Iranian Voice Quality of Life Profile (IVQLP): Factor Analysis

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Summary: Objectives. An important domain in health-related quality of life evaluations is quality of life perceptions due to having a voice disorder. The objective of this study was to examine the factor structure of the Iranian Voice Quality of Life Profile (IVQLP) based on Exploratory Factor Analysis and confirmatory factor analysis.

Methods. The study sample consisted of 280 patients (174 males and 106 females) diagnosed with MTD, benign organic disorders such as polyps and nodules, and unilateral vocal fold paralysis and cancer. To evaluate the different dimensions of the IVQLP, a principal component analysis (PCA) was conducted. Confirmatory factor analysis (CFA) was used to investigate the fitting of extracted dimensions and construct validity of the IVQLP.

Results. The results showed that the IVQLP has a 4-factor structure. The first factor has 17 items and refers to Emotions. The second factor has 12 items and refers to Individual/Social Relations. The third factor with 6 items refers to Occupation, and the forth with 5 items relates to Psychosomatic characteristics.

Conclusions. The conclusion of this study is that the concept of quality of life in Iranian patients with voice disorders is somewhat different from that of Western patients. This difference can be seen in the large number of items related to an Emotional factor and the identification of a Psychosomatic factor.

Key Words: Quality of life—Health related quality of life—Voice disorders—Iranian population—IVQLP.

INTRODUCTION

One of the main domains in health-related quality of life (HRQoL) studies is the quality of life related to having a voice disorder. Voice-disordered quality of life is a “disease-specific construct” that assesses activity limitations and participation restrictions resulting from having a voice disorder.1,2 Based on the literature, quality of life is a culture-dependent concept.3–5 Because a no-culture-based instrument exists for the people of Iran to measure outcomes of voice disorders, it was decided to develop a tool for assessing quality of life based on the Iranian culture, and this has been named the Iranian Voice Quality of Life Profile (IVQLP) (see Appendix S1 with 65 items and Appendix S2 with 43 items).6 The 65-item version is the primitive version of the IVQLP, whereas the 43-item version was obtained after a Rasch analysis.5 This instrument makes it possible to evaluate the level of self-perceived handicap that Iranian patients experience as a result of their voice disorders. The IVQLP has good internal consistency and reliability, and can accurately reflect the subjective perceptions of Iranian patients relative to voice disorder severity.7 Construct validity testing is an ongoing process and has been incorporated as part of IVQLP development.

Exploratory factor analysis (EFA) is a technique within factor analysis, the main goal of which is to identify the underlying relationships between the measured variables,6 and serves to identify a set of latent constructs underlying a test of measured variables.7 Also, because the IVQLP is in its early stages of development, the relationships among variables are unknown or ambiguous, a situation for which EFA is well suited for analysis.3 A commonly used method to investigate construct validity is confirmatory factor analysis (CFA).9,10 Like EFA, CFA can transform the overall number of observed variables into latent factors based on commonalities within the data. CFA differs from EFA in that it assists in the reduction of measurement error and allows for the comparison of alternatively proposed a priori models at the latent factor level.11 CFA can also be used to statistically compare the factor structure of two or more groups (eg, different disease conditions). The use of CFA to investigate the construct validity of hypothesis-based testing instruments adds a level of statistical precision and can assist in the development of abbreviated forms of an instrument or confirmation of its possible subdomains. Finally, the EFA and CFA are used for identifying construct validity. Therefore, the purpose of the current study was to identify the construct validity of the new index (IVQLP) using EFA and CFA.

METHODS

Participants

The study sample consisted of 280 patients, 174 males and 106 females, diagnosed between September 2015 and February 2016 in Tehran city with muscle tension dysphonia, benign organic disorders such as polyps and nodules, unilateral vocal fold paralysis, and cancer. These individuals had an age range of 18–75 years, with a mean age of 43.16 ± 13.63 years. The dysphonia group consisted of the following subgroups: mild dysphonia—110 individuals with muscle tension disorder (65 males, 45 females); moderate dysphonia—99 individuals (63 males, 36 females) with benign organic disorders such as polyps and nodules; and severe dysphonia—41 individuals with unilateral vocal fold paralysis (25 males, 16 females) and 30 individuals with cancer (21 males, 9 females). Individuals with dysphonia had vocal pathologies for at least 6 months and were selected from the ENT ward of...
Amir Alam Hospital in Tehran city. People who participated in the current study had no surgical or speech therapy intervention for at least 6 months prior to the study.

**Instruction**
The 280 individuals rated their responses to each question on a 4-point Likert scale in the IVQLP questionnaire. In this scale, a rating of 1 meant “never affected” and 4 meant “always affected.” The subjects were given an explanation of the purpose of the study and were assured of confidentiality of their responses.

**Statistical analysis**
To evaluate the different dimensions of the IVQLP, a principal component analysis (PCA) as the first phase of EFA was conducted using SPSS 22.0 (IBM Corporation, New York, United States). Before the PCA was performed, various assumptions on the intercorrelations of the 43 IVQLP items were tested. The determinant has to be >0.00001 and Bartlett’s test was highly significant \( (P < 0.001) \). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for all variables, as well as the individual variables, was set at >0.75.

We opted to extract factors with eigenvalues greater than 1 (Kaiser’s criterion [K1]) and to repeat the PCA after inspection of the scree plot, a graph plotting each eigenvalue against the factor.\(^1\) The cutoff point for selecting factors should be at the point of inflection of this curve.\(^1\) We chose a factor solution after analyzing the interpretability and estimating the reliability of the retained factors. Per factor, four variables are the minimum\(^2\) and at least four factor loadings have to be greater than 0.6.\(^3\) With communalities in the 0.5 range, samples between 100 and 200 can be good enough.\(^6\)

PCA was conducted with oblique rotation and interpreted using primarily the pattern matrix.\(^1\) To assess the fit of the factor models, the differences between the observed correlations and the model-based correlations were taken into account. No more than 50% of the residuals should be greater than 0.05.\(^1\)

CFA was used to investigate the fit of extracted dimensions and the construct validity of the IVQLP. Several fit indices were selected to test which CFA model best represents the present dataset: root mean square error of approximation (RMSEA), comparative fit index (CFI), chi-square, and change in chi-square given the change in degrees of freedom between models. RMSEA is a measure of the average of the residual variance and covariance; good models have RMSEA values that are at or less than 0.08.\(^17,18\) CFI is an index that falls between 0 and 1, with values greater than 0.90 considered to be indicators of good fitting models.\(^18\) When comparing models, a lower chi-square value indicates a better fit, given an equal number of degrees of freedom.\(^18\) CFA was carried out by LISREL 8.8 (Scientific Software International, Skokie, IL).

**RESULTS**

**EFA**
Bartlett’s test of sphericity relates to the significance of the study and thereby shows the validity and suitability of the responses collected to the problem being addressed through the study. For factor analysis to be recommended suitable, the Bartlett’s test of sphericity must be less than 0.05.\(^19\)

Exploring the correlation matrix suggests that the variables were suited for a factor analysis. Bartlett’s test was 13,751.6 and it was highly significant \( (P < 0.0001) \). Also, KMO is a measure of sampling adequacy that is recommended to check the case-to-variable ratio for the analysis being conducted\(^19\) while the KMO ranges from 0 to 1; the worldwide accepted index is over 0.6. In the current study, the KMO resulted in a value of 0.97. The K1 criterion resulted in five-factor and four-factor solutions.

**The five-factor solution**
The five-factor solution explained 72.9% of the variance. The inspection of the scree plot indicated a five-factor solution (Figure 1).

Stevens recommends interpreting only factor loadings with an absolute value greater than 0.4 (which explains approximately 16% of the variance).\(^20\) Therefore, the construct matrix that was obtained was based on a seven varimax rotation and factor loadings with an absolute value greater than 0.4 (Table 1).

Table 1

As shown in Table 1, all of the 43 items have factor loadings with an absolute value greater than 0.4.

Based on the findings, the following conclusions were reached:

1. Items 11, 22, and 43 are complex and their factor loading is focused on two factors.
2. The rest of the items are very pure or without complexity.
3. The maximum coefficient is related to item 40 (0.887).
4. The minimum coefficient is related to item 1 (0.505).

Some of the items have a factor loading that is focused on more than one factor, and also the questions related to the first and fifth factors were very similar to each other and belongs to the emotional domain. Therefore, the separation of content into two factors (the first and fifth) did not have any theoretical justification. Thus, it was decided that the complex items 11, 22, and 43 could be deleted and factor analysis was performed again. This reanalysis resulted in a four-factor structure.

**The four-factor solution**
The four-factor solution explained 70.97% of the variance. The inspection of the scree plot supported the four-factor solution (Figure 2). The eigenvalues of the four factors, % of variance, and cumulative % are shown in Table 2. The construct matrix that was obtained based on the six varimax rotation and factor loadings with an absolute value greater than 0.4 is shown in Table 3.

In general, this study shows the following results:

1. The first factor with 17 items refers to the emotional factor.
2. The second factor with 12 items refers to the individual or social relations factor.
3. The third factor with 6 items refers to the occupational factor.
The fourth factor with 5 items refers to the psychosomatic factor.

The final questionnaire with extracted factors is provided in Appendix S3.

Internal consistency
Many experts such as Thorndike believe that after the implementation of factor analysis and distinctive cluster definitions, the internal consistency determination of a set of items indicating the distinctive factors is essential. Thus, the best item set is that which has the highest degree of internal consistency. A conventional method for estimating the internal consistency is using Cronbach’s alpha coefficient. The results are shown in Table 4.

Generally, an internal consistency of $\alpha \geq 0.90$ is considered excellent and $0.70 \leq \alpha < 0.90$ is considered good. As shown in Table 4, the internal consistency coefficients were high for the extracted factors. Coefficients were never less than 0.6. This suggests that the number of factors was properly extracted.

CFA
It is important to note that CFA was performed to ensure that the factors were properly extracted. In addition, one dimensionality of the concept of quality of life in the four-factor model was suggested by the EFA. The fit indices are given in Table 5. As seen in Table 5, chi-square was significant and $\chi^2/df$ was less than 2 and in accordance with accepted standards. Indices of goodness of fit (goodness of fit index [GFI], normed fit index [NFI], and CFI) were high and show good fit to the data. Also, the RMSEA was 0.051. Hu and Bentler suggested $\leq 0.06$ as a cutoff value for a good fit. Thus, it can be concluded that the four-factor structure of the IVQLP was empirically verified.

Internal validity
To assess the internal validity of the IVQLP, correlation coefficients among the four factors were calculated and are shown in Table 6. As seen in Table 6, all correlation coefficients of the IVQLP factors in patients with voice disorders are significant. The highest correlation (0.86) belongs to the individual or social relations factor and the emotion factor, and the lowest correlation coefficient (0.45) is between the psychosomatic and occupational factors. Correlation coefficients between the factors and the total score are also very high, with the highest correlation being between the emotion factor and total score (0.95), and the lowest between the occupational factor and total score (0.72).

DISCUSSION
The factor structure of the IVQLP
As seen in Appendix S3, the first set of items includes the following: “I am ridiculed by others,” “I feel humiliation,” “I’m embarrassed,” “I feel rejection and loneliness,” “I have no hope for the future,” “I have trouble in friend finding,” “I feel my opinions not taken seriously by others,” and “I feel anxious.” Based on the findings of clinical psychology, the mentioned items are under an emotional domain. This factor has the largest number of questionnaire items (17 items) and highlights the importance of this factor based on the views of Iranian patients. The content of this factor is consistent with the literature. Based on the literature, the above-mentioned items can be categorized as the emotional factor. This factor is under the individual characteristic factor in the Ferrans et al model, and as mentioned in previous questionnaires this factor is one of the key components of the concept of quality of life in patients with voice disorders.

Based on the literature, a variety of psychological factors affect the health-related quality concept. The psychological factors
The intrinsic factors can be subdivided into those resources that enhance health and factors associated with increased risk of disease. Such risk factors include negative emotions (eg, anxiety and depression) and cognition (eg, hopelessness and hostility); examples of resources are coping ability, sense of coherence, and perceived control over life. Many patient-based studies have demonstrated that psychological factors are vital correlates of HRQoL. Psychological risk factors include negative emotions that have a negative impact on HRQoL. The current study supports the negative impact of risk factors on quality of life provided by negative emotions.

As shown in Appendix S3, the items are clustered in the second factor: “I avoid speaking as much as possible” and “People ask me to speak louder” are under a relations domain. The set of these items indicates a problem associated with interpersonal communication with others. This factor is under environmental factors in the France (2005) and the World Health Organization (2007) models. Extracting this factor according to the principle that communication relies on voice is not unreasonable. Thus, the relations factor is one of the most important factors that make up the concept of quality of life in people with voice disorders, and this factor has been considered within the majority of the quality of life questionnaires.

Bayor et al state that quality of life related to relationships in patients with voice disorders consists of several physiological factors (voice quality), individual factors (effective responses, coping strategies), and social factors (physical environment, other people, participation in social legislation). The content structure of this factor is concentrated on social relationships and communication with others.

Based on the information in Appendix S3, clustering of content items of the third factor (occupation) indicates that another factor and component of quality of life in patients with voice disorder is being able to carry out one’s job and meeting one’s economic needs. Patients indicate that their voice disorder impairs them relative to carrying out their professional duties properly.

Ma and Yiu state that quality of life is a term to describe well-being in the areas of economic, social, and psychological realms, and this well-being is related to performance of individuals in their daily activities and the contributions of those individuals in these activities. Any limitations in daily activities may lead to a degradation of their quality of life, and people with voice disorders have serious problems in carrying out their professional affairs as part of their daily activities. This factor is consistent with the previous studies.

The item set of the fourth factor indicates that another domain of the quality of life concept in Iranian patients with voice disorder is the psychosomatic domain, with items such as “I have headache in speaking,” “My voice sometimes is good and sometimes goes wrong,” “Because of my voice, I get nervous,” etc. This is consistent with the findings of Bogaardt and colleagues. Bogaardt et al analyzed the voice handicap index (VHI) questionnaire based on the Rasch model analysis and reduced three domains of VHI—physical, functional, and emotional—to two domains—psychosocial and physical-functional. The physical-functional domain of Bogaardt et al is consistent with the psychosomatic domain of the current study. However, there were differences between them, including such item as “I have headache in speaking”; this may be more related to Iranian patients’ cultural specificity. According to the study of Bash that was conducted in collaboration with the World Health Organization between 1963 and 1976 in different parts of Iran, entitled “Epidemiology of psychosomatic disorders in Iran,” psychosomatic

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Note: Item numbers belong to the Rasch analysis version of the IVQLP (Appendix S2).

Abbreviation: IVQLP, Iranian Voice Quality of Life Profile.
headaches are common in Iran. Narahæti (a noun; the adjective is narahæt) is a general term used by Iranians to express undifferentiated, unpleasant emotional and physical feelings. It is not entirely translatable. Narahæti is used to denote a wide range of negative emotions, such as being depressed, inconvenience, nervous, anxious, troubled, uneasy, worried, upset, disappointed, bothered, not tranquil, being in a bad mood, not feeling well, and restless. The adjective narahæt is used in ordinary conversation to express and describe a variety of adverse feelings, both physical and emotional. In the Iranian culture, where people may be reticent to express private narahæti, complaints about bodily discomfort such as chest pains, stomachaches and other digestive problems, and pains in the limbs are commonplace.

This issue in the current study is reflected in items such as “I have headache in speaking” or “Because of my voice, I get nervous.”

The CFA showed that the four-factor structure of the IVQLP was empirically verified. This means the construct explored by EFA was a four-factor construct and has the best fitness of the hypothesized construct for the new index (IVQLP).

**Internal validity**

As mentioned in the Results section, the highest correlation among the factors of the IVQLP belongs to the individual or social relations factor and the emotion factor, with a value of 0.86. In other words, improving individual or social relations may also correspond to improved emotional responses. Emotions are central to any interpersonal relationship. They are physiological, behavioral, or communicative reactions to stimuli that are cognitively processed and experienced as emotional, and are divided into primary and secondary emotions. Primary emotions are innate emotions that are experienced for short periods of time and appear rapidly, usually as a reaction to an outside stimulus, and are experienced similarly across cultures. The primary emotions are joy, distress, anger, fear, surprise, and disgust. Secondary emotions are not as innate as primary emotions, and they do not have a corresponding facial expression that makes them universally recognizable. Secondary emotions are processed by a different part of the brain that requires higher order thinking, and therefore are not reflexive. The secondary emotions are love, guilt, shame, embarrassment, pride, envy, and jealousy. These emotions develop over time, take longer to fade away, and are interpersonal because they are most often experienced in relation to real or imagined others. Therefore, these kinds of emotions are more influenced by and formed in interpersonal human relationships. They can impress and affect those relationships. This is in excellent alignment with the findings of the current study.

In addition, correlation coefficients between the emotion factor and total score are also very high. This finding suggests the importance of emotions in shaping behaviors and it is consistent with the literature.

### TABLE 2. Eigenvalues, % of Variance, and Cumulative % of the Four Factors

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**CONCLUSIONS**

Based on the findings of the current study, it seems that the concept of quality of life in Iranian patients with voice disorders is somewhat different from that of Western patients. This difference can be seen in the factor structure of the IVQLP obtained by exploratory and confirmatory factor analyses in the
current study. As Konnai et al stated, “the perceptions of a disability regarding its effect on work, social, and daily activities of an individual in the population of less-developed countries may be different from those of highly developed Western nations” (p. 206). In the clinical scope, the IVQLP can satisfy speech language pathologists’ needs in Iran to include outcome measures, along with cultural specificities. As Hofstede noted, “countries that have tried to transfer Western ideas wholesale have been in trouble- Iran for example” (p. 397). Therefore, developing the quality of life concept based on the culture of a particular country is more applicable to the patients of that country. Also, clinically, identifying the structure of quality of life in patients based on their culture can help achieve a more precise evaluation and consequently better treatment. For example, the psychosomatic domain is a unique domain in the IVQLP that is not in the previous indexes and was explored based on the Iranian patient culture, and can help the Iranian clinician obtain a better understanding of the dynamic concept of quality of life in the target population.

**Acknowledgment**

We are thankful to all our participants for their cooperation in this study.

**SUPPLEMENTARY DATA**

Supplementary data related to this article can be found online at doi:10.1016/j.jvoice.2017.01.001.
REFERENCES


