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Reliability and validity of the Chinese (Queen Mary Hospital, Hong Kong version) of the Disabilities of the Arm, Shoulder and Hand on patients with upper extremity musculoskeletal disorders in Hong Kong

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Abstract

Objective: This study aimed to translate, culturally adopt and validate a Chinese version of the Disabilities of the Arm, Shoulder and Hand (DASH) for use in patients with upper extremity musculoskeletal diseases in Hong Kong.

Methods: We followed a standard five-stage process: forward translation, synthesis, backward translation, expert panel review and field-testing to achieve linguistic and conceptual equivalence. The version was officially known as Chinese (Queen Mary Hospital, Hong Kong version) DASH. (Chinese QMH,HK version DASH) (http://www.dash.iwh.on.ca/sites/dash/public/translations/DASH_Chinese_HK_2013.pdf).

Results: Its internal consistency was then evaluated with 138 participants suffering from upper extremity musculoskeletal conditions. The results were high in DASH-Disability/Symptom module (DASH-DS) (Cronbach alpha 0.97), DASH-Work module (DASH-W) (Cronbach alpha 0.97) and DASH-Sports / Performing Arts module (DASH-SM) (Cronbach alpha 0.99). The test-retest reliability was evaluated with a subgroup of participants who had completed the Chinese (QMH,HK version) DASH on two occasions, with a median interval of 6.5 days. The results were excellent among DASH-DS Intraclass Correlation Coefficient (ICC) = 0.98 and DASH-W (ICC = 0.90). Good test-retest reliability was found in DASH-SM (ICC = 0.89). Construct validity of DASH-DS showed good correlation with the sub-domains of physical functioning (r = –.564) and social functioning (r = –.544) of the Short Form 36 Health Survey (SF-36). Similarly, construct validity of DASH-W also showed good correlation with the sub-domains of physical functioning (r = –.510) and bodily pain (r = –.503) of SF-36.

Conclusion: The Chinese (Queen Mary Hospital, Hong Kong version) Disabilities of the Arm, Shoulder and Hand is considered as a reliable and valid instrument that can provide a standardised measure of patient-centred outcomes for patients with upper extremity musculoskeletal disorders in Hong Kong.

Keywords

Disabilities of the Arm, Shoulder and Hand, upper extremity musculoskeletal disorders, reliability, validity

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Introduction

Validated patient rated outcome measures (PROMs) are robust tools in modern patient-centred healthcare (Black, 2013). They allow documentation of specific outcomes in accordance to patients' experience and

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their quality of life (QOL). Both general and region-specific PROM are essential tools in research, quality assurance and monitoring the effectiveness of the medical interventions. Owing to the importance of evidence-based practice and patient-centred care, standardised, linguistically translated and culture-specific PROMs become standard practice for outcome assessment and clinical research (Guyatt, Feeny, & Patrick, 1993).

The Short Form 36 Health Survey (SF-36) is a well-recognised health-related QOL useful in various musculoskeletal disorders (Atroshi, Gummesson, Andersson, Dahlgren, & Johansson, 2000). Since the SF-36 is designed to measure outcomes over a range of dimensions in various diseases, it lacks sensitivity for region-specific problems in musculoskeletal conditions (Davis et al., 1999; Swiontkowski, Buckwalter, Keller, & Haralson, 1999). In this sense, region-specific outcome measure instrument is more useful and more applicable in clinical research for specific groups of disorders.

Upper extremity injury is among the most frequent occurrence of accidents in daily living. The Disabilities of the Arm, Shoulder and Hand (DASH) is a PROM co-developed by the American Academy of Orthopaedic Surgeons (AAOS), the Council of the Musculoskeletal Specialty Societies, the Institute for Work and Health and others in 1994 (Hudak et al., 1996). As a region-specific instrument, it measures upper extremity disability and symptoms for acute as well as chronic disorders (Hudak et al., 1996) by a self-report system. No special equipment and examiners are required for completing the instrument to avoid scheduling follow-up assessment and to minimise the possibility of observer bias. It is especially useful when patients' perception is important to assess (Schuind et al., 2003).

To facilitate the use of DASH in daily practice and as a research tool in countries with different cultural backgrounds, cross-cultural adaptation of DASH has been advocated. DASH is translated and adopted for over 50 linguistic and cultural variations like Korean (Lee, Lim, Oh, & Ko, 2008), Japanese (Imaeda et al., 2005), (Offenb€acher, Ewert, Sangha, & Stucki, 2003) German and French (Fayad et al., 2008). DASH is now considered one of the most commonly used outcome assessment tools for various upper limb musculoskeletal conditions including injuries, chronic neuropathy and degenerative diseases (Alotaibi, 2008).

The aim of this study was to carry out a cross-cultural adaptation and validation of the DASH to Chinese in Hong Kong and evaluated the Chinese (QMH, HK version) DASH reliabilities (repeatability and internal consistency) and construct validity in patients with upper extremity musculoskeletal disorders in Hong Kong.

Materials and methods

The DASH questionnaire (Table 3)

The DASH is a 30-item upper extremity scale that measures disability, symptoms and QOL issues related to upper extremity pathology during the preceding weeks.

For the mandatory 30-items DASH Disability/Symptom (DASH-DS) module, 21 items relate to the degree of ability and disability in performing various daily living tasks requiring use of the upper limbs. The nine remainders include: two items specific to pain and activity-related pain; three items ask about the severity of other symptoms like tingling and stiffness; two items address social life and work; one item relates to sleeping and one item relates to perceived capability.

There are also two optional modules of the DASH. Work module (DASH-W) (four items) determines the ability to work; the other is Sports/Performing Arts module (DASH-SM) (four items) concerns the ability to play a musical instrument or to perform sports.

Score calculation

Each item has five response choices and patients give scores from 1 to 5 on each item. The raw score is then transformed to a 0–100 scale, whereby 0 reflects no or minimum disability and 100 represents most severe or maximum disability.

Based on the initial 30 questions, the DASH-DS score would be calculated with the following equation

$$\text{DASH} - \text{DS score} = \left[\frac{(\text{sum of responses})}{n} - 1\right] \times 25$$

where n is equal to the number of completed responses.

(DASH-DS score may not be calculated if there are greater than three missing items)

Based on the four questions in the optional modules, optional module score would be calculated with the following equation

$$\text{DASH} - W/\text{DASH} - \text{SM score} = \left[\frac{(\text{sum of responses})}{4} - 1\right] \times 25$$

(An optional module score may not be calculated if there is any missing item).

The medical outcomes study questionnaire short form 36 Health Survey (SF-36)

The Short Form 36 Health Survey (SF-36) is a widely used, self-administered questionnaire to measure the health-related QOL in various musculoskeletal disorders (Lins & Carvalho, 2016). The SF-36 contains 36 items with eight subscales for domains of health. It has also been used to evaluate a wide variety of physical and mental pathologies (Ware & Sherbourne, 1992). The eight domains of health-related QOL are general health (gh), physical functioning (pf), social functioning (sf), bodily pain (bp), role physical (rp), role emotional (re), mental health (mh) and vitality (vt). The normalised and validated Hong Kong Chinese version of SF-36 was used in this study for construct validity (Lam, Gandek, Ren, & Chan, 1998).

The translation and adaptation process

Stage 1: Forward translation

The translation process was based on the five-stage process proposed (Guillemin, Bombardier, & Beaton, 1993). The original DASH was separately translated to traditional Chinese by two bilingual translators who were competent in both English and Chinese. One translator had no medical background and was not aware of the goal of the questionnaire while the other had medical background and was aware of the concept and purpose of the questionnaire.

Stage 2: Synthesis into one version

The differences between these two 'forward' translations of DASH were identified and resolved by consensus between the two translators and finally one common translation was synthesised.

Stage 3: Backward translation

This version was then backward translated to English by two back translators, whose native language was English. They were blinded to the original version of the DASH and had no medical background. The forward translators then reviewed the back translations to identify and resolve any unexpected meanings in the version. Ten participants who were patients with musculoskeletal disorders were invited to fill in the questionnaire to find out any confusion and misunderstanding over the questions. Those items were highlighted and resolved among the translators.

Stage 4: Expert panel review

The revised version was reviewed by expert panel consisting of two orthopaedic surgeons, one occupational therapist, one linguistic expert, one methodologist and three translators to rate their agreement on each question in terms of semantic, idiomatic, experiential and conceptual equivalence. The comments and recommendations of the expert panel were reviewed. Discrepancies were resolved by group consensus until 80% or above agreement on each item were achieved.

Stage 5: Field-testing

A pre-final version of the translated and culturally adopted DASH was produced and subjected to field-testing on 35 participants with different upper extremity problems. They were probed individually about their understanding, interpretation of the meaning of each item and their response. Any further items with common missing response and confusion were highlighted and resolved.

The current translated and adopted Chinese version of the DASH was already approved by AAOS and officially known as the Chinese (Queen Mary Hospital, Hong Kong version) DASH, here referred as Chinese (QMH, HK version) DASH. This translated version is available in the official DASH website: http://www.dash.iwh.on.ca/sites/dash/public/translations/DASH_Chinese_HK_QMH_2013.pdf.

Patients and methods

Chinese (Cantonese dialect) speaking patients in Hong Kong with injuries involved shoulder, elbow, forearm, wrist and hand were recruited for this study in the Occupational Therapy Department, David Trench Rehabilitation Centre, Hong Kong. Convenience sampling was adopted to recruit patients with upper limb injuries. Exclusion criteria were aged below 18, and unable to read or comprehend the questionnaire adequately. Written and informed consent had been obtained from the patients in advance before the administration of the questionnaires.

All patients completed the Chinese (QMH, HK version) DASH and the SF-36. Subgroup of patients were invited to complete the second questionnaire one week after the initial administration to avoid memory effect and to minimise change in functioning. Two sets of data for test–retest reliability measurement were obtained.

Statistical analysis

Internal consistency and reliability

To assess the internal consistency, Cronbach's alpha (Cronbach, 1951) was evaluated. A Cronbach's alpha coefficient between 0.7 and 0.9 is considered as acceptable (Portney & Watkins, 2015). Item–total correlation was also examined. Item with correlation coefficient higher than 0.2 showed acceptable level of correlation. Test–retest reliability was evaluated using the intraclass correlation coefficients (ICCs) (one-way random-effects model) of the two sets of data. Reliable scores should have ICC higher than 0.75 (Portney & Watkins, 2015).

Construct validity

For construct validity, Pearson product moment correlation coefficient was assessed to examine the relationship between DASH-DS, DASH-W and DASH-SM and subscales of the SF-36. A correlation coefficient above 0.5 indicated good correlation (Portney & Watkins, 2015). Good correlation with SF-36 pf, rp, bp and weak correlations with mh and vt was hypothesised and in accordance to other validation studies of DASH (Atroshi et al., 2000; Imaeda et al., 2005).

All statistical tests were carried out using SPSS (IBM, Armonk, USA) software version 25.0, with $p = 0.05$ set at the significance level.

Results

One hundred and forty-two patients were recruited. There were 106 (74.6%) men and 36 (25.4%) women. Mean age of the participants was 40 years old, ranging from 18 to 67. For all the patients, 39.4% suffered from forearm injury while 33.8% had hand injury; remaining 26.8% patients suffered from shoulder, elbow, wrist and other miscellaneous injuries.

The mean of the DASH-DS, DASH-W and DASH-SM scores was 40.9 (SD 23.1), 54.5 (SD 28.2) and 62.2 (SD 33.4), respectively. The minimum and maximum score of DASH-DS were 0 and 95.8, respectively, while the minimum and maximum score of DASH-W and DASH-SM were 0 and 100, respectively. Details refers to Table 1.

Table 1. Descriptive statistics of the study sample.

	Number	%
Gender	106	74.6
Male		
Female	36	25.4
Conditions of injury		
Forearm	56	39.4
Hand	48	33.8
Shoulder, elbow, wrist and miscellaneous cases	38	26.8
Age range (years)	18–67	
DASH-DS (mean±SD)	40.9 (23.1)	
DASH-W (mean±SD)	54.5 (28.2)	
DASH-SM (mean±SD)	62.2 (33.4)	

DASH: Disabilities of the Arm, Shoulder and Hand; DASH-DS: DASH-Disability/Symptom module; DASH-SM: DASH-Sports/Performing Arts module; DASH-W: DASH-Work module.

Internal consistency and reliability

Among the 142 recruited patients, four of them were found have left more than three questions not answered in the DASH-DS module. These four cases were excluded from internal consistency analysis of DASH-DS (Figure 1).

Thirty-four patients had 1–3 questions not answered in DASH-DS. According to the scoring criteria, the DASH-DS score is still valid for calculation if missing item is less than three. The rest 104 patients had no missing item. The DASH-DS internal consistency was high (Cronbach's alpha = 0.97, N = 138). The item–total correlation for all items ranged from 0.54 to 0.87.

For optional module DASH-W, we had 138 patients responded without missing item. Cronbach's alpha for DASH-W was found to be 0.97. The item–total correlation ranged from 0.91 to 0.93.

Another optional module DASH-SM, we had 42 patients giving response without missing item. The Cronbach's alpha was found to be 0.99. The item–total correlation ranged from 0.97 to 0.98 for DASH-SM.

Test–retest reliability in a subgroup of patients showed that the ICC of the Chinese (QMH, HK version) DASH-DS was 0.98 (95% CI 0.97–0.99, N = 44). The ICC of the DASH-W was 0.90 (95% CI 0.81–0.94, N = 44). The ICC of DASH-SM was 0.89 (95% CI 0.69–0.94, N = 23). Results indicated excellent agreement between the two repeated measures in DASH-DS and DASH-W. Good agreement was indicated in DASH-SM.

Construct validity

For construct validity, the three modules of the Chinese (QMH, HK version) DASH were negatively correlated with the SF-36 scores in a subgroup of patients as higher DASH score indicated worse health-related QOL (Table 2).

For convergent validity, the DASH-DS score had good correlation (correlation coefficient above 0.5) with SF-36 pf and sf; moderate correlation was found with bp, rp and re. The DASH-W had good

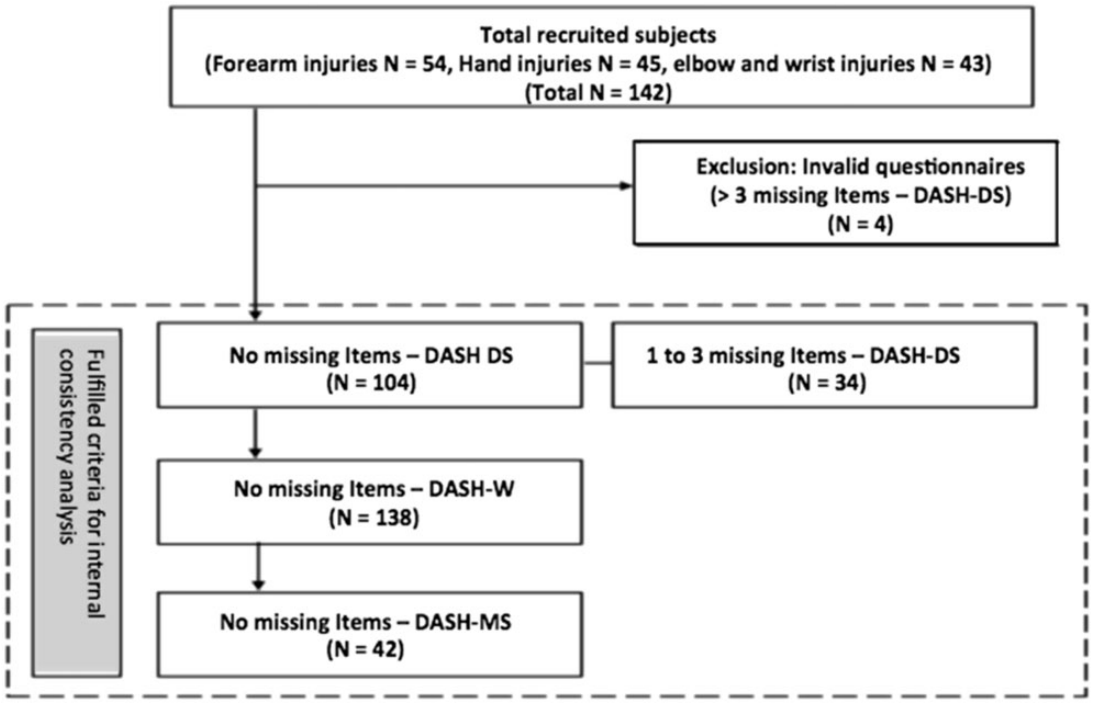

Figure 1. STROBE flow diagram of recruited subjects analysis fulfilling criteria for internal consistency.
DASH: Disabilities of the Arm, Shoulder and Hand; DASH-DS: DASH-Disability/Symptom module; DASH-SM: DASH-Sports/Performing Arts module; DASH-W: DASH-Work module.

Table 2. Correlation of DASH-DS, DASH-W and DASH-SM score and SF-36 sub-scores.

	DASH-DS correlation (N= 83)	DASH-W correlation (N= 80)	DASH-SM correlation (N= 39)
SF-36 physical functioning	−.564 ($p < .05$)	−.510 ($p < .05$)	−.302 ($p > .05$)
SF-36 social functioning	−.544 ($p < .05$)	−.464 ($p < .05$)	−.228 ($p > .05$)
SF-36 bodily pain	−.487 ($p < .05$)	−.503 ($p < .05$)	−.061 ($p > .05$)
SF-36 role physical	−.475 ($p < .05$)	−.448 ($p < .05$)	−.242 ($p > .05$)
SF-36 role emotional	−.465 ($p < .05$)	−.475 ($p < .05$)	−.144 ($p > .05$)
SF-36 mental health	−.294 ($p < .05$)	−.371 ($p < .05$)	−.123 ($p > .05$)
SF-36 general health	−.270 ($p < .05$)	−.302 ($p < .05$)	−.002 ($p > .05$)
SF-36 vitality	−.203 ($p > .05$)	−.348 ($p < .05$)	−.133 ($p > .05$)

DASH: Disabilities of the Arm, Shoulder and Hand; DASH-DS: DASH-Disability/Symptom module; DASH-SM: DASH-Sports/Performing Arts module; DASH-W: DASH-Work module; SF-36: Short Form 36.

correlation with SF-36 pf and bp; moderate correlation was found with re, sf and rp. All findings above were statistically significant.

For divergent validity, the DASH-DS score had weak correlation (correlation coefficient less than 0.3) with mh, gh and vt.

Discussion

During cross-cultural adaptation process, the instructions, name of activities and responses were translated without much difficulty. Most of the discrepancies arose from difference in linguistic issues or conceptual equivalence. For example, in item 18 for recreational activities, 'hammering' was considered to be a non-recreational activity in Hong Kong. This discrepancy was eventually resolved by the expert panel to add other recreational activities, such as playing volleyball, to achieve the conceptual equivalence in this item.

Following the guidelines of translation process, we were able to evaluate the change in outcome due to health status change. There was no patient having

full score in DASH-DS, indicating no score was at ceiling level.

We find that the Chinese (QMH, HK version) DASH is a reliable and valid instrument for measuring patient-centred outcomes in different upper extremity musculoskeletal conditions. The Chinese (QMH, HK version) DASH demonstrated high internal consistency. The DASH-DS and DASH-W also showed excellent test–retest reliability and the DASH-SM showed good test–retest reliability, which was also comparable to other validation studies.

The construct validity hypothesis of the DASH-DS and DASH-W was confirmed by good correlation of pf and bp and weak correlation of mh and vt, which matched with our hypothesis and other validation studies. The correlation between DASH-SM and SF-36 was not statistically significant. It may be due to the relative small sample size as it was an optional module with limited responses from the patients.

Traditionally, clinicians mainly focus on objective outcome such as range of motion, strength or dexterity. Being a PROM, the Chinese (QMH, HK version) DASH would minimise the bias introduced by clinicians when evaluating patients' condition and patients' perception of the outcome is considered. With the Chinese (QMH, HK version) DASH, clinicians would evaluate patients' disability and QOL from patients' perspective and allow clinicians to monitor the effectiveness of interventions.

It required 10–15 min to complete and was potentially burdening. The shortened version (Quick-DASH) was also being translated and culturally adopted for use. Study on patients' responsiveness of the Chinese (QMH, HK version) DASH could be considered as a future direction after completion of this study.

Conclusion

To conclude, the Chinese (QMH, HK version) DASH is a reliable and valid PROM for upper extremity musculoskeletal conditions for Chinese (Cantonese dialect) speaking patients in Hong Kong.

Declaration of conflicting interests

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Appendix 1

Table 3. The items in the Disability/Symptom module of DASH.

1	Open a tight or new jar
2	Write
3	Turn a key
4	Prepare a meal
5	Push open a heavy door
6	Place an object on a shelf above your head
7	Do heavy household chores (e.g. wash walls, wash floors)
8	Garden or do yard work
9	Make a bed
10	Carry a shopping bag or briefcase
11	Carry a heavy object (over 10 lb)
12	Change a light bulb overhead
13	Wash or blow dry your hair
14	Wash your back
15	Put on a pullover sweater
16	Use a knife to cut food
17	Recreational activities which require little effort (e.g. card playing, knitting, etc.)
18	Recreational activities in which you take some force or impact through your arm, shoulder and hand (e.g. golf, hammering, tennis, etc.)
19	Recreational activities in which you move your arm freely (e.g. playing Frisbee, badminton, etc.)
20	Manage transportation needs (getting from one place to another)
21	Sexual activities
22	Effects on social activities
23	Effects on work and other regular daily activities
24	Degree of pain
25	Degree of pain when performing specific activities
26	Degree of tingling in upper limb
27	Degree of weakness in upper limb
28	Degree of stiffness in upper limb
29	Difficulty in sleeping
30	Impact on self-image

DASH: Disabilities of the Arm, Shoulder and Hand.