Validity and Reliability Study of Bahasa Malaysia Version of Voice Handicap Index-10

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Summary: Objectives: This study aimed to determine the validity and reliability of Bahasa Malaysia version of Voice Handicap Index-10 (mVHI-10).
Materials and Methods: This cross-sectional study was carried out in the Otorhinolaryngology, Head and Neck Surgery Department of Universiti Kebangsaan Malaysia Medical Centre (UKMMC) from June 2015 to May 2016. The mVHI-10 was produced following a rigorous forward and backward translation. One hundred participants, including 50 healthy volunteers (17 male, 33 female) and 50 patients with voice disorders (26 male, 24 female), were recruited to complete the mVHI-10 before flexible laryngoscopic examinations and acoustic analysis. The mVHI-10 was repeated in 2 weeks via telephone interview or clinic visit. Its reliability and validity were assessed using interclass correlation.
Results: The test-retest reliability for total mVHI-10 and each item score was high, with the Cronbach alpha of >0.90. The total mVHI-10 score and domain scores were significantly higher ($P < 0.001$) in the pathology groups (20.92 ± 8.74) than healthy volunteers (1.54 ± 1.97), depicting excellent discriminant validity. The Kaiser-Meyer-Olkin measure was 0.92, which depicted excellent construct validity. There was a significant positive correlation between the mVHI-10 score and jitter and shimmer result ($P < 0.001$).
Conclusions: The present study showed good reliability and validity of the mVHI-10 when applied to both healthy volunteers and patients with voice disorders. We recommend the use of the mVHI-10 in daily clinical practice among Bahasa Malaysia-speaking population.
Key Words: Voice Handicap Index-10−Dysphonia−Bahasa Malaysia version−Voice disorder−Quality of life.

INTRODUCTION

Hoarseness is a general term used when someone experienced change in voice quality due to pathologies in the larynx.[1−3] Many terms have been used to describe the changes of vocal quality such as rough, raspy, rough, rattling, dry, hard, choked, thin, and sickly, which were then classified into rough, breathy, and asthenic.[2] The changes of harmonic components and the additional noise components to the acoustic characteristics of the voice ensue hoarseness.[3,4] A patient may get hoarseness secondary to various voice disorders that are categorized into organic voice disorder (structural or neurogenic) and functional voice disorder.[5,6] There is marked overlap between the two groups where organic changes in the phonatory system may also lead to functional disturbance and vice versa.[7] Voice disorders may affect the health and quality of life of patients in many different ways, which are much dependent on factors such as types of personality, family influence, occupation, cultural, and lifestyle.[8−11] It may affect job performance, limit career opportunities, reduce social interaction, and cause psychological issues such as depression.[12−14] The adverse effects may also indirectly affect people who are related to the voice disorders patients. Rogerson and Dodd documented that any degree of vocal alteration among teachers may interfere with children's speaking process and therefore may have a negative effect on their education.[15]

A cross-sectional telephone survey among 1326 adults in Iowa and Utah by Nelson Roy showed that the lifetime prevalence of voice disorder was 29.9%, in which 6.6% of the participants suffered ongoing voice disorder.[13] Potential risk factors for voice disorders identified were female gender, age, professional voice users, voice use patterns and demands, esophageal reflux, chemical exposures, and frequent cold or sinus infection[13,16,17] Professional voice users may be defined as those who depend on good voice quality in performing their job and will be likely looking for a new job when the voice is afflicted with hoarseness. Among the professional voice users, the greatest incidence of voice disorder was documented among teachers.[18,19] Screening, identifying, diagnosing, and treating voice disorders especially among professional voice users are pertinent to avoid the abovementioned untoward consequences. These would involve measurement of voice quality and grading the severity of hoarseness.

Measurement of voice quality is important in managing patients with voice disorders with respect to deciding treatment options, monitor treatment outcomes, and standardize outcome measures in clinical trials involving voice. The measurement is recommended to be multidimensional because of the complexity of voice production.[20] Methods that have been proposed to assess voice disorder ranged from subjective to objective assessment.[20] Objective assessment with acoustic analysis that measures the perturbation

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of voices has some limitations and it is not advisable to be used as a standalone test because of its arguable reliability.[21,22] Subjective assessment using certain voice-specific patient self-reported outcomes that measure quality of life affected by voice issues, on the contrary, depicted high validity and reliability.[21]

Quality of life outcome measure has been increasingly used in clinical trials.[23,24] Voice-specific patient self-reported outcome is a disease-specific quality of life measures. It has high content validity as the patients have been living with the voice so their satisfaction may reflect success of treatment.[21] The tool enables assessment of level of handicap and impact of voice problems on the quality of life. This kind of outcome measure also allows assessment of the patient's ability to use his or her voice at working or social environment.[25] Furthermore, objective measurements of voice on one particular day and time may not represent the overall voice quality of the patient. The voice may vary throughout the day or worse at the end of working day or fluctuate from one day to another day. Therefore, the voice-specific patient self-reported outcome may be the most appropriate tool to assess the overall voice quality, patients' satisfaction, and success of intervention.

There are a number of validated voice-specific patient self-reporting tools in the literature. Voice Handicap Index (VHI),[26] Vocal Performance Questionnaire (VPQ), and Voice Symptom scale (VoiSS) have been used widely in voice research. All of these tools were shown to have excellent internal consistency (Cronbach coefficient = 0.81−0.95).[21] Of the three tools, VHI reached the highest repeatability, with intraclass correlation value of 0.83. However, VHI is a long questionnaire that consists of 30 questions. Rosen et al had done further factor analysis, shortened the VHI to 10 questions (VHI-10), and validated it.[27] It comprises three domains: functional (five items), physical (three items), and emotional (two items). Deary et al. compared VHI-10 and VPQ as both are short and convenient. It was found that both are internally consistent and good overall indicator of the severity of voice disorders.[28] The VHI-10 has been used in other retrospective or prospective trials involving unilateral vocal fold paralysis patients and was able to demonstrate treatment effect before and after the operations.[25,29−31]

Employing the VHI-10 in the local language in managing patients with voice disorder is pertinent for language and cultural adaptation as cultural groups may vary in disease expression.[32,33] Hence, the VHI-10 has been translated and validated in several languages, including Spanish, Chinese, Brazilian Portuguese, and Italian. Most of the translated versions of Voice Handicap Index showed high reliability and validity.[34−40]

For Malaysia that is populated by multicultural and multiethnic people, the local language is Bahasa Malaysia. To date, the Bahasa Malaysia version of VHI-10 (mVHI-10) has not been rigorously evaluated for its reliability and validity.

Therefore, the present study aimed to assess the reliability and validity of the mVHI-10, testing it on healthy volunteers and patients with voice disorder.

MATERIALS AND METHODS

This cross-sectional study was carried out in the Department of Otorhinolaryngology, Head and Neck Surgery of Universiti Kebangsaan Malaysia Medical Centre (UKMMC) from June 2015 to May 2016. The mVHI-10 was produced following a rigorous forward and backward translation and piloted by the Universiti Sains Malaysia (USM) researchers lead by NF, the present paper co-author (unpublished data) (Table 1). The present study has obtained ethics approval from UKKMC ethics committee.

The forward-backward procedure developed by the European Organization for Research and Treatment of Cancer was used for translation.[41] Professional translators from School of Languages, Literacies and Translation of USM were involved in this study. All the professional translators were informed about the objectives of the research. Two of

TABLE 1.
The Bahasa Malaysia Version of VHI-10 Questionnaire and the Original English Version

Item in Bahasa Malaysia	Item in English
F1: Keadaan suara saya membuatkan orang susah untuk mendengar percakapan saya.	F1: My voice makes it difficult for people to hear me.
F2: Orang lain susah untuk memahami percakapan saya di dalam bilik yang bising.	F2: People have difficulty understanding me in a noisy room.
F8: Masalah suara saya mengehadkan kehidupan peribadi dan sosial saya.	F8: My voice difficulties restrict personal and social life.
F9: Keadaan suara saya menyebabkan saya berasa ketinggalan dalam perbualan.	F9: I feel left out of conversations because of my voice.
F10: Masalah suara saya menyebabkan saya hilang pendapatan.	F10: My voice problem causes me to lose income.
P5: Saya berasa seperti saya perlu meneran untuk menghasilkan suara.	P5: I feel as though I have to strain to produce voice.
P6: Kejelasan suara agak sukar dijangka.	P6: The clarity of my voice is unpredictable.
E4: Saya kecewa dengan masalah suara saya.	E4: My voice problem upsets me.
E6: keadaan suara saya menyebabkan saya berasa tidak sempurna.	E6: My voice makes me feel handicapped.
P3: Ada orang bertanya, "Kenapa dengan suara awak?"	P3: People ask, "What's wrong with your voice?"

them performed the forward translation from English to Bahasa Malaysia to provide a provisional translation. Subsequently, two other translators, who were not involved with the forward translation, backtranslated the provisional forward translation to English without reference to the English original. The results were then compared with the original English version. After that, a panel of experts in the field of speech and language pathology program made an agreement between the two sets of forward-backward translations and the original to produce the final translation of VHI-10 in Malay version (mVHI-10) for content validation.

The sample size calculation was based on the rules-of-thumb that vary from 4 to 10 subjects per variable, with a minimum number of 100 subjects to ensure stability of the variance-covariance matrix.[42,43]

Participant selection

A total of 100 participants, including 50 healthy volunteers and 50 patients with voice disorders, who were able to understand Bahasa Malaysia language were recruited.

For the patient group, the voice disorders were classified into three pathology groups, namely structural, neurogenic, and functional voice disorder groups based on their clinical diagnosis. Patients with voice disorder secondary to nasal or soft palate pathologies (hyponasal or hypernasal voice) or with psychiatric disorders were excluded from the study.

For the healthy volunteer group, participants who do not have any voice issues were recruited among hospital staff and patients who visited the hospital with symptoms unrelated to voice issues. Those who smoke cigarette and had recent history of upper respiratory tract infection or severe bronchopulmonary disease were excluded from the study.

Each participant was required to complete the mVHI-10 before flexible laryngoscopic examination and acoustic analysis. The completion of mVHI-10 was then repeated within 2-week interval via telephone interview or clinic visit.

For the objective voice evaluation, an acoustic analysis was performed in a quiet room with noise threshold of −39 dBFS, using OperaVOX by the iPod's (Oxford Research Wave Ltd, UK) internal microphone with a sampling rate of 45 kHz with attached lanyard of 30 cm lips to device distance.[44]

Pertubation measures (jitter % and shimmer percent) and noise-to-harmonic ratio were documented from the acoustic analysis parameters.

Statistical analysis

The evaluation of reliability involves the degree to which the results of measurement are consistent across repeated measurements. The reliability of total mVHI-10, 3 subdomains, and 10 items in the mVHI-10 was assessed using interclass correlation (ICC). The internal consistency or the homogeneity of the questionnaire and of the items included in each subdomain was determined using the Cronbach alpha. A value greater than 0.8 is considered "good" and greater than 0.9 "excellent," whereas a value greater than 0.7 is often considered satisfactory.

Factor analysis was used to determine the construct validation of the mVHI-10. The aims were to assess the factor structure and to investigate whether the questionnaire showed the same dimension across different groups. Its construct validity was evaluated using the Kaiser-Meyer-Olkin, with value of >0.6 indicating a good and valid result.[15]

The mVHI-10 discriminant validity was assessed by comparing the mean of total mVHI-10 between the two groups by using *t* test. Pearson correlation was used to assess the correlation between the mVHI-10 with the acoustic analysis parameters (jitter, shimmer, maximum phonation time [MPT], and noise-to-harmonic ratio [NHR]).

RESULTS

Samples' demographic data

The mVHI-10 was completed independently by 100 of participants, including 50 healthy volunteers (17 male, 33 female) and 50 dysphonic group (26 male, 24 female), with the mean age of 28 (±9.81) and 53 (±16.15), respectively. The effect of age may be negligible as there was no significant correlation between the age and the mVHI-10 scores in either healthy volunteers or pathology group ($r = -0.04$, -0.24, $P > 0.001$).

The majority of the dysphonic groups were Malay followed by Chinese and Indian. Of 50 patients, 21 were structural, 27 were neurogenic, and 2 were functional type of voice disorders. The pathologies of the larynx identified were laryngeal tuberculosis (1), glottis carcinoma (12), leukoplakia (3), vocal cord polyp (5), vocal cord palsy (27), and muscle tension dysphonia (2). The demographic data were summarized in Table 2.

Measurements of mVHI-10, acoustic analysis, and MPT

The total mean scores of mVHI-10 were 1.54 (±1.97) and 20.92 (±8.74) for the healthy volunteers and dysphonic group,

TABLE 2.
Summary of the Demographic Data of Participants in the Present Study

	Healthy Volunteers	Dysphonic Group
Number	50	50
Repeated group	35	23
Mean age	28 (±9.81)	53 (±16.15)
Race		
Chinese	7	15
Indian	5	9
Malay	36	24
Others	2	2
Male	17	26
Female	33	24
Dysphonic group		
Structural	—	21
Neurogenic	—	27
Functional	—	2

TABLE 3.
Summary of the Results of mVHI-10, Acoustic Analysis (Jitter, Shimmer, NHR, and MPT in Healthy Volunteers and Pathology Group

Mean Score	Healthy Group	Pathology Group
Jitter	1.05 ± 0.79	6.48 ± 3.29
Shimmer	3.58 ± 1.49	15.38 ± 9.02
NHR	0.07 ± 0.25	0.78 ± 1.11
MPT	18.15 ± 5.16	8.76 ± 5.28

respectively. The repeated mean mVHI-10 scores were 0.66 (±1.41) and 21.61 (±9.25) for the two groups, respectively.

For the acoustic analysis in the healthy volunteers, the mean of jitter, shimmer, and NHR were 1.05 ± 0.79%, 3.58 ± 1.49%, and 0.07 ± 0.25, respectively. For the dysphonic group, the measurements were 6.48 ± 3.29%, 15.38 ± 9.02%, and 0.78 ± 1.11, respectively. The acoustic parameters were significantly higher in the dysphonic group than healthy volunteers group ($P < 0.001$).

TABLE 4.
Reliability Result of the Total Score mVHI-10, Each Subdomain, and Each Item in the mVHI-10

Cronbach Alpha		Interclass Correlation (Lower Bound, Upper Bound)
Total mVHI-10	0.997	0.995 (0.991, 0.997)
Physical	0.996	0.996 (0.998, 0.996)
Functional	0.994	0.994 (0.990, 0.996)
Emotional	0.990	0.990 (0.983, 0.994)
1st item	0.968	0.968 (0.945, 0.981)
2nd item	0.980	0.980 (0.967, 0.988)
3rd item	0.992	0.992 (0.987, 0.995)
4th item	0.993	0.993 (0.989, 0.996)
5th item	0.981	0.981 (0.968, 0.989)
6th item	0.985	0.985 (0.975, 0.991)
7th item	0.994	0.994 (0.990, 0.996)
8th item	0.993	0.993 (0.989, 0.996)
9th item	0.969	0.969 (0.984, 0.982)
10th item	0.995	0.995 (0.992, 0.997)

The MPT for the dysphonic group (8.76 ± 5.28 seconds) was significantly reduced compared with the healthy volunteers (18.15 ± 5.16 seconds). Results of mVHI-10, acoustic analysis, and MPT were summarized in Table 3.

Test and retest reliability

The internal consistency and reliability for total mVHI-10 score were excellent, with the Cronbach alpha of 0.97 with ICC of 0.995 (0.991, 0.997). The reliability of the three subdomains (physical, functional, and emotional) of mVHI-10 was excellent, with ICC of 0.996 (0.988, 0.996), 0.994 (0.990, 0.996), and 0.990 (0.983, 0.994), respectively.

The score for each item of mVHI-10 questionnaire showed high internal consistency and reliability, with the Cronbach alpha of 0.981−0.995, as shown in Table 4.

Discrimination validity

The total mVHI-10 score and subdomain scores were significantly higher in the dysphonic groups than the healthy volunteers ($P < 0.001$). The results were summarized in Table 5.

Construct validity

The Kaiser-Meyer-Olkin measure of the mVHI-10 was 0.92, which indicates excellent construct validity.

Correlation test between mVHI-10 and objective parameter (jitter, shimmer, MPT, and NHR)

There was a significant positive correlation between the mVHI-10 score and jitter (r = 0.63), shimmer (r = 0.57), and NHR (r = 0.71) ($P < 0.0001$) in healthy volunteers and dysphonic group (Figure 1A−C). The MPT was negatively correlated with the total mVHI-10 score (r = 0.44) with $P < 0.001$ (Figure 1D).

DISCUSSION

Assessment of vocal function principally requires a multidimensional evaluation ranging from an array of subjective to objective assessments.[45] Patient voice-specific self-reported outcome, although is subjective in nature, is of growing importance in daily clinical practice and clinical trials.[21,44]

TABLE 5.
Comparison of Total Mean Score of mVHI-10 and Three Total Subdomain Scores Among Healthy Volunteers and Dysphonic Group

Group		Mean	Standard Deviation	*t*	*P*
Total mVHI-10	Healthy volunteers	1.54	1.97	−15.30	0.001
	Pathology	20.92	8.74		
Total physical subdomain score	Healthy volunteers	0.56	1.01	−15.77	0.001
	Pathology	7.90	3.13		
Total functional subdomain score	Healthy volunteers	0.92	1.23	−13.58	0.001
	Pathology	9.14	4.45		
Total emotional subdomain score	Healthy volunteers	0.02	0.14	−12.40	0.001
	Pathology	4.44	2.52		

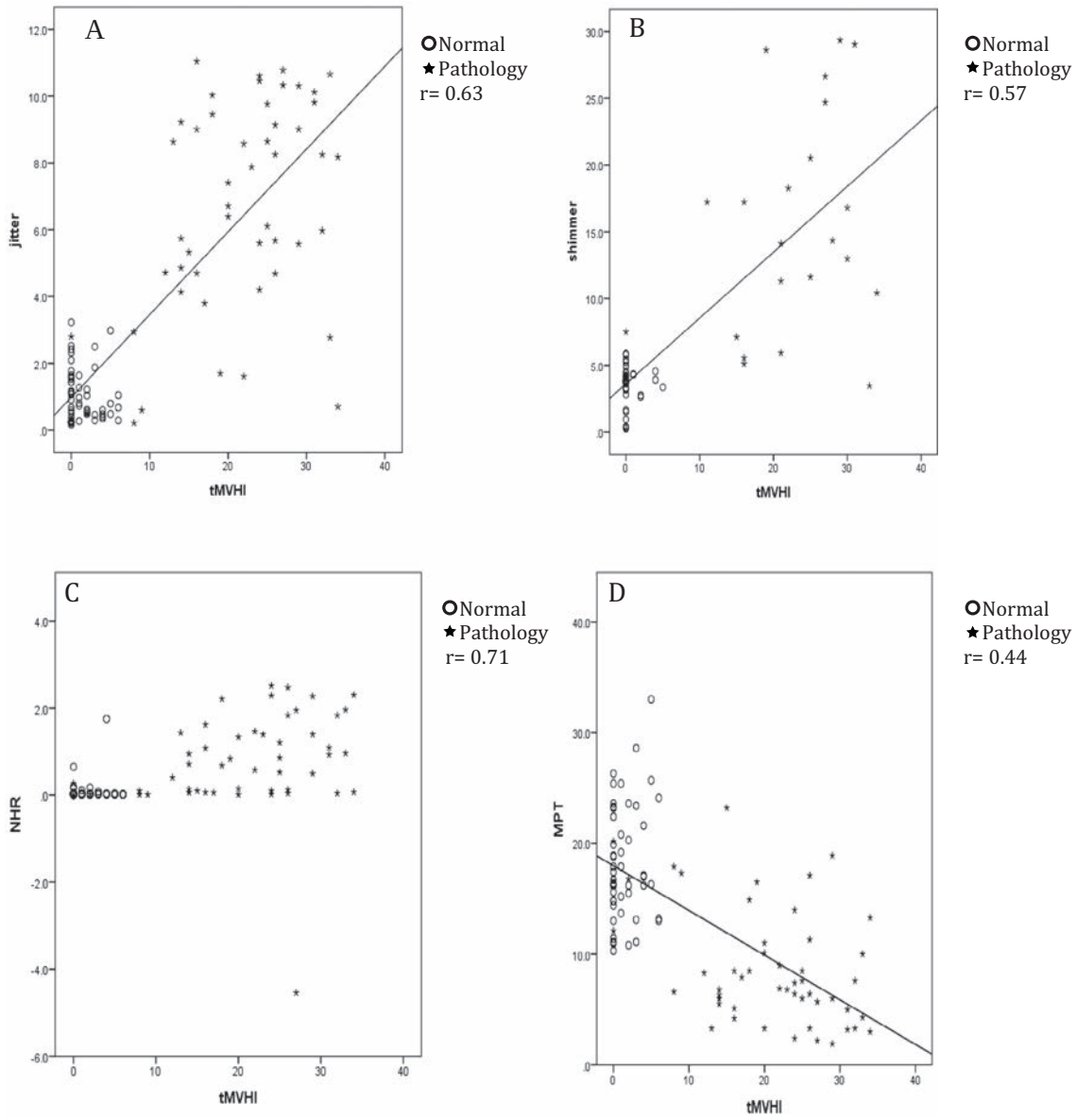

FIGURE 1. Correlation between jitter (**A**), shimmer (**B**), NHR (**C**), and MPT (**D**) with total score mVHI-10.

This is because it is the patient that has to live with his or her voice; hence, he or she is in the best position to evaluate the disability and effectiveness of treatment.[20] VHI-10 is a widely used voice-specific self-reported outcome that is short, convenient, reliable, and contains good overall voice indicator.[21,28]

The guidelines for functional assessment of voice by the European Laryngological Society published in 2001 suggest that a particular subjective voice assessment needs to be carefully quantified, compared, and correlated with the data of objective assessment.[20] The basic aim of VHI-10 is to differentiate deviance of voice quality and grade severity of disability in daily social and professional life. Its validity was demonstrated in many studies of differing languages including the original study,[27] as well as in its Brazilian Portuguese,[46] Chinese,[47] Italian,[37] and Greek[34] versions. Translation process allows comparison of response across population with different language or culture. The advantages are to offer a standard measurement for use in international studies; to avoid the frequent bias of representing only the dominant culture of the country; and less costly and time-consuming to generate a new measure that requires more complicated process.[26] Therefore, the VHI-10 was translated to the official language of Malaysia that is Bahasa Malaysia (mVHI-10). The present study evaluated the reliability and validity of the mVHI-10, correlating with the data of objective assessment.

The results of the present study showed excellent reliability for the total score of mVHI-10, three subdomains, and each items of the questionnaire with the Cronbach alpha coefficient ranged from 0.980 to 0.996. The mVHI-10 also depicted excellent construct validity with Kaiser-Meyer-Olkin measure of 0.92. Furthermore, mVHI-10 showed great discriminant validity, with the mVHI-10 and subscale scores being significantly higher in dysphonic group than the healthy volunteers. This shows that the mVHI-10 is a

reliable tool to discriminate patients with and without dysphonia. Similar high reliability was reported by other authors.[34,46,47]

The validity of VHI-10 was reported against numerous objective and subjective voice assessment parameters including stroboscopic analysis[31] and vocal self-assessment.[46] Behlau et al reported strong relationship between subjective self-assessment of voice among dysphonic patients and the total VHI-10 score. While a strong relationship was demonstrated, correlation with an objective assessment tool was not explored. In the present study, a significant positive correlation between the total mVHI-10 score and jitter, shimmer, and NHR was observed. A higher score of mVHI-10 resulted in the higher values of the acoustic parameters. In addition, the MPT was negatively correlated with the total mVHI-10 score. The subjective voice assessment with mVHI-10 score showed participants with shorter MPT scored higher mVHI-10. Hence, the subjective voice assessment with mVHI-10 was seen in agreement with objective evaluation. We believe that the present study is the first to document a significant correlation between the mVHI-10 and acoustic parameters using OperaVOX.

The present study was not the first study conducted to translate to the local Malaysian language and validate its clinical use. Moy et al[48] studied the effect of voice disorder among secondary school teachers in Peninsular Malaysia using a translated Malay version of VHI-10 that was done within the study. This study also showed that the dysphonic teachers were more likely to report poorer quality of life, higher anxiety level, and higher rate for absent from work. However, this study had only included a specific targeted group of teachers. It may not represent the actual Malaysian population. Furthermore, this study demonstrated fair test-retest reliability compared with the present study that showed excellent reliability. A future study would be beneficial to investigate whether the interchangeable use of these two local versions can be recommended.

Another study by Xu et al conducted in China evaluated the reliability of the translated Mandarin Chinese version of VHI. The study population comprised 1766 patients and the translated Mandarin Chinese version was shown to be[47] reliable and valid in assessing dysphonia in Mandarin Chinese speakers, with Cronbach alpha of 0.956. In Malaysia, some of the Chinese population speaks Mandarin as well but they may embrace different culture from the Chinese in China. Therefore, it is recommended that the Mandarin Chinese version of VHI-10 to be translated by the local Chinese and evaluate its reliability and validity to achieve cross-cultural adaptation. A comparison study between the two Mandarin versions is also proposed in the future.

In the present study, the healthy volunteers were younger than the dysphonic group, with mean age of 28 (±9.81) and 53 (±16.15), respectively. However, the effect of age was not statistically significant as there was no significant correlation between the age and the total mVHI-10 scores in either healthy volunteers or pathology group, eliminating the age as a potential confounder.

CONCLUSIONS

mVHI-10 depicted excellent reliability and validity, discriminant validity, and construct validity and showed significant correlation with objective voice parameters. Hence, we would like to recommend the routine use of the mVHI-10 in otorhinolaryngology clinics in Malaysia in managing patients with voice disorder.

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