

Occupational and individual risk factors for dysphonia in teachers

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Background	In recent decades several groups of researchers have been interested in describing and understanding vocal morbidity in teachers in order to explain the large number of teachers diagnosed with dysphonia and account for the absenteeism attributed to vocal disability.
Aims	To determine the proportion of teachers who reported a diagnosis of dysphonia and measure associations between individual and contextual factors and the event of interest.
Methods	Teachers were recruited from the city of Belo Horizonte and invited to complete a web-based institutional intranet questionnaire.
Results	In total, 649 teachers responded; 32% (CI 28.5–35.5) reported that they had received a physician diagnosis of dysphonia. This prevalence was significantly higher among female teachers (prevalence ratio (PR) 2.33; CI 1.41–3.85), and groups who reported limited technical resources and equipment (PR 1.56; CI 1.14–2.15), a diagnosis of gastritis (PR 1.59; CI 1.28–1.98), not being summoned for an annual physician examination (PR 0.47; CI 0.32–0.68), or absenteeism (PR 1.39; CI 1.06–1.81).
Conclusions	The high prevalence of dysphonia in teachers was not associated with any individual variables, except for sex and comorbidity (diagnosis of gastritis). Limited technical resources and equipment were associated with dysphonia and suggests policy change is important in preventing dysphonia.
Key words	Occupational disease; teachers; voice disorder.

Introduction

In the past decade, researchers in several countries—including Brazil—have described and investigated vocal morbidity in teachers quantifying more precisely the numbers of teachers diagnosed with dysphonia [1] and the absenteeism attributed to vocal disability [2–3]. In Spain the prevalence of clinically diagnosed vocal disorders was 57% [3], and 79% of teachers reported symptoms of vocal alteration and 20% reported a confirmed diagnosis of laryngeal injury. The incidence was 3.9 new cases per year per 1000 teachers. In Finland, laryngeal evaluation detected alterations in 51% of the teachers [4].

Dysphonia results from minor structural alterations in the vocal folds (sulci, strias, mucosal bridge, and cysts) and can present in adults whose jobs impose great vocal demands. Environmental and social factors are associated with vocal symptoms and influence the diagnosis of dysphonia and the course of rehabilitation [5–8].

Outpatient evaluation by ENT specialists and speech and language therapists identifies a high frequency of reports of vocal alteration by teachers

exposed to the risk factors described by epidemiological studies: heavy teaching loads, high ambient noise levels and constant vocal demands ('has to talk a lot'). These evaluations document high rates of self-perceived vocal alteration, a mild degree of vocal deviation, and the presence of exophytic lesions on the vocal folds [9]. Among the subjects on leave from teaching because of a vocal disorder, researchers described diagnoses of vocal nodules (33%) and chronic laryngitis (32%) [10].

Differences in the constructs, definitions and methods used in studies of vocal disorders make it difficult to interpret and compare prevalences—which can range from 4% to 96%—across different populations and occupational groups. Comparisons are hampered by the great variability among symptoms and other criteria used to define the presence of voice alterations [11]. Methodological limitations have been identified in studies of occupational voice disorders arising from the necessity for employees to accept work conditions and the risks from professional activities [1].

The aim of this study was to determine the percentage of teachers who reported a medical diagnosis of dysphonia and measure associations between individual and contextual factors and the diagnosis of dysphonia.

Methods

We conducted a cross-sectional study using a self-administered web-based survey instrument. The study was approved by the Research Ethics Committee (Opinion: 0054.0.410.000.09^a).

To calculate the sample size, we considered the target population of 8600 teaching positions and used the lowest self-reported prevalence of voice disorders reported in the literature (17%) [11]. We assumed a sampling error of three percentage points; with a 95% confidence interval, the calculated sample size was 536 teachers.

The questionnaire and the informed consent form were made available through the institutional intranet between September and December 2009. The study was also publicized through management meetings and employee wage slips in order to clarify the study objectives and importance of participation.

The dependent variable was a medical diagnosis of dysphonia, as reported by teacher in response to the question 'Has a doctor told you that you have dysphonia?' with 'yes' or 'no' the possible responses. A doctor's diagnosis reported by the respondent was considered more reliable than a self-reported alteration in voice. It is important to note that the teachers in this sample had access to regular check-ups from the employee health service (and were supposed to have an annual examination).

A literature review enabled the construction of a theoretical model that guided the selection of independent variables, which were classified into blocks for the development of models for analysis.

The first block included the variables sex (male, female), age (0–29, 30–39, 40–49, 50 or older), marital status (has a partner, no partner), number of children (none, one, two, three or more) and years of schooling completed (<17, ≥17).

With regard to attributes of their work, teachers were asked about the number of teaching shifts per day (one, two, or three). The teacher's perception of their work environment was gauged by aggregating responses to questions about ventilation, lighting and temperature. Each response was assigned a score on the following scale: poor = 1 point, fair = 2 points, satisfactory = 3 points. Teachers were then assigned into two categories for analysis: those who had a good working environment (scores above the median) and those who had a poor working environment (scores below the median). Noise was assessed by aggregating the responses to questions about noise in the classroom, school and outside of school, scored on the following scale: negligible = 1 point, moderate = 2 points, high = 3 points. After the

sum of the scores was calculated, teachers were again assigned into two categories for analysis: modest noise (scores below the median) and unpleasant (scores above the median). We also examined technical resources and equipment in workplace (poor, fair, satisfactory).

Quantifying the physical demands of the work was done by aggregating responses to six questions related to posture, physical exertion and breaks. Each question had four possible responses, scored as follows: never = 1 point, rarely = 2 points, sometimes = 3 points, and always = 4 points. The physical demands variable was divided at the median into low (below the median cutoff point) and high (above the cut-off).

The Job Stress Scale (JSS) is an instrument that assesses the dimensions of demand, control and support at work, which are considered sources of psychosocial stress. We used the short version of the JSS, previously translated and adapted into Portuguese and validated [12].

The responses of the JSS block were grouped according to Karasek's Demand and Control Model: Active Work (high demand and high control), Low Strain (low demand and high control), High Strain (high demand and low control) and Passive Work (low demand and low control). The social support dimension is defined as levels of social integration, existing at work, both with colleagues and with superiors. Lack of support can generate negative health consequences [12].

We examined the satisfaction with the ability to work (satisfied, intermediate and dissatisfied). Aggression (or threat) in the workplace was investigated by obtaining responses to questions about aggression (or the threat of aggression) from students, parents, superiors or colleagues toward students and by superiors or colleagues towards co-workers. Responses were scored according to the following scale: never = 0 points, once = 1 point, and a few times = 2 points. After summing the scores, respondents were assigned to one of two categories for analysis: no (zero score) and yes (scores of 1 or higher).

To gauge their general health, teachers were asked about diagnoses of respiratory tract diseases, specifically rhinitis/sinusitis and asthma (no, yes—one or more diagnoses); diagnosis of gastritis (no, yes); diagnosis of a sleep disorder (no, yes); whether they had gone for their annual physical examination when summoned (yes, no, not summoned); and absenteeism (no, yes—one or more days of authorized sick leave).

The 20-question version of the Self-Reporting Questionnaire (SRQ-20) was used to screen for the common mental disorders [13]. The SRQ-20 is an instrument designed by the World Health Organization (WHO) for use in populations of developing countries. In this study, we defined the cut-off for classification as suspected of having a common mental disorder at seven or more positive responses, the cut-off adopted by other authors [14,15].

Lifestyle habits were investigated by means of answers to questions concerning leisure activities (no, yes), physical activity (no, yes: 3 or more times per week) and smoking (never smoked, former smoker, current smoker).

We conducted a descriptive analysis of the data by means of absolute measurements and percentages. Poisson regression was used for the analysis of factors associated with a diagnosis of dysphonia. The magnitude of the association of each factor was measured by a prevalence ratio (PR) and its statistical significance by its confidence interval. Multivariate analysis was used to evaluate potential confounding factors. Factors associated at a P level ≤ 0.20 in univariate analysis were included in the multivariate model. By means of sequential elimination of the variables, the final multivariate model included variables associated at a P level ≤ 0.05 . STATA version 10.0 (Stata Corp., College Station, Texas, USA) was used to perform these statistical analyses.

Results

A total of 649 teachers completed the questionnaire. The prevalence of a reported diagnosis of dysphonia in the sample was 32% (95% CI 28, 5–35,5), predominantly amongst women aged 40–49 years with graduate education, a partner and two or more children. The prevalence of dysphonia was higher among women ($P < 0.001$) (Table 1, available as Supplementary data at *Occupational Medicine Online*).

The following were associated with a diagnosis of dysphonia in the univariate analysis: poor work environment ($P < 0.05$), poor technical resources and equipment ($P < 0.001$), work with high physical demands ($P < 0.05$), active work ($P < 0.01$), high strain ($P < 0.001$) and being present when aggression or threat of aggression occurred in the workplace ($P < 0.05$) (Table 2).

In terms of the teachers' general health, a higher prevalence of dysphonia was associated with a report of respiratory problems ($P < 0.001$), gastritis ($P < 0.001$), a sleep disorder ($P < 0.001$), greater likelihood of a common mental health disorder ($P < 0.001$), not being summoned for an annual check-up ($P < 0.001$) and absenteeism ($P < 0.001$) (Table 3).

With regard to lifestyle, most denied smoking and claimed they did some leisure activity, but were otherwise physically inactive. No association of these lifestyle factors with a diagnosis of dysphonia was found (Table 4, available as Supplementary data at *Occupational Medicine Online*).

The variables that remained statistically associated with a diagnosis of dysphonia in the multivariate regression were female sex (PR 2.33), poor technical resources and equipment in workplace (PR 1.56), diagnosis of gastritis (PR 1.59), not being summoned for an annual check-up (PR 0.47) and absenteeism (PR 1.39) (Table 5).

Discussion

In this study, almost a third of teachers (32%) reported that they had received a physician diagnosis of dysphonia. This prevalence was significantly higher among female teachers, groups who reported limited technical resources and equipment, those who had a diagnosis of gastritis, those who had not been summoned for an annual physician examination and those with a history of absenteeism.

Large-scale studies of voice disorders in occupational groups may provide clues about trends in the prevalence of dysphonia and help identify risk factors that predispose workers to dysphonia. Self-administered computer-assisted questionnaires can be an expeditious and relatively inexpensive way to provide estimates in large populations, as the cost and time required for direct interviews would be prohibitive.

This study had several limitations. Teachers could only access the questionnaire on the intranet at work; because teachers on medical leave could not complete the questionnaire, the prevalence of dysphonia we found probably underestimates the true prevalence. On the other hand, teachers with dysphonia may be more likely to participate, and there is the potential for self-reporting bias in any self-administered questionnaire. The cross-sectional nature of the study means that conclusions on causation cannot be made; because the study relies on reporting of all variables by the same individual, there is the possibility of common method variance that we have not checked for.

Most studies report a higher prevalence of voice disorders in women than in men. This may be due to reporting bias related to gender [3,16,17], differences in the biological characteristics of the human vocal apparatus [18,19], with the female vocal apparatus less able to withstand louder projection and continued use, and there is evidence of differences in the way men and women teach [20].

Subjects were asked if they had a history of other health problems, but gastritis was the only comorbid condition associated with a diagnosis of dysphonia. The literature describes a significant association between the presence of dysphonia and gastro-oesophageal reflux disease (GORD) [4]. Estimates of the frequency of GORD range from 10 to 50% among patients with laryngeal and voice changes [21], including hoarseness, chronic cough and the presence of laryngeal lesions [22]. In a sample of teachers in Belo Horizonte receiving speech therapy for dysphonia, the use of medication for the treatment of GORD was reported by 15% of those interviewed [9]. The use of medication to reduce stomach acidity was positively associated with dysphonia among Spanish teachers [3]. Our questionnaire did not ask about GORD specifically, but we suspect that respondents with GORD symptoms responded affirmatively to the question about gastritis, which may explain the association between gastritis and dysphonia obtained. GORD may not be as prevalent among teachers

Table 2. Univariate analysis of the work characteristics associated with the prevalence of dysphonia

	Diagnosis of dysphonia		PR (CI)
	No <i>n</i> (%)	Yes <i>n</i> (%)	
Aspects related to work			
Number of teaching shifts per day			
One	73 (17)	36 (17)	1
Two	278 (63)	126 (62)	0.94 (0.70–1.28)
Three	90 (20)	42 (21)	0.96 (0.67–1.39)
Perception of work environment			
Good	298 (75)	123 (65)	1
Bad	101 (25)	65 (35)	1.34 (1.05–1.70)*
Noise assessment			
Modest	223 (57)	94 (49)	1
Unpleasant	171 (43)	97 (51)	1.22 (0.97–1.54)
Perception of technical resources and equipment in workplace			
Satisfactory	168 (38)	56 (27)	1
Fair	218 (50)	106 (52)	1.31 (0.99–1.73)
Poor	53 (12)	42 (21)	1.77 (1.28–2.44)***
Physical demands			
Low	186 (42)	69 (34)	1
High	253 (58)	134 (66)	1.28 (1–1.63)*
Psychosocial work demands (JSS)			
Low strain	129 (30)	35 (18)	1
Active work	182 (43)	94 (47)	1.60 (1.14–2.24)**
Passive work	40 (9)	20 (10)	1.56 (0.98–2.48)
High strain	75 (18)	49 (25)	1.85 (1.28–2.67)***
Social support at work			
High social support	232 (56)	116 (60)	1
Low social support	186 (44)	78 (40)	0.89 (0.70–1.13)
Satisfaction with the ability to work			
Satisfied	276 (65)	114 (58)	1
Intermediate	83 (20)	42 (22)	1.15 (0.86–1.54)
Dissatisfied	63 (15)	40 (20)	1.33 (1–1.77)
Aggression (or threat) at the workplace			
No	127 (31)	36 (20)	1
Yes	285 (69)	141 (80)	1.50 (1.09–2.06)*

P* < 0.005, *P* < 0.01, ****P* < 0.001.

as dysphonia; the presence of gastro-oesophageal reflux was not significant in a sample of Taiwanese teachers [23].

In addition to individual factors (female sex) and comorbid conditions (gastritis), among teachers that reported inadequacies in materials and equipment needed to teach, a higher proportion reported dysphonia. This suggests that a combination of individual factors and contextual factors are at play, affirming the multidimensional nature of dysphonia.

Thus illness and absenteeism reflect work conditions [24,25]. Prolonged use of the teacher’s voice and environmental factors (ambient noise, poor acoustic design and poor air quality) affect the type and intensity of phonation or the vibratory characteristics of vocal folds, resulting in vocal overloading by the teacher [20,26].

Medical leave is recommended when a health problem is incompatible with effectively performing one’s job, when there is a need for rest, or the need to undergo diagnostic or therapeutic procedures during work hours.

In this study, going for a regular medical check-up in the group of subjects who reported a diagnosis of dysphonia would not be unexpected because they would have perceived the need for medical care or had confirmed the diagnosis of dysphonia during medical visits. Not having been summoned to a regular workplace, physical examination was significantly associated with a lower prevalence of dysphonia compared with those who were summoned.

The association between dysphonia and absenteeism has also been found in other studies [2,27,28]. In Belo

Table 3. Univariate analysis of general health associated with the prevalence of dysphonia

	Diagnosis of dysphonia		PR (CI)
	No n (%)	Yes n (%)	
General health			
Diagnosis of respiratory problem			
No	202 (46)	61 (30)	1
Yes	239 (54)	143 (70)	1.61 (1.25–2.08)***
Diagnosis of gastritis			
No	343 (78)	119 (58)	1
Yes	98 (22)	85 (42)	1.80 (1.45–2.25)***
Diagnosis of asleep disorder			
No	330 (75)	111 (54)	1
Yes	110 (25)	93 (46)	1.82 (1.46–2.27)***
Common mental disorders (SRQ20)			
Less likelihood of mental disorder			
	294 (71)	100 (54)	1
Greater likelihood of mental disorder			
	117 (29)	85 (46)	1.66 (1.31–2.10)***
Went for annual medical check-up			
Yes	291 (66)	165 (81)	1
No	28 (6)	15 (7)	0.96 (0.63–1.48)
Not summoned	122 (28)	24 (12)	0.45 (0.31–0.67)***
Absenteeism due to medical licence or illness			
Absent	199 (45)	56 (28)	1
Present	241 (55)	145 (72)	1.71 (1.31–2.23)***

*** $P < 0.001$.

Horizonte, 29% of teachers seen as outpatients reported missing work because of voice problems [9]. During their careers, about one-third of elementary school

teachers leave teaching because of voice problems [27]. Voice fatigue and limitations on work performance are expected when the teacher, although ill, continues to

Table 5. Final model of factors associated with dysphonia in teachers

	PR (CI)
Sociodemographic	
Sex	
Male	1
Female	2.33 (1.41–3.85)***
Aspects related to work	
Perception of technical resources and equipment in workplace	
Satisfactory	
	1
Fair	
	1.21 (0.93–1.59)
Poor	
	1.56 (1.14–2.15)**
General health	
Diagnosis of gastritis	
No	1
Yes	1.59 (1.28–1.98)***
Went for annual medical check-up	
Yes	1
No	1.06 (0.70–1.61)
Not summoned	0.47 (0.32–0.68)***
Absenteeism due to illness or sick leave	
Absent	1
Present	1.39 (1.06–1.81)*

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

teach in the classroom [16]. Teachers with voice disorders have a poorer perception of their health status and more difficulties at work [17]. When a teacher experiences symptoms and an inability to use their voice in various settings, they may elect to miss work because of limited ability to respond to the normal demands of the classroom or prevent the condition worsening [5].

The prevalence and evolution of dysphonia in teachers worldwide, even in countries considered developed, highlights the importance of public health action, especially given the absence of legal protection or recognition [26–29].

In conclusion, the high prevalence of dysphonia was not associated with any individual variables except for gender and comorbidity (diagnosis of gastritis). The impact of limited technical resources and equipment reinforces the importance of the working environment in teaching and suggests that policy change is an important factor in reducing dysphonia.

Key points

- The high prevalence of dysphonia in teachers was not associated with any individual variables, except for sex and comorbidity (diagnosis of gastritis).
- Limited technical resources and equipment were associated with dysphonia and suggests policy change is important in preventing dysphonia.

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Conflicts of interest

None declared.

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