THIEME OPEN ACCESS

Original Article

Cross-cultural Adaptation and Psychometric Evaluation of the Kurdish Version of the Disabilities of Arm, Shoulder, and Hand (DASH-KU) Scale

Rebwar A. Hasan[1]   Omer A. Barawi[2]   Jalal A. Hasan[3]

[1] Department of Surgery, College of Medicine, University of Slemani, Kurdistan Region, Iraq
[2] Division of Orthopedic Surgery, Department of Surgery, College of Medicine, University of Slemani, Kurdistan Region, Iraq
[3] Division of Plastic Surgery, Department of Surgery, College of Medicine, University of Slemani, Kurdistan Region, Iraq

Address for correspondence Rebwar A. Hasan, Department of Surgery, College of Medicine, University of Slemani, Kurdistan Region 46001, Iraq (e-mail: rebwar.hassan@univsul.edu.iq; rebwar.allaf@gmail.com).

Abstract

Background The disabilities of arm, shoulder, and hand (DASH) questionnaire addresses the patient's disabilities and symptoms to evaluate the extent and the impact of injuries in the patient's daily-life activities. This study aims to develop a valid and reliable adaptation of DASH into the Kurdish language and culture (DASH-KU).

Methods American Association of Orthopedic Surgeons Outcomes Committee guideline was used for the cross-cultural adaptation of DASH to the Kurdish version. This study was conducted at the Shahid Saifaddin consultation clinic in Sulaymaniyah, Iraq between April and October 2022. A total of 300 participants, who were included in the study using an available sampling method, completed the self-report DASH-KU questionnaire during two consecutive assessments with a 24-hour interval.

Results The DASH-KU questionnaire demonstrated excellent internal consistency (Cronbach's $\alpha = 0.99$) and test–retest reliability (intraclass correlation $= 0.99$). A strong correlation between DASH-KU scores and the patient-rated wrist/hand evaluation tool ($r = 0.792$) supported its construct validity. Bland–Altman plots showed good agreement between assessments with no floor (3%) or ceiling (0%) effects. Factor analysis found the scale had high adequacy (0.700) and significant sphericity ($p < 0.001$). The major factor explained 40% of variance with an eigenvalue of 13.14. Additionally, a five-item model explained 81.23% of DASH-KU variance, though responsiveness was suboptimal, possibly due to the short 24-hour interval between measurements.

Conclusion Our results demonstrate that DASH-KU has excellent reliability and validity in identifying upper limb injuries, and the psychometric properties of DASH-KU were similar to its original version.

Keywords
► upper limb conditions
► reliability and validity
► patient-reported outcome measures
► self-report

Introduction

The global burden of upper extremity injuries has recently faced an upward trend.[1] Patient-oriented outcome measures provide a better understanding of the patient's overall functional outcomes following musculoskeletal injuries. Therefore, various subjective, patient-rated assessment tools were developed in the evaluation of the upper extremity injuries, including the patient-rated wrist/hand evaluation (PRWHE) and the disabilities of arm, shoulder, and hand (DASH) questionnaires.[2–4]

Patient-reported outcome measures (PROMs) are questionnaires that allow patients to self-report their health status and health-related quality of life. PROMs provide important insights into patients' perspectives on their functional status and well-being. They complement clinical measures by capturing aspects of health that can only be assessed by the patients themselves.[5,6]

The DASH questionnaire is a 30-item PROM developed by the American Academy of Orthopaedic Surgeons and the Institute for Work and Health. It evaluates disabilities and symptoms related to upper extremity disorders. The DASH assesses the extent to which injuries impact patients' ability to perform daily activities over the past week. It contains 21 physical function items, 6 symptom items, and 3 social role items. DASH has demonstrated strong clinometric properties and correlates well with the International Classification of Functioning, Disability, and Health (ICF).[7,8]

Cross-cultural adaptation involves not just linguistic translation but ensuring content validity and reliability is maintained across different cultures and languages. Successful cross-cultural adaptation has made the DASH a valuable global PROM for upper extremity function. Validated translations are available in over 50 languages including Spanish,[9] Nepali,[10] Arabic,[11] Afrikaans,[12] and Brazilian Portuguese.[13]

In this regard, Kc et al demonstrated that considerable changes during the cross-cultural adaptation of the Nepali version of DASH led to an excellent intraclass correlation (ICC) and test–retest reliability.[10] Lee et al introduced the Korean version of DASH and reported an ICC of 0.91 and a high internal consistency.[14] In addition, the reliability and validity of this scoring tool were also approved in the Greek cross-cultural adaptation.[15]

Since this questionnaire is not available in the Kurdish language, it was necessary to conduct this study with the aim of creating a valid and reliable adaptation of the DASH questionnaire for the Kurdistan language (DASH-KU).

Methods

Participants

Patients with various wrist/hand injuries were enrolled in this cross-sectional study using an available sampling method. In this study, 300 subjects were consecutively recruited from the Shahid Saifaddin consultation clinic in Sulaymaniyah, Iraq, between April and October 2022. Inclusion criteria were adult patients (over 18 years old) with any wrist disability and at least primary education, and patients without cognitive, language, or visual impairment, and having informed consent. The study excluded patients who expressed regret for their participation and individuals who did not fully complete the questionnaires.

Cross-cultural Adaptation of DASH to Kurdish (DASH-KU)

American Association of Orthopedic Surgeons Outcomes Committee guideline was used for the cross-cultural adaptation of the DASH score to the Kurdish language.[16] This guideline ensures standard translation by instructing on five steps. A detailed explanation of each step is provided below.

Forward Translation

Two expert translators independently translated the DASH questionnaire into the Kurdish language. The translated drafts were compared, and any disagreements were resolved by consulting a third translator. A uniform edited version of the DASH-KU was prepared, and any discrepancies were removed.

Back Translation

Two bilingual linguistics experts back-translated the DASH-KU to English. Any inconsistencies, challenging points, and vague phrases between the back-translated version of DASH-KU and the original DASH questionnaire were addressed.

Cross-cultural Modifications

The phrases below were changed in the DASH questionnaire due to cross-cultural discrepancies. The phrase "no matter which hand is used" was confusing to test subjects, and therefore, this phrase was verbally clarified for all participants. In item 7, doing heavy household chores, "washing walls" was replaced by "rubbing walls" due to linguistic differences. Kilogram is the standard weight measurement unit in the Kurdistan region, and thus, 10 lbs. was changed to its equivalent, 5 kg, in item 11. Golf is not a common sport in the Kurdistan region and was removed from the examples provided in item 18. Due to cultural differences, item 21 which addresses sexual activities was considered optional. Finally, the word "tingling" was replaced by the words compatible with pins or needle due to having no exact synonyms in the Kurdish language.

Expert Committee Review

An expert committee consisting of methodologists, translators, and linguistic experts re-evaluated the modified DASH-KU questionnaire with the help of our research team members and provided the final version of DASH-KU.

Pre-testing

Cognitive face-to-face interviews were conducted on ten subjects to evaluate the self-report performance of the DASH-KU questionnaire. The subjects were selected purposively to represent a diverse sample in terms of age, sex, education level, and type of wrist/hand injury.

The interviewer asked probing questions after each item on the DASH-KU to assess the subjects' comprehension.

Questions included "What did this question mean to you?," "Were the words clear and easy to understand?," "Was the intent of the question clear?," "Did you find any part confusing or ambiguous?"

Based on the subjects' feedback, minor modifications were made to improve clarity. The phrase "tingling (pins and needles)" was revised to "numbness or tingling" for better understanding. No major changes to content or structure were needed after pre-testing.

The interviews confirmed that the adapted DASH-KU was easy to understand and covered relevant activities to assess wrist/hand disability in the target population.

Psychometric Properties

Outcome Measures
Participants completed the self-report DASH-KU questionnaire two consecutive times within 24 hours. An interval of 24 hours was deemed appropriate due to the acute nature of most wrist/hand injuries.

Due to the acute presentation of injuries in our sample, we deemed 24 hours to be an appropriate compromise that balanced feasibility with minimally confounding the measurements by intervening treatments or a natural recovery course over too long a period. Nonetheless, the potential for this short interval to underestimate the questionnaire's ability to detect changes should be taken into consideration when interpreting our responsiveness results. Further studies utilizing longer retest periods would help provide a more robust evaluation of DASH-KU's sensitivity to changes in patients over time.

Statistics
A sample size of 60 patients was calculated to be enough for this study according to the test–retest reliability of 0.90, reported in a previous study,[10] and considering a 20% dropout rate (α of 5% and β of 10%).

Reliability
The reliability of the DASH-KU questionnaire was evaluated by assessing Cronbach's α, ICC, and kappa statistics. Cronbach's α determines the internal consistency of the questionnaire, and scores of 0.70 to 0.79, 0.80 to 0.89, and more than 90 were defined as acceptable, good, and excellent, respectively. ICC was used to evaluate test–retest reliability between the first and second assessments of DASH-KU. An ICC of more than 0.75 was considered excellent. Kappa coefficients were also assessed to indicate the extent of agreement between participants' answers in two instances. Kappa coefficients of more than 0.90 were considered excellent.

Validity
The DASH-KU questionnaire's validity was measured by assessing the Pearson correlation coefficient of the DASH-KU and PRWHE scores. Criterion validity was evaluated by calculating the concordance correlation coefficient (CCC). In addition, ceiling and floor effects were reported. Ceiling and floor effects were considered as scores higher than the 90th

percentile and lower than the 10th percentile of the total possible score, respectively.

Moreover, we performed a factor analysis and rested the Kaiser-Meyer-Olkin sample adequacy index. A value greater than 0.60 was considered acceptable.[17] Sphericity was assessed by Bartlett's test. Finally, we conducted a principal component analysis and designed a Cattell's scree plot.

Responsiveness
Effect size, standardized response means (SRM), standard error in measurement (SEM), minimal detectable change (MDC) with a confidence interval of 95% (MDC95) and 90% (MDC90) were measured to assess responsiveness. The effect size and SRM were used to determine the ability of DASH-KU to detect improvement rates following the treatments. SEM, MDC95, and MDC90 were calculated to assess the ability of DASH-KU to distinguish true changes in the clinical status of a patient from an error in measurements during the follow-up period. All analyses were performed in MedCalc statistical software version 20.2.

Results

Descriptive Statistics
Three-hundred patients were included in our study. The mean age of the participants was 45.18 ± 13.48 years old. The population's demographic composition was 45% from 18 to 44 years old, 39% from 45 to 59, and 16% from 59 to 65. The majority of the included patients were females (67.67%), urban residents (70%), nonsmokers (82.33%), and without an academic-level education degree (88.67%; ►**Table 1**). The

Table 1 Demographic characteristics of the included subjects

Variables	Value ($n = 300$)
Age (year)	
Mean ± SD	45.18 ± 13.48
18–44	135 (45.0)
45–59	117 (39.0)
59–65	48 (16.0)
Male: female (%)	32.33: 67.67
Educational status (n, %)	
Nonacademic	266 (88.67)
Academic	34 (11.33)
Occupation (n, %)	
Employed	183 (61.0)
Unemployed	117 (39.0)
Residency status (n, %)	
Urban	210 (70.0)
Rural	90 (30.0)
Smoking status (n, %)	
Smoker	53 (17.67)
Nonsmoker	247 (82.33)

Abbreviation: SD, standard deviation.

Table 2 Clinical characteristics of included subjects

Variables	Value ($n = 300$)
Involved region side (n, %)	
Right	167 (55.67)
Left	133 (44.33)
Involved region of body (n, %)	
Shoulder	18 (6.0)
Arm	12 (4.0)
Elbow	21 (7.0)
Forearm	62 (20.67)
Wrist	132 (44.0)
Hand	55 (18.33)
Duration of presence of symptoms (mean ± SD; weeks)	15.69 ± 7.10

Abbreviation: SD, standard deviation.

mean duration of symptoms was 15.69 ± 7.10 weeks. The right upper limb was more prevalently involved (55.67% compared with 44.33%) and injuries had commonly occurred in the wrist (44%), forearm (20.67%), and hand (18.33%; ►**Table 2**). The mean total score of DASH was 31.40 ± 12.31 in the first and 31.40 ± 12.30 in the second assessment. The mean difference in the time required to complete the form was 0.38 ± 0.84 (►**Table 3**). The etiology of upper extremity injuries was carpal tunnel syndrome (31%), radius fracture (20.67%), phalangeal fracture (10%), scaphoid fracture (9%), trigger digits (8.33%), frozen shoulder (6%), humerus fracture (4%), wrist tenosynovitis (4%), tennis elbow (3.67%), and ulnar nerve entrapment at elbow (3.33%; ►**Fig. 1**).

Psychometric Properties of the DASH-KU Questionnaire

Reliability

The analysis showed excellent internal consistency among the first and second assessments of the DASH-KU questionnaire. The Cronbach's α of the questionnaire was calculated as 0.9995.

ICC of DASH-KU was 0.9995 (95% confidence interval [CI]: 0.9994–0.9996), representing excellent test-retest reliability. In addition, kappa statistics of the score was 0.993 (95% CI: 0.987–0.999), demonstrating the questionnaire's excellent reliability.
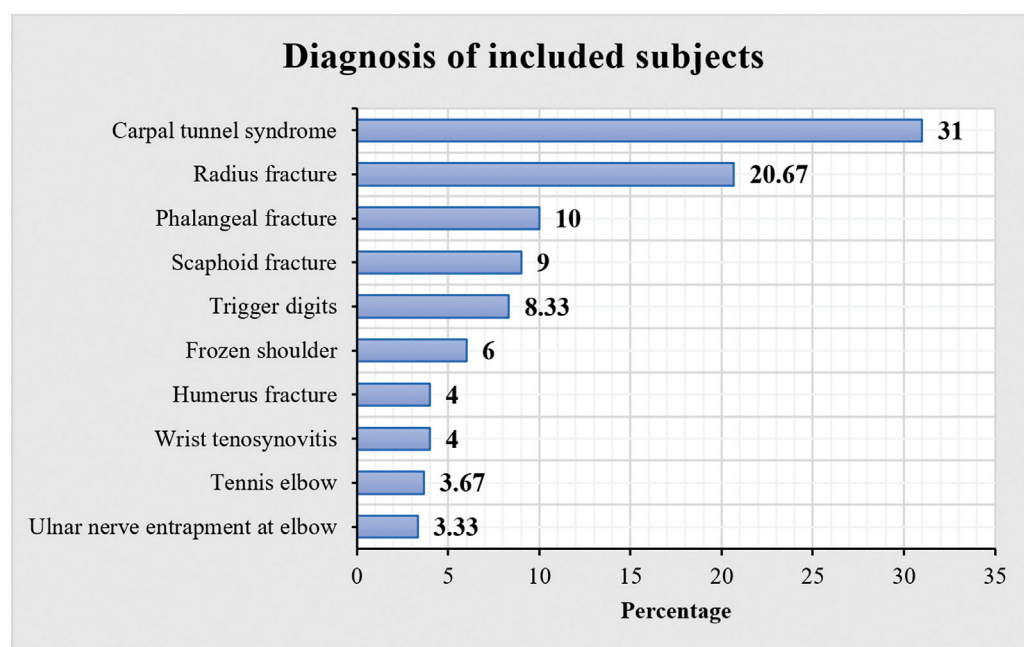
Table 3 Total score of DASH scale in the first assessment and follow-up time

	First assessment	Second assessment	Mean difference
DASH			
Total score	31.40 ± 12.31	31.40 ± 12.30	−0.001 ± 0.55
Time needed to complete (min)	7.35 ± 0.87	6.97 ± 1.03	0.38 ± 0.84
PRWHE			
Total score	43.16 ± 15.09	43.12 ± 15.07	0.04 ± 0.24
Time needed to complete (min)	3.62 ± 0.81	3.37 ± 0.68	0.25 ± 0.68

Abbreviations: DASH, disabilities of arm, shoulder, and hand; PRWHE, patient-rated wrist/hand evaluation.

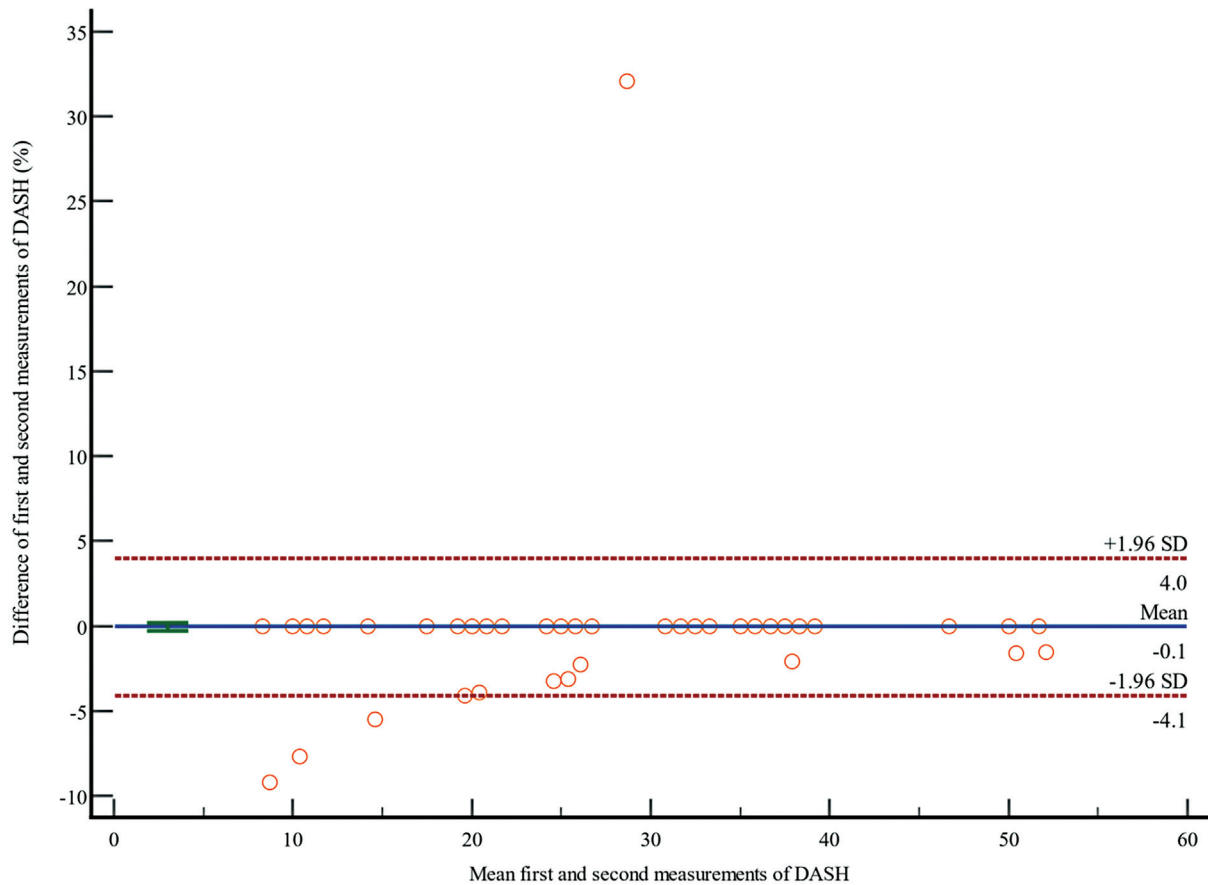**Fig. 1** Diagnosis of the included patients. Data are presented as a percentage of patients.

Fig. 2 Agreement between first and second measurements of disabilities of arm, shoulder, and hand (DASH). SD, standard deviation.

Validity

Construct validity of the DASH-KU questionnaire was assessed by evaluating the correlation of DASH-KU with the PRWHE questionnaire. Results showed a high correlation between the DASH-KU score and PRWHE ($r = 0.7921$; $p < 0.0001$). In addition, the CCC of DASH-KU (0.9990, 95% CI: 0.9987–0.9992) demonstrated strong correlation and validity. Bland–Altman plot showed good agreement between the two assessments of DASH-KU (►**Fig. 2**). No floor (3%) nor ceiling effects (0%) were observed (►**Table 4**).

Factor analysis showed that the DASH-KU scale had a high acceptable adequacy (adequacy index = 0.700) and a significant sphericity ($p < 0.001$; ►**Table 5** and ►**Fig. 3**). The analysis showed a major factor that accounted for 40% of the observed variance with an eigenvalue of 13.14. In addition, five items also explained 81.23% of the DASH-KU scale variance (►**Table 5**).

Responsiveness

The effect size and SRM of DASH-KU were −0.00005 (95% CI: −0.012–0.003) and 0.001 (95% CI: −0.122 to −0.220), respectively. Since the follow-up period was 24 hours, a large effect size and SRM were not expected. The ability to detect changes was assessed by estimating SEM, MDC$_{90}$, and MDC$_{95}$. The DASH-KU scale's SEM, MDC90, and MDC95 were 0.275, 0.640, and 1.255, respectively (►**Table 4**).

Table 4 Psychometric properties of the Kurdish version of DASH

Properties	Value (95% CI)
Reliability	
Cronbach α	0.9995
ICC	0.9995 (0.9994–0.9996)
Kappa	0.993 (0.987–0.999)
Validity	
Pearson Rho	0.7921
Ceiling effect	0%
Floor effect	3.0%
CCC	0.9990 (0.9987–0.9992)
Responsiveness	
Effect size	−0.00005 (−0.012 to 0.003)
SRM	0.001 (−0.122 to −0.220)
Ability to detect changes	
SEM	0.275
MDC 90	0.640
MDC95	1.255

Abbreviations: CCC, concordance correlation coefficient; CI, confidence interval; DASH, disabilities of arm, shoulder, and hand; ICC, intraclass correlation; MDC, minimal detectable change; SEM, standard error in measurement; SRM, standardized response means.

Table 5 Results of factor analysis

Component	Eigenvalues	% Variance	Cumulative %
1	13.143	43.81	43.81
2	4.155	13.85	57.66
3	3.241	10.802	68.462
4	2.198	7.326	75.788
5	1.632	5.441	81.229
6	1.145	3.818	85.046
7	0.893	2.975	88.022
8	0.712	2.374	90.395
9	0.558	1.86	92.256
10	0.487	1.624	93.88
11	0.438	1.46	95.339
12	0.26	0.866	96.205
13	0.223	0.744	96.95
14	0.197	0.657	97.607
15	0.142	0.475	98.082
16	0.121	0.402	98.484
17	0.108	0.359	98.843
18	0.089	0.296	99.139
19	0.064	0.214	99.352
20	0.057	0.19	99.542
21	0.036	0.121	99.663
22	0.028	0.092	99.756
23	0.025	0.082	99.838
24	0.014	0.047	99.886
25	0.012	0.041	99.927
26	0.009	0.03	99.957
27	0.007	0.022	99.979
28	0.003	0.009	99.988
29	0.002	0.007	99.995
30	0.001	0.005	100
Kaiser-Meyer-Olkin index = 0.700			
Bartlett's test of sphericity = 9302.143; $p < 0.0001$			

Discussion

This cross-cultural adoption of DASH into the Kurdish language showed that DASH-KU has excellent reliability, validity, and acceptable responsiveness in identifying upper limb injuries. Our results demonstrated similar psychometric properties for DASH-KU and its original version.

The reliability of DASH-KU in the present study was excellent. Both internal consistency and test–retest reliability of the DASH-KU was higher than 0.99. In line with this study, Lee et al, by examining 161 patients, showed that the ICC of the Korean version of DASH was 0.91 and its Cronbach's α was 0.94.[18] Also, Themistocleous et al reported a

Cronbach's α equal to 0.96 for the Greek version of DASH.[15] Kc et al demonstrated that the reliability of the Nepali translation of DASH was at an excellent level (ICC = 0.97 and α = 0.92).[10]

The construct validity of DASH-KU was compared with PRWHE. A strong correlation between DASH-KU and PRWHE was observed in this study ($r = 0.79$). Other studies have reported the construct validities of the translated versions of DASH ranging from 0.52 to 0.91.[10,14,15,17–21] Lee et al showed a moderate-to-high relationship between Korean DASH and other tools.[14] Also, Themistocleous et al stated that there is a moderate relationship between the Greek DASH and the 36-Item Short Form Survey questionnaire.[15] In addition, Fayad et al have reported that the correlation coefficient of the French version of DASH with other tools such as visual analog score, activities of daily living score, strength score, and range of motion score varied between 0.52 and 0.78.[21]

Cross-cultural adaptations are necessary to use a standardized tool in evaluating the patients, their recovery, and the successfulness of treatments. Changes in the structure and content of the questionnaire should accompany the translation into other languages. Cross-cultural adaptation is a standard method used in medical sciences for many years. Various studies show that using this method not only does not negatively affect the psychometric properties of an instrument but is equally excellent in most cases.[22–24] For example, Themistocleous et al demonstrated that the Greek DASH questionnaire has the same reliability and validity as its English version.[15] However, there are still differences of opinion on the utilization of cross-cultural adaptations, as some researchers believe that errors may occur in the process of cross-cultural adoption. A systematic review examining the articles in 16 health literacy tools showed that most of the included studies had methodological flaws, did not follow all the steps of cross-cultural adoption, and thus, most included studies were rated as low-quality.[25]

The ability of a questionnaire to detect clinically important changes among the studied patients is evaluated by its responsiveness. Two main values of effect size and SRM are reported as the main parameters for assessing responsiveness. Our results showed a small effect size and SRM since patients were followed for only 24 hours, which is a short time interval to observe any recoveries in patients. Thus, a large effect size was not to be expected in this study for the responsivity of the questionnaire. However, many studies have shown that the translated versions of DASH accurately detect clinically important changes.[18,26,27] For example, Lee et al reported acceptable responsiveness for Nepali DASH,[18] and Farzad et al concluded that the tool is highly responsive in hand injuries (effect size = 1.65).[28] Therefore, the 24-hour time interval in our study to retest each participant limited the evaluation of responsiveness.

Identification of the condition and outcome of the treatment has yet to be investigated in cross-cultural adoption studies. Although responsiveness is examined in some studies, statistical indicators such as sensitivity, specificity, and the area under the curve provide more informative data. It is
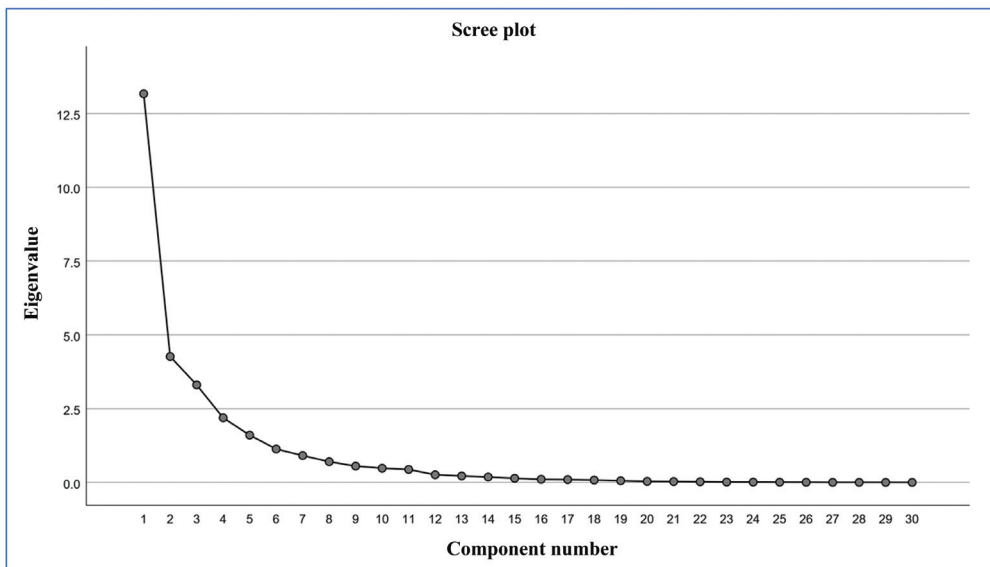
Fig. 3 The scree plot of disabilities of arm, shoulder, and hand score.

worth mentioning that psychometric properties are not representative of the diagnostic performance of the utilized tool, and tools with acceptable psychometric properties do not necessarily have high sensitivity and specificity. For example, Moraes et al reported that the DASH score has 80% sensitivity and 60.3% specificity in identifying cases.[29] Therefore, assessing the diagnostic accuracy of tools in cross-cultural adaptations is suggested.

While the reliability and validity of DASH-KU were comparable or higher than other translated versions, some minor differences were observed. The higher reliability and validity in DASH-KU could be due to cultural and linguistic characteristics specific to the Kurdish language and population studied that better preserved the original meaning and interpretation of items. Alternatively, variations in sample characteristics, study protocols, and data collection methods between studies may contribute to disparities in reliability estimates. A more standardized approach across validation studies could help control for these potential confounding factors. Also, this study had some limitations. The short 24-hour follow-up period. Data was also only collected at one center, limiting generalizability. Further research with longer follow-ups could strengthen validation of the DASH-KU's measurement properties.

Conclusion

In this study, we sought to validate the Kurdish version of the DASH questionnaire (DASH-KU) for use in evaluating upper limb injuries among Kurdish patients. Our findings demonstrate that the DASH-KU performs remarkably similar to the original English version, with results comparing favorably in terms of reliability, validity, and ability to detect change over time. Specifically, our analyses revealed strong internal consistency, test–retest reliability, and construct validity for the translated measure. These robust psychometric properties provide clinicians and researchers confident use of the

DASH-KU to accurately assess patient-reported functional status and outcomes. With its demonstrated measurement qualities, the DASH-KU represents a valid cross-cultural adaptation that will allow improved musculoskeletal care and outcome monitoring for Kurdish-speaking populations suffering from various upper limb conditions.

Ethical Consideration

The ethics committee of Sulaymaniyah University has approved this study (Ethical code: 7/29–4758 on April 18th, 2022). Informed written consent was obtained from all participants.

Funding
None.

Conflict of Interest
None declared.

References

1 Crowe CS, Massenburg BB, Morrison SD, et al. Global trends of hand and wrist trauma: a systematic analysis of fracture and digit amputation using the Global Burden of Disease 2017 Study. Inj Prev 2020;26(Suppl 1):i115–i124

2 MacDermid JC, Turgeon T, Richards RS, Beadle M, Roth JH. Patient rating of wrist pain and disability: a reliable and valid measurement tool. J Orthop Trauma 1998;12(08):577–586

3 van Gorp B, Krastman P, Kraan G, Mathijssen NMC, Bierma-Zeinstra SMA, Runhaar J. Psychometric qualities of the patient rated Wrist/Hand evaluation (PRWHE) in Dutch primary care patients with wrist complaints. BMC Prim Care 2022;23(01):274

4 Hudak PL, Amadio PC, Bombardier CThe Upper Extremity Collaborative Group (UECG) Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. Am J Ind Med 1996;29(06):602–608

5 Churruca K, Pomare C, Ellis LA, et al. Patient-reported outcome measures (PROMs): a review of generic and condition-specific measures and a discussion of trends and issues. Health Expect 2021;24(04):1015–1024

6   Printza A. Patient-reported outcome measures in diseases of the head and neck. J Clin Med 2022;11(12):3358

7   Bot SD, Terwee CB, van der Windt DA, Bouter LM, Dekker J, de Vet HC. Clinimetric evaluation of shoulder disability questionnaires: a systematic review of the literature. Ann Rheum Dis 2004;63(04): 335–341

8   Dixon D, Johnston M, McQueen M, Court-Brown C. The Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) can measure the impairment, activity limitations and participation restriction constructs from the International Classification of Functioning, Disability and Health (ICF). BMC Musculoskelet Disord 2008;9:114

9   Hervás MT, Navarro Collado MJ, Peiró S, Rodrigo Pérez JL, López Matéu P, Martínez Tello I. [Spanish version of the DASH questionnaire. Cross-cultural adaptation, reliability, validity and responsiveness]. Med Clín (Barc) 2006;127(12):441–447

10 Kc S, Sharma S, Ginn K, Almadi T, Subedi H, Reed D. Cross-cultural adaptation and measurement properties of the Nepali version of the DASH (disability of arm, shoulder and hand) in patients with shoulder pain. Health Qual Life Outcomes 2019;17(01):51

11 Alnahdi AH. Structural validity of the Arabic version of the disabilities of the Arm, Shoulder and Hand (DASH) using Rasch measurement model. J Patient Rep Outcomes 2021;5(01):119

12 de Klerk S, Jerosch-Herold C, Buchanan H, van Niekerk L. Structural and cross-cultural validity of the Afrikaans for the Western Cape Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. J Patient Rep Outcomes 2023;7(01):1

13 Orfale AG, Araújo PM, Ferraz MB, Natour J. Translation into Brazilian Portuguese, cultural adaptation and evaluation of the reliability of the Disabilities of the Arm, Shoulder and Hand Questionnaire. Braz J Med Biol Res 2005;38(02):293–302

14 Lee J-Y, Lim J-Y, Oh JH, Ko Y-M. Cross-cultural adaptation and clinical evaluation of a Korean version of the disabilities of arm, shoulder, and hand outcome questionnaire (K-DASH). J Shoulder Elbow Surg 2008;17(04):570–574

15 Themistocleous GS, Goudelis G, Kyrou I, et al. Translation into Greek, cross-cultural adaptation and validation of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH). J Hand Ther 2006;19(03):350–357

16 Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine 2000;25(24):3186–3191

17 Durand M-J, Vachon B, Hong QN, Loisel P. The cross-cultural adaptation of the DASH questionnaire in Canadian French. J Hand Ther 2005;18(01):34–39

18 Lee EWC, Lau JSY, Chung MMH, Li APS, Lo SK. Evaluation of the Chinese version of the Disability of the Arm, Shoulder and Hand (DASH-HKPWH): cross-cultural adaptation process, internal consistency and reliability study. J Hand Ther 2004;17(04):417–423

19 Öke Topcu D, İkbali Afşar S. Reliability, validity, and cross-cultural adaptation study of the Turkish version of the Patient-Rated Wrist/Hand Evaluation questionnaire. Turk J Med Sci 2019;49 (02):574–582

20 Estrella EP, Orillaza NS Jr, Castillo-Carandang NT, Cordero CP, Juban NR. The validity, reliability and internal consistency of the cross-cultural adaptation of the FIL-DASH (Filipino Version of the Disability of the Arm, Shoulder and Hand) questionnaire in patients with traumatic brachial plexus injuries. J Hand Surg Asian Pac Vol 2019;24(04):456–461

21 Fayad F, Lefevre-Colau M-M, Macé Y, et al. Validation of the French version of the Disability of the Arm, Shoulder and Hand questionnaire (F-DASH). Joint Bone Spine 2008;75(02):195–200

22 Aljathlani MF, Alshammari MO, Alsuwaygh MA, et al. Cross-cultural adaptation and validation of the Arabic version of the upper extremity functional index. Disabil Rehabil 2022;44(19): 5656–5662

23 Javeed S, Greenberg JK, Plog B, et al. Clinically meaningful improvement in disabilities of arm, shoulder, and hand (DASH) following cervical spine surgery. Spine J 2023;23(06):832–840

24 de Klerk S. Assessment of structural and cross-cultural validity of the Disabilities of the Arm, Shoulder and Hand questionnaire: a scoping review. Hand Ther 2023;28(01):3–15

25 Praveen S, Parmar J, Chandio N, Arora A. A systematic review of cross-cultural adaptation and psychometric properties of oral health literacy tools. Int J Environ Res Public Health 2021;18(19): 10422

26 SooHoo NF, McDonald AP, Seiler JG III, McGillivary GR. Evaluation of the construct validity of the DASH questionnaire by correlation to the SF-36. J Hand Surg Am 2002;27(03):537–541

27 Beaton DE, Katz JN, Fossel AH, Wright JG, Tarasuk V, Bombardier C. Measuring the whole or the parts? Validity, reliability, and responsiveness of the Disabilities of the Arm, Shoulder and Hand outcome measure in different regions of the upper extremity. J Hand Ther 2001;14(02):128–146

28 Farzad M, MacDermid JC, Shafiee E, et al. Clinimetric testing of the Persian version of the Patient-Rated Tennis Elbow Evaluation (PRTEE) and the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaires in patients with lateral elbow tendinopathy. Disabil Rehabil 2022;44(12):2902–2907

29 Moraes VY, Faria JC, Fernandes M, Raduan-Neto J, Okamura A, Belloti JC. Disability of arm, shoulder and hand and Michigan hand outcomes questionnaires: exploring responsiveness and diagnostic performance in a sample of outpatients with and without hand and wrist complaints. Rev Bras Ortop 2022;57:449–454