Title: Cross cultural adaptation and validation of the Voice Handicap Index into Italian

Article Type: Full Length Article

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Abstract: Objectives: evaluate the internal consistency, reliability and clinical validity of the Italian version of the VHI.

Study design: cross-sectional survey study.

Methods: 175 patients with voice disorders, divided in four groups according to the ethiology of the disease (neurogenic, structural, functional and inflammatory), and 84 asymptomatic subjects were included in the study. Internal consistency was analyzed through Cronbach α coefficient. For the VHI test-retest reliability analysis, the Italian VHI was filled twice by 56 patients and 56 control subjects. The test-retest reliability was assessed through the Pearson correlation test. For the clinical validity assessment, the scores obtained in the pathological group were compared with those found in asymptomatic individuals through the Kruskal-Wallis test. Also the correlation between VHI and the grade of voice disorder was assessed. Finally, the effect of age and gender on overall VHI and its 3 subscales was analyzed.

Results: optimal internal consistency was found (α = .93); the test-retest reliability in both groups was high (r > .86). Non-parametric Kruskal-Wallis analysis of variance for the overall VHI score and

its three domains revealed a significant main effect for group (p = .000). The control group scored significantly lower than the four groups of voice disorder patients. The overall VHI score positively correlated with the grade of voice disorder (r = .43). In the voice disorder group age and gender were not correlated to the overall VHI score and to its the three domains.

Conclusion: the Italian VHI is highly reproducible, and exhibits excellent clinical validity.

Att: Robert T. Sataloff
Editor-in-Chief
Journal of Voice

Milan, 07-05-2009

Dear Editor,

  Please find enclosed the revised version of the manuscript entitled **"CROSS CULTURAL ADAPTATION AND VALIDATION OF THE VOICE HANDICAP INDEX INTO ITALIAN"** (Ms. Ref. No.: JVOICE-D-09-00023) with answers to referee's comments.

Looking forward to hearing from you

Your sincerely,

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Answer to reviewers' comments

1. In the present study only a mild correlation between G and VHI was found (r = 0.43); in the original study of Jacobson et al (1997) a moderate correlation (r = 0.60) between VHI and self-rating of voice disorders was reported. The data are not surprising since the perceptual and self-assessment questionnaires assess different dimension of the voice. In particular, VHI brings into play many factors, including societal attitudes, environmental barriers, the client's psychosocial traits, family and community supports, pre-morbid lifestyle, education, age, gender, vocation, avocations, and cultural and ethnic backgrounds. GRBAS scale, instead, concentrates on auditory perceptual parameters of dysphonia. The text has been modified, explaining the possible reasons of the mild correlation between VHI and G (page 9, lines 7-12).

2. As reported in reviewer's comment, the conclusions reached in the study of Franic et al (2005) seem to contradict those of the AHRQ report (2002). This contradiction is mainly related to a different vision of the voice disorders field. In the AHRQ report it is written "both the Voice Handicap Index (VHI) and the Kay Elemetrics MultiDimensional Voice Program (MDVP) met our criteria for reliability, validity and availability of normative data". This conclusion was reached because dysphonia may have different origins and the field of voice disorders was considered new, allowing the application of less stringent reliability criteria. On the contrary, Franic et al argued that "given that little is known about the origin and treatment of many voice disorders, and because the clinical purpose of instrument use is to guide individual decision making, then a strict rather a more relaxed criterion should be used in assessing any instrument". Nonetheless, both the study of Franic et al and the AHRQ report support the application of VHI scores for individual-level decision making.

The authors of the present paper agree that deeper presentation the several voice-related quality of life instrument could help ongoing discussion; the text was modified as well (page 1, lines 17-23).

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Journal of Voice

Article Title: CROSS CULTURAL ADAPTATION AND VALIDATION OF THE VOICE HANDICAP INDEX INTO ITALIAN

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CROSS CULTURAL ADAPTATION AND VALIDATION OF THE VOICE HANDICAP INDEX INTO ITALIAN

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Abstract

Objectives: evaluate the internal consistency, reliability and clinical validity of the Italian version of the VHI.

Study design: cross-sectional survey study.

Methods: 175 patients with voice disorders, divided in four groups according to the ethiology of the disease (neurogenic, structural, functional and inflammatory), and 84 asymptomatic subjects were included in the study. Internal consistency was analyzed through Cronbach α coefficient. For the VHI test-retest reliability analysis, the Italian VHI was filled twice by 56 patients and 56 control subjects. The test-retest reliability was assessed through the Pearson correlation test. For the clinical validity assessment, the scores obtained in the pathological group were compared with those found in asymptomatic individuals through the Kruskal-Wallis test. Also the correlation between VHI and the grade of voice disorder was assessed. Finally, the effect of age and gender on overall VHI and its 3 subscales was analyzed.

Results: optimal internal consistency was found ($\alpha = .93$); the test-retest reliability in both groups was high ($r > .86$). Non-parametric Kruskal-Wallis analysis of variance for the overall VHI score and its three domains revealed a significant main effect for group ($p = .000$). The control group scored significantly lower than the four groups of voice disorder patients. The overall VHI score positively correlated with the grade of voice disorder ($r = .43$). In the voice disorder group age and gender were not correlated to the overall VHI score and to its the three domains.

Conclusion: the Italian VHI is highly reproducible, and exhibits excellent clinical validity.

Introduction

As defined by the World Health Organization, health has to be considered a multidimensional

concept, incorporating physical, mental and social state of being [1]. For this reason the evaluation

of a patient has moved from a traditional assessment, related only to physical well-being, to a more

holistic approach that includes quality of life (QOL) measures. QOL measures describe the way an

individual experiences his or her disease, it may influence treatment planning and may be used as

outcome measures [2]. In the field of voice disorders, the assessment of a patient, as well as his or

her treatment outcome, has also moved away from traditional evaluations, based on perceptual,

acoustic, aerodynamic measurements and videolaryngostroboscopy, to a more holistic approach,

that includes QOL measures [3]. Neither objective voice measures, nor video or auditory perceptual

ratings, in fact, can assess the level of handicap that a person experiences as a result of a voice

disorder [4]; thus, patient-based, voice-specific outcomes measures can potentially provide

additional information to the biological and physiological variables that are associated with voice

production and impact on treatment planning.

Voice-related QOL instruments include the Voice-Related Quality of Life (V-RQOL) [5], the Voice

Handicap Index (VHI) [6], the Vocal Performance Questionnaire [7], the Voice Activity and

Participation Profile [8], and the Voice Symptom Scale [9]. The psychometric properties of all these

instruments appeared satisfactory. In particular, the VHI meets the criteria placed by the Agency for

Healthcare Research and Quality for determining disability in speech-language disorders [10]. In a

recent study, the psychometric properties of voice-related QOL measures were compared; it

appeared that the VHI and the V-RQOL satisfied the largest number of criteria used for the

comparison [11].

The VHI is a 30-item questionnaire, in which the subjects have to rate each statement using a five-

point equal scale scored from zero (never) to four (always). The VHI furnishes a non-standardized

index of the subject's self-rating degree of his/her voice-related problems in three domains:

emotional, functional and physical. There are 10 items corresponding to each domain, which were

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developed from patient statements taken from case history interviews with speakers with a wide range of voice disorders. Jacobson et al showed that the VHI has good internal consistency, test-retest reliability, and correlation with patient judgment of voice disorder severity [6]. Subsequent studies further validated the VHI. It was found that the VHI correlates significantly with the Medical Outcomes Trust Short Form 36-Item (SF-36) [12,13]. Benninger et al showed that the mental and general health and role functioning domains of SF-36 correlate significantly with the VHI domains and total score [4]; Wuyts et al [14] found a significantly high correlation ($r = -0.79$) between VHI and the Dysphonia Severity Index (DSI), an objective measure of vocal quality based on a multiparameter approach. Rosen et al [15] indicated that the VHI is sensitive to a speaker's perception of voice change after different types of intervention (surgery, medical and voice therapy) and is therefore a useful instrument to measure treatment efficacy. Similarly, Spector et al [16] showed that the VHI is an important instrument in the evaluation of patients with unilateral vocal fold paralysis (UVFP) before and after thyroplasty; Lee et al [17] reached the same conclusion in patients with UVFP who underwent polyacrylamide hydrogel injection laryngoplasty. Finally, the VHI appeared to be sensitive to changes following voice therapy in patients with phonotraumatic vocal fold lesions, and after surgery in patients undergoing thyroidectomy [18-19].

The VHI is the most widely used voice-related QOL instrument; it has been translated and validated into many languages and the equivalence of a different translation has been assessed [20-30]. An Italian version of VHI has been provided [31] and used in several studies [32-34]; however, no validation study has yet been published. The aim of this study was to evaluate the internal consistency, reliability and clinical validity of the Italian VHI.

Materials and Methods

The Italian version of the original English VHI-30 [30] was used for the present study (see Table 1). Items of the questionnaire were translated into Italian, translated back into English and compared with the original items by a qualified professional translator. Thirty patients (20 females and 10 males) with a mean age of 53 years (range 32-68), reporting symptoms of voice disorder were enrolled in a pilot study; each patient autonomously filled in the first translation of the Italian VHI and discussed the wording and meaning of each item of the VHI with the senior clinician. The wording of the questionnaire was modified on the basis of suggestions from patients involved in the pilot study.

The study was carried out according to the Declaration of Helsinki and approved by the Institutional Review Board. Each patient included in the study gave written informed consent.

Participants

Clinical data were obtained from 175 consecutive dysphonic patients (87 men and 88 women) consulting for voice disorders. The median age of the participants was 61.49 ± 16.46 years, with a range of 26 to 88 years. Only patients with normal cognitive function were included in the study. This group of patients was diagnosed with a variety of voice disorders by a phoniatrician and a speech and language pathologist. The patients were categorized into four groups on the basis of laryngeal videostroboscopic findings: 1) neurogenic, 2) structural, 3) inflammatory and 4) functional. The neurogenic group included vocal fold palsy, spasmodic dysphonia and Parkinson's disease. The structural group included vocal fold lesions such as polyps, nodules and cysts. The inflammatory group included laryngitis either caused by voice abuse or laryngopharyngeal reflux. Finally the "functional" group included muscle tension dysphonia and hypokinetic dysphonia. In the present study, 59 (33.7%) patients had neurogenic etiologies, 65 (37.1%) patients had structural etiologies, 26 (14.9%) patients were diagnosed to have inflammatory etiologies and 25 (14.3%) patients had functional etiologies. From the 175 patients, 56 individuals, 14 for each group, were

randomly selected for test-retest reliability analysis.

Eighty-four asymptomatic control subjects, 26 males and 58 females, with no history of voice disorder were included to establish normative data. The mean age was 33.01 ± 13.72 years, ranging from 20 to 78 years. From the 84 asymptomatic subjects, 56 individuals were randomly selected for reliability analysis. The characteristics of the studied populations are reported in Table 2.

Internal consistency

The internal consistency of the Italian version of the VHI was assessed using Cronbach's alpha coefficient. A value greater than 0.8 is considered "good" and greater than 0.9 "excellent", while a value greater than 0.7 is often considered satisfactory [34]. For this analysis the VHI scores, obtained in a group of 75 patients (13 with neurological dysphonia, 26 with structural dysphonia, 10 with inflammatory dysphonia and 26 with functional dysphonia) were used.

Test –retest reliability analysis

For the VHI test-retest reliability analysis, the Italian VHI was completed twice with a period of approximately two weeks between each administration by both the patients and the controls selected for this analysis. This interval period was selected because no substantial change was expected to take place in the voice condition of the subjects within this period. When the subjects completed the second VHI, they had no access to their responses from the first VHI. The test-retest reliability was assessed for the total score as well as for each of the three subscales of VHI.

Clinical validity

For the VHI clinical validity assessment, the VHI total scores, as well as the scores obtained in each of its three subscales, obtained in the four groups of patients (neurogenic, structural, inflammatory and functional) were compared with the normative data obtained from 84 asymptomatic individuals. The VHI scores obtained in males and females patients were also compared. Finally, the correlation

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between VHI and age, as well the correlation between VHI and the auditory perceived grade of voice disorder, assessed during the evaluation of patients, was analyzed.

Statistical Analysis

Statistical tests were performed using the SPSS 17.0 statistical software (SPSS, Inc., Chicago, IL). The internal consistency was assessed using Cronbach's alpha coefficient. Pearson product-moment correlation was used to evaluate the test-retest reliability of the VHI by comparing the baseline and retesting responses. Comparison of VHI scores in the four voice disorder diagnosis subgroups and in the control group were made using nonparametric Kruskal-Wallis test. In order to control the increased risks of Type 1 errors, due to the large number of comparisons assessed with Mann-Whitney test, Bonferroni corrections were performed and a more stringent alpha level for each comparison was set ($p = 0.005$). Nonparametric Mann-Whitney test was used to assess the differences between the control group and all pathological groups for all subscales as well as for the total score. The correlation between VHI scores and grade of dysphonia, as well as those with age, were assessed using Pearson product-moment correlation. The distribution of VHI scores in male and female subjects with voice disorders were compared using the nonparametric Mann-Whitney test.

Results

All of the 84 subjects and the 175 patients included in the study managed to complete the VHI without any need of assistance; the time required to fill in the questionnaire never exceeded 10 minutes. The mean scores obtained from the patients and from controls are reported in Table 3. These data show a consistent trend of lower values of the total and subscales scores for the control group, in comparison with all pathological groups. For both the total score and the three subscale the neurogenic group scored highest, followed by the functional, structural and inflammatory group. In addition, the severity ratings of the four pathological groups maintained similar hierarchy within the three subscales: the physical VHI subscale was scored highest, followed by the functional and emotional subscales.

Internal consistency analysis

The overall Cronbach α coefficient value for the questionnaire for the 75 patients was extremely high (α = .93); for the physical, functional and emotional subscales the Cronbach α coefficient values were respectively α = .91 α = .89 α = .87.

Reliability analysis

The VHI scores obtained for the intra-rater reliability analysis in both the patient and control groups are reported in Table 4 A minor decrease of the mean VHI score in the re-test condition was visible in both groups; however, the Pearson correlation score was very high for each group.

Validity analysis

Non-parametric Kruskal-Wallis analysis of variance for the total score and for the functional, physical and emotional subscales revealed a significant main effect for group (p = 0.000). The results of Mann-Whitney comparison between the control group and the four different groups of patients are reported in Table 5. A significant difference was found between the control group and

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the four groups of voice disordered patients. Besides, the neurogenic group showed significantly higher scores than those found in the functional dysphonia group.

The overall VHI score positively correlated with the grade of voice disorder, assessed jointly by the phoniatrician and the speech and language pathologist during the evaluation of patients ($r = .43$). Each of the three separate domains (with $r = .25$, $r = .47$ and $r = .39$ for the physical, functional and emotional domain respectively) was also positively correlated to the grade of voice disorder. In the voice disordered group age was not significantly correlated to the overall VHI score and to its three domains.

The mean total VHI score for male subjects was 40.6 ± 25.5, while for the female subjects it was 41.6 ± 24.8; the difference was not statistically significant ($p = .99$). The mean physical, functional, and emotional VHI scores were respectively 14.0 ± 9.2, 14.9 ± 9.3, 11.7 ± 10.2 for male patients and 15.6 ± 9.8, 15.1 ± 9.2, 11.3 ± 10.1 for female patients. The difference between mean males and females functional, physical, emotional VHI scores was not significant ($p = .35$, $p = .88$, $p = .66$ respectively).

Discussion

The psychometric properties of the Italian VHI were studied in a group of 175 patients and in a control group of 84 subjects; the results showed strong internal consistency, high test-retest reliability and optimal clinical validity for the overall VHI scores, as well as for the scores of the physical, functional and emotional domain of the VHI. These findings are in agreement with those reported in several studies [6, 17, 19-30].

Specific findings related to the Italian VHI are noteworthy. In particular, each of the questionnaires was completed fully, suggesting that all of the subjects understood all of the questions and were comfortable answering all of them. It might therefore be speculated that the Italian VHI is not a burdensome instrument, being easily self-administered and requiring no more than ten minutes to complete. Different authors reported the validation of VHI in different languages; as shown in Table 6, internal consistency and test-retest reliability appeared optimal in the different translations. This datum is particularly interesting, since it support trans-cultural research in voice related QOL.

The internal consistency of the Italian VHI appeared high with Cronbach α coefficient values ranging from .87, for the emotional subscale, to .93 for the physical one. The overall Cronbach α coefficient value was extremely high. These findings are in agreement with those found in the other studies [20-27]. As far as the reliability of the Italian VHI is concerned, the scores obtained in the test-retest condition for both the patient and control groups support the idea that the VHI has a high stability and reproducibility over time. In fact, the Pearson correlation scores for both the patient and control groups was always higher than .86, a value considered optimal for both group comparison and individual measurements over time. Furthermore, these findings are in agreement with those found in other studies [20-30].

In the voice disorder group, the scores of the physical domain of the VHI were higher than the scores of the emotional and functional domain, according with previous reports [22, 23, 35]. A possible explanation would be that the physical symptoms are the prominent perceptual parameters patients directly associate with dysphonia while emotional and functional issues are not specifically

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associated with a voice disorder.

Data from the present study indicate that the VHI may be a sensitive tool to identify voice disorders. The overall VHI score and its three domains in the control group were significantly lower than those found in the voice disorder groups. These findings agree with those of several studies [20-27] according to which voice disordered patients had significantly higher scores than the control comparison group. In addition, a mild but significant correlation between VHI scores and grade of dysphonia was found. This datum is not surprising since VHI and perceptual scales assess two different dimension of dysphonia. In particular while perceptual assessment concentrates on auditory parameters, self-assessment instrument, such as VHI, brings into play many factors, including societal attitudes, environmental barriers, the client's psychosocial traits, family and community supports, pre-morbid life-style, education, age, gender, vocation, and cultural and ethnic backgrounds. The Italian version of the VHI is also unaffected by age and by gender. This last issue is of special interest for languages that use morphology linguistic markers for gender (eg, Italian). Similarly to the study of Amir et al [26], results of this study revealed no gender differences in responding to the adapted Italian version.

Although the VHI is not intended to distinguish between different pathological groups, because it is aimed at quantifying subjective perception of the voice problem [6], intriguing findings on the relationship between different laryngeal pathology were discovered. Grouping the subjects according to the type of voice disorder, the neurogenic group had the highest VHI scores, followed by functional, structural and inflammatory group in that order. These findings are in agreement with those of several previous studies. Rosen et al [15] evaluated three dysphonic groups of patients before and after treatment and found that the highest pre-treatment VHI scores were obtained in patients with UVFP, followed by patients with benign vocal fold lesions. In the studies of Helidoni et al [20], Lam et al [22] and Amir et al [30], it was found that the neurogenic group had the highest VHI scores while the lowest scores occurred in the inflammatory group. Finally, Hsiung et al [36] reported that the glottic insufficiency group received the highest VHI scores, followed by the

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vocal mass group and the functional voice disorder group. Thus, it is probably that the VHI scores could be affected by the type of voice disorder.

Conclusion

The Italian VHI is easily administered, highly reproducible, and exhibits excellent clinical validity. Thus, the Italian VHI appears to be a useful self-administered questionnaire for the initial assessment of patients with voice disorders as well as for the evaluation over time. The VHI provides an additional information for the clinician to understand the manner in which patients perceive their voice problem and is recommended in the standard protocol for voice assessment.

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References

1. World Health Organization. The economics of health and disease. WHO Chronicles 1971; 25: 20-24.

2. Schuster M, Lohscheller J, Hoppe U et al. Voice Handicap of Laryngectomees with Tracheoesophageal Speech. Folia Phoniatrica et Logopedica 2004; 56: 62-67.

3. Hogikvan ND, Rosen CA. A review of outcome measurements for voice disorders. Otolaryngol Head Neck Surg 2002; 126: 562-572.

4. Benninger MS, Atiuja AS, Gardner G et al. Assessing outcomes for dysphonic patients. J Voice 1998; 12: 540-550.

5. Hogikvan ND, Sethuraman G. Validation of an instrument to measure Voice-Related Quality of Life (V-RQOL). J Voice 1999; 13: 557-569.

6. Jacobson BH, Johnson A, Grywalski C et al. The Voice Handicap Index (VHI): development and validation. *Am J Speech Lang Pathol* 1997; 6: 66–70.

7. Carding P, Horsley IA, Docherty GJ. A study of the effectiveness of voice therapy in the treatment of 45 patients with nonorganic dysphonia. *J Voice* 1999; 13: 72–104.

8. Ma EP-M, Yiu EM-L. Voice activities and participation profile: assessing the impact of voice disorders on daily activities. *J Speech Lang Hear Res* 2001; 44: 511–524.

9. Deary IJ, Wilson JA, Carding PN, MacKenzie K. VoiSS: A patient-derived Voice Symptom Scale. *J Psychosom Res* 2003; 54: 483–489.

10. Agency for Healthcare Research and Quality. Criteria for determining disability in speech-language disorders. Evidence Report/Technology Assessment. January 2002, Number 52.

11. Franic DM, Bramlett RE, Bothe AC. Psychometric evaluation of disease specific quality of life instruments in voice disorders. *J Voice* 2005; 19: 300–315.

12. Smith E, Verdolini K, Gray S et al. Effect of voice disorders on quality of life. J Med Speech-Lang Pathol 1996; 4: 223-244.

13. Stewart MG, Chen AY, Atach CB. Outcomes analysis of voice and quality of life in patients

with laryngeal cancer. Arch Otolaryngol Head Neck Surg 1998; 124: 143-148.

14. Wuyts FL, De bodt MS, Molenberghs G et al. The dysphonia severity index: an objective measure of vocal quality based on a multiparameter approach. JSLHR 2000; 43: 796-809.

15. Rosen CA, Murry T, Zinn A et al. Voice handicap index change following treatment of voice disorders. J Voice 2000; 378-386.

16. Spector BC, Netterville JL, Billante C et al. Quality-of-life assessment in patients with unilateral vocal cord paralysis. Otolaryngol Head Neck Surg 2001; 125: 176-182.

17. Lee SW, Son YI, Kim CH et al. Voice outcomes of polyacrylamide hydrogel injection laryngoplasty. 2007; 117: 1871-1875.

18. Behrman A, Rutledge J, Hembree A et al. Vocal hygiene education, voice production therapy, and the role of patient adherence: a treatment effectiveness study in women with phonotrauma. J Speech Lang Hear Res 2008; 51: 350-366.

19. Stojadinovic A, Henry LR, Howard RS et al. Prospective trial of voice outcomes after thyroidectomy: evaluation of patient-reported and clinician-determined voice assessments in identifying postthyroidectomy dysphonia. Surgery 2008; 143: 822-823.

20. Helidoni ME, Murry T, Moschandreas J et al. Cross-cultural Adaptation and Validation of the Voice Handicap Index Into Greek. J Voice 2008; in press.

21. Nunez-Batalla F, Conte-Santos P, Senaris-Gonzalez E et al. Adaptation and Validation to the Spanish of the Voice Handicap Index (VHI-30) and its shorted version (VHI-10). Acta Otorrinolaringol Esp 2007; 58: 386-392.

22. Lam PK, Chan KM, Ho WK et al. Cross-cultural adaptation and validation of the Chinese Voice Handicap Index-10. Laryngoscope 2006; 116: 1192-1198.

23. Kilic MA, Okur E, Yildirim I et al. Reliability and Validity of the Turkish version of the Voice Handicap Index. Kulak Burun Bogaz Ihtis Derg 2008; 18: 139-147.

24. Woisard V, Bodin S, Puech M. The Voice Handicap Index: impact of the translation in French on the validation. Rev Laryngol Otol Rhinol 2004; 125: 307-312.

25. Hakkesteegt MM, Wieringa MH, Gerritsma EJ. Reproducibility of the Duch version of the Voice Handicap Index. Folia Phoniatr Logop 2006; 58: 132-138.

26. Nawka T, Wiesmann U, Gonnermann U. Validation of the German version of the Voice Handicap Index (VHI). HNO 2003; 51: 921-929.

27. Guimaraes I, Adderton E. An investigation of the Voice Handicap Index with speakers of Portuguese: preliminary data. J Voice 2004; 18: 71-82.

28. Pruszewicz A, Obrebowsky A, Wiskirska-Woznica B et al. Complex voice assessment-Polish version of the Voice Handicap Index (VHI). Otolaryngol Pol 2004; 58: 547-549.

29. Verdonck-de Leeuw IM, Kuik DJ, De Bodt M et al. Validation of the voice handicap index by assessing equivalence of European translations. Folia Phoniatr Logop 2008; 60: 173-178.

30. Amir O, Tavor Y, Leibovitzh T et al. Evaluating the validity of the voice handicap index-10 (VHI-10) among Hebrew speakers. Otolaryngol Head Neck Surg 2006; 135: 603-607.

31. Schindler A, Gilardone M, Spadola Bisetti M. L'esame obiettivo nella sindrome disfonica. Acta Phon Lat 2000; 22: 355-363.

32. Schindler A, Cuccarini V, Bottero A et al. Long-term vocal functional results after glottectomy: a multi-dimensional analysis. Eur Arch Otorhinolaryngol 2007; 264: 1039-1044.

33. Schindler A, Favero E, Nudo S et al. Long-term voice and swallowing modifications after supracricoid laryngetomy: objective subjective and self-assessment data. Am J Otolarhingol 2006; 27: 378-383.

34. Schindler A, Bottero A, Capaccio P et al. Vocal improvement after voice therapy in unilateral vocal fold paralysis. J Voice 2008; 22: 113-118.

35. Kianifard F. Evaluation of Clinimetric Scales: basis principles and methods. Statistician 1994; 4: 475-482.

36. Hsiung MW, Lu P, Kang BH et al. Measurement and validation of the Voice Handicap Index in voice-disordered patients in Taiwan. J Laryngol Otol 2003; 117: 478-481.

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Table(s)

Instructions: These are the statements that many people have used to describe the effects of their voices on their lives. Check the response that indicates how frequently you have the same experience. (Never = 0 points; Almost never = 1 point; Sometimes = 2 points; Almost always = 3 points; Always = 4 points).

Instruzioni: Queste sono affermazioni che molti hanno usato per descrivere le loro voci e gli effetti della loro voce nella loro vita. Indichi per ogni affermazione quanto sovente ha avuto la stessa esperienza (Mai = 0 punti; Quasi mai = 1 punto; Qualche volta = 2 punti; Quasi sempre = 3 punti; Sempre = 4 punti

F1	My voice makes it difficult for people to hear me La mia voce è udita con difficoltà dalla gente	0	1	2	3	4
F2	People have difficulty understanding me in a noisy room La gente ha difficoltà a capirmi in una stanza rumorosa	0	1	2	3	4
F3	My family has difficulty hearing me when I call them throughout the house La mia famiglia ha difficoltà a udirmi quando li chiamo in casa	0	1	2	3	4
F4	I use the phone less often than I would like Adopero il telefono meno sovente di quanto vorrei	0	1	2	3	4
F5	I tend to avoid groups of people because of my voice Tendo a evitare i gruppi di persone a causa della mia voce	0	1	2	3	4
F6	I speak with friends, neighbours, or relatives less often because of my voice Parlo meno sovente con amici, vicini e parenti a causa della mia voce	0	1	2	3	4
F7	People ask me to repeat myself when speaking face-to-face La gente mi chiede di ripetere quando parlo a faccia a faccia	0	1	2	3	4
F8	My voice difficulties restrict my personal and social life Le mie difficoltà di voce restringono la mia vita personale e sociale	0	1	2	3	4
F9	I feel left out of conversations because of my voice Mi sento tagliato fuori dalle conversazioni a causa della mia voce	0	1	2	3	4
F10	My voice problem causes me to lose income I miei problemi di voce mi fanno guadagnare di meno	0	1	2	3	4
P1	I run out of air when I talk Esaurisco l'aria quando parlo	0	1	2	3	4
P2	The sound of my voice varies throughout the day Il suono della mia voce varia durante la giornata	0	1	2	3	4
P3	People ask, "What's wrong with my voice? La gente mi chiede "Cosa c'è che non va con la tua voce?"	0	1	2	3	4
P4	My voice sounds creaky and dry La mia voce è stridula e secca	0	1	2	3	4
P5	I feel as though I have to strain to produce voice Mi sembra di dovermi sforzare per produrre la voce	0	1	2	3	4
P6	The clarity of my voice is unpredictable La chiarezza della mia voce è imprevedibile	0	1	2	3	4
P7	I try to change my voice to sound different Cerco di cambiare la mia voce per farle avere un suono differente	0	1	2	3	4
P8	I use a great deal of effort to speak Faccio molto sforzo per parlare	0	1	2	3	4
P9	My voice is worse in the evening La mia voce è peggiore la sera	0	1	2	3	4
P10	My voice "gives out" on me in the middle of speaking La mia voce viene meno nel bel mezzo del parlare	0	1	2	3	4
E1	I'm tense when talking with others because of my voice Sono teso a causa della mia voce quando parlo con gli altri	0	1	2	3	4
E2	People seem irritated with my voice La gente sembra irritata dalla mia voce	0	1	2	3	4
E3	I find other people don't understand my voice problem Trovo che gli altri non comprendano i miei problemi di voce	0	1	2	3	4

E4	My voice problem upsets me Il mio problema di voce mi sconvolge	0	1	2	3	4
E5	I am less outgoing because of my voice problem Esco di meno per i miei problemi di voce	0	1	2	3	4
E6	My voice makes me feel handicapped La mia voce mi fa sentire handicappato	0	1	2	3	4
E7	I feel annoyed when people ask me to repeat Mi scoccio quando la gente mi chiede di ripetere	0	1	2	3	4
E8	I feel embarrassed when people ask me to repeat Mi sento imbarazzato quando la gente mi chiede di ripetere	0	1	2	3	4
E9	My voice makes me feel incompetent La mia voce mi fa sentire un incapace	0	1	2	3	4
E10	I'm ashamed of my voice problem Mi vergogno del mio problema di voce	0	1	2	3	4

Table 2: Demographic factors of the participants.

Participants	Number	Male	Female	Mean age ± standard deviation (range)
Neurogenic group	59	26	33	70.52 ± 10.39 (53-85)
Parkinson disease	25			
Unilateral Vocal Fold Paralysis	20			
Spasmodic dysphonia	14			
Functional group	25	21	4	54.64 ± 14.30 (35-88)
Muscle tension dysphonia	15			
Hypokinetic dysphonia	10			
Structural group	65	30	35	55.72 ± 18.51 (27-86)
Vocal fold nodules	31			
Vocal fold polyp	19			
Vocal fold cyst	15			
Inflammatory group	26	10	16	43.02 ± 11.92 (26-57)
Overuse laryngitis	14			
Reflux laryngitis	12			
Total	175	87	88	61.49 ± 16.46 (26-88)
Control subjects	84	26	58	33.01 ± 13.72 (23-68)

Table 3: The mean, standard deviation and range of total VHI scores as well as the emotional, physical and functional subscales scores in the four different groups of dysphonic patients studied and in the control group are reported. The results are reported as mean ± standard deviation; range values are reported in brackets.

	Physical VHI	Functional VHI	Emotional VHI	Total VHI
Neurogenic dysphonia	16.88 ± 10.52 (0-37)	15.55 ± 10.10 (0-38)	13.89 ± 10.59 (0-38)	45.96 ± 28.01 (0-111)
Functional dysphonia	15.12 ± 10.31 (0-32)	12.20 ± 9.75 (0-40)	8.44 ± 8.31 (0-27)	35.76 ± 24.99 (3-96)
Structural dysphonia	14.65 ± 8.89 (0-36)	11.26 ± 9.08 (0-33)	7.98 ± 8.06 (0-32)	33.67 ± 20.89 (0-86)
Inflammatory dysphonia	14.00 ± 9.27 (4-27)	10.16 ± 7.25 (2-18)	5.5 ± 5.31 (0-13)	29.66 ± 10.76 (16-48)
Total	15.57 ± 9.85 (0-37)	13.42 ± 9.78 (0-40)	10.63 ± 9.67 (0-38)	38.38 ± 25.27 (0-111)
Control subjects	3.96 ± 2.5 (0-11)	4.07 ± 2.4 (0-9)	2.37 ± 2.6 (0-8)	10.40 ± 6.5 (3-27)

Table 4: Test-retest reliability in the 80 patients with dysphonia and in the control group assessed by Pearson test. Mean standard ± deviation and Pearson test data are reported.

VHI scale and subscale	Test mean value (patients)	Test mean value (control group)	Retest mean value (patients)	Retest mean value (control group)	Pearson test (patients)	Pearson test (control group)
Total VHI tot	35.57 ± 16.2	10.40 ± 6.0	34.51 ± 17.8	10.11 ± 6.5	.97	.97
Physical VHI	16. 65 ± 6.8	3.96 ± 2.5	16.54 ± 7.7	3.66 ± 2.6	.93	.87
Functional VHI	12. 04 ± 6.9	4.07 ± 2.4	11.23 ± 6.9	3.96 ± 2.8	.93	.86
Emotional VHI	6.92 ± 6.4	2.37 ± 2.6	6.69 ± 6.8	2.48 ± 2.5	.93	.91

Table 5: Results of Mann-Whitney comparison between the control group and the four different groups of patients.

Compared Groups	Total VHI	Emotional VHI	Functional VHI	Physical VHI
Control vs Neurogenic	.000*	.000*	.000*	.000*
Control vs Inflammatory	.000*	.087	.002*	.003*
Control vs Functional	.000*	.000*	.000*	.000*
Control vs Structural	.000*	.000*	.000*	.000*
Neurogenic vs Inflammatory	.149	.038	.738	.086
Neurogenic vs Functional	.004*	.000*	.005	.182
Neurogenic vs Structural	.069	.016	.093	.345
Inflammatory vs Functional	.786	.565	.436	.233
Inflammatory vs Structural	.751	.542	.643	.575
Functional vs Structural	.921	.931	.783	.968

* = statistically significant (because of Bonferroni correction significance level was set at $p = .005$).

Table 6: Internal consistency and test-retest reliability of VHI validation studies in different languages. * = Pearson product moment correlation test; ** = Interclass Correlation Coefficent (ICC).

Study	Country	Number of patients	Cronbach α coefficient value	Test-retest reliability for VHI total score
Helidoni M et al	Greece	67	.95	.96**
Nunez-Batalla F et al	Spain	232	.93	.82*
Lam PK et al	China	131	.98	.84*
Kilic MA et al	Turkey	220	.97	.93*
Woisard V et al	France	63	.91	> .87*
Nawka T et al	Germany	316	.96	-
Hakkesteegt MM et al	Holland	104	-	.95*
Amir et al	Israel	182	.97	-
Jacobson BH	USA	63	.95	.92*