

# Association between limitation at work because of the voice, working conditions and social vulnerability of metropolitan schools in Brazil

## Associação entre limitação no trabalho por causa da voz, condições de trabalho e vulnerabilidade social de escolas metropolitanas no Brasil

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### ABSTRACT

**Purpose:** To verify the prevalence of limitations at work due to the voice of Brazilian basic education teachers in metropolitan schools and the association with working hours, self-reported noise and Social Vulnerability Index (SVI) in schools. **Methods:** Cross-sectional observational study with a probabilistic sample of Brazilian teachers. A total of 4979 teachers from metropolitan schools participated and the following variables were analyzed: age, gender, level of education, workday for 40 hours/week or more, perception of intense noise with the need to raise the voice and SVI of the municipality. Descriptive analysis and multivariate Poisson regression model with robust variance were performed and a significance level of 5%. **Results:** The Brazilian prevalence of limitation at work due to voice was 20.37%. It was found that there was a statistically significant difference between limitation at work due to voice and being female, elementary school level or combined levels, 40 or more working hours, perception of raising one's voice in the presence of intense noise at work and medium and high/very high SVI. **Conclusion:** Of every 100 teachers, approximately 20 reported limitations at work due to voice in Brazil, and considering the federative units, higher prevalences were observed in the North and Northeast regions. Being female, working 40 hours or more per week, teaching elementary school or at combined levels, perceiving raising one's voice due to intense noise, and working in schools located in regions with medium, high/very high SVI increased the prevalence of perception of limitation at work due to vocal problems.

**Keywords:** Voice Disorders; Work conditions; Social vulnerability; School teachers; Occupational health

### RESUMO

**Objetivo:** Verificar a prevalência de limitação no trabalho por causa da voz de professores brasileiros da educação básica das escolas metropolitanas e a associação com a jornada de trabalho, ruído autorreferido e Índice de Vulnerabilidade Social das escolas. **Métodos:** Estudo observacional transversal com amostra probabilística de professores brasileiros. Participaram 4979 professores de escolas metropolitanas e foram analisadas as seguintes variáveis: idade, gênero, nível de ensino, jornada de trabalho por 40 horas semanais ou mais, percepção do ruído intenso com necessidade de elevar a voz e Índice de Vulnerabilidade Social do município. Foi realizada análise descritiva e modelo multivariado de regressão de Poisson, com variância robusta e nível de significância de 5%. **Resultados:** A prevalência brasileira de limitação no trabalho por causa da voz foi de 20,37%. Verificou-se diferença estatisticamente significativa entre limitação no trabalho por causa da voz e ser do gênero feminino, nível de ensino fundamental ou níveis combinados, jornada de trabalho de 40 horas ou mais, percepção de elevar a voz na presença de ruído intenso no trabalho e Índice de Vulnerabilidade Social médio e alto/muito alto. **Conclusão:** A cada 100 professores, aproximadamente 20 relataram limitação no trabalho por causa da voz no Brasil e, considerando as unidades federativas, observou-se maior prevalência nas Regiões Norte e Nordeste. Ser do gênero feminino, trabalhar 40 horas semanais ou mais, lecionar para o ensino fundamental ou em níveis combinados, perceber necessidade de elevar a voz devido ao ruído intenso e trabalhar em escolas localizadas em regiões com Índice de Vulnerabilidade Social médio, alto/muito alto foram aspectos que evidenciaram o aumento da prevalência de percepção de limitação no trabalho devido a problemas vocais.

**Palavras-chave:** Distúrbios da voz; Condições de trabalho; Vulnerabilidade social; Professores escolares; Saúde ocupacional

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## INTRODUCTION

Occupational voice disorders are defined as vocal deviations with or without laryngeal changes related to professional occupation, which may compromise, limit, or prevent the worker's performance and communication<sup>(1)</sup>. An epidemiological study with a representative sample of Brazilian teachers highlights voice disorder as the main health problem that keeps teachers away from the classroom<sup>(2)</sup>, being a limiting factor in their occupational activity<sup>(3)</sup>.

An integrative review indicated a mean 44.2% prevalence of vocal disorders in teachers associated with working conditions<sup>(4)</sup>, elucidating the relationship between work and voice problems. Unfavorable environmental working conditions (such as noise and inappropriate acoustics) and organizational factors of the work process (such as intense work hours, teaching more than one level of education, and teaching classes with too many students) can directly impact teachers' vocal health<sup>(5)</sup>.

The voice is considered the teacher's main working tool. It is important for establishing the teacher-student bond and consolidating the teaching-learning process<sup>(6)</sup>. Research associates teachers' vocal disorders with student learning at school<sup>(7,8)</sup>. Thus, teachers' vocal disorders interfere with their professional and classroom performance. They also impact and harm students' performance and learning, as it requires greater cognitive effort to process the information transmitted by a dysphonic voice<sup>(7)</sup>. Hence, the presence of noise and the teacher's impaired voice quality influence speech perception and auditory comprehension, especially in school-age students<sup>(8)</sup>.

Social vulnerability is another important aspect, which can impact health events<sup>(9)</sup>. Three main components (urban infrastructure, human capital, and income) must be considered to understand this variable better. A Finnish study with teachers who worked in schools in socioeconomically disadvantaged regions found that they were more absent from work due to illness<sup>(10)</sup>. The continental dimensions of Brazil pose clear disparities between its federative units; therefore, it is necessary to understand the extent to which teachers from schools in different regions of the country have suffered from limitations in their work due to vocal problems.

This study hypothesized that teachers' work limitations due to vocal problems are greater in schools in municipalities with higher Social Vulnerability Indexes (SVI) and worse working conditions. Therefore, it aimed to verify the prevalence of voice-related work limitations among Brazilian basic education teachers in metropolitan schools and its association with working hours, self-reported noise, and SVI in schools.

## METHODS

This cross-sectional observational study was based on information from the National Survey on Working Conditions and Absences of Teachers in Basic Education Schools in Brazil (Educatel, in Portuguese), stratifying the sample as follows: large regions, location, age group, sex, school administration type, employment relationship, and teaching level. The sample was defined by simple random selection. Data from the 2014 School Census (the most up-to-date database on the study population

available at the time of the Educatel sample draw) were used to calculate the sample size. The Educatel research population consisted of teachers registered in the 2014 School Census who taught at the same school in 2015, the year of data collection. An article that presents the Educatel methodological details, including steps for sample calculation, is recommended to understand the survey better<sup>(11)</sup>. Teachers who worked at schools with inoperative telephone numbers or who worked at schools in rural areas were ineligible. Thus, the total number of participants was 4,979 basic education teachers. The data of interest collected for this study were secondary (sex and age, obtained from the 2014 School Census) and primary (extracted from interviews via phone calls with a trained team). All study participants agreed to the informed consent form, which was presented over the phone. The project was approved by the institution's Research Ethics Committee, under evaluation report no. 1.305.863.

The response variable was the self-reported voice-related work limitations, obtained from the following question: "In the last four weeks, have you had problems at work or in your professional development because of your voice?". The answers could be: "often/sometimes/rarely/never" or "almost never". In the end, these answers were transformed into a dichotomous indicator, redefined, and grouped into "yes" (often/sometimes) and "no" (rarely/never or almost never).

The explanatory variables were working week of 40 or more hours (no/yes), perception of loud noise with the need to raise one's voice (often/sometimes, rarely/never), and the municipality's Social Vulnerability Index (SVI) in 2010 (very low/low, medium, high/very high). All municipalities that make up the country's federative units have their SVI<sup>(12)</sup> verified. Brazil is divided into 26 states and one Federal District, totaling 27 federative units. The SVI has 16 indicators, organized into three dimensions: Urban Infrastructure (access to basic sanitation and urban mobility); Human Capital of the households in the territory; Income and Work (access to work and employment relationship [formal or not] of residents in the households). Each of these dimensions gathers a set of variables obtained from the demographic census databases of the Brazilian Institute of Geography and Statistics (IBGE), which reflect different aspects of living conditions. The indicator presents its normalized value on a scale ranging from 0.000 to 1.000, in which 0.000 corresponds to the ideal or desirable situation, and 1.000 corresponds to the worst situation. These values are set in the following five vulnerability ranges: 0.000 to 0.199 represents the "very low" range; 0.200 to 0.299, "low"; 0.300 to 0.399, "medium"; 0.400 to 0.499, "high"; and 0.500 to 1.000, "very high"<sup>(12)</sup>. For analyses, the "very low" range was grouped with "low"; "high" was grouped with "very high", and "medium" remained as intermediate. Data analysis was performed using Stata 13.0 software, with the svy command for weighting factors (as this was a complex sample), followed by descriptive analysis and a multivariate Poisson regression model with robust variance (adjusted prevalence ratio). The significance level was set at 5% (p-value  $\leq$  0.05).

## RESULTS

Most study participants were women (80.99%), teachers with a weekly workload of 40 or more hours (55.34%), who

reported the frequent need to raise their voices due to loud noise (64.87%) and worked in schools in municipalities with very low/low SVI (59.09%). Most teachers were up to 34 years old (31.72%), working in elementary schools (20.19%) or more than one education level simultaneously (49.25%) (Table 1).

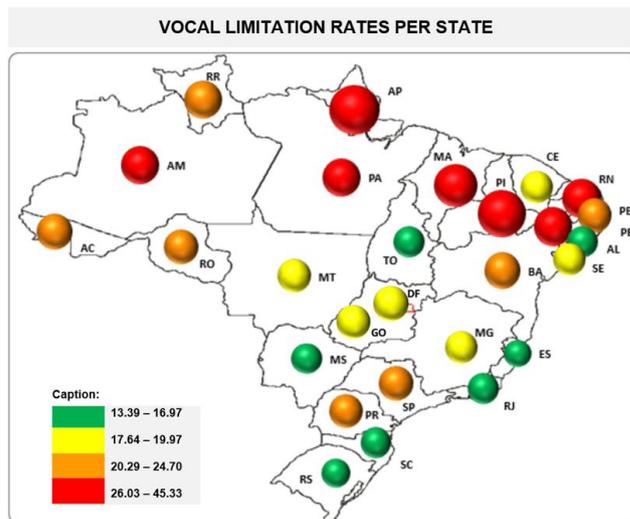
The national prevalence of voice-related work limitations was 20.37%, and the median (Q<sub>1</sub>-Q<sub>3</sub>) for the outcome was 20.29% (16.97-24.70). This rate in the federative units (26 states and the Federal District) ranged from 13.39% (Espírito Santo) to 45.33% (Amapá), with a higher prevalence in the North and Northeast regions (Figure 1).

There was a statistically significant difference between voice-related work limitations and females (PR = 1.23; 95% CI = 1.07-1.41), elementary school (PR = 1.43; 95% CI = 1.07-1.90), combined education levels (PR = 1.35; 95% CI = 1.03-1.77), working week of 40 or more hours (PR = 1.17; 95% CI = 1.02-1.34), perception of raising the voice due to intense noise at work (PR = 1.17; 95% CI = 2.52-3.69), and medium SVI (PR = 1.17; 95% CI = 1.02-1.35) and high/very high SVI (PR = 1.32; 95% CI = 1.11-1.59). Therefore, being a woman, working in an elementary school or at different levels of education, with a working week of 40 or more hours, with a frequent need to raise their voice due to intense noise, and working in schools with greater vulnerability were aspects that evidenced the increased prevalence of self-reported voice-related work limitations (Table 1).

## DISCUSSION

This nationwide study focused on basic education teachers in urban areas and analyzed the relationship between working conditions, school vulnerability, and voice-related work

limitations. A prevalence of 20.37% of teachers reported difficulties at work due to their voice. A review study pointed to difficulties teachers face due to excessive use of their voice in the workplace<sup>(4)</sup>. Teachers choose to teach in the classroom



**Figure 1.** Prevalence of voice-related work limitations per Federative Unit of Brazil

**Subtitle:** AC = Acre; AL = Alagoas; AP = Amapá; AM = Amazonas; BA = Bahia; CE = Ceará; DF = Distrito Federal; ES = Espírito Santo; GO = Goiás; MA = Maranhão; MT = Mato Grosso; MS = Mato Grosso do Sul; MG = Minas Gerais; PA = Pará; PB = Paraíba; PR = Paraná; PE = Pernambuco; PI = Piauí; RJ = Rio de Janeiro; RN = Rio Grande do Norte; RS = Rio Grande do Sul; RO = Rondônia; RR = Roraima; SC = Santa Catarina; SP = São Paulo; SE = Sergipe; TO = Tocantins

**Table 1.** Descriptive analysis and multivariate model of the relationship between Brazilian teachers' perception of voice-related work limitations, working conditions, and the vulnerability index of metropolitan schools

Variables	Description	Voice-related work limitations			
		Total (%)	No (%)	Yes (%)	PR (95% CI)
Age (in years)	Up to 34	31.72	32.13	30.10	1
	35 to 44	29.39	29.36	29.51	1.05 (0.89-1.24)
	45 to 54	27.72	26.89	30.93	1.16 (0.98-1.36)
	55 or more	11.18	11.62	9.46	0.98 (0.77-1.25)
Sex	Males	19.01	19.79	15.95	1
	Females	80.99	80.21	84.05	1.23 (1.07-1.41)*
Teaching level	Adult/vocational education	9.98	10.91	6.36	1
	Preschool	10.29	10.89	7.91	1.00 (0.71-1.42)
	Elementary/middle school	20.19	19.35	23.5	1.43 (1.07-1.90)*
	High school	10.29	10.58	9.17	1.20 (0.86-1.67)
	Others	49.25	48.27	53.06	1.35 (1.03-1.77)*
Working week of 40 or more hours	No	44.66	46.09	39.04	1
	Yes	55.34	53.91	60.96	1.17 (1.02-1.34)*
Perception of loud noise with the need to raise one's voice	Rarely/never	35.13	40.38	14.6	1
	Often/sometimes	64.87	59.62	8.54	3.05 (2.52-3.69)*
Social Vulnerability Index of the municipality (SVI)	Very low/Low	59.09	60.43	53.82	1
	Medium	28.32	27.6	31.14	1.17 (1.02 - 1.35)*
	High/Very high	12.59	11.97	15.05	1.32 (1.11 - 1.59)*

Poisson regression robust variance. \*p-value ≤ 0.05

**Subtitle:** % = percentage; PR = prevalence ratio; CI = confidence interval

with vocal limitations not to neglect their duties, which can worsen their voices and lead to leaves of absence<sup>(2)</sup>. Thus, teachers are often unable to achieve their best performance in the classroom due to their vocal problems, harming the students' learning process<sup>(6-8,13)</sup>. From the perspective of the biopsychosocial model, it was found that impaired functioning affects work activities and participation – including at work, in this case, the school.

The results showed that work limitations due to voice were 23% more frequent among women. In general, women tend to have a higher prevalence of vocal disorders than men<sup>(7)</sup>, which may be related to the predominance of women in teaching and their greater anatomical and physiological laryngeal susceptibility to changes. Cultural issues, such as gender inequality in teaching and the social marker of gender, influence the health-disease process, as women have more jobs that are less valued and pay less<sup>(14)</sup>. Women are the majority in basic education<sup>(15)</sup>, while men occupy more teaching positions in higher education<sup>(16)</sup>. Moreover, female teachers are subjected to work overloads that go beyond the school setting since the demands of teaching transpose the physical space of the school and are usually accompanied by the challenges of working at home – where women are also generally responsible for unpaid domestic work and family care<sup>(14)</sup>. In addition, females have a greater demand for health services than males, corresponding to approximately 80% of clinical referrals for voice-related disorders, which may be related to the greater number of diagnoses of laryngeal changes in women<sup>(17)</sup>. Confirmation of the clinical diagnosis and greater access to health services may contribute to greater recognition of voice-related problems at work.

Regarding the level of education at which they taught, the study showed that those who worked in elementary school had a prevalence of more than 43% of voice-related work limitations, contrasting with teachers who taught young adults and vocational courses. In addition, this limitation was likewise more prevalent among teachers who worked in more than one level of education. It can be inferred that teachers who work at more than one education level face longer working hours and greater noise exposure<sup>(18)</sup>, which can also increase their physical and mental exhaustion, leading to a greater chance of voice-related work limitations. Another study indicated that the prevalence of dysphonia was higher in teachers who worked in elementary schools due to greater exposure to loud noise, allergic infections, and the amount of time they used their voices<sup>(19)</sup>. However, the same study showed no difference in vocal self-assessment according to the teachers' education level, suggesting that these professionals often do not perceive their vocal changes well, considering them intrinsic to the profession. Nevertheless, regardless of the education level they teach, they are part of the same professional group and, therefore, are exposed to similar risks, requiring constant care to avoid the onset of vocal disorders<sup>(20)</sup>.

The working week with 40 or more hours was another relevant factor. This data indicated that very long working hours demand more from teachers and, consequently, their voices, with a 17% higher prevalence of voice-related work limitations than teachers with a lower weekly workload. The association between workload and voice use is in line with a previous study<sup>(13)</sup>, which indicated a relationship between the negative

impacts on the voice of teachers and a high average teaching workload per week.

The teachers in this study who reported having to raise their voices due to loud noise at school had more than three times the prevalence of voice-related work limitations. The higher the noise level, the greater the need for teachers to raise their voices to be heard and communicate, thus harming their health and causing vocal disorders. Moreover, noise at school can hinder class progress and interaction, damaging the teaching-learning context, and harming the interactional dynamics between teacher and students<sup>(6,8,21)</sup>. Thus, it affects both the teachers professionally and socially and the students in that context.

The medium and high/very high SVI of the municipality where the school is located had respectively higher prevalences of 17% and 32% of voice-related work limitation than the very low/low SVI. Therefore, teachers who worked in schools with worse socioeconomic conditions had a higher prevalence of voice-related work limitations than those who taught in schools with better conditions. Another study showed the association between teachers' absence from work due to voice and psychological problems and the location of Brazilian metropolitan schools in socioeconomically disadvantaged areas<sup>(5)</sup>.

Of all Brazilian schools surveyed (84.1% of which are metropolitan and 15.9% rural), the study showed a higher frequency of voice-related work limitations in the North and Northeast than in the Southeast region<sup>(3)</sup>. These regions also had a higher prevalence of absences from work due to voice problems<sup>(2)</sup>. Thus, the municipality's SVI is believed to be a good indicator of the quality of teachers' working conditions.

The five major regions of Brazil have different social vulnerability realities, which highlights the need for specific public policies for each of them. This study showed that the prevalence of voice-related work limitations with disability was higher in municipalities in the North and Northeast. Social vulnerability is a historical problem in these regions<sup>(22)</sup>, and this study reaffirms the regional disparities in the country, emphasizing the perception of problems at work or in doing one's duties due to voice. Furthermore, the SVI of the municipalities of the major Brazilian regions is heterogeneous, which needs to be considered. The indicators that make up the SVI refer to the socioeconomic aspects of the municipality and its residents. Social determinants, including income, education, housing, access to health services, and physical environment, play a fundamental role in determining the population's health. Unfavorable determinants, such as poor socioeconomic conditions, lack of access to quality health services, and inadequate environments, people face greater vulnerability and risk of illness<sup>(9)</sup>. Thus, it is suggested that teaching in schools in more vulnerable regions may further harm their conditions since teachers who work there are more likely to report voice-related work limitations.

Therefore, political, social, and cultural interventions must be implemented to improve socioeconomic conditions in the most disadvantaged regions, promote greater access to health services, and create healthy school environments. School actions must be proposed and adapted to the reality of each school and must consider the factors that generate noise and greater vocal demands for teachers.

In this sense, it is worth highlighting the importance of this study, as it covered areas of Brazil with greater vulnerability. It also analyzed these data to identify priority areas with

precarious conditions and risk of voice-related work limitations, aiming at intervention, resource allocation, and specific public policies. However, the SVI is not collected in rural schools, which is a limiting factor of this study, as it could not compare the results between metropolitan and rural schools. Thus, further investigation is needed in rural schools to identify and detail their reality. Another aspect to be pointed out is that the data were collected before the COVID-19 pandemic. Hence, it did not analyze changes in teaching that may have occurred during this period – although it is inferred that such findings may differ from those in this study. Nonetheless, the results described here elucidated regional discrepancies in the country regarding the perception of voice-related work limitations and the high prevalence of precarious working conditions, impacting the teachers' functioning even before the disturbing pandemic scenario.

## CONCLUSION

The prevalence of teachers with voice-related work limitations in Brazil was 20.37%, and in the states, it ranged from 13.39% (Espírito Santo) to 45.33% (Amapá), with a higher prevalence in the North and Northeast regions. Being female, working 40 or more hours per week, teaching elementary school or combined levels, raising the voice due to loud noise, and working in schools in regions with medium, high, or very high SVI evidenced the increased prevalence of perceived voice-related work limitations. These findings suggest the need to develop public policies aimed at improving teachers' living and working conditions, considering the regional disparities in the social vulnerability of Brazilian schools.

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