Design, building and validation of an instrument to assess occupational dysphonia risk

Diseño, construcción y validación de un instrumento para evaluar el riesgo de disfonía ocupacional

Carlos Alberto Calvache-Mora,[1*] Jennifer Zarate-Serna.[1]

Abstract

Objective: to design and validate an instrument that enables self-reported risk assessment for occupational dysphonia.

Method: transversal design, exploratory type of evaluative nature. Four phases were developed: (1) consolidation of the conceptual framework of occupational dysphonia risk; (2) design of the instrument; (3) judge evaluation - content validity; and, (4) application of the instrument, reliability.

Results: The Assessment Instrument for Risk of Occupational Dysphonia - AIROD is composed of 25 items, distributed into 5 categories established by Risk Factors assessed on a Likert scale. The statistical test yielded a modified Lawshe's index of 0.853 and a Cronbach's Alpha of 0.809. A review of the literature is provided to support the conceptualization of risk factors related to occupational dysphonia.

Conclusions: AIROD becomes an objective tool designed and validated to measure the risk of occupational dysphonia. It enables a self-reported identification of the risks a person who uses his or her voice as a work tool may be exposed to.

Keywords: .occupational dysphonia, voice, risk factor, assessment instrument

*Correspondence: Carlos Alberto Calvache Mora. Corporación Universitaria Iberoamericana, Communication Sciences and Disorders Department, Bogota, Colombia. Calle 67 # 5 - 27. Email: carlos.calvache@ibero.edu.co

[1] Corporación Universitaria Iberoamericana, Communication Sciences and Disorders Department, Bogotá, Colombia

Resumen

Objetivo: Diseñar y validar un instrumento que permita la evaluación autorreportada de riesgos para disfonía ocupacional.

Método: Diseño transversal, tipo exploratorio de carácter evaluativo. Se desarrollaron 4 fases: (1) consolidación del marco conceptual del riesgo de disfonía ocupacional; (2) diseño del instrumento; (3) evaluación de jueces - validez de Contenido; y (4) aplicación del instrumento, confiabilidad.

Resultados: El Instrumento para la Evaluación del Riesgo de Disfonía Ocupacional – INERDOC está conformado por 25 ítems, distribuidos en 5 categorías establecidas por factores de riesgo evaluados a través de una escala tipo Likert. La prueba estadística arrojo un índice de Lawshe modificado de 0.853 y un Alpha de Cronbach de 0.809. Se entrega una revisión de la literatura como soporte de la conceptualización de los factores de riesgo relacionados con disfonía ocupacional.

Conclusiones: INERDOC se convierte en una herramienta objetiva diseñada y validada para medir el riesgo de una disfonía ocupacional. Permite identificar de forma autorreportada los riesgos a los que puede estar expuesta una persona que utilice su voz como herramienta de trabajo.

Palabras clave: Disfonía Ocupacional, Voz, Factor de Riesgo, Instrumento de Evaluación.

Introduction

In modern society, the number of people who use their voice as a work tool continues to increase. Professionals such as teachers, singers, gym instructors, counselors, oral narrators, lecturers, priests, politicians, call center agents, among others, depend on the quality of their voice for effective communication, which makes voice the main tool of their professional activity.[1] An alteration in the voice of these professionals can directly interfere with work activities and, in this way, cause economic and production difficulties for both workers and contracting companies.[2]

Voice deficiencies related to its use at the workplace are often anteced by long-lasting non-organic voice disorders, a deficiency known as functional dysphonia; untreated functional dysphonia often leads to irreversible laryngeal lesions, such as nodules, polyps, hypertrophy, among other alterations that disturb the vocal condition.[3]

To make an effective diagnosis of the occupational voice, Speech Language Pathologists must have clinical experience that enables them to clearly recognize the origin of the deficiency. That is, in the case of voice professionals make a

differential diagnosis of vocal deficiencies (organic and / or functional) between those which do not have an occupational origin and those related to the high burden of the voice and to other risk factors associated with the occupation of the person. Institutions, agreements or decrees have been set up as regards occupational diseases; these consider actions to prevent dysphonia and promote vocal health; however, not all Latin American countries officially recognize occupational dysphonia as an occupational disease.[4]

In addition to this, there are few international protocols or reports defined in relation to the objective way to assess the severity of occupational dysphonia, and fewer on the objective way to evaluate the risk factors for occupational dysphonia. Currently, referring to the existing medical legal guidelines, doctors and insurance experts generally quantify the level of disability due to dysphonia on a scale from 1% to 10% (in extreme cases up to 30%).[5] However, literature on the development of accurate instruments for such measurement is very scarce.

Clinical methods to assess occupational dysphonia include laryngeal videostroboscopy, aerodynamic measurement tests, electroglottography, acoustic voice analysis, as well as self-report instruments for the recognition of vocal deficiencies.[6,7] Dysphonia from occupational origin requires a meticulous and complex examination, which must include the subjective self-evaluation of the patients as regards the characteristics of their dysphonia, habits and risk factors for vocal alteration.[3] Currently, there are not many standardized methods for occupational voice self-assessment; one of the most popular and widely used vocal self-perception scales is the Voice Handicap Index,[8,9] however this is not enough to determine the occupational risk of dysphonia.

Objective: to design and validate AIROD. A self-report type instrument, which allows identifying occupational dysphonia risks, based on the categories defined by the Colombian Occupational Health and Safety Management System;[10] the Technical Guide for the Identification of Hazards and Assessment of Occupational Health and Safety Risks;[11] and, the Technical Guide for the Analysis of Exposure to Occupational Risk Factors for the Qualification of Origin of Occupational Illness.[12]

Methods

Cross-sectional, exploratory type of evaluative design that allows establishing characteristics for the phenomenon under analysis and generating an instrument for its assessment.[13]

Instrument design and validation procedure were as following:

Phase I. Conceptual framework of the risk of occupational dysphonia: a systematic review of the literature was carried out in order to conceptually support the concepts addressed in the research, with a view to having a basic conceptual framework for the creation of the instrument. This systematization was developed through a matrix that included data related to year, authors, language, journal, research objective, method and results of scientific articles, which dealt with the subject under study, found in the databases Pubmed, EBSCOHost, Scopus and Web of Science. The keywords used for the search were "occupational voice", "occupational risk", "occupational dysphonia", in Spanish, English and Portuguese. The time window for analysis was between 2010 and 2018.

Phase II. Design of the instrument: based on the matrix consolidated in phase I and the categories

defined by the Colombian Occupational Health and Safety Management System,[10] the Technical Guide for the Identification of Hazards and the Assessment of Occupational Health and Safety Risks,[11] and the Technical Guide for the Analysis of Exposure to Occupational Risk Factors for the Qualification of Origin of Occupational Illness,[12] 5 risk categories and 5 items for each were defined to assess the risk of occupational dysphonia. The construction of each item in each category is supported by the literature, summarized as citations of the systematic review carried out in phase I.

Phase III. Judge evaluation - Content validity: 5 expert judges with the following professional profile were summoned: speech-language pathologist, specialist in work health and safety, with certified expertise of at least 5 years in the voice area. Each evaluator signed an informed consent to preserve the confidentiality of the research. The instrument was delivered to each judge; the evaluation was carried out with the following rubric, applied to each of the items of the instrument by category (Table 1).

Table 1. Assessment categories for each item

CATEGORIE	*DEFINITION*	CALIFICATION		
		1: Does not meet the criteria	**2: Moderate level**	**3: High level**
SUFFICIENCY	The item allows to measure dimension sufficiently.	The item is not sufficient to measure the dimension.	The item must be complemented to be able to evaluate the dimension in a comprehensive way.	The item is enough.
COHERENCE	The item is logically related to the dimension or indicator that it is measuring.	The item has no logical relationship with the dimension.	The item has a moderate relationship with the dimension that is measuring.	The item is completely related to the dimension you are measuring.
RELEVANCE	The item is essential or important, that is, it must be included.	The item can be removed without affecting the dimension measurement.	The item is relatively important.	The item is truly relevant and must be included.
CLARITY	The item is easily understood, that is, its syntactics and semantics are adequate.	The item is not clear.	An awfully specific modification of some of the terms of the item is required.	The item is clear, has adequate semantics and syntax.

For content validity, Lawshe's Index was used, a model that consists in organizing an assessment panel of specialists in the task to be assessed; in order to evaluate the Content Validity Ratio (CVR), it was decided to work with the Lawshe's criteria modified by Tristán,[14] in three categories: essential, useful but not essential, and not necessary. Content validity ratio (CVR and CVR') was determined for each of the items using the equations described in Lawshe's model; equation 1 is the formula to ascertain the content validity ratio for each item (CVR);[15] equation 2, the formula to find out the content validity ratio for each item following Lawshe's model modified by Tristán;[14,15] finally, equation 3 produces the content validity index.

(1) $CVR = \dfrac{n_e - N/2}{N/2}$

Where, n_e corresponds to the number of experts who agree on the essential category and N to the total number of experts.

(2) $CVR' = \dfrac{CVR + 1}{2}$

Where, CVR corresponds to the content validity ratio of each item and N to the total number of experts.

(3) $CVI = \dfrac{\sum_{i=1}^{M} CVRi}{M}$

Where CVRi is the content validity ratio of the acceptable items according to Lawshe's criteria and M to the total acceptable items in the instrument.

Items whose CVR is greater than or equal to 0.58 are considered acceptable (Table 2).[14] These items are the ones that can become parts of the instrument or item bank. Unaccepted items must be reviewed, corrected and submitted to the judges for a new opinion.

Table 2. Minimum CVR values for Lawshe's coefficients modified by Tristán

Panelists	Agreements in "essential"	Number of Agreements	r	CVR
2	2	0	1.00	1.00
3	2	1	0.33	0.67
4	3	1	0.50	0.75
5	3	2	0.20	0.60
6	4	2	0.33	0.67
7	5	2	0.43	0.71
8	5	3	0.25	0.63

From this evaluation by the judges, the instrument was adjusted taking into account the qualifications and observations received; those adjustments were aimed at unifying criteria and modifying some items to achieve sufficiency, coherence, relevance and clarity when piloting the instrument.

Phase IV. Application of the instrument - Reliability of the Instrument: the piloting of the instrument was carried out with 15 workers from a call center in the private sector, aged between 18 and 37 years and from various socioeconomic strata; they had a registration time of 25 minutes. All the participants were workers who use their voice as a work tool for long periods of time (8 hours a day).

The reliability of the internal consistency of the instrument was estimated with Cronbach's Alpha. This measure assumes that the items (on a Likert-type scale) measure the same construct and are highly correlated. The closer the alpha value is to 1, the greater the internal consistency of the items analyzed. For the present study, the value estimated by Huh J. *et al*.[16] is taken as the base value of significance, as they affirm that the value of reliability in exploratory research must be equal to or greater than 0.6.

Results

In the conceptual framework phase of the risk of occupational dysphonia, 30 articles included in the literature review became support for the construction of the instrument. Each category and, in turn, each item were theoretical supported on a citation from the literature review. Table 3 shows information on the 30 articles used in the conceptual framework of the instrument produced.

Table 3. Articles consolidated in the systematic review of the literature

Nº	TITLE	YEAR	JOURNAL	COUNTRY	TYPE OF STUDY	BIBLIOGRAPHIC REFERENCE
1	Work-related voice disorder	2015	Revista brasileira de otorrinolaringologia	Brasil	Bibliographic review	Przysiezny, P. E., & Przysiezny, L. T. S. (2015). Work-related voice disorder. Brazilian journal of otorhinolaryngology, 81(2), 202-211.
2	Applicability of the vocal tract discomfort (VTD) scale in evaluating the effects of voice therapy of occupational voice disorders.	2012	Medycyna Pracy	Polonia	Descriptive-Comparative	Woźnicka, E., Niebudek-Bogusz, E., Kwiecień, J., Wiktorowicz, J., & Śliwińska-Kowalska, M. (2012). Applicability of the vocal tract discomfort (VTD) scale in evaluating the effects of voice therapy of occupational voice disorders. Med Pr, 63(2), 141-52.
3	Factores ambientales y hábitos vocales en docentes y funcionarios de pre-escolar con alteraciones de voz	2011	Salud Pública	Colombia	Descriptive transversal	Barrreto-Munévar, D. P., Cháux-Ramos, O. M., Estrada-Rangel, M. A., Sánchez-Morales, J., Moreno-Angarita, M., & Camargo-Mendoza, M. (2011). Factores ambientales y hábitos vocales en docentes y funcionarios de pre-escolar con alteraciones de voz. Revista de Salud Pública, 13(3).
4	Evaluation of the results of the prevention program "protect your voice" implemented by the greater poland center of occupational medicine of poznań	2017	Medycyna Pracy	Polonia	Descriptive transversal	Jalowska, M., Wośkowiak, G., & Wiskirska-Woźnica, B. (2017). Evaluation of the results of the prevention program" Protect your voice" implemented by The Greater Poland Center of Occupational Medicine of Poznan. Medycyna pracy, 68(5), 593-603.
5	Study of Risk Factors for Development of Voice Disorders and its Impact on the Quality of Life of School Teachers in Mangalore, India	2017	journal of clinical and diagnostic research	India	Transversal	Alva, A., MAchAdo, M., Bhojwani, K., & SrEEdhArAN, S. (2017). Study of risk factors for development of voice disorders and its impact on the quality of life of school teachers in mangalore, India. Journal of clinical and diagnostic research: JCDR, 11(1), MC01.

Nº	TITLE	YEAR	JOURNAL	COUNTRY	TYPE OF STUDY	BIBLIOGRAPHIC REFERENCE
6	Dores corporais em teleoperadores e sua relação com o uso da voz em atividades laborais	2012	Revista brasileira de otorrinolaringologia	Brasil	Descriptive	Constancio, S., Moreti, F., Guerrieri, A. C., & Behlau, M. (2012). Dores corporais em teleoperadores e sua relação com o uso da voz em atividades laborais; Body aches in call center operators and the relationship with voice use during work activities. Rev Soc Bras Fonoaudiol, 17(4), 377-384.
7	Voice disorders in teachers. Implications for occupational health nursing care	2013	Investigación y Educación en enfermería	Brasil	Quantitative Exploratory	Vaz, C., Regina, M., de Oliveira Severo, L., Miritz Borges, A., Alves Bonow, C., Pereira Rocha, L., & de Almeida, M. C. V. (2013). Voice disorders in teachers. Implications for occupational health nursing care. Investigación y Educación en Enfermería, 31(2), 252-260.
8	Relation between voice disorders and work in a group of Community Health Workers	2013	CoDAS	Brasil	Analitic	Cipriano, F. G., Ferreira, L. P., Servilha, E. A. M., & Marsiglia, R. M. G. (2013). Relation between voice disorders and work in a group of Community Health Workers. In CoDAS (Vol. 25, No. 6, pp. 548-556). Sociedade Brasileira de Fonoaudiologia.
9	Biofeedback on Voice Use in Call Center Agents in Order to Prevent Occupational Voice Disorders	2012	Journal of voice	Austria	Prospective	Schneider-Stickler, B., Knell, C., Aichstill, B., & Jocher, W. (2012). Biofeedback on voice use in call center agents in order to prevent occupational voice disorders. Journal of Voice, 26(1), 51-62.
10	Dysphonia risk screening protocol.	2016	Clinical Science	Brasil	Exploratory	Nemr, K., Simões-Zenari, M., Duarte, J. M. D. T., Lobrigate, K. E., & Bagatini, F. A. (2016). Dysphonia risk screening protocol. Clinics, 71(3), 114-127.
11	Ali je glasovna motnja lahko tudi poklicna bolezen?	2012	Zdrav Vestn	Eslovenia	Bibliographic review	Gluvajić, D., Bilban, M., & Hočevar Boltežar, I. (2012). Ali je glasovna motnja lahko tudi poklicna bolezen. Zdrav Vestn, 81, 796-805.
12	Prevalence and Influencing Risk Factors of Voice Problems in Priests in Kerala	2016	Journal of voice	India	Descriptive	Devadas, U., Jose, N., & Gunjawate, D. (2016). Prevalence and Influencing Risk Factors of Voice Problems in Priests in Kerala. Journal of Voice, 30(6), 771-e27.

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Nº	TITLE	YEAR	JOURNAL	COUNTRY	TYPE OF STUDY	BIBLIOGRAPHIC REFERENCE
13	Correlation of the Dysphonia Severity Index (DSI), Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V), and Gender in Brazilians With and Without Voice Disorders	2016	Journal of voice	Brasil	Analitic	Nemr, K., Simões-Zenari, M., de Souza, G. S., Hachiya, A., & Tsuji, D. H. (2016). Correlation of the Dysphonia Severity Index (DSI), Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V), and gender in Brazilians with and without voice disorders. Journal of Voice, 30(6), 765-e7
14	Prevalence of Voice Disorders and Associated Risk Factors in Teachers and Nonteachers in Iran.	2016	Journal of voice	Irán	Comparative	Seifpanahi, S., Izadi, F., Jamshidi, A. A., Torabinezhad, F., Sarrafzadeh, J., Sobhani-Rad, D., & Ganjuie, M. (2016). Prevalence of voice disorders and associated risk factors in teachers and nonteachers in Iran. Journal of Voice, 30(4), 506-e19.
15	Distúrbio de voz e estresse no trabalho docente: um estudo caso-controle	2012	Cadernos de Saude Pública	Brasil	Control case	Giannini, S. P. P., Latorre, M. D. R. D. D., & Ferreira, L. P. (2012). Distúrbio de voz e estresse no trabalho docente: um estudo caso-controle. Cadernos de Saúde Pública, 28(11), 2115-2124.
16	Evaluando la salud laboral de los docentes de centros concertados: el Cuestionario de Salud Docente	2015	Journal of work and organizational psychology	España	Exploratory	Fernández-Puig, V., Mayayo, J. L., Lusar, A. C., & Tejedor, C. V. (2015). Evaluando la salud laboral de los docentes de centros concertados: el Cuestionario de Salud Docente. Revista de Psicología del Trabajo y de las Organizaciones, 31(3), 175-185.
17	Analysis of possible factors of vocal interference during the teaching activity	2017	Revista de saúde pública	Brasil	Descriptive	Silva, B. G., Chammas, T. V., Zenari, M. S., Moreira, R. R., Samelli, A. G., & Nemr, K. (2017). Analysis of possible factors of vocal interference during the teaching activity. Revista de saude publica, 51, 124.
18	The Influence of Occupation on Self-perceived Vocal Problems in Patients with Voice Complaints	2017	Journal of voice	EEUU	Exploratory	Ebersole, B., Soni, R. S., Moran, K., Lango, M., Devarajan, K., & Jamal, N. (2017). The Influence of Occupation on Self-perceived Vocal Problems in Patients With Voice Complaints. Journal of Voice.

Nº	TITLE	YEAR	JOURNAL	COUNTRY	TYPE OF STUDY	BIBLIOGRAPHIC REFERENCE
19	Relationship between working and voice conditions self-reported by telemarketers of an emergency call center	2015	CoDAS	Brasil	Descriptive	Santos, C. T. D., Santos, C., Lopes, L. W., Silva, P. O. C., & Lima-Silva, M. F. B. D. (2016, October). Relationship between working and voice conditions self-reported by telemarketers of an emergency call center. In CoDAS (Vol. 28, No. 5, pp. 583-594). Sociedade Brasileira de Fonoaudiologia.
20	The Effect of Surface Hydration on Teachers' Voice Quality: An Intervention Study	2017	Journal of voice	Brasil	Exploratory	Santana, É. R., Masson, M. L. V., & Araújo, T. M. (2017). The effect of surface hydration on teachers' voice quality: an intervention study. Journal of Voice, 31(3), 383-e5.
21	Long-Time Voice Accumulation During Work, Leisure, and a Vocal Loading Task in Groups With Different Levels of Functional Voice Problems	2016	Journal of voice	Sweden	Descriptive	Whitling, S., Lyberg-Åhlander, V., & Rydell, R. (2017). Long-time voice accumulation during work, leisure, and a vocal loading task in groups with different levels of functional voice problems. Journal of Voice, 31(2), 246-e1.
22	Comparative Analysis of Characteristics of Voice Use Amidst Clergy	2017	Journal of voice	EEUU	Exploratory	Reed, J. P., & Sims, H. S. (2017). Comparative analysis of characteristics of voice use amidst clergy. Journal of Voice, 31(2), 256-e7.
23	Relação entre as condições de trabalho e de voz autorreferidas por teleoperadores de uma central de emergência	2016	CoDAS	Brasil	Descriptive	Santos, C. T., Santos, C., Lopes, L. W., Silva, P. O. C., & Bonfim, M. F. (2016). Relação entre as condições de trabalho e de voz autorreferidas por teleoperadores de uma central de emergência.
24	Relationship between working conditions and voice symptoms among operators of a model call center	2017	Audiol, Commun	Brasil	Descriptive	Girardi, B. B., Marchand, D. L. P., Moreira, T. D. C., Drummond, R. L., & Cassol, M. (2017). Relationship between working conditions and voice symptoms among operators of a model call center. Audiology-Communication Research, 22.
25	Questionário de Auto-avaliação Vocal: Instrumento Epidemiológico de Controle da Síndrome Disfônica Ocupacional em Professores	2010	International archives of otorhinolaryngology	Brasil	Exploratory	Almeida, S. I. C. D., Pontes, P., Bussacos, M. A., Neves, L., & Zambon, F. (2010). Questionário de auto-avaliação vocal: instrumento epidemiológico de controle da síndrome disfônica ocupacional em professores. Arquivos Internacionais de Otorrinolaringologia.

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N°	TITLE	YEAR	JOURNAL	COUNTRY	TYPE OF STUDY	BIBLIOGRAPHIC REFERENCE
26	Evaluación de desórdenes vocales en profesionales que usan su voz como herramienta de trabajo. Occupational Voice Quick Screening	2016	Revista Ciencias de la Salud	Colombia	Exploratory	Ruiz, J. N. F., & Martínez, J. A. C. (2016). Evaluación de desórdenes vocales en profesionales que usan su voz como herramienta de trabajo. Occupational Voice Quick Screening. Revista Ciencias de la Salud, 14, 97-112.
27	A Joyful Noise: The Vocal Health of Worship Leaders and Contemporary Christian Singers	2017	Journal of voice	EEUU	Exploratory	Neto, L., & Meyer, D. (2017). A joyful noise: The vocal health of worship leaders and contemporary Christian singers. Journal of Voice, 31(2), 250-e17.
28	Risk Factors of Voice Disorders and Impact of Vocal Hygiene Awareness Program Among Teachers in Public Schools in Egypt	2017	Journal of voice	Egipto	Descriptive	Bolbol, S. A., Zalat, M. M., Hammam, R. A., & Elnakeb, N. L. (2017). Risk Factors of Voice Disorders and Impact of Vocal Hygiene Awareness Program Among Teachers in Public Schools in Egypt. Journal of Voice, 31(2), 251-e9.
29	Evaluation of Singing Vocal Health in Yakshagana Singers	2017	Journal of voice	India	Exploratory	Gunjawate, D. R., Aithal, V. U., Devadas, U., & Guddattu, V. (2017). Evaluation of singing vocal health in Yakshagana singers. Journal of Voice, 31(2), 253-e13.
30	Working 9-5: Causal Relationships Between Singers' "Day Jobs" and Their Performance Work, With Implications for Vocal Health.	2017	Journal of voice	Australia	Descriptive	Bartlett, I., & Wilson, P. H. (2017). Working 9–5: Causal Relationships Between Singers'"Day Jobs" and Their Performance Work, With Implications for Vocal Health. Journal of Voice, 31(2), 243-e27.

AIROD comprises 25 items, distributed into 5 categories established by Risk Factors; the instrument assesses the risk of occupational dysphonia through the application of a Likert-type scale. The 5 categories are:

1. Personal habits: related to the performance of inappropriate practices that affect health. In the area of voice, they are evidenced by habits such as increased intensity, lack of hydration and constant throat clearing.

2. Biological: these are risks that are generated by the worker's exposure to biological secretions, microorganisms and toxins, which cause counterproductive effects on his or her health such as the development of allergic reactions.

3. Physical / environmental: those conditions that can produce changes in workers and that cannot be controlled by the employer; e.g., environmental and auditory noise pollution.

4. Labor: a set of elements that, being present in the working conditions, can trigger a decrease in the health of the worker, and can cause damage in the workplace.

5. Psychosocial: psychosocial conditions whose identification and evaluation show negative effects on the health of workers or at work (with aspects related to the use of voice).

In the upper part of the instrument, the worker is instructed on how to answer on a Likert scale: 0 = Absence; 1 = Minimum presence; 2 = Medium presence; and, 3 = High presence. After the questions, there is an observation item to report aspects such as the ergonomic conditions of the context, adverse events or important situations in their professional careers.

Lawshe's CVI: to determine if there was consensus among the experts, a CVR greater than 0.58 was considered. The result of the statistical test yielded a modified Lawshe's index of 0.853, which according to the interpretation given by Tristan-López is satisfactory.[14] Table 4 shows the global CVI value and that for each category evaluated in the instrument by the 5 judges, highlighting the categories "Relevance" and "Coherence", where a CVI of 0.942 and 0.985, respectively, was obtained. For their part, the categories "Clarity" and "Sufficiency" obtained a lower CVI, 0.728 and 0.757, respectively, though

still acceptable for the validity of the content of AIROD. Table 4 also shows the number of items to modify and to retain, plus the items to eliminate, according to the evaluation of the judges.

Table 4. Reason Validity of content Lawshe´s CVI

Criterion Evaluated	CVI Lawshe	Items to Modify	Items to Hold	Items to Delete
Relevancia	0,942	4	21	0
Claridad	0,728	12	13	0
Suficiencia	0,757	15	10	0
Coherencia	0,985	1	24	0
CVI Lawshe Global	*0,853*	-	-	-

Based on the results of Lawshe's CVI, the items to be modified were adjusted, taking into account the observations of the expert judges. The number of items or categories in the instrument did not change; adjustments in the wording of items with a lower rating in the categories "Clarity" and "Sufficiency" were applied.

Cronbach's alpha shows the reliability of the internal consistency of the instrument; the closer the alpha value to 1, the greater the consistency. Table 5 shows the scores of each of the items for the 15 subjects in the pilot test. With these scores, when applying the formula, a Cronbach's Alpha of 0.809 is obtained, which taking into account the interpretation given by Huh J. *et al.*, is suitable for an exploratory study (Table 6).

Table 5. Scores in the pilot test

Score per item in pilot test				
Item	*0 (Absence)*	*1 (Minimal presence)*	*2 (Medium presence)*	*3 (High presence)*
1	3	7	2	3
2	5	4	2	4
3	12	0	1	2
4	7	2	3	3
5	4	2	5	4
6	7	2	3	3
7	7	4	2	2
8	3	3	4	5
9	0	0	4	11
10	5	5	3	2
11	0	2	4	9
12	1	5	4	5
13	3	2	5	5
14	7	3	3	2
15	13	2	0	0
16	0	0	1	14
17	3	4	5	3
18	4	6	4	1
19	11	2	1	1
20	7	2	3	3
21	12	1	1	1
22	5	4	2	4
23	13	2	0	0
24	13	1	0	1
25	12	2	1	0

Table 6. Cronbach's Alpha

Cronbach's Alpha	*Number of elements*
0,809	15

Discussion

People with hyperfunctional dysphonia related to the use of voice at work are usually diagnosed by means of symptoms of vocal fatigue, a result of inadequate compensation of vocal load.[17,18] This discomfort experienced by workers is related to sensitivity and pain in the laryngeal and perilaryngeal structures. It is clear that prolonged and untreated dysphonia causes problems in the neuromuscular system of the larynx.[19,20] Such tension induces incoordination between breathing, phonation, resonance and articulation, an aspect that negatively affects the quality and efficiency of the voice in activities related to an individual's work.

These elements must be recognized in the workers in advance, and the way to do it is through an instrument that allows identifying the risk factors to reach such a vocal state. In the context of work health and safety, to date there is no standardized and validated instrument to assess the risk of occupational dysphonia. There are different self-report formats to assess different factors associated with voice alterations;[8,21–24] none that points to the field of occupational dysphonia in the Spanish language, though.

AIROD bridges a gap in the field of occupational voice; it becomes an easy and fast tool to determine and recognize risk factors of occupational dysphonia, it allows integrating worker health and safety management systems to preserve the voice and vocal health promotion plans and prevention of vocal deficiencies in organizations that watch over these factors in workers. [10-12]

The present study makes an important conceptual contribution in relation to the frame of reference on which the risk factors of occupational dysphonia should be based, it includes a systematic review of the literature that supports the creation of AIROD.[25–30]

Likewise, it broadens the perspective from which risk factors for occupational dysphonia must be presented; a perspective that began with studies developed in this field.[31–35]

Regarding the dimensions included in AI-ROD, this study was consistent with what was reported and defined by the Occupational Health and Safety Management System of Colombia;[10] the Technical Guide for the Identification of Hazards and the Assessment of Risks in Occupational Safety and Health;[11] and, the Technical Guide for the Analysis of Exposure to Occupational Risk Factors for the Qualification of Origin of Occupational Illness.[12] The categories of each risk defined in the instrument have conceptual support and are included in Colombia's legal framework of health and safety systems at work.

None of the tools currently created for our country describes, theoretically supports and evaluates the risks of occupational dysphonia, which is why the importance of this instrument is underscored, as it allows having an easily accessible tool, validated for the Colombian population and that positions the work of speech pathology in the field of voice at the occupational level.

There are limitations in the present study, especially the very small sample with which the instrument was piloted, in spite of demonstrating the reliability of AIROD, further studies are suggested with the aim of applying the instrument to a larger population, which will enable increasing the internal consistency of the instrument. This limitation is also because of the way the sample was selected: convenience sampling.

A future line of research should be aimed at linking this instrument to specific actions within the framework of vocal health promotion and voice disorder prevention for workers, complying with the processes established for worker health management.

Conclusion

AIROD has become an objective tool designed and validated to measure the risk of occupational dysphonia. It enables identifying in a self-reported way the risks which a person who uses his or her voice as a work tool may be exposed to. It is important to replicate the study by increasing the sample size in the pilot test to increase the reliability of the instrument. Subsequent studies should focus on the construction of instruments that not only assess the risk of occupational dysphonia, but also approach a comprehensive voice diagnosis at occupational level. In like manner, this instrument may be used to create strategies and lead actions to promote vocal health and prevent vocal disorders within the framework of the so-called worker health and safety management systems.

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Ethical responsibilities

Protection of people and animals. The authors declare that no experiments were performed on humans or animals in this research.

Data confidentiality: the authors declare that no patient data appear in this article.

Right to privacy and informed consent: the authors declare that no patient data appear in this article.

Conflict of Interest: the authors declare there is no conflict of interest.

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Appendix

Instrumento para la Evaluación del Riesgo de Disfonía Ocupacional – INERDOC

A continuación, encontrará una serie de preguntas, las cuales debe responder teniendo en cuenta que la calificación corresponde a:

0= Ausencia, 1= Mínima presencia, 2= Mediana presencia y 3= Alta presencia.

Factor de Riesgo	Ítem	Calificación 0 1 2 3
Biológico	1. ¿Presenta cuadros gripales a repetición?	
	2. ¿Con qué frecuencia presenta reflujo gastroesofágico?	
	3. ¿Presenta algún diagnóstico médico relacionado con su voz (respiratorio, laríngeo, reflujos gástricos)?	
	4. ¿Sufre de rinitis o de algún cuadro alérgico que afecte su voz?	
	5. ¿Siente tensión o dolor muscular en el cuello?	
Hábitos	1. Tengo dificultades para hidratarme con agua	
	2. ¿Con qué frecuencia fuma?	
	3. ¿Consume alimentos/bebidas mentolados?	
	4. ¿Consume bebidas oscuras? (café, Coca-Cola, té negro)	
	5. ¿Carraspea constantemente para aclarar su voz?	
Físico / ambiental	1. ¿Considera que trabaja en un ambiente ruidoso?	
	2. ¿El ambiente donde se desempeña es húmedo y frío?	
	3. ¿Debe aumentar el volumen de su voz para que le escuchen?	
	4. ¿Su puesto de trabajo le permite tener una postura adecuada durante su jornada laboral?	
	5. ¿En el ambiente de trabajo se utiliza constantemente aire acondicionado o algún tipo de ventilación?	
Laboral	1. ¿Trabaja más de 7 horas al día con su voz?	
	2. Es imposible hacer descansos durante la jornada laboral	
	3. ¿Con qué continuidad al finalizar su jornada laboral, siente fatiga vocal y/o dolor de garganta?	
	4. ¿Ha presentado incapacidad por dificultades con su voz?	
	5. ¿Después de varias llamadas percibe su voz ronca?	
Psicosocial	1. ¿Considera que su voz es un limitante para comunicarse?	
	2. ¿Presenta episodios de estrés a repetición?	
	3. ¿Pierde efectividad en la comunicación a causa de su voz?	
	4. ¿Sus compañeros de trabajo parecen irritarse con su voz?	
	5. ¿Se siente incómodo por cómo suena su voz al comunicarse?	
Observaciones		

Score table

Categories	Risk Level (points)
Biological	
Habits	
Physical/ Environmental	
Labor	
Psychosocial	
Global Risk (Total)	

Classification table

	Points	Percentage
Absence	0	0
Minimal Risk	0 to 25 points	0,1% to 33,3%
Medium Risk	26 to 50 points	33,4% to 66,6%
High Risk	51 to 75 points	66,7% to 100%

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