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# The Prevalence of Voice Disorders in University Teaching Faculty

Kristen P. Higgins

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**THE PREVALENCE OF VOICE DISORDERS IN UNIVERSITY TEACHING  
FACULTY**

By

Kristen P. Higgins

B.A. University of Maine, 2004

A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Arts

(in Communication Sciences and Disorders)

The Graduate School

The University of Maine

May, 2006

Advisory Committee:

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# **THE PREVALENCE OF VOICE DISORDERS IN UNIVERSITY TEACHING**

## **FACULTY**

By Kristen P. Higgins

Thesis Advisor: Dr. Allan B. Smith

An Abstract of the Thesis Presented  
In Partial Fulfillment of the Requirements for the  
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K-12 teachers are known to be at a higher than average risk for developing voice disorders. Less is known about the prevalence of voice disorders among teaching faculty in higher education. In this study, 100 university teaching faculty members were interviewed to assess possible voice problems. Information on risk factors such as demographic variables (i.e. gender and age) and health and behavioral variables (i.e. illness, use of tobacco, alcohol, and medications) was also gathered. The results were compared to published data on K-12 teachers and non-teachers. University professors reported significantly more cases of voice disorders than non-teaching professionals, but significantly fewer cases than K-12 teachers. With such an elevated prevalence, it is important to continue research on this population. Such research could assist in creating eventual preventative measures, and have a substantial effect on the productivity and quality of life of university teaching faculty.

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*“A man can only attain knowledge with the help of those who possess it.”*

*-Gurdjieff*

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in every card, and every time you brag about me. Thanks to each of you for teaching me some combination of dreams and responsibility. Oh, and thanks for AAA!

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*To my friends:*

(Warning: This one's riddled with quotes)

*"Among those whom I like or admire, I can find no common denominator, but among those I love I can: all of them make me laugh." – W.H. Auden*

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for the laughs, for being you, and letting me be me. To end this rambling, I have found an incredibly cheesy, but very true quote:

*“You that would judge me, do not judge alone...*

*Come to this hallowed place where my friends’ portraits hang and look thereon;...*

*Think where man’s glory most begins and ends*

*And say my glory was I had such friends.”*

*-Yeats*

***To God:***

**Thank you.**

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	ii
LIST OF TABLES.....	ix
INTRODUCTION.....	1
Overview of Voice Functioning and Disorders.....	1
Defining Voice Disorder.....	2
Early Signs of Voice Disorder.....	4
Possible Risk Factors for Voice Disorders.....	5
Voice Disorders in Teachers.....	7
RATIONALE.....	10
METHOD.....	12
Participants.....	12
Materials.....	14
Design and Procedures.....	14
Statistical Analysis.....	16
RESULTS.....	16
University Teaching Faculty.....	16
Research Question 1a: What is the Prevalence of Voice Disorders in University Teaching Faculty?.....	16
Research Questions 1b: What are the Symptoms Reported by University Teaching Faculty with Voice Disorder?.....	17
Research Question 1c: Is There a Disproportionate Prevalence of Voice Disorder According to Demographic Variables?.....	19



Research Question 1d: Is There a Disproportionate Prevalence of Voice Disorder According to Health and Behavioral Variables Associated with Voice Disorder.....	19
University Teaching Faculty Compared to Other Groups.....	23
Research Question 2a: Are There Significant Group Differences Between University Teaching Faculty and K-12 Teachers in the Prevalence of Voice Disorder?.....	23
Research Question 2b: Are There Significant Group Differences Between University Teaching Faculty and Non-Teachers in the Prevalence of Voice Disorder?.....	25
Research Question 3a: Are There Significant Differences Between University Teaching Faculty and K-12 Teachers in Demographic Variables Associated with Voice Disorder?.....	25
Research Question 3b: Are There Significant Differences Between University Teaching Faculty and Non-Teachers in Demographic Variables Associated with Voice Disorder?.....	27
Research Question 4a: Are There Significant Differences Between University Teaching Faculty and K-12 Teachers in Health and Behavioral Variables Associated with Voice Disorder?.....	29

Research Question 4b: Are There Significant Differences Between University Teaching Faculty and Non-Teachers in Health and Behavioral Variables Associated with Voice Disorder?.....	29
DISCUSSION.....	33
Voice Disorders in University Teaching Faculty.....	33
Group Comparisons.....	38
Prevalence and Severity of Vocal Disorder.....	38
Other Group Differences.....	39
Summary & Conclusion.....	43
REFERENCES.....	46
APPENDIX A. Informed Consent Script.....	49
APPENDIX B. Voice Problem Questionnaire.....	50
APPENDIX C. Voice Handicap Index.....	51
APPENDIX D. Demographic Data of Sample Populations.....	52
BIOGRAPHY OF THE AUTHOR.....	53

## LIST OF TABLES

Table 1a.	University teaching faculty: Prevalence and duration of disorder.....	18
Table 1b.	Frequency of reported symptoms among the university teaching faculty with voice disorder.....	20
Table 1c.	University teaching faculty with voice disorder and without voice disorder according to demographic variables.....	21
Table 1d.	University teaching faculty with voice disorder and without voice disorder according to health and behavioral variables.....	22
Table 2a.	University teaching faculty compared with K-12 teachers according to prevalence and duration of disorder. K-12 data were reported by Roy et al. (2004).....	24
Table 2b.	University teaching faculty compared with non-teaching professionals, according to prevalence and duration of voice disorder. Non-teaching data were reported by Roy et al.(2004).....	26
Table 3a.	University teaching faculty compared with K-12 teachers according to demographic variables. K-12 data were reported by Roy et al. (2004).....	28
Table 3b.	University teaching faculty compared with non- teachers according to demographic variables. Non-teacher data were reported by Roy et al. (2004).....	30
Table 4a.	University teaching faculty compared with K-12 teachers according to health and behavioral factors. K-12 data were reported by Roy et al.(2004).....	31
Table 4b.	University teaching faculty compared with non- teachers according to health and behavioral factors. Non-teacher data were reported by Roy et al. (2004).....	32

Table 5.	University teaching faculty according to age and gender.....	52
Table 6.	K-12 teachers compared to nonteachers according to age and gender. data reported by Roy et al. (2004).....	52

## **INTRODUCTION**

Verdolini and Ramig (2001) estimated that one quarter of U.S. workers rely on their voice in the workplace. Titze et al. (1997) described a subset of these workers as heavy occupational voice users. Included among heavy occupational voice users are clergy, therapists, singers, telemarketers, and teachers. For these individuals, voice difficulties such as hoarseness, vocal discomfort, and reduced loudness can create an occupational limitation.

Many occupations that demand heavy vocal use are associated with a high prevalence of voice difficulties, as compared to other professions. Apparently, prolonged speaking at high intensity levels contributes to frequent occurrence of voice problems in these occupations. Indeed, long periods of vocal use at high intensity is often cited as the cause of certain voice problems, for example vocal nodules (Colton & Casper, 1990). Avoiding such patterns of vocal use is often suggested as part of a treatment program for voice disorders. It is unfortunate that for most heavy occupational voice users, minimizing vocal use would likely interfere with job performance.

### **Overview of Voice Functioning and Disorders**

In order to comprehend the effects of a disordered voice, one must first have an adequate understanding of how the voice functions under normal circumstances, and the ways in which voice disorder manifests itself.

Speech requires four main systems: respiration, phonation (voice), resonance, and articulation. Voice, or phonation, is the major source of sound in speech. It does not refer to aspects of speech controlled by movement of the tongue, jaw, or lips. Rather,

voice provides the source of the sound, which is then modified by the structures above the larynx (Stemple, Glaze & Klaben, 2000).

Voice is produced by movement of the vocal folds in the larynx. Air pressure from the lungs builds up below the vocal folds, then is forced through, causing the vocal folds to vibrate rapidly. This vibration is perceived as pitch; the faster the frequency of vibratory cycles, the higher the pitch (Stemple, Glaze & Klaben, 2000).

Overuse and misuse of the vocal mechanism can lead to physiological changes in the vocal folds. These physiological changes can include fatigued muscles, pathology such as nodules or polyps, and/or muscle tension. These physiological changes can correlate to a variety of symptoms, including, but not limited to hoarseness, decreased pitch control, decreased volume control, breathiness, increased effort, and/or discomfort (Stemple, Glaze & Klaben, 2000).

### **Defining Voice Disorder**

In past research, there has been remarkable inconsistency in defining what constitutes a voice disorder. Three key sources of inconsistency appear to be (1) the severity that the condition needs to reach before a voice disorder is diagnosed, (2) anatomical and physiological evidence of laryngeal dysfunction, and (3) the relative importance of clients, clinicians, and society in their perceptions of a deviation from typical or appropriate vocal sound.

It is not difficult to find several examples of how researchers vary in their definitions of voice disorder. In the study by Verdolini and Ramig (2001), voice disorder was defined 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 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 subjects through the use of videoendoscopy and videolaryngostroboscopy (Kosztyla-Hoina, Rogowski, Ruczaj, Pepinski, & Lobaczuk-Sitnink, 2004). Stemple (2004) provides three possible definitions, each with its own criteria. One definition describes the speaker’s voice differing from the voices of others within their culture, age range, etc. The second states that a voice disorder may be present when deviant characteristics of voice draw attention to the speaker. Stemple’s third definition describes both physical and functional aspects of voice, suggesting that a voice disorder may be present when there are problems with the structure, the function, or both, of the laryngeal mechanism.

It is likely that researchers differ in their definitions of voice disorder partly because the demands of their individual studies vary. Pitch range is often included as an important determiner of vocal problems in studies of singers (e.g. Sandage & Emerich, 2002). This is because professional singers rely upon their particular pitch range, and even slight changes in this pitch range can cause considerable difficulty in vocal performance. The concept of an *operational* definition is important in approaching these differences across studies (Portney & Watkins, 1993). An operational definition specifies how a phenomenon is identified for the purpose of a particular study. Operational definitions clarify how conditions and other variables were determined in a detailed manner. This process allows a better understanding of how the study was conducted and how it might be replicated. In contrast, a *conceptual* definition corresponds closely to a dictionary definition, conveying general characteristics that are likely to be agreed upon

by large numbers of people. Although the differences across studies in prevalence of voice disorders might first appear to be disagreement over how many individuals are identified with a conceptual definition, it is likely that differences in operational definitions explain the majority of variation.

### **Early Signs of Voice Disorders**

While vocal overuse may lead to severe disorders such as aphonia, subtle problems may result as well. One subtle form of voice disorder is referred to as “vocal fatigue” (Welham & Maclagan, 2003). Vocal fatigue has been defined as a “negative vocal adaptation that occurs as a consequence of prolonged voice use” (Welham & Maclagan, p. 22). This negative adaptation may be associated with perceptual differences, such as voice quality, range in pitch and amplitude, and the level of effort required to phonate. It may also cause physical changes by affecting tension and comfort of the vocal mechanism, diminishing the control thereof, or changing respiratory support.

Several researchers have attempted to induce vocal fatigue in order to study its effects (e.g., Welham & Maclagan, 2003). Unfortunately, the value of these studies in understanding vocal fatigue is questionable. Welham and Maclagan suggested that lack of success could be attributed to the studies’ “artificiality” (p. 26). That is, subjects were not required to participate in vocal loading tasks for a long enough period of time, and/or were not in a realistic situation with multiple factors affecting the vocal mechanism. These researchers have begun to focus on the question of vocal fatigue through subjects that experience vocal fatigue symptoms, and by, “conducting experiment under realistic occupational demands” (p. 26).



Vocal fatigue may be considered a precursor to, or a mild form of voice disorder. Symptoms of vocal fatigue closely resemble other descriptions of voice disorder which include hoarseness, change in voice quality after short use, difficulty projecting voice, discomfort, and increased speech effort (Roy et al., 2004). At the first signs of vocal fatigue, speakers could take measures to minimize voice use (if possible), amplify their voice electronically, or change the speaking environment to reduce the demands for loudness. As such, recognition of vocal fatigue could help to avoid later voice problems, increasing success and productivity among heavy occupational voice users.

### **Possible Risk Factors for Voice Disorders**

Several commonly studied factors that can affect one's vocal parameters are speaking, intensity, and fundamental frequency. More specifically, prolonged speaking, higher intensity, and higher fundamental frequencies than are used in normal conversation have been noted as possible risk factors. This is referred to as a vocally loading task. A study by Lauri, Alku, Vilkmann, Sala and Sihvo (1997, as cited in Artkoski, Tommila, & Laukkanen, 2002) found that after a vocally loading task, female voices move toward hyperfunctional. After a similar task, the voices of male subjects in their sample did the same thing, to a lesser extent. However, other males in their sample had voices which moved toward hypofunctional.

Speakers tend to increase the intensity of their voices in loud environments. This phenomenon is known as the Lombard effect. For every 10 dB above 40 dB, speakers raise their speech intensity 3 dB (van Heusden, Plomp, & Pols, 1979 as cited in Jonsdottir, 2002; and in Jonsdottir, Boyle, Martin & Sigurdardottir, 2002). In the presence of loud background noise, speakers often raise their vocal fundamental

frequency as well (Vilkman, as cited in Jonsdottir et al., 2002). This combination means that both the frequency and force of vocal fold contact are increased in loud environments (Jiang & Titze, 1994, as cited in Jonsdottir et al., 2002).

There may be differences between men and women in prevalence of voice disorders (Roy et al., 2004; Verdolini & Ramig, 2002). Specifically, women have been found to be at higher risk than men. It is likely that in women, the vocal folds are particularly exposed to the effects of use due to higher vibratory rates than in men (Titze, Svec, & Popolo, 2003). To accomplish the same speaking task, vocal folds in women tend to vibrate nearly twice as fast as in men. 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.

Finally, a number of medical conditions and medicine used to treat them have been associated with increased risk of voice disorders (Colton & Casper, 1990; Roy et al., 2004). For example, colds, influenza, and infections of the throat can lead to inflammation of the vocal folds, causing discomfort and perceptible changes in the sound of the voice. The effects are usually mild but in rare cases (e.g. laryngitis), aphonia may occur. Another medical condition associated with voice disorder is respiratory allergies, although the evidence is primarily anecdotal. Acid reflux, tobacco smoking, and alcohol use have also been reported to increase risk of voice disorders (e.g., Colton & Casper, 1990). Finally, medications such as decongestants, antihistamines, and antidepressants have been suspected as increasing occurrence of voice problems.

## Voice Disorders in Teachers

The prevalence of voice disorders has often been examined among individuals who rely on their voice for their profession. In particular, teachers have been the focus of many studies (Kosztyla-Hojna et al., 2004; Roy et al., 2004; Roy et al., 2003; Verdolini & Ramig, 2001). The prevalence of voice disorders is significantly higher among teachers than nonteacher 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 (as cited in Verdolini & Ramig, 2001). Other studies range from a prevalence of voice disorders in teachers of 20% to 50% (McCabe & Titze, 2002).

In the largest study of its kind, Roy et al. (2004) randomly surveyed by telephone 1,243 teachers and 1,279 nonteachers in Utah and Iowa. One of the research questions from the study was whether voice disorders were more prevalent among teachers than other professionals in non-teaching professions. Symptoms of these voice disorders 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. It was found that 11% of teachers claimed to have a voice disorder during the survey, compared to 6.2% of nonteachers, which was shown to be statistically significant with a Chi-Square analysis. It was also found that teachers had a significantly higher prevalence of voice disorders over their lifetime compared to nonteachers (57.7% and 28.8%, respectively). There was no significant difference between the Utah and Iowa sample in voice disorder prevalence. Roy et al. also compared the two groups, by questionnaire, according to a variety of

previously suspected risk factors (such as gender, age, alcohol use, or tobacco use), and also according to history of voice disorder. It was found that women have a higher prevalence of voice disorders over their lifetime, when compared to men, and a higher prevalence of chronic (lasting greater than four weeks) voice disorders. Voice disorders were also reported more around middle-age (age 40 to 59) and were associated with a number of health-related issues including colds, asthma, allergies, sinus and infection.

Vocal disorder has an impact on a teacher's ability to teach. In a study by Smith et al. (1997), over 20% of teachers had missed one or more days of work in the previous year because of voice-related issues. In contrast, almost no voice-related absences were reported by nonteachers (Roy, Merrill, Thibeault, Gray, & Smith, 2004; Verdolini & Ramig, 2001). Smith et al. also found that greater than one-third of the teachers surveyed indicated that their voices did not work as they would like it to more than five days a year. Additionally, 39% of teachers surveyed stated that they reduced the number of activities because of their voice-related difficulties (Smith, Kirchner, Taylor, Hoffman, & Lemke, 1998, as cited in Roy, Merrill, Thibeault, Gray, & Smith, 2004).

One issue teachers are forced to endure in the workplace is increased vocal intensity in the presence of background noise in the classroom. The recommended upper limit of ambient noise in an unoccupied classroom is 30-40 dB (MacKenzie, 1998, as cited in Jonsdottir, 2002). The American Speech-Language-Hearing Association (ASHA) recommends that background noise not exceed 35 dB in order for speech to be intelligible. However, most classrooms have an ambient noise level of 50 dB (Berg, 1993). An acoustic analysis of U.K. classrooms found an average noise level of 77.3 dB when the children were working (Airey, 1998, as cited in Jonsdottir, 2002).

Such high levels of background noise, in combination with speakers increasing their intensity in loud environments could have an effect on the prevalence of vocal disorder in the teaching population. In a 2005 study, Simberg, Sala, Vehmas and Laine suggested an increase in reported vocal symptoms. This study compared the data of teachers surveyed in 1988 to those surveyed in 2001. This survey studied the presence of six vocal symptoms over the two years prior to each survey. The 1988 results indicated that 12% of those surveyed reported weekly (or more often) vocal symptoms. The 2001 results indicated that 20% of those surveyed experienced two or more symptoms weekly. This increase was attributed, by the teachers, to a variety of issues, including increase in class sizes, increase in number of children who misbehave, subsequently increasing classroom noise and stress. Because teachers reportedly speak for over six hours per school day (Anderson, 2003), in less than optimal conditions, it is no surprise that they are at high risk for vocal disorders.

It is possible that other factors may have influenced the high prevalence of voice disorders in teachers in past studies. Recall that past studies have suggested that women are at a higher risk for voice disorders than men. Past studies of vocal problems in teachers have included more women than men, presumably reflecting demographics of teachers in the population (Kostyla-Hojna et al., 2004; Rantala, Vilkmán, & Bloigu, 2002; Roy et al., 2004; Sala, Laine, Simberg, Pentti, & Suonpaa, 2001; Yiu, 2002). This demographic difference could partially account for the high incidence of voice disorders in teachers.

Several medical conditions are also associated with voice disorders, as noted above. These include common illnesses such as infections, colds, and influenza, which

are common in schools. These illnesses can lead to inflammation and irritation of the vocal folds and surrounding structures of the larynx (Colton & Casper, 1990). As such, common illnesses in schools might also play a role in creating a high risk environment for teachers.

The negative impact of poor vocal quality on teachers can also be measured in monetary value. Based on estimates reported by Smith et al. (1997), and on the average number of people with voice problems that seek treatment (Smith, Lemke, Taylor, Kirchner, & Hoffman, 1998), Verdolini and Ramig (2001) estimated that over one billion dollars are spent each year on treatment. The cost of hiring substitute teachers to replace teachers with voice disorders is difficult to estimate, but is undoubtedly substantial.

### **RATIONALE**

A review of literature indicates that the prevalence of voice disorders is higher for teachers than for other professions with less demand for occupational voice use. These studies 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 on the vocal mechanism.

Teaching faculty members at a college or university encounter similar risks as that of grade school teachers. Specifically, they must talk for long periods of time in environments with background noise, often increasing their volume and raising their pitch.

While similarities are apparent, there are also differences between university teaching faculty and K-12 teachers. For example, the time spent teaching, and the time

spent speaking while teaching, may differ between the two groups. It is not uncommon for a faculty member to lecture for longer than 2 hours without pause. This could differ from the speaking patterns of a K-12 teacher who may lecture for 30 minutes, then pause while the students work on in-class activities that do not require constant direction. Additionally, teaching faculty at universities often teach in larger rooms than K-12 teachers, and to larger audiences. Both of these factors could affect the way in which one must speak in order to be heard, which could be demanding on the vocal mechanism. These differences between the two groups (university teaching faculty and K-12 teachers) provide a rationale for studying university teaching faculty as a separate group.

The specific research questions in this study are presented below. Questions 1a-1d address the prevalence and symptoms of voice disorder in university teaching faculty, as well as the demographic, health, and behavioral variables which may be associated with voice disorder. Questions 2 through 4 allow comparisons with K-12 teachers and non-teaching professionals.

1) Prevalence of Voice Disorders, and Characteristics of University Teaching Faculty

- a) What is the prevalence of voice disorders in university teaching faculty?
- b) What are the symptoms reported by university teaching faculty with voice disorder?
- c) Is there a disproportionate prevalence of voice disorder according to demographic variables?
- d) Is there a disproportionate prevalence of voice disorder according to health and behavioral variables?

2) Group Comparisons Between According to Prevalence of Voice Disorder

- a) Are there significant group differences between university teaching faculty and K-12 teachers in the prevalence of voice disorder?
- b) Are there significant group differences between university teaching faculty and nonteachers in the prevalence of voice disorder?

3) Group Comparisons According to Demographic Variables

- a) Are there significant group differences between university teaching faculty and K-12 teachers in demographic variables associated with voice disorder?
- b) Are there significant group differences between university teaching faculty and nonteachers in demographic variables associated with voice disorder?

4) Group Comparisons According to Health and Behavioral Variables

- a) Are there significant differences between university teaching faculty and K-12 nonteachers in health and behavioral variables associated with voice disorder?
- b) Are there significant differences between university teaching faculty and nonteachers in health and behavioral variables associated with voice disorder?

## **METHOD**

### **Participants**

The subjects that participated in the survey for this study consisted of 105 teaching faculty members from the University of Maine, Orono. Three of the surveys



were incomplete, or contained ambiguous information, and two were completed by university teaching faculty who were not teaching a course during the semester they were surveyed. For these reasons, 100 complete surveys were used in the analysis. It is estimated that greater than 80% of those contacted chose to participate in the initial survey. Participants were not paid for their services. They were treated in a manner approved by the Internal Review Board at the University of Maine, and in accordance with the “code of Ethics,” of the American Speech-Language-Hearing Association.

The researcher selecting faculty attempted to approach participants randomly, in two ways: (1) university teaching faculty were approached in person, either outside a weekend research presentation, or in their offices, or (2) by phone, at their office number. The majority of subjects were reached in this second manner. The researcher utilized the University Telephone Directory, calling the office telephone numbers of professors in alphabetical order. The name of each person who answered the phone was written down, in order to avoid multiple calls to the same individual. Data related to which people chose to participate was not written down, as the Human Subjects board had stipulated, in order to protect anonymity. Each person who answered the phone was read a statement by the researcher, in order to explain the study and obtain informed consent (see Appendix A for Informed Consent Script). Following this, a questionnaire was administered (see Design and Procedures).

Because the refusal rate was so low (an estimated 20%), subjects were of a wide age-range, both genders were represented, and respondents were approached on different days of the week and times of day, the researcher is confident that the risk of an unrepresentative sample was minimized. The sample was composed of 32 males, and 68

females. The majority of the subjects were between the ages of 40 and 59 years of age. The faculty sample had a higher proportion of men when compared to the K-12 sample (68% v. 31%, respectively). Conversely, it had fewer females than did the K-12 sample (32% v. 69%, respectively). The proportions of faculty in different age ranges were similar to the K-12 sample. However, this study did not have any subjects between the ages of 20-29, and we included data from subjects older than the age of 66.

### **Materials**

A survey (similar to that used by Roy et al., 2004) was administered by the researcher, which related to history of voice disorder, symptoms, vocal activities in and out of work environment, medical conditions, work disruption caused by voice disorder, sociodemographic characteristics, and the participants' work history (see Appendix B). Also used in this study was the Voice Handicap Index (see Appendix C).

### **Design and Procedures**

A questionnaire was administered to determine the prevalence of voice disorders. This instrument was designed to be similar to that used by Roy, Merrill, Thibeault, Parsa, Gray, and Smith (2004). The study was conducted during a single five-minute telephone interview, or in person. The interview format was designed to assess the following areas:

#### I. Prevalence.

- A. Presence of voice difficulty, 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 subject answered in the affirmative, the question was followed by, "To the point that it affects communication?" Those who answered "yes" to this second question were classified as voice disordered. Interviewees with voice difficulties

were asked all the remaining questions below, and were also asked to complete the Voice Handicap Index (see Appendix B) via interdepartmental mail. This is a 30-item survey which enables a subject to rate his/her voice problem and its effect on his/her life. Interviewees without voice difficulty were skipped to the “risk factors” and were not asked to complete the Voice Handicap Index.

- B. Characteristics of voice difficulty/disorder, as reported by the subject, including (a) inadequate loudness, (b) increased effort in order to be heard, (c) voice-related discomfort, (d) hoarse or rough sounding voice, (e) shaky voice, (f) decreased pitch range, (g) difficulty and/or discomfort while swallowing.
- C. Duration of difficulty/disorder (a) four weeks or longer, or (b) less than four weeks.
- D. When the difficulty/disorder presents itself (a) only while teaching, (b) only at times other than teaching, (c) while teaching and at other times.
- E. Severity as defined by (a) degree to which voice problem affects teaching performance, (b) number of days of teaching missed due to voice problems.

## II. Risk factors.

- A. 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) surgery of vocal folds.
- B. Medications (a) to treat hypertension, (b), anxiety, depression, (c) cold, flu, or allergies.
- C. Family history of voice problems.

- D. Tobacco and/or alcohol use.
- E. Age.
- F. Work-related factors: (a) Number of sections presently taught, (b) number of students in sections, (c) proportion of class time spent speaking, and (d) years teaching.

### **Statistical Analysis**

Data from the interviews were entered into a single Excel workbook. Most variables were dichotomous and were entered as either 0 or 1. Chi-square analyses were conducted for each variable, except when the expected number of occurrences in at least one of the cells was below 1, as suggested by Portney and Watkins (1993). None of the respondents reported having vocal fold surgery so that variable was excluded from the remainder of the study.

## **RESULTS**

### **University Teaching Faculty**

The first four research questions in this study address the prevalence of voice disorder in University teaching faculty and the characteristics of the sample.

#### **Research Question 1a: What is the Prevalence of Voice Disorders in University Teaching Faculty?**

When asked about voice function, 45 of the 100 university teaching faculty reported that they had a voice disorder (as defined for the purposes of this study). Only 6.7% (n = 3) of those who reported voice disorders stated that symptoms lasted greater than four weeks. This information is summarized in Table 1a.

**Research Question 1b: What are the Symptoms Reported by University Teaching Faculty with Voice Disorder?**

Each of the subjects that reported voice disorder was asked to identify symptoms that manifested themselves during the period of the disorder. Symptoms included, but were not limited to, decreased amplitude control, decreased pitch control, vocal shakiness, vocal discomfort, hoarseness, difficulty swallowing, and “other symptoms” (which the subject then identified independent of the list that was supplied to them). Subjects were also asked (1) whether the difficulty occurred during teaching, at times other than teaching, or both, and (2) whether they had missed work due to these vocal symptoms. Hoarseness, vocal discomfort, increased vocal effort, decreased loudness, and pitch changes were each reported by the majority of subjects with voice disorders. Most subjects reported difficulty both while teaching and at times other than teaching. Very few subjects ( $n = 3, 7\%$ ) reported missing work due to such symptoms. Data are summarized in Table 1b.

**Table 1a. University teaching faculty: Prevalence and duration of disorder.**

	Respondents	
	<i>n</i>	%
Voice disorder		
Yes	45	45%
No	55	55%
Duration of voice difficulty (for item 1 above)		
Acute	42	93.3%
Chronic <sup>a</sup>	3	6.7%

<sup>a</sup> reported as lasting for longer than four weeks

**Research Question 1c: Is There a Disproportionate Prevalence of Voice Disorder According to Demographic Variables?**

Past studies have suggested that gender and age may be factors that increase a person's risk for developing a voice disorder. This study, however, did not illustrate such a pattern. The demographic data for university teaching faculty, according to presence of disorder are shown in Table 1c. The subjects in the present study did not follow any trend.

**Research Question 1d: Is there a disproportionate prevalence of voice disorder according to health and behavioral variables associated with voice disorder?**

To assess the possible risk factors for voice disorder in the university teaching faculty subjects, another series of Chi-square tests were conducted. The results of this analysis are shown in Table 1d. Only one risk factor was significantly associated with presence of voice disorder. A greater proportion of faculty with a cold, flu, and/or sinus infection were reported by faculty with voice disorder, as compared to faculty without voice disorder,  $\chi^2(1) = 6.5, p < .05$ .

Overall, the presence of voice disorder was not strongly associated with most health and behavioral variables thought to be risk factors for voice problems. For example, there were no significant associations between voice difficulty and respiratory infections, medications, or alcohol use. In general, trends were in the expected direction. One exception is worth noting. Tobacco use was reported by only 9 of the 45 faculty with voice disorder (20%). In comparison 20 of the 55 faculty without voice disorder reported tobacco use. The trend toward fewer voice disorders in faculty using tobacco approached, but did not reach, significance ( $p = .073$ ).

**Table 1b.**

**Frequency of reported symptoms among the university  
teaching faculty with voice disorder**

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Symptom	Respondents	
	<i>n</i>	%
Affects communication	45	100%
Decreased loudness	25	56%
Vocal discomfort	29	64%
Vocal shakiness	10	22%
Pitch change	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%

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**Table 1c.**

**University teaching faculty with voice disorder and without voice disorder according to demographic variables.**

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	With voice disorder	Without voice disorder	$\chi^2$	<i>p</i>
<hr/>				
Gender				
Male	13	19	0.04	.546
Female	32	36		
Age				
30-39	4	5	0.5	.905
40-49	14	15		
50-59	19	22		
60+	8	13		

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**Table 1d.****University teaching faculty with voice disorder and without voice disorder according to health and behavioral variables.**

	With disorder	Without disorder	$\chi^2$	<i>p</i>
Cold, flu, infection				
Yes	37	40	1.3	.262
No	8	15		
Respiratory allergies				
Yes	19	19	0.9	.344
No	25	37		
Medications				
Yes	16	13	1.7	.191
No	29	42		
Dry mouth				
Yes	7	6	0.5	.492
No	38	49		
Diabetes, arthritis, hypertension				
Yes	10	6	2.4	.125
No	35	49		
Acid Reflux/ulcers				
Yes	4	5	>0.1	.972
No	41	50		
Tobacco <sup>a</sup>				
Yes	9	20	3.2	.073
No	36	35		
Alcohol <sup>b</sup>				
Yes	32	36	.04	.546
No	13	19		

<sup>a</sup> defined as tobacco use for a year or longer. <sup>b</sup> defined as drinking an average of one or more alcoholic beverages a week for one year or longer.

## **University Teaching Faculty Compared to Other Groups**

The remaining research questions addressed possible group differences between the University teaching faculty data and the responses from K-12 teachers and non-teachers reported by Roy et al. (2004). These research questions dealt with the prevalence of voice disorder, demographics, health, and behavioral variables across the three groups.

### **Research Question 2a: Are There Significant Group Differences Between University Teaching Faculty and K-12 Teachers in the Prevalence of Voice Disorder?**

In this study, voice disorder was defined as vocal differences that were noticed by speakers and accompanied by self-reported interference with communication. The reported presence and severity of voice disorder for the 100 university teaching faculty members is shown in Table 2a. The data from K-12 teachers in the study by Roy et al. (2004) are included in Table 2a as well, allowing comparisons between the two data sets. Chi-square analyses were performed using absolute numbers of respondents, although percentages are also shown in the table and used in the text to permit clearer comparisons between results of this study and those of Roy et al. In the present study, 45% of the university teaching faculty stated that they had experienced voice disorder. Of the K-12 teachers surveyed in the study by Roy et al., 58% reported voice disorders. A chi-square analysis comparing these data indicated the difference was significant,  $\chi^2(1) = 4.1, p < .05$ .

Specifically, fewer university teaching faculty reported voice disorder than K-12 teachers. Among university teaching faculty with voice disorder, 3 subjects (6.67%) reported that on one or more occasion the condition lasted for more than four weeks. By comparison, nearly 17% of the teachers in the Roy et al. (2004) study reported voice

**Table 2a.**

**University teaching faculty compared with K-12 teachers according to prevalence and duration of disorder. K-12 data were reported by Roy et al. (2004).**

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	University		K-12		$\chi^2$	<i>p</i>
	<i>n</i>	%	<i>n</i>	%		
<hr/>						
Voice disorder						
Yes	45	45%	717	57.7%	4.1	< .05
No	55	55%	526	42.3%		
<hr/>						
Duration of voice difficulty (for item 1 above)						
Acute	42	93.3%	595	89.0%	3.1	.076
Chronic <sup>a</sup>	3	6.7%	119	16.7%		

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<sup>a</sup>reported as lasting for longer than four weeks

disorder lasting longer than four weeks. A chi-square analysis comparing these data did not indicate that this relationship was significant,  $\chi^2(1) = 3.1, p = .076$ .

**Research Question 2b: Are There Significant Group Differences Between University Teaching Faculty and Non-Teachers in the Prevalence of Voice Disorder?**

The reported presence and severity of voice disorder for university teaching faculty members in this study and the group of non-teaching professionals in the Roy et al. (2004) study are outlined in Table 2b. A significant difference was found between these groups,  $\chi^2(1) = 11.6, p < .05$ . More university faculty reported voice disorder compared to non-teachers. Among non-teachers experiencing voice disorder, over 22% reported that the condition lasted longer than four weeks. A chi-square analysis comparing data indicated this difference was significant,  $\chi^2(1) = 8.9, p < .01$ .

**Research Question 3a: Are There Significant Group Differences between University Teaching Faculty and K-12 teachers in Demographic Variables Associated with Voice Disorder?**

Demographic differences between university faculty and K-12 teachers were present (see Table 3a). There was a statistically significant gender difference between the groups. Of the university teaching faculty in this study, 68% were male, 32% were female. In comparison, more K-12 teachers were female in the Roy et al. (2004) data,  $\chi^2(1) = 56.5, p < .001$ . Another demographic difference between participants in the present study and the Roy et al. study was the age range,  $\chi^2(1) = 26.5, p < .001$ . For example, the 50- to 59-year-old age range contained the largest number of respondents in the present study. In the Roy et al. study, the 40- to 49-year-old age range was the largest. Additionally, the present study included no respondents in the 20- to 29-year-old

**Table 2b.**

**University teaching faculty compared with non-teaching professionals, according to prevalence and duration of voice disorder. Non-teaching data were reported by Roy et al. (2004).**

	University		Non-teacher		$\chi^2$	<i>p</i>
	<i>n</i>	%	<i>n</i>	%		
<b>Voice disorder</b>						
Yes	45	45%	371	28.8%	11.6	<.01
No	55	55%	917	71.2%		
<b>Duration of voice difficulty</b>						
Acute	42	92.3%	288	77.6%	8.9	<.01
Chronic <sup>a</sup>	3	6.7%	83	22.4%		

<sup>a</sup> reported as lasting for longer than four weeks

age range whereas this age range comprised approximately 7% of the Roy et al. data.

There are precautions against using the Chi-square analyses when small numbers are expected in any cell (e.g., Portney & Watkins, 1993). However, we included the 20- to 29-year-old age range in this study for comparisons with the Roy et al. study.

Presumably, the differences across studies are reflective of demographic age and gender differences between university and K-12 teachers.

**Research Question 3b: Are There Significant Group Differences between University Teaching Faculty and Non-Teachers in Demographic Variables Associated with Voice Disorder?**

Demographic variables of the university teaching faculty differed from those of the non-teachers (Roy et al., 2004) as well. Higher proportions of the university subjects were male (68% vs. 31%),  $\chi^2(1) = 30.0, p < .001$  (see Table 3b). Significant differences were also present in the age ranges of participants in the two studies,  $\chi^2(1) = 51.6, p < .001$ . University faculty were considerably older than the non-teacher respondents in the Roy et al. study. For example, the largest age group of university faculty was the 50- to 59-year-olds, whereas 40- to 49-year-olds represented the largest group of non-teachers.

**Table 3a.**

**University teaching faculty compared with K-12 teachers according to demographic variables. K-12 data were reported by Roy et al. (2004).**

Demographic Variable	University		K-12		$\chi^2$	<i>p</i>
	<i>n</i>	%	<i>n</i>	%		
<b>Gender</b>						
Male	68	68%	386	31%	56.5	** < .001
Female	32	32%	857	69%		
<b>Age</b>						
20-29	0	0%	83	7%	26.5	** < .001
30-39	9	9%	255	21%		
40-49	29	29%	455	37%		
50-59	41	41%	378	30%		
60+	21	21%	137	11%		



**Research Question 4a: Are There Significant Differences between University Teaching Faculty and K-12 Teachers in Health and Behavioral Variables Associated with Voice Disorder?**

Due to the significantly higher proportion of voice disorder among K-12 teachers compared to university teaching faculty, it was of interest to compare the two groups with respect to potential risk factors. The results of this analysis are displayed in Table 4a. Several differences between the groups are worth noting. For example, university teaching faculty were far less likely to have reported a cold, flu, or sinus infection, compared to K-12 teachers,  $\chi^2(1) = 144.7, p < .001$ . In contrast, university teaching faculty in the sample reported more instances of respiratory infections than K-12 teachers,  $\chi^2(1) = 12.1, p < .001$ . The groups also differed in their reported consumption of alcohol, with university teaching faculty reporting higher use than K-12 teacher,  $\chi^2(1) = 45.8, p < .001$ .

**Research Question 4b: Are There Significant Differences between University Teaching Faculty and Non- Teachers in Health and Behavioral Variables Associated with Voice Disorder?**

Health and behavioral factors of the university teaching faculty differed from those of non-teachers (Roy et al., 2004) as well. University faculty were significantly more likely to report respiratory allergies  $\chi^2(1) = 23.7, p < .001$ , and alcohol consumption,  $\chi^2(1) = 27.8, p < .001$ , compared with non-teachers (see Table 4b).

**Table 3b.**

**University teaching faculty compared with non- teachers according to demographic variables. Non-teacher data were reported by Roy et al. (2004).**

Demographic Variables	University		Non-Teachers		$\chi^2$	<i>p</i>
	<i>n</i>	%	<i>n</i>	%		
Gender						
Male	68	68%	513	40%	30.0	** < .001
Female	32	32%	775	60%		
Age						
20-29	0	0%	189	15%	51.6	** < .001
30-39	9	9%	302	23%		
40-49	29	29%	404	31%		
50-59	41	41%	256	20%		
60+	21	21%	137	11%		

**Table 4a.**

**University teaching faculty compared with K-12 teachers according to health and behavioral factors. K-12 data were reported by Roy et al. (2004).**

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	University		K-12		$\chi^2$	<i>p</i>
	<i>n</i>	%	<i>n</i>	%		
<b>Cold, flu, infection<sup>a</sup></b>						
Yes	77	77%	1119	99%	144.7	** < .001
No	33	33%	15	1%		
<b>Respiratory allergies</b>						
Yes	38	38%	281	23%	12.1	** < .001
No	62	62%	962	77%		
<b>Tobacco<sup>b</sup></b>						
Yes	29	29%	303	24%	1.1	.302
No	71	71%	962	76%		
<b>Alcohol<sup>c</sup></b>						
Yes	68	68%	424	34%	45.8	** < .001
No	32	32%	819	66%		

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<sup>a</sup> Cold, flu, and infections of ear, nose, throat and sinuses are reported in this study whereas Roy et al. reported only colds. <sup>b</sup> Tobacco use was defined as using any tobacco product for a year or longer. <sup>c</sup> Defined as drinking an average of one or more alcoholic beverages a week for one year or longer.

\* *p* < .05. \*\* *p* < .01.

**Table 4b.**

**University teaching faculty compared with non- teachers according to health and behavioral factors. Non-teacher data were reported by Roy et al. (2004).**

Risk factor	University		Non-Teachers		$X^2$	<i>p</i>
	<i>n</i>	%	<i>n</i>	%		
Cold, flu, infection <sup>a</sup>						
Yes	77	77%	1100	98%	121.5	** < .001
No	23	23%	20	2%		
Respiratory allergies						
Yes	38	38%	232	18%	23.7	** < .001
No	62	62%	1056	82%		
Tobacco <sup>b</sup>						
Yes	29	29%	615	48%	13.1	** < .001
No	71	71%	673	52%		
Alcohol <sup>c</sup>						
Yes	68	68%	527	41%	27.8	** < .001
No	32	32%	761	59%		

<sup>a</sup> Cold, flu, and infections of ear, nose, throat and sinuses are reported in this study whereas Roy et al. reported only colds. <sup>b</sup> Tobacco use was defined as using any tobacco product for a year or longer. <sup>c</sup> Defined as drinking an average of one or more alcoholic beverages a week for one year or longer. \*  $p < .05$ . \*\*  $p < .01$ .

## DISCUSSION

This study examined how voice disorders are manifested in a sample of university teaching faculty at the University of Maine. Prevalence and severity of voice disorder were examined, as well as demographic, health, and behavioral variables. In addition to studying these factors in our sample of people, we compared our results to other samples, using data from a previous study by Roy et al. (2004). It was anticipated that this investigation would provide further insight into possible risk factors for voice disorder.

### **Voice Disorders in University Teaching Faculty**

According to the past studies, K-12 teachers have an increased prevalence of voice disorders. It was anticipated that voice disorders would be prevalent in university teaching faculty as well. In the present study, 45% of the university teaching faculty surveyed reported having had a voice disorder (as defined for the purposes of this study). Among those who reported voice disorder, very few (6.7%) claimed to have it for greater than four weeks at a time, which was defined as chronic voice disorder in this study.

As was previously reported, hoarseness, vocal discomfort, increased vocal effort, decreased loudness, and pitch changes were each reported by more than 50% of those subjects with voice disorders. These are all quite common symptoms of voice disorders (Jonsdottir et al., 2002; Roy et al., 2004; Verdolini & Ramig, 2001), and were expected in this study. Whether voice disorders in these subjects were related to fatigue, muscle tension, or illness, the vocal mechanism would be altered and could cause any of these symptoms. It is not known why the other possible symptoms were reported less often among those with voice disorders. An example of a rarely reported symptom is “difficulty swallowing.” It is likely that difficulty swallowing is not necessarily always

related to the voice itself, and as such, respondents did not report it as a symptom of the voice disorder. Further research may shed light on which symptoms respondents associate with phrases such as “the voice does not work, perform, or sound as it normally should” and “interfering with communication.”

Of those who reported having had a voice disorder, nearly all reported that symptoms were present both while teaching and at times other than teaching. This being said, it was anecdotally reported (as there was no formal survey item that asked specifically) that symptoms often presented themselves at the beginning of the fall semester, and then resolved when they had become more acclimated to teaching again. It is possible that subjects reporting this seasonal pattern of voice disorder (1) re-familiarized themselves with a less physically traumatic manner of speaking, or (2) became accustomed to the discomfort or other symptoms, and/or (3) simply did not perceive the true sound of their voice. Again, this is only speculation, and further research is required.

Chi-square analysis showed that, in this sample, none of the previously suggested risk factors showed a significant relationship to the presence of voice disorder in university teaching faculty. These results suggest that the key differences between the groups (university teaching faculty, K-12 teachers, and nonteachers) lie in the job of teaching itself, rather than any difference in the prevalence of health or behavioral variables (illness, alcohol consumption, tobacco use, or medications). The data suggest that the difference in prevalence of voice disorder lies in something about the jobs themselves, something that makes teachers more prone to voice disorders than university teaching faculty members are. This difference could be attributed to any number of

variables, including time spent speaking while teaching, total time spent teaching, number of students, or level of background noise.

Demographic variables led to surprising findings in this study. Past research had suggested that females may be at higher risk for voice disorders than males. The present study showed no such tendency. Further research, for the purpose of clarifying this discrepancy, is advisable. It had also been suggested in previous research that increased age might increase the risk for voice disorder. The present study did not support this trend either. One possible reason for the lack of an age effect might be differences in age ranges compared to other studies of educators. The sample for this study did not contain any faculty members below the age of 30. This is likely because professors often have a doctoral degree, which takes significantly longer to earn than a bachelor's degree. This being the case, the present sample is limited in this young age range. Perhaps if this study had access to people in this younger age range, an age-related trend would have been more easily viewed. Without further research, though, such conjectures are unsubstantiated. Another possible reason for these data could be that the more experienced university teaching faculty have learned more efficient and less harmful ways to utilize their voices when lecturing. Also, they may not teach the larger courses, such as introductory courses which are often taught by newer faculty, thus sparing their voices long lectures, to large quantities of people (sometimes exceeding 200 students).

Through the use of Chi-square analyses, this study was able to identify possible risk factors for voice disorder by examining a variety of health and behavioral variables. It was discovered that, as previously mentioned, illnesses such as cold, flu, or infections of the ear, nose throat or sinuses were significantly related to the presence of voice

disorders in faculty members. This was the only variable that was shown to have a significant relationship. Many variables that had been suggested as risks in previous studies (respiratory infections, medications, alcohol use) did show trends in the expected directions, but relationships were not shown to be significant.

One variable, however, showed an adverse relationship to what was expected. Tobacco use was reported by only one-fifth of those faculty members with voice disorder. However, more than one-third of those without voice disorder reported tobacco use. It should be clarified that tobacco use was defined as use of a tobacco product for a year or longer at some point in the respondent's life. Therefore, many respondents qualifying as tobacco users were not current tobacco users. One possible reason for this could be that a different medium of tobacco was used, such as chewing tobacco, which did not have as much of a drying effect as smoking tobacco might. It is also possible that, despite having used a tobacco product for a year, the subjects may have not used the tobacco products regularly. Still, it was unexpected that the trend would be toward more tobacco use among those without voice disorders. What is particularly striking, though, about this variable is the fact that a similar relationship between tobacco use and voice disorder was reported by Roy et al. (2004), with the effect reaching statistical significance. Roy et al. did not offer any explanation for the result. Further research of this variable would be of particular interest.

As was previously discussed, there are a variety of ways to define "voice disorder." In this study chose to rely on subjects' self-report, with voice disorder operationally defined as, "any time the voice does not work, perform, or sound as it normally should, so that it interferes with communication." This definition was selected



to allow comparisons with past research (Roy et al., 2004, p. 283) which used the same definition of voice disorder. Another possibility would have been to identify a group of subjects who notice difficulties with their voices, but do not report that these difficulties interfere with communication. Further, we looked at data from university teaching faculty who reported voice difficulty, but did not feel that said difficulty affected their communication. Therefore, those with voice disorder were a subset of this larger definition of “vocal difficulty.” Due to the apparent influence of defining “difficulty” differently than “disorder,” statistical comparisons were not made between the vocal difficulty data and K-12 or non-teacher data.

Not surprisingly, data suggested that there were significantly more incidences of voice difficulty compared to voice disorder in university teaching faculty. This makes sense, as most people (teaching faculty or non-teachers) are likely to admit that at some point their voice has not functioned as they would have liked it to. As one might suspect, those who claimed their voice function issues had an impact on their communication showed a higher prevalence of chronic voice disorder. This is not surprising, as any person who had difficulty with their voice for longer than four weeks would likely state that it affected their communication abilities. While there is no K-12 or nonteacher data with which to compare this group with less severe voice deficits, it is worth noting that such a population exists. Further research is advisable to examine in greater detail the possible differences between these two populations. It is possible that such research could provide insight of a preventative nature.

## **Group Comparisons**

### **Prevalence and severity of vocal disorder**

To our knowledge, this study represents the only investigation carried out on the prevalence of voice disorders in university teaching faculty. The results suggest that a significantly smaller proportion of university teaching faculty experience voice disorder, compared to the K-12 teacher in the study by Roy et al. (2004). However, the university faculty reported significantly more cases of voice disorder than non-teaching professionals. These results suggest an increased risk of voice disorder in university faculty, but not to the extent experienced by K-12 teachers.

Overall, the self-reported difficulty experienced by university faculty was minimal. For example, severity ratings and work absenteeism due to voice difficulty were low. Only 7% of the university teaching faculty with voice disorders reported chronic (lasting longer than four weeks, on one or more occasions) problems, compared to 17% of teachers. This could be for a variety of reasons. One reason may be the schedule of K-12 teachers; they tend to teach every day, leaving little time for recovery or if they do experience voice difficulty. Professors' schedules vary more than this, however, often having a full day or two between class sessions. If a professor begins to have voice difficulty, he or she may have more time to recover before teaching again, therefore avoiding exacerbation of symptoms. Absenteeism procedures may differ across the professions as well, perhaps leaving university faculty with more options when faced with a voice problem. For example, university faculty might attend work, but avoid or minimize lecturing after experiencing symptoms such as vocal discomfort or decreased loudness. In contrast, there may be fewer opportunities for K-12 teachers to engage in

non-vocal tasks at work, leading to increased absenteeism. At the present time, little is known about how employees in various professions react to voice disorders with either absenteeism or continued work. The decision to avoid teaching could be assumed to reflect a form of “self-treatment” which may forestall a more serious voice disorder. Future research in absenteeism practices and mechanisms for reporting absenteeism across workplaces would be helpful.

There were several indications of more serious problems than voice disorder in the symptoms reported by the participants in this study, as shown in Table 1b. Hoarseness, vocal discomfort, and increased vocal effort are symptoms of potentially serious problems, such as vocal nodules, polyps, and laryngeal carcinoma. The data provide no evidence that these more serious voice disorders were present, but it certainly cannot be ruled out without further medical examination. When symptoms resemble those of more serious conditions, there is reason for concern. Frequent occurrence of these symptoms could mask the more serious disorders, if such conditions were to develop.

### **Other group differences**

University faculty members were found to differ from K-12 teachers according to several variables. Some of these variables can be categorized as demographic. There were significantly more males in the university faculty sample compared to the K-12 teachers (68% and 31.1%, respectively), more reported cases of alcohol use (68% and 24%), respiratory allergies, and significant differences in the age distribution. University faculty reported significantly fewer instances of colds, influenza, and/or ear/nose/throat/sinus infections. These differences could be explained any number of

ways (though not substantiated without further research). For instance, perhaps more males become professors than K-12 teachers, or perhaps there is just an over-representation in this sample of University of Maine teaching faculty. It is, perhaps, not surprising that university teaching faculty had fewer reported cases of colds, influenza and/or ear/nose/throat/sinus infections. These are illnesses that can be contagious, and K-12 teachers may have more exposure to them through physical proximity to sick children, whereas professors tend to be able to keep a further distance from their students.

The university teaching faculty who participated in this study resided in Maine, whereas those surveyed in the study by Roy et al. (2004) resided in Utah or Iowa. This introduces a difference in climate across the groups. Differences in humidity may affect phonation through superficial dehydration of the vocal folds. A dry climate has been shown to have a negative effect on the phonation of people who are prone to vocal fatigue (Sivansanker & Fisher, 2002). Such climactic and physical differences might explain some portion of the difference in prevalence of voice disorder between the samples. Note however, that the prevalence of voice disorder in university faculty fell *between* the samples of K-12 teachers and nonteachers, with the latter two groups in drier climates. This strongly suggests that the presence of voice disorder is related to profession rather than climate.

Overall, it appears that differences between the demands of the professions examined in this study account for the observed differences in voice disorder. From this perspective, a K-12 teaching position could be taken to place greater demands on the voice than a university teaching position. Although university teaching faculty may often speak for longer periods of time while teaching, in larger classrooms with more students

than K-12 teachers, other factors are undoubtedly present. One such factor could be background noise. Ideally, background noise should not exceed 35 dB in order for speech to be intelligible. However, K-12 classrooms reportedly have an average ambient noise level of 50 dB (Berg, 1993) with some studies indicating noise levels over 75dB (Airey, 1998, as cited in Jonsdottir, 2002). While average noise levels in university teaching environments are less clear, it is reasonable to suspect that they are considerably lower than K-12 classrooms, as many classes, particularly the larger ones, take place in the form of a lecture. This being the case, there may be less moving around, and/or less discussion as compared to a K-12 classroom. Assuming this is the case, the need to be heard in the noisier K-12 classroom may play an important role in the development of voice disorders in K-12 teachers. Recall that in noisy environments, speakers tend to increase vocal intensity as well as fundamental frequency, both of which are associated with increased risk of voice problems (Jiang & Titze, 1994, as cited in Jonsdottir et al., 2002). Data on noise levels in university teaching environment could lend support for this explanation.

Another possible reason for the high prevalence of voice disorder among K-12 teachers is exposure to colds and influenza. While this variable was not significantly associated with voice disorder among university professors, two other findings suggest an important relationship between sickness and voice disorder. First, there was a significant association between sickness such as colds and voice disorder among K-12 teachers. Second, K-12 teachers reported more sickness than university professors. Therefore, it remains possible that at least some cases of voice disorder were related to sicknesses such as colds and influenza.

Other variety of risk factors have been reported throughout the literature. For example, Roy et al. (2004) found that females tend to be at higher risk for voice disorders, especially those between the ages of 40-59. Although, gender and age were not significantly associated with voice disorder among university teaching faculty, it is notable that the Roy sample of K-12 teachers did contain significantly higher proportions of women at all age levels. However, it is not clear why gender and age would be important factors in the K-12 setting, whereas no such pattern was found in the university setting. The larger number of subjects in the Roy et al. study could offer a partial explanation, However, even the direction of the means in this study (Table 1c) do not suggest trends toward gender and age as risk factors.

Several suspected risk factors were not found to be associated with voice disorders in this study. One such risk factor is tobacco use. Tobacco use was reported by 20% of the faculty with voice disorder. In comparison 36% of the faculty without voice disorder reported tobacco use. The trend toward fewer voice disorders in faculty using tobacco approached, but did not reach, significance ( $p = .073$ ). Interestingly, the same pattern appears in the Roy et al. (2004) data on K-12 teachers and non-teachers. In the Roy et al. data ( $n = 2531$ ), the effect is highly significant ( $p < .001$ ). It is possible that other demographic variables interacted with tobacco use (e.g., age, gender) causing the appearance of more voice disorders among non-smokers in the Roy et al. study. One seemingly obvious explanation may lie in age differences – older people may be more likely to have smoked at some time in their life (e.g., due to more years of opportunity, differences in knowledge of health risks). However, the data do not support this

explanation. There was no evidence of age-related increase in voice disorders in this study.

Another variable, gender, did not follow the pattern suggested by past studies. However, voice difficulty was reported by 63% of females and 71% of males in this study. While this trend did not reach statistical significance, the result is clearly inconsistent with proposals that women are at a higher risk for voice disorders than men. Further research might be advisable in order to clarify this inconsistency.

### **Summary & Conclusion**

University teaching faculty were at a significantly higher risk for voice disorders than non-teaching professionals. On average, however, the problems experienced by university faculty with voice disorder were mild. For example, self-reported work absenteeism due to voice difficulty was low and severity ratings were low. Additionally, all of those who reported voice disorder scored in the “minimal handicap range” on their Vocal Handicap Index, suggesting that the presence of voice disorder has minimal effect on the functional, physical, or emotional life of these university teaching faculty members.

The respondents in the present study differed from comparison groups (K-12 teachers and non-teachers) along a number of behavioral and demographic variables. Compared to the other groups, university faculty were older, and reported more respiratory allergies and more alcohol use. University faculty reported significantly fewer instances of colds, influenza, and ear/nose/throat/sinus infections than K-12 teachers and non-teachers. Further study of the possible risk of presenting with certain combinations

of these variables (e.g., age range, class size, and teaching load) could provide insight into ways to avoid voice disorders in the future.

Significantly fewer cases of vocal disorder were reported by university teaching faculty than K-12 teachers. However, significantly more cases of voice disorder were reported by university faculty than non-teachers. That is, university faculty members are between K-12 teachers and non-teachers on a continuum of risk for voice disorders. With such an elevated prevalence, it is important to continue research on this population.

One of the difficulties in this study was that, because of the randomized sample, we had university of teaching faculty that had a variety of teaching environments and schedules. Some subjects taught three times a week for long periods of time, others taught only one short course each week. Because of this, it was impossible to determine if time spent speaking while teaching, total time spent teaching, number of students, or size of classroom were significantly correlated to increased prevalence of voice disorder. In future research it would be useful to separate subjects into specific groups according to such variables. For instance, grouping subjects that teach only one course, and comparing them to those who teach two courses. It would also be interesting to compare subjects according to the subject that they teach, as that may have an effect on how the courses are taught. Another method might be to acoustically measure background noise in the classroom and see if there is a significant relationship between this variable and prevalence of voice disorder. In addition to this, it would particularly useful to be able to examine the vocal mechanism of the subject who did report voice disorder in order to determine (1) if there is a physical problem, and (2) determine if the disorder is related to muscle tension, fatigue, vocal fold pathology, or some other factor.



This study had a quantitative design. For example, subjects had a limited list of responses from which to choose, and these lists were decided upon before the data were gathered. Future research could be done in a different format, one seeking out data of a more qualitative variety. For instance, an interview might provide richer information that the researchers may not have previously considered. An example of this information can be found in the anecdotal reports from the present study. It was reported by several university teaching faculty that voice problems were worse at the onset of the academic year. This was not considered prior to administering the survey, and thus was not able to be analyzed in the same manner as the other data, as not all subjects were asked if the same was true of their voice. Also, in asking subjects an open-ended question such as to describe their voice, instead of giving them a list of symptoms, one might gain more diverse information than yes/no answers can provide.

Any number of methods are possible in the examination of this grossly under-researched population. Such research could assist in creating eventual preventative measures, and have a substantial effect on the productivity and quality of life of university teaching faculty.

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## APPENDIX A

### Informed Consent Script

My name is \_\_\_\_\_. I'm doing a research project on voice disorders. The purpose of this study is to assess the prevalence of voice disorders among teaching faculty at the University of Maine, and to compare that to the prevalence of voice disorders in the non-teaching population. We will also compare the prevalence in males compared to females, and look at possible risk factors. If you agree to participate, I will ask you questions such as, "Are there times when your voice doesn't work or sound as you feel it should?" and, "To what degree do voice problems affect your teaching performance?"

Participation is voluntary, and you may skip any questions you do not wish to answer. Your name will not be attached to the data, the study is anonymous. Would you like to participate?

## APPENDIX B

### Voice Problem Questionnaire

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? (Y / N),  
IF NO, SKIP TO ITEM 6, IF YES, COMPLETE ITEMS 1 THROUGH 11:

1. to the point where it affects how you communicate? \_\_\_\_\_

2. Characteristics:

inadequate loudness \_\_\_\_\_ increased effort in order to be heard \_\_\_\_\_  
voice-related discomfort \_\_\_\_\_ hoarse or rough sounding voice \_\_\_\_\_  
shaky voice \_\_\_\_\_ difficulty and/or discomfort while swallowing \_\_\_\_\_  
decreased pitch range \_\_\_\_\_ or other? (explain other) \_\_\_\_\_

3. Duration of disorder: 4 or more weeks \_\_\_\_\_, or less than 4 weeks \_\_\_\_\_.

4. Problem occurs only while teaching \_\_\_\_\_, only at times other than teaching \_\_\_\_\_,  
while teaching and at other times \_\_\_\_\_.

5. Severity: degree to which voice problem affects teaching performance (1-10) \_\_\_\_\_  
number of days of teaching missed due to voice problems \_\_\_\_\_

6. Cold, flu, infections of the throat, nose, ears, and/or sinuses within the past year \_\_\_\_\_  
respiratory allergies, or asthma \_\_\_\_\_  
diabetes, arthritis, or hypertension \_\_\_\_\_  
acid reflux or ulcers \_\_\_\_\_  
dry mouth \_\_\_\_\_  
surgery of vocal folds \_\_\_\_\_

7. Medications: (a) to treat hypertension, (b), anxiety, depression, (c) cold, flu, or  
allergies (Y / N) \_\_\_\_\_.

8. Family history of voice problems \_\_\_\_\_.

9. Tobacco \_\_\_\_\_ and/or alcohol use \_\_\_\_\_.

10. Age: 20-30 \_\_\_\_\_, 30-40 \_\_\_\_\_, 40-50 \_\_\_\_\_, 50-60 \_\_\_\_\_, 60 + \_\_\_\_\_.

11. Work-related factors:

Number of sections presently taught \_\_\_\_\_  
Approximate number of students in section \_\_\_\_\_  
proportion of class time spent speaking \_\_\_\_\_  
years teaching \_\_\_\_\_

## APPENDIX C

### Voice Handicap Index

These are statements that many people have used to describe their voices and the effects of their voices on their lives. Circle 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

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

#### Part II-P

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

#### Part III-E

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

From:

Jacobson et al. (1997). The Voice Handicap Index (VHI): Development and Validation. *American Journal of Speech-Language Pathology*, 6(3), 66-70, 1997

## APPENDIX D

### Demographic Data of the Sample Populations

**Table 5.**  
**University teaching faculty according to age and gender.**

	Age			
	30-39	40-49	50-59	60+
Gender				
Male	6	17	29	16
Female	3	12	12	5

**Table 6.**  
**K-12 teachers compared to nonteachers according to age and gender. Data reported by Roy et al. (2004).**

Demographic Variable	Nonteachers		K-12	
	<i>n</i>	%	<i>n</i>	%
Gender				
Male	513	40%	386	31%
Female	775	60%	857	69%
Age				
20-29	189	15%	83	7%
30-39	302	23%	255	21%
40-49	404	31%	455	37%
50-59	256	20%	378	30%
60+	137	11%	137	11%



## **BIOGRAPHY OF THE AUTHOR**

Kristen P. Higgins was born in Bangor, Maine on December 29, 1981 on a cold, wintry night. She was raised in Corinth, Maine and graduated from Central High School in 2000 (to the surprise of many). She attended The University of Maine and graduated in 2004 with a Bachelor's degree in Communication Sciences and Disorders, and a minor in Music. She entered the Communication Sciences and Disorders graduate program in the fall of 2004. In addition to Kristen's clinical placements as a graduate student, she has worked at The Acadia Hospital as a Psychiatric Technician, and as a research and teaching assistant for Dr. Nancy Hall, examining the interactions between language development and fluency, and teaching the exciting world of APA format to undergraduates in the CSD department. She has presented three research projects of which she has been author and/or co-author at two ASHA conventions, and looks forward to presenting at the International Fluency Association's 5<sup>th</sup> Annual World Congress in Fluency, in Dublin, Ireland in the summer of 2006. She has also been a member of the National Student Speech-Language-Hearing Association, and was Executive Vice President for the Orono chapter of the National Society of Collegiate Scholars. Impressive, no?

Kristen is a candidate for the Master of Arts degree in Communication Sciences and Disorders from The University of Maine in May, 2006.