Literature Review

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Voice disorder and risk factors in spoken voice professionals: an integrative review

Distúrbio de voz e fatores de risco em profissionais da voz falada: uma revisão integrativa

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ABSTRACT

Purpose: To identify scientific evidence about (Work-Related Voice Disorder) and risk factors, as well as to point out vocal symptoms, instruments and evaluation methods in spoken voice professionals. **Research strategy:** Integrative literature review carried out in LILACS, SciELO, MEDLINE/PubMed and Scopus databases. **Selection criteria:** Articles with spoken voice professionals, which addressed individual, organizational and/or environmental risk factors linked to symptoms and/or voice disorders, observational studies, fully available, without restriction to language and year of publication. **Results:** 58 papers were included, the largest publication between the years 2014 and 2022, predominantly in Brazil, with emphasis on the teacher. The most used evaluation method was vocal assessment using self-assessment protocols, followed by auditory-perceptual assessment and laryngological examination. The mostly identified risk factors were individual ones, followed by organizational and environmental ones, in addition to sensory and auditory vocal symptoms having been reported. **Conclusion:** The most often self-reported factors were noise, intense voice use, respiratory changes, being female and inappropriate vocal practices. For sensory vocal symptoms, dry throat, throat clearing and vocal fatigue stand out, and for auditory symptoms, hoarseness.

Keywords: Voice; Voice disorders; Dysphonia; Occupational health; Risk factors

RESUMO

Objetivo: Identificar evidências científicas sobre o distúrbio de voz relacionado ao trabalho e fatores de risco, além de apontar os sintomas vocais, instrumentos e métodos de avaliação em profissionais da voz falada. **Estratégia de pesquisa:** Revisão integrativa da literatura, realizada nas bases de dados LILACS, SciELO, MEDLINE/PubMed e Scopus. **Critérios de seleção:** Artigos com profissionais da voz falada, que abordassem os fatores de riscos individuais, organizacionais e/ou ambientais vinculados aos sintomas e/ou distúrbios de voz, estudos observacionais, disponíveis na íntegra, sem restrição ao idioma e ano de publicação. **Resultados:** Foram incluídos 58 estudos, maior publicação entre os anos de 2014 e 2022, predominantemente no Brasil, em destaque, o professor. O método de avaliação mais utilizado foi autoavaliação com o uso dos protocolos, seguido da avaliação perceptivo-auditiva e do exame laringológico. Os fatores de risco mais identificados foram os individuais, seguidos dos organizacionais e ambientais, além de terem sido relatados os sintomas vocais sensoriais e auditivos. **Conclusão:** Os fatores mais autorreferidos são ruído, uso intenso da voz, alterações respiratórias, ser do gênero feminino e práticas vocais inadequadas. Quanto aos sintomas vocais sensoriais, destacam-se garganta seca, pigarro e fadiga vocal, e quanto aos auditivos, rouquidão.

Palavras-chave: Voz; Distúrbios da voz; Disfonia; Saúde ocupacional; Fatores de risco

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INTRODUCTION

Spoken voice professionals have specific characteristics and practices regarding their occupational context, which favors the risk of developing voice disorders when compared to the general population. In this population, the voice is considered the main work instrument[1], and some factors may interfere with the conditions of vocal production. The factors can be endogenous, which are related to the subjects themselves, such as the presence of respiratory allergies. Furthermore, they can be exogenous, referring to aspects external to the individual, such as noise, dust/mold, temperature, and others[2].

Endogenous and exogenous factors (i.e., individual, organizational, and environmental risks) contribute to the occurrence of vocal complaints and symptoms[3] that, associated with occupational activity, may help in the genesis and/or maintenance of work-related voice disorder (WRVD)[4].

Studies that seek to understand the vocal condition of spoken voice professionals have highlighted the high prevalence of vocal complaints in females. In addition, they emphasized the presence of neck, shoulder, and back pain, respiratory alterations, lack of restful sleep, anxiety, and irregular general health as individual factors[5-7].

The environmental risks that may predispose to dysphonia mentioned in the literature include high noise, exposure to irritating chemicals of the upper airways (solvents, metal vapors, asphyxiating gases), the presence of dust or smoke in the workplace, inadequate ventilation of the environment, low humidity, unfavorable acoustics, inadequate or insufficient furniture, and material resources, among others[6,8-11].

Regarding organizational risks, there is intensive use of voice, work-related stress, lack of autonomy, lack of training, inadequate posture and equipment, work under strong pressure, overload of functions, deprivation of access to toilets and hydration, salary dissatisfaction, and others[8,10,12-15].

These risk factors may contribute to the presence of vocal signs and symptoms, such as hoarseness, dry throat, effort when speaking, strained speech and neck pain, difficulty in treble, lack of vocal volume and projection, loss of vocal efficiency, poor resistance when speaking, throat clearing, and inconstancy and/or tremor in the voice. When added to psychoemotional/psychosomatic factors, these signs and symptoms can evolve to WRVD[7,8,15-17]. The development of WRVD is multicausal and requires an in-depth assessment to analyze the professionals in all their contexts.

The speech-therapy evaluation of a voice disorder is complex, and since it is related to occupational activity, its multifactorial characteristic should be considered[18]. The evaluation of vocal patterns can be done through vocal self-assessment, with the application of protocols, auditory-perceptual judgment, and acoustic analysis of the voice, in addition to the laryngological examination performed by an otorhinolaryngologist[19,20].

Furthermore, it is important to investigate individual, organizational, and environmental risk factors and their relationships with voice disorders in the context of spoken voice since studies with this proposal help better evaluate, promote, and prevent WRVD. Moreover, they avoid damage to physical and mental health and quality of life, which involves these professionals' social and work aspects. The specific assessment and self-assessment instruments for this population of spoken voice professionals are relevant to investigate their entire occupational and vocal health context.

GOAL

This literature review aimed to identify scientific evidence on work-related voice disorders (WRVD) and risk factors. Furthermore, it pointed out vocal symptoms, instruments, and assessment methods related to spoken voice professionals.

RESEARCH STRATEGY

This study is an integrative review of the literature. It included the following steps: elaborating the guiding question, searching the scientific literature, and quantitative and qualitative data analysis.

The following question guided this study: "What are the risk factors, vocal symptoms, instruments, and assessment methods present in studies aimed at spoken voice professionals with WRVD?". The formulation of the question and the strategic search were based on the strategy of the acronym PVO (P stands for population, context, or problem-based situation; V stands for variables, and O stands for *outcomes*, such as expected or unexpected results)[21]. Thus, "P" corresponded to the speaking voice professionals, "V" to individual, organizational, and environmental risk factors and the assessment instruments and methods, and "O" represented voice disorders.

The consulted databases included: *Latin American and Caribbean Health Sciences Literature* (LILACS*), Scientific Electronic Library Online* (SciELO), *Medical Literature Analysis and Retrieval System Online* (MEDLINE)/*Public Medicine Library* (PubMed), and *Scopus*. The keywords were selected from a consultation of the *Health Sciences Descriptors* (DeCS) and the *Medical Subject Headings* (MeSH). The descriptors included "*Voice*", "*Voice Disorders*", "*Dysphonia*", "*Occupational health*", and "*Risk factors".*

Next, a strategic search based on two combinations of descriptors was carried out. It used the Boolean operators "OR" and "AND", respectively. It included the databases a) SciELO/Scopus/LILACS: "*Dysphonia*" *OR* "*Voice Disorders*" *OR* "*Voice*" AND "*Occupational health*" AND "*Risk factors*"; b) MEDLINE: (((("*Phonation Disorders*") OR ("*Phonation Disorder*") *OR* (*Dysphonia* [MeSH])) OR (("*Voice Disorder*") *OR* ("*Voice Disturbance*") *OR* ("*Disturbance*, *Voice*") *OR* ("*Voice Disorders*" [MeSH])) OR (("*Voices*") OR ("*Voice*" [MeSH])) *AND* (("*Health*, *Occupational*") *OR* ("*Occupational Health"* [MeSH])) *AND* (("*Factor*, *Risk*") OR ("*Risk Factor*") OR ("*Risk Factors*" [MeSH]))).

SELECTION CRITERIA

Regarding the inclusion criteria, we adopted articles whose population comprised spoken voice professionals, which addressed individual, organizational, and/or environmental risk factors related to voice symptoms and/or disorders, and observational studies available in full and without restriction regarding language and year of publication.

Exclusion criteria included repetition in databases, monographs, dissertations, theses, literature reviews, books, and book chapters.

Two team members independently and blindly conducted the search between May and July 2022. The first stage of article selection comprised reading and analyzing the titles and abstracts of all detected publications. It identified the repetition of articles in different databases. Then, the selected studies were read in full. Articles that did not meet the eligibility criteria were excluded. In cases of disagreement among the members, a reasoned discussion of the pre-established criteria was foreseen with a third, more experienced researcher. However, there was no need to do so. Figure 1 shows the flowchart used to identify and select the articles.

DATA ANALYSIS

Data analysis was performed descriptively, with a quantitative-qualitative synthesis of the data. In the first phase, the data from the studies were compiled and then divided into three tables. Based on the survey, a specific database was elaborated in a Microsoft Excel spreadsheet to extract the following variables: year of publication, country of study, study design, spoken voice sample/professional, methods and techniques for voice assessment, self-assessment (validated protocol, non-validated protocol), endogenous vocal risk factors (individual), exogenous vocal risk factors (environmental and organizational), and sensory and auditory vocal symptoms.

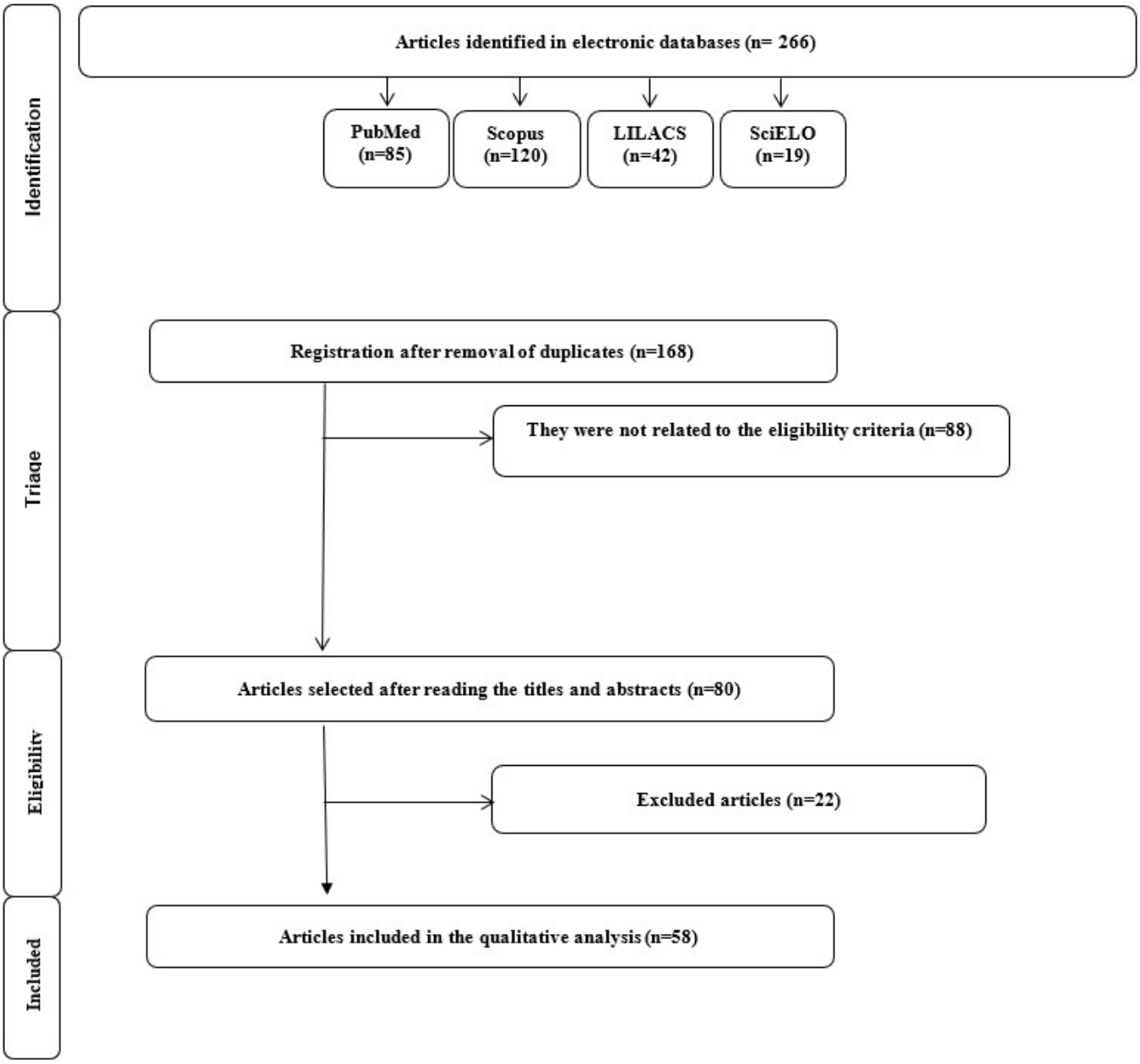

Figure 1. Flowchart for identification and selection of articles for integrative review based on the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses*
Subtitle: n = number of articles

FINDINGS

The electronic searches identified a total of 266 references. Of these, 58 were selected for this study according to the eligibility criteria. Chart 1 shows the characteristics of the selected studies.

The publication of studies was higher between 2014 and 2022 (62.1%; n=36). Studies were predominantly conducted in Brazil (46.5%; n=27), followed by Finland (12.1%; n=7) and India (10.3%; n=6). Regarding the study design, cross-sectional was the most frequent (81.0%; n=47), with teachers being the most studied category of spoken voice professionals (67.2%; n=39). Table 1 shows the results of the characteristics of the selected studies.

Table 2 shows the methods, instruments, and techniques of voice assessment used in the included articles. All studies (100%; n=58) applied self-assessment protocols, and most (39.6%; n=23) were validated; Vocal Production Condition - Teacher - VPC-T (20.6%; n= 12) and Vocal Handicap Index-VHI-10 (18.9%; n= 11). It was observed that 10.3% (n=6) used the auditory-perceptual assessment and 10.3% (n=6) the laryngological examination.

Table 3 shows the number of risk factors for dysphonia and vocal symptoms related to WRVD in the selected studies. Endogenous (individual) factors were identified in most of the articles (94.8%; n=55). Exogenous factors related to working conditions were described in 93.1% (n=54) of the studies, and exogenous environmental factors were observed in 69.0% (n=40). Most articles investigated sensory vocal symptoms (77.5%; n=45), auditory vocal symptoms were investigated by 74.1% (n=46) of the publications, and both symptoms were investigated by 48.27% (n=28).

Chart 1. Qualitative variables related to the characteristics of the selected studies

Title	Author	Year	Locality	Spoken Voice Professional	Characteristics of the self-assessment protocol used
Working Conditions and Workplace Barriers to Vocal Health in Primary School Teachers	Munier, C., Farrell, R.	2016	Ireland (Dublin)	Elementary School Teachers	Not validated
Voice Disorders are Associated With Stress Among Teachers: A Cross-Sectional Study in Finland	Vertanen-Greis, H., Loyttyniemi, E., Uitti, J.	2020	Finland	Primary and secondary school teachers	Both Protocol *Single-item measure of stress symptoms*
Voice Problems in New Zealand Teachers: A National Survey	Leão, S. et al.	2015	New Zealand	Primary and secondary school teachers	Not validated
Voice Needs and Voice Demands of Professional Newsreaders in Southern India	Gunasekaran,N., Boominathan, P., Seethapathy, J.	2016	India	Journalists	Validated *Interview Questionnaire for Professional Newsreaders*
Vocal Tract Discomfort and Risk Factors in University Teachers	Korn, G.P., Pontes, A. A. L., Abranches, D., Pontes, P. A. L,	2016	Brazil	University professors	Not validated
Vocal Symptoms in University Professors: Their Association With Vocal Resources and With Work Environment	Gomes, N. R., Teixeira, L. C., Medeiros, A. M.	2020	Brazil	University professors	Both Vocal Signs and Symptoms Questionnaire (BVSSQ)
Vocal Health Practices Among School Teachers: A Study From Chennai, India	Sathyanarayan, M., Boominathan, P., Nallamuthu, A.	2019	India	Primary and secondary school teachers	Adapted *Vocal Health Questionnaire*
The Prevalence of Teachers' Vocal Symptoms inMunicipal Network of Education in Campo Grande,Mato Grosso do Sul, Brazil	Hermes, E. G. C., Bastos P. R. H. O.	2016	Brazil	Teachers	Adapted Vocal Production Condition – Teacher (VPC-T)
Work ability of teachers associated with voice disorders, stress, and the indoor environment: A questionnaire study in Finland	Vertanen-Greis, H., Loyttyniemi, E., Uitti, J., Putus, T.	2020	Finland	Teachers	Both *Work Ability Score (*WAS), contained in the *Work Ability Index* (Tuomi et al., 1997), For stress: 5-point Likert scale, PIEQ, based on the MM 040 questionnaire (Anderson, 1998)
Voice burden in teachers and non-teachers in a UK population: A questionnaire-based survey	Gadepalli, C., Fullwood, C., Ascott, F., Homer, J. J.	2019	United Kingdom	Primary and secondary school teachers	Both *Voice Handicap Index-10* (VHI-10)
Vocal Problems in Sports and Fitness Instructors: A Study of Prevalence, Risk Factors, and Need for Prevention in France	Fontan, L. et al.	2017	France	Sports & Fitness Instructors	Both *Voice Handicap Index-10* (VHI-10)
Vocal Fatigue-Do Young Speech-Language Pathologists Practice What They Preach?	Joseph, B., Joseph, A., Jacob, T.	2020	India	Audiologists	Validated Own of the study
Vocal effort and voice handicap among teachers	Sampaio, M. et al.	2012	Brazil	Elementary School Teachers	Validated *Voice Handicap Index-10* (VHI-10)
The prevalence of voice disorders in 911 emergency telecommunicators	Johns-Fiedler, H., Mersbergen, M.	2015	United States (Illinois)	Teleoperators	Validated *Voice Handicap Index-10* (VHI-10)
Situations of violence at school and the teacher's voice	Dornelas, R. et al.	2017	Brazil	Elementary School Teachers	Validated Vocal Production Condition – Teacher (VPC-T), Voice Disorder Screening Index (SIVD)

Chart 1. Continued...

Title	Author	Year	Locality	Spoken Voice Professional	Characteristics of the self-assessment protocol used
Association between readiness for behavior changes and complaint of dysphonia in teachers	Rossi-Barbosa, L. A. et al.	2015	Brazil	Teachers	Both Urica -Voice
Risk Factors of Voice Disorders and Impact of Vocal Hygiene Awareness Program Among Teachers in Public Schools in Egyp	Bolbol, S. A., Zalat, M. M., Hammam, A. M., Elnakeb, N. L.	2016	Egypt	Teachers	Both *Voice Handicap Index-10* (VHI-10)
Risk Factors for Voice Disorders in University Professors in Cyprus	Kyriakou, K., Petinou, K., Phinikettos, I.	2018	Cyprus	University professors	Both *Voice Handicap Index-10* (VHI-10)
Relationship between self-reported working and voice conditions by teleoperators in an emergency switchboard	Santos, C. T. et al.	2016	Brazil	Teleoperators	Validated Telemarketer Voice Profile (PVOT)
Relationship between self-reported dysphonia and potential risk factors among primary school teachers, Porto Alegre - RS	Petter, V., Oliveira, Barros, P. A. B., Fischer, P. D.	2006	Brazil	Elementary School Teachers	Not informed
Relationship between working conditions and self-assessment in elementary school teachers	Palheta Neto, F. X.	2014	Brazil	Elementary School Teachers	Not validated
Vocal complaints in radio announcers in the city of Salvador, Bahia	Souza, C. L., Thoméb, R. C.	2006	Brazil	Announcers	Not validated
Health complaints in university professors and their relationship with risk factors present in the organization of work	Spea, E. A., Arbach, M. D. P.	2011	Brazil	University professors	Validated Vocal Production Condition – Teacher (VPC-T)
Prevalence of voice problems in priests and some risk factors contributing to them	Hagelberg, A. M., Simberg, S.	2015	Finland	Priests	Not validated
Prevalence of Voice Disorders and Associated Risk Factors in Teachers and Nonteachers in Iran	Seifpanahi, S. et al.	2016	Iran	Primary and secondary school teachers	Not validated
Prevalence of and Risk Factors for Self-reported Voice Problems Among Hindu Temple Priests	Devadas, U., Hegde, M., Maruthy, S.	2019	India	Priests of Hindu temples	Validated Own of the study
Prevalence and Risk Factors of Voice Problems Among Primary School Teachers in India	Devadas, U., Bellur, R., Maruthy, S.	2017	India	Elementary School Teachers	Not validated
Prevalence and Influencing Risk Factors of Voice Problems in Priests in Kerala	Devadas, U., Navya, J., Gunjawate, D.	2016	India	Priests	Not validated
Phonotraumatic Injury in Fitness Instructors: Risk Factors, Diagnoses, and Treatment Methods	Estes, C., Sadoughi, B., Coleman, R., D'Angelo, D., Sulica, L.	2020	United States (New York)	Fitness instructors	Validated *Voice Handicap Index-10* (VHI-10)
Kuwaiti Teachers Perceptions of Voice Handicap	Albustan, S. A., Marie, B. S., Natour, Y. S., Darawsheh, W. B.	2018	Kuwait	Teachers	Validated *Voice Handicap Index-10* (VHI-10)
Inadequate vocal hygiene habits associated with the presence of self-reported voice symptoms in telemarketers	Fuentes-López, E., Fuente, A., Contreras, K. V.	2017	Chile	Call Center *Operators*	Validated Own of the study
Four-day Follow-up Study on the Self-reported Voice Condition and Noise Condition of Teachers: Relationship Between Vocal Parameters and Classroom Acoustics	Cantor Cutiva, L. C. et al.	2019	Italy,	Teachers	Not validated
Factors associated with voice disorders in female teachers	Araújo, T. M.	2011	Brazil	Preschool and elementary school teachers	Both *Job Content Questionnaire* (JCQ)
Factors associated with voice disorders among teachers: a case-control study	Giannini, S. P. P., Latorre, M. R. D. O., Ferreira, L. P.	2013	Brazil	Teachers	Validated Vocal- Production Condition- Teacher (VPC-T), *Job Stress Scale* (JSS) and Work Ability Index (WAI)
Correlations between environmental conditions, work organization, vocal symptoms self-reported by university professors, and speech-language pathology evaluation	Servilha, E. A. M., & Correia, J. M.	2014	Brazil	University professors	Validated Vocal Production Condition-Teacher (VPC-T)
Connections between voice ergonomic risk factors and voice symptoms, voice handicap, and respiratory tract diseases	Rantala, L. M., Suvi J. Hakala, S. J., Holmqvist, S., Room, E.	2012	Finland	Elementary School Teachers	Both *Voice Ergonomic Assessment in Work Environment — Handbook and Checklist* (VEAW), *Voice Handicap Index-10* (VHI-10)
Clinical, sociodemographic, and occupational characteristics of teachers with dysphonia	Bassi, I. B., Assunção, A. A., Gama, A. C. C., & Gonçalves, L. G.	2011	Brazil	Teachers	Both Participation and Vocal Activities (VAPP)
Analysis of the vocal health of pastors of Seventh-day Adventist churches	Palheta Neto, F. X. et al.	2014	Brazil	Pastors	Not validated

Chart 1. Continued...

Title	Author	Year	Locality	Spoken Voice Professional	Characteristics of the self-assessment protocol used
Vocal illness in teachers and strategies to overcome it	Servilha, E. A. M., Mestre, L. R.	2009	Brazil	Teachers	Validated Vocal Production Condition-Teacher (VPC-T)
Relation between voice disorders and work in a group of Community Health Workers	Cyprian, F. G., Ferreira, L. P., Spea, E. A. M., Marsiglia, R. M. G.	2013	Brazil	Community Health Workers	Adapted Vocal Production Conditions – Teacher (VPC-T)
Prevalence and risk factors associated with communicative changes in street vendors in Popayán, Colombia	Palacios-Pérez, A. T., Sierra-Torres, C. H.	2014	Colombia	Hawkers	Both Wilson's Vocal Profile
Occupational Context, Vocal Abuse and Misuse in Teachers of the City of Iquique	Pino, K. M. M. et al.	2018	Chile	Teachers	Not validated
Factors associated with self-reported voice complaints by community health workers	Myrtle, J. A. N. et al.	2020	Brazil	Community Health Workers	Both Voice Disorder Screening Index (VDSI), State-Trait Anxiety Inventory (STAI)
Prevalence of vocal complaints and study of associated factors in a sample of elementary school teachers in Maceió, Alagoas State, Brazil	Alves, L. P., Araújo, L. T. R., Xavier Neto, J. A.	2010	Brazil	Elementary School Teachers	Not validated
Vocal production conditions of teleoperators: correlation between health issues, habits, and vocal symptoms	Ferreira, L. P. et al.	2008	Brazil	Teleoperators	Not validated
Prevalence of voice alteration in educators and its relationship with Self-perception	Simões, M., Latorre, M. R. D. O.	2006	Brazil	Nursery school teachers	In the process of validation Vocal Production Conditions – Teacher (VPC-T)
Impact of telehealth work activity on vocal symptoms and complaints: an analytical study	Rechenberg, L., Goulart, B. N. G., Roithmann, R.	2011	Brazil	Teleoperators	Adapted Jones et al.
Voice complaints in community health agents: correlation between general health problems, lifestyle habits, and vocal aspects	Cyprian, F. G., Ferreira, L. P.	2011	Brazil	Community Health Workers	Validated Vocal Production Conditions – Teacher (VPC-T)
Evaluation of risk factors for voice disorders in teachers and vocal acoustic analysis as an epidemiological assessment tool	Pizolato, R. A. et al.	2013	Brazil	Primary and secondary school teachers	Validated Vocal Production Conditions – Teacher (VPC-T)
Voice disorder and stress in the teaching work: a case-control study	Giannini, S. P. P., Latorre, M. R. D. O., Ferreira, L. P.	2013	Brazil	Kindergarten, primary, and secondary school teachers	Validated *Grade, Roughness, Breathiness, Asteny, Strain, Instability* (GRBASI), Vocal Production Condition – Teacher (VPC-T), *Job Stress Scale* (JSS)
Voice symptoms of call center customer service advisers experienced during a work-day and effects of a short vocal training course	Lehto, L., Paavo Alku, P., Tom Backstro, T., Vilkman, E.	2005	Finland	Teleoperators	Not validated
Associations between voice ergonomic risk factors and acoustic features of the voice	Rantala, L. M., Hakala, S., Holmqvist, S., Room, E.	2013	Finland	Teachers	Validated *Voice Ergonomic Assessment in Work Environment — Handbook and Checklist, Voice Handicap Index-10* (VHI-10)
Determinants of voice-related symptoms and complaints in different categories of teachers: The importance of the psycho-emotional component	Dejonkere, P. H.	2011	Belgium	Teachers	Validated *Voice handicap Index-10* (VHI-10)
School teachers, vocal use, risk factors, and voice disorder prevalence: Guidelines to detect teachers with current voice problems	Alvear, R. M. B., Baron, F. J. B., Martínez-Arquero, A. G.	2011	Spain	Teachers	Not validated
Voice problems experienced by Finnish comprehensive school teachers and realization of occupational health care	Smolander, S., Huttunen, K.	2006	Finland	Teachers	Not validated
Voice Disorder and Burnout Syndrome in Teachers	Mota, A. F. B. et al.	2019	Brazil	Teachers	Validated Vocal Production Teacher Condition (VPC-T), Screening Index for Voice Disorder (SIVD), and Burnout Syndrome Assessment Questionnaire (BSAQ)
Analysis of teacher working environment: factors that influence the voice	Cediel, M. R., Neira, J. A. R.	2014	Colombia	Elementary School Teachers	Not validated
Incidence of Voice Disorders among Private School Teachers in Taiwan: A Nationwide Longitudinal Study	Chen, B. L., Cheng, Y. Y., Lin, C. Y., Guo, H. R.	2022	China	Elementary, secondary, and university private school teachers	Not validated

Table 1. Qualitative variables related to the characteristics of the results of the selected studies

Variable	n	%
Years of publication	58	100
2014-2022	36	62.1
2005-2013	22	37.9
Country of study		
Brazil	27	46.5
Finland	7	12.1
India	6	10.3
Chile	2	3.4
Colombia	2	3.4
Belgium	1	1.7
China	1	1.7
Cyprus	1	1.7
Ireland (Dublin)	1	1.7
Egypt	1	1.7
Spain	1	1.7
France	1	1.7
United States (Illinois)	1	1.7
Iran	1	1.7
Italy	1	1.7
Kuwait	1	1.7
United States (New York)	1	1.7
New Zealand	1	1.7
United Kingdom	1	1.7
Study design	58	100
Transverse	47	81
Case-control	5	8.6
Not informed	3	5.2
Longitudinal	3	5.2
Spoken Voice Pros	58	100
Teacher	39	67.2
Teleoperator	5	8.6
Community Health Worker	3	5.2
Priest	2	3.4
Announcer	1	1.7
Audiologist	1	1.7
Journalist	1	1.7
Fitness Instructor	1	1.7
Priest	1	1.7
Call Center *Operator*	1	1.7
Herdsman	1	1.7
Peddler	1	1.7

Subtitle: n = Number of studies; % = Percentage

Table 2. Methods and techniques of voice assessment used in the articles found

Variable	n	%
Evaluation	15	25.8
Auditory-perceptual	6	10.3
Laryngeal examination	6	10.3
Acoustics	3	5.2
Self-Assessment	58	100
Validated protocol	23	39.6
VPC-T	12	20.6
VHI-10	11	18.9
Protocol Not Validated	19	32.8
Both (Validated and Non-Validated Protocol)	15	25.9
Not informed	1	1.7

Subtitle: n = Number of studies; % = Percentage; VPC-T = Vocal Production Condition – Teacher; VHI-10 = Vocal Handicap Index-10

Table 3. Quantitative risk factors for dysphonia and vocal symptoms located in the selected articles

Variable	n	%
Endogenous (individual) factors	55	94.8
Exogenous (Organizational) factors	54	93.1
Exogenous (Environmental) Factors	40	69
Sensory symptoms	45	77.6
Auditory symptoms	43	74.1
Both (sensory and auditory symptoms)	28	48.3

Subtitle: n = Number of studies; % = Percentage

DISCUSSION

This integrative review study sought to identify evidence in the literature of the link between work-related risk factors and voice disorders. Furthermore, it aimed to point out the symptoms, instruments, and assessment methods in spoken voice professionals.

The articles included in this review were predominantly carried out in Latin America, specifically in Brazil, with the highest number of publications between 2014 and 2022. It is believed that the interest in the study of this population of voice professionals by the scientific community in Brazil is due to the historical-political movement, debates among occupational health professionals, Reference Centers for Workers' Health (Centro de Referência em Saúde do Trabalhador - CERESTs), universities, associations, legal professions, speech therapists, and others, for the recognition of WRVD amid environmental conditions and the organization of the work process[8,22].

Regarding the design, there was a greater number of cross-sectional observational studies. In cross-sectional studies, the frequency with which a given event manifests itself in a specific population and the associated factors are estimated at the same historical moment without the researcher's intervention[23]. Thus, some studies aimed to verify the prevalence, i.e., the number of cases existing at a given moment[9,10,16,24-27]. Other studies investigated the association of risk factors for voice disorders in the many categories of spoken voice professionals[11,28-30].

The most investigated professional category was that of teachers[31-33] of kindergarten, elementary school, high school, or university level. It is the category with the highest prevalence of voice disorder when compared to other spoken voice professionals. The intensive use of the voice, in addition to the working conditions, such as environmental noise, aspects related to dust, cleanliness, lighting, room size, workload, and individual factors, such as respiratory allergies and stress, among others, generate a higher risk for the development of voice disorders[32,33].

Vocal self-assessment was used in all studies in this review, obtained through the application of protocols. It is widely used and conceptualized in clinical practice and research in the area, helps in the patient's perception, and enables self-knowledge regarding a given condition[34]. The instrument most applied in the articles selected for this review was the Vocal Production Conditions - Teacher (VPC-T), elaborated and validated[35], which investigates sociodemographic aspects, teachers' working conditions, vocal aspects/habits, and lifestyle.

Through the VPC-T, studies have verified the self-reported findings of the teachers' population, with an association between vocal symptoms, voice disorders, and working conditions[12,14,36,37]. Another study[38] did not find a significant relationship between voice disorders and working conditions and pointed out the situation of violence against teachers at school. Furthermore, some studies evaluated the relationship between voice-related disorders and mental health. We highlight a study that applied the VPC-T protocols with the *Job Stress Scale* (JSS) and Work Ability Index (WAI), detecting the association of voice disorders with stress and loss/limitation of work ability[33]. Another study applied the Screening Index for Voice Disorder (SIVD) and the Burnout Syndrome Assessment Questionnaire (BSAQ) combined with the VPC-T. It identified that Burnout syndrome was associated with a probable voice disorder[39].

Moreover, the VPC-T was adapted and used in research with several voice professionals, such as in the category of health agents. They found an association between the development of voice disorders and environmental factors, such as dust, temperature, and work organization. Among those reported, intensive use of the voice, taking work home, intense physical exertion, inadequate furniture, physical and psychological violence/aggression, and complaints related to vocal and emotional symptoms and back pain stand out[40,41].

This review included another protocol, the Vocal Handicap Index (VHI-10)[13,42,43]. It is a shortened version of the VHI, designed to assess the self-perception of the impact of a voice disorder, validated and originated from English and then adapted and validated in other languages, such as Brazilian Portuguese[44]. It is not specifically indicated for the occupational context because it does not present domains related to working conditions. Furthermore, it is worth mentioning the Screening Index for Voice Disorders (SIVD)[45], validated for vocal screening for the risk of voice disorders in the presence of vocal symptoms[38,39].

Studies that applied the VHI-10 with spoken voice professionals, teachers[42,46], and fitness instructors[13] showed changes in individual factors. These include respiratory infections, cough, throat clearing, frequent stress, vocal abuse, and use of medications, in addition to the prevalence being female and elementary school. Regarding the data concerning environmental conditions, another elaborated protocol (not validated) developed by the authors was applied.

It is worth noting that, when investigating the validation of the evaluation protocols used in the selected studies, the authors elaborated part of the instruments to verify the individual aspects related to voice, environment, and working conditions. However, regardless of the point to be analyzed, some protocols did not go through the validation process. Thus, choosing a validated instrument with psychometric properties is important to ensure accuracy, specificity, sensitivity, reliability, and safety in clinical investigation and diagnosis. Moreover, it is important to ensure the population results with scientifically robust measures[47].

As pointed out in the evaluation methods of the selected studies, the auditory-perceptual assessment has been the main reference standard for characterizing the parameters of voice quality, identifying and measuring the intensity of the deviation and the phonatory pattern of vocal production[12,26,33,48,49].

Another evaluation method observed was the laryngological examination[12,13,33,48,49], which is performed by an otorhinolaryngologist and evaluates the anatomical and physiological aspects of the larynx, especially the vocal folds to diagnose the presence or absence of laryngeal lesions[18].

In this review, the results showed that, among the individual risk factors, the presence of respiratory alterations (allergies and asthma), being female, and having inadequate vocal habits[6,9,11,29,30,50-54] predominated. In studies with teachers, vocal symptoms were associated with respiratory alterations since inadequate breathing causes fatigue in speech, which can have repercussions on voice projection and resonance. This effect induces an increase in overload throughout the vocal tract[36,55].

Female spoken voice professionals are more predisposed to vocal problems when compared to male voices. It is believed that this fact is due to hormonal and anatomical issues, work requirements, and the role of women in society[5,7,49,56]. However, a study with community health agents with and without vocal complaints observed no significant difference[40].

Inadequate vocal habits were another very evident aspect in this population[5,6,9,29,36,52,53,57-59]. A study with Hindu priests showed a significant association between voice problems, vocal abuse, and high-intensity vocal production, in addition to the lack of vocal rest in cases of throat pain[25]. The complaint was also mentioned by street vendors, community health agents, and teachers[7,41,56,57], showing that individual characteristics may be associated with other risk factors in work activity, such as the intensive use of the voice self-reported by several categories of spoken voice professionals.

In a study with teachers[13,24,36,48-50,60], the authors concluded that voice disorder is triggered by the intensive and continuous use of the voice, with the possibility of the occurrence of lesions in the vocal folds[48,60]. In addition, there is a lack of training and sound amplification resources[13,24,49,50].

Another organizational factor highlighted in this review associated with voice disorders comprised issues related to mental health, such as stress. This fact is believed to be due to unfavorable working conditions[33,61].

Regarding the environmental working conditions, noise was the most frequent risk factor related to complaints of voice disorders[6,9,11,17,29,32,36,52,59,62-64]. A study conducted with teleservice operators revealed that most teleservice operators who work in noisy environments complain of voice disorders[4] and high levels of background noise in the classroom[65]. Another study did not present the same data on environmental factors for dysphonia[62]. This result may be characteristic of implementing risk control measures since this frequent exposure damages vocal production and causes vocal illness due to increased vocal intensity and overload.

It is understood that vocal illness and dysphonia are symptoms related to voice disorders, may present insidious onset, and do not depend on the presence or absence of vocal fold lesions[18]. This vocal symptom can be classified as sensory or auditory[2].

Regarding the auditory vocal symptom, the most frequently reported by spoken voice professionals in this review was hoarseness[5,11,29,36,46,50,57,58], followed by voice loss[58,61]. Hoarseness is characterized as the sensation of irregularity in vocal quality, and both are consequences of vocal overload, affecting the vocal tract and folds. A study also pointed to an association with inadequate vocal habits[57].

The most frequently reported sensory vocal symptoms included dry throat, throat clearing, and vocal fatigue[26,35,39,40,63]. This result can be justified by the fact that some of the populations, such as journalists, teachers, community health agents, and teleoperators, use their voices in environmental conditions and work organization in an unfavorable way, in addition to the individual's conditions[26,35,39,40,63]. In agreement with this information, the authors mention the work routine as one of the factors of vocal illness in the category of priests in India since the dry throat and vocal fatigue symptoms stem from respiratory infections due to exposure to cold temperatures and the smoke responsible for irritating the lining of the nasal mucosa and vocal tract[25]. Furthermore, there is the presence of gastroesophageal reflux disease (GERD)[10,56,65,66].

In the studies included in this review, no standardized and validated self-assessment protocol encompassed the many categories of speaking voice professionals, hindering the analysis and reliability of the results for occupational voice disorder. Another limitation identified included the absence of specification of the items in the self-assessment protocols and the high heterogeneity in the application of the protocols, some of which were not validated and specific for this population group. It is worth mentioning that individual factors alone do not characterize WRVD. They must be related to organizational and environmental aspects.

Based on the results, further studies should be carried out for the development of validated, safe, and reliable instruments that allow the investigation of WRVD in the full multifactorial context for this category of voice professionals, being fundamental for the analysis and decision-making of the speech-language pathologist for this population.

CONCLUSION

The link between individual and external work conditions and the genesis and/or maintenance of vocal symptoms/disorders is perceived. The most frequent evaluation method is the application of a validated self-assessment instrument.

It is verified that the WRVD has a significant relationship with factors of the environment and work organization. Noise and intensive use of the voice are the most self-reported, in addition to individual risk factors, such as respiratory disorders, being female, and inadequate vocal habits. Hoarseness is the most frequently mentioned auditory vocal symptom. Dry throat, throat clearing, and vocal fatigue are the most frequently mentioned sensory vocal symptoms.

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