Cross-Cultural Adaptation and Validation of the Voice Handicap Index in the Quebec French Population (VHI-QF)

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Summary: Background and Objectives. The Voice Handicap Index (VHI) is a widely recognized, self-administered questionnaire, designed to evaluate patients' perception of voice-related disability. It takes into consideration the physical, functional and emotional impacts of dysphonia. The VHI has been translated and validated in many languages, including European French. The purpose of our study is to translate, adapt and validate a new version of the VHI in Quebec French.

Methods. The original VHI was translated into Quebec French (QF) by forward and backward translations by four professional translators, including a speech-language pathologist. The content validity of the resulting VHI-QF was examined in focus groups with six patients and seven speech-language pathologists. Another sample of 154 patients with voice disorders and 150 healthy controls allowed evaluation of the new questionnaire's convergent and discriminant validity, and internal consistency. Satisfaction toward the questionnaire was also evaluated for all patients, as well Test-retest reliability and responsiveness for a sub-sample.

Results. The VHI-QF showed a moderate correlation with dysphonia severity level, indicating adequate convergent validity. Both total and subscale scores also exhibited adequate ability to discriminate between patients and controls (discriminant validity), high internal consistency, and good test-retest reliability. The analysis of pre- and post-treatment VHI-QF scores revealed adequate responsiveness to voice treatment. Patients were overall satisfied with the questionnaire.

Conclusion. The VHI-QF is a valid, reliable and clinically useful self-reported tool to evaluate the severity and change of voice disorders in Quebec French population. Therefore this questionnaire can be used in clinical and research contexts.

Key Words: Voice Handicap Index−Dysphonia−Normal voice−French−Handicap.

INTRODUCTION

Voice disorder assessment can be a clinical challenge even for most experienced clinicians. Part of the challenge originates from the difficulty to evaluate the overall impact of a voice disorder in a patient's daily life. The effectiveness of an intervention is also difficult to evaluate at follow-up. Many validated questionnaires on voice problems in daily life exists, including the 30-item Voice Handicap Index (VHI)[1] and his shortened version, the VHI-10,[2] the 28-item Voice Activity and Participation Profile,[3] the 10-item Voice-Related Quality of Life Questionnaire,[4] and the Voice Outcome Survey.[5] Franic et al[6] evaluated the psychometric properties of these questionnaires and recommended the VHI for clinical use with individual patients as it showed preferable measurement characteristics on item information, practicality, and reliability when compared to other voice quality of life measurement instruments.

The original English version of the VHI questionnaire was developed in 1997 by Jacobson et al[1] It shows strong internal consistency (Cronbach's alpha coefficient for total score = 0.95) and test-retest reliability (functional [$r = 0.84$], emotional [$r = 0.92$], physical [$r = 0.86$], and total score [$r = 0.92$]) for the assessment of voice disorders.[1] The VHI is a 30-item self-reported questionnaire measuring the perceived handicap in daily life secondary to dysphonia. It contains three subscales that evaluate the functional, physical, and emotional aspects of the handicap. Since its development, the VHI has undergone extensive validation, showing satisfactory content validity, good discrimination ability, and the ability to measure treatment effect.[7]

Since its development, the VHI has been validated in many languages,[8] including European French.[9] According to the authors, the European French translation of the VHI followed a valid process, but some discrepancy was found between the original and this translated version during the validation analyses. For example, some items initially associated to a specific subscale were more strongly correlated to another subscale.

Recent studies[10] have proposed guidelines for cross-cultural adaptation of self-reported measures. According to

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these guidelines, if an evaluation instrument is to be used across cultures, its items must not only be translated linguistically, but must also be adapted culturally to maintain the content validity of the instrument at a conceptual level across different cultures. Additional guidelines have been developed by the *Critical Appraisal Skills Program* and present 12 recommendations to follow in order to appropriately develop a questionnaire adaptation procedure.[8]

The question of linguistic variation and its description is critical to the adequate usage of a questionnaire such as the VHI for a specific population. For example, French is used in many countries around the world and its Quebec (Canada) variety differs from its European variants on numerous aspects, including lexical, semantic, and phonetic levels.[11] With regard to these cultural and linguistic differences, there is a need for a standardized voice-related quality of life measure adapted to the Quebec French population, given significant differences at linguistic and cultural levels between French speakers of Europe (mostly France, Belgium, Switzerland) and Quebec. Therefore, the aims of this current prospective cohort study were as follows: (1) conduct a Quebec French translation and cultural adaptation of the VHI based on a rigorous procedure and (2) measure the validity of this new adaptation. A secondary set of objectives was to measure its test-retest reliability and its ability to capture change following treatment. These objectives were completed following all but one recommendations of the 12 item checklist developed by the *Critical Appraisal Skills Program* and recommended by Seifpanahi et al.[8]

METHODS

Ethical consideration

The research protocol was approved by the ethics committee *CHU de Québec*, #2017-3152 for the collection of the patient's data. The data on healthy adults were collected as part of a larger research project on voice aging that was approved by the Institutional Ethical Committee of the Institut Universitaire en Santé Mentale de Québec (#192-2017). Informed consent was obtained from the study participants, and data were collected in an anonymized database. Control participants were compensated for their participation.

Translation and cultural adaptation

The original English version of the VHI was first translated into Quebec French by two independent native Quebec French certified translators who, after an initial independent work, proposed a single Quebec French version upon agreement. This agreement was reached during an afterward meeting between the two translators. One of those translators was also a certified speech-language pathologist, but did not take part in the rest of the study. This version was then translated back into English by the same process by two different and independent native Canadian English certified translators who proposed a single version upon agreement. Both French (forward) and English (back) translations were reviewed with regard to wording by two speech-language pathologists (LD and VMS), one otolaryngologist with specific expertise in voice disorders (SG), and an otolaryngology resident (JMB) to propose an initial version of the Voice Handicap Index Quebec French (VHI-QF). A total of six persons, both experts and nonexperts, were therefore involved during each translation. Next, the VHI-QF was reviewed in two different focus groups. The first group involved six patients recruited in the out-patient voice clinic of *CHU de Québec*, and the second involved seven speech language pathologists from the Province of Quebec (including LD and VMS), a laryngologist (SG), and an otolaryngology resident (JMB). During the process, each question was reviewed and adjusted. Other elements such as formatting or instruction clarity were also discussed. Following these meetings, a final version of the VHI-QF was produced. A short satisfaction questionnaire was developed for responders, which consisted of three questions, scored on a Likert scale of one to five, investigating (1) the adequacy of the format of the test, (2) the clarity of the questions, and (3) the allowed time to complete the 30 questions.

Validation

Setting and participants

Following the translation and adaptation of the VHI-QF, 304 subjects were prospectively enrolled for validation. A total of 154 adult patients with voice disorder referred to the outpatient voice clinic of the Department of Otolaryngology Head and Neck Surgery and Speech Pathology Clinic of the CHU de Quebec were recruited. Dysphonia etiology varied between patients and included (1) structural damage to the vocal fold (eg nodules and polyps), (2) neurological causes (eg vocal fold paralysis), (3) vocal abuse or misuses, (4) functional/psychogenic causes, and (5) idiopathic causes. All participants completed the VHI-QF at the clinic as well as the satisfaction questionnaire. Both questionnaires were self-administered to avoid interaction with interviewer and prevent a bias in the way the questions were asked and answered. In addition, voice usage (professional vs nonprofessional) and dysphonia severity was assessed by a speech-language pathologist. Participants were considered as professional voice users if they were a professional signer, an actor, or occupied any employment requiring significant vocal capacities.

A second sample of 150 healthy adults was recruited from the general population; they were reached by way of posters disseminated in Quebec City, and emails to university mailing lists and various groups. Participants reported no voice disorder, gastric reflux, sleep apnea, swallowing disorder, allergies, asthma, or chronic cough. Half the participants in this group took part in a nonprofessional group singing. Even though VHI scores are known to be different for professional singers, it is believed that this element would not specifically have an influence on the results for the present

study since singing for these participants is not a major part of their daily life. All participants completed the VHI-QF.

Convergent validity

Convergent validity refers to the ability for an instrument to give comparable results to what is measured by another instrument supposed to evaluate a similar construct. Convergent validity was measured by conducting a Pearson's correlation between the VHI-QF total score and the severity of the dysphonia on a six-point Likert scale (ranging from "normal" to "severe"), as evaluated by the treating speech-language pathologist.

Discriminant validity

Discriminant validity refers to the ability for an instrument to correctly differentiate two different groups. The questionnaire's ability to detect a difference between healthy controls ($n = 150$) and patients suffering from dysphonia ($N = 0$ 154) was evaluated with independent-sample t tests when (parametric) or Mann-Withney U tests (nonparametric) depending on the respect or violation of the homogeneity of variances assumption following Levene's test.

Internal consistency

Internal consistency refers to the ability for items in an instrument to correlate with each other, given that they are measuring the same construct. As the VHI contain three subscales, internal consistency for total, physical, functional, and emotional subscales were assessed using Cronbach's α coefficients. The α's value was interpreted as sufficient when larger than 0.7, good when > 0.8, and excellent when larger than 0.9.[12]

Test-retest reliability

In a valid questionnaire documenting a stable or chronic condition, responses are not expected to change over a period of time. Ten participants who did not receive speech therapy were randomly selected from the patient cohort to complete the VHI-QF a second time at least two weeks following their enrollment ($M = 21.1$, SD = 18.8 weeks). Test-retest reliability was measured using a two-factor mixed-model intraclass correlation analysis (absolute agreement type) on the total score. The ICC score was interpreted as an indicator of poor (<0.5), moderate (0.5−0.75), good (0.76−0.9), or excellent (>0.9) test-retest reliability.[13] Regarding the sample size, it has been suggested that a sample of $n = 10$ is sufficient for ICC measurements (<0.7) with power = 80%, $\alpha = 0.05$, and two observations per subject.[14]

In addition, using the reliability of the instrument, critical difference scores can be calculated, corresponding to threshold over which a score difference is considered statistically significant. These critical difference scores were calculated using a bootstrap procedure (1000 iterations) by calculating 95% confidence intervals for the functional, physical, emotional subscales, and for the VHI total score. The same procedure was used in the original VHI development study.[1]

Responsiveness

Responsiveness is defined as "The ability of an instrument to detect change over time in the construct to be measured".[15] Thus, thirteen patients were asked to fill the VHI-QF following a complete voice therapy program of an average duration of 18.7 (SD = 9.3) weeks. While each patient's therapy program was specifically tailored for the patient's needs, most interventions targeted either respiration (eg improving breathing patterns), vocal usage (eg increasing the use of a resonating voice), or behavioral changes (eg increasing body hydration). The responsiveness analysis was performed for overall score and each subscale using paired-sample t tests.

Patient's satisfaction

As the VHI-QF is a self-administered questionnaire, we were interested in evaluating patients' satisfaction towards it. Patients were asked to score, using a Likert scale of one to five, the format of the test, the clarity of the questions, and the time allowed to complete the questionnaire. We report patient satisfaction using descriptive statistics. Response patterns as a function of voice usage (professional or not) were compared using Pearson's Chi-square tests. This analysis was conducted to ensure that the questionnaire was similarly adequate for both professional and nonprofessional voice users.

RESULTS

The mean age of the patient group ($n = 154$) was 50.3 (SD = 16.8) years, ranging from 18 to 88 years. The group was composed of 107 women (69.5 %) and 47 men (30.5 %). Thirty-six of them (23.4 %) were professional voice users.

TABLE 1.
Mean Values (Std. Deviation) of the VHI-QF Scores for Control and Patient Groups Assessed with Mann-Whitney *U* Tests (*P* value)

VHI Scale	Control Group ($n = 150$)	Patient Group ($n = 154$)	Mann-Whitney U Test	Effect Size (Cohen's d)
Functional	3.0 (2.7)	13.0 (8.7)	$U = 13.6$, $P < 0.001$	1.22
Physical	3.3 (3.3)	19.2 (7.1)	$U = 25.1$, $P < 0.001$	1.64
Emotional	1.4 (1.7)	11.8 (8.0)	$U = 15.8$, $P < 0.001$	1.33
Total	7.7 (6.4)	43.9 (21.5)	$U = 20.1$, $P < 0.001$	1.50

The mean age of the control group ($n = 150$) was 53.5 (SD = 20.1) years ranging from 20 to 98 years of age. The group was composed of 87 (58.0 %) women and 63 (42.0 %) men. None of them was a professional voice user but 50% of the sample took part in group singing activities. There was no significant age difference between groups according to a Mann-Withney U test, $U = 1.465$, $P = 0.144$. However, a significant difference in the distribution of sex was found, χ^2 (1, $N = 304$) = 4.337, $P = 0.037$. The high proportion of women in the patient group follows previous published literature on dysphonia prevalence in treatment–seeking population amongst men and women.[16]

Convergent validity

The correlation between the VHI-QF total score and the speech therapist severity score (which used a Likert scale of 0 to 5) was significant but moderate, $r_{(154)} = 0.512$, $P < 0.001$, suggesting that the VHI-QF is measuring similar but not identical parameters. The functional, physical and emotional subscale showed significant moderate to weak correlations (functional: $r_{(154)} = 0.481$, $P < 0.001$; physical: $r_{(154)} = 0.558$, $P < 0.001$; emotional: $r_{(154)} = 0.355$, $P < 0.001$). The correlation was best with the physical subscale of the VHI-QF.

Discriminant validity

Table 1 reports the mean VHI-QF totals for patients and controls, as well as scores for each subscale in each group.

TABLE 2.
Critical Difference Scores for the VHI-QF, the European French Version* and the Original American English Version†

VHI Scale	VHI-QF	European French Version	American English (Original)
Functional	7	6	8
Physical	5	10	8
Emotional	5	6	8
Total	14	15	18

* Woisard et al., 2004.
† Jacobson et al., 1997.

Due to the violation of the assumption of homogeneity of variances between the two groups for each score (Levene's test F value ranging from 65.4.0 to 171.4, $P < 0.001$), non-parametric Mann-Whitney U tests were conducted to assess group differences. These differences were found significant for all scores (total and subscales) (Table 1). Further, Cohen's effect size value, ranged from $d = 1.22$ to $d = 1.64$, exceeded Cohen's[17] convention for a large effect ($d > 0.80$).

Internal consistency

For the patient group, the Cronbach α coefficient of the VHI-QF total score questionnaire was 0.94. The internal consistency of the functional, physical, and emotional subscale was 0.89, 0.82, and 0.87, respectively, indicating good to excellent internal consistency.

Test-retest reliability

A total of 10 patients with chronic dysphonia who did not receive speech therapy filled the VHI-QF a second time after a period of at least six weeks (mean = 21.1, SD = 18.8). A Shapiro-Wilk test on both distributions was performed and indicates that VHI scores follow a normal distribution, at both test W(10) = 0.964, $P = 0.633$ and retest measurements, W(10) = 950, $P = 0.673$. A two-factor mixed-model intraclass correlation coefficient analysis showed good test-retest reliability (ICC = 0.865, $F_{(9,9)} = 8.426$, $P = 0.004$). In addition, using the reliability of the instrument, critical difference scores can be calculated, corresponding to threshold over which a score difference is considered statistically significant. These critical difference scores were calculated using a bootstrap procedure (1000 iterations) by calculating 95% confidence intervals for the functional, physical, emotional subscales, and for the VHI total score. Table 2 reports these scores: a difference in the functional subscale of 7, of 5 for the physical and emotional subscales, and of 14 for the total score (or greater) indicates a significant change not due to inherent variability of the questionnaire's score.

Responsiveness

Thirteen patients who were treated for dysphonia completed the VHI-QF a second time following a complete voice treatment program, to evaluate the ability of the questionnaire

TABLE 3.
Mean Values (With Standard Deviations) of the VHI-QF Scores Before and After Speech Therapy, as Assessed Using Paired Sample *t* Tests (*P* Value)

VHI-QF Scale	Pretreatment ($n = 13$)	Post-treatment ($n = 13$)	Paired Sample t Test
Functional	14.2 (8.2)	5.2 (4.5)	$t_{(12)} = 4.821$, $P < 0.001$
Physical	18.8 (6.5)	9.5 (8.6)	$t_{(12)} = 4.666$, $P = 0.001$
Emotional	12.0 (7.8)	4.6 (5.3)	$t_{(12)} = 4.214$, $P = 0.001$
Total	45.0 (18.7)	19.2 (19.2)	$t_{(12)} = 5.160$, $P < 0.001$

to measure improvement. The mean VHI-QF total pre- and postvoice therapy were respectively 45.0 (SD = 18.7) and 19.2 (SD = 16.2). A paired sample *t* test showed a significant effect ($t_{(12)} = 5.160$, $P < 0.001$). Subscales analysis for physical, functional, and emotional scores are reported in Table 3. All analyses revealed statistically significant differences.

Patient's satisfaction

Patients were asked if the format of the questionnaire makes it simple to complete. A total of 96.6% of responders were in agreement or total agreement with this statement. When asked if the questions were clear and easy to understand, 94.4 % of responders were in agreement or total agreement. Finally, when asked about time allowed to fill the VHI-QF, 99.3% agreed or totally agreed that the allotted time to complete questionnaire was sufficient. It is to note that patients were asked to complete the questionnaire at the clinic, while waiting for a consultation with an laryngologist or SLP. Overall, these results indicate that the VHI-QF meets patient's needs in terms of a global evaluation of their dysphonia in a clinical setting.

A proportion analysis was conducted in order to compare the pattern of response for patient's satisfaction depending on their voice usage (professional or not). No difference was found ($\chi^2_{(2,\ N\ =\ 144)} = 0.028$, $P = 0.986$).

DISCUSSION

This study aimed to create a cross-culturally adapted version of the VHI for the Quebec French population, and to validate this version, based on a rigorous methodology following published guidelines.[8] For the adaptation process, the *Critical Appraisal Skills Program*[8] suggests that (1) the translation should be made by more than 3 people, (2) at least one "lay person" should be involved, (3) at least one voice expert should be involved, (4) a panel should be involved, (5) a back-translation procedure should be completed, and (6) cultural equation should be performed. The present study followed all these recommendations. Only the recommendation that the back-translation should be analyzed by the original authors of the questionnaire was not followed here. Nevertheless, the present study went further by involving patients and professionals in the VHI-QF validation process. This follows the *Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures*.[10] This method ensures that an adaptation is equivalent to the original questionnaire and allows the comparability of responses across populations divided by language or by culture.

The main finding of the present study is that the VHI-QF is valid, reliable, and sensitive to change. The VHI-QF showed adequate convergent validity and very good discriminant validity. Internal consistency measures were coherent with the validation of the original questionnaire by Jacobson et al[1] It was observed that the total score for internal consistency was higher than subscales' internal consistency which has also been observed in other language adaptation and validation of the VHI.[18] This may reflect the interconnection of the physical, functional, and emotional impact of a voice disorder.

For the test-retest reliability, intraclass coefficient correlation was used to reduce the risk of overestimation of the relationship with a small sample size. A good test-retest reliability was obtained as shown by a high intraclass correlation coefficient value. However, compared to the original American English version, the test-retest reliability coefficient of the VHI-QF was somewhat lower (0.89 vs 0.92) which may be explained by the small subsample size ($n = 10$). Nevertheless, this value represents a good test-retest reliability. A lower test-retest coefficient has also been observed in other languages cross-cultural adaptation and validation.[19,20]

The VHI-QF's ability to capture changes due to treatment was significant for total score and all subscales. This means that patient self-reported an improvement for the physical, functional, and emotional components of their voice disorder following voice therapy. This result was expected, because all three components are therapeutic targets of typical voice therapy protocols. The VHI-QF presents a moderate correlation with the Likert scale score for dysphonia severity as reported by the speech pathologist who evaluate the patients. This was also an expected result as the VHI is designed to propose a global evaluation of the patient's handicap related to his/her dysphonia and not dysphonia severity *per se*. Patients were overall satisfied by the format, clarity of questions, and time to fill out the questionnaire which is important because the VHI is a self-reported questionnaire that is often completed in clinical settings where time is limited. Importantly, professional and nonprofessional voice users were similarly satisfied with the questionnaire, supporting its use in both populations.

Strengths and limitations of the study

This study developed and validated the VHI-QF in a large population representative of voice clinic attendees as well as a large adult control group. The standardized translation and involvement of speech language pathologist and patients in the process ensured that the cultural adaptation was most appropriate from both a professional and a naive perspective. However, this study also has some limitations. First, the sample size for test-retest reliability was low ($n = 10$), and considerably lower than the sample size used in the original study ($n = 63$). This is due to the difficulty recruiting patients from the speech therapy outpatient clinic. Nevertheless, good test-retest reliability was obtained, and critical difference scores were measured for each subscale as well as total score. These values were similar to those obtained for the European French adaptation of the questionnaire, and even lower than those of the original questionnaire. The sample size used for the measurement of change with treatment was also small ($n = 13$). This is also due to the clinical setting of the study (outpatient clinic) in which the vast majority of the patients only receive

one intervention session without a follow-up. Nevertheless, the questionnaire showed a good ability to capture treatment effects. This element is of particular interest, because even though the VHI is commonly used in clinical settings to measure subjective changes following voice treatment, this type of reliability is rarely investigated in similar studies.[8] Taken together, these results confirm the validity and reliability of the questionnaire.

Even though it represents a clinical reality, the use of dysphonia severity to assess the convergent validity of the VHI may not be the ideal measure for this type of analysis. In fact, both measures do not evaluate the exact same construct: the former represents dysphonia severity as judged by the speech-language pathologist while the latter represents the vocal handicap as reported by the patient. However, this methodological choice was made because there is no other validated questionnaire or measure in Quebec French to assess vocal handicap and dysphonia severity. This lack of clinical tool forced us to use this clinical measure to compare the VHI-QF. It would have been interesting to also compare the VHI-QF scores with a visual analogue scale filled by the patient to assess their own overall perception of dysphonia, similar to the procedure used for the validation of the European French VHI.[9]

Finally, the VHI-QF, as its name implies, has been developed for the Quebec French population and not for the general French Canadian population. Even though Canadian French shares more similarity with Quebec French than European French, both variants are different, mostly in terms of lexical use. It is of note that the population of Canada that speaks French as a first language is mostly represented (85.3%) in the province of Quebec.[21] It is unclear, therefore, if the VHI-QF could be used in the general French-Canadian population. This will need to be investigated.

CONCLUSION

A robust method was used to adapt cross-culturally and to validate the VHI to the Quebec French population. The resulting questionnaire—VHI-QF—is a useful self-assessment tool to evaluate the severity and change of perceived voice handicap in the Quebec French population. It is therefore a reliable tool that can be used by otolaryngologists, speech-language pathologists, or even other professionals, such as physicians, in the context of evaluation and follow-up of vocal disorders in a clinical setting. The psychometric qualities of the VHI-QF are good and suggest an adequate use in daily practice and in research projects as it can help clinicians to assess the patient's perception of the severity of their dysphonia.

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