



Reliability and validity of Simplified Chinese version of Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) questionnaire: cross-cultural adaptation and validation

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Abstract

Objective To translate and cross-culturally adapt Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) Questionnaire into a Simplified Chinese version (QuickDASH-C), and evaluate the reliability and validity of the QuickDASH-C in patients with upper limb disorders.

Methods Cross-cultural adaptation was performed according to the internationally recognized guidelines of American Academy of Orthopedic Surgeons Outcome Committee. A total of 150 participants were recruited in this study. Internal consistency was estimated using Cronbach's alpha. Intra-class correlation coefficient (ICC) was used to determine test-retest reliability. Construct validity was analyzed by evaluating the correlations between QuickDASH-C and Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire and visual analogue scale (VAS) as well as the short form (36) health survey (SF-36).

Results The original version of the QuickDASH was well cross-culturally adapted and translated into Simplified Chinese. QuickDASH-C was indicated to have excellent reliability (Cronbach's alpha = 0.818, ICC = 0.907). QuickDASH-C correlated almost perfectly to DASH ($r = 0.820$, $p < 0.001$). Moderate to substantial correlations between QuickDASH-C and VAS ($r = 0.463$, $p < 0.001$), as well as physical function ($r = -0.630$, $p < 0.001$), role physical ($r = -0.471$, $p < 0.001$), bodily pain ($r = -0.563$, $p < 0.001$) and general health ($r = -0.414$, $p < 0.001$) subscales of SF-36, were observed.

Conclusion QuickDASH-C was demonstrated to have excellent acceptability, reliability, and validity in patients with upper limb disorders, which could be recommended for patients in mainland China.

Key Points

- This study translated and cross-culturally adapted Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) questionnaire into a Simplified Chinese version.
- The reliability and validity of Simplified Chinese version of QuickDASH were good in evaluating patients with upper limb disorders.

Keywords Quality of life · QuickDASH · Reliability · Upper limb disorders · Validity

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Introduction

Upper limb disorders can make a significant impact on short- and long-term disability, such as pain, decreased social contact, and psychological distress [1–3], which has a profound impact on health-related quality of life (HRQoL) [4, 5]. For a better understanding of patients' disorder severity and more appropriate therapeutic approach [6], a large body of patient-based HRQoL questionnaires has been developed [7], such as the Disability of the Arm, Shoulder, and Hand (DASH) questionnaire. This need has become more essential with the growing number of multicenter studies among different countries and cultures [7], which provide more statistical power of evidence-based trials [8]. When one reliable, valid questionnaire is used in populations with different cultures, it is necessary to test the psychometric properties of the questionnaire rather than simply translating the content to avoid bias due to cultural variety [9, 10].

The DASH questionnaire, consisting of 30 items, is widely used in evaluating upper limb function and has been considered one of the best upper limb measures clinimetrically [11, 12]. However, this 30-item questionnaire is time-consuming to fulfill, and some items are difficult for elderly patients to answer. Therefore, a shortened version of the DASH, known as Quick Disabilities of the Arm, Shoulder, and Hand questionnaire (QuickDASH) consisting of 11 items, was developed to measure physical function and symptoms in patients with upper limb disorders [13]. The original version of QuickDASH is expressed in North American English and has been cross-culturally translated/adapted into British English, Japanese, Korean, Hungarian, and French versions [14–18]. All of these versions above were proven to have good reliability and validity, which facilitated the wider use of QuickDASH in upper limb disabilities evaluation. Chinese is the language spoken by the largest population in the world. However, there is no QuickDASH in Chinese version for this population so far.

Considering the cultural gap and social environment between China and western countries, the purpose of this study was to translate, adapt the original version of QuickDASH into a Simplified Chinese version (QuickDASH-C) cross-culturally, and evaluate the reliability and validity of QuickDASH -C in native Chinese-speaking patients who suffered from upper limb disorders.

Methods

Translation and cross-cultural adaptation

The steps of translation and trans-cultural adaptation followed previous guidelines and studies in five steps [7, 9, 19]. First, forward translation. Two bilingual translators translated the

QuickDASH from English to Simplified Chinese independently. One translator was an orthopedist in the author's hospital; the other one was a professional translator without a medical background. Second, synthesis of the translation. Two translators and other researchers unified contradictions regarding language expression and cultural differences in a consensus meeting and obtained the first QuickDASH-C. Third, backward translation. Two native English speakers with fluent English and blind to the previous original English version of QuickDASH independently translated the first QuickDASH-C back into English version. Fourth, summarization of prefinal QuickDASH-C. A consensus meeting with all researchers was held to resolve all discrepancies, ambiguities, or any other verbal issues to reach a prefinal QuickDASH-C. Fifth, determination of final QuickDASH-C. Twenty patients were invited to test the prefinal version of QuickDASH-C preliminarily, and feedbacks were collected from them.

Eventually, all researchers involved in this study discussed issues in steps and outcome of translation and developed the final QuickDASH-C.

Patients and data collection

From August 2016 to September 2018, 150 participants were recruited from patients suffering from upper limb chronic disorders regarding frozen shoulder, rotator cuff injury, acromion impingement, tennis elbow, golf elbow, upper limb tendinitis, nerve injury, or other upper limb chronic diseases that compromised upper limb function; and treated at outpatient department in authors' hospitals. The inclusion criteria were as follows: (1) age > 18 years of age; (2) literate native Chinese speakers; (3) patients with stable illness condition of diseases above for more than 1 month. Participants were excluded for patients with (1) similar symptoms at contralateral limb; (2) other diseases that limited patient sport or movement ability; (3) unstable condition of illness during measurement gap; and (4) other uncontrolled systematic disorders, such as diabetes mellitus, malignant tumor, or hepatitis. Participants met the inclusion criteria and presented no item in exclusion criteria were recruited in this study. The number of patients also needed to meet the standard proposed by Terwee et al. [20] that study should include at least 50 patients for floor or ceiling effects, reliability, and validity analysis. All included participants were required to sign an informed consent and the study was approved by the clinical research Ethics Committees of hospitals of authors.

Patients should provide demographic data regarding gender, year of age, side of affected upper limb, and diagnosis at the first day approving to participate the study, and then finished QuickDASH-C, DASH, visual analogue scale (VAS) scores, and the short form (36) health survey (SF-36). All

participants filled in QuickDASH-C for the second time 7–14 days later to assess its test-retest reliability.

Instruments

QuickDASH is a disease-specific questionnaire for patients suffering from upper limb complaints, and the main part of the QuickDASH consists of 11 items [13]. All questions are answered from no symptoms to extreme symptoms, corresponding to 1 to 5 scores. The final scores were calculated according to the formula as $(\frac{\text{sum of } n \text{ scores}}{n} - 1) \times 25$, ranging from 0 (no disability) to 100 (the severest disability). Lower scores refer to a better outcome.

The DASH consists of 30 items, 21 regarding daily activity; 5 regarding symptoms; 3 about participation (the impact of the condition on daily life); and 1 about confidence in abilities [21]. Its final scores were calculated in the same way of QuickDASH. The VAS score evaluates the perception of pain for patients scoring 0–10, in which 0 demonstrates no pain at all and 10 corresponds to pain of highest level [22]. SF-36 is a questionnaire assessing general quality of life. It is composed of 36 items in 8 subscales to evaluate the patient's general condition. Scores for each subscale range from 0 (poor) to 100 (good) [23]. All of the scales above have been translated into Chinese, and proven good reliability and validity [24, 25].

Psychometric assessments and statistical analysis

To assess acceptability of QuickDASH-C, patients were asked the difficulties encountered. Statistical analysis for score distribution was performed. Floor and ceiling effects were defined as being present if more than 15% of patients reported lowest (0) or highest (100) possible scores [26].

Reliability was examined regarding test-retest reliability and internal consistency. The test-retest reliability was tested by comparing outcomes when the same patient without changes in health answered QuickDASH-C at two separated situations with proper duration interval. It was evaluated by the intra-class correlation coefficient (ICC), which derived from a two-way analysis of variance in a random effect model. $ICC > 0.8$ and > 0.9 were considered good and excellent reliability [27]. Bland-Altman plots were carried out to estimate systematic bias between the two measures [28]. Meanwhile, Cronbach's alpha was used to assess internal consistency of the questionnaire, and > 0.7 , 0.8 , and 0.9 were considered acceptable, good, and excellent internal consistency, respectively [20].

Validity tests for QuickDASH-C included content validity and construct validity. To assess content validity, one rehabilitation therapist and three orthopedists were invited to analyze the correlation between content in each item and state of

disease. As to construct validity, good construct validity meant that the questionnaire correlated well with measures of the same construct (convergent validity) and correlated poorly with measures of different constructs (divergent or discriminant validity) [29]. In view of this theory, we assumed that the score of QuickDASH-C should be in accordance with DASH, VAS, and disease-related subscales (physical component) of SF-36, but not with other subscales (mental component) of SF-36. Under such hypothesis, we calculated the Pearson correlation coefficient (r) between QuickDASH-C and DASH and VAS, as well as subscales of SF-36. Then, the construct validity for QuickDASH-C was evaluated by comparing how data conformed to the calculated correlations, judged as poor ($r = -0.2 \sim -0.2$), fair ($r = 0.2 \sim 0.4 / -0.4 \sim -0.2$), moderate ($r = 0.4 \sim 0.6 / -0.6 \sim -0.4$), substantial ($r = 0.6 \sim 0.8 / -0.8 \sim -0.6$), or almost perfect ($r = 0.8 \sim 1.0 / -1.0 \sim -0.8$) [29].

Statistical Package for the Social Sciences, version 20.0 (SPSS, Chicago, IL) was used in data analysis. p values of 0.05 or less were considered significant.

Results

Participants

From August 2016 to September 2018, a total of 183 patients were invited to participate in our study, and 150 of them (82.0%) agreed to participate in the study. All patients completed two rounds of instruments without withdrawn cases. Detailed demographic and clinical characteristics of participants were listed in Table 1.

Translation and cross-cultural adaptation process

There were no major problems in the forward and back translations of QuickDASH. However, “wash” in items 2 (“wash windows”) and 5 (“wash your back”) was translated to “rub (擦)” and “clean (清洁)” in accordance with language idiomatic manner. Besides, “use a knife to cut food” in item 5 was not a common dietary habit in Chinese culture and was cross-culturally adapted into “use chopsticks to pick food.” After the adaptation, no special issue was raised by participants in the prefinal test. In consequence, the final version of QuickDASH-C could be used to evaluate the patients' condition in further research.

Acceptability and score distribution

In the formal investigation, no participants complained any content was too difficult to understand at the time they filled QuickDASH-C, and the answer rate was 100%.

Table 1 Demographic and clinical characteristics of participants

Characteristics		Number of mean $\pm$ SD
Age (years)		48.4 $\pm$ 10.7
Range		22–75
Gender		Total = 150
Female		86 (57.3%)
Male		64 (42.7%)
Side		
Right		95 (63.3%)
Left		55 (36.7%)
Diagnosis		
Shoulder	Frozen shoulder	31
	Rotator cuff injury	18
	Acromion impingement	8
Elbow	Tennis elbow	31
	Golf elbow	4
Wrist	Tendinitis	20
Hand	Tendinitis	21
	Trigger finger	12
	Nerve injury	5

Absolute values of all 4 scores were listed in Table 2. No ceiling effect (0%) and floor effect (0%) were observed QuickDASH.

Reliability

Mean scores of QuickDASH were comparable with the first test. ICC for QuickDASH was 0.907, demonstrating its

Table 2 Absolute values of all scores

Scales	Mean $\pm$ SD	Minimum	Median	Maximum
QuickDASH	42.1 $\pm$ 11.3	13.6	40.9	72.7
DASH	41.5 $\pm$ 13.1	11.7	40.0	72.5
VAS	3.24 $\pm$ 1.38	1	3	8
SF-36				
Physical functioning	42.0 $\pm$ 20.0	0	45	95
Role physical	35.0 $\pm$ 16.3	0	25	75
Bodily pain	36.1 $\pm$ 14.6	0	41	84
General health	38.3 $\pm$ 21.4	0	40	100
Vitality	39.1 $\pm$ 22.8	0	40	95
Social functioning	40.1 $\pm$ 24.9	0	37.5	100
Role emotional	40.7 $\pm$ 26.4	0	33.3	100
Mental health	40.3 $\pm$ 21.9	0	40	96

SD, standard deviation; *QuickDASH*, Quick Disabilities of the Arm, Shoulder, and Hand questionnaire; *DASH*, Disabilities of the Arm, Shoulder and Hand questionnaire; *VAS*, visual analogue scale; *SF-36*, short form 36

excellent test-retest reliability. Bland-Altman plots for the two measures revealed no systematic error (Fig. 1), which suggested good test-retest accordance and reproducibility of QuickDASH [28]. The internal consistency for QuickDASH was good, with Cronbach's alpha coefficient of 0.818.

Validity

According to the evaluation of rehabilitation expert and orthopedic experts, content validity was good in QuickDASH-C and information derived from all items was adequate to assess the function of included patients.

Table 3 lists the data of construct validity of QuickDASH-C. The total score of QuickDASH-C showed almost perfect correlation with DASH score and moderate correlation with VAS (Table 3). When comparing QuickDASH-C with SF-36, its correlation coefficients with subscales of physical function ($r = -0.603$, $p < 0.001$), role physical ($r = -0.471$, $p < 0.001$), bodily pain ($r = -0.563$, $p < 0.001$), and general health ($r = -0.414$, $p < 0.001$) were moderate to substantial; meanwhile, this correlation was just weak to fair for social function ($r = -0.178$, $p = 0.030$) and mental health ($r = -0.165$, $p = 0.043$), and scores of QuickDASH was not relevant to vitality ($r = -0.053$, $p = 0.516$) and role emotional ($r = -0.010$, $p = 0.904$), which consistently matches our hypothesis.

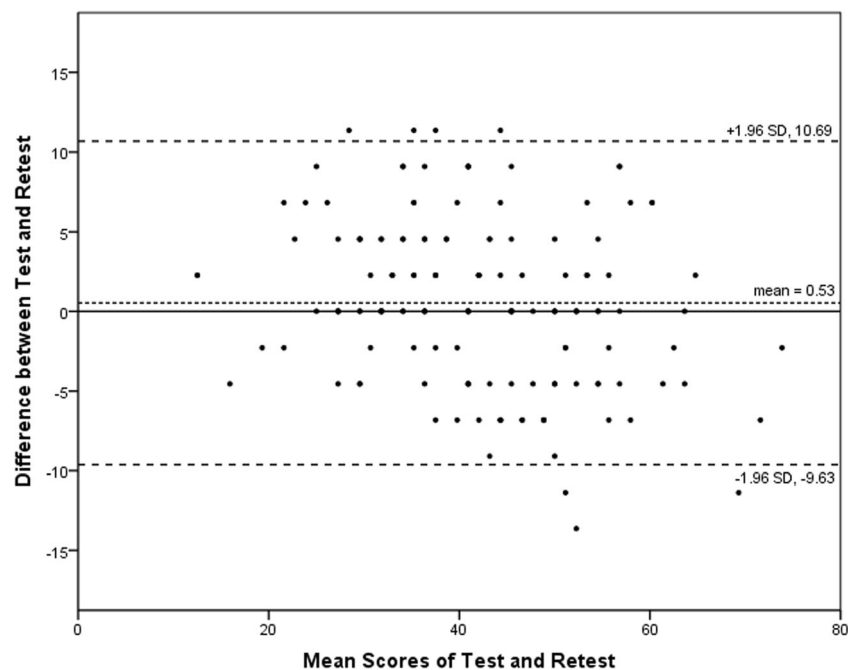
Discussion

In this study, the original English version of QuickDASH was successfully translated and cross-culturally adapted into Simplified Chinese. The QuickDASH-C had good reliability and validity in evaluating patients with upper limb disabilities.

HRQoL questionnaires are very important and valuable in the quantification of patients' function and data analysis among studies. Nowadays, with the invigorating strategy through science, technology, and education and greater science and technology input in China, the number of papers annually published in China is the second largest all over the world [29–31]. Therefore, valid questionnaires are urgently needed to support this huge amount of clinical research.

In the process of translation and adaptation, authors strictly followed the standardized procedure listed in the literature. Due to no corresponding Simplified Chinese word in linguistic perspective, some words were replaced according to the context. Although the word “wash” in items 2 and 5 was the same in English, they were translated into “rub” and “clean” respectively for better understanding among mainland Chinese. Apart from linguistic manners, cross-cultural adaptation was also performed to overcome culture gap. Knife and fork were seldom used among mainland Chinese. Instead, they commonly use chopsticks to pick food. Although it seems that chopsticks mobilize hand muscles more, and arm

Fig. 1 The Bland-Altman plot for test-retest agreement of QuickDASH. The differences between scores for QuickDASH from test and retest were plotted against the mean of the test and retest. The line indicates mean difference value of the two sessions and the 95% (mean $\pm$ 1.96 standard deviation) limits of agreement



muscles less than knife and fork, their activity intensity, specific parts of muscles, and mode of action were basically the same.

The QuickDASH-C consists of 11 items for the main scale and 2 optional 4-item scales. The amount of items for QuickDASH-C is less than the full DASH (30 + 4 + 4). Besides, some items set in the full DASH could seldom be

performed by specific patients, such as sexual activities, which might cause a higher possibility of unfinished scale [17]. In the QuickDASH, such activities were eliminated. Therefore, QuickDASH could be used to substitute DASH in epidemiological studies for better feedback.

The floor and ceiling effects were excellent in QuickDASH-C, which was consistent with literature before [15, 17]. However, the floor or ceiling effects were higher than 0 in previous studies, but both floor and ceiling effects were 0 in this study, which might be due to the following reasons. Firstly, all patients included in our study were treated in the outpatient department, so patients' severity of symptoms was usually moderate. Secondly, all included patients suffered from chronic diseases. Under the circumstances, their symptoms were persistent, which could be easy to influence the quality of life to a moderate but not an extreme extent.

In our study, QuickDASH showed very good internal consistency (Cronbach's Alpha = 0.818) and test-retest reliability (ICC = 0.907). The results above were basically in agreement with the data reported by Hong et al. (Korean QuickDASH), Imaeda et al. (Japanese QuickDASH), Varjú et al. (Hungarian QuickDASH), Fayad et al. (French QuickDASH), and Hammond et al. (British English QuickDASH) [14–18]. Among previous studies, ICCs in British English and Korean version of QuickDASH were more than 0.9 and higher than ICC in the Japanese version, which could be attributed to these reasons. Firstly, patients included in studies of British English and Korean were of less heterogeneity. In the study of British English version, authors only included rheumatoid arthritis patients; likewise, authors of Korean version only included patients with carpal tunnel syndrome. Similar to our study, the study of Japanese version included patients with

Table 3 Construct validity of QuickDASH-C

Scales	Correlation coefficient r_p^a	p value
DASH	0.820**	< 0.001
VAS	0.463**	< 0.001
SF-36 subscales		
Physical function	−0.630**	< 0.001
Role physical	−0.471**	< 0.001
Bodily pain	−0.563**	< 0.001
General health	−0.414**	< 0.001
Vitality	−0.053	0.516
Social function	−0.178*	0.030
Role emotional	−0.010	0.904
Mental health	−0.165*	0.043

The sample size for the analysis of construct validity was 150

QuickDASH-C, Simplified Chinese version of Quick Disabilities of the Arm, Shoulder, and Hand questionnaire; *DASH*, Disabilities of the Arm, Shoulder and Hand questionnaire; *VAS*, visual analogue scale; *SF-36*, short form 36

* Correlation is significant at the 0.05 level (two-tailed)

** Correlation is significant at the 0.01 level (two-tailed)

^a Calculated by the Pearson's correlation coefficient (r_p) of the QuickDASH-C with DASH, VAS, and SF-36

diverse upper limb disorders. Secondly, only 38 patients were included for the test-retest reliability in the study of Japanese version, which was much less than study of British English (180 patients) and Korean (83 patients) version. Similar to the study of Japanese version, the study of French version only included 42 patients for test-retest reliability [14]. However, its ICC reached 0.94, which was comparable with studies of British English and Korean. As far as we were concerned, the most important reason was the shorter interval between first and second interviews for the study of French version (mean = 3.3 days).

The correlation between QuickDASH-C and DASH and VAS, as well as SF-36 subscales, was in accordance with our hypothesis. Higher scores in QuickDASH, DASH, and VAS indicated worse function; whereas, they indicated better function or quality of life in subscales of SF-36. Hence, it was reasonable that the values of r between QuickDASH and subscales of SF-36 were negative. Almost all correlations between QuickDASH-C and DASH and VAS, as well as SF-36 subscales, were significant, except the correlation with vitality and role emotional subscales of SF-36. However, r value for these correlations varied a lot. In our study, QuickDASH-C correlated better with DASH, VAS, and physical function, role physical, bodily pain, and general health subscales of SF-36. Whereas, these correlations were weaker between QuickDASH-C and vitality, social function, role emotional, and mental health subscales of SF-36. One possible reason might be that QuickDASH was designed for evaluation of function and symptoms in upper limbs, and vitality, social function, role emotional and mental health subscales of SF-36 indicated psychological or social state of patients, which could be affected by many factors other than physical situation and symptoms comparing with other scales of high correlation with QuickDASH-C. Specially, the correlation coefficient between QuickDASH-C and DASH was almost perfect ($r = 0.820$), which was consistent with our prior hypothesis, because QuickDASH was derived from DASH as a short version of that, and items from both of these two scales were designed to evaluate the quality of life in the same direction. Interestingly, correlations between QuickDASH and physical function and bodily pain subscales of SF-36 were slightly higher than other subscales of SF-36. This might be contributed to the fact that pain was the most important factor that lowered patients' quality of life, which also emphasize the importance of analgesia in treating the diseases included in our study. All of these above suggested satisfied divergent or discriminant validity for QuickDASH-C in patients with upper limb disorders.

There are several limitations in our study. First, the sample was limited in size and may not fully represent the mainland Chinese population. Second, although Simplified Chinese is the official language in China, China is a country with multiple nationalities, most of which have their own language.

Thus, the problem of national cultural differences should be noted. Finally, responsiveness of QuickDASH-C was not evaluated, which could be carried out in future studies.

Conclusion

The QuickDASH was successfully translated and cross-culturally adapted into Simplified Chinese. The QuickDASH-C had good reliability and validity in evaluating patients who suffered from upper limb disorders in mainland China.

Authors' contributions Study design: SQC, YD, and QRQ. Data analysis: SQC and HBZ. Collection of data: RZ, YC, HPC, and ZCL. Manuscript writing: SQC, RZ, and HBZ.

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

Compliance with ethical standards

Disclosures None.

Ethics approval and consent to participate All procedures performed in this study involving human participants were approved by the Ethical Committee of Sixth Medical Center of PLA General Hospital and Changzheng Hospital, which followed the ethical standards of the institutional and national research committee and the 1964 Helsinki Declaration and its later amendments. Informed consent was obtained from all individual participants included in the study.

Abbreviations QuickDASH, Quick Disabilities of the Arm, Shoulder, and Hand; QuickDASH-C, Simplified Chinese version of Quick Disabilities of the Arm, Shoulder, and Hand; HRQoL, health-related quality of life; DASH, Disability of the Arm, Shoulder, and Hand; VAS, visual analogue scale; SF-36, short form (36) health survey; ICC, intra-class correlation coefficient

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