The Chinese Version of The Quality of Life in Childhood Epilepsy Questionnaire-16-C (QOLCE-16-C): Translation, Validity, and Reliability

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Abstract

Background

Epilepsy is one of the most common chronic neurological diseases that adversely impact the quality of life of patients and their families. The 16-item measure of the Quality of Life Childhood Epilepsy Questionnaire (QOLCE-16) was designed to assess health-related quality of life (HRQOL) among children with epilepsy. The purpose of the study was to translate and evaluate psychometric properties of the QOLCE-16.

Methods

The 10 steps of Principles of Good Practices for translation and cultural adaptation of measures were adopted to translate the QOLCE-16 into Chinese. After that, item analysis, internal consistency, test-retest reliabilities, content validity and construct validity were conducted to test its applicability in children with epilepsy under the culture of China.

Results

A total of 414 objects were enrolled in our study. The results of item analysis showed the QOLCE-16-C had good discrimination, and each item was significantly related to the total scale ($P < 0.001$). The Cronbach's α value was 0.938 and the Test-retest reliability was 0.724. For validity, results showed that the QOLCE-16-C had good content validity. Exploratory factor analysis indicated it was reasonable that the QOLCE-16-C consists of four dimensions after rotation. Confirmatory factor analysis demonstrated good validity ($\chi^2/df = 1.698$, GFI = 0.913, CFI = 0.974, RMSEA = 0.058).

Conclusion

The Chinese version of QOLCE-16-C appears to be a culturally appropriate, valid and reliable tool to assess the health-related quality of life of children with epilepsy in China.

Plain English Summary

Epilepsy is one of the most common chronic neurological diseases. High prevalence and serious adverse effects have made epilepsy as one of the major public health concerns. Health related quality of life (HRQOL) is a multidimensional concept, which is used to obtain a wider range of treatment and recovery information of patients in clinical practice and the ability to precisely measure HRQOL becomes critical for children living with epilepsy. To date, several inventories have been established to evaluate the HRQOL of children with epilepsy, among them, QOLCE-16 not only has good measurement characteristics, but also has a small number of items, which is suitable for the busy clinical work in China. However, there is no Chinese version of the scale in China at present. In this study, we have translated the QOLCE-16 from English into Chinese, followed by an assessment of the psychometric properties of the Chinese version of the Quality of Life in Childhood Epilepsy Questionnaire-16-C (QOLCE-16-C). This study indicates that the

Chinese version of QOLCE-16-C appears to be a culturally appropriate, valid and reliable tool to assess the health-related quality of life of children with epilepsy in China.

Background

Epilepsy is one of the most common chronic neurological diseases, which is characterized by abnormal brain discharge accompanied with unpredictable and recurrent seizures[1]. Studies have shown that there are about 9.84 million people with epilepsy in mainland China, and most of them are pediatric patients[2]. Children with epilepsy are experiencing issues not only associated with neurological deficits and functional limitations but also going through profound psychiatric and psychosocial influences compared with patients with other chronic diseases[3–5]. Moreover, children with epilepsy are limited in social activities, restricted on driving in the future, and discriminated with social stigma, which leading to decreased in self-esteem and add to negative emotion (e.g., depression and social isolation), all of which could pose obstacles for their quality of life improving[6]. High prevalence and serious adverse effects have made epilepsy as one of the major public health concerns[7].

Considering the chronic nature and its dramatic negative effects on multiple aspects of children's life, the traditional treatment of seizure control no longer meets the current focus of long-term care for epilepsy, reducing the seizure frequency and improving the quality of life should be regarded as the primary goals of antiepileptic treatments[8]. Health related quality of life (HRQOL) is a multidimensional concept, which is used to obtain a wider range of treatment and recovery information of patients in clinical practice[9–11]. Measurement of HRQOL in children with epilepsy helps to accurately reflect their physical, emotional, and psychosocial functioning[12]. Hence, the ability to precisely measure HRQOL becomes critical for children living with epilepsy.

To date, several inventories have been established to evaluate the HRQOL of children with epilepsy, such as the Quality of Life in Epilepsy for Adolescents (QOLIE-AD-48)[13], the Quality of Life in Childhood Epilepsy Questionnaire (QOLCE-55)[14], and the Health-Related Quality of Life Measure for Children with Epilepsy (CHEQOL-25)[15]. However, the relatively lengthy items of these tools cost reporters plenty of time and patience to complete, and add management burden to medical staffs, which may limit its practical use in busy clinical research settings, especially China.

In order to minimal respondent burden, recently Goodwin and other scholars developed a 16-item-version measure (QOLCE-16) from the QOLCE-55 that allow capture of HRQOL while maintain the strong properties of the original tool based on the item response theory methods[8, 16]. The QOLCE-16 accesses child's HRQOL through parents report according four domains: cognitive, emotional, social, and physical functioning, with each domain consists of four items. The reliability and sensitivity of the QOLCE-16 was tested across age, sex, and time, which shows this short version is time-saving and is an appropriate measure for clinicians[8].

Given the QOLCE-16 is an excellent and practical inventory for China's busy clinical and scientific environment, however, its use in China is currently blank as the absence of a Chinese version. The

purpose of this study was to first translate the QOLCE-16 from English into Chinese, followed by an assessment of the psychometric properties of the Chinese version of the Quality of Life in Childhood Epilepsy Questionnaire-16-C (QOLCE-16-C). Expectations for the Chinese version QOLCE-16-C were the following: (1) appropriate cultural equality; (2) high internal consistence; (3) good test-retest reliability; (4) strong structural validity.

Methods

This study consists of two phases: (1) translation of the QOLCE-16 to Chinese, followed by a cross-cultural adaptation among the parents with children with epilepsy; (2) testing of the psychometric properties of the QOLCE-16-C, including reliability and validity assessments.

Phase 1: Translation and cross-cultural adaptation procedure

The goal of phase 1 was to produce a semantically equivalent, grammatically fluent, culturally compatible, and readily comprehensible QOLCE-16-C. Due to the lack of gold translation standard[17], we adopt the 10 steps of Principles of Good Practices for translation and cultural adaptation of measures established by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR)[18], which has been commonly used in large international researches including those of Patient-reported outcome measurement information system (PROMIS)[19], the World Health Organization Quality of Life (WHOQOL)[20], the Neuro-quality of life (Neuro-QoL)[21], and others[22, 23]. Figure 1 shows the specific translation steps.

Forward and backward translation

After receiving permission for translating from the development group of QOLCE-16 (Professor Kathy N. Speechley) through E-mails, the forward translation team (1 pediatric neurology nurse, 2 master students) translated the instrument independently. All three of them were bilingual and all have experience living in English-speaking countries for at least one year. The three forward translated version were then reconciled into one through discussion among the three translators as well as the leader of the project. After that, another three bilingual translators (1 child neurologist, 1 child health doctor, 1 English-speaking translator) who were blind to the study objects and original QOLCE-16 conducted the back-translation. After discussion, an integrated and back-translated English version was obtained.

Harmonization

A 5-member harmonization team (1 linguistic specialist, 2 medical school teachers with experience in scale translation research, 2 pediatric nursing doctoral students) conducted an evaluation and comparison between the original scale, forward version and back-translated version to produce an agreement on a draft version.

Culture adaption

To evaluate the equivalence of the draft version with the original version, the cognitive interviewing technique was used in 5 parents whose child had epilepsy. Prior to the cognitive interview, an interview outline was developed and evaluated by experts to make sure its rationality. According to the interview outline, parents were asked about their understanding of the whole scale and the expression of specific items. A 10-point scale was used to measure how well parents understood the items. A rating of “1” meant that the item was difficult to answer, while a rating of “10” meant that the item was easy to answer. General probing and paraphrasing techniques were used for some of the items[24, 25].

Expert review

The Delphi Method was used during this procedure[26]. 9 experts (1 child neurologist, 1 child neurosurgeon, 1 child health doctor, 1 child rehabilitation doctor, 1 pediatrician in public health, 2 professor of nursing, 1 head nurse of neurosurgery, and 1 head nurse of neurology) were invited to make comparison among the above original scale, forward version, back-translated version, and cognitive interview integrated version through E-mail, and to form the final integrated version, the QOLCE-16-C.

Phase 2: QOLCE-16-C psychometric testing procedure

Study subjects and settings

Parents with children who had epilepsy from Shanghai Children’s hospital were invited to take part in the study. A convenience sampling method was adopted to recruit the eligible participants in Neurology department inpatient and outpatient clinics. The inclusion criteria were children who were (1) aged 4 to 18 years, (2) with a diagnosis of epilepsy, (3) with parents able to speak and read Chinese, and (4) willing to participate in this study and have their parent’s permission. Parents who have cognitive or mental impairment and refuse to participate in the investigation were excluded. When the children and their parents came to the clinic, the researchers explained to the participants the purpose of the study and asked them if they would be willing to participate in the survey. After obtaining the written informed consent of the participants, the data were collected through self-filled questionnaires which were filled out in the doctor’s office. All the questionnaires will be returned on the spot after they had been filled out. A total of 430 questionnaires were distributed from June to November 2020, and 414 were effectively returned, with an effective response rate of 96.3%. To assess the test-retest reliability, 40 parents were randomly selected to answer the QOLCE-16-C again 2–3 weeks after their first complement. The test-retest data was collected in two ways: paper questionnaires and electronic questionnaires filled out on the WeChat platform. Finally, 32 valid retest questionnaires were recovered.

Instruments

General demographic scale

The general demographic scale was used to obtain demographic data, including information about children with epilepsy and family information. Data related to children with epilepsy includes gender, age,

grade of study and information related to epilepsy disease. Family data includes parents' age, education background, family monthly income, payment methods for medical expenses.

Chinese version of the QOLCE-16

This was a short-form version of the QOLCE-55[14], which consists of 16 items and was divided into 4 dimensions: cognitive, emotional, social, and physical functioning. The internal consistency reliability of the original QOLCE-16 was excellently high ($\alpha = 0.90$)[16]. A 5-point Likert scale was used to calculate the scores for each domain and the scores for the total scale: 1 = very often, 2 = fairly often, 3 = sometimes, 4 = almost never, 5 = never[16]. Ratings were transformed linearly, presenting total scores take values from 0 (low HRQOL) to 100 (high HRQOL). It is worth noting that the scale also includes the sixth option: 6 = not applicable, but this option does not participate in scoring. If the answer to an item is “not applicable”, the item will be considered as missing data. The translation procedure of the Chinese version of the QOLCE-16 has been reported in phase 1.

Data analysis

IBM SPSS Statistics 23.0 and SPSS Amos24.0 were used for analyzing the psychometric properties.

Item analysis

In item analysis, the mean and standard deviation ($\bar{x} \pm s$) of each and total items in the inventory was reported. The critical ratio (CR) was calculated for every item, with a value above 3 was considered statistically significant[27]. After that, the item-total correlation coefficient was tested.

Reliability

Reliability was tested by internal consistency and test-retest reliability. Cronbach's α coefficient was used to assess internal consistency with a value of α above 0.7 is considered as acceptable[28]. Interclass correlation coefficients (ICC) was used for test-retest reliability, with ICC lower than 0.4 is considered low, 0.4–0.6 considered normal, 0.6–0.8 considered moderate and higher than 0.8 considered high[29].

Content validity

Content validity index (CVI) was used to evaluate the content validity of the scale, including the scale level CVI (S-CVI) and the item level CVI (I-CVI). 9 experts (the 9 experts mentioned in the expert review process) were asked to score the whole scale and each item on clarity and relevancy on a 4-point Likert scale (0 = undesirable, 1 = somewhat desirable, 2 = desirable, 3 = fully desirable). The CVI was calculated by the number of the evaluators gave fully desirable and desirable divided by the total number of questions. The cut-off of the S-CVI should be 0.9 or higher, and the I-CVI should be 0.78 or higher[30].

Construct validity

Although the QOLCE-16 has been proved has good structural validity by its original author, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted considering that the translated QOLCE-16-C was applied for the first time in Chinese children with epilepsy.

First, exploratory factor analysis (EFA) was performed to obtain the factor structure by using principal components analysis with varimax rotation[31]. Before the EFA, Kaiser-Meyer-Olkin (KMO) measure and Bartlett's sphericity were chosen for verification, with KMO index greater than 0.50 was considered as eligible to conduct EFA[32]. Criteria used to determine the number of effective factors were: (1) eigenvalues greater than 1.0, (2) the percentage of total explained variance accounted for, and (3) items with loading greater than 40% in absolute value[31]. Second, confirmatory factor analysis (CFA) was conducted to verify the factor structure determined in the exploratory study. The maximum likelihood estimation method was used to estimate the parameters in the model. Items were first loaded onto 4 factors and then integrated into one factor. The model fit indices are deemed acceptable by $\chi^2/df \leq 3$, comparative fit index (CFI) ≥ 0.90 , goodness of fit index (GFI) ≥ 0.90 and root-mean-square error of approximation (RMSEA) ≤ 0.08 [33]. After that, the convergent validity of each dimension was tested by the values of the average variance extracted (AVE) and discriminant validity was determined by comparing the square root value of AVE of each dimension with the correlation coefficient of a particular dimension with those of other dimensions[34].

Results

Phase 1: translation and cross-cultural adaptation

Forward and backward translation

The translation results of the three forward translators were basically reached an agreement, except for the phrase "health and well-being", and item 1 "Had trouble understanding directions". As the word "health" and "well-being" both mean health, but "well-being" also has a meaning of subjective experience of one's happiness in life. After discussing they were together translated into "health and life quality". In addition, there were objections to the translation of "directions", as it contains both the direction and indication two kinds of meanings. However, since this item belongs to the cognitive dimension, it was more appropriate to translate it as an indication, as cognitive impairment is common in children with epilepsy. During the backward translation, we observed that most of the items and instructions were almost coincided with the original scale, because these were mostly daily expressions and had few abstract concepts. The integrated forward and backward version of the QOLCE-16 were delivered for further harmonization and review.

Harmonization

The 5-member harmonization team generally agree with the forward and backward translation, but put some adjustments to the order of items in the same dimension. For example, in the original scale, "Had difficulty following complex instructions" came before "Had difficulty following simple instructions".

However, in the Chinese language, it is more common to put the simple first. Therefore, the order of the two items were reversed.

Culture adaption

Five native Chinese parents (one father, four mothers) whose child had epilepsy were interviewed, ranging in age from 31 to 40 years, with educational level covers junior high school education to doctor's degree. Generally, participants reported that all the items and instructions were appropriate without any uncomfortable. Two parents had different opinions on one translation respectively: "instructions" was understood as "imperative commands" by one mother; "supervision" was understood as "overprotective" by another mother. Considering that the two mothers are of low educational level, we believe that it may be an isolated phenomenon, so we didn't change it, instead, it was handed over to expert review.

Expert review

A total of three rounds of expert review were conducted, and all high experts gave feedback actively. The semantic meaning and content of the scale were examined according to the local Chinese culture. Beyond that, the uncertainties encountered in the translation and cultural adaption process were discussed in detail. The phrase "health and well-being" was eventually translated into "quality of life" in Chinese, as it was consistent with the content measured by the scale. The word "supervision" in the item "Need more supervision than other children his/her age" was determined to be translated as "caring" so that parents can better understand it. In addition, experts determined the expression of the answers to the scale, such as "All of the time" and "Very often" were translated as "always" in Chinese. Finally, the Chinese version of QOLCE-16 was obtained (Appendix 1).

Phase 2: Psychometric Properties of the QOLCE-16-C

Demographic characteristics of the subjects

We recruited 414 epilepsy children with 414 respondents from Shanghai Children's hospital, including 203 for the EFA and 211 for the CFA. Among these 414 epilepsy children, 203 (49%) were boys, the mean age was 9.73 years with a standard deviation of 3.31 years, 170 (41.1%) were partial seizures, 173 (41.8%) were generalized seizures, most children 298 (63.0%) took only one or zero antiepileptic drug. Of these 414 respondents, 298 (72.0%) were mothers, 13 (3.1%) were fathers, 103 (24.9%) were grandparents, with ages ranged from 27 to 80 (44.2 ± 12.52) years, 246 (59.42%) had a college education or above. The detailed demographic characteristics of the total subjects are presented in Table 1.

Item analysis

The item analysis results shown that the CR coefficients of all items were higher than 3 ($P < 0.001$). The scores of all items are significantly related to the total scores (Table 2).

Reliability analysis

The results shown that the Cronbach's α coefficients for the total and four dimensions of the QOLCE-16-C were 0.938, 0.945, 0.814, 0.922, and 0.891 respectively. There were 32 people completed the retest survey. The ICC for the total and each dimension were 0.724, 0.716, 0.615, 0.650, and 0.672 respectively (Table 3).

Validity

Content validity

The positive coefficients of the 9 experts were 100%. The S-CVI and the I-CVI was 1, except for item 5, which was 0.89, indicating that the importance of all items in the QOLCE-16-C has reached an expert consensus.

Construct validity

The exploratory factor analysis shown that the KMO value was 0.928, Bartlett's test $\chi^2 = 5514.698$, $P < 0.01$, which was suitable for exploratory factor analysis. Principal component analysis method was used to extract 4 common factors. The characteristic values after the axis were 3.573, 3.145, 3.131, 2.660, all greater than 1. Its cumulative variance contribution rate was 78.183%, which meet the requirement that the cumulative variance contribution rate should at least be 40% [31]. The factor loading of each item was between 0.621 and 0.877. See Table 4 for details.

The CFA was performed to test the fitness of the total scale. The construct of the total scale was acceptable for $\chi^2/df = 1.698$, GFI = 0.913, CFI = 0.974, RMSEA = 0.058 (Table 5). The value of AVE of each dimension, the square root of every AVE value, and correlation coefficients between dimensions are shown in the Table 6. The square roots of AVE were higher than any other correlation coefficients of every dimension with other dimensions, suggesting acceptable discriminant validity.

Discussion

To the best of our knowledge, this study presents a first attempt to translate the QOLCE-16 into Chinese and to test its validity and reliability among Chinese children with epilepsy.

The steps of cross-cultural translation are rigorous and have firm basis. The 10-step translation method of the guidelines for the Principles of Good Practices for translation and cultural adaptation was used to translate QOLCE-16, which provides effective guidance for cross-cultural translation. During the translation, we adjusted a few items based on the results of parents' cognitive interviews and the opinions given by expert consultants, such as translating "Supervision" to "caring", so that the questioner could understand them better. In addition, the order in which items were placed had been adjusted according to the cognitive habits of the Chinese. Consequently, the translated scale can convey the meaning smoothly in the semantics and is also acceptable in the culture.

Items are well identified and significantly correlated with the total scale. The results of item analysis illustrated that the CR values of each items were greater than 3, which meet the requirement that CR values should be greater than 3 and statistically significant[27]. Moreover, there was a significant correlation between the scores of each item and the total scores, indicating that all items were valid.

Internal consistency and test-retest reliability of the QOLCE-16-C are acceptable. The Cronbach's α coefficients for each dimension was higher than 0.7, and the cognitive and social dimensions were higher, 0.945 and 0.922 respectively, which was consistent with the results of Goodwin (value of 0.92 and 0.85) [16]. The test-retest reliability was completed among 32 parents, and the results shown that the ICC between the two tests ranged between 0.615 and 0.716. The lower correlation may be related to the length of the interval in our study (2–3 weeks). In addition, the way the retest data was collected may also have contributed to the low correlation, as more than half of the retest data was collected through WeChat electronic questionnaires.

Content validity and structure validity are reasonable. The S-CVI in QOLCE-16-C reached 1, and the I-CVI was 0.89 ~ 1, indicating good expert content validity. In structural validity, EFA produced four common factors, which were highly consistent with the results of the original scale. The results of CFA were acceptable for $\chi^2/df = 1.698$, GFI = 0.913, CFI = 0.974, RMSEA = 0.058. In addition, the QOLCE-16-C also showed good discriminative validity. In future studies, the measurement equivalence of the QOLCE-16-C should be further verified by differences groups, such as age, gender and time[8].

Finally, we have to reiterate the purpose of the development of QOLCE-16 proposed by the original author Goodwin: to simplify QOLCE-55 and to provide an easy-to-use measurement tool for clinic. Therefore, QOLCE-55 is the preferred measure in cases where specific domain information or a more comprehensive HRQOL assessment is required. In contrast, QOLCE-16 is more suitable for focusing on aggregate summary scores[16].

There are several limitations of this study should be considered. (1) Convenience sampling survey conducted in only one children's hospital, which may have some impact on the scale's generalizability. (2) the 5 cognitive interviewees we included were relatively small in sample size, as the acceptable range is 10 to 15 subjects recommended in the literature [35]. The results brought by small samples may result in an unreasonable translation and expression of items. (3) Convergent and divergent validity were performed on 4 dimensions, but did not evaluated on the total QOLCE-16-C, which would have required a comparison with the QOLCE-16-C scores with other validated measures. Future studies need to be carried out in different groups (e.g., age, sex, and time) to further confirm its applicability in Chinese children with epilepsy.

Conclusions

In conclusion, this study conducted a translation of QOLCE-16 under the culture of China, along with its reliability and validity tests in Chinese children with epilepsy. The contents and items of the QOLCE-16-C

are simple and easy to understand. Moreover, the small items can effectively save the time of answering, and reduce the burden of reporters. After verification, the QOLCE-16-C has been proved to have good reliability and validity, and is suitable for the evaluation of health-related quality of life of children with epilepsy in China. Future studies need to be carried out in different groups to further confirm its applicability in Chinese children with epilepsy.

Abbreviations

HRQOL

Health related quality of life

QOLIE-AD-48

Quality of Life in Epilepsy for Adolescents

QOLCE-55

Quality of Life in Childhood Epilepsy Questionnaire

CHEQOL-25

Quality of Life Measure for Children with Epilepsy

QOLCE-16

Quality of Life Childhood Epilepsy Questionnaire

QOLCE-16-C

Chinese version of the Quality of Life in Childhood Epilepsy Questionnaire

ISPOR

International Society for Pharmacoeconomics and Outcomes Research

PROMIS

Patient-reported outcome measurement information system

WHOQOL

World Health Organization Quality of Life

Neuro-QoL

Neuro-quality of life

CR

Critical ratio

ICC

Interclass correlation coefficients

CVI

Content validity index

S-CVI

scale level of content validity index

I-CVI

item level of content validity index

EFA

Exploratory factor analysis

CFA

Confirmatory factor analysis

KMO

Kaiser-Meyer-Olkin

CFI

Comparative fit index

GFI

Goodness of fit index

RMSEA

Root-mean-square error of approximation

AVE

Average variance extracted

Declarations

Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available to preserve the privacy of the participants but are available from the corresponding author on reasonable request.

Ethical approval and consent to participate

This study protocol was approved by the Ethics Committee of the Shanghai Children's hospital, and informed consent was obtained before the study began, and the ethical approval number is 2020R053-E01. Inform consent and assent were obtained.

Consent for publication

Not application.

Availability of supporting data

The datasets during and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors contributed equally to this work.

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Tables

Table 1 Demographic characteristics of the subjects (n=414)

Variable	N (%)
Information about epilepsy children	
Gender	
Male	203 (49.03%)
Female	211 (50.97%)
Mean age (SD)	9.73 (3.31)
Grade level	
Haven't started school	4 (1.0%)
Kindergarten	62 (14.98%)
Primary school	235 (56.76%)
Secondary school	91 (21.98%)
High school	14 (3.38%)
Special school	8 (1.93%)
Epilepsy type	
Partial	170 (41.06%)
Generalized	173 (41.79%)
Don't know	71 (17.15%)
Mean duration of epilepsy (SD)	3.95 (3.19)
Types of AEDs	
0~1	298 (71.98%)
2~3	113 (27.29%)
≥3	3 (0.72%)
Information about the respondents and families	
Relationship to child	
Farther	13 (3.14%)
Mother	298 (71.98%)
Grandparents	103 (24.88%)
Mean age (years)	44.24 (12.52)
Education level	

Variable	N (%)
Primary school	4 (0.97%)
Secondary school	56 (13.53%)
High school/Technical school	108 (26.09%)
Undergraduate/Junior College	153 (36.96%)
Master or above	93 (22.46%)
Average monthly household income	
2000~5000	16 (3.86%)
5000~8000	67 (16.18%)
8000~10000	120 (28.99%)
≥10000	63 (50.97%)

Table 2 Item Analysis for the QOLCE-16 (n=414)

Item	Mean $\pm$ SD	CR	P	Item-total correlation	P
C_1	75.42 $\pm$ 24.383	21.095	≤ 0.001	0.772**	≤ 0.001
C_2	67.63 $\pm$ 28.588	20.769	≤ 0.001	0.750**	≤ 0.001
C_3	80.13 $\pm$ 21.291	17.563	≤ 0.001	0.753**	≤ 0.001
C_4	64.98 $\pm$ 28.730	20.324	≤ 0.001	0.745**	≤ 0.001
E_1	69.02 $\pm$ 20.707	11.327	≤ 0.001	0.564**	≤ 0.001
E_2	65.94 $\pm$ 22.403	10.374	≤ 0.001	0.542**	≤ 0.001
E_3	67.81 $\pm$ 21.050	7.904	≤ 0.001	0.510**	≤ 0.001
E_4	64.07 $\pm$ 22.545	13.436	≤ 0.001	0.639**	≤ 0.001
S_1	79.05 $\pm$ 25.867	17.048	≤ 0.001	0.639**	≤ 0.001
S_2	71.62 $\pm$ 22.897	19.312	≤ 0.001	0.791**	≤ 0.001
S_3	72.40 $\pm$ 24.186	18.719	≤ 0.001	0.775**	≤ 0.001
S_4	73.55 $\pm$ 23.231	21.491	≤ 0.001	0.797**	≤ 0.001
P_1	67.75 $\pm$ 21.910	18.551	≤ 0.001	0.749**	≤ 0.001
P_2	63.83 $\pm$ 23.481	19.205	≤ 0.001	0.752**	≤ 0.001
P_3	70.59 $\pm$ 22.687	15.229	≤ 0.001	0.700**	≤ 0.001
P_4	61.65 $\pm$ 24.264	11.948	≤ 0.001	0.530**	≤ 0.001

Note: ** Correlation is significant at 0.01 level (2-tailed)

Table 3 The Reliability of the QOLCE-16

	Cronbach's α (n=414)		Test-retest reliability (n=32)
	Canadian version	Chinese version	
Cognitive	0.92	0.945	0.716
Emotion	0.75	0.814	0.615
Social	0.85	0.922	0.650
Physical	0.80	0.891	0.672
Total	0.90	0.938	0.724

Table 4 Factor loadings of Chinese version of QOLCE-16 (n=203)

Items		Factor 1	Factor 2	Factor 3	Factor 4
Cognitive	C_2	0.877	0.239	0.245	0.120
	C_1	0.868	0.246	0.237	0.199
	C_4	0.847	0.231	0.199	0.173
	C_3	0.799	0.255	0.292	0.202
Social	S_4	0.269	0.807	0.324	0.192
	S_2	0.235	0.794	0.312	0.250
	S_3	0.274	0.767	0.313	0.199
	S_1	0.333	0.728	0.213	0.227
Physical	P_1	0.296	0.244	0.839	0.175
	P_3	0.287	0.241	0.797	0.130
	P_2	0.337	0.243	0.757	0.206
	P_4	0.099	0.287	0.720	0.072
Emotional	E_2	0.213	0.041	0.107	0.838
	E_1	0.104	0.169	0.196	0.787
	E_3	0.161	0.221	0.009	0.737
	E_4	0.082	0.413	0.255	0.621
Characteristic values		3.573	3.145	3.131	2.660
Variance contribution (%)		22.332	19.659	19.566	16.626
Cumulative (%)		22.332	41.991	61.557	78.183

Note: The bold parts indicate that they belong to the same factor

Table 5 Fitness of the QOLCE-16 (n=211)

c ²	df	P	c ² /df	CFI	GFI	RMSEA
166.378	98	0.000	1.698	0.974	0.913	0.058

Table 6 Discriminative validity analysis (n=211)

	AVE	Cognitive	Emotional	Social	Physical
Cognitive	0.825	0.908			
Emotional	0.458	0.503	0.677		
Social	0.704	0.632	0.654	0.839	
Physical	0.714	0.74	0.552	0.745	0.845

Note: The bold parts are the square root of AVE

Figures

Figure 1

Translation of the QOLCE-16

Supplementary Files

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- [Appendix1.docx](#)