoustic correlate of loudness) of their voices in loud environments. This phenomenon is known as the Lombard effect. For every 10 dB >40 dB, speakers generally raise their speech intensity an average of 3 dB (Jonsdottir, 2002; Jonsdottir, Boyle, Martin, & Sigurdardottir, 2002), although individual speakers vary considerably in their response to background noise (Lindstrom, Persson Waye, Södersten, McAllister, and Ternström, 2011). In the presence of loud background noise, speakers also often raise their vocal fundamental frequency (i.e., the vibratory rate of the vocal folds; Jonsdottir et al., 2002). This combination means that speakers increase both the frequency and force of vocal fold contact in loud environments (Jiang & Titze, 1994; Morrow & Connor, 2011).

Voice disorder has sometimes been thought to occur more often in older individuals, making increased age a possible risk factor (e.g., Roy, Merrill, Thibeault, Parsa, et al., 2004; Villanueva-Reyes, 2011). It is possible that anatomical changes in the structure of the vocal folds and surrounding laryngeal structures play a role in such a relationship. There may also be differences between men and women regarding the prevalence of voice disorders (Laukkanen, Ilomaki, Leppanen, & Vilkmán, 2008; Rantala, Vilkmán, & Bloigu, 2002; Roy, Merrill, Thibeault, Parsa, et al., 2004; Verdolini & Ramig, 2002; Villanueva-Reyes, 2011). Specifically, women have been found to be at higher risk for voice disorders than men. It is likely that in women, the vocal folds are particularly exposed to the effects of use due to higher vibratory rates (Titze, Svec, & Popolo, 2003). To accomplish the same speaking task, women’s vocal folds tend to vibrate nearly twice as fast as men’s. Therefore, vocal fold tissue in women speakers receives more of what might be thought of as a mild form of trauma over long periods of time.

In addition to environmental factors and speaker characteristics, a number of medical conditions and medications used to treat them have been associated with increased risk of voice disorders (Colton & Casper, 1990; Roy, Merrill, Thibeault, Gray, & Smith 2004). For example, colds, influenza, and infections of the throat can lead to inflammation of the vocal folds, causing discomfort and perceptible changes in how the voice sounds (e.g., Villanueva-Reyes, 2011). The effects are usually mild, but in some cases (e.g., laryngitis),

aphonia may occur. Another medical condition associated with voice disorder is respiratory allergy, although the evidence is primarily anecdotal. Acid reflux, tobacco smoking, and alcohol use have also been reported to increase the risk of voice disorders (e.g., Colton & Casper, 1990). Finally, medications such as decongestants, antihistamines, and antidepressants have been suspected to cause voice problems.

Voice Disorders in Teachers

Among heavy occupational voice users, teachers have been the focus of many studies (Grillo & Fugowski, 2011; Kosztyla-Hojna et al., 2004; Morrow & Connor, 2011; Roy, Merrill, Thibeault, Parsa, et al., 2004; Roy et al., 2003; Sala, Laine, Simberg, Pentti, & Suonpaa, 2001; Verdolini & Ramig, 2001). The prevalence of voice disorders is substantially higher among teachers than among other professionals. Smith, Gray, Dove, Kirchner, and Heras (1997) estimated that 40% of U.S. teachers experience hoarseness, and the same amount report that teaching adversely affects their voices. Other studies report a prevalence of voice disorders in teachers ranging from 20% to 50% (McCabe & Titze, 2002).

Voice disorders undoubtedly have an impact on a teacher’s ability to teach. Smith et al. (1997) reported that >20% of teachers missed 1 or more days of work in the previous year because of voice-related issues. In contrast, nearly no voice-related absences were reported by nonteachers (Roy, Merrill, Thibeault, Gray, & Smith, 2004; Verdolini & Ramig, 2001). Smith et al. also found that >½ of the teachers surveyed indicated that their voice did not work as they would like it to >5 days a year. Additionally, 39% of the teachers surveyed stated that they reduced the number of activities they took part in because of voice-related difficulties (Smith, Kirchner, Taylor, Hoffman, & Lemke, 1998).

Simberg, Sala, Vehmas, and Laine (2005) compared data from 1988 to data from 2001 and suggested that there has been an increase in reported vocal symptoms during this time. They defined voice disorders conservatively as having symptoms weekly or more frequently. Survey results indicated that 12% and 20% of teachers reported voice disorders for 1988 and 2001, respectively. Teachers attributed the increase to a variety of issues, including larger class size and more student misbehavior, subsequently increasing the level of classroom noise.

The recommended upper limit of ambient noise in an unoccupied classroom is 30–40 dB (Jonsdottir, 2002). In order for speech to be intelligible, the American Speech-Language-Hearing Association (2005) recommends that background noise not exceed 35 dB, but most classrooms have higher levels (Berg, 1993). In noisy environments, speakers tend to increase their vocal intensity and fundamental frequency (Morrow & Connor, 2011). As noted earlier, these adaptations might increase demands on the larynx. However, not all teachers have been found to respond to noisy environments with increased intensity and fundamental frequency (Lindstrom et al., 2011).

Roy, Merrill, Thibeault, Gray, and Smith (2004) surveyed 1,243 teachers and 1,279 nonteachers in Utah and Iowa by telephone. Voice disorders were reported by 11.0% of the

teachers and 6.2% of the nonteachers. Roy, Merrill, Thibeault, Gray, and Smith also found that the teachers had a significantly higher prevalence of voice disorders over their lifetime compared to the nonteachers (57.7% and 28.8%, respectively). Symptoms included hoarseness, change in voice quality after short use, trouble speaking or singing softly, difficulty projecting voice, discomfort, loss of singing range, monotone voice, speech requiring effort, and bitter or acid taste. The two groups were also compared on a variety of previously suspected risk factors (e.g., gender, age, alcohol use, or tobacco use) and according to a history of voice disorder. It was found that women had a higher prevalence of voice disorders over their lifetime than men and a higher prevalence of chronic (lasting >4 weeks) voice disorders. Voice disorders were also reported more around middle age (age 40–59) and were associated with a number of health-related issues, including colds, asthma, allergies, and sinus infection.

Purpose of the Present Study

It seems clear that the prevalence of voice disorders is higher for teachers than for other professionals with less demand for occupational voice use. Past studies finding this prevalence have focused on kindergarten through Grade 12 (K–12) teachers. However, the prevalence of voice disorders in other educators remains unclear. To our knowledge, no research has been done to study the effect of teaching in higher educational settings.

Teaching faculty members at a college or university encounter risks similar to those of primary and secondary school teachers. Specifically, they must talk for long periods of time in environments with background noise, often increasing their loudness and raising their pitch. However, there are also differences between university teaching faculty and K–12 teachers. For example, the allocation of time spent speaking while teaching may differ between the two groups. Noise levels within the teaching environment may also differ. Additionally, teaching faculty at universities often teach in larger rooms than K–12 teachers, and to larger audiences. These factors could affect the way in which one must speak in order to be heard, placing greater demand on the vocal mechanism. These differences between the two groups provide a rationale for studying university teaching faculty as a separate group.

The purpose of this study was to examine the prevalence of voice disorders in a group of university teaching faculty. The symptoms and characteristics of voice disorders in the sample will be identified, as will the relationship between voice disorders and health/behavioral variables. Finally, the results will be compared with data from past studies of K–12 teachers and nonteachers.

METHOD

Participants

The participants in this study were faculty members from a single university who responded to a survey. Participants were not paid. It was estimated that >80% of those

contacted agreed to participate in the survey. Those who refused typically did so before knowing the study topic and therefore did not decline based on their experience with voice disorders. The first author approached potential participants randomly, in one of three ways: (a) in person, outside a weekend research presentation; (b) in person, in faculty offices; or (c) by telephone, at the phone number listed for teaching faculty in the university directory. These three methods of contact helped to avoid approaching students and other nonfaculty university employees by mistake. Names of respondents were monitored to avoid multiple responses from the same individuals. There were 105 original respondents, five of whom provided incomplete information or were not teaching faculty, leaving 100 surveys appropriate for use in the analysis.

Although participants were randomly contacted, more women ($n = 68$) participated than men ($n = 32$). As such, it is possible that women were overrepresented in the sample. The majority of faculty in the sample was within an age range of 40 to 59, which is generally consistent with university personnel records for the institution as a whole.

Procedure

The first author administered the survey to each participant. The survey assessed participants' demographic variables, reported characteristics of voice problems, and health/behavioral characteristics. The survey was similar to the one described by Roy, Merrill, Thibeault, Parsa, et al. (2004), but was streamlined to be administered in 5–10 min per respondent. Because the original survey was designed for a student to use with faculty in a campus setting, certain items used by Roy, Merrill, Thibeault, Parsa, et al. were omitted (e.g., asking about income level, hormone replacement medications, oral contraceptives).

The survey was designed to assess the following areas:

- **Prevalence.** Presence of voice disorder, as defined by self-reported *yes* to the question, "Are there times when your voice doesn't work or sound as you feel it should?" If a participant answered in the affirmative, the question was followed by, "To the point that it affects communication?" Respondents who answered *yes* to this second question were classified as people with a voice disorder and were asked the remaining questions categorized below.
- **Symptoms/characteristics.** Characteristics of voice disorder, as reported by the participant: (a) inadequate loudness, (b) voice-related discomfort, (c) shaky voice, (d) decreased pitch range (e) increased effort in order to be heard, (f) hoarse or rough sounding voice, (g) difficulty and/or discomfort while swallowing, (h) other symptom.

When the disorder presents itself: (a) while teaching, (b) at times other than teaching, and (c) whether work was missed due to voice problems.

- **Health/behavioral risk factors.** Medical conditions: (a) cold, influenza, infections of the throat, nose, ears, and/or sinuses within the past year; (b) respiratory

allergies or asthma; (c) diabetes, arthritis, hypertension; (d) acid reflux, ulcers of the stomach or duodenum; (e) dry mouth; or (f) surgery of vocal folds.

Medications to treat cold, flu, infection, allergies, asthma, diabetes, arthritis, hypertension, anxiety, or depression.

Tobacco and/or alcohol use.

Age.

The survey used for this study is provided in the Appendix.

RESULTS

Of the 100 participants, 45 reported having a voice disorder. None were experiencing the symptoms at the time of the study, and all but three described symptoms lasting ≤ 4 weeks. Chi-square analyses indicated no significant relationships between voice disorder prevalence and either gender or age (Table 1). The 45 participants with a voice disorder self-reported a variety of symptoms (Table 2).

The health and behavior variables for participants with and without voice disorders are presented in Table 3. Chi-square analyses were conducted to determine whether there were disproportionate numbers of participants with voice disorder, according to each health and behavioral variable. None of the respondents reported having vocal fold surgery, so that variable was excluded from the analyses. The remaining variables were used only when the number of occurrences was >1 , as suggested by Portney and Watkins (1993). Outcomes were typically in the expected direction, but with none reaching statistical significance.

The sample of university teaching faculty was compared with K-12 teachers and nonteachers according to prevalence of voice disorder (Table 4). Chi-square tests showed a significantly greater prevalence of voice disorders among K-12 teachers than university professors, $\chi^2(1) = 4.1, p < .05$, as well as a significantly greater prevalence of voice disorders among university professors than nonteachers, $\chi^2(1) = 11.6, p < .05$.

DISCUSSION

This study examined the prevalence of voice disorders; voice symptoms; and demographic, health, and behav-

Table 1. University teaching faculty with and without a voice disorder according to age and gender.

	<i>With voice disorder</i>	<i>Without voice disorder</i>	χ^2	df	p
Gender					
Male	13	19	>0.1	1	.55
Female	32	36			
Age					
30-39	4	5	0.5	3	.91
40-49	14	15			
50-59	19	22			
60+	8	13			

Table 2. Frequency of reported symptoms among university teaching faculty with a voice disorder.

<i>Symptom</i>	n	%
Affects communication	45	100
Decreased loudness	25	56
Vocal discomfort	29	64
Vocal shakiness	10	22
Pitch range decrease	24	53
Increased vocal effort	32	71
Hoarseness	37	82
Difficulty swallowing	19	42
Other symptom	6	13
Difficulty while teaching	41	91
Difficulty while not teaching	40	89
Work missed	3	7

ioral variables in a sample of university teaching faculty members. The results indicated that 45% of the university teaching faculty reported having had a voice disorder (as defined for the purposes of this study). Those with voice disorders reported symptoms including hoarseness, vocal discomfort, increased vocal effort, decreased loudness, and pitch changes, with each of these symptoms reported by $>1/2$ of the participants. These symptoms have been reported in other studies of voice disorders (Jonsdottir et al., 2002; Roy, Merrill, Thibeault, Parsa, et al., 2004; Verdolini & Ramig, 2001). Nearly all participants with voice disorders reported that their symptoms were present both while teaching and at times other than teaching, indicating that the symptoms were not isolated to the immediate demands of lecturing.

The analysis of demographic variables in this study led to surprising findings. Past research suggested that women may be at higher risk for voice disorders than men (Grillo & Fugowski, 2011; Jonsdottir et al., 2002; Laukkanen et al., 2008; Rantala et al., 2002). The present results suggested no such gender effect. It had also been suggested in previous research that increased age can raise the risk for voice disorder, with greater prevalence among individuals in their 40s and 50s (e.g., Roy, Merrill, Thibeault, Parsa, et al., 2004; Villanueva-Reyes, 2011), but the present results were not consistent with those findings.

Among the 100 participants, none of the previously suggested risk factors showed a statistically significant relationship to the presence (or absence) of voice disorder. One interpretation of these results is that the high occurrence of voice disorder in this population may have more to do with the task of teaching itself rather than other health or behavioral variables (e.g., illness, alcohol consumption, tobacco use, or medications). In any case, once a voice disorder is present, changing these health and behavioral variables (e.g., discontinuing use of alcohol, tobacco, medications) may still be helpful in treatment; however, the data in this study do not address that issue.

Variables that had been suggested as risks in previous studies (e.g., respiratory infections, medications, alcohol use) showed trends in the expected directions in the current study, but relationships were not shown to be significant. One nonsignificant trend, however, revealed an unexpected relationship: Tobacco use was reported by only $1/5$ of those

Table 3. University teaching faculty with and without voice disorder according to health and behavioral variables.

	<i>With disorder</i>	<i>Without disorder</i>	χ^2	df	p
Cold, flu, infection					
Yes	37	40	1.3	1	.26
No	8	15			
Respiratory allergies					
Yes	19	19	0.9	1	.34
No	25	37			
Diabetes, arthritis, hypertension					
Yes	10	6	2.4	1	.13
No	35	49			
Medication					
Yes	16	13	1.7	1	.19
No	29	42			
Acid Reflux/ulcers					
Yes	4	5	>0.1	1	.97
No	41	50			
Dry mouth					
Yes	7	6	0.5	1	.49
No	38	49			
Tobacco ^a					
Yes	9	20	3.2	1	.07
No	36	35			
Alcohol ^b					
Yes	32	20	>0.1	1	.55
No	13	35			

^aDefined as tobacco use for ≥ 1 year. ^bDefined as drinking an average of one or more alcoholic beverages a week for ≥ 1 year.

Table 4. Percentage of university teaching faculty reporting a voice disorder compared with K-12 teachers and nonteachers reported by Roy, Merrill, Thibeault, Parsa, et al. (2004).

	<i>University</i>	<i>K-12</i>	<i>Nonteacher</i>
Voice disorder			
Yes	45.0	57.7	28.8
No	55.0	42.3	71.2

faculty members with a voice disorder, but by $>1/3$ of those without voice disorder. A similar relationship was reported in a study of 2,522 respondents (Roy, Merrill, Thibeault, Parsa, et al., 2004), with the effect reaching significance. It should be clarified that in both studies, tobacco use was defined as the use of a tobacco product for ≥ 1 year at some point in the respondent's life. Therefore, many respondents qualifying as tobacco users were not current users. In any case, one plausible interpretation of the nonsignificant trend in the present study is that it occurred by chance (i.e., Type II error) and is not a reflection of a negative correlation between tobacco use and voice disorder in the general population.

Compared to the study by Roy, Merrill, Thibeault, Parsa, et al. (2004), the present results suggest that a significantly smaller proportion of university teaching faculty experience voice disorder than K-12 teachers, whereas a significantly larger proportion of university faculty experience voice disorder than nonteaching professionals. It should be noted, however, that other characteristics of these samples are likely to differ, such that the difference in prevalence may

not be entirely attributable to workplace requirements. For example, the Roy, Merrill, Thibeault, Parsa, et al. samples were younger overall, contained a greater proportion of women, and reported illness more frequently. Although such differences do not allow us to isolate the variables of workplace demands, the data likely reflect actual demographic and behavioral differences that exist among the professions in the overall population.

In conclusion, a sample of professors at a university were found to be at significantly higher risk for voice disorders than other individuals in nonteaching professions. The symptoms of the voice disorder were not always severe but were substantial enough to interfere with normal communication. In most cases, participants were affected both in and out of the teaching environment. Demographic and behavioral factors suspected as increasing voice disorders had very little apparent effect on prevalence in this sample. Overall, the results suggest that the task of lecturing in a university environment is demanding on the voice, although perhaps not to the degree experienced by K-12 teachers.

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APPENDIX. VOICE DISORDER SURVEY

I. Prevalence

"We're interested in how teaching might affect instructors' voices."

"Are there times when your voice doesn't work or sound as you feel it should?" _____

"...to the point where it affects how you communicate?" _____

II. Symptoms/Characteristics

A. Subject-reported characteristics

(1) inadequate loudness _____

(2) voice-related discomfort _____

(3) shaky voice _____

(4) decreased pitch range _____

(5) increased effort in order to be heard _____

(6) hoarse or rough sounding voice _____

(7) difficulty and/or discomfort while swallowing _____

(8) other (explain) _____

B. Problem occurs only while teaching _____, only at times other than teaching _____

C. Was work missed due to voice problems _____

III. Health/Behavioral Risk Factors

A. Medical conditions

(1) cold, flu, infections of the throat, nose, ears, and/or sinuses within the past year _____

(2) respiratory allergies, asthma _____

(3) diabetes, arthritis, hypertension _____

(4) acid reflux, ulcers _____

(5) dry mouth

(6) surgery of vocal folds

B. Medications to treat:

(a) cold, flu, infection of nose, ears, sinuses

(b) respiratory allergies or asthma

(c) diabetes, arthritis, hypertension

(d) anxiety, depression _____

C. Tobacco _____ and/or alcohol use _____

D. Age: 20-30 _____, 30-40 _____, 40-50 _____, 50-60 _____, 60+ _____