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CROSS-CULTURAL ADAPTATION, VALIDATION, AND RELIABILITY OF THE MICHIGAN HAND OUTCOMES QUESTIONNAIRE AMONG PERSIAN POPULATION

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ABSTRACT

We aimed to validate a cross-culturally adapted version of the Persian Michigan Hand Outcomes Questionnaire (MHOQ). We followed the Beaton's guideline to translate the questionnaire to Persian. We administered the final version to 223 patients among which 79 patients returned 3 days later to respond to the Persian MHOQ for the second time. In the first visit, respondents also filled the Disabilities of the Arm Shoulder and Hand (DASH) and rated the pain based on the Visual Analogue Scale (VAS). Cronbach's alpha for the total MHOQ was 0.79 which showed good internal consistency. Intraclass correlation coefficient (ICC) for the total MHOQ was 0.84 which demonstrated good reliability between test and retest. The absolute correlation coefficient between total MHOQ and the DASH was as high as 0.74. Persian version of the MHOQ proved to be a reliable and valid instrument to be implemented among Persian population with the hand and wrist disorders.

Keywords: Michigan Hand Outcomes Questionnaire; Persian; Psychometric; Reliability; Validity.

INTRODUCTION

Hand and wrist disorders are among the most common problems of the upper extremity. In a recent study on the epidemiology of upper limb injuries presenting to the emergency department in the United States, the incidence of 1130 upper extremity injuries per 100,000 persons per year was reported. Finger lacerations, wrist fractures and finger fractures were the most common injuries.[1] About 20% of referral to emergency departments was for the hand and wrist problems.[2] According to an Injury epidemiology of the National Trauma Project in Iran, hand and wrist injuries were accounted for 5.4%.[2]

To report patient's perception of the outcome, self-reported clinical questionnaires have been designed. Michigan Hand Outcomes Questionnaire (MHOQ) is a hand-specific patient-reported questionnaire representing outcomes.[3] A linguistically well-translated and culturally well-adapted and validated transcript of the MHOQ would facilitate multicentre, regional and international investigations as well as increasing feasibility of meta-analysis studies.

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In some countries in the Southwest and central Asia including Iran, Afghanistan, Tajikistan and some areas of Iraq and Pakistan, Persian is the first language used in dialogues. In the present study, we aimed to develop a cross-culturally adapted Persian version of the original MHQ and to assess the validity and reliability of this version in the hand and wrist disorders in Iran.

METHODS

We planned to perform the study in three phases. In phase I, we performed the translation and cultural adaptation process into Persian language using Beaton's guideline.[4] In phase II, we conducted a pilot study to pre-test the Persian version of MHOQ for any difficulties in understanding and acceptability. In phase III, we administered the final Persian MHOQ to patients with the hand and wrist problems to test its reliability and validity.

Michigan Hand Outcomes Questionnaire

MHOQ is a hand-specific questionnaire consisted of 37 questions spread in 6 dimensions including: Overall hand function, activities of daily living (ADL), work performance, pain aesthetic and satisfaction.[3] Except pain and work performance subscales that are accounted for both sides, the other subscales should be administered separately for left and right, in which the total number will reach up to 57 questions. Each question is scored from 1 to 5. Every subscale gets a score from 0 to 100 with zero being the worst and 100 for the best ever result except for pain. In the pain scale, high scores indicate greater pain; while in the other five scales high scores demonstrate better hand performance.

The raw scale score for each of the six scales is the sum of the responses of each scale item. The raw score is converted to a score ranging from 0 to 100. The score for the affected hand is obtained by selecting either the right or the left hand score. If both hands are affected (for instance, rheumatoid arthritis), the right and left hand scores are averaged to get the score.

Missing values may affect on the validity of subscale scores. If 50% or more of the items in a scale are missing, then that particular scale cannot be scored. If two or more subscales could not be scored due to missing values, then the total score cannot be calculated either. For scales with less than 50% missing, the average of the existing scale items may be inputted for the missing items. For example, the Aesthetics scale has 4 questions. If only 2 questions are answered and 2 are missing, the scale cannot be scored because 50% of the responses are missing. If 3 questions are answered and 1 is missing, the responses for the answered questions are averaged and this average number is entered as the value for the missing response. Then the raw score can be calculated as usual with summing up the responses in each scale. An overall MHOQ score can be obtained by summing the scores for all six scales after reversing the pain scale (pain $= 100 -$ pain score) and then dividing by 6.[3]

Adaptation of the MHOQ to Persian Language and Culture

The MHOQ developers confirmed the validation process. For cross-cultural adaptation of the MHOQ, we followed the guidelines provided by Beaton *et al.*[4–6] Three independent Persian-speaking individuals including two orthopaedic surgeons and one professional English teacher with no medical background translated the original English version of the MHOQ to Persian (Farsi). Then in a meeting, these three translations were reconciled and combined together into a single Persian MHOQ version. Afterwards, a Native American English speaker who is fluent in Persian as well and was not aware of the original English MHOQ back translated this Persian version to English.

In a second meeting of authors with professional translators, backward English translation was discussed in regards to conformity with the Persian and the original English MHQ. The discrepancies were minor and therefore, a consensus was achieved on the pre-final version of Persian MHOQ. To pre-test this version in a pilot study, Persian MHOQ was administered to 30 patients with hand and wrist disorders. Minor difficulties in understanding were addressed and final version was created.

Patients

In this institutional review board approved study, a total of 223 patients with common hand disorders were enrolled from January 2013 to December 2013.

The inclusion criteria were age 18 years or older, ability to read and write Persian as a mother language, and at least four-week duration of symptoms. Hand and wrist disorders

Table 1 **Characteristics of Patients with the Hand and Wrist Problems (N = 223).**

Age, Mean (SD) Sex, No. (%)	35 (15)
Male	114 (51)
Female	109 (49)
Career, no. (%)	
Heavy worker	64 (29)
Employee	16 (7.0)
Jobless	48 (22)
Housekeeper	63 (28)
Retired	32 (14)
Education, no. (%)	
School	21 (10)
Undergraduate	139 (62)
Graduate	30 (13)
Post-graduate	33 (15)
Involved side, no. (%)	
Right	102 (46)
Left	94 (42)
Bilateral	27 (12)
Diagnosis, no. (%)	
Trigger finger	6 (2.6)
Non-specific pain	62 (28)
Lunate osteonecrosis	3 (1.3)
CTS	28 (12)
Fracture	31 (14)
Amputation	3 (1.3)
1st CMC OA	15 (8.0)
De Quervain	34 (15)
Ganglion cyst	15 (6.8)
Other	25 (11)

Note: CTS = Carpal Tunnel Syndrome, CMC OA = Carpometacarpal osteoarthritis.

were the primary reasons of the visit. Patients with the history of hand surgery were included if at least four weeks had been elapsed from surgery. Exclusion criteria were patients who were not able to fill out the forms, with major neurologic disorders, acute trauma or laceration, and with simultaneous elbow or shoulder problem. All of the participants were provided with a written informed consent at their initial visit (Table 1).

Two orthopaedic surgeons and a medical student collected demographic and clinical data. Patients filled the Persian MHOQ as well as and the Persian version of the disabilities of the arm shoulder and hand (DASH) questionnaire[7] and visual analogue scale (VAS) at a concurrent session. We planned to perform the retest three days after the initial visit. Patients who did not receive major treatment such as injection or operation that would substantially alter the clinical situation were asked to return. Patients were convenient with the three-day interval. A total of 79 patients returned to fill the MHOQ for the second time.

Reliability

It is comprised of two aspects of internal consistency and reproducibility (test–retest). Internal consistency assesses the consistency of respondent's answers across items within a questionnaire.[8] Using a Cronbach's alpha, we tested the subscales of MHOQ. Commonly accepted values of Cronbach's alpha are described as excellent for $\alpha > 0.9$, good for $0.7 > \alpha > 0.9$, acceptable for $0.6 > \alpha > 0.7$, poor for $0.5 > \alpha > 0.6$ and unacceptable for $\alpha < 0.5$.[9] However, we have to be careful for $\alpha > 0.9$ in terms of redundancy of questions.[8]

Reproducibility (test–retest reliability) is tested by administering a questionnaire to a single patient on two separate occasions with no substantial change in symptoms.[10] Test–retest reliability is measured with the intraclass correlation coefficient (ICC). To measure the ICC, 79 patients filled the Persian MHQ three days after the initial visit. A correlation coefficient of 0 shows no reproducibility, whereas a value of 1 indicates excellent reproducibility.[10]

Construct Validity

To test the construct validity, the new questionnaire is tested to a valid questionnaire in the same context to show whether any correlation exists in terms of what they are supposed to measure.[11] Here, we compared the Persian MHOQ scores to the DASH and VAS scores. Validity and reliability of DASH questionnaire has been documented in Persian language.[7] In this study, VAS was based on a 0–10 scale rating with 0 showing no pain and 10 expressing the worst pain. Moderate correlation is considered when $0.2 < r < 0.8$ and strong correlation is considered when $r > 0.8$.[11]

RESULTS

Translation and Cross-Cultural Adaptation

The translators perceived no major linguistic or cultural problems in the forward and back translations of the MHOQ. After

addressing the difficulties that were recognised over the pilot study, the final version was comprehensible for all patients. The average time to complete the questionnaire was 8 min. (Figs. 1A–1D).

Patients

We enrolled 223 patients with common hand and wrist problems. (Tables 1 and 2).

Test–Retest Reliability

The ICCs demonstrated a good correlation between test–retest (Table 3).

Internal Consistency

Cronbach's alpha coefficient showed good internal consistency across the items in each subscale and in total Persian MHOQ. The lowest Cronbach's alpha was calculated for the overall hand function at the first visit in which further deletion of item 4 would have increased the internal consistency from 0.65 to 0.71. However, Cronbach's alpha showed substantial improvement for this subscale at the second visit (Table 3).

Construct Validity

There was a strong correlation between subscales of MHOQ and the total DASH score. Moreover, the total MHQ score showed a significant correlation with VAS and strong correlation with the DASH and 2 subscales of sport and work of the DASH. The highest correlation was between activities of daily living (ADL) and total DASH score. (Table 4) We found strong Interscale correlation between subscales of the MHOQ as well (Table 5).

DISCUSSION

The purpose of this study was to develop a cross-culturally adapted Persian version of the original MHOQ and assess the validity and reliability of this version among Persian-speaking population with hand and wrist disorders.

(A)

Michigan Hand Outcome Questionnaire
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نام بیمار: شماره تماس: سن : شغل: تحصیلات:
آدرس:
تشخیص و علائم بالینی: سمت درگیر:
لطفاً به ۳۷ سوال چند گزینه ای زیر پاسخ دهید:
سوالات زیر به علمکرد دست (دستها) یا مچ (مچ ها) شما طی هفته ۳گذشته مربوط می شود....

۱. به طور کلی، دست شما چقدر خوب عمل می کند؟
خیلی خوب□ خوب□ قابل قبول□ ضعیف□ خیلی ضعیف□
۲. انگشتان شما چقدر خوب حرکت می کند؟
خیلی خوب□ خوب□ قابل قبول□ ضعیف□ خیلی ضعیف□
۳. مچ شما چقدر خوب حرکت می کند؟
خیلی خوب□ خوب□ قابل قبول □ ضعیف□ خیلی ضعیف□
۴. قدرت دست شما چگونه بوده است؟
خیلی خوب□ خوب□ قابل قبول □ ضعیف□ خیلی ضعیف□
۵. قدرت لاسه در دست شما چگونه بوده است؟
خیلی خوب□ خوب□ قابل قبول □ ضعیف□ خیلی ضعیف□
۶. چرخاندن دستگیره در؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۷. برداشتن یک سکه؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۸. نگه داشتن لیوان آب؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۹. چرخاندن کلید داخل قفل؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□

1

(B)

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۱۰.نگه داشتن ماهی تابه؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۱۱. باز کردن در شیشه (مثلا شیشه نوشابه)؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۱۲. بستن یا باز کردن دکمه های پیراهن یا بلوز؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۱۳. غذا خوردن با چاقو و چنگال؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۱۴. حمل خواروبار منزل؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۱۵. شستن ظروف؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۱۶. شستن موهایتان؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۱۷. بستن بند کفش ها یا گره زدن؟
اصلاً مشکل نیست□ کمی مشکل است□ تا حدودی مشکل است□ نسبتأ مشکل است□ خیلی سخت است□
۱۸. هر چند وقت یکبار شما به خاطر مشکل دست (ها) / مچ (ها) قادر به انجام کارتان نبوده اید؟
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□
۱۹. هر چند وقت یکبار شما به خاطر وجود مشکل در دست (ها) تان مجبور به کوتاه کردن کار روزانه خود بوده اید؟
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□
۲۰. هر چند وقت یکبار شما به خاطر مشکل دست (ها) یا مچ (ها)تان مجبور به کم کردن بارکاری در سرکار خود بوده اید؟
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□

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Fig. 1   (A)–(B): Persian (Farsi) version of the MHOQ administered to patients with the hand and wrist problems.

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21. هر چند وقت یکبار شما به خاطر وجود مشکل در دست (ها) یا مچ (ها) تان به کمتر از آنچه خواسته اید در کارتان نایل شده اید؟
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□

22. هر چند وقت یکبار شما به خاطر وجود مشکل در دست (ها) یا مچ (ها) مجبور بوده اید که در سر کار خود کارها را طولانی تر انجام دهید؟
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□

23. هر چند وقت یکبار شما در دست (ها) یا مچ (ها) تان درد داشته اید؟
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□

24. لطفاً دردی که در دست (ها) یا مچ (ها)تان داشته اید را توصیف کنید؟
خیلی مختصر□ اندک□ متوسط□ شدید□ خیلی شدید□

25. هر چند وقت یکبار درد شما با خواب شما تداخل داشته است؟
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□

26. هر چند وقت یکبار درد در دست (ها) یا مچ (ها) تان با فعالیت های روزانه تان تداخل می کند؟ (مانند غذاخوردن یا حمام گرفتن)
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□

27. هر چند وقت یکبار درد در دست (ها) یا مچ (ها) تان شما را ناخوشایند می کند؟
همیشه□ اغلب□ گاهی اوقات□ به ندرت□ هیچ وقت□

28. من از ظاهر دستم راضی هستم:
قویاً موافقم□ موافقم□ نه موافق، نه ناموافق□ مخالفم□ کاملاً مخالفم□

29. ظاهر دستم بعضی اوقات باعث می گردد تا در جمع احساس خوبی نداشته باشم .
قویاً موافقم□ موافقم□ نه موافق، نه ناموافق□ مخالفم□ کاملاً مخالفم□

30. ظاهر دستم افسرده ام کرده است.
قویاً موافقم□ موافقم□ نه موافق، نه ناموافق□ مخالفم□ کاملاً مخالفم□

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(C)

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31. ظاهر دستم باعث تداخل در فعالیت های معمول اجتماعی من شده است
قویاً موافقم□ موافقم□ نه موافق، نه ناموافق□ مخالفم□ کاملاً مخالفم□

32. عملکرد کلی دست شما؟
خیلی راضی□ تاحدودی راضی□ نه راضی، نه ناراضی□ تاحدودی ناراضی□ خیلی ناراضی□

33. حرکات انگشتان دست شما؟
خیلی راضی□ تاحدودی راضی□ نه راضی، نه ناراضی□ تاحدودی ناراضی□ خیلی ناراضی□

34. حرکات مچ شما ؟
خیلی راضی□ تاحدودی راضی□ نه راضی، نه ناراضی□ تاحدودی ناراضی□ خیلی ناراضی□

35. میزان قدرت دست شما؟
خیلی راضی□ تاحدودی راضی□ نه راضی، نه ناراضی□ تاحدودی ناراضی□ خیلی ناراضی□

36. میزان درد دست شما ؟
خیلی راضی□ تاحدودی راضی□ نه راضی، نه ناراضی□ تاحدودی ناراضی□ خیلی ناراضی□

37. قدرت لامسه دست شما؟
خیلی راضی□ تاحدودی راضی□ نه راضی، نه ناراضی□ تاحدودی ناراضی□ خیلی ناراضی□

از همکاری شما سپاسگذاریم

نمره فانکشن دست: ٪
نمره انجام کارهای روزمره: ٪
نمره انجام کارهای شغلی: ٪
نمره درد: ٪
نمره ظاهر: ٪
نمره رضایت: ٪
نمره کلی: ٪

4

(D)

Fig. 1 (*Continued*)

Table 2 Average Functional and Pain Score of Patient with the Hand and Wrist Problems.

	Visit 1 ($N = 223$)	Visit 2 ($N = 79$)
DASH, mean (SD)		
DASH-Total	46 (26)	
DASH-Work	42 (33)	
DASH-Sport	45 (36)	
VAS, mean (SD)	4.5 (4.3)	
MHQ, mean (SD)		
Hand Function	53 (24)	46 (24)
ADL	60 (33)	58 (25)
Normal Work	46 (30)	45 (29)
Pain	42 (25)	41 (21)
Appearance	56 (30)	56 (34)
Satisfaction	51 (26)	51 (20)
Total	51 (21)	49 (17)

DASH = Disabilities of the Arm Shoulder and Hand, VAS = Visual Analogue Scale, MHG = Michigan Hand Questionnaire, ADL = Activities of Daily Living.

Table 3 Internal Consistency and Test–Retest Reliability of the Persian Version of the MHOQ.

Subscale	Number of Items	Cronbach's Alpha (T1, T2)	(Intraclass Correlation Coefficient)		
			ICC	95% CI	*p* Value
Hand function	5	0.65, 0.80	0.81	0.32–0.94	<**0.001**
ADL	12	0.96, 0.92	0.78	0.41–0.92	**0.0020**
Normal work	5	0.92, 0.94	0.86	0.64–0.95	<**0.001**
Pain	5	0.79, 0.87	0.78	0.65–0.86	<**0.001**
Appearance	4	0.83, 0.92	0.84	0.75–0.90	<**0.001**
Satisfaction	6	0.83, 0.63	0.73	0.31–0.90	**0.0040**
Total	37	0.79, 0.75	0.84	0.60–0.94	<**0.001**

T1 = Test, T2 = Retest, SD = Standard Deviation, ICC = Intraclass Correlation Coefficient, CI = Confidence Interval, ADL = Activities of Daily Living.

Table 4   Convergent Validity Expressed by Spearman's Correlation (r) Between Subscales of the Persian MHOQ and VAS and DASH (N = 223).

	VAS	DASH-Total	DASH-Work	DASH-Sport
Hand function	(−0.23)**	(−0.70)**	(−0.60)**	(−0.48)**
ADL	(−0.21)**	(−0.75)**	(−0.52)**	(−0.55)**
Normal work	−0.10	(−0.53)**	(−0.39)**	(−0.47)**
Pain	**0.15***	**0.41***	0.24	0.24
Appearance	0.03	(−0.24)**	−0.21	(−0.38)*
Satisfaction	(−0.22)**	(−0.67)**	(−0.64)**	(−0.61)**
Total MHOQ	(−0.19)**	(−0.74)**	(−0.59)**	(−0.61)**

Note: MHOQ = Michigan Hand Outcomes Questionnaire, VAS = Visual Analogue Scale, DASH = Disabilities of the Arm Shoulder and Hand, ADL = Activities of Daily Living.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

Table 5   MHOQ Interscale Correlation.

	ADL	Normal Work	Pain	Appearance	Satisfaction
Hand function	0.74**	0.56**	0.39**	0.33**	0.72**
ADL	—	0.50**	0.43**	0.34**	0.66**
Normal work		—	0.36**	0.31**	0.53**
pain			—	0.19**	0.43**
Appearance				—	0.38**

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

This study depends on how accurate patients responded to the questions. Over one-third of patients returned after three days which is acceptable for reliability testing. We administered the Persian MHOQ in a level-1 hospital where it resulted in diversity in demographic characteristics of subjects.

Our findings confirmed the validity and reliability of the Persian MHOQ as a useful instrument in the hand and wrist problems. The thorough questionnaire demonstrated good internal consistency, good reliability and significant convergent validity. The level of reliability and validity of the Persian version is as high as its original English and the subsequent translated versions. In addition, significant correlation between MHOQ and DASH score proves the conformity in that both are measuring the same context.

MHOQ was first developed and validated by Chung *et al.*[3] In order to apply the translation of a questionnaire in a different language, it should be adapted first with cultural issues and its validity and reliability should be tested. The MHOQ is validated and adapted in various languages and hand disorders.[12−18]

Internal consistency is an important property for psychometric measurement of a questionnaire that is expected to measure a concept by multiple questions. Calculated Cronbach's alpha in Korean, Turkish, Colombian and original English versions was 0.79–0.97, 0.85–0.96, 0.92 and 0.86–0.97, respectively.[3,12,13,17] The calculated ICC for reliability testing of Turkish version ranged from 0.79 to 0.96 (12) and for Korean version, from 0.88 to 0.96 (see Ref. [13]) for the 6 subscales. A multicenter study testing responsiveness of the MHOQ in patients with rheumatoid arthritis, demonstrated good rest–retest reliability ($r = 0.66$) and good internal consistency with Cronbach's alpha ranged between 0.79 and 0.90.[18]

For validity assessment of the Persian-MHOQ, we used Persian-DASH as the standard instrument that is acceptable in almost all countries. Turkish, Korean and Dutch versions also applied the DASH questionnaire to test for the convergent validity of the MHOQ.[12−14] The results of Korean version demonstrated high correlations between pain subscale of the MHOQ and DASH score with a value of 0.63.[13] On the other side, the least correlation was between satisfaction subscale of the MHOQ and work subscale of the DASH ($r = -0.17$).[13] In Turkish version, the least correlation was found between work performance subscale of the MHOQ and work subscale of DASH ($r = -0.4$) and between aesthetic subscale of the MHOQ and disability/symptom of the DASH ($r = -0.33$).[12]

In our study, the total MHOQ and most of the subscales had significant correlation with the DASH and its subscales, except pain and aesthetic subscales of the MHOQ with work and sport subscales of the DASH which are still concordant in the direction of what they are supposed to measure. Somewhat similar results also were reported in the other studies. Presumably, in the mindset of our patient's population, aesthetic is not as impressive as that the hand function and pain are. Slight differences in cultural adaptation can be acceptable as long as the questionnaire proves to be reliable and valid.

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References

1. Ootes D, Lambers KT, Ring DC, The epidemiology of upper extremity injuries presenting to the emergency department in United States, *Hand (N Y)* **7**(1):18–22, 2012.

2. Karbakhsh M, Zandi NS, Rouzrokh M, Zarei MR, Injury epidemiology in Kermanshah: The National Trauma Project in Islamic Republic of Iran, *East Mediterr Health J* **15**(1):57–64, 2009.

3. Chung KC, Pillsbury MS, Walters MR, Hayward RA, Reliability and validity testing of the Michigan Hand Outcomes Questionnaire, *J Hand Surg Am* **23**(4):575–587, 1998.

4. Guillemin F, Bombardier C, Beaton D, Cross-cultural adaptation of health-related quality of life measures: Literature review and proposed guidelines, *J Clin Epidemiol* **46**(12):1417–1432, 1993.

5. Gjersing L, Caplehorn JR, Clausen T, Cross-cultural adaptation of research instruments: Language, setting, time and statistical considerations, *BMC Med Res Methodol* **10**:13, 2010.

6. Beaton DE, Bombardier C, Guillemin F, Ferraz MB, Guidelines for the process of cross-cultural adaptation of self-report measures, *Spine (Phila Pa 1976)* **25**(24):3186–3191, 2000.

7. Mousavi SJ, Parnianpour M, Abedi M, Askary-Ashtiani A, Karimi A, Khorsandi A, Mehdian H, Cultural adaptation and validation of the Persian version of the disabilities of the arm, shoulder and hand (DASH) outcome measure, *Clin Rehabil* **22**(8):749–757, 2008.

8. Kline P, *The Handbook of Psychological Testing*, Routledge, London, p. 13, 2000.

9. George D, Mallery P, *SPSS for Windows Step by Step: A Simple Guide and Reference*, Allyn & Bacon, Boston, pp. 53–55, 2003.

10. Koch GG, Intraclass correlation, in Kotz S, Johnson NL (eds.), *Encyclopedia of Statistical Sciences*, 4th edn., John Wiley & Sons, New York, pp. 212–217, 1983.

11. Smith EV, Evidence for the reliability of measures and validity of measure interpretation: A Rasch measurement perspective, *J Appl Meas* **2**(3):281–311, 2001.

12. Öksüz C, Akel BS, Oskay D, Leblebicioğlu G, Hayran KM cross-cultural adaptation, validation, and reliability process of the Michigan hand outcomes questionnaire in a Turkish Population, *J Hand Surg Am* **36**(3):486–492, 2011.

13. Roh YH, Yang BK, Noh JH, Baek GH, Song CH, Gong HS, Cross-cultural adaptation and validation of the Korean version of the Michigan hand questionnaire, *J Hand Surg Am* **36**(9):1497–1503, 2011.

14. van der Giesen FJ, Nelissen RG, Arendzen JH, de Jong Z, Wolterbeek R, Vliet Vlieland TP, Responsiveness of the Michigan Hand outcomes questionnaire — Dutch language version in patients with rheumatoid arthritis, *Arch Phys Med Rehabil* **89**(6):1121–112, 2008.

15. Dias JJ, Rajan RA, Thompson JR, Which questionnaire is best? The reliability, validity and ease of use of the patient Michigan hand outcome measure evaluation measure, the disabilities of the arm, shoulder and hand and the michigan hand outcome measure, *J Hand Surg Eur* **33**(1):9–17, 2008.

16. Shauver MJ, Chung KC, The Michigan hand outcomes questionnaire after 15 years of field trial, *Plast Reconstr Surg* **131**(5):779e–787e, 2013.

17. Miranda D, Ramírez J, Rueda L, Garcia J, Wolf G, Lugo LH, Validación del "Michigan Hand Outcomes Questionnaire" para población colombiana, *Rev Colomb Reumatol* **15**(4):271–290, 2008.

18. Waljee JF, Chung KC, Kim HM, Burns PB, Burke FD, Wilgis EF, Fox DA, Validity and responsiveness of the Michigan Hand Questionnaire in patients with rheumatoid arthritis: A multicenter, international study, *Arthritis Care Res (Hoboken)* **62**(11):1569–1577, 2010.