

# Cross-Cultural Adaptation and Validation of the Vocal Fatigue Index into Persian

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**Summary: Introduction.** The aim of the present study was the cross-cultural adaptation and validation of the Vocal Fatigue Index (VFI) in Persian.

**Methods.** The English version of the VFI was translated to Persian using the guidelines of International Quality of Life Assessment. Eighty participants with voice disorders and 50 healthy controls without any voice disorders completed the Persian version of the VFI. The 80 participants with voice disorders completed the VFI a second time a week from the initial completion to evaluate test-retest reliability.

**Results.** The VFI measure demonstrated a strong internal consistency. Cronbach alpha coefficient was 0.95 for tiredness and avoidance of voice use, 0.86 for physical discomfort and 0.83 for improvement or lack thereof of symptoms with voice rest. VFI also showed a high test-retest reliability ( $r = 0.75-0.89$ ).

**Conclusions.** The Persian version of the VFI is considered to be a valid and reliable questionnaire for identifying individuals with probable vocal fatigue. The VFI can be utilized in clinics across Iran in the assessment and treatment of individuals with vocal fatigue.

**Key Words:** Vocal fatigue—Reliability—Validity—Sensitivity—Questionnaire.

## INTRODUCTION

Vocal fatigue (VF) is one of the most common symptoms of a voice disorder<sup>1,2</sup> and is frequently addressed in research and clinical practice. However, there is a lack of a universally accepted definition for VF that is convergent across different authors.<sup>3-6</sup> VF has been conceptualized in different ways; in terms of a set of symptoms of a voice disorder<sup>1,7,8</sup> or in terms of physiological changes.<sup>9-11</sup>

Generally, the presence of VF is assessed and described by the presence of a variety of symptoms.<sup>10,12,13</sup> A few primary symptoms identified during or after a vocal task that seem to describe VF in the literature include breathy or hoarse vocal quality, increased vocal effort, unsteady or loss of voice, reduced pitch and loudness range, inability to maintain typical pitch, neck or shoulder tension or pain, tightness and fatigue in throat, deterioration of symptoms across the speaking day, and improvement of symptoms after rest.<sup>3,4,10,14-17</sup> There are several definitions in the literature: for example, Welham and Maclagan defined VF as a perceptual, acoustic, or physiologic concept that occurs as a consequence of vocal loading or prolonged voice

use. This definition characterizes the changes in the functional condition of the laryngeal mechanism as unexpected and undesirable<sup>5</sup> and as a result of voice use. In another definition, Vikman<sup>18</sup> introduced VF as a subjective term that emphasizes on the self-perceived status and negative sensations about voicing. Another well-accepted definition of VF is based on physiology and kinesiology literature,<sup>19-21</sup> where VF was defined based on self-report and the observable-behavioral results of prolonged physical activity. Accordingly, McCabe and Titze<sup>21</sup> defined VF as a progressive increase in phonatory effort and decrease in phonatory abilities.

With numerous definitions of VF, there is an increased difficulty in accurately identifying the features associated with VF, the underlying mechanisms of it, and its appropriate treatment options.<sup>11,22</sup> Recently, Nanjundeswaran et al (2015) developed and validated the VFI—a self-assessment tool,<sup>11</sup> based on self-reported symptoms of VF. This protocol is utilized in the reliable and consistent identification of individuals with VF for both research and clinical purposes.<sup>23-25</sup> The index includes 19 items across three domains: tiredness and avoidance of voice use (11 items), physical discomfort with voice use (five items), and improvement of symptoms or lack thereof with rest (three items).

Currently, there is a lack of a comprehensive self-assessment tool to identify and understand VF in Iran. According to the Scientific Advisory Committee of the Medical Outcome Trust,<sup>26</sup> the first step for an instrument to be used in another language and culture, is its cultural and linguistic adaptation. VFI has been adapted across multiple languages and cultures and presented to scientific societies. Cross-cultural adaptation of the Portuguese version of the VFI is currently published.<sup>27</sup> There is no data available on psychometric properties of the VFI for the Persian language. Therefore, the objective of the present manuscript

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is the cultural and linguistic adaptation and validation of the VFI into Persian.

## METHOD

### Translation procedure

A Persian translation of the validated English version of the VFI was completed following the rules and instructions suggested by the International Quality of Life Assessment Project for a cross-cultural translation of any test-related wordings.<sup>28,29</sup> Prior to the initiation of translation, the researchers asked the test developer of the VFI, for permission to use the questionnaire for translation and adaptation to Persian. The first step involved the translation of the 19 items of the VFI to Persian by two speech-language pathologists and an English translator. The three independent translations were discussed by a panel of experts (a translator, three speech and language pathologists, and a clinical psychologist).<sup>28,30,31</sup> The discussion topics focused on translation clarity, the use of general words, and conceptual equivalence. In other words, a panel of experts measured content validity of all items and if all members agreed on the irrelevancy of a word, appropriate change was made.<sup>31</sup> A revised form of translation was finalized (see [Appendix 2](#)).

A back-translation of the new Persian version of the VFI was completed by a professional translator who was bilingual in English and Persian.<sup>31</sup> The aim of back translation was to find any errors in meaning and concept non-equivalence.<sup>31–33</sup> In comparison with the original version of the VFI, the retranslated questionnaire was confirmed by the test developer as being a genuine and understandable translation.

A pilot study of the Persian VFI was completed by 14 individuals (seven men and seven women) in the age range of 27–52 years old (mean age: 40) with a variety of voice disorders. Participants completed the questionnaire and participated in a face-to-face interview<sup>34,35,28</sup> to specify the items in the Persian version of VFI that was unclear. This step helped remove potential misunderstandings and ambiguities.<sup>36</sup> No change in wordings was made to the Persian version of the VFI following the pilot study.

## VALIDATION OF THE PERSIAN VFI

### Participants

All participants signed a written consent for their participation in the study. The study was approved by the Ethics Committee at Jundishapur University of Medical Sciences, Ahvaz. All subjects were assured that their personal data would remain confidential in the research. Eighty individuals with a wide range of voice disorders- henceforth dysphonic group (34 men and 46 women, mean age  $36.43 \pm 9.99$ ) completed the final version of the Persian VFI ([Tables 1](#) and [2](#)).

**TABLE 1.**  
**Participant Demographics**

Participants	Number	Male	Female	Mean Age $\pm$ SD
Dysphonia group	80	34	46	$36.43 \pm 9.99$
Vocally healthy group	50	23	27	$35.72 \pm 7.93$
Total	130	57	73	$36.16 \pm 9.23$

All diagnoses were completed by an otorhinolaryngologist and a speech and language pathologist.

In the control group, 50 vocally healthy individuals (23 men and 27 women) completed the Persian version of the VFI. The mean age of the participants in the control group was  $35.72 \pm 7.93$  years ([Table 1](#)). Videostroboscopic evaluation and voice evaluation by the otorhinolaryngologist and speech and language pathologist, revealed no pathological alterations in their laryngeal structure and function.

All participants (patients and controls) filled in the VFI questionnaire in a quiet room without any help or explanation by the examiner in the Otorhinolaryngology clinic and other clinics in the hospitals in Ahvaz. For test-retest reliability of the VFI, the dysphonic group was asked to fill in the VFI questionnaire for a second time within the interval of one week. They returned to clinic to complete the VFI for the second time. The dysphonic group received no treatment during this time period. This interval was chosen because the time was short enough to limit changes in vocal symptoms and long enough to make sure that the patients would not remember their answers.<sup>37,38</sup> The subjects did not have access to their first responses while they were answering the VFI for the second time.

Data was analyzed for internal consistency, and test-retest reliability using discrimination coefficient, Cronbach alpha coefficient, and Spearman correlation respectively.

**TABLE 2.**  
**Patient Diagnoses (N = 80)**

Diagnosis	Male	Female	Total
Laryngitis	3	3	6
Paralysis	4	3	7
Scar	1	1	2
Cancer	3	1	4
Paresis	1	0	1
Vocal fold hemorrhage	2	1	3
Spasmodic dysphonia	2	0	2
Nodules	4	7	11
Polyps	4	3	7
LPR	0	5	5
MTD	10	22	32

**TABLE 3.**  
**The Results of Spearman's Correlation Test Between Each Item and total factor Score**

Tiredness of Voice Items	d*	Physical Discomfort Items	d*	Improvement of Symptoms Items	d*
1	0.82	12	0.75	17	0.88
2	0.78	13	0.79	18	0.82
3	0.84	14	0.75	19	0.87
4	0.78	15	0.80		
5	0.82	16	0.77		
6	0.82				
7	0.72				
8	0.76				
9	0.85				
10	0.85				
11	0.81				

\* d, correlation coefficient between the score of each item and total factor score. Correlation is significant at the 0.01 level (two tailed).

Additionally, clinical validity of the VFI was analyzed by comparing scores of each of the factors for dysphonic and control group, comparing scores for male versus female and analyzing scores of the VFI according to age. All statistical analysis was completed using the Statistical Package for the Social Sciences (SPSS 21.0) for Windows. Descriptive statistical analyses were used to demonstrate the clinical and demographic characteristics (gender, age, and type of disorder).

## RESULTS

### Scale reliability and internal consistency

All participants in this study were able to complete the VFI questionnaire without any help or instruction. Data were analyzed for internal consistency and scale reliability using Cronbach alpha coefficient. The results showed a high Cronbach alpha coefficient for tiredness of voice (0.95), physical discomfort (0.86), and improvement of symptoms with rest (0.83). The discrimination coefficient of each item using Spearman correlation test showed a relationship between each item and its total factor score

(Table 3). Additionally, the results of the item role in reliability of VFI (Table 4) demonstrated that after the deletion of each item, a decrease in Cronbach alpha value occurred (Cronbach alpha value).

### Reliability analysis

Eighty dysphonic completed the VFI second time and returned it. The mean interval between completion of the two questionnaires was six days ( $SD = \pm 2$ ). Test-retest reliability results for the scores of the three factors of the VFI were obtained using Spearman correlation. Strong test-retest reliability was seen for all three factors: tiredness of voice ( $r = 0.89$ ,  $P < 0.001$ ), physical discomfort ( $r = 0.78$ ,  $P < 0.001$ ) and improvement of symptoms ( $r = 0.75$ ,  $P < 0.001$ ).

### Clinical predictive validity analysis

The mean and standard deviation of the three factors of VFI (tiredness of voice, physical discomfort, and improvement of symptoms subscale) gained by the vocally healthy

**TABLE 4.**  
**Cronbach's Alpha Coefficient if Each Item Eliminated**

Tiredness of Voice Items	$\alpha$	Physical Discomfort Items	$\alpha$	Improvement of Symptoms Items	$\alpha$
1	0.94	12	0.83	17	0.72
2	0.94	13	0.82	18	0.82
3	0.94	14	0.87	19	0.76
4	0.93	15	0.82		
5	0.94	16	0.81		
6	0.93				
7	0.95				
8	0.94				
9	0.95				
10	0.94				
11	0.94				

**TABLE 5.**  
**Mean and SD for the Tiredness of Voice, Physical Discomfort, and Improvement of Symptoms Subscale Scores in Dysphonic Patients and Vocally Healthy Individuals**

Groups	Tiredness of Voice	Physical Discomfort	Improvement of Symptoms
Vocally healthy group	5.21 ± 2.8	2.05 ± 1.07	4.26 ± 2.32
Dysphonia group	24.48 ± 10.18	8.53 ± 4.85	7.59 ± 3.08

group and dysphonic group, are presented in Table 5. In comparison to the vocally healthy group, the dysphonic group showed higher scores for VFI subscales. A significant difference was found between the vocally healthy group and the dysphonic group for three factors of the VFI using the Mann-Whitney test (tiredness of voice:  $P = 0.000$ , physical discomfort:  $P = 0.000$ , and improvement of symptoms:  $P = 0.000$ ).

In the dysphonic group, age was not correlated to the scores of the VFI factors. The mean values of female patients for tiredness of voice, physical discomfort, and improvement of symptoms was  $25.2 \pm 10.5$ ,  $8.9 \pm 4.6$ ,  $7.7 \pm 3.1$ , respectively and for male patients was  $23.2 \pm 9.6$ ,  $7.9 \pm 5.1$ ,  $7.3 \pm 3.1$ , respectively. The difference between mean female and male for three factors of VFI was not significant (tiredness of voice,  $P = 0.48$ , physical discomfort,  $P = 0.56$ , and improvement,  $P = 0.54$ ).

## DISCUSSION

The aim of the present study was to culturally adapt and study the psychometric properties of the VFI in Persian language. No items were deleted during the cultural adaptation process of the VFI in to Persian. The results of our study revealed that the Persian version of VFI has a good internal consistency and are consistent with the findings reported by Nanjundeswaran et al.<sup>11</sup> Additionally, the values obtained by test-retest reliability for the Persian version of the VFI on each of the three factors, confirmed the high reliability of the VFI during time interval. Although these results were in agreement with the findings of similar research in the English language,<sup>11</sup> the values obtained in this research were higher for factor 3 and lower for factors 1 and 2 compared to the English version of VFI.<sup>11</sup> Also, the scores of three factors of Persian version of VFI were not influenced by gender and age. The Persian VFI can be used to reliably identify persons with VF and has good clinical validity and reliability.

Similar to previous works, the mean of the three factor scores of the VFI in the dysphonic group were higher than those in the control group of healthy persons. Scores can be interpreted similar to the original version of the VFI. In other words, scores on factor 1 may vary from 0 to 44, and factor 2 may be from 0 to 20, with 0 demonstrating no experience of the symptoms of VF and a severe VF with scores of 44 and 20 on each of the factors 1 and 2 respectively. In other words, a higher score on factors 1 and 2 indicate an experience of severe VF. The findings confirmed that the patients with various voice disorders have higher VF compared to individuals with healthy voice. Questions on factor 3 are worded positively and therefore lower scores represent that fatigue does not improve with rest. Due to the discrepancy in the wording, a total VFI score was not calculated as indicated in the original VFI.<sup>11</sup> In addition, each factor is conceptually different and the scores of each factor provide more accurate insight into a patient's experience of VF. The Persian version of the VFI may prove to be a sensitive and reliable index that could be used in identifying individuals with VF.

## IMPLICATIONS

According to importance of the client-centered evaluations, a valid and reliable Persian version of the VFI can be used across clinical settings to more precisely and reliably identify individuals with VF and assess symptom progression pre and posttreatment. In addition, the Persian version of the VFI will allow the voice therapists to exert a more comprehensive assessment of the patients with voice disorders and study the effects of different interventions for VF with this questionnaire.

## CONCLUSIONS

Good psychometric properties of the Persian version of the VFI suggest that it is a valid, reliable, and suitable index for the evaluation of VF and for identifying individuals with and without VF in Iran.

**APPENDIX****APPENDIX 1: Back translation of Vocal Fatigue Index**

Voice problems usually are associated with some symptoms.

Notice to this symptoms and their repetition and experience

in yourself. Circle the suitable answer (0-never, 1-almost never, 2-sometimes, 3-almost always, 4-always).

**Part 1**

1. After using the voice, I don't want to talk more.	0	1	2	3	4
2. When I talk a lot, I feel tired in my voice.	0	1	2	3	4
3. While I am using the voice, I feel having a lot of effort.	0	1	2	3	4
4. While I am using the voice, my voice gets hoarse.	0	1	2	3	4
5. When I use my voice, I feel doing a hard work.	0	1	2	3	4
6. Generally after using the voice, I tend to limit my talking.	0	1	2	3	4
7. I avoid going to social situations where I have to talk more there.	0	1	2	3	4
8. After a work day, I feel I cannot talk with my family members	0	1	2	3	4
9. After using voice, it is hard for me to produce my voice.	0	1	2	3	4
10. While using the voice, it is hard for me to produce loud and clear voice.	0	1	2	3	4
11. After using voice, I feel my voice is weak.	0	1	2	3	4

**Part 2**

12. At the end of the day that I had used my voice, I feel pain in the neck.	0	1	2	3	4
13. At the end of the day that I had used my voice, I feel throat pain.	0	1	2	3	4
14. When I talk a lot, I feel my voice get harsh.	0	1	2	3	4
15. With using my voice, I feel pain in my throat.	0	1	2	3	4
16. With using my voice I feel pain in my neck.	0	1	2	3	4

**Part 3**

17. After taking a rest, my voice gets better.	0	1	2	3	4
18. After taking rest, the effort to produce my voice decreases.	0	1	2	3	4
19. After taking rest, the hoarseness of my voice gets better.	0	1	2	3	4

## APPENDIX 2: Persian translation of Vocal Fatigue Index

### شاخص خستگی صدا

مشکلات صدا معمولاً با یک سری نشانه‌ها همراهند. با توجه به میزان تکرار و تجربه این علائم در شما، دور پاسخ مناسب خط‌بکشید (0- هرگز، 1- خیلی کم، 2- گاهی اوقات، 3- اغلب، 4- همیشه)

بخش 1.					
4	3	2	1	0	1. بعد از مدتی استفاده از صدا، تمایلی برای صحبت کردن ندارم.
4	3	2	1	0	2. زمانیکه زیاد صحبت می‌کنم، در صدایم احساس خستگی می‌کنم.
4	3	2	1	0	3. هنگام استفاده از صدایم، احساس تلاش زیادی دارم.
4	3	2	1	0	4. صدایم هنگامیکه از آن استفاده می‌کنم، گرفته می‌شود.
4	3	2	1	0	5. هنگامیکه از صدایم استفاده می‌کنم، این احساس را دارم که کار سختی انجام می‌دهم.
4	3	2	1	0	6. معمولاً بعد از مدتی استفاده از صدا تمایل کمتری برای صحبت کردن دارم.
4	3	2	1	0	7. از شرکت در موقعیت‌های اجتماعی که میدانم باید در آنها زیاد صحبت کنم، دوری می‌کنم.
4	3	2	1	0	8. احساس می‌کنم که بعد از یک روز کاری، نمی‌توانم با اعضای خانواده صحبت کنم.
4	3	2	1	0	9. بعد از مدتی استفاده از صدا، تولید صدا برایم دشوار می‌شود.
4	3	2	1	0	10. برایم دشوار است که هنگام استفاده از صدا، صدای بلند و واضحی تولید کنم.
4	3	2	1	0	11. بعد از مدتی استفاده از صدا، احساس می‌کنم صدایم ضعیف می‌شود.
بخش 2.					
4	3	2	1	0	12. در انتهای روزی که از صدایم استفاده می‌کنم، دچار گردن درد می‌شوم.
4	3	2	1	0	13. در انتهای روزی که از صدایم استفاده می‌کنم، دچار گلو درد می‌شوم.
4	3	2	1	0	14. زمانیکه زیاد صحبت می‌کنم، احساس می‌کنم صدایم خشن می‌شود.
4	3	2	1	0	15. با استفاده از صدایم، گلویم دردناک می‌شود.
4	3	2	1	0	16. با استفاده از صدایم، در گردنم احساس ناراحتی می‌کنم.
بخش 3.					
4	3	2	1	0	17. بعد از اینکه استراحت می‌کنم، صدایم بهتر می‌شود.
4	3	2	1	0	18. بعد از استراحت کردن، میران تلاش و تقلایم برای تولید صدا کمتر می‌شود.
4	3	2	1	0	19. بعد از استراحت کردن، گرفتگی صدایم بهتر میشود.

## REFERENCES

- Koufman JA, Blalock PD. Vocal fatigue and dysphonia in the professional voice user: Bogart-Bacall syndrome. *Laryngoscope*. 1988;98:493-498.
- Smith E, Gray S, Dove H. Frequency and effects of teachers with voice problems. *J Voice*. 1997;11:81-87.
- Kitch JA, Oates J. The perceptual features of vocal fatigue as self-reported by a group of actors and singers. *J Voice*. 1994;8:207-214.
- Solomon NP. Vocal fatigue and its relation to vocal hyperfunction. *Int J Speech Lang Pathol*. 2008;10:1-13.
- Welham NV, MacLagan MA. Vocal fatigue: current knowledge and future directions. *J Voice*. 2003;17:21-30.
- Boucher VJ, Ayad T. Physiological attributes of vocal fatigue and their acoustic effects: a synthesis of findings for a criterion-based prevention of acquired voice disorders. *J Voice*. 2010;24:324-336.
- Colton RH, Casper JK. *Understanding Voice Problems: A Physiological Perspective for Diagnosis and Treatment*. 2nd ed. Baltimore, MD: Williams & Wilkins; 1996.
- Boone DR, McFarlane SC. *The Voice and Voice Therapy*. Englewood Cliffs, NJ: Prentice Hall; 1988.
- Burzynski CM, Titze IR. Assessment of vocal endurance in untrained singers. In: Lawrence VL, ed. *Transcripts of the Fourteenth Symposium*.

- Care of the Professional Voice. New York: The Voice Foundation; 1986:96–101.
10. Kostyk BE, Rochet AP. Laryngeal airway resistance in teachers with vocal fatigue: a preliminary study. *J Voice*. 1998;12:287–299.
  11. Nanjundeswaran C, Jacobson BH, Gartner-Schmidt J, et al. Vocal Fatigue Index (VFI): development and validation. *J Voice*. 2015;29:433–440.
  12. Sivasankar M. Effects of vocal fatigue on voice parameters of Indian teachers. *Indian J Otolaryngol Head Neck Surg*. 2002;54:245–247. PMID:23119905.
  13. Laukkanen AM, Ilomaki I, Leppanen K, et al. Acoustic measures and self-reports of vocal fatigue by female teachers. *J Voice*. 2008;22:283–289. PMID:17134877.
  14. Colton RH, Casper JK, Leonard R. *Understanding Voice Problems: A Physiological Perspective for Diagnosis and Treatment*. 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2006.
  15. Gotaas C, Starr CD. Vocal fatigue among teachers. *Folia Phoniatri (Basel)*. 1993;45:120–129.
  16. Stemple JC, Glaze LE, Klaben BG. *Clinical Voice Pathology: Theory and Management*. 3rd ed. San Diego, CA: Singular Publishing; 2000.
  17. Scherer RC, Titze IR, Raphael BN, et al. Vocal fatigue in a trained and an untrained voice user. In: Baer T, Sasaki C, Harris K, eds. *Laryngeal Function in Phonation and Respiration*. San Diego, CA: Singular Publishing Group; 1991:533–555.
  18. Vilkman E. Occupational safety and health aspects of voice and speech professions. *Folia Phoniatri Logop*. 2004;56:220–253.
  19. Enoka RM, Stuart DG. Neurobiology of muscle fatigue. *J Appl Phys*. 1992;72:1631–1648.
  20. Enoka RM, Stuart DG. The contribution of neuroscience to exercise studies. *Fed Proc*. 1985;44:2279–2285.
  21. McCabe DJ, Titze IR. Chant therapy for treating vocal fatigue among public school teachers: a preliminary study. *Am J Speech Lang Pathol*. 2002;11:356–369.
  22. Paolillo NP, Pantaleo G. Development and validation of the voice fatigue handicap questionnaire (VFHQ): clinical, psychometric, and psychosocial facets. *J Voice*. 2015;29:91–100. PMID:25261955.
  23. Nanjundeswaran C, VanSwearingen J, Abbott KV. Metabolic mechanisms of vocal fatigue. *J Voice*. 2017;31:378.e1–378.e11.
  24. Banks RE, Bottalico P, Hunter EJ. The effect of classroom capacity on vocal fatigue as quantified by the Vocal Fatigue Index. *Folia Phoniatri Logop*. 2017;69:85–93.
  25. Hunter EJ, Banks RE. Gender differences in the reporting of vocal fatigue in teachers as quantified by the Vocal Fatigue Index. *Ann Otolaryngol Rhinol Laryngol*. 2017;126:813–818.
  26. Aaronson N, Alonso J, Burnam A, et al. Assessing health status and quality-of-life instruments: attributes and review criteria. *Qual Life Res*. 2002;11:193–205. PMID:12074258.
  27. Zambon F, Moreti F, Nanjundeswaran C, et al. *Cross-cultural adaptation of the Brazilian version of the Vocal Fatigue Index—VFI29* Sociedade Brasileira de Fonoaudiologia; 2017. InCoDAS.
  28. Acquadro C, Conway K, Hareendran A, et al. Literature review of methods to translate health-related quality of life questionnaires for use in multinational clinical trials. *Value Health*. 2008;11:509–521.
  29. Bullinger M, Alonso J, Apolone G, et al. Translating health status questionnaires and evaluating their quality: the IQOLA project approach. *J Clin Epidemiol*. 1998;51:913–923.
  30. Aronson AE, Bless DM. *Clinical Voice Disorders*. New York: Thieme; 2009.
  31. Beaton DE, Bombardier C, Guillemin F, et al. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*. 2000;25:3186–3191.
  32. Nawka T, Wiesmann U, Gonnermann U. Validation of the German version of the Voice Handicap Index. *HNO*. 2003;51:921–930.
  33. Pruszewicz A, Obrebowski A, Wiskirska-Woznica B, et al. Complex voice assessment—Polish version of the Voice Handicap Index (VHI). *Otolaryngol Pol*. 2004;58:547–549.
  34. Helidoni ME, Murry T, Moschandreass J, et al. Cross-cultural adaptation and validation of the voice handicap index into Greek. *J Voice*. 2010;24:221–227.
  35. Ohlsson AC, Dotevall H. Voice handicap index in Swedish. *Logoped Phoniatri Vocol*. 2009;34:60–66.
  36. Haynes SN, Nelson K, Blaine DD. Psychometric issues in assessment research. In: Kendal PC, Butcher JN, Holmbeck GN, eds. *Methodological Issues in Research Using Projective Methods*. New York, NY: John Wiley & Sons, Inc.; 1999:144.
  37. Zhu W, Zeng NN, Wang N. Sensitivity, specificity, accuracy, associated confidence interval and ROC analysis with practical SAS implementations; *Paper Presented at: NESUG 2010*. Baltimore, MD, Nov 14–17, 2010. <http://www.nesug.org/Proceedings/nesug10/hl/hl07.pdf>.
  38. Hakkesteeft MM, Wieringa MH, Brocaar MP, et al. The interobserver and test-retest variability of the Dysphonia Severity Index. *Folia Phoniatri Logopaedica*. 2008;60:86–90.