

Original article

# Cultural adaptation of the Michigan Hand Outcomes Questionnaire in patients with Carpal Tunnel Syndrome: A Turkish version study

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## Abstract

**Objective:** Cultural adaptations of the questionnaires are important for easy use. We aimed to assess the reliability and validity of the Turkish Version of the Michigan Hand Outcomes Questionnaire in patients with Carpal Tunnel Syndrome.

**Methods:** To assess test-retest reliability, the Turkish “Michigan Hand Outcomes Questionnaire” and “Disabilities of Arm, Shoulder and Hand” questionnaires were answered by patients and controls and were repeated a week later. For testing internal consistency, the Cronbach's alpha test was used. For testing validity, correlations between the subscales of the “Michigan Hand Outcomes Questionnaire” and “Disabilities of Arm, Shoulder and Hand” questionnaire were measured in patient groups. One hundred patients with idiopathic Carpal Tunnel Syndrome and 50 healthy participants were included in the study.

**Results:** In test-retest reliability, intraclass correlations of the subscales of the “Michigan Hand Outcomes Questionnaire” were high. Cronbach's alphas were found to be high in all subscales. There was no significant correlation between aesthetics and pain scales. We found significant differences between patients and controls regarding all subscales of the “Michigan Hand Outcomes Questionnaire”. Correlations between subscales of the “Michigan Hand Outcomes Questionnaire” and “Disabilities of Arm, Shoulder and Hand” questionnaire were significant. We found no difference between one-hand effected and two-hand effected patients, in terms of the “Michigan Hand Outcomes Questionnaire”, “Disabilities of Arm, Shoulder and Hand” questionnaire Function/Symptom and Work average scores.

**Conclusion:** This study showed that the Turkish version of the “Michigan Hand Outcomes Questionnaire” is reliable and valid and can be used in Turkish patients with Carpal Tunnel Syndrome because it is comprehensible and practicable.

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**Keywords:** Questionnaire design; Carpal tunnel; Reliability; Validity

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## Introduction

Carpal tunnel syndrome (CTS) is one of the most seen compressive neuropathy of the limbs.<sup>1</sup> Characteristics of CTS are nocturnal pain and paresthesias. These symptoms awaken the patient, and symptoms are relieved by shaking hands.<sup>2</sup> Weakness, decreased tactile sensation and numbness in the first three digits are the other common symptoms.<sup>3</sup> Discomfort, work disability, and limitation of activities are the results of CTS.<sup>4,5</sup>

There are several developed tools for assessing the functions of limbs. Standardized self-administered questionnaires allow collecting and analyzing data of symptoms, functions, responsiveness to treatment, and quality of life.<sup>4,6</sup> These questionnaires are generic, domain or, disease specific.<sup>7</sup> Domain and disease specific instruments have the potential to be more responsive and sensitive than generic instruments,<sup>8</sup> and their clinical importance for measuring treatment outcomes has been highlighted.<sup>9</sup>

Until Levine et al developed a self-administered, disease-specific questionnaire, there was no standardized assessment method for the severity, functional capacity, and treatment outcomes of CTS.<sup>10,11</sup> As a domain specific instrument the “Michigan Hand Outcomes Questionnaire” (MHQ) has been developed to assess symptoms and physical function in hand-specific disorders like CTS and rheumatoid arthritis and was found reliable and valid.<sup>12,13</sup> The MHQ has proven to be more responsive to clinical changes after CTS surgery than the commonly performed sensibility test, and is useful when independent scores from different domains are required or when comparison with an unaffected hand is needed.<sup>14</sup>

Although its responsiveness has been shown in various populations of patients with problems in hand function, its sensitivity to change has not yet been investigated in patients with CTS.<sup>12,13</sup> The aim of this study was to conduct the Turkish validation and cross-cultural adaptation study of MHQ on Turkish patients with CTS.

## Patients and methods

### *Questionnaires*

The MHQ was created by Chung et al and was published in 1998.<sup>12</sup> It is a hand-specific questionnaire for patients with chronic hand conditions.<sup>12</sup> It has been used in patients with CTS,<sup>15</sup> distal radius fracture,<sup>16</sup> reconstruction,<sup>17</sup> and arthroplasty in rheumatoid arthritis.<sup>13</sup> Consisting of 37 core questions, it

distinguishes between the left and right hands over six domains including overall hand function, activities of daily living, pain, work performance, aesthetics, and patient satisfaction with function.<sup>12,18</sup> Each domain is scored using an unweighted method, by adding the responses (ranging from 1 to 5) in each scale, and normalizing the scores to a scale from 0 to 100. A lower score shows more severe disability except for the pain domain where the opposite holds true. The final score is obtained by averaging the six scores after reversing the pain score. The overall symptom severity score is calculated as the mean of the scores.<sup>12</sup>

The “Disabilities of Arm, Shoulder and Hand” questionnaire (DASH) is a 30-item questionnaire used to assess disability for disorders affecting the upper extremity by measuring severity of symptoms and difficulty in completing specific tasks.<sup>19</sup> Its validity, reliability, and responsiveness have been shown for a variety of upper extremity conditions.<sup>20–22</sup> The Turkish version of DASH is found to be reliable and valid in patients with upper extremity conditions.<sup>23</sup> The questionnaire includes a 30-item disability/symptom scale: function (21 items), symptom severity (six items), and psychological factors (three items). There are also two optional scales: work (four items) and sports/performing arts (four items). The score, which does not distinguish between the right and left extremities, is transformed to a scale of 0–100, where a higher score indicates a more severe disability.<sup>19</sup>

### *Translations and cultural adaptation*

The translation and cross-cultural adaptation of the original questionnaire were performed in accordance with recently published guidelines. The index was at first translated from English to Turkish by three bilingual authors whose native language was Turkish. These two translations were reviewed and discussed by two authors and a synthesis was formed. This version was translated back to English by two English-speaking language specialists. A committee (medicine doctor and English teacher) controlled the grammar of the index and compared it with the original questionnaire. After a careful review and cultural adaptation, the prefinal Turkish version of the questionnaire was provided.

Testing the prefinal version was the final stage of the process (face validity). The purpose of this stage was to determine the comprehensibility of this version and capability of assessing the intended parameters. Ten patients with idiopathic CTS and 10 healthy participants completed the prefinal Turkish version of the MHQ and they were interviewed to get their general

comments on the difficulty of the questionnaire or understanding the text. All of the patients and healthy participants correctly understood the questionnaire. All findings from this phase of the adaptation process were evaluated and the final Turkish version of the questionnaire was provided.

#### *Patients and assessments*

The Turkish version of the MHQ was administered to 100 native Turkish-speaking patients (20 men and 80 women) who were admitted with idiopathic CTS and 50 healthy participants (22 men and 28 women). Their informed consent was obtained. The study was approved by the ethics committee.

The diagnosis of CTS was based on the characteristic symptoms, physical examination and electrophysiological studies. The demographic data including age, gender, educational level, and dominant hand were recorded. For providing a homogeneous subject population, patients with thyroid disease, diabetes mellitus, rheumatoid arthritis, hand osteoarthritis, radiculopathy of cervical spine, pregnancy, inability to complete questionnaire due to cognitive impairment, previous hand surgery, and language difficulties were excluded from the study.

All patients and healthy participants were assessed by the same physician, and completed a brief form that described the patient's demographic and clinical characteristics. To assess the test-retest reliability of the Turkish MHQ, questionnaires were answered by the patients and the healthy controls. All assessments were repeated a week later. To perform construct validity, patients were also assessed by correlations between the subscales of the MHQ and DASH.

#### **Statistical analysis**

Statistical analyses were performed with SPSS 11.5 for Windows and the MedCalc11 program. The Shapiro–Wilk test was used to analyze the normal distribution assumption of the quantitative outcomes. Descriptive data are presented as mean  $\pm$  standard deviation (SD). To compare two groups the Mann–Whitney *U* test was used.  $P < 0.05$  was considered statistically significant.

#### *Reliability*

Two types of reliability (reproducibility and internal consistency) were evaluated for the MHQ. Test-retest reliability measures stability over time, by

administering the same test to the same subjects at two points in time. In this investigation, a time interval of 7 days was used. The correlation of the total scores between two administrations was measured with the intraclass correlation coefficient (ICC) for test-retest reliability. ICCs can vary from 0.00 to 1.00, where values of 0.60–0.80 are regarded as good reliability and with those above 0.80 indicating excellent reliability.<sup>24</sup>

Internal consistency measures how well all the questions in a scale are correlated with each other and high inter-item correlations may suggest that all the questions measure the factor of interest. Internal consistency is expressed by the Cronbach's alpha test, which is a measure of the reliability of the summative rating scale. Cronbach's alpha scores can range from 0 to 1.0, where 1.0 indicates perfect internal consistency. The Cronbach's alpha scores of greater than 0.80 in a scale are considered acceptable.<sup>25</sup>

#### *Construct validity*

Construct validity is a major component in the testing of all outcomes instruments. It means that the scales in the questionnaire behave as expected. For example, in the MHQ, patients with poor overall hand function are expected to have poor performance in their work. By establishing the theoretical relationships between scales, we were able to test the validity of the MHQ.<sup>12</sup>

For testing validity, correlations between the subscales of the MHQ and DASH were studied in the patient group. Construct validity was measured by the Spearman correlation coefficient. The Spearman coefficient was used because of the limited sample size and non-normal distributions. A value between 0 and 0.25 was accepted as 'no or poor', 0.26–0.50 as 'moderate', 0.51–0.75 as 'good', and 0.76–1.00 as a 'very good' correlation.<sup>26</sup>

#### **Results**

All the patients and healthy controls completed the MHQ and DASH. The response rate was 100%. [Table 1](#) lists demographic data.

[Table 2](#) presents the results of the intraclass correlation for the test-retest reliability. Test-retest showed an excellent correlation in the six hypothesized scales. Scores of 1.0 indicate a perfect correlation and scores of 0 indicate no correlation. All of the six scales had strong correlation scores over 0.9.

Internal consistency is expressed by the Cronbach's alpha score and, all scales in the MHQ had Cronbach's

**Table 1**  
Demographic data for the 100 patients and 50 healthy controls who completed the MHQ and DASH.

Demographic data	Patients (n = 100)	Controls (n = 50)	P-values
Age, year (mean ± SD)	49.82 ± 9.54	49.28 ± 8.01	0.716
Gender (%)			
Female	80	78	0.943
Male	20	22	
Dominant hand (%)			
Right	93	98	0.270
Left	7	2	
Education (%)			
Primary education	70	68	0.979
Secondary education	23	24	
College	7	8	

MHQ: Michigan Hand Outcomes Questionnaire, DASH: Disabilities of Arm, Shoulder and Hand, SD: Standard Deviation, Significant Level:  $P < 0.05$ .

alpha greater than 0.90. **Table 3** summarizes the alpha score for the six scales.

For construct validity, we hypothesized that the functional scales in the MHQ (overall hand function, activities of daily living, work performance, pain, aesthetics and satisfaction with hand function) would be significantly correlated with each other. For example, patients with poor overall hand function would have difficulties performing activities of daily living. **Table 4** lists the Spearman's rank correlation for the six scales in the MHQ. While there was no significant correlation between aesthetics and the pain scales, there were significant correlations between the other scales.

**Table 2**  
Test-retest Correlation for the six scales in the Michigan Hand Outcomes Questionnaire (n = 150).

Subscales	ICC
Overall hand function	
Right hand	0.99
Left hand	0.99
Activities of daily living	
Right hand	0.99
Left hand	0.99
Both hands	0.98
Work performance	0.98
Pain	0.99
Aesthetics	
Right hand	0.99
Left hand	0.99
Satisfaction with hand function	
Right hand	0.99
Left hand	0.99

ICC: Intraclass Correlation Coefficient; 1.0 indicates perfect correlation.

**Table 3**  
Cronbach's Alphas for the six scales in the Michigan Hand Outcomes Questionnaire (n = 150).

Subscales	Cronbach's alphas
Overall hand function	
Right hand	0.96
Left hand	0.97
Activities of daily living	
Right hand	0.94
Left hand	0.95
Both hands	0.94
Work performance	0.97
Pain	0.96
Aesthetics	
Right hand	0.92
Left hand	0.92
Satisfaction with hand function	
Right hand	0.97
Left hand	0.97

Cronbach's Alphas: 1.0 indicates perfect internal consistency.

There were significant correlations between subscales of the MHQ and subscales of the DASH. We compared one-hand effected and two-hand effected patients, and found no significant difference between the groups in terms of MHQ, DASH function/symptom and DASH work average scores;  $P = 0.741$ ,  $P = 0.578$ , and  $P = 0.315$ , respectively.

We did find statistically significant differences between the patients and the controls regarding all subscales of the MHQ ( $P < 0.001$ ).

## Discussion

In recent years, most nations have undergone a basic change in how they perceive health. Instead of emphasizing only disease processes, the new paradigm focuses on other outcomes relating to health, function, and well-being.<sup>27</sup>

**Table 4**  
Spearman's Rank Correlation for the six scales in the Michigan Hand Outcomes Questionnaire (n = 100).

r	OHF	ADL	Work performance	Pain	SHF	Aesthetics
OHF	1.00					
ADL	0.77 <sup>†</sup>	1.00				
Work performance	0.68 <sup>†</sup>	0.74 <sup>†</sup>	1.00			
Pain	-0.60 <sup>†</sup>	-0.65 <sup>†</sup>	-0.59 <sup>†</sup>	1.00		
SHF	0.71 <sup>†</sup>	0.73 <sup>†</sup>	0.65 <sup>†</sup>	-0.66 <sup>†</sup>	1.00	
Aesthetics	0.20*	0.19*	0.31 <sup>†</sup>	-0.13	0.34 <sup>†</sup>	1.00

\* $P < 0.05$ , <sup>†</sup> $P < 0.01$ , r: Spearman's Rank Correlation of subscales, OHF: Overall hand function, ADL: Activities of daily living, SHF: Satisfaction with hand function.

Traditionally, outcomes in hand disorders are based on objective measures, such as grip strength and range of motion. Although these variables are useful in assessing physical changes in the hand, they do not measure outcomes that directly affect patients' daily lives.<sup>28</sup>

There is a study reported by Oksuz et al evaluating the Turkish version of the MHQ that was conducted with 70 patients with multiple hand disorders instead of a homogeneous population, and they found that the MHQ was valid and reliable.<sup>28</sup> Different from the Oksuz study, we established our study in a single, common, prototype disease without the assessment of the treatment for a correct statistical measurement in a homogeneous group. Also, in contrast to the Oksuz study we prepared the questionnaire to be the same as the original MHQ, separately evaluating both hands for pain. The reliability and the validity of the Turkish Version of MHQ has not been studied yet in a single, wide CTS patient group. The aim of this study was to conduct a validation of the Turkish version and a cross-cultural adaptation study of the MHQ in Turkish patients with CTS.

The quality of a measurement is based on reliability, validity, and ease of use.<sup>29</sup> The MHQ was adapted to the Turkish population using recommended guidelines.<sup>30</sup> The completion time was reported as approximately 15 minutes.<sup>12</sup> We found patients completed in 9 min and patients indicated that it was an acceptable length of time, similar to reports in the literature.<sup>12,31</sup> Patients had no difficulty in completing the questionnaire. The ease of administration allowed the MHQ to be easily given in a clinic setting, which markedly increased the response rate.

In our study, we found statistically significant difference between the patients and the controls regarding all subscales of the MHQ. This result showed the positive predictiveness of the MHQ.

In our study, MHQ was found to have high test-retest reliability and internal consistency. This was similar to that found with the other studies.<sup>12,32,33</sup> For test-retest reliability, Spearman's correlation exceeded 0.9 in all the scales, indicating that the scales were highly reliable in repeated testing and were stable over time. In the present study, the Cronbach's alpha scores were over 0.9 in all the scales. This indicates that the Turkish version of the MHQ has high internal consistency for all items of the questionnaire.

While there was no significant correlation between aesthetics and the pain scales, there were significant correlations between other scales (Table 4). In the original version of the MHQ, high correlations were reported between the five scores of MHQ except

aesthetics.<sup>12</sup> Although aesthetics was considered as an important outcome, correlations were lower than the other functional scales. Because aesthetic is a subjective symptom for patients, if they have no differences in their hand appearance (atrophy e.g.) then a significant difference in their aesthetic scores are not expected. Therefore, we did not use aesthetic scores to calculate the MHQ scores similar to a previous study which did not use aesthetic scores.<sup>34</sup> Our findings were consistent with other studies.<sup>12,34</sup>

A high correlation was found between the DASH's Function/Symptom and Work subscales with the five scores of MHQ, excepting aesthetics. These findings indicate that either DASH or MHQ can be used in patients with CTS.

We compared one-hand effected and two-hand effected patients, and found no significant difference between the groups in terms of MHQ, DASH Function/Symptom and DASH Work average scores. Similar to other studies, this result showed that the MHQ could evaluate both hands separately.<sup>12,34</sup>

There are some limitations in this study. This was a single-center study with patients having only one type of hand disorder. Although the sample size was adequate for instrument testing and cultural adaptation, the study must be extended to include other hand disorders. For example, arthroplasty in rheumatoid arthritis, hand involvement in complex regional pain syndrome, hand involvement in hemiplegia need to be included. Future studies must include the response to the treatment with some other parameters evaluating CTS, like visual analog scale and hand grip strength.

## Conclusion

This study showed that the Turkish Version of MHQ is reliable and valid on Turkish patients with CTS. This instrument can be used in Turkish patients with CTS because it is comprehensible and practicable; it evaluates both hands separately and also evaluates patients' satisfaction. Responsiveness of the MHQ for different hand disorders will need to be assessed in longitudinal studies to better define its utility.

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