The Frequency of Perceived Stress, Anxiety, and Depression in Patients with Common Pathologies Affecting Voice

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Journal of Voice

Volume 22, Issue 4, July 2008, Pages 472-488

Accepted 8 August 2006.

Available online 18 April 2008.

Summary

The study's objectives were to investigate (1) the frequency of perceived stress, anxiety, and depression for patients with common voice disorders, (2) the distribution of these variables by diagnosis, and (3) the distribution of the variables by gender. Retrospective data were derived from self-report questionnaires assessing recent stress (Perceived Stress Scale-10), anxiety, and depression (Hospital Anxiety and Depression Scale) in a cohort of new patients presenting to a voice clinic. Data are presented on 160 patients with muscle tension dysphonia (MTD), benign vocal fold lesions, paradoxical vocal fold movement disorder (PVFMD), or glottal insufficiency. Pooled data indicated that average stress, anxiety, and depression scores were similar to those found for the healthy population. However, 25.0%, 36.9%, and 31.2% of patients showed elevated stress, anxiety, and depression scores, respectively, compared to norms. Patients with PVFMD had the most frequent occurrence—and patients with glottal insufficiency had the least frequent occurrence of elevated stress, anxiety, and depression. Stress and

depression were more common with MTD than with lesions, whereas reverse results were obtained for anxiety. More females than males had elevated stress, anxiety, and depression scores. The data are consistent with suggestions that stress, anxiety, and depression may be common among some patients with PVFMD, MTD, and vocal fold lesions and more common for women than men. However, individual variability in the data set was large. Further studies should evaluate the specific role of these conditions for selected categories of voice disorders in susceptible individuals.

Key Words: Perceived stress; Anxiety; Depression; Psychobiology; Muscle tension dysphonia (MTD); Vocal fold lesions; Paradoxical vocal fold movement disorder (PVFMD); Glottal insufficiency

Introduction

It is the *Zeitgeist* to acknowledge that the mind and body are integrated and that psychological stress affects health. Links between stress and health are corroborated by a body of health psychology research indicating that stress may affect health via psychobiological, psychoneuroimmunological, and behavioral pathways.[1] Moreover, stress is increasingly in the spotlight for two general reasons: (1) chronic stress appears to be on the rise in modern life and (2) stress is partly a gender issue apparently affecting more women than men.[‡]

In greater detail, life and job stresses are reported to be increasingly pervasive and can produce serious physical and economic consequences.[2] Arguments have been made that up to 80% of all illnesses are stress-related either directly or indirectly.[3] Alarmingly, more than 90% of women report moderate and higher levels of stress in their lives.[4] In fact, stress is only one piece in the bigger picture of advancing mental health issues among women. More women than men report stress and have an anxiety and/or depression disorder.[4], [5] and [6] More specifically, in 2001, most working days lost due to stress, anxiety, and neurotic disorders involved White, non-Hispanic women aged between 25 and 54 years.[2]

Hence, it is clear that (1) stress constitutes a substantive public health concern associated with mental and physical consequences, and moreover (2) stress can also be seen as a women's health issue. Given the current health care climate that emphasizes

the detrimental effects of stress on health, a growing health psychology literature linking stress to adverse health outcomes, and national mandates requesting increased mind-body research, the formal and systematic extension of stress research to the voice domain is both timely and warranted.[7]

The present study represents an initial attempt at such extension by assessing the frequency of elevated levels of self-reported perceived stress in a relatively large cohort of patients with common pathologies affecting voice. The study also assesses the frequency of elevated anxiety and depression in that patient group, as well as gender effects in the data. The following paragraphs provide background information followed by specific experimental hypotheses.

Stress and emotion

Definitions of stress usually center around a "process in which environmental demands tax or exceed the adaptive capacity of an organism, resulting in psychological and biological changes that may place persons at risk for disease".[8(p.3)] Thus, stress is a condition in which environmental, psychological, and biological factors interact. In the psychological domain, the *perception* of stress is commonly highlighted in relation to negative health outcomes.[9] A complication to the foregoing definition of stress is that stress and emotions are closely related. The link between stress and emotion, in particular the emotion "anxiety," can be conceptually confusing because stress and (state) anxiety often co-occur.[5] Further, anxiety, which has not only emotional but also cognitive correlates, may be associated with the stress response.[10] and [11] Thus, anxiety, as in an époque of worry, may add to the sense of stress.[5] and [10] To complicate matters further, the psychological model views both anxiety and depression as lying on a continuum from normal to severe, allowing for possible overlap.[10] Despite links between stress and anxiety, stress may also be present without anxiety, and chronic stress may be a prognostic factor predicting a risk for future psychological distress or psychiatric disease such as depression, which is the leading cause of disability in the United States in individuals aged between 15 and 44 years.[12], [13] and [14]

Stress, anxiety, depression, and voice disorders

With regard to voice disorders, it has been hypothesized that individuals may develop a voice disorder caused or exacerbated by stress, emotional, or personality factors.[15] It is acknowledged that emotional distress may be both primary and secondary to a voice disorder, thus potentially promoting a vicious cycle.[11] One condition that has been particularly emphasized along those lines is primary muscle tension dysphonia (MTD) or "psychogenic", "functional", or "nonorganic" dysphonia.[11] and [15] It is well accepted that MTD is a multifactorial voice disorder with various potential contributing etiologies that include stress.[11], [16] and [17] More broadly, the notion has been put forth that nonorganic voice disorders should be considered as a *spectrum* ranging from psychogenic aphonia to MTD as a chiefly muscular phenomenon.[11], [16], [18] and [19] Of note, stress in patients with MTD has been anecdotally reported to have more to do with daily anxieties than with frank psychiatric problems.[11]

Despite claims about stress's role in MTD, reports in the literature have generally focused on anxiety, depression, introversion, neuroticism, inhibition, and social anxiety in relation to this disorder.[11], [20], [21], [22], [23], [24], [25] and [26] Some studies that have looked specifically at stress in relation to MTD have found patients with MTD to either be more "stress reactive" based on scores on the "stress reaction" subscale of the Multidimensional Personality Questionnaire (MPQ) [24], [26] and [27] or have increased stress in their lives as indicated by stressful life event measures.[19], [28], [29], [30] and [31]

Studies based on "life event" measures have found the highest levels of life stress in patients with functional aphonia (extreme MTD),[19] and [31] followed by patients with functional dysphonia (MTD),[19], [28] and [29] as compared to patients with exogenously induced vocal pathologies[28] or vocal fold nodules,[29] whose stress scores were comparable to those of healthy controls.[19], [28] and [29] A limitation to those studies is that traditional life event checklist measures are now considered problematic,[32] because the pure number of adjustment-related life events may not reflect the level of *perceived* stress.[8] Thus, a shift has been seen in the psychology literature away from life event measures in assessing stress toward an emphasis on person-by-situation interactions that may account for levels of individually perceived stress.[8] and [10]

In sum, despite suggestions that stress may play a role in MTD,[15] extremely few studies have been conducted on that relation using assessment tools acceptable by current

psychometric standards. In particular, data on *perceived stress* and MTD are lacking in the literature.

Turning to other clinical conditions that affect voice, varying claims have been made about role of stress, anxiety, and depression in patients with benign vocal fold lesions[24] and [29] and paradoxical vocal fold movement disorder (PVFMD).[33] and [34] However, those studies also looked at stress as documented by unsystematic patient report in medical records (PVFMD), by a personality battery assessing trait "stress reactivity," or by life event questionnaires (vocal fold nodules). Thus, *perceived* stress was not formally addressed in those studies. In fact, as noted, most studies on psychological factors in voice disorders have not focused on stress *per se* but have rather pointed to personality and emotional issues.

In summary, stress appears frequently in the general population, and clinical wisdom as well as existing literature suggests that stress may also be frequent and even causal in certain subpopulations of patients with voice disorders. However, no systematic studies have been conducted to date, of which we are aware, on the frequency of *perceived stress* among individuals with voice disorders. Similarly, data are sparse in the literature on the frequency of anxiety and depression among patients with voice disorders. Our study targets these issues.

Stress, population demographics, and voice disorders

As noted, both stress and voice disorders can be framed as women's health issues.[5], [35] and [36] Similarly, anxiety and depression may also be considered women's health issues, as these conditions predominate in women.[4], [5], [6] and [37] Similar to findings on the frequency of stress, anxiety, and depression in the population, voice disorders also can be considered a women's health concern as they are most frequent and chronic in White, non-Hispanic women between 40 and 64 years of age.[35] and [36] However, few if any formal data exist in the literature on how stress, anxiety, and depression may distribute across voice disorders as a function of gender.

Clinical implications of research on stress and voice disorders

From a clinical perspective, there is consensus that if psychological and emotional factors that *initiated*, *exacerbated*, or *maintained* a voice disorder are not addressed—

for where MTD is concerned—the chance of long-term treatment efficacy decreases even if short-term success is achieved for the patient.[11], [15], [25], [38], [39], [40] and [41] Our research program takes the position that stress, anxiety, and depression may be important psychological factors in this regard that should receive systematic research to the ultimate end of improving understanding of their role in voice disorders and modulating treatment programs according to such understanding.

Long-term research goals

The current study represents an initial step in a long-term research program that aims to explore the mechanisms by which stress, in particular, may affect voice, and to develop efficacious treatment protocols targeting those mechanisms.[7] The present study represents a first step in the long-term program by addressing the validity of the assumption that *perceived* stress is indeed elevated in many conditions affecting voice in the first place. Data consistent with that assumption would provide encouragement on the pursuit of the long-range goals. Data inconsistent with the assumption would dampen enthusiasm for pursuing them in any large-scale way. A secondary emphasis in the present study is on the frequency of anxiety and depression in common pathologies affecting voice, ultimately with an eye on issues of intervention.

Objectives and hypotheses

The first objective of our study was to investigate the frequency of perceived stress, anxiety, and depression among patients with common pathologies affecting voice. The selection of clinical conditions targeted for the study took into consideration reports on pathologies that may be particularly vulnerable to stress, anxiety, and depression, and that is MTD, benign vocal fold lesions (eg, nodules), and PVFMD.[15], [24] and [42] Thus, those conditions were targeted for study in the present venue. Another condition, glottal insufficiency (eg, vocal fold paralysis), was chosen as a comparison condition, because its causes are not generally thought to involve stress or emotional factors. A second objective was to investigate the distribution of stress, anxiety, and depression as a function of diagnosis in the same patient cohort. Based on literature reviewed, the prediction was that elevated stress, anxiety, and depression would be found for the patient set as a whole, and would be found more often for patients with MTD, vocal fold lesions, and PVFMD than for patients with glottal insufficiency. Finally, a third

objective was to examine the distribution of stress, anxiety, and depression as a function of gender. The prediction was that these psychological conditions would be more common in women than in men with voice disorders.

At this stage of inquiry, which was intended as exploratory and preliminary, we did not aim to investigate additionally the relations among the severity of an individual's voice disorder and scores on stress, anxiety, and depression.

Methods

Subjects

Subjects were consecutive adult outpatients, 18 years and older, presenting to a large voice center between October 2004 and May 2005. Questionnaire data were obtained on stress, anxiety, and depression, as described below, from a total of 281 patients. However, our focus was a subset of 160 patients with diagnoses for which psychological factors are commonly thought to be relevant—PVFMD, MTD, and benign mucosal vocal fold lesions[15], [24] and [42]—and a group for which psychological factors are not usually considered central—glottal insufficiency. Laryngopharyngeal reflux (LPR) and *secondary* MTD were allowed as secondary diagnoses for PVFMD, lesions, and glottal insufficiency. Only LPR was allowed as a secondary diagnosis for *primary* MTD. Specific diagnostic criteria for the conditions are indicated below. Figure 1 displays the percentage of patients in each diagnostic category with “pure” versus primary plus secondary diagnoses. However, it should be noted that although secondary diagnoses were allowed, no overlap occurred between patients for *primary* diagnoses. Thus, patient groups were independent in the sense that groups were made of separate individuals.

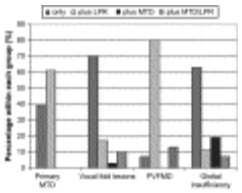
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Figure 1. The distribution of multiple diagnoses within each diagnostic group.

Figure 1 shows that secondary diagnoses of both LPR and secondary MTD were common in our data set. This finding is consistent with other reports in the literature on clinical populations[43] and anecdotal clinical observation.

The age of patients for the data set examined ranged from 18 to 90 years with a mean of 50.6 years (SD 17.8). Patients were predominantly Caucasian (88.1%) and non-Hispanic (99.4%). The percentage of African-American patients was 7.5%, Asian patients 2.5%, and multiple races 1.9%. Other specifics about patient characteristics are provided in Table 1.

Table 1.

Patient Characteristics

Diagnosis	**All**	**Females**	**Males**	**Age Range (y)**	***M* (SD)**
Primary MTD	28	24	4	21–68	48.0 (11.6)
Vocal fold lesions	40	32	8	18–63	37.8 (12.9)
PVFMD	30	26	4	18–76	49.8 (15.3)
Glottal insufficiency	62	35	27	18–90	60.4 (18.4)

Design and procedure

Overview

A retrospective within-subject, nonexperimental design was used. Data were derived from new patients who presented to a voice clinic between October 2004 and May 2005. Patients completed self-report questionnaires that assessed perceived stress (Perceived Stress Scale; PSS-10)[13] and anxiety and depression (Hospital Anxiety and Depression Scale; HADS-A and HADS-D).[44] Subsequently, patients underwent medical and speech-language pathology examination. All patients consented to the University of Pittsburgh IRB-approved ENT research registry.

Diagnostic criteria

Diagnoses were made by a laryngologist based on physical examination with laryngeal videoendoscopy and stroboscopy. In this retrospective clinical study, data about reliability and validity of diagnoses as assessed by a second laryngologist were not available, and no attempt was made to obtain them. It is acknowledged at the outset that reliability and validity of diagnoses of laryngeal status may be poor. We will return to this concern in the Discussion, but for reasons of expositional parsimony, we will not further reiterate qualifications on the concern until that point.

Standard diagnostic criteria were used in the identification of the conditions of interest for the study.[17] The diagnosis "primary MTD" encompassed a range of voice disorders not known to have organic substrate. Depending on the case, those disorders variably involved labels of "functional aphonia," "functional dysphonia," and MTD proper. For the MTD group, only LPR was allowed as a co-occurring laryngeal diagnosis. The diagnosis "vocal fold lesions" involved benign-appearing, unilateral or bilateral midmembranous vocal fold lesions. Secondary MTD—defined as MTD that is reactive to another, primary condition—and LPR were allowed as co-occurring laryngeal diagnoses for this category. The diagnosis "PVFMD" was based on observation of paradoxical vocal fold movement during inspiration or expiration, laryngeal hypersensitivity, and/or chronic cough. Again, secondary MTD and LPR were allowed as co-occurring conditions. The diagnosis "glottal insufficiency" included observations consistent with unilateral vocal fold paralysis, unilateral or bilateral vocal fold paresis, and/or unilateral or bilateral vocal fold atrophy. That is, these cases involved vocal fold immobility, reduced mobility, and/or lack of vocal fold bulk. Secondary MTD and LPR were again allowed as co-occurring diagnoses.

Perceived Stress Scale (PSS-10)

The PSS-10 is a 10-item questionnaire that is the most widely used tool to measure global perceived stress in relation to health-related outcomes (Appendix).[32] The total score is a measure of the degree to which an individual appraises his or her life as unpredictable, uncontrollable, and overloaded over the preceding month.[13] The maximum PSS score of 40 indicates the highest level of stress (note reverse scoring of items 4, 5, 7, and 8). Norms are based on an L. Harris Poll that gathered information using the PSS-10 with 2387 respondents in the United States.[13]

The PSS-10 has been established as a psychometrically reliable, valid, and economical tool. Specifically, the internal consistency of the tool has been reported as relatively high (Cronbach's $\alpha = 0.78$).[13] In terms of construct validity, PSS scores have been shown to correlate with self-reported health and health services measures, health behavior measures, smoking status, and help seeking behavior.[13] For instance, higher stress scores were associated with failure to quit smoking, failure among persons with diabetes to control blood sugar levels, greater vulnerability to stressful life event–elicited depressive symptoms, decreased wound healing, and more colds.[13], [45] and [46] Although there is some overlap between the phenomena measured in perceived stress and standard psychological distress scales, the authors of the PSS argue that the PSS not only measures psychological symptomatology in general, but also independently predicts physical symptoms and health outcomes as compared to depressive symptomatology.[12] and [13] High scores on the PSS can also indicate a risk factor for future distress.[13] Further, the PSS has been shown to predict health outcomes better than life event scales and the PSS is sensitive to chronic stress, especially if administered repeatedly.[12]

Hospital Anxiety and Depression Scale

The HADS assesses anxiety and depression with two, separate seven-item subscales that address symptoms from the preceding week (Appendix).[44] In the context of the HADS, anxiety refers to generalized anxiety and depression refers to a loss of pleasure.[47] The HADS is considered a reliable, valid, and simple tool to screen for anxiety and depression.[44] and [48] In an extensive review of the literature, internal consistency was shown to be good (HADS-A Cronbach's $\alpha = 0.83$; HADS-D Cronbach's $\alpha = 0.82$).[48] The maximum score of 21 for each subscale indicates the greatest severity of anxiety and depression, respectively. The HADS provides cutoff scores indicating mild (8–10), moderate (11–14), or severe (15–21) anxiety or depression.[44] An appealing aspect of the tool for the present purpose is that it has been previously used in the assessment of patients with voice disorders as compared to controls.[22] and [49]

Statistical analysis

Before approaching data analysis pertinent to the experimental questions, the internal consistency of PSS, HADS-A, and HADS-D scores in the present data set was evaluated using Cronbach's coefficient α. Relative to the experimental questions, the study's focus was primarily descriptive. Descriptive statistics included frequencies, percentage distributions, ranges, and measures of variability and central tendencies of PSS, HADS-A, and HADS-D raw scores for the pooled data set and for each diagnostic category. However, the main focus in descriptive analyses was the number of cases across and within each diagnostic category with a *z*-score indicating one or more standard deviations above the mean for the healthy population. The rationale for selecting $z \geq 1$ as a cutoff was that this approach would maximize the likelihood of capturing abnormal responses ("hits") compared to larger *z*-criteria (eg, ≥ 2), and at this stage of inquiry we wished to optimize the ability to capture abnormalities if they are present. To address the noted analysis, raw scores were converted to gender-adjusted *z*-scores based on population norms available for the PSS-10 ($n = 2387$)[13] and the HADS ($n = 51$).[49]

In addition to descriptive analyses, three separate one-way between-subjects analyses of variance (ANOVA) were undertaken to assess diagnostic group differences in gender-adjusted *z*-scores for the PSS, HADS-A, and HADS-D, respectively. For each of the ANOVAs, the independent variable was primary laryngological diagnosis (primary MTD, vocal fold lesions, PVFMD, or glottal insufficiency). The dependent variable was the PSS, HADS-A, or HADS-D score, depending on the test. Before conducting each test, the data were screened for normality, homogeneity of variance, and independence of subjects. As described in greater detail in the Results, transformations of scores were performed where necessary to achieve satisfaction of ANOVA assumptions, unless the parameter in question was not particularly threatening to the validity of the ANOVA, eg, as for data normality.[50] A significance level of $P < 0.05$ (two-tailed) was set for each of the three ANOVAs, without correcting for potential alpha inflation in this early-stage inquiry. The statistical software *SPSS* Version 12.0 was used for all descriptive and inferential statistics; the univariate general linear model function was used to conduct the ANOVAs.

Finally, although not a focus in this study, we calculated correlations among PSS, HADS-A, and HADS-D *z*-scores. Pearson *r* was used to compute the correlations.

Results

Frequency of elevated stress, anxiety, and depression in the sample as a whole

Stress

The internal consistency of PSS scores in our study was $\alpha = 0.87$, which was better than $\alpha = 0.75$ reported by previous authors.[13] More pertinent to the first experimental question (on perceived stress, anxiety, and depression for patients with the voice disorders evaluated), the mean stress score for the pooled data set of raw scores was $M = 14.30$ (SD 7.82). Norms for healthy adults of various ages are reported to range from a mean of 11.9 (SD 6.9; age 55–64 years) to 14.2 (SD 6.2; age 18–29 years).[13] Thus, it was not clear from the pooled data set that stress scores were substantially higher for these patients with voice disorders than for the healthy population. However, raw score conversions of the data into gender-adjusted *z*-scores indicated that 25% of the pooled subject group showed deviations from normal ($z \geq 1$).

Anxiety

The internal consistency of HADS-A scores in our data set was $\alpha = 0.85$, which was generally equivalent to findings from a previous report ($\alpha = 0.83$).[48] Pertinent to the first experimental question, the mean anxiety score for the pooled data set was $M = 6.54$ (SD 4.12). In a healthy population, the average HADS-A mean score is reported to be 4.6 (SD 3.3) for females and 4.8 (SD 3.3) for males.[49] Thus, as for stress scores, raw score analysis of anxiety scores failed to reveal sharp differences in anxiety for the patient group as compared to the healthy population. However, raw score conversions of the data into gender-adjusted *z*-scores indicated that 36.9% of the patient group as a whole showed deviations from normal ($z \geq 1$).

Depression

The internal consistency of the HADS-D in our data set was $\alpha = 0.77$, which was somewhat poorer than the consistency reported in a previous study ($\alpha = 0.82$).[48] The mean depression score for the pooled data set was $M = 3.68$ (SD 3.05). In a healthy population, the average HADS-D mean score is reported to be 2.2 (SD 2.7) for females and 2.4 (SD 2.3) for males.[49] Thus once again, a sharp departure from depression scores

for the healthy population was not shown in the data. However, raw score conversions of the data into gender-adjusted *z*-scores indicated that 31.2% of the patient group as a whole showed deviations from normal ($z \geq 1$).

Relations among stress, anxiety, and depression scores

Although relations among stress, anxiety, and depression were not a focus in this study, we calculated correlations among PSS, HADS-A, and HADS-D *z*-scores, anyway. All pairwise correlations were significant at the $P = 0.01$ level (two-tailed). Specifically, the correlation for the PSS versus HADS-A scores was $r = 0.71$ and the correlation between PSS and HADS-D was $r = 0.61$. The correlation between the HADS-A and HADS-D was $r = 0.50$. Therefore, stress, anxiety, and depression measures were clearly interrelated in the data set.

Distribution of stress, anxiety, and depression as a function of diagnostic group

Stress

Comprehensive PSS data as a function of diagnostic group are summarized in Table 2. The mean raw scores were the lowest scores for patients with glottal insufficiency ($M = 12.29$, SD 7.50) and were progressively higher for patients with MTD ($M = 14.32$, SD 8.54), PVFMD ($M = 16.00$, SD 8.47), and vocal fold lesions ($M = 16.41$, SD 6.76). A boxplot display of the data in Figure 2 reveals high variability in the data especially for patients with MTD and PVFMD, who had the highest standard deviations. Raw score conversions of the data into gender-adjusted *z*-scores indicated that the highest percentage of deviations from normal ($z \geq 1$) was found for patients with PVFMD (40.0%), followed by patients with MTD (28.6%), vocal fold lesions (22.5%), and glottal insufficiency (17.7%).

Table 2.

Raw Scores and Standardized Scores on the Perceived Stress Scale (PSS-10) by Voice-Related Pathology and Gender

Diagnosis	**PSS-10 Raw Scores**						**PSS-10 *z*-Scores ≥ 1 Above Norm***					
	All		**Females**		**Males**		**All**		**Females**		**Males**	
	n	***M* (SD)**	***n***	***M* (SD)**	***n***	***M* (SD)**	***n***	**%**	***n***	**%**	***n***	**%**
Primary MTD	28	14.32 (8.54)	24	14.75 (8.99)	4	11.75 (5.12)	28	28.6	24	29.2	4	25
Vocal fold lesions	40	16.41 (6.76)	32	17.46 (6.72)	8	10.88 (3.87)	40	22.5	32	28.1	8	0
PVFMD	30	16.00 (8.47)	26	15.75 (8.88)	4	17.63 (5.59)	30	40	26	38.5	4	50
Glottal insufficiency	62	12.29 (7.50)	35	12.99 (8.04)	27	11.38 (6.78)	62	17.7	35	17.1	27	18.5

* Norm references for healthy controls[13]: females *M* = 13.7 (SD 6.6), males *M* = 12.1 (SD 5.9).

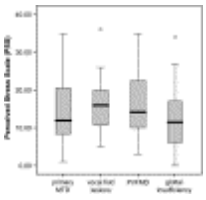

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Figure 2. Variability in stress scores (PSS-10).

A one-way between-subjects ANOVA was performed on *z*-adjusted PSS scores as a function of diagnosis. Assumptions of normality, homogeneity of variance, and independence of subjects were met without transformation of the data. However, the computed ANOVA was not statistically significant for the group factor [$F(3,156) = 2.12$, $P = 0.100$, $\eta^2 = 0.039$].

Anxiety

Comprehensive data for anxiety scores are shown in Table 3. The mean raw scores were the lowest in patients with glottal insufficiency (M = 5.08, SD 3.25), and increased, in order, for patients with MTD (M = 6.23, SD 4.54), vocal fold lesions (M = 7.49, SD 3.32), and PVFMD (M = 8.56, SD 5.18). The boxplot display for raw anxiety scores in Figure 3 shows that, again, the high variability in the data is striking, especially for patients with MTD and PVFMD. Raw score conversions of the data into gender-adjusted z-scores indicated that the highest percentage of deviations from normal ($z \geq 1$) was found for patients with PVFMD (53.3%), followed by patients with vocal fold lesions (50.0%), MTD (42.9%), and glottal insufficiency (17.7%).

Table 3.

Raw Scores and Standardized Scores on the Hospital Anxiety and Depression Scale (HADS-A) by Voice-Related Pathology and Gender

Diagnosis	**HADS-A Raw Scores**						**HADS-A z-Scores ≥ 1 Above Norm**[‡]					
	All*		**Females**		**Males**		**All**		**Females**		**Males**	
	n	***M* (SD)**	***n***	***M* (SD)**	***n***	***M* (SD)**	***n***	**%**	***n***	**%**	***n***	**%**
Primary MTD	28	6.23 (4.54)	24	5.94 (4.83)	4	8.00 (1.41)	28	42.9	24	45.8	4	25
Vocal fold lesions	40	7.49 (3.32)	32	8.05 (3.27)	8	5.25 (2.61)	40	50	32	59.4	8	12.5
PVFMD	30	8.56 (5.18)	26	8.19 (5.29)	4	11.00 (4.08)	30	53.3	26	50	4	75
Glottal insufficiency	62	5.08 (3.25)	35	5.66 (3.50)	27	4.33 (2.79)	62	17.7	35	22.9	27	11.1

*P = 0.001; glottal insufficiency < vocal fold lesions P = 0.018; and glottal insufficiency < PVFMD P = 0.004.

[†] Norm references for healthy controls[49]: females M = 4.6 (SD 3.3), males M = 4.8 (SD 3.3).

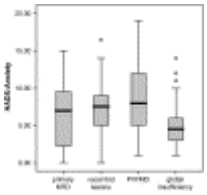
 Full-size image (20K)

Figure 3. Variability in anxiety scores (HADS).

For the one-way between-subjects ANOVA performed to assess anxiety *z*-scores as a function of diagnostic category, the assumption of normality was met except for the group with glottal insufficiency (Shapiro-Wilk W (62) = 0.901, $P < 0.001$). However, ANOVA is relatively robust against violations of normality as long as the skewness of the dependent variable within each group is in the same direction.[50] The data were indeed positively skewed to some degree in all groups. Thus, the data were not transformed to achieve improved normality for any group. The assumption of homogeneity of variance was not met (Brown-Forsythe, F (3,156) = 5.02, $P = 0.002$). A square root transformation of HADS-A scores rendered the data homogeneous, and transformed data were used for subsequent analyses. These analyses revealed a significant difference in anxiety scores as a function of diagnostic category [F (3,156) = 5.56, $P = 0.001$, $\eta^2 = 0.097$]. *Post hoc* pairwise comparisons were performed using the Bonferroni adjustment. Patients with glottal insufficiency had significantly lower anxiety scores than patients with vocal fold lesions ($P = 0.018$) or PVFMD ($P = 0.004$). None of the other comparisons approached significance.

Depression

Overall, raw scores for depression were lower than anxiety scores. The mean raw scores ranged from the lowest numbers for patients with MTD (M = 3.18, SD 3.48) to intermediate numbers for patients with vocal fold lesions (M = 3.29, SD 2.94) and glottal insufficiency (M = 3.66, SD 2.89), and the highest scores were shown for patients with PVFMD (M = 4.69, SD 3.03). The boxplot display for raw depression scores in Figure 4 shows that, again, the high variability in the data is striking, especially for patients with vocal fold lesions and PVFMD. Raw score conversions of the data into gender-adjusted *z*-scores indicated that the highest percentage of deviations

from normal ($z \geq 1$) was found for patients with PVFMD (50.0%), followed by patients with glottal insufficiency (28.8%), MTD (28.6%), and vocal fold lesions (27.5%). Comprehensive data on depression are summarized in Table 4.

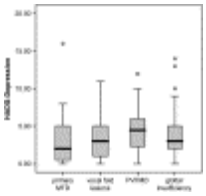
 Full-size image (20K)

Figure 4. Variability in depression scores (HADS).

Table 4.

Raw Scores and Standardized Scores on the Hospital Anxiety and Depression Scale (HADS-D) by Voice-Related Pathology and Gender

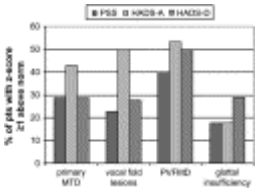
Diagnosis	**HADS-D Raw Scores**						**HADS-D *z*-Scores ≥ 1 Above Norm***					
	All		**Females**		**Males**		**All**		**Females**		**Males**	
	n	***M* (SD)**	***n***	***M* (SD)**	***n***	***M* (SD)**	***n***	**%**	***n***	**%**	***n***	**%**
Primary MTD	28	3.18 (3.48)	24	3.46 (3.67)	4	1.50 (1.00)	28	28.6	24	33.3	4	0
Vocal fold lesions	40	3.29 (2.94)	32	3.58 (3.11)	8	2.13 (1.81)	40	27.5	32	31.2	8	12.5
PVFMD	30	4.69 (3.03)	26	4.68 (3.14)	4	4.75 (2.50)	30	50	26	46.2	4	75
Glottal insufficiency	62	3.66 (2.89)	35	3.51 (2.78)	27	3.85 (3.06)	62	28.8	35	25.7	27	25.9

* Norm references for healthy controls[49]: females $M = 2.2$ (SD 2.7), males $M = 2.4$ (SD 2.3).

A one-way between-subjects ANOVA was performed on depression as a function diagnostic group. Assumptions on homogeneity of variance and independence of subjects were met. However, the distributions in subjects with primary MTD (Shapiro-Wilk W (28) = 0.817, $P < 0.001$), vocal fold lesions (Shapiro-Wilk W (40) = 0.906, $P = 0.003$), and glottal insufficiency were not normal (Shapiro-Wilk W (62) = 0.852, $P < 0.001$). As previously noted, ANOVA is relatively robust against violations of normality as long as the skewness of the dependent variable within each group is in the same direction. That requirement was met, as all four groups had positively skewed data to various degrees. Thus, the data were not transformed to achieve normality for any group. However, the computed ANOVA was not statistically significant.

Summary of data by diagnostic group

In summary, Figure 5 illustrates the distribution of stress, anxiety, and depression scores within and among the diagnostic groups. Overall, patients with PVFMD had the highest (poorest) scores on all three measures. Patients with primary MTD and vocal fold lesions had relatively similar profiles, however, patients with vocal fold lesions were characterized by higher anxiety scores and patients with MTD had slightly higher stress scores. Last, patients with glottal insufficiency scored overall lowest on all three measures.



Full-size image (23K)

Figure 5. The distribution of stress, anxiety, and depression scores.

Gender effects in the data

Stress

In the pooled data set, females had numerically higher stress scores than males. For females, the average stress score was M = 15.19 (SD 8.19) and for males the average

stress score was M = 11.90 (SD 6.21). In a healthy population, the average PSS stress score is reported to be 13.7 (SD 6.6) for females and 12.1 (SD 5.9) for males.[13] Thus, the raw data suggested that as for the healthy population, average stress scores were slightly higher for females than for males in our data set. However, gender-adjusted z-scores provided stronger evidence of a possible gender effect in the data. The highest percentage of deviations from normal stress scores ($z \geq 1$) was found for female patients (27.4%) in comparison to male patients (18.6%). Considering gender effects as a function of diagnosis, female patients with MTD, vocal fold lesions, and glottal insufficiency reported high stress raw scores more often than males. In contrast, male patients with PVFMD had elevated stress scores more often than females with that diagnosis (Table 2). Specifically, the percentage of deviations from normal ($z \geq 1$) was 29.2% for females with MTD (as compared to 25.0% for males), the percentage was 28.1% for females with vocal fold lesions (as compared to 0% for males), it was 17.1% for females with glottal insufficiency (as compared to 18.5% for males), and it was 50.0% for males with PVFMD (as compared to 38.5% for females) (Table 2).

Anxiety

In the pooled data set, average anxiety scores were numerically slightly higher for females than for males (mean score for females was M = 6.93, SD 4.30; mean score for males was M = 5.47, SD 3.41). Gender-adjusted z-scores indicated that the highest percentage of deviations from normal ($z \geq 1$) was clearly found for female patients (43.6%) in comparison to male patients (18.6%). These scores indicated that the percentage of deviations from normal ($z \geq 1$) was higher for females than for males in all but one diagnostic group, patients with PVFMD. Specifically, 45.8% of females with MTD, 59.4% of females with vocal fold lesions, and 50.0% of females with PVFMD anxiety scores $\geq z = 1$. In contrast, 75.0% of males with PVFMD showed a higher frequency of anxiety in comparison with females (Table 3).

Depression

In the pooled data set, females reported numerically slightly higher depression scores than males. The average depression score for females was M = 3.78 (SD 3.14) and for males, the average depression score was M = 3.40 (SD 2.80). When gender-adjusted z-scores were used, the highest percentage of deviations from normal ($z \geq 1$) was again

found for female patients (33.3%) in comparison to male patients (25.6%). Gender-adjusted conversions of raw scores by diagnosis indicated that the percentage of deviations from normal ($z \geq 1$) was higher for females than for males in all but one diagnostic group (PVFMD). Similar to results for anxiety, female patients with MTD (33.3%), vocal fold lesions (31.2%), and PVFMD (46.2%) showed a relatively high rate of abnormal depression scores in comparison to males. However, males with PVFMD (75.0%) showed a higher rate of abnormal depression scores in comparison to females (Table 4).

Discussion

The primary objective of this study was to investigate the frequency of stress, anxiety, and depression for patients with common pathologies affecting voice. The pathologies targeted were MTD, vocal fold lesions, and PVFMD, due to their putative relation to psychological conditions, and glottal insufficiency due to its lack of obvious relation. Before proceeding with a discussion of the results, two cautionary statements are in order. (1) All diagnoses were based on a single laryngologist's examination. No attempt was made to gain information about the reliability or validity of any diagnosis. (2) The severity of an individual's voice problem was not included in the data analysis. Although the inclusion of vocal handicap data would have provided additional valuable insight, we have elected to defer the investigation of quantitative issues to future studies that will build upon this exploratory and preliminary research. Thus, any conclusions must be tempered with these observations and followed up with further, prospective studies.

Having said as much, in the present study, when raw data were pooled across diagnostic groups and gender, the results indicated stress, anxiety, and depression scores were in the range of those found for the healthy population at large. However, analysis of gender-adjusted *z*-scores revealed something of a different picture. Specifically, 25% of patients reported stress scores deviating from the healthy norm and 36.9% and 31.2% of reported elevated anxiety and depression scores, respectively ($z \geq 1$). Thus, anxiety appeared most common, followed by depression and stress for the pooled patient set. At the global level, the data appear to make three points, depending on how one views them. First, using the *z*-score cutoff ≥ 1, stress, anxiety, and depression may indeed be

relatively common in some groups of patients with voice disorders, as often claimed.[15], [29] and [42] Second, individual differences clearly play a role in such involvement. At minimum, such differences may at least partly relate to gender. Third, and related, although something on the order of 25% to 37% of the patient pool as a whole displayed elevated stress, anxiety, or depression, the corollary is that about 63% to 75% of patients did *not* show these conditions. Thus, caution should be exercised in making any *a priori* assumptions about the presence of these psychological conditions in patients with voice disorders in general.

More specific to results in relation to a specific diagnosis, the study's second objective was to investigate the distribution of elevated stress, anxiety, and depression as a function of diagnostic condition. Again, gender-adjusted *z*-scores were used to evaluate this question. Evaluation of the results is somewhat complicated by the fact that many patients had secondary diagnoses involving secondary MTD and/or LPR. Interestingly, results revealed that some evidence of psychological tendencies as a function of diagnostic category survived and emerged in the data set, anyway (Figure 5). Patients with a diagnosis of PVFMD (worst) or glottal insufficiency (best) were at the far ends of the spectrum in terms of the frequency of all three psychological conditions as measured in this study, except for depression, which was about as common in patients with glottal insufficiency as it was for patients with lesions and MTD. The frequency of depression was lowest in absolute in patients with vocal fold lesions. Patients with primary MTD and vocal fold lesions had relatively similar profiles. Up to half of the patients with MTD and vocal fold lesions reported abnormal state anxiety (slightly more common in patients with vocal fold lesions), and approximately one fourth of those patients reported elevated stress and depression (slightly more common in patients with MTD).

The final objective was to examine gender effects in the data. As already noted, the data were quite clear that gender mattered in the results. Descriptively, females in the data set reported elevated stress, anxiety, and depression more often than males, based on gender-adjusted *z*-scores. This finding was especially notable for female patients with MTD and vocal fold lesions. Interestingly, male patients with PVFMD reported more stress, anxiety, and depression more often than their female counterparts. Due to the

small number of male patients in the group with PVFMD (n = 4), no speculations can be made about the reliability of that result based on the present data set.

Because the findings for PVFMD and glottal insufficiency represented polar extremes, there is value to examining them further. PVFMD has long been described as having an emotional component that may be as severe as it occurs in reactions to life-threatening experiences.[42] However, the exact role of emotional conflict in the disorder is still unclear.[42], [51] and [52] Anxiety and stress have been described as causal, trigger, exacerbating, and maintaining factors.[17], [33], [34], [42], [51] and [52] Further, PVFMD has been predominantly diagnosed in females and depression as a result of PVFMD has been mentioned as a consideration.[33] In our sample, patients with PVFMD showed the strongest deviations from the norm for all variables tested. That is, about half of those patients reported elevated scores for all three mental health issues—stress, anxiety, and depression. However, the exact role of each of these issues remains speculative at this point.

The opposite finding, pointing to the lowest stress and anxiety scores in patients with glottal insufficiency, is not altogether intuitive. The reason is that a majority of these patients had vocal fold paralysis (58%), which is often associated with a major stressful life event such as surgery or disease. On the other hand, the glottal insufficiency group was the only one with mostly older patients (60.4 years, SD 18.4). The corollary is that elderly individuals tend to perceive less stress than younger and middle-aged people in general (55–64 years, M = 11.9, SD 6.9; 65 years and older, M = 12.0, SD 6.3).[13] Therefore, one might assume that stress and anxiety are heightened issues especially in working middle-aged individuals, who were more commonly represented in the other diagnostic categories in our study. Stated differently, although we initially argued that we were interested in including one common diagnostic category in our study for which psychological factors are not strongly implicated at the causal level, age effects might have attenuated stress that might have been a *result* of their medical condition.

There is also value to further consideration of findings for patients with lesions, the majority of which would probably be considered nodules by most practitioners. Patients with vocal fold nodules have often been described as anxious and stress reactive.[24], [25], [29], [53] and [54] Thus, psychological distress in patients with vocal fold nodules may not be uncommon. In studies by Roy et al,[24] and [25] both patients with vocal fold nodules and

patients with MTD were relatively high in trait anxiety and stress reactivity based on personality questionnaires, but relatively speaking, patients with vocal fold nodules showed less stress and anxiety than patients with MTD.[24] and [25] Results from our study generally replicated the findings for stress (slightly less common for patients with lesions than for MTD; 22.5% vs 28.6%, respectively), but reversed results somewhat for anxiety (50% of patients with lesions had elevated scores, vs 42% of patients with MTD who had elevated scores). However, it should be pointed out that results from our study reflect *state* anxiety and *perceived* stress as opposed to *trait* anxiety and *stress reactivity* examined by Roy et al. Especially, the high anxiety scores in our study might reflect the current concern of patients with vocal fold lesions about their condition and future.

Regarding further evaluation of results for patients with primary MTD, a somewhat unexpected finding given general *a priori* assumptions about these patients was that they did not stand out in terms of higher stress or anxiety scores than patients with PVFMD or lesions. That finding was unanticipated, given common assumptions in clinical practice about a putative role of stress in MTD.[24] In fact, only after standardizing and gender adjusting the raw scores were patients with MTD seen to have a slightly higher rate of elevated stress scores, descriptively, than patients with vocal fold lesions. As important or more important, in terms of the ranges of scores, patients with MTD constituted a more heterogeneous group than patients with vocal fold lesions (Figure 2 and Figure 3). We reexamined the data to determine if an inherent heterogeneity of subdiagnoses within the MTD group might account for the variability in the data (primary MTD $n = 21$, "functional dysphonia" $n = 5$, and "functional aphonia" $n = 2$). However, no correspondence was found between variability in the data and MTD subgroup.

The data for patients with MTD are indeed consistent with the view of MTD as a wide *spectrum* of conditions, which may range from psychogenic aphonia to little or no psychological involvement as may occur in "musculogenic" MTD.[11] and [16] Stated differently, some caution should be exercised to guard against an overestimation of psychological factors as causal in the average individual with MTD.[18] and [19] There seems to be some agreement that psychological disturbances are the most common and conspicuous in patients with functional aphonia, but even in that group underlying personality and psychopathology factors have been found to be heterogeneous.[19], [30] and

[31] Our data provide dim confirmation regarding suggestions about heterogeneity across individuals with MTD, insofar as one of our two patients with functional aphonia had elevated stress and anxiety scores, but the other patient did not.

Brief commentary is also warranted about the relation of stress with anxiety and depression data in our sample. PSS questions are framed to capture information across a longer time window than the HADS (1 month vs 1 week). Thus, PSS data imply something about chronicity, whereas HADS data are more geared toward capturing an individual's current state (past week). At a qualitative level, the PSS addresses more serious and general issues such as the feeling of an unpredictable, uncontrollable, and overloaded life (eg, “In the last month, how often have you felt that you were unable to control the important things in your life?”)[13] as opposed to anxious states of mind (eg, “Worrying thoughts go through my mind.”).[44] In our data set, the frequency of elevated anxiety was clearly higher for patients with PVFMD, lesions, and MTD than the frequency of stress. It is conceivable that the data were skewed by patients' current anxiety over having a voice disorder, while they might have felt that their lives were still under control in general. Thus, this asymmetry could have skewed the data in some way, although suggestions about the direction of such skew would be purely speculative at this point.

Correlation coefficients indicated that measures of stress, anxiety, and depression were clearly interrelated in the data set, in particular, stress and anxiety. The various strengths of relationships—strongest for stress and anxiety ($r = 0.71$) and least for anxiety and depression ($r = 0.50$)—are consistent with the literature that says that stress and anxiety often co-occur.[5] Thus, our results replicate others suggesting that stress and anxiety questionnaires partly capture overlapping constructs, but that there are also some differences between the measures.

A limitation of the study is its cross-sectional design. Due to the use of that design, no information can be gleaned about a possible causal relation between stress, anxiety, or depression and the voice disorders studied. Nonetheless, the relatively high frequency of stress, anxiety, and depression for patients in the present study is noteworthy and may lend support to the notion that these conditions may be as much a *result* of some voice disorders as a *cause* of them. In fact, it has been established that voice disorders often decrease an individual's quality of life in relation to work, social, psychological,

physical, and communication problems almost independent of sex and type of voice disorder.[55] and [56] Further, the likely bidirectionality of relations between stress and voice may promote a *vicious circle* in which both stress and voice problems reciprocally amplify and reinforce each other.[11] and [38] In this context, as mentioned previously, it would have been valuable to investigate how the severity of an individual's voice disorder correlated with the stress, anxiety, and depression scores in addition to one's voice diagnostic category. However, we are using the current findings to conceptualize studies that will explore these complex relations in more detail.

Ultimately, results from this study may have both clinical and research implications. The data indicate that stress, anxiety, and depression may be individual factors in some conditions affecting voice and *individual* patients may be affected differentially. Thus, there may be merit in addressing them at various points during the treatment process as potentially: (1) (co-)causal, (2) precipitating, (3) exacerbating, or (4) maintaining for the conditions. Especially, attempts to break the potential vicious cycle of stress, anxiety, and depression in voice disorders in susceptible individuals become a foremost goal. Support for this notion comes, for example, from studies that investigated patients with recurring versus nonrecurring MTD. Patients with relapses were predominantly female, experienced psychological stress, and were more anxious as compared to nonrelapsing patients.[38] and [39] With regard to research, there is need for systematic study on how the noted vicious cycles might be interrupted. As noted earlier, our long-term research goals address this issue, in the context of a theoretically guided psychobiological framework we proposed for studying stress—at least—and its relation to voice disorders.[7]

Conclusions

Stress is pervasive, persistent, and nearly unavoidable in modern life.[5] Anxiety appears similarly pervasive,[10] as does depression.[57] Additionally, stress, anxiety, and depression have been labeled women's issues, thus national mandates are increased on research into them. Data from the present study indicate that stress, anxiety, and depression may be part of the clinical profile for a subset of patients with PVFMD, MTD, and vocal fold lesions in particular. However, individual factors are clearly at play, and the present data shed no light on the specific role these mental health issues may play for the disorders. A cautious conclusion is that stress, anxiety, and depression may play a role at least in

the maintenance of some voice disorders, especially those associated with PVFMD, vocal fold lesions, and MTD.

Acknowledgments

The work was supported by Grant No. R01 DC005643 to the second author from the National Institute on Deafness and Other Communication Disorders. The authors would also like to thank Dr. Elaine Rubinstein from the Office of Measurement and Evaluation of Teaching at the University of Pittsburgh for her generous assistance with statistical analysis.

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Appendix. Perceived Stress Scale—10

The questions in this scale ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by circling ***how often*** you felt or thought a certain way.

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?.....**0 1 2 3 4**

2. In the last month, how often have you felt that you were unable to control the important things in your life?.....**0 1 2 3 4**

3. In the last month, how often have you felt nervous and "stressed"? **0 1 2 3 4**

4. In the last month, how often have you felt confident about your ability to handle your personal problems?.....**0 1 2 3 4**

5. In the last month, how often have you felt that things were going your way?..... .**0 1 2 3 4**

6. In the last month, how often have you found that you could not cope with all the things that you had to do? **0 1 2 3 4**

7. In the last month, how often have you been able to control irritations in your life?..... **0 1 2 3 4**

8. In the last month, how often have you felt that you were on top of things?.....**0 1 2 3 4**

9. In the last month, how often have you been angered because of things that were outside of your control? **0 1 2 3 4**

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?..... **0 1 2 3 4**

The PSS-10 scale is reprinted with permission of the American Sociological Association, from Cohen S., Kamarck T., Mermelstein R. A global measure of perceived stress. *Journal of Health and Social Behavior*. 1983;24:386–396.

Presented at the Voice Foundation's 34th Annual Symposium: Care of the Professional Voice, June 2005, in Philadelphia, Pennsylvania.

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‡ We would like to emphasize, however, that stress is also a widespread health concern for men