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Alteração vocal auto-referida em professores: prevalência e fatores associados = Self-reported voice problems among teachers: prevalence and associated factors

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# Self-reported voice problems among teachers: prevalence and associated factors

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## ABSTRACT

**OBJECTIVE:** To estimate the prevalence of self-reported voice problems and to identify associated factors.

**METHODS:** A cross-sectional study was carried out in a sample of 393 public elementary and middle school teachers in Florianópolis, Southern Brazil, in 2009. A self-administered questionnaire was used. A multivariable Poisson regression model was performed to estimate prevalence ratios and their related 95% confidence intervals.

**RESULTS:** The prevalence of voice problems was 47.6% (95%CI 42.6;52.5). In the final adjusted analysis the following variables remained associated with a higher prevalence of voice problems: being female and the presence of rhinitis/sinusitis and pharyngitis.

**CONCLUSIONS:** A high prevalence of self-reported voice problems was found among the teachers studied.

**DESCRIPTORS:** Voice Disorders, epidemiology. Faculty. Occupational Health. Cross-Sectional Studies.

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## INTRODUCTION

Voice problems are common disorders among teachers who are professional voice users where the voice is a key instrument in their work.<sup>9</sup>

Dysphonia is any change in voice due to a functional and/or organic disorder of the vocal tract that prevents natural production of voice. It can manifest as several symptoms such as tiredness or strain while talking, hoarseness, persistent throat clearing or cough, sensation of chest tightness or heaviness in the throat, voice failures, among others.<sup>2,9</sup> A 2006 study found an association between voice disorders and professional voice use.<sup>8</sup> A review of Brazilian and international studies on vocal disorders among teachers showed a prevalence ranging between 20% and 89%.<sup>12</sup>

High vocal demand, sociodemographic factors and risks directly related to work organization and environment are all related to the occurrence of dysphonia. While working teachers are exposed to other harmful factors in the workplace that can affect their general and vocal health by creating competing sounds and leading to greater vocal strain and demand. Environments with internal and external background noise, classrooms with inadequate acoustics, excessive number of students in a classroom, exposure to dirt and chalk in the classroom

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<sup>8</sup> Medeiros AM. Disfonia e condições de trabalho das professoras da rede municipal de ensino de Belo Horizonte [Mater's dissertation]. Belo Horizonte: Universidade federal de Minas Gerais; 2006.

are some of the harmful agents that can negatively affect teachers' vocal health.<sup>3</sup> Age-related changes, gender-related differences in human vocal anatomy, allergies, upper respiratory infections, drug use, smoking and dehydration of vocal fold surface have also been associated with voice disorders.<sup>9-11</sup>

The multifactorial nature of causes of dysphonia, its high prevalence and limited knowledge about vocal output have encouraged speech and language therapists (SLTs) to develop collective works with teachers. A sound knowledge of the professional use of voice as well as of the work environment and job characteristics can help planning specific prevention actions targeted to this professional group<sup>2,3</sup> such as Workplace Health and Wellness Program at local public schools in the city of Florianópolis, Southern Brazil.

This study aimed to estimate the prevalence of self-reported voice problems and to identify associated factors among teachers.

## METHODS

A cross-sectional study including teachers actively working in 36 public elementary and middle schools (grades 1 to 9) was conducted in the city of Florianópolis.

Florianópolis had an estimated population of 416,269 inhabitants in 2007 and a literacy rate of 96.7%. There were 107 public schools, of which 36 elementary and middle schools and 71 preschools with 3,945 teachers, 31.8% of them permanent and 68.2% replacement/contracted. Elementary/middle school teachers accounted for a third of all teachers working in public schools, of which 56% were permanent, 38% replacement and 6% relocated.<sup>b</sup>

All teachers actively working in 2009 were eligible to participate in the study, regardless of the type of their employment contract, totaling 1,044.

Physical education, sign language, support rooms, and foreign language teachers and those performing administrative activities were excluded from the study because the characteristics of their work organization, physical workplace and vocal demand were different from those of the target population.

For sample size estimation, a universe of 1,044 teachers was used based on the lowest self-reported prevalence of voice problems in the literature<sup>7</sup> (17%), with a sampling error of three percentage points, 95% confidence level ( $\alpha = 5\%$ ) and 10% added to compensate for losses and non-responses, totaling 420 teachers. For operational reasons, a new sample size was then estimated considering a sampling error of four percentage

points, which meant reducing the precision of the prevalence estimate.

Systematic sampling was carried out. The sample fraction was calculated using the following formula:  $k = N/n = 1,044/420 = 2.48 \sim 3$ . The sample was drawn from a single list of eligible teachers in alphabetical order and every third name was selected.

Data was collected using a self-administered questionnaire, which was pre-tested in a sample of 20 teachers from a state public school with similar characteristics as those defined in the present study. Questionnaires from other similar studies were the basis for the development of the study instrument used.<sup>3,6</sup> The questionnaire comprised questions on demographic and socio-economic characteristics (gender, age, marital status, education level, family income in the month prior to the study, number of persons living in the respondent's household); information on the teacher's work organization at school (type of employment, years working as a teacher, number of classes, number of students per class, total hours worked per week); information about their work environment (noise levels, room acoustics, dirt and chalk dust, moisture, resting area, rest break, relationship with colleagues, performance monitoring, teacher-student relationship, school violence); information on health behaviors and self-reported morbidities (hydration level, hypertension, diabetes, rhinitis/sinusitis, asthma, hearing loss, depression, pharyngitis, ulcers, gastritis, physical activity, alcohol use, smoking) and self-reported voice problems.

Data was collected from May to July 2009 and data collection was repeated in August to minimize losses.

The school management authorized the researchers to conduct the study prior to data collection. The questionnaires were delivered to school coordinators who handed them out and returned them 15 days later.

The study was conducted in schools where teachers worked and anonymity of institutions and respondents was assured. The questionnaires were coded and placed into sealed envelopes with instructions for questionnaire completion and a consent form enclosed.

The dependent variable was self-reported voice problem (yes/no) "in the last four weeks" obtained by asking the following question: "Do you have any voice problem?"

Data were analyzed using Stata version 9.0.

First, it was carried out the descriptive analysis of all variables using frequency distributions for categorical variables and measures of central tendency and dispersion for continuous variables, later converted into

<sup>b</sup> Municipal Administration of Florianópolis. Perfil de Florianópolis. Florianópolis. [cited 2009 Nov 05]. Available from: [http://portal.pmf.sc.gov.br/arquivos/arquivos/pdf/05\\_11\\_2009\\_13.00.43.d53d27cbe464ff1805a76d8b9631cf6c.pdf/](http://portal.pmf.sc.gov.br/arquivos/arquivos/pdf/05_11_2009_13.00.43.d53d27cbe464ff1805a76d8b9631cf6c.pdf/)

categorical variables for analysis. All categories with few responses were combined (classroom noise levels – “negligible” + “acceptable;” outside school noise levels – “unacceptable” + “high;” and moisture in the classroom – “always” + “often;” good relationship with colleagues – “no” + “sometimes;” water intake during the day – “none” + “less than 1 L;” and alcohol use – “daily” + “weekends”). The outcome prevalence was estimated based on the independent variables by testing differences between proportions using Pearson’s chi-square test and the chi-square for linear trend if applicable.

For the analysis of factors associated with self-reported voice problems, Poisson regression with robust variance was performed and the reference category was no voice problems. The magnitude of the association of each factor with voice problems was assessed by crude and adjusted prevalence ratios (PR) and their related 95% confidence intervals (95% CI) and p-value (Wald test). The analyses followed a theoretical hierarchical model where the variables were arranged in four blocks. The first block, more distal, included demographic and socioeconomic variables, which conditioned the variables in block 2, work organization, and block 3, environmental (physical and psychosocial) factors, which in turn had an effect on the variables in block 4 (health-related behaviors and self-reported morbidities) and the study outcome. Variables with  $p < 0.20$  in the bivariate analysis were selected to be included in the multiple analysis, and those with  $p \leq 0.05$  in the hierarchical blocks remained in the final model.

The study was approved by the Human Research Ethics Committee of the Pro-Reitoria de Pesquisa e Extensão da Universidade Federal de Santa Catarina (protocol no. 237/2008). All participants signed a free consent form.

## RESULTS

Of 420 teachers randomly selected, 393 (93.6%) completed the questionnaire. Of the 27 (6.4%) teachers who did not participate in the study, four were on sick leave, five were on maternity leave, three were on leave due to voice problems and 15 refused to participate.

The prevalence of self-reported voice problems was 47.6% (95%CI 42.6;52.5). Table 1 shows that most of the study sample were female (86.8%), 57.1% were married, and over half had specialization. The mean age was 40.2 years (SD 7.8) and average *per capita* income was 1765.08 reais (SD 1,038.43). The prevalence of self-reported voice problems was higher among women ( $p = 0.021$ ) and those in the first tertile of *per capita* income ( $p = 0.013$ ).

Regarding the characteristics of work organization (Table 2), 63.4% of the respondents worked 21 to 40 hours weekly, 64.9% were permanent teachers, and 53.9% had 28 or fewer students per class. No variable in

this group was statistically associated with self-reported voice problems.

Table 3 shows that more than half of the respondents rated the noise level in the classroom and in the school area as high or unacceptable. Over 60% reported frequent or continuous exposure to dirt and chalk dust in the classroom. The following variables were associated with the study outcome: unacceptable noise levels in the classroom ( $p = 0.019$ ), unacceptable noise levels in the school area ( $p = 0.004$ ), constant exposure to dust in the classroom ( $p = 0.007$ ), no break between classes ( $p = 0.002$ ), constant monitoring of their performance ( $p = 0.036$ ), strained teacher-student relationship ( $p < 0.001$ ) and school violence ( $p = 0.003$ ).

As for health-related behaviors and self-reported morbidities (Table 4), 80.0% of the teachers reported drinking water during classes, but 62.0% reported drinking less than one liter of water a day. The most frequently reported comorbidities were rhinitis/sinusitis (47.0%) and depression (27.6%). The presence of morbidities such as rhinitis/sinusitis ( $p < 0.001$ ),

**Table 1.** Prevalence of voice problems according to individual characteristics among teachers of local public schools. Florianópolis, Southern Brazil, 2009.

Variable	Study population		Voice problems	p
	n	%	%	
Total (n = 393)	393	100.0	47.6	
Sex (n = 393)				
Male	52	13.2	32.7	0.021 <sup>a</sup>
Female	341	86.8	49.9	
Age (years, n = 393)				
23 to 37	134	34.1	45.5	0.074 <sup>b</sup>
38 to 43	119	30.3	49.6	
44 to 62	140	35.6	47.9	
Marital status (n = 392)				
Married	226	57.2	55.7	0.819 <sup>a</sup>
Single	119	30.1	29.4	
Divorced	44	11.0	11.7	
Widowed	3	0.7	0.5	
Education level (n = 393)				
Graduate degree	74	18.8	33.8	0.080 <sup>a</sup>
Specialization	256	65.1	51.6	
College degree	63	16.0	47.6	
<i>Per capita</i> income (reais, n = 257)				
> 2,000.00	71	27.6	36.6	0.013 <sup>b</sup>
1,200.00 – 2,000.00	99	38.5	45.5	
200.00 – 1,200.00	87	33.9	56.3	

<sup>a</sup> Pearson’s chi-square test

<sup>b</sup> Chi-square for linear trend

**Table 2.** Prevalence of voice problems according to job characteristics among teachers of local public schools. Florianópolis, Southern Brazil, 2009.

Variable	Study population		Voice problems	p
	n	%	%	
Total (n = 393)	393	100.0	47.6	
Type of employment (n = 393)				
Permanent	255	64.9	44.3	0.078 <sup>a</sup>
Temporary	138	35.1	53.6	
Years of working as a teacher (n = 393)				
≤ 10	146	37.2	45.2	0.497 <sup>b</sup>
11 to 18	115	29.3	48.7	
19 to 32	132	33.6	49.2	
Number of classes (n = 393)				
6 or more	139	35.4	43.9	0.406 <sup>b</sup>
3 to 5	82	20.9	51.2	
Up to 2	172	43.8	48.8	
Number of students per class (n = 393)				
≤ 28	212	53.9	44.8	0.234 <sup>a</sup>
29 to 60	181	46.1	50.8	
Weekly work hours (hours, n = 393)				
≤ 20	61	15.5	45.9	0.798 <sup>a</sup>
21 to 40	249	63.4	47.8	
> 40	83	21.1	48.2	

<sup>a</sup> Pearson's chi-square test

<sup>b</sup> Chi-square for linear trend

depression ( $p = 0.001$ ) and pharyngitis ( $p < 0.001$ ) and physical inactivity ( $p = 0.043$ ) were associated with higher prevalence of self-reported voice problems.

In the final adjusted model (Table 5) being female (PR 2.0 [95%CI 1.1;3.6]), reporting rhinitis/sinusitis (PR 1.4 [95%CI 1.1;1.8]) and pharyngitis (PR 1.7 [1.2;2.4]) remained associated with higher prevalence of self-reported voice problems.

## DISCUSSION

The prevalence of self-reported voice problems was 47.6%, very close to that found in similar studies carried out in cities of the state of Rio Grande do Sul,<sup>c</sup> Bahia, Northeastern Brazil,<sup>d</sup> and Pará, Northern Brazil,<sup>8</sup> and much higher than 17%<sup>7</sup> used in the estimate of the study sample, though it should be noted that different definitions of voice problems and methods were used.<sup>3,6,16</sup> Despite these difficulties in comparing results, the high prevalence of vocal problems in teachers is a consensus in Brazil and in other countries.<sup>2,9,10</sup>

Female teachers more often reported more voice problems than their male colleagues,<sup>10,14</sup> which is partly explained by gender-related differences of the larynx. For example, hyaluronic acid, a protein that increases water flow to the lamina propria of vocal folds leading to fewer traumas during emission, is more abundant in males. The glottic proportion in the female larynx is smaller, which may hinder phonic adaptations for heavy voice use.<sup>1</sup> Social and cultural factors, expressed by specific characteristics and the potentially demanding female social role may also contribute to voice problems among women.<sup>15</sup> In addition, it should be noted the small number of men included in the study sample.

There was found a significant association between self-reported voice problems and rhinitis/sinusitis and pharyngitis. Other studies also showed a positive association between dysphonia and respiratory problems such as allergic rhinitis<sup>13</sup> and pharyngitis.<sup>4</sup> Exposure to dirt and chalk dust in the classroom increases the likelihood of developing upper airway conditions. These respiratory problems are associated with environmental conditions and affected by individual predisposing factors.<sup>4</sup>

The present study did not find an association between self-reported vocal problems and work organization (years working as a teacher and workload), which is consistent with other studies.<sup>2,4</sup> This finding may be explained by the healthy worker effect, since the development of severe vocal problems may lead to a career change, or even early retirement.<sup>4,16</sup> It may also be that during the course of their careers, teachers tend to develop compensatory strategies or techniques to minimize the difficulty in voice production, which may have an effect on their perception of voice quality.<sup>13,16</sup> Besides, this finding may have resulted from an homogeneous distribution of the population according to the variables workload and years working as a teacher.

The prevalence of self-reported voice problems was associated with low per capita income in the crude analysis. Income is a determinant of the health-disease process, and those with lower income tend to get sick more often, are more susceptible to diseases and are more exposed to several risk factors.<sup>5</sup>

In the crude analysis, the prevalence of self-reported voice problems was significantly higher among teachers who reported exposure to dirt and chalk dust and unacceptable noise levels in the classroom and in the school area. These environmental conditions of dust and noise negatively interfere with learning activities, and similar data were reported to have a significant association in other studies.<sup>3,9</sup>

<sup>c</sup> Peter V. Relação entre disfonia referida e potenciais fatores de risco no trabalho em professores do ensino fundamental de Porto Alegre- RS [Master's dissertation]. Porto Alegre: Universidade Federal do Rio Grande do Sul; 2004.

<sup>d</sup> Thomé CR. A voz do professor: relação entre distúrbio vocal e fatores psicossociais do trabalho [Master's dissertation]. São Paulo: Pontifícia Universidade Católica de São Paulo; 2007.

**Table 3.** Prevalence of voice problems according to work environment characteristics among teachers of local public schools. Florianópolis, Southern Brazil, 2009.

Variable	Study population		Voice problems	p
	n	%	%	
Total (n = 393)	393	100.0	47.6	
Noise level in the classroom (n = 393)				
Acceptable	109	28.0	69.6	0.019 <sup>b</sup>
High	254	64.5	45.7	
Unacceptable	34	8.5	73.5	
Internal noise in the school (n = 393)				
Negligible	23	6.0	39.1	0.004 <sup>b</sup>
Acceptable	154	39.1	44.2	
High	175	44.5	44.6	
Unacceptable	41	10.4	78.0	
External noise in the school (n = 392)				
Negligible	57	14.5	52.6	0.479 <sup>b</sup>
Acceptable	237	60.5	44.3	
High	110	28	52.7	
Room acoustics (n = 374)				
Poor	182	48.7	50.0	0.415 <sup>b</sup>
Fairly adequate	145	38.8	43.4	
Adequate	47	12.5	46.8	
Dirt in the classroom (n = 387)				
Never	25	6.5	40.0	0.007 <sup>b</sup>
Sometimes	123	32.0	43.9	
Often	176	45.5	44.3	
Always	63	16.0	68.3	
Chalk dust in the classroom (n = 391)				
Never	67	17.1	44.8	0.169 <sup>b</sup>
Sometimes	47	12.1	48.9	
Often	163	41.6	42.3	
Always	114	29.2	57.0	
Moisture in the classroom (n = 377)				
Never	108	28.6	52.8	0.570 <sup>b</sup>
Sometimes	181	48.0	42.0	
Often	88	23.4	54.6	
Resting area (n = 393)				
No	96	24.4	52.1	0.310 <sup>a</sup>
Yes	297	75.6	46.1	
Rest breaks between classes (n = 392)				
Often	62	16.0	38.7	0.002 <sup>b</sup>
Sometimes	182	46.0	42.3	
No	148	38.0	58.1	
Good relationship with colleagues (n = 390)				
Sometimes	19	4.8	50.0	0.623 <sup>b</sup>
Often	132	34.0	47.7	
Always	239	61.2	46.9	

To be continued

Table 3 continuation

Variável	Study population		Voice problems	p
	n	%	%	
Performance monitoring (n = 372)				
Never	42	11.3	33.3	0.036 <sup>b</sup>
Sometimes	175	47.0	45.1	
Often	114	30.6	49.1	
Always	41	11.1	56.1	
Strained teacher-student (n = 390)				
Never	17	4.4	29.4	< 0.001 <sup>b</sup>
Sometimes	174	44.6	42.0	
Often	130	33.0	47.7	
Always	69	18.0	68.1	
School violence (n = 390)				
Never	217	55.6	41.9	0.003 <sup>b</sup>
One episode	67	17.0	49.3	
Fairly regular episodes	89	23.0	58.4	
Frequent episodes	17	4.4	64.7	

<sup>a</sup> Pearson's chi-square test<sup>b</sup> Chi-square for linear trend

Teachers strain their voice in noisy environments for long periods and do not have enough time to rest or recover it and are often exposed to stressful situations.<sup>9</sup> Although the association lost significance in the adjusted model, there were few reports of rest breaks between classes, and bearing in mind the school day-to-day and total workload of teachers, it can be assumed that teachers work two to three shifts daily with vocal overload.<sup>3</sup>

A study found an increased prevalence of vocal symptoms between 1998 and 2001, and concluded that the deterioration of working conditions during the 1990s with increasing inappropriate behaviors and noise levels in the classroom can be all be stressors among teachers.<sup>11</sup> In the present study, even though on borderline statistical significance, persistent strained teacher-student relationship was associated with the outcome. Recent studies have showed an association between strained relationship with students and lower voice-related quality of life and reported voice symptoms.<sup>6,7</sup>

A study has reported a positive association with water intake for maintaining and improving vocal quality,<sup>17</sup> however our study did not corroborate this finding. Given the cross-sectional design of this study a cause and effect relationship cannot be established. It is believed that people with voice problems drink more water to alleviate their voice symptoms. However,

**Table 4.** Prevalence of voice problems according to health-related behaviors and self-reported morbidities among teachers of local public schools. Florianópolis, Southern Brazil, 2009.

Variable	Study population		Voice problems %	p
	n	%		
Total (n = 393)	393	100.0	47.6	
Water intake during classes (n = 389)				
Yes	311	80.0	50.5	0.057 <sup>a</sup>
No	78	20.0	38.5	
Amount of water intake during the day (liters, n = 393)				
<1	248	63.0	47.7	0.896 <sup>b</sup>
1 to 2	130	33.0	48.5	
> 2	15	4.0	40.0	
Hypertension (n = 393)				
No	351	89.3	47.6	0.996 <sup>a</sup>
Yes	42	10.7	47.6	
Diabetes (n = 393)				
No	379	96.4	47.0	0.203 <sup>a</sup>
Yes	14	3.6	64.3	
Rhinitis/sinusitis (n = 393)				
No	208	53.0	38.5	< 0.001 <sup>a</sup>
Yes	185	47.0	57.8	
Asthma (n = 393)				
No	340	86.5	45.9	0.087 <sup>a</sup>
Yes	53	13.5	58.5	
Hearing loss (n = 393)				
No	345	87.8	46.1	0.087 <sup>a</sup>
Yes	48	12.2	58.3	
Depression (n = 392)				
No	284	72.4	42.3	0.001 <sup>a</sup>
Yes	108	27.6	61.1	
Pharyngitis (n = 393)				
No	360	91.6	44.7	< 0.001 <sup>a</sup>
Yes	33	8.4	78.8	
Ulcers (n = 393)				
No	375	95.4	46.9	0.239 <sup>a</sup>
Yes	18	4.6	61.1	
Gastritis (n = 393)				
No	289	73.5	46.4	0.421 <sup>a</sup>
Yes	104	26.5	51.0	
Weekly physical activity (n = 391)				
≥ 3 times	72	18.4	41.7	0.043 <sup>b</sup>
1 to 2 times	194	49.6	44.3	
Inactive	125	32.0	55.2	

To be continued

Table 4 continuation

Variable	Study population		Voice problems %	p
	n	%		
Alcohol use (n = 393)				
Never	156	40.0	48.7	0.764 <sup>a</sup>
Sometimes	162	41.0	45.1	
Often	75	19	52.6	
Smoking (n = 393)				
No	355	90.3	47.3	0.754 <sup>a</sup>
Yes	38	9.7	50.0	

<sup>a</sup> Pearson's chi-square test<sup>b</sup> Chi-square for linear trend

the reverse causality bias cannot be ruled out when examining the associations between the outcome and the variables presence of rhinitis/sinusitis, presence of pharyngitis, frequent exposure to chalk dust in the classroom and strained teacher-student relationship.

The Municipal School Department of Florianópolis, together with the Workplace Health and Wellness Program, launched the Campaign for Vocal Health Promotion in 2008, which may have influenced the results of this study.

The study sample size was adequate to estimate the prevalence of voice problems, and it was randomly drawn with high response rate, which indicates internal validity. Losses and refusals occurred randomly at a low rate minimizing selection bias.

A major limitation of this study related to the exclusion of teachers on medical leave, which probably underestimated the actual prevalence of the outcome studied. Also, studies based on self-administered questionnaires are prone to the existence of self-report bias.

We used the time frame “in the last four weeks” for self-report of voice problems that allows adequate recall by the teachers and can improve the quality of information provided.

The study results showed that voice problems in teachers can be associated with gender-related factors and self-reported morbidities and, on borderline statistical significance, with psychosocial and work environment aspects as well. These findings reinforce the need for actions for promoting voice health among teachers so that there is a good interaction between the teachers, their working conditions and their general and voice health.

These actions should involve structural changes in the workplace as well as increased awareness about voice care among teachers through workshops to develop

**Table 5.** Prevalence ratios and confidence intervals for the association between voice problems and associated variables among teachers of local public schools. Florianópolis, Southern Brazil, 2009.

Variable	Crude analysis			Adjusted analysis		
	PR	95%CI	p	PR	95%CI	p
<b>Block 1</b>						
Sex			0.041			0.008 <sup>a</sup>
Male	1.0	-		1.0	-	
Female	1.5	1.0;2.3		2.0	1.1;3.6	
<i>Per capita</i> income (reais)			0.014			0.080 <sup>a</sup>
> 2,000.00	1.0	-		1.0	-	
1,200.00 – 2,000.00	1.2	0.9;1.8		1.1	0.7;1.6	
200.00 – 1,200.00	1.5	1.1;2.2		1.3	0.9;1.9	
<b>Block 3</b>						
Chalk dust in the classroom			0.180			0.073 <sup>c</sup>
Never	1.0	-		1.0	-	
Sometimes	1.1	0.7;1.6		1.5	0.9;2.6	
Often	0.9	0.7;1.3		1.4	0.9;2.2	
Always	1.3	1.0;1.7		1.5	1.0;2.4	
Strained teacher-student relationship			< 0.001			0.052 <sup>c</sup>
Never	1.0	-		1.0	-	
Sometimes	1.4	0.7;3.0		1.6	0.7;3.5	
Often	1.6	0.7;3.4		1.8	0.8;4.0	
Always	2.3	1.0;5.0		2.0	0.8;5.0	
<b>Block 4</b>						
Water intake during classes			0.077			0.052 <sup>d</sup>
Yes	1.0	-		1.0	-	
No	0.7	0.5;1.0		0.7	0.4;1.0	
Rhinitis/sinusitis			< 0.001			0.007 <sup>d</sup>
No	1.0	-		1.0	-	
Yes	1.5	1.21;1.8		1.4	1.1;1.8	
Pharyngitis			< 0.001			0.005 <sup>d</sup>
No	1.0	-		1.0	-	
Yes	1.7	1.4;2.1		1.7	1.2;2.4	

<sup>a</sup> Adjusted for variables  $p < 0.20$  in Block 1.

<sup>b</sup> Adjusted for variables  $p < 0.20$  in Block 2 and variables  $p < 0.20$  in Block 1.

<sup>c</sup> Adjusted for variables  $p < 0.20$  in Block 3, variables  $p < 0.20$  in Block 2 and variables  $p < 0.20$  in Block 1.

<sup>d</sup> Adjusted for variables  $p < 0.20$  in Block 4, variables  $p < 0.20$  in Block 3, variables  $p < 0.20$  in Block 2 and variables  $p < 0.20$  in Block 1.

knowledge and perception regarding voice production and health promotion.

Further studies are needed to better understand factors

related to voice health so that prevention actions can be developed targeting psychosocial and environment aspects and effective interventions can be implemented in the workplace.

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The authors declare that there are no conflicts of interest.