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Development of a Chinese version of the National Eye Institute Visual Function Questionnaire (CHI-VFQ-25) as a tool to study patients with eye diseases in Hong Kong

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ABSTRACT

Background: To develop a Chinese version of the National Eye Institute Visual Function Questionnaire (CHI-VFQ-25) and to test its reliability and validity in a group of patients with eye diseases in Hong Kong.

Methods: The National Eye Institute Visual Function Questionnaire (NEI-VFQ) was translated into Chinese. Patients were recruited from Hong Kong, and their demographic data and visual acuity were documented. Psychometric properties of the CHI-VFQ-25, including internal consistency, test–retest reliability, item–scale correlations and construct validity were tested.

Results: 250 patients were recruited. The mean age of the patients was 66.04 (SD 14.00). 46% of them were male. The non-response rate and the floor and ceiling numbers of the CHI-VFQ-25 were calculated. The internal consistency was high in most subscales (except the general health and driving subscales), with Cronbach α ranging from 0.72–0.90. The test–retest reliability was excellent (intraclass correlation coefficient >0.90). Patients with worse visual acuity had significantly lower scores on the CHI-VFQ-25 supporting construct validity.

Conclusion: The CHI-VFQ-25 is a reliable and valid tool for assessing the visual functions of Chinese patients with eye diseases in Hong Kong. Some questions had high non-response rates and should be substituted by the available alternatives.

Visual function questionnaires (VFQ) have increasingly been used to measure the impact of diseases and the outcomes of treatment. The National Eye Institute Visual Function Questionnaire (NEI-VFQ) has been widely used to study the visual functions of patients with cataract, glaucoma, age-related macular degeneration, diabetic retinopathy and retinal detachment.[1–5] To date, the English, Spanish, French, Italian, Japanese and Turkish versions of the NEI-VFQ are available.[6–11]

Research activities in the life sciences during the past few years have increased appreciably in China, both in output and in impact. Although several Chinese VFQ are available, most have not been validated[12 13] and none were universally adopted.[14–16] The widespread adoption of a validated questionnaire would add to the rigor of ophthalmic research and, if this was a Chinese version of the NEI-VFQ, would also facilitate the international comparison of results of clinical trials.

The purpose of this study was to evaluate the psychometric properties of the NEI-VFQ translated into Chinese (CHI-VFQ-25) and tested on Chinese ophthalmic patients. We used all the supplementary questions and selected those that were most suitable for ethnic Chinese patients.

METHODS

Two hundred and fifty patients were recruited from the Department of Ophthalmology, Queen Mary Hospital, Hong Kong between May 2008 and July 2008. Based on Snellen visual acuity measurements, the patients were divided into two groups, group A (with a presenting visual acuity of worse than 20/60) and group B (with a presenting visual acuity of 20/60 or better). All visual acuities were measured by an optometrist with patients wearing their own glasses (if applicable). We aimed to measure presenting vision, and so no refraction or pin-hole vision was used. Eligible participants had to be at least 18 years old, Chinese speaking and without any cognitive impairment. Patients were enrolled consecutively into either group until the target number was achieved. This study was approved by the Institutional Review Board of the University of Hong Kong and adhered to the tenets of the Declaration of Helsinki.

After obtaining informed consent, patients' basic demographics including age, gender, education level, the nature of eye disease and other comorbidities were recorded. A subgroup of patients, 20% from each group, was selected randomly to return in 2 weeks for retesting.

Twenty-five-Item National Eye Institute Visual Function Questionnaire (NEI-VFQ-25)

The NEI-VFQ-25 consists of 11 vision-related domains and one general health rating question. It also includes additional items that can expand the NEI-VFQ-25 into a 39-item questionnaire. The 11 vision-related subscales include: general vision, difficulty with near and distance activities, driving difficulties, limitations with peripheral and colour vision, ocular pain, social functioning, role limitations, dependency and mental health. The NEI-VFQ-25 is scored using standard algorithms. Higher scores indicate better visual functions.[17]

Development of CHI-VFQ-25

The development of CHI-VFQ-25 involved six steps:

1. Translation of the NEI-VFQ-25 from English to Chinese was done by two professional translators.

2. Reconciliation of the Chinese translations was done by a panel to produce a second draft of CHI-VFQ-25.

3. A third translator, who was not involved in the forward translation and blinded to the original questionnaire, back-translated the drafted CHI-VFQ-25 into English.

4. The back-translated CHI-VFQ-25 was compared with the original English version to identify any discrepancies, which was then revised by the panel.

5. Cognitive debriefing of the drafted CHI-VFQ-25 was performed on five people with visual impairment to test their understanding and interpretation of the questionnaire.

6. The final version of the CHI-VFQ-25 was established after minor revisions, taking into account the outcome of the cognitive debriefing.

Statistical analysis

Descriptive statistics were used to determine the distribution of demographic and clinical characteristics. The percentage of item response at the ceiling (highest possible score) and floor (lowest possible score) and the number of non-response items (not doing the suggested activity for reasons other than visual problem) of the CHI-VFQ-25 were also calculated.

Internal consistency (Cronbach α) is a measure of the extent to which items within a single subscale correlate with each other. The optimal range of Cronbach α is 0.70–0.90. To further determine scale homogeneity, the item–scale correlation coefficient was calculated. A coefficient greater than 0.40 is considered acceptable.[18]

A subgroup of patients was retested after 2 weeks to determine the test–retest reliability (intraclass correlation coefficient) of the questionnaire. The time point was set at 2 weeks as this was short enough to avoid changes in visual acuity and long enough for patients not to remember the answers. Reliability coefficients above 0.70 are considered satisfactory.[6]

Construct validity was determined by comparing the CHI-VFQ-25 scores from the two groups of patients. Patients with worse visual acuity should have lower scores on the CHI-VFQ-25.

All analyses were conducted at the 5% significance level, using SPSS version 16.0 (SPSS, Chicago).

RESULTS

The mean time required to complete the CHI-VFQ-25 was 10.83 (SD 3.81) min. The mean age of the 250 participants was 66.04 (14.00); 115 (46%) were male. Patients in group A were significantly older, were less well educated and had more coexisting medical conditions (table 1).

Item analysis

The percentages of non-response items and responses at the floor and ceiling of each subscale are shown in table 2.

Items in the driving subscale had the highest non-response rate. One hundred per cent of participants in group A and 90% in group B did not respond. Items related to going out to watch movies, plays or sporting events had the next highest non-response rate at 70% in group A and 52% in group B. Items associated with literacy also had higher rates (about 20%) than other items in the CHI-VFQ-25.

Floor effect was not found in any of the subscales. However, the percentage of subjects scoring at the ceiling was over 20% in five out of 12 subscales (ocular pain, social functioning, dependency, colour vision and peripheral vision).

Table 1 Demographic characteristics of study participants

	Group A	Group B	Total	p Value*
Age (mean (SD))	73.48 (9.00)	58.61 (14.26)	66.04 (14.00)	0.001
<50	2 (1.6)	29 (23.2)	31 (12.4)	
50–59	10 (8.0)	35 (28.0)	45 (18.0)	
60–69	18 (14.4)	30 (24.0)	48 (19.2)	
70–79	58 (46.4)	26 (20.8)	84 (33.6)	
⩾80	37 (29.6)	5 (4.0)	42 (16.8)	
Gender				0.703
Male	59 (47.2)	56 (44.8)	115 (46.0)	
Female	66 (52.8)	69 (55.2)	135 (54.0)	
Education				0.000
No schooling	64 (51.2)	26 (20.8)	90 (36.0)	
Primary	33 (26.4)	20 (16.0)	53 (21.2)	
Secondary	25 (20.0)	60 (48.0)	85 (34.0)	
Tertiary	3 (2.4)	19 (15.2)	22 (8.8)	
No of comorbidities				0.002
0	17 (13.6)	40 (32.0)	57 (22.8)	
1	45 (36.0)	45 (36.0)	90 (36.0)	
2	40 (32.0)	28 (22.4)	68 (27.2)	
⩾3	23 (18.4)	12 (9.6)	35 (14.0)	
Principal diagnosis				<0.001
Age-related macular degeneration	8 (6.4)	11 (8.8)	19 (7.6)	
Cataract	29 (23.2)	54 (43.2)	83 (33.2)	
Diabetic retinopathy	14 (11.2)	23 (18.4)	37 (14.8)	
Glaucoma	4 (3.2)	5 (4.0)	9 (3.6)	
Retinal detachment	21 (16.8)	7 (5.6)	28 (11.2)	
Others	49 (39.2)	25 (20.0)	74 (29.6)	

With the exception of age, data are expressed as the number of subjects, with the percentage of the total group in parentheses.
*Probabilities are from the χ^2 test (categorical variables) contrasting group A and group B patients.

Table 2 Results of item–scale correlation, number and percentage of non-response data, floor number and ceiling number

Subscale and item	Item–scale correlation	Non-response no (%)	Floor no (%)	Ceiling no (%)
General Health			3 (1.2)	0
5-level health rating	0.86	0		
0–10 health rating	0.87	0		
General Vision			0	0
6-level vision rating	0.86	0		
0–10 vision rating	0.89	0		
Ocular Pain			0	88 (35.2)
Amount of pain	0.90	0		
Amount of time in pain	0.89	0		
Near Activities			0	19 (7.6)
Reading ordinary print in newspaper	0.87	55 (22.0)		
Seeing well up close	0.77	12 (4.8)		
Finding objects on crowded shelf	0.73	4 (1.6)		
Reading small print	0.84	51 (20.4)		
Reading bills accurately	0.74	57 (22.8)		
Shaving/styling hair/makeup	0.36	7 (2.8)		
Distance Activities			0	28 (11.2)
Reading street signs/names of stores	0.83	0		
Going down stairs at night	0.79	12 (4.8)		
Going out to watch movies/plays/sporting events	0.84	153 (61.2)		
Recognising people from across a room	0.58	0		
Taking part in active sports/other outdoor activities	0.60	59 (23.6)		
Watching television	0.83	5 (2.0)		
Social Functioning			0	114 (45.6)
Seeing how people react	0.74	1 (0.4)		
Visiting others/parties/going to restaurants	0.93	23 (9.2)		
Entertaining friends and family at home	0.65	55 (22.0)		
Dependency			7 (2.8)	85 (34.0)
Amount true: stay home most of the time	0.86	0		
Amount true: reply on others	0.84	0		
Amount true: need help from others	0.85	0		
Mental Health			0	24 (9.6)
Amount of time: worry	0.53	0		
Amount true: frustrated	0.83	0		
Amount true: no control	0.75	0		
Amount true: embarrassed	0.73	0		
Amount true: irritated	0.77	0		
Role Difficulties			1 (0.4)	33 (13.2)
Accomplish less	0.80	0		
Limited in endurance	0.75	0		
Receive more help from others	0.75	0		
Limited in things can do	0.83	0		
Colour Vision			0	222 (88.8)
Difficulty in matching clothes	1.00	0		
Peripheral Vision			0	145 (58.0)
Seeing objects off to side	1.00	2 (0.8)		
Driving			0	3 (1.2)
Familiar places during daytime	0.50	238 (95.2)		
Driving at night	0.73	238 (95.2)		
Driving under difficult condition	0.87	239 (95.6)		

Correlation

The item–scale correlations coefficients were generally high, ranging from 0.50 to 0.93 (table 2). Only one item in the ''near activity'' subscale (difficulty with shaving/styling hair/putting on makeup) had a correlation coefficient less than 0.40.

Reliability

Cronbach α of the CHI-VFQ-25 ranged from 0.50 to 0.90. Except for the general health and driving subscales, Cronbach α values were greater than or equal to 0.70 (table 3). Test–retest reliability was high, with an intraclass correlation coefficient above 0.90 in all subscales (table 3).

Construct validity

After controlling for age and education level, patients in group A had lower marks in all subscales than that of group B. The differences were statistically significant, except for general health, ocular pain, colour vision and peripheral vision

Table 3 Internal consistency (Cronbach α) and test–retest reliability of CHI-VFQ-25 subscales

Subscale	Cronbach α	Test–retest reliability
General Health	0.50	0.97
General Vision	0.73	0.96
Ocular Pain	0.74	0.95
Near Activities	0.84	0.96
Distance Activities	0.90	0.95
Social Functioning	0.72	0.96
Mental Health	0.81	0.98
Role Difficulties	0.81	0.98
Dependency	0.81	0.97
Driving	0.68	NA†
Colour Vision	NA*	0.92
Peripheral Vision	NA*	0.92

*Cronbach α cannot be calculated in subscales with only one item.
†Too few cases (N = 1) for the analysis.
NA, not applicable.

(tables 4, 5). No participant in group A drove. Therefore, the construct validity of the driving subscale cannot be estimated.

DISCUSSION

Visual loss has been found to have a negative impact on quality of life[2–4 19 20] and was ranked second to paralysis as the most feared disability by the Chinese.[21] Traditionally, the success or failure of medical therapy for eye diseases has been judged by meeting an objective criterion, such as visual acuity. However, there are disparities between ophthalmologists and their patients in estimating the benefit of treatment because clinical examinations do not evaluate patient's perceptions of their own diseases.[22] Thus, a vision-specific questionnaire is needed to study how visual impairment affects patients' subjective physical and psychosocial well-being.

We successfully translated the NEI-VFQ into Chinese and evaluated its psychometric properties in a group of patients with visual impairment. Overall, we found that the CHI-VFQ-25 has psychometric properties comparable with those of the original version and is a reliable and valid tool for assessing the visual functions of Chinese patients.

We suggest making several changes. Compared with the original version, the non-response rate was very much higher in the driving subscale. Almost all participants did not drive. A high non-response rate in this subscale was also found in the Japanese (61%) and French versions (34%).[8 10] Therefore, we suggest that the "driving" subscale should be omitted in the CHI-VFQ-25.

Going out to watch movies, plays or sporting events also had a high non-response rate, especially in older patients. Over two-thirds of participants aged 60 or above did not participate in these activities, while only two-fifths of participants below the age of 60 did not respond. Although a high non-response rate was also found in the Japanese version, the percentage was much lower than that of the Chinese version (32% vs 61%).[10] Participants either think that the tickets were too expensive or were not interested in those activities. We suggest substituting this question with another question in the appendix (difficulty when watching and enjoying programmes on TV).

Of note are the questions related to literacy, which also had a higher rate of missing data than those in the French (0%) and Japanese (2–12%) versions of the NEI-VFQ.[8 10] In our population, where most were 70 years or older, 36% did not receive any education. This lack of formal education might be related to the few schools available before and after the Second World War and the relative poverty in the region at that time. The inability of many patients to recognise the letters of the alphabet meant that we could not use the ETDRS chart. We employed a Snellen Chart with roman numerals for this study, and we are validating a logMAR chart using numbers for future studies.

The reliability of CHI-VFQ-25 was satisfactory in all subscales except for the general health and driving subscales. The Cronbach α values were slightly lower than those of the US version,[6] but were similar or better than those of other translations.[7–11]

The low reliability of the driving subscale was probably due to the high non-response rate. However, the low Cronbach α for the general health subscale suggest that the subscale constructs were not homogenous. In rating the general health, participants

Table 4 Construct validity of the Chinese version of the National Eye Institute Visual Function Questionnaire (CHI-VFQ-25) in group A and group B patients in different age groups

	Group A					Group B					
	<50	50–59	60–69	70–79	⩾80	<50	50–59	60–69	70–79	⩾80	p Value*
General Health	42.5 (7.1)	40.8 (15.0)	40.1 (11.8)	42.2 (19.7)	42.7 (16.1)	51.7 (18.2)	50.6 (17.3)	45.2 (14.0)	42.5 (18.6)	37.5 (26.5)	0.277
General Vision	45.0 (0.0)	48.0 (21.1)	40.8 (11.0)	46.8 (14.4)	47.4 (14.5)	65.7 (13.4)	64.6 (14.4)	56.3 (11.1)	56.5 (13.5)	55.0 (7.1)	0.001
Ocular Pain	81.3 (26.5)	67.5 (23.7)	69.4 (28.8)	74.4 (24.0)	82.8 (21.3)	79.3 (18.7)	83.2 (19.9)	76.3 (21.1)	72.1 (26.5)	90.0 (10.5)	0.269
Near Activities	68.8 (26.5)	57.3 (25.4)	52.6 (23.1)	60.2 (24.4)	58.5 (25.0)	86.6 (15.9)	77.3 (14.5)	76.6 (18.7)	70.5 (18.2)	70.8 (22.1)	0.001
Distance Activities	62.5 (35.4)	65.6 (22.9)	60.4 (22.1)	65.9 (19.4)	62.2 (26.1)	89.0 (13.0)	85.8 (15.1)	84.6 (15.8)	75.3 (19.7)	85.3 (18.2)	0.001
Social Functioning	83.3 (23.6)	70.0 (23.0)	66.2 (25.4)	72.3 (24.2)	73.0 (27.0)	94.8 (12.3)	93.8 (14.8)	92.1 (13.0)	89.6 (14.2)	93.3 (14.9)	0.001
Mental Health	87.5 (17.7)	61.0 (32.1)	55.8 (24.3)	64.1 (26.4)	60.4 (28.6)	82.8 (13.7)	83.3 (14.5)	78.8 (21.8)	66.9 (29.6)	73.0 (29.7)	0.024
Role Difficulties	71.9 (13.3)	71.3 (20.0)	57.6 (27.8)	61.1 (22.5)	53.9 (27.9)	82.3 (14.2)	83.9 (17.2)	77.1 (17.1)	65.4 (19.2)	81.3 (13.3)	0.001
Dependency	100.0 (0.0)	70.0 (26.5)	66.7 (26.3)	57.1 (25.5)	51.4 (29.1)	96.1 (7.7)	94.8 (13.3)	87.3 (17.0)	70.2 (28.6)	82.5 (22.3)	0.001
Colour Vision	100.0 (0.0)	95.0 (10.5)	88.9 (23.0)	94.0 (17.7)	92.6 (21.1)	100.0 (0.0)	97.1 (8.1)	99.2 (4.6)	93.3 (16.7)	100.0 (0.0)	0.210
Peripheral Vision	100.0 (0.0)	72.5 (24.9)	79.2 (24.6)	79.7 (24.5)	74.3 (28.1)	94.8 (14.0)	87.9 (17.5)	86.7 (19.4)	86.5 (21.5)	85.0 (22.4)	0.121
Composite	80.0 (14.3)	67.8 (18.3)	63.8 (16.1)	67.6 (15.1)	65.5 (18.3)	87.2 (8.8)	85.2 (11.0)	81.5 (11.1)	74.6 (14.3)	81.6 (8.4)	0.001

Composite is the average subscale scores excluding the general health subscale. The Driving subscale was omitted, as there were too few cases for analysis.
*Probabilities are from univariate analysis of variance contrasting group A and group B patients in different age groups.

Table 5 Construct validity of the Chinese version of the National Eye Institute Visual Function Questionnaire (CHI-VFQ-25) in group A and group B patients with different education levels

	Group A				Group B				
	No schooling	Primary	Secondary	Tertiary	No schooling	Primary	Secondary	Tertiary	p Value*
General Health	39.7 (16.8)	43.3 (15.6)	44.4 (18.3)	52.5 (28.4)	39.5 (17.8)	47.0 (16.2)	47.9 (16.3)	47.4 (17.7)	0.390
General Vision	45.9 (12.9)	45.3 (17.7)	47.4 (14.7)	53.3 (11.6)	53.3 (14.4)	60.3 (11.8)	62.2 (12.7)	67.4 (13.1)	0.001
Ocular Pain	74.8 (24.4)	77.7 (19.7)	75.5 (29.2)	75.0 (33.1)	76.0 (21.2)	81.9 (20.9)	77.9 (22.2)	80.9 (20.6)	0.434
Near Activities	56.3 (25.2)	60.2 (23.0)	60.6 (24.5)	70.8 (21.7)	68.6 (19.6)	78.3 (15.8)	77.8 (17.4)	88.6 (10.6)	0.001
Distance Activities	60.5 (22.2)	67.8 (22.2)	65.5 (20.7)	80.6 (26.8)	74.3 (19.1)	89.8 (15.0)	84.9 (15.6)	88.7 (11.1)	0.001
Social Functioning	65.4 (26.8)	77.2 (21.9)	78.2 (20.3)	87.5 (21.7)	85.6 (17.2)	96.3 (6.3)	92.6 (14.3)	99.1 (3.8)	0.001
Mental Health	58.4 (27.7)	68.2 (24.7)	62.8 (29.4)	61.7 (18.9)	65.8 (27.8)	85.0 (20.2)	78.8 (19.2)	86.8 (8.7)	0.001
Role Difficulties	58.6 (24.1)	58.1 (25.8)	64.5 (25.3)	50.0 (34.8)	69.0 (18.6)	85.9 (13.3)	78.1 (18.3)	81.3 (16.1)	0.001
Dependency	52.1 (26.8)	61.6 (27.3)	70.3 (27.2)	64.6 (3.6)	68.8 (28.4)	93.1 (9.3)	90.9 (10.3)	97.7 (7.3)	0.001
Colour Vision	89.8 (23.0)	97.7 (7.3)	94.0 (18.1)	100.0 (0.0)	94.2 (16.3)	98.8 (5.6)	97.9 (7.0)	100.0 (0.0)	0.408
Peripheral Vision	74.2 (26.8)	83.3 (24.7)	78.0 (23.2)	91.7 (14.4)	81.7 (21.9)	91.3 (18.6)	90.0 (17.4)	92.1 (14.6)	0.097
Composite	63.5 (16.1)	69.7 (16.1)	69.7 (16.8)	73.5 (14.9)	73.7 (13.6)	86.1 (9.0)	83.1 (11.7)	88.2 (6.1)	0.001

Composite is the average subscale scores excluding the general health subscale. The Driving subscale was omitted, as there were too few cases for analysis
*Probabilities are from univariate analysis of variance contrasting group A and group B patients with different education levels.

were asked to choose from "excellent," "very good," "good," "fair" or "poor" in question 1. Most participants rated their general health as "fair," which corresponded to 25 marks. When they were asked to rate their general health in the appendix on a scale of 0–10 (0 is as poor as death, and 10 is excellent health), those who rated "fair" had scores ranging from 0 to 10 (which corresponded to 0 to 100 marks), indicating a low homogeneity. Therefore, we suggest substituting the five-level general health rating (question 1) with the 0–10 rating scale in the appendix for our Chinese participants.

All subscales had intraclass correlation coefficients greater than 0.90, indicating that the CHI-VFQ-25 has excellent test–retest reliability.

The item–scale correlations were satisfactory. Most items showed similar or slightly poorer correlations when compared with those in the US version.[6] Only one item in the "near activities" subscale (difficulties with shaving/styling/putting on makeup) showed a poor correlation with its corresponding subscale.

After controlling for age and education level, the CHI-VFQ-25 was able to discriminate between patients with good and poor visual acuities with the exception in the subscales of general health, ocular pain, colour vision and peripheral vision. The lack of difference in the general health subscale between the two groups was expected, as it was not a vision-related subscale. However, the lack of a significant difference in ocular pain, colour vision and peripheral vision subscales was probably due to the fact that the majority of patients had diseases that were less affected in these areas. Similar findings were also found in previous studies.[9 11]

It is important to consider the following limitations when interpreting the results of this study. Visual acuity was the only factor we considered for the loss of vision. However, other clinical measurements, such as contrast sensitivity,[23] visual field[2] and glare,[24] may affect visual functions independently. Second, the responsiveness of the questionnaire (the change in visual functions after treatment) was not assessed in our study. We also only studied two groups. This therefore limits the conclusion that we can draw from the study as to whether it can discriminate between minimally and significantly reduced vision. A larger study involving segregation of patients into disease groups and more accurate measurement of visual acuity together with other parameters such as contrast sensitivity might enable us to better define the relationship between the VFQ and visual function. Lastly, all the patients were recruited from a single hospital, and they might not represent the whole population in Hong Kong.

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