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Occupational voice disorder in basic education teachers: A scoping review

Distúrbio de voz relacionado ao trabalho em professores da educação básica: revisão de escopo

Transtorno de la voz relacionado con el trabajo en docentes de educación básica: revisión del alcance

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Abstract

Introduction: Occupational voice disorders are any form of vocal deviation related to professional activity that interferes with the worker's performance. **Objective:** To map the occurrence of dysphonia in basic education teachers and its association with work characteristics. **Methods:** The scoping review searched the PubMed/MEDLINE, LILACS, Scopus, Web of Science, and Embase databases and the gray literature, aiming to answer the research question, "What vocal characteristics and factors associated with voice disorders do basic education teachers have?". The search was updated in July 2024, using descriptors and free terms related to teachers, work issues, and voice. Two judges selected articles independently, reading titles and abstracts in phase 1 and the full papers in phase 2. **Results:** The review included 20

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studies, which indicated that dysphonia occurred in 7% to 97% of teachers; 15.6% of them were absent from work due to voice problems, reporting symptoms of hoarseness, speech with effort, and strain. The teachers' main risk factors were work environment, noisy classrooms, dust, chalk, stress, vocal effort, strain, excessive workload, and many students in the classroom. They were also associated with being female and stress (mental disorders). **Conclusion:** The literature records a significant occurrence of dysphonia in basic education teachers in various countries; the main risk factors are their work environment and occupational activities.

Keywords: School Teachers; Voice; Dysphonia; Speech, Language and Hearing Sciences.

Resumo

Introdução: o Distúrbio de Voz Relacionado ao Trabalho **é** definido como qualquer forma de desvio vocal relacionado à atividade profissional que interfira na atuação do trabalhador. **Objetivo**: mapear a ocorrência das disfonias no professor da educação básica e sua associação com as características laborais. **Métodos**: a revisão de escopo foi realizada nas bases *PubMed/MedLine, Lilacs, Scopus, Web of Science* e Embase, além da literatura cinzenta, visando responder à pergunta norteadora "Quais características vocais e fatores associados ao distúrbio vocal são apresentados por professores da educação básica?". A atualização da busca foi realizada em julho de 2024, utilizando descritores e termos livres relacionados ao professor, às questões de trabalho e a voz. A seleção foi realizada por dois juízes de modo independente, sendo que na fase 1 foi realizada a leitura de títulos e resumos, e na fase 2, a leitura dos trabalhos na íntegra. **Resultados:** foram incluídos 20 estudos, os quais indicaram ocorrência de disfonia nos professores de 7% a 97%, sendo 15,6% afastados do trabalho por problemas de voz, relatando sintomas de rouquidão, fala com esforço e tensão. Os principais fatores de risco apresentados pelos professores foram ambiente de trabalho, salas ruidosas, poeira, giz, estresse, esforço vocal, tensão, carga horária excessiva e grande número de alunos em sala de aula, além de associar ao sexo feminino e com o estresse (transtornos mentais). **Conclusão**: a literatura registra importante ocorrência de disfonia em professores da educação básica em vários países, e os principais fatores de risco são o ambiente laboral e suas atividades ocupacionais.

Palavras-chave: Professores Escolares; Voz; Disfonia; Fonoaudiologia.

Resumen

Introducción: El Trastorno de la Voz Relacionado con el Trabajo se define como cualquier forma de desviación vocal relacionada con la actividad profesional que interfiere con el desempeño del trabajador. **Objetivo:** mapear la ocurrencia de disfonía en docentes de educación básica y su asociación con las características laborales. **Métodos:** la revisión del alcance se realizó en las bases de datos PubMed/MedLine, Lilacs, Scopus, Web of Science y Embase, además de literatura gris, con el objetivo de responder a la pregunta orientadora "¿Qué signos y síntomas vocales y características laborales asociadas presentan los profesores de educación básica?" La búsqueda se actualizó en julio de 2024, utilizando descriptores y términos libres relacionados con el docente, temas laborales y voz. La selección fue realizada por dos jueces de forma independiente, con una fase 1 de lectura de títulos y resúmenes, y una fase 2 de lectura de los trabajos completos. **Resultados:** se incluyeron 20 estudios, los cuales indicaron una ocurrencia de disfonía en docentes que oscila entre el 7% y el 97%, siendo el 15,6% ausente del trabajo por problemas de voz, refiriéndose síntomas de ronquera, habla con esfuerzo y tensión. Los principales factores de riesgo que presentaron los docentes fueron ambiente de trabajo, aulas ruidosas, polvo, tiza, estrés, esfuerzo vocal, tensión, carga excesiva de trabajo y gran número de estudiantes en el aula, además de estar asociados al sexo femenino y al estrés (trastornos mentales). **Conclusión**: la literatura registra una ocurrencia significativa de disfonía en docentes de educación básica en varios países, y los principales factores de riesgo son el ambiente de trabajo y sus actividades ocupacionales.

Palabras clave: Maestros; Voz; Disfonía; Fonoaudiología.

Introduction

Teachers comprise the category of occupational voice users with the highest prevalence of risk for developing vocal problems[1], due to excessive vocal demand related to environmental and organizational factors of teaching, characterizing voice changes such as occupational voice disorder (OVD).[2,3,4] This condition is defined as any form of vocal deviation related to professional activity that reduces, compromises, or prevents the worker's performance or communication, with or without organic laryngeal changes.[2] This disorder can lead to absence from work and inability to perform functions[3], causing high financial and social costs; it is considered a public health/occupational health problem. The 2014 Brazilian School Census and the National Survey of Teachers' Working Conditions and Absences in Brazilian Basic Education Schools (Educatel) conducted a study with 6,510 basic schoolteachers of both sexes, with 54 questions answered by telephone. The results showed that they were absent from the classroom for various reasons, mainly because of voice disorders (17.7%), followed by respiratory (14.4%) and emotional (14.5%) problems.[5]

OVD was included in the Brazilian Ministry of Health's list of occupational health problems and the list of mandatory notifications, enabling assistance and surveillance measures toward workers' vocal health.[2,4,5] However, Brazil still does not have official epidemiological data from the Unified Health System (SUS) on the importance of this problem, making it difficult to implement public policies. This draws attention to the great need to raise awareness among workers and health professionals about this issue.[2]

OVD is multicausal and is associated with several factors, such as environmental, organizational, and individual ones. Factors in the teacher's work environment may include noisy classrooms, poor air quality, inadequate ventilation, dust, and chalk use. Factors related to organization and working conditions include long working hours, large number of students in the classroom, low salary, stress, and violence.[2] Individual factors include being female, respiratory allergies, medications, caffeine consumption, elitism, smoking, hormonal problems, vocal misuse and abuse (speaking loudly), and a high number of classes taught per week.[6]

These combined factors contribute to the onset of vocal fatigue symptoms[7], musculoskeletal pain[8], and changes in sleep quality[9], negatively impacting this population's quality of life.[10] A study found that the prevalence of changes in sleep quality ranged from 12% to 81%, and that of stress ranged from 17% to 81%. It was also found that teachers who reported experiencing stress in the workplace were more likely to have voice problems, while those who slept more than 6 hours a day were less likely to report voice problems.[9]

The impact of working conditions on public school teachers' voices mainly involves the onset of vocal fatigue[7] and the greater occurrence of vocal symptoms.[11] In another study with 967 teachers, 25.7% reported having frequent voice problems – i.e., one in four basic education teachers suffers from this disorder at work.[12]

These situations help to make teachers ill, including emotional exhaustion and a variety of mental disorders[13], such as burnout syndrome.[14] Moreover, vocal changes in teachers are known to negatively impact the student's learning process, causing demotivation and difficulty in understanding the message/content teachers convey.[15]

Therefore, it is important to explore and synthesize studies in the literature on OVD in basic education teachers to help better understand their needs and assist in the future implementation of public policies that support teachers' vocal and overall health. Thus, this study aimed to map the occurrence of dysphonia in basic education teachers and its association with work characteristics.

Methods

This scoping review followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses – Extension for Scoping Reviews (PRISMA-ScR)[16] to answer the research question, "What vocal characteristics and factors associated with voice disorders do basic education teachers have?", registered on the Open Science Framework by doi: 10.17605/OSF.IO/Y578A.

Eligibility criteria

This study defined the review eligibility with the acronym "PCC" (Participants, Concept, Context), as follows:

- Population (P): teachers

- Concept (C): of both sexes, from public and private basic education schools.
- Context (C): characterization of symptoms of dysphonia and associated work conditions.

Thus, the review included studies with teachers from public and private basic education schools, of both sexes, exposed to risk factors for dysphonia such as chalk dust, dust on curtains and ventilation appliances, classroom noise, need to speak loudly due to the large number of students, gastroesophageal reflux, stress, and so forth. It included primary studies, without language or time limitations, measuring specific aspects of the voice in this population through structured vocal self-assessment tools, medical examinations, and speech-language-hearing assessments of vocal behavior (perceptual-auditory evaluation and/or acoustic analysis of voice).

Secondary studies (reviews) and those that did not measure aspects related to voice through structured protocols were excluded, as well as those with confounding factors for this outcome, such as neurological diseases, poor vocal habits prior to career (e.g., smoking, and alcohol intake), and publications such as letters to the editor and books.

Information sources and search strategy

The following databases were consulted on January 18, 2022, updated on July 24, 2024: PubMed/MEDLINE, Latin American and Caribbean Health Sciences Literature (LILACS), Scopus, Web of Science, and Embase. The study also consulted gray literature (Google Scholar, ProQuest Theses and Dissertations, and MedVrix), the reference list of the studies included in the review, and experts.

An experienced reviewer (C.C.C.) constructed search strategies with controlled health descriptors (exploring the databases' specific term library) and free terms, duly adapted for each database (as shown in Appendix 1), using words related to teachers, work issues, and voice. An attempt was made to include the word "teacher", however there was divergence in the findings of the proposed theme. Hence, the list of references and experts listed by Scopus was consulted to mediate this limitation, as recommended by PRISMA.

The files with studies originating from the searches were exported to Mendeley® (Elsevier Inc. New York, NY), removing duplicates. Then, a library was constructed in the Rayyan® software to begin the selection.

Phase 1 of the selection consisted of reading the titles and abstracts, and the included studies were read in full in phase 2. Both selection phases were carried out independently (B.O.S. and Q.T.B.), and at the end of each stage a consensus meeting was held; if doubts remained, a third reviewer with greater clinical experience and academic training was consulted (C.C.C.).

The kappa concordance coefficient was calculated with the first 50 articles retrieved from the Scopus database to verify the consistency of the screening based on the eligibility criteria. Study selection began only when the concordance value exceeded 0.8, indicating a good level of agreement.[17]

Data extraction and analysis

The judges extracted the following data independently for subsequent analysis and discussion of conflicts: author, year, country, study objective, sample characterization (case study), assessment instruments regarding voice, the main results related to the impact of work on the voice, and its associated factors. They were extracted independently and later gathered in a consensus meeting.

Results

Altogether, 298 studies were found in the databases. After reading the titles and abstracts, 66 studies remained; and after reading them in full, 20 studies were considered, as shown in Figure 1 and Table 1. Details of the exclusions are found in Appendix 2.

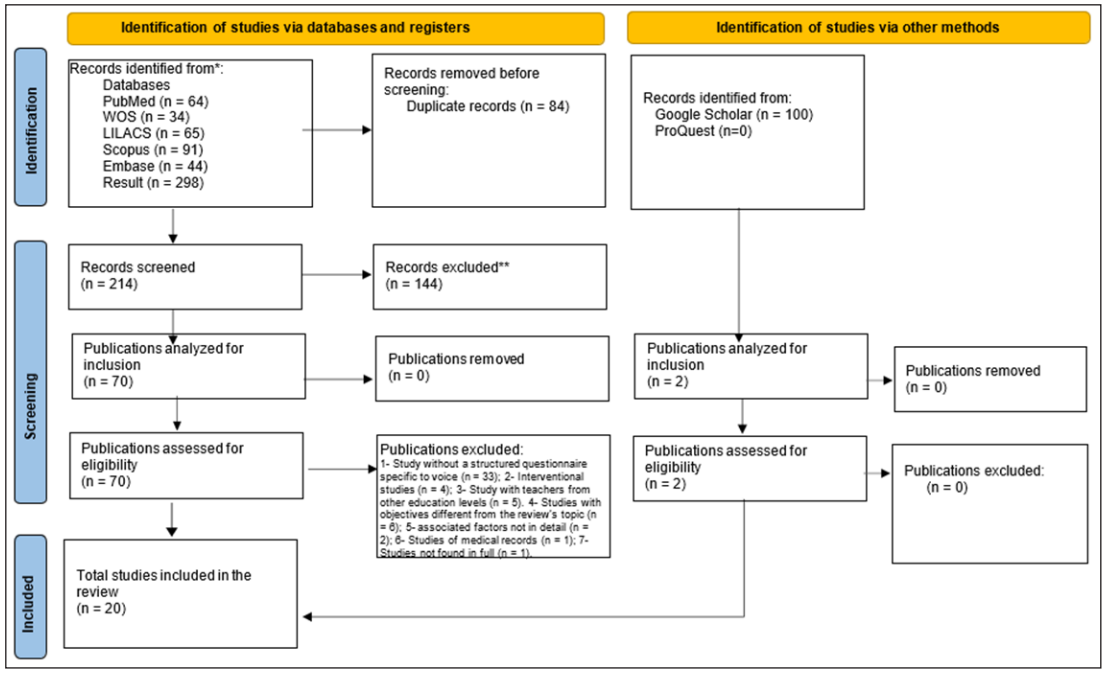

Figure 1. Flowchart demonstrating the selection of articles for the scoping review with the research question, "What vocal characteristics and factors associated with voice disorders do basic education teachers have?".

Table 1. Articles included in the scoping review with the research question, "What vocal characteristics and factors associated with voice disorders do basic education teachers have?".

Author, year Country	Objective	Sample (number of people, age, sex)	Assessment instruments	Voice characteristics	Factors associated with voice disorder
Alvear et al., 2009[18] Spain	To analyze the problems associated with voice disorders in teachers	282 teachers, (200 women and 82 men) Age group: not specified Unhealthy voice group (UVG): 168 Healthy voice group (HVG): 114	Self-perception with VPQ and VAPP	95% noticed vocal strain in the workplace. VAPP average: 54 points for GVI and 8.5 for GVS	Physiological and psychosocial dimensions, with impact on socioeconomic levels and quality of life
Banks et al., 2017[7] USA	To quantify the effect of teacher training on vocal fatigue	506 female teachers Mean age of 42.9 years	Self-assessment of vocal fatigue with VFI	Over 60% experienced vocal fatigue Higher VFI scores in teachers who were in larger classrooms	Age, classroom size, and very large classes

Author, year Country	Objective	Sample (number of people, age, sex)	Assessment instruments	Voice characteristics	Factors associated with voice disorder
Calosso et al., 2017[19] Italy	To determine changes in teachers' voice use over the school year and study the relationships between voice use and acoustic parameters in the classroom	31 teachers from two secondary schools in Turin (Italy) Age range: 38 to 62 years old, with a mean of 52 years	Voice Care – Used to detect skin acceleration due to vocal fold vibration; measuring classroom noise	Teachers speak with a louder voice sound pressure level at the end of a school year in speaking tasks (mean increase of 3.8 dB) Teachers who worked in the worst classroom acoustic conditions increased by 2.3 dB in the mean SPL and decreased by 10% the percentage of voicing time at the end of the school year. A Lombard effect was found at a rate of 0.4 dB	Use of louder voice during work activities; Poor acoustic conditions; High noise levels due to classroom acoustics, high voice sound pressure levels
Cediel et al., 2014[20] Colombia	To identify the factors in the work environment that influence the voice production of elementary school teachers, and the impact of vocal rest and the methodology used to teach	90 primary school teachers, both male and female Age range: 45 to 65 years old	APE using GRBAS; measuring noise, temperature, classroom size	48% of teachers had vocal deviations according to GRBAS, of which 75.5% had mild vocal deviation and 24.5% had moderate vocal deviation The room noise level was 77 dB. Temperature and humidity measurements showed a tendency for a hot and humid environment. The most common teaching method was lectures. Factors in the teacher's work environment correlated with the presence of dysphonia	Environment, noise, temperature. However, environmental factors alone do not contribute to triggering the risk of dysphonia.
Cielo et al., 2016[21] Brazil	To characterize and relate the vocal, occupational, and general health profile of elementary school teachers in Santa Maria/RS, Brazil	127 teachers, 117 women and 10 men Age range: 20 to 64 years old	APE with CAPE-V and acoustic analysis (Fo, Fo standard deviation, disturbance measures, noise, SPI, VTI)	Most of them did not have deviations in APE parameters. In the acoustic analysis, they had changes in the frequency and amplitude disturbance and noise measures. Teachers with vocal problems had a higher daily workload than those who did not have them; They also had significant changes in jitter.	High workload (7.03h/day) and respiratory disorders
Ferreira et al., 2022[22] Brazil	To analyze the association between quality of life and voice disorders in municipal school teachers in São Paulo	272 female teachers (167 experimental group and 105 control group) Age range: 30 to 49 years old	Self-perception with VPC-T and APE, using the GRBASI to separate the experimental from the control group	The groups were similar in sociodemographic data, functional situation, environment (no resting place, noisy environment, dust, and smoke), and work organization (with stressful pace and repetitive work)	The groups did not differ regarding age, education, classes per week, length of employment, smoking, or alcohol consumption.
Joshi et al., 2022[23] India	To study the prevalence of voice disorders in Indian female secondary school teachers	200 teachers	VHI, GRBAS, vocal acoustic analysis and laryngeal evaluation	18.5% vocal disorder 81.5% normal laryngeal examination	Risk factors: 41 to 60 years old, chronic respiratory allergies, more years of teaching, and more classroom hours per week

Author, year Country	Objective	Sample (number of people, age, sex)	Assessment instruments	Voice characteristics	Factors associated with voice disorder
Mahato et al., 2018[24] Nepal	To evaluate the voice quality of school teachers before and after teaching practice	60 teachers Age range: 22 to 40 years 3 to 10 years of teaching experience	Extraction of acoustic measurements: jitter, shimmer, oscillatory frequency (Fo), harmonic-to-noise ratio (HNR), MPT.	Difference in four parameters, except for the jitter value. Fo and shimmer increased after class There was a decrease in HNR and MPT after teaching practice Excessive musculoskeletal tension	Speaking at high intensity; vocal effort for a long time
Mendes et al., 2016[25] Brazil	To identify whether the teachers' vocal intensity is correlated with classroom noise and symptoms of vocal tract discomfort before and after class	27 female teachers Age range: mean of 43 years	Self-assessment with VPC-T and VTDS; measurement of noise in the classroom with a sound level meter	Mean noise level in the classroom: 70.7 dB(A) 63% have already had some voice disorder and 29.6% reported it at the time of collection Increased vocal intensity of teachers correlates with high noise levels Vocal intensity correlated with symptoms of vocal tract discomfort, with greater frequency and intensity after class	Intensive use of voice (74.1%), exposure to noise (55.6%), and allergy (48.1%)
Menon et al., 2021[26] India	To document the prevalence of subjective dysphonia in the school teaching community. The secondary objective was to compare the prevalence and severity of dysphonia among elementary and high school teachers.	702 teachers, 651 women and 51 men. Age range: Mean of 40 years	Self-assessment with VHI	11.2% of teachers with vocal problems had voice handicaps 70.1% prevalence of voice disorders in the population, with 45% having had a problem at the time of the study, and 52.8% in the previous year	Physical and psycho-emotional factors; teaching high school; number of students in the classroom
Mohseni, Sandoughdar, 2016[27] Iran	To investigate the acoustic parameters of the voice of Iranian female teachers	90 elementary school teachers	Fo, jitter, shimmer, harmonic-to-noise ratio (HNR) and maximum phonation time (MPT)	Teachers had increased Fo, jitter, and shimmer and decreased HNR and MPT	Overuse, abuse or misuse of the voice
Mota et al., 2018[28] Brazil	To assess the association between burnout syndrome and the probable presence of vocal disorders in teachers at a public elementary school in inland Sergipe, Brazil	208 teachers, 160 women and 48 men Age range: mean of 41 years	VPC-T, SIVD, and Burnout Syndrome Assessment Questionnaire (BSAQ)	64,4% were at risk for voice disorders. Highest occurrence of symptoms: dry throat (88.1%), hoarseness (84.4%), and fatigue when speaking (82.1%). 33.8% without risk for voice disorders reported having hoarseness "sometimes" or "always".	Exhaustion related to psychological factors; intense physical activities; constant supervision; and repetitive work
Moura et al., 2019[29] Brazil	To analyze the voice-related quality of life and vocal changes in teachers from reference high schools in Petrolina/PE, Brazil, and investigate their relationship with classroom noise in these schools.	18 teachers (17 female teachers and 1 male teacher) Age range: 31 to 55 years old	Self-assessment with V-RQOL and ambient noise using sound level meter and dosimeter	V-RQOL: negative impact on voice-related quality of life 88.9% of teachers stated that they had already felt some type of vocal change that interfered with their work. Increased loudness of teachers	Noise levels: above 80 dB, interfering with teachers' speech intelligibility

Author, year Country	Objective	Sample (number of people, age, sex)	Assessment instruments	Voice characteristics	Factors associated with voice disorder
Munévar et al., 2011[30] Colombia	To determine the relationship between vocal habits, environmental and occupational conditions, and voice disorders (dysphonia) in teachers and employees working in community early childhood education centers (daycare centers)	198 participants, 197 women and 1 man Age range: 20 to 52 years old	Screening to assess predictive factors of any vocal pathology, including factors related to the work setting and environmental conditions. Acoustic analysis with measurements of jitter, shimmer, and oscillatory frequency (Wilson Vocal Profile and Multi-Dimensional Voice Program®)	13.6% consumed alcoholic beverages 32% had occupational dysphonia, of which 3.1% reported adequate hydration habits. The habit of speaking loudly was associated with changes in jitter, shimmer, and oscillatory frequency 37% reported being incapacitated for 1 or 3 days in the previous year due to some disorder. 97% had reduced Maximum Phonation Time.	Relationship between dysphonia and noise; climatic environment: cold, hot, or temperate and pollutants
Pascotini et al., 2015[31] Brazil	Analyze the voice of elementary school teachers with vocal problems according to the education system	74 teachers Age range: 20 to 62 years old	APE through the CAPE-V, acoustic analysis of glottal and spectrographic sources	Teachers from municipal schools had greater vocal deviation for roughness and overall severity of vocal deviation, greater presence of noise among harmonics and probable hyperfunctional vocal compensations evidenced by the greater darkening of the spectrographic trace	Large number of classes; workload of up to 60 hours/week; anxiety and depression caused by fear of unemployment
Rocha et al., 2016[32] Brazil	To identify risk factors for the incidence of perceived vocal disorders in teachers, specifically related to the influence of common mental disorders	469 teachers Age range: over 40 years old	Self-assessment with VHI and symptomatology of mental disorder using the Self-Reporting Questionnaire	The incidence of vocal disorders was 17.1%, based on the VHI score, demonstrating voice handicap Time away from work due to voice problems was reported by 15.6% of participants; 34.8% were diagnosed with perceived voice change, and 39.2% had signs of common mental disorder	Teaching from the fifth grade onwards; absences; common mental disorder (anxiety, depression, or somatoform disorders).
Valente et al., 2015[33] Brazil	To analyze the prevalence and factors associated with voice disorders in teachers	317 female teachers (71.6%) Age range: mean of 40.43 years	Self-assessment with VPC-T	81% of teachers self-reported voice disorders	Work organization and activities concomitant with speaking (e.g., stress, dust in the workplace, and speaking while carrying weight)
Khanlou et al., 2019[34] Iran	To investigate the effect of different risk factors on vocal disorders in teachers	73 teachers, both men and women	Self-assessment with VHI	Voice disorders in 55%, being more prevalent in women Vocal fatigue and roughness are the most common symptoms in teachers	Environmental conditions (allergies, work tools, poor air quality), inadequate vocal rest, and work stress are occupational risk factors that have helped increase voice disorders in teachers.

Author, year Country	Objective	Sample (number of people, age, sex)	Assessment instruments	Voice characteristics	Factors associated with voice disorder
Rezende et al., 2023[35] Brazil	To analyze work limitations due to voice and associated characteristics among basic education teachers in Brazil	6,324 basic education teachers 80.3% female	Cross-sectional study, with data collection via phone calls to Brazilian basic education teachers	32.7% reported some frequency of limitations at work due to their voice at some point in the previous month.	4.1% reported smoking, 33.9% had trouble sleeping, 14.3% used anxiolytic or antidepressant medication. Loud classroom noise (33%) and a hectic environment due to students' lack of discipline (31.9%). One third reported having suffered some episode of verbal or physical violence by students. 40.8% did not have enough time to complete their work tasks
Verduyckt et al., 2024[36] Canada	To characterize the nature and severity of vocal difficulties among preschool professionals in Quebec, Canada.	194 education professionals	9 closed questions and 1 open question about self-reported vocal difficulties and the implementation of health measures	66.5% had difficulty making themselves heard, 68.1% had to strain their voice, 38.1% had a sore throat after work, and 25.2% were concerned about their vocal health 35.6% noticed that their voice had changed moderately or a lot, and 75.3% did not feel equipped to take care of their vocal health.	Vocal difficulties related to being female. Insufficient information about voice care

Caption: RS – Rio Grande do Sul; SPL – Sound Pressure Level; M- Mean; PE - Pernambuco; dB- Decibel; CAPE-V - Consensus Auditory-Perceptual Evaluation of Voice; VPC-T - Voice Production Condition-Teachers; VTDS - Vocal Tract Discomfort Scale l; VHI - Voice Handicap Index; VFI - Vocal Fatigue Index; SIVD - Screening Index for Voice Disorder; LVSS - List of Vocal Signs and Symptoms; V-RQOL - Voice-Related Quality-of-Life; VPQ - Vocal Performance Questionnaire; VAPP - Voice Activity and Participation Profile; APE – auditory-perceptual evaluation; BSAQ - Burnout Syndrome Assessment Questionnaire.

The selected studies were published between 2009 and 2024. Most of the studies originated in Brazil[21,22,24,28,29,31-33,35], totaling nine articles, two in Iran[27,34], two in Colombia[20,30], two in India[23,26], one in Spain[18], one in the United States[7], one in Italy[19], one in Nepal[24], and one in Canada[36]. The study objectives were to evaluate voice disorders and characteristics in basic education teachers in public and private schools. They also surveyed working conditions, teaching activity, and factors associated with vocal difficulties.

The studies included in this review used self-assessment and vocal behavior assessment protocols to verify vocal changes in the study population. The self-assessment protocols were the Vocal Fatigue Index (VFI)[7], Voice Handicap Index (VHI)[23,24,26,32,34], Vocal Performance Questionnaire (VPQ)[18], Voice Activity and Participation Profile (VAPP)[18], Voice Production Condition-Teachers (VPC-T)[22,27,28,33], Voice-Related Quality-of-Life (V-RQOL)[28], List of Vocal Signs and Symptoms (LVSS)[25], Vocal Tract Discomfort Scale (VTDS)[22,25], Screening Index for Voice Disorder (SIVD)[28], Burnout Syndrome Assessment Questionnaire (BSAQ)[28], and mental disorder symptomatology by the Self-Reporting Questionnaire.[32]

The assessment of vocal behavior analyzed vocal quality through auditory-perceptual evaluation (using the GRBASI[20,22,23] and CAPE-V[21,31]) and acoustic analysis (oscillatory frequency, maximum phonation time, disturbance, noise measurements of the vocal signal, and spectrographic analysis of the vocal signal)[21,23,24,26,27,30,31]. Tissue acceleration was also analyzed by vibration of the vocal folds with an accelerometer[19], in addition to measuring vocal and classroom intensity using a sound level meter and dosimeter.[19,20,27,29]

Studies have shown an occurrence of 18.5% to 97% of dysphonia/vocal problems in basic education teachers[7,18-36]. Their vocal assessment specifically identified roughness[19,27,30,33], reduced maximum phonation time[31], and vocal fatigue[35]. These signs and symptoms caused 15.6% to 37%[30,32,35] of teachers to be absent from work and have mental disorders such as anxiety, depression, and stress.[28,30,32]

The risk factors associated with dysphonia in these studies are related to environmental and organizational factors[6], such as high noise levels in the classroom, small rooms, excessive number of students, dust, chalk dust, poor acoustic conditions, and high workload without enough time to prepare all work demands.[5,16-19,24,28,29,32-34] The studies also pointed out individual factors[6], such as age and sex, showing higher occurrences in female teachers, with a mean age of 40 years.[7,30,33-35]

Other important problems were reinforced in a recent study, which showed a high frequency of sleeping problems in this population and reports of having suffered some episode of verbal or physical violence by students.[35]

Teachers also reported not feeling sufficiently informed about voice care.[36]

Discussion

Teachers' voices are essential to their occupation, assisting in interpersonal interactions necessary for the best development of the teaching-learning process. They have excessive vocal demand with greater impairment of their vocal health[1,3], characterizing it as an occupational health problem, specifically as OVD.[2] This problem is considered the second cause of absence and absenteeism from teaching in Brazil.[2] Therefore, this review was necessary to collaborate with scientific evidence regarding this population's vocal health and help implement public measures, specifically for basic education teachers, with their specificities and unique vocal use in the classroom.

Of the studies included in this review, 13 (59.1%) were published between 2015 and 2019, and seven were published before these dates. Despite the many studies with teachers in the literature, the specificity with basic education teachers is still a recent concern regarding the problems of voice disorders and associated factors.

The studies analyzed in this review were conducted with samples ranging from 27 to 6,324 teachers of both sexes, but with a greater number of female teachers[25,35] and consequently, a higher incidence of dysphonia in this sex. This result was influenced by the number of female teachers and the anatomical configuration of their larynx, which is more rounded, favoring the appearance of a physiological cleft. This incomplete glottal closure, when associated with inadequate vocal habits, vocal misuse, and muscle tension, predisposes them to developing OVD.[38] Thus, being female is one of the individual factors that can trigger voice changes in occupational voice users[2]. These findings corroborate studies with university teachers, as females have the highest incidence of dysphonia and perception of vocal symptoms.[9,10]

The studies analyzed in this study investigated voice disorders in teachers from public and private schools, with the majority being carried out in public schools. In comparison, teachers from public schools had worse working conditions than those from private schools, and a higher incidence of voice disorders, exemplifying this association between OVD and worse environmental conditions and work organization.[11]

The outcomes analyzed in the studies showed that they used a great diversity of self-assessment questionnaires with teachers, making it difficult to compare the findings. It is also important to establish standardized questionnaires for basic education teachers[24], enabling a more reliable profile of teachers' vocal signs and symptoms and the impact on their life and occupational activities. Thus, public policies must include speech-language-hearing interventions and health promotion practices in primary health levels to screen voices and direct vocal therapy systematically.[2]

The results of a study showed that even teachers without a risk of developing voice disorders[28] reported having hoarseness "sometimes" or "always". In general, the signs most often perceived by teachers were hoarseness, dry throat, itching, strain when speaking, muscle tension, throat clearing, effort when speaking, loss of voice, fatigue, pain, and discomfort.[7,22,24,28] Such symptoms may characterize vocal fatigue, defined as a self-reported sensation of phonatory effort due to increased vocal load.[7] Vocal fatigue may be one of the OVD symptoms resulting from several teaching factors, such

as those related to the environment, organization, physical, and psychological factors.[7]

Teachers are extremely affected by dysphonia, to the point of having to take time off work due to vocal problems. One study showed that 15.6% of teachers evaluated had to take time off work due to voice problems during their career.[32]

This review showed that environmental factors (such as noisy environments caused by fans, air conditioning, and large classrooms) were decisive for recording OVD in teachers[7,19-22,25,29,30,33-35], increasing vocal intensity when speaking at sound pressure levels above 80 dB[25] – a phenomenon known as the Lombard effect. The increase in vocal intensity generates vocal abuse and compromises vocal health, resulting in the perception of vocal fatigue symptoms[7,34] since there is an increase in glottal adduction. A study concluded that unsatisfactory acoustic treatment of classrooms causes teachers to speak with greater effort, leading to vocal fatigue; it reports that one of the origins of these symptoms is the large number of students in the classroom.[7,34] Moreover, there are organizational factors such as violence, low pay, and lack of time for work demands. These factors feed back into the severity of vocal changes, culminating in mental disorders such as anxiety, depression, and burnout syndrome.[28]

The auditory-perceptual evaluation found hoarseness and reduced maximum phonation time, mostly with a mild deviation.[22,28,30,31,34] The acoustic analysis demonstrated that basic education school teachers may have changes in jitter, shimmer, and oscillatory frequency and a decrease in harmonic-to-noise ratio (HNR)[21,23,24,26,27,30,31]. These findings were related to the impact after high vocal demand, combined with environmental and organizational factors. The literature reinforces that dysphonia implies loss of work performance and increased stress, generating a chronic cycle, which is a public health problem.[39]

Future primary studies should standardize assessment protocols and increase the number of self-assessment protocols for teachers to standardize the approach to this population, aiming at a better perception of the characterization of individual, vocal, and work aspects, helping establish targeted and specific health promotion actions for teachers.

Another urgent point that this study highlights is the need for public policies that support the vocal and overall health of basic education teachers, improving their work activity and quality of life, effectively contributing to the transformation of education in Brazil.

Regulations published in 2024 regarding the inclusion of OVD in the list of work-related diseases and compulsory notification is a milestone for workers' health promotion, disease prevention, rehabilitation, and health surveillance. However, attention is still needed to the practical procedures for implementing protective measures for workers' health. Public policies must address the communication of the occurrence of this health problem to the health authority in order to take adequate intervention measures in work processes and environments. This helps formulate and evaluate health policies, plans, and programs, supporting decision-making, and improving this population's health status.

Conclusion

The literature records a significant number of occurrences of dysphonia in basic education teachers in various countries; the main risk factors are the work environment and their occupational activities. The results demonstrated that they need instructions about voice care, speech-language-hearing intervention, and awareness of dysphonia as a health problem for workers (a significant health problem), providing legal support and more assertive and effective health promotion, prevention, and rehabilitation interventions.

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Appendix 1. Adapted search strategy for databases and grey literature

Database	Search strategy (January 18, 2022; August 24, 2024)
LILACS	("Professores Escolares" OR "School Teachers" OR "Maestros" OR "School Teacher") AND ("Occupational Exposures" OR "Exposição Ocupacional" OR "Occupational Exposure" OR "Exposición Profesional" OR "Riscos Ocupacionais" OR "Occupational Risks" OR "Riesgos Laborales" OR "Saúde do Trabalhador" OR "Occupational Health" OR "Salud Laboral" OR "Condições Inseguras no Trabalho" OR "Periculosidade Laboral" OR "Risco Ocupacional" OR "Risco Profissional" OR "Trabalho Precário" OR "Condiciones Inseguras en el Trabajo" OR "Riesgo Laboral" OR "Riesgo Profesional" OR "Riesgos Profesionales" OR "Higiene do Trabalho" OR "Higiene Industrial" OR "Saúde dos Empregados" OR "Saúde dos Trabalhadores" OR "Saúde Industrial" OR "Saúde Ocupacional" OR "Segurança do Trabalho" OR "Segurança dos Trabalhadores" OR "Segurança no Trabalho" OR "Segurança Ocupacional" OR "Higiene del Trabajo" OR "Higiene Industrial" OR "Salud de los Trabajadores" OR "Salud del Empleado" OR "Salud Industrial" OR "Salud Ocupacional" OR "Seguridad de los Trabajadores" OR "Seguridad del Trabajo" OR "Seguridad en el Trabajo" OR "Seguridad Laboral" OR "Seguridad Ocupacional" OR "Occupational Safety" OR "Employee Health") AND ("Disfonia" OR "Dysphonia" OR "Disfonía" OR "Distúrbios da Voz" OR "Voice Disorders" OR "Trastornos de la Voz" OR "Qualidade da Voz" OR "Voice Quality" OR "Calidad de la Voz" OR "Voz" OR "Voice" OR "Fonação" OR "Phonation" OR "Fonación" OR "Fala" OR "Speech" OR "Habla" OR "Qualidade Vocal" OR "Distúrbios da Fonação" OR "Transtornos da Fonação" OR "Voices" OR "Voice Quality" OR "Voice Disturbance" OR "Phonation Disorder" OR "Phonation Disorders" OR "Voice Disorder" OR "Voice Disturbance" OR "Voice Disturbances" OR "Voice Fatigue") AND (db:("LILACS"))
PubMed	(("School Teachers"[MeSH] OR "School Teachers" OR "School Teacher") AND ("Occupational Exposure"[MeSH] OR "Occupational Exposure" OR "Occupational Exposures" OR "Occupational Risks" OR "Occupational Health"[MeSH] OR "Occupational Health" OR "Occupational Safety" OR "Employee Health")) AND ("Dysphonia"[MeSH] OR "Dysphonia" OR "Voice Disorders" OR "Voice Disorders"[MeSH] OR "Voice Quality" OR "Voice"[MeSH] OR "Voice" OR "Phonation" OR "Speech" OR "Voices" OR "Voice Quality"[MeSH] OR "Voice Quality" OR "Voice Disturbance" OR "Phonation Disorder" OR "Phonation Disorders" OR "Voice Disorder" OR "Voice Disturbance" OR "Voice Disturbances" OR "Voice Fatigue")
Scopus	((TITLE-ABS-KEY ("School Teachers" OR "School Teacher") AND TITLE-ABS-KEY ("Occupational Exposure" OR "Occupational Exposures" OR "Occupational Risks" OR "Occupational Health" OR "Occupational Safety" OR "Employee Health") AND TITLE-ABS-KEY ("Dysphonia" OR "Voice Disorders" OR "Voice Quality" OR "Voice" OR "Phonation" OR "Speech" OR "Voices" OR "Voice Quality" OR "Voice Disturbance" OR "Phonation Disorder" OR "Phonation Disorders" OR "Voice Disorder" OR "Voice Disturbance" OR "Voice Disturbances" OR "Voice Fatigue"))
Embase	#4 #1 AND #2 AND #3 #3 ('school teachers'/exp OR 'school teachers' OR 'school teacher'/exp OR 'school teacher') #2 ('occupational exposure'/exp OR 'occupational exposure' OR 'occupational exposures' OR 'occupational risks' OR 'occupational health'/exp OR 'occupational health' OR 'occupational safety'/exp OR 'occupational safety' OR 'employee health') #1 ('dysphonia'/exp OR 'dysphonia' OR 'voice disorders'/exp OR 'voice disorders' OR 'voice'/exp OR 'voice' OR 'phonation'/exp OR 'phonation' OR 'speech'/exp OR 'speech' OR 'voices' OR 'voice quality'/exp OR 'voice quality' OR 'phonation disorder' OR 'phonation disorders' OR 'voice disorder'/exp OR 'voice disorder' OR 'voice disturbance' OR 'voice disturbances' OR 'voice fatigue')
Web of Science	("School Teachers" OR "School Teacher") (Todos os campos) AND ("Occupational Exposure" OR "Occupational Exposures" OR "Occupational Risks" OR "Occupational Health" OR "Occupational Safety" OR "Employee Health") (Todos os campos) AND ("Dysphonia" OR "Voice Disorders" OR "Voice Quality" OR "Voice" OR "Phonation" OR "Speech" OR "Voices" OR "Voice Quality" OR "Voice Disturbance" OR "Phonation Disorder" OR "Phonation Disorders" OR "Voice Disorder" OR "Voice Disturbance" OR "Voice Disturbances" OR "Voice Fatigue") (Todos os campos)
GRAY LITERATURE	
Google Scholar	("School Teachers") AND ("Occupational Exposure" OR "Occupational Risks") AND ("Voice") filetype:PDF
ProQuest	NOFT("School Teachers" OR "School Teacher") AND NOFT ("Occupational Exposure" OR "Occupational Exposures" OR "Occupational Risks" OR "Occupational Health" OR "Occupational Safety" OR "Employee Health") AND NOFT ("Dysphonia" OR "Voice Disorders" OR "Voice Quality" OR "Voice" OR "Phonation" OR "Speech" OR "Voices" OR "Voice Quality" OR "Voice Disturbance" OR "Phonation Disorder" OR "Phonation Disorders" OR "Voice Disorder" OR "Voice Disturbance" OR "Voice Disturbances" OR "Voice Fatigue")

Appendix 2. Articles excluded in phase 2 of selection and their respective reasons for exclusion..

Author, Year	Reason for exclusion
Abbaszadeh et al., 2019	1
Abou-Rafée et al., 2019	2
Alves et al., 2010	1
Brisson et al., 2024	3
Cercal et al., 2020	3
Chen et al., 2022	3
de Alvear et al., 2011	1
de Oliveira Bastos et al., 2017	2
de Souza et al., 2011	1
Devadas et al., 2016	1
Di-Giusto et al., 2022	4
El Dalatony et al., 2021	1
Escalona, 2006	1
Faham et al., 2015	2
Fahmy et al., 2020	1
Fillis et al., 2016	1
Fuess et al., 2006	1
Granjeiro et al., 2021	3
Hermes et al., 2015	1
Herndon et al., 2017	4
Karjalainen et al., 2020	4
Laukkanen et al., 2006	1
Lee et al., 2010	1
Lee et al., 2018	1
Lee et al., 2012	5
Limoeiro et al., 2019	5
López et al., 2017	2
Luchesi et al., 2009	1
Mangena MC, Matlala, 2023	3
Marçal et al., 2011	1
Munier et al., 2015	1
Munier et al., 2008	1
Nusseck et al., 2017	1
Ostadi et al., 2016	4
Penha et al.,2023	4
Pino et al., 2018	1
Palheta et al., 2008	1
Petrović-Lazić et al., 2011	1
Petter et al., 2006	1
Provenzano et al., 2010	6
Rezende et al., 2020	1
Rossi-Barbosa et al., 2015	1
Russell et al., 1998	1
Santos et al., 2019	4
Sathyanarayan et al., 2018	1
Seifpanahi et al., 2015	1
Sisto et al., 2018	1
Tanzariello et al., 2004	7
Tenor et al., 1999	1
Thibeault et al., 2004	1
Vertanen et al., 2018	1
Yeung, 2008	1

Caption: 1- Study without a structured questionnaire specific to voice (n = 33); 2- Interventional studies (n = 4);
3- Study with teachers from other education levels (n = 5). 4- Studies with objectives different from the review's topic (n = 6);
5- associated factors not in detail (n = 2); 6- Studies of medical records (n = 1); 7- Studies not found in full (n = 1).

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