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The Polish version of the Michigan Hand Outcomes Questionnaire: Cross-cultural adaptation, reliability, construct validity, and measurement error

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Abstract

The aims of this study were to translate the Michigan Hand Outcomes Questionnaire into the Polish language and to test the measurement properties of its quality criteria. A total of 120 patients with hand complaints completed the Polish Michigan Hand Outcomes Questionnaire and the Disabilities of the Arm, Shoulder, and Hand questionnaire on the first assessment, along with the grip test, pinch test, and pain sore assessed using a visual analogue scale during activity. After 7 days, 76 patients completed the Michigan Hand Outcomes Questionnaire the second time. The Cronbach alpha of the Michigan Hand Outcomes Questionnaire subscales ranged from 0.79 to 0.96. The intraclass correlation coefficient varied from 0.82–0.97, and the Bland–Altman method indicated the Michigan Hand Outcomes Questionnaire total score limit of agreement was −13.2–12.3 and −9.18–9.62 for the right and left hand, respectively. The construct validity revealed a moderate to strong correlation between every subscale of the Polish Michigan Hand Outcomes Questionnaire and Disabilities of the Arm, Shoulder, and Hand, but they only correlated with the grip test and the visual analogue scale, and neither correlated with the pinch test. The study demonstrated properties similar to the original version, validating the belief that the use of this questionnaire in medical practice in Poland is justified.

Keywords

Michigan Hand Outcomes Questionnaire, Polish, psychometric, reliability, construct validity, measurement error

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Introduction

Since 1998, the Michigan Hand Outcomes Questionnaire (MHQ) has been successfully used to assess various hand-related diseases and injuries. The MHQ is mainly used in the hand, plastic, and orthopaedic surgical fields (Shauver and Chung, 2013). Patient-reported outcome measures (PROMs) obtained from the MHQ are useful. The questionnaire was specifically designed to allow clinicians to better understand how patients' lives are affected by their diseases and to help a physician and their patient develop common treatment goals. PROMs can guide physicians in establishing appropriate patient treatment methods resulting in higher satisfaction

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among patients, and they also can be used to monitor results of different medical treatments and interventions.

The MHQ is a hand-specific instrument that measures the outcomes of patients with hand and/or wrist disabilities/injuries (Chung et al., 1998). It assesses both a patient's subjective feelings and the manner in which patients' lives are affected by their disease by quantifying these two parameters based on different scales. This results in an objective numerical measurement. Functionality of the left and right hand is assessed separately using 37 core questions. The MHQ contains six distinct scales: (1) overall hand function (five questions); (2) activities of daily living (ADLs) (five with an additional seven questions); (3) work performance (five questions); (4) pain (five questions); (5) aesthetics (four questions); and (6) patient satisfaction with hand function (six questions).

Each question is expressed as a whole number from 1 to 5. Results from each of the six scales are scored and converted to values from 0 to 100. A higher numerical score means better results, except for a pain scale in which a higher score is associated with more intense pain. The final score can then be calculated separately for each hand.

The MHQ has been translated from English and successfully implemented in many countries (Ebrahimzadeh et al., 2015; Knobloch et al., 2011; Meireles et al., 2014; Öksüz et al., 2011; Roh et al., 2011). Almost 40 million people worldwide use Polish as their first language; therefore, there is value in developing a Polish language version of the MHQ (Lewis, 2015). The aims of this study were to translate and adapt the MHQ into Polish and to examine whether it is a valid and reliable instrument for assessing outcomes in patients undergoing operations/treatments for various hand disorders.

Material and methods

Study population and clinical design

The following study had a cross-sectional design, and methodology consisted of two phases (Figure 1). The first phase was to translate the English version of the MHQ into Polish. The second phase was to check the reliability and validity of the Polish MHQ by testing it on patients with various hand disorders. The official license and translation agreement from the Regents of the University of Michigan were obtained (academic license #3372). The study was approved by the Bioethical Committee of the Jagiellonian University Medical College in Kraków (#122.6120.107.2015). The methods were carried out in accordance with the approved guidelines.

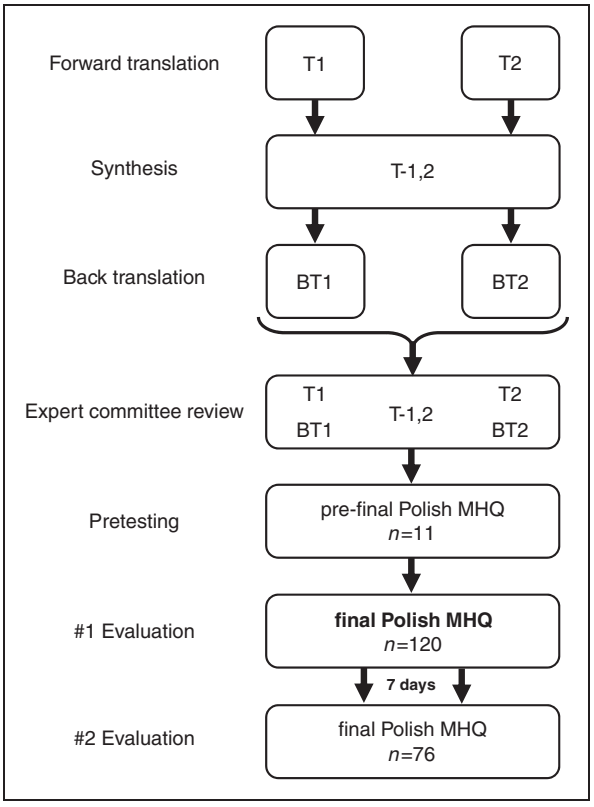

Figure 1. Flowchart showing the study methodology of the adaptation and translation process of the Polish version of the Michigan Hand Outcomes Questionnaire (MHQ).
T1, T2, BT1 and BT2 are four independent translators: T1 – first translation into Polish; T2 – second translation into Polish (was not informed of the study concept); T-1,2 – synthesis of two forward translations into the primary Polish version; BT1 – first backward translation from the primary Polish version into English; BT2 – second backward translation from the primary Polish version into English (translator with medical degree).

The study was conducted in the Second Department of General Surgery, Jagiellonian University Medical College from January 2015 to January 2016. The inclusion criteria were as follows: individuals with a hand/wrist condition, no surgery on the affected hand/wrist in the last 6 months, patients older than 18 years old, the ability to read and write to complete the questionnaire independently, Polish as a first language, no expected major change in symptoms between the first and second measurement after 7 days, and no history of neurological and/or mental disease. Written informed consent was obtained from all study participants.

Instruments and measures

The translation of the MHQ into Polish was made in accordance with the American Academy of Orthopedic Surgeons Outcome Committee's guidance, which

is illustrated in Figure 1 (Beaton et al., 2000). Two independent researchers (T1, T2) fluent in Polish and English, who are specialists in plastic surgery/hand surgery and orthopaedic surgery, made the translations from the original MHQ from English to Polish. Subsequently, a synthesis was performed with a developer where all minor discrepancies were resolved to create one consistent version (T-1,2). T2 was blinded to the study concepts. The next step was a backward translation, which was made by two language professional, native English speakers, one of which completed high school education in Polish and university and medical school education in English (BT1, BT2). All the translations made were then compared and discussed with an expert committee consisting of three researchers, two translators, and a developer. This resulted in creating a pre-final version of the Polish MHQ.

The next step was the testing process, where the pre-final version was distributed to 11 patients to check patient understanding and interpretation of the questionnaire. Those patients were asked to indicate any incomprehensible or ambiguous questions. The data collected enabled the construction of the final version of the Polish MHQ and the evaluation of it on a larger group for test–retest, reliability, internal consistency, and validity.

The Polish version of the Disabilities of the Arm, Shoulder and Hand (DASH) outcome measure translated by Dominik Golicki (http://www.dash.iwh.on.ca) was chosen as a tested questionnaire where the scores can be compared with the MHQ (Hudak et al., 1996). DASH is a 30-item, patient-report questionnaire designed to measure physical function and symptoms in patients with one or more musculoskeletal disorders of the upper limb. The final outcome is converted to a number from 0 to 100. The score achieved has an inverse correlation with better functionality and the condition of the patient. Two modules were used: function/symptoms (FS) and work. According to the scoring algorithm of the FS module, if more than three of the items are missing, then the DASH cannot be scored. The work module score may not be calculated if there are any missing items.

The intensity of pain during activity was evaluated using a 10 cm visual analogue scale (VAS) score ranging from 0 to 10, where a higher score is associated with greater pain.

Grip strength and key-pinch strength were evaluated using a Jamar hydraulic hand dynamometer and the pinch gauge (Patterson Medical kit, Warrenville, IL). Three measurements were taken and the final outcome was reported as a mean in kilograms (0.1 kg approximation) for both hands.

Eligible patients for the study were informed about the study during their visit at the hand surgery and orthopaedics outpatient clinic. Informal consent was obtained and the first MHQ was distributed to them, along with the DASH and VAS. During the same visit the grip and pinch tests were performed. Demographic data, such as sex, age, body mass index (BMI), education level, type of hand disorder, duration of symptoms (defined as time span of symptoms of specific disease or time from injury to control visit), and dominant hand side, were also collected. All patients were asked to complete the questionnaire for a second time 7 days later.

At the conclusion of testing, the data were scored and analysed. According to the MHQ scoring mechanism for scales with less than 50% of the questions unanswered, the average of the existing scale items may be substituted for the missing scale(s).

Statistical analysis

Continuous data were presented as a mean with a standard deviation or median with interquartile range. Discrete data were shown by means of frequency and percentages.

Reliability, which is a measure of the overall consistency, was assessed using internal consistency, reproducibility, and measurement error. To evaluate internal consistency the alpha was used, which is a function of the number of items in a test, the average covariance between item pairs, and the variance of the total score (Cronbach, 1951). The higher outcome (ranged 0.7–0.95) is preferable (Terwee et al., 2007).

Reproducibility informs us about the grade of similar answers for questions in repeated measurement in a stable person (test–retest). It was assessed by two analyses. The first was the intraclass correlation coefficient ($ICC_{2,1}$), a two-way random effects absolute agreement model. The correlation ranges between 0–1 and values above 0.7 show a strong score (Terwee et al., 2007). The correlation coefficient is a misleading analysis to establish an agreement between two measurements, as data can present a high and significant positive correlation but still be poor in agreement (Bland and Altman, 1986). Therefore, the Bland–Altman method, which consists of plotting the mean of two MHQ measures against their difference, was chosen as the second method. The plot illustrates the mean of the difference and its limits, defined as standard deviation (SD) $1.96 \times$ SD of the differences of the mean with corresponding 95% confidence interval (95%CI) of each limit bound. The plot for each hand's MHQ score was paired together with a scatterplot between the first and second assessment.

The standard error of measurement ($SEM = SD * \sqrt{1 - ICC}$) is the amount of error that can be attributed to measurement error. The minimal detectable change ($MDC95 = 1.96 * SEM * \sqrt{2}$) is the minimum amount of change in a patient's MHQ score that ensures that the change cannot be attributed to a measurement error.

Construct validity informs us about the convergence between tested instruments and other outcomes that measure similar constructs. In other words, if it measures the features for which it was created (Kirshner and Guyatt, 1985; Terwee et al., 2007). The Spearman correlation coefficient was used to find the associations of the MHQ with the Polish DASH, VAS during activity, the grip test, and the pinch test. In this analysis, MHQ outcomes were only taken into account in injured and/or affected hands. When both hands were affected, only the dominant one was analysed. There are no existing predefined hypotheses to investigate the construct validity, so we decided to test one hypothesis for each additional instrument using correlation coefficient R value (Hinkle et al., 2003). The following hypotheses were stated: $R \leq -0.5$ to show at least moderate correlation between the MHQ total score and DASH; $R \leq -0.5$ to show at least moderate correlation between the MHQ total score and DASH work; $R \geq 0.5$ to show at least moderate correlation between the MHQ pain and VAS during activity; $R \geq 0.3$ to present at least mild correlation between the MHQ hand function and grip test or/and key pinch test. Because in DASH, DASH work, and VAS a better score indicates a worse result, an inverse correlation was reported. Ceiling and floor effects were calculated using the 15% criterion (McHorney and Ware, 1995).

A *P*-value of <0.05 was considered to be statistically significant.

Table 1. Patients' demographic and clinical data (total $n = 120$).

Characteristic	Value (n; mean)	(%; SD)
Sex		
Male	38	32%
Female	82	68%
Nationality		
Polish	120	100%
Age (years)	56.4	14.9
BMI (kg/m^2)	26.7	4.8
Affected hand		
Right	65	54%
Left	45	38%
Bilateral	10	8%
Dominant hand		
Right	109	91%
Left	10	8%
Ambidextrous	1	1%
Symptom duration (months)	24.5	22.2
Diagnosis		
Carpal tunnel syndrome	55	46%
Cubital tunnel syndrome	27	23%
Osteoarthritis	16	13%
Injury	14	12%
Dupuytren's disease	3	2%
Trigger finger	2	2%
Other	3	2%
Educational level		
Primary school	15	12%
Professional technical school	20	17%
High school	48	40%
Higher education	37	31%

BMI: body mass index; SD: standard deviation.

Results

In total, 120 patients were included in the study: 38 (32%) men and 82 (68%) women. The average age was 56.4 SD 14.9 years (Table 1). The most common education level completed by a patient was high school (40%). Almost all of the patients were right-handed (91%). The right hand was affected in 54% of patients, the left in 38%, and both hands were affected in 8% of patients. The mean duration of symptoms was 24.5 SD 22.2 months and the average BMI was 26.7 SD 4.8 kg/m^2 and all of the participants were Polish (Caucasian).

No linguistic issues were noted during the translation process. None of the activities were renamed because of transcultural adaptation. Pretesting on a group of 11 patients showed only very minor difficulties, which did not recur during the testing of the final version of the questionnaire. Missing items were observed in five (4%) cases at the baseline and in two (3%) cases at the second assessment and referred to different patients. No floor or ceiling effects were observed.

Table 2 presents average values for measured hand parameters in the first and second assessment. Seventy-six patients (63%) filled the questionnaire for a second time (Figure 1). The general MHQ score was 47.1 (34.7–71.3) for the right hand and 52.9 (39.4–70.1) for the left hand at the first assessment and 46.3 (36.3–61.8) and 48.6 (38.3–66.6) at the second assessment, respectively. Moreover, the MHQ score for the affected/injured hand was calculated as 43.2 (34.6–57.7) and 43.1 (34.7–53.8) for the first and the second assessment, respectively. The minimal

Table 2. Results of measured parameters. Presented as mean with corresponding standard deviation and median with interquartile range.

	#1 Assessment	#2 Assessment	$ICC_{2,1}$	SEM	MDC95
MHQ ($n = 120$; $n = 76$)					
Total right	51.9 ± 21.6	49.6 ± 19.1	0.95	4.8	13.4
	47.1 (34.7–71.3)	46.3 (36.3–61.8)			
Total left	53.9 ± 19.8	51.4 ± 18.3	0.96	4.0	11.0
	52.9 (39.4–70.1)	48.6 (38.3–66.6)			
Injury/dysfunctional hand	46.0 ± 17.1	44.5 ± 16.5	0.91	5.1	14.2
	43.2 (34.6–57.7)	43.1 (34.7–53.8)			
DASH					
DASH-function/symptoms ($n = 120$)	48.5 ± 21.7				
	51.7 (36.7–63.3)				
DASH-work ($n = 34$)	52.9 ± 21.6				
	50.0 (43.8–75.0)				
VAS ($n = 50$)	6.5 ± 2.1				
	6.5 (5.0–8.0)				
Grip test – injury hand ($n = 40$)	22.1 ± 12.0 kg				
	20.0 (12.0–30.0)				
Pinch test – injury hand ($n = 40$)	5.5 ± 3.2 kg				
	5.0 (2.6–7.0)				

MHQ: Michigan Hand Outcome Questionnaire; DASH: disabilities of the arm, shoulder and hand; VAS: pain visual analogue scale during activity; $ICC_{2,1}$: intraclass correlation coefficient (a two-way random effects absolute agreement model); MDC95: minimal detectable change 95%; SEM: standard error of measurement.
Higher MHQ and lower DASH scores reflect better overall hand function.

detectable change 95 (MDC95) value for the right, left, and affected/injured hand MHQ scores were 13.4, 11.0, and 14.2 respectively.

Internal consistency, mean values of the particular MHQ scale, and test–retest reliability are shown in Table 3. The Cronbach alpha was high in all domains and ranged from 0.79 to 0.96. The ICC varied from 0.82 to 0.97, which indicates good retest reliability. Moreover, SEM range was 5.8–10.7 and MDC95 reference was 15.6–29.6 (Table 3). The lowest score was the satisfaction domain for the right hand [37.5 (25.0–79.8)], and the highest score was associated with the aesthetic [68.8 (50.0–90.6)]. The limits of agreement (LoA) for the right MHQ total score varied from −13.2 (95% CI: −15.77 to −10.62) to 12.3 (95% CI: 9.73 to 14.88), and for the left MHQ total score varied from −9.18 (95% CI: −11.08 to −7.28) to 9.62 (95% CI: 7.72 to 11.52) for the 7-day time interval. The Bland–Altman plot along with scatterplot graph are presented in Figure 2.

The interscale correlation for the affected/injured hand was checked and is presented in Table 4. The MHQ set a good correlation with DASH-FS and DASH-work in every subscale, as well as with the final score ($p < 0.05$). The VAS was significantly correlated with the MHQ final score and four subscales: ADLs, pain, appearance, and aesthetics. The grip test outcomes were moderately correlated with ADL and normal work subscales, but correlation with the MHQ final score was insignificant ($p = 0.057$). The pinch test results were not statistically associated with the MHQ results (Table 5).

Discussion

Developing a reliable and condition-appropriate questionnaire for patients that suffer with hand diseases and disorders is an important undertaking. Questionnaires can be used as a helpful tool to convey subjective feelings of a patients (pain, emotions, etc.) to a physician by use of a numerical (objective) and reproducible scale that can be used to monitor disease progression. Since patients' feelings can be related to many aspects of their condition and expressed in different ways by different individuals, it is often hard for the physician to evaluate the feelings of the patient. The validation process of our questionnaire followed the guidelines set by the American Academy of Orthopedic Surgeons Outcome committee (Beaton et al., 2000). The steps of translation and back-translation did not demonstrate any major cultural or linguistic discrepancies.

Table 3. Internal consistency and test–retest reliability of the Polish Version of the MHQ. Presented as mean with corresponding standard deviation and median with interquartile range.

MHQ subclass	#1 Assessment ($n = 120$)	#2 Assessment ($n = 76$)	Cronbach's alpha	$ICC_{2,1}$	SEM	MDC95
I. Overall hand function						
Right	53.0 ± 24.6	48.3 ± 21.2	0.79	0.93	6.5	18.0
	50.0 (35.3–70.0)	50.0 (32.5–65.0)				
Left	54.6 ± 25.1	53.0 ± 22.4	0.94	0.95	5.6	15.6
	50.0 (40.0–70.0)	50.0 (40.0–70.0)				
II. Activities of daily living						
Right	55.4 ± 32.5	53.9 ± 30.6	0.95	0.95	7.3	20.1
	47.5 (25.0–90.0)	50.0 (25.0–82.5)				
Left	59.8 ± 33.5	57.9 ± 31.9	0.96	0.97	5.8	16.1
	60.0 (35.0–97.5)	57.5 (30.0–90.0)				
Both	46.4 ± 27.2	43.7 ± 25.8	0.94	0.94	6.7	18.5
	42.9 (23.2–66.1)	39.3 (23.2–60.7)				
III. Work performance	47.5 ± 23.5	48.4 ± 21.4	0.91	0.88	8.1	22.6
	45.0 (25.0–65.0)	50.0 (30.0–55.0)				
IV. Pain						
Right	53.3 ± 30.0	56.6 ± 27.0	0.78	0.91	9.0	24.9
	60.0 (40.0–75.0)	65.5 (50.0–75.0)				
Left	47.2 ± 30.3	53.6 ± 26.2	0.79	0.89	10.0	27.9
	55.0 (20.0–70.0)	60.0 (42.5–70.0)				
V. Aesthetic						
Right	67.7 ± 24.4	65.6 ± 23.4	0.86	0.82	10.4	28.7
	68.8 (50.0–90.6)	68.8 (50.0–81.3)				
Left	66.6 ± 25.9	65.4 ± 24.2	0.86	0.83	10.7	29.6
	68.8 (50.0–93.8)	68.8 (50.0–81.3)				
VI. Satisfaction						
Right	45.5 ± 28.5	38.8 ± 24.6	0.94	0.93	7.5	20.9
	37.5 (25.0–79.8)	33.3 (20.8–54.2)				
Left	48.6 ± 28.5	43.1 ± 24.6	0.95	0.94	7.0	19.4
	41.7 (25.0–72.9)	41.7 (25.0–64.6)				

MHQ: Michigan Hand Outcome Questionnaire; $ICC_{2,1}$: intraclass correlation coefficient (a two-way random effects absolute agreement model); MDC95: minimal detectable change 95%; SEM: standard error of measurement; SD: standard deviation.

We did not have to make any major changes to the content of the questionnaire.

The advantage of the MHQ is its multidimensional design in measuring patient-rated outcomes in symptoms, functionality, aesthetics, and satisfaction, while addressing aspects of patient satisfaction that are not present in other questionnaires. There are various questionnaires available that can be used for the assessment of patients undergoing hand surgery (Sambandam et al., 2008; Zyluk and Piotuch, 2009). Attention needs to be paid to the choice of the survey in order for the selection to be well matched to the purpose of a given research project in both a substantial and formal manner. Researchers supported the thesis that modern research projects measuring outcomes in hand surgery need to be conducted, along with questionnaires, as an obligatory element of a complex assessment (Zyluk and Piotuch, 2009). High internal consistency of the collected data is also important in the assessment of the natural course of the disease and its natural progression.

In this study, the translation of the MHQ achieved excellent results in test–retest reliability. The Cronbach alpha score was high, ranging from 0.79 to 0.96 and the ICC varied from 0.82 to 0.97. This result might be explained by the short time period between the administration of the two surveys. Our findings were very similar to Chung and Morris' (2014) results, where questionnaire parameters were tested for the

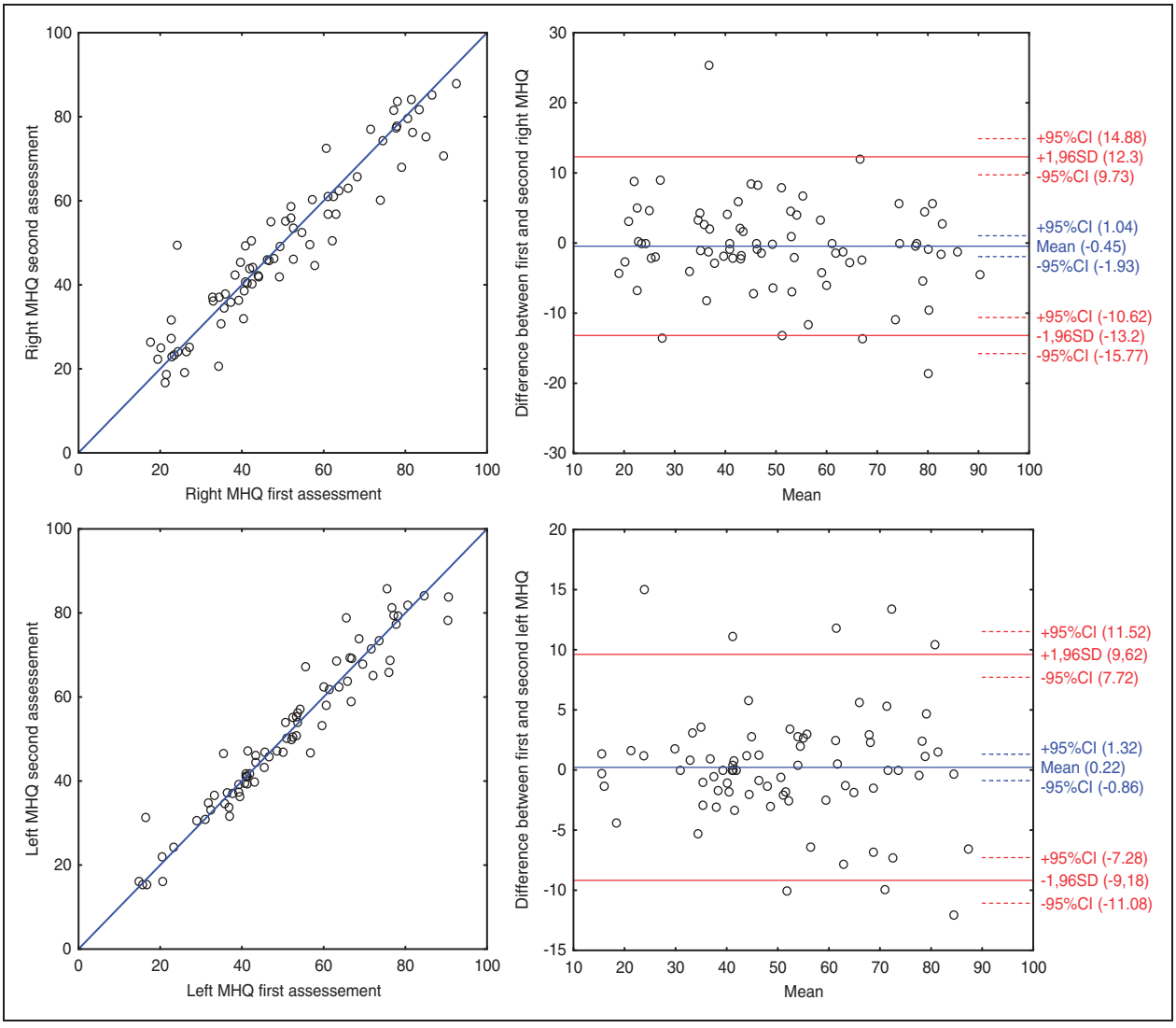

Figure 2. The Bland–Altman plot for the results on a 7-day time interval for right and left Michigan Hand Outcomes Questionnaire (MHQ) Scores.

Table 4. Interscale correlation for the affected hand. When both hands were affected, only the dominant one was analysed.

	Hand function	ADL	Normal work	Pain	Appearance	Satisfaction
Hand function	–					
ADL	0.81*	–				
Normal work	0.53*	0.61*	–			
Pain	−0.69*	−0.61*	−0.38*	–		
Appearance	0.61*	0.58*	0.3*	−0.53*	–	
Satisfaction	0.85*	0.75*	0.53*	−0.69*	0.65*	–

*$p < 0.001$.
ADL – Activity of daily living.

Table 5. Spearman's Correlation of the MHQ with DASH, VAS, grip strength, and pinch strength for the affected hand. When both hands were affected, only the dominant one was analysed.

	DASH-function/symptoms ($n=120$)		DASH-work ($n=34$)		VAS ($n=50$)		Grip test ($n=40$)		Pinch test ($n=40$)	
Polish MHQ	R[a]	*p*	R[a]	*p*	R[a]	*p*	R	*p*	R	*p*
Hand function	**−0.58**	**0.000**	**−0.51**	**0.001**	−0.22	0.118	**0.33**	**0.048**	0.20	0.256
ADL	**−0.70**	**0.000**	**−0.42**	**0.011**	**−0.28**	**0.042**	**0.37**	**0.027**	0.26	0.133
Normal work	**−0.55**	**0.000**	**−0.51**	**0.002**	−0.11	0.455	**0.38**	**0.026**	−0.05	0.794
Pain	**0.47**	**0.000**	**0.41**	**0.016**	**0.56**	**0.000**	−0.17	0.313	−0.22	0.211
Appearance	**−0.41**	**0.000**	**−0.34**	**0.048**	**−0.34**	**0.017**	0.17	0.323	0.19	0.267
Satisfaction	**−0.56**	**0.000**	**−0.47**	**0.005**	**−0.37**	**0.009**	0.21	0.230	0.29	0.091
Total	**−0.68**	**0.000**	**−0.56**	**0.000**	**−0.44**	**0.001**	**0.31**	**0.057**	0.17	0.324

MHQ: Michigan Hand Outcome Questionnaire; DASH: disabilities of the arm, shoulder and hand; VAS: pain visual analogue scale during activity; ADL: activities of daily living.
[a]Inverse correlation because in DASH, DASH work, and VAS better score indicates worse result.
Statistically significant values are bold.

English version of the MHQ. The Cronbach alpha ranged from 0.84 to 0.95, and the ICC ranged from 0.71 to 0.84 for the subscales. Lack of variability of the collected data can also be explained by the advanced stage of disease, whereas a large variability is expected in the acute phase of a disease. Since the mean age of disease in this study was 24.5 months (SD 22.2 months), we concluded that a 7-day period was appropriate to observe small fluctuations in the health status of our patients and that the data obtained was a true measurement of patients' health status associated with injury. This time period also allowed us to minimize the possibility of the patient remembering their initial responses to the survey's questions, minimizing the possibility of recall bias.

The strength of this study is the homogeneity of the group of participants (100% Caucasian) and the relatively large sample size of 120 patients. An additional strength is only including patients who were at least 6 months post-surgery and/or patients who did not undergo a procedure during the time of the study. Moreover, applying the Bland and Altman analysis allowed us to overcome some of the limitations of the test–retest method to assess the agreement of the results. The LoA analyses have shown that the discrepancy between the average of the two measurements and their difference was not high, suggesting an acceptable agreement between the measures at the 7-day period: right MHQ total score from −13.2 to 12.3 and left MHQ total score from −9.2 to 9.6. These findings are comparable with previous studies, where such form of analysis was performed by Chung and Morris (2014). They observed 77 participants with various hand problems that the magnitude of the LoA for the MHQ subscales ranged from 13.8 to 26.2. Meireles et al. (2014) observed 30 patients with rheumatoid arthritis that the LoA values for MHQ total score were between (−9.6; 8.0) and (−11.0; 8.0) for right and left, respectively.

Changes within the LoA are likely to be due to random measurement errors, whereas changes outside the LoA should be considered as a systematic error. The latter might occur because of the learning effect changes on pain perception of the patient owing to the patient knowing he is being studied/treated and is expecting a decrease in pain. Pain can also be affected by the activity level of the patients during the specific day, time of the day, and other variables. Therefore, it is hard to assess true pain perception of the patient based on a single measurement. However, the measurement outside of LoA range are not much different and are seen at both sides of the spectrum (upper and lower limits). The results clustering around only one side of the spectrum would suggest the lack of agreement in a sense that outcomes of the second measurement are lower (or higher) than in the first one.

Moreover, MDC was used as a repeatability coefficient, which is also related with the measurement error. The differences of the MHQ test being smaller than the MDC value (the range of the minimal and maximal scores) represent the random measurement error, and a larger score than MDC might be caused by the noticeable change of patient's feeling about his/her hand.

The construct validity of our MHQ translation had a good correlation with DASH-FS and DASH-work in every subscale as well as in the final score

($p < 0.001$). The VAS was significantly correlated with the MHQ's subscales instead of with normal work and satisfaction subscales.

The data obtained in our study had a low incidence of missing data, both at the baseline (4%) and at the time of the second administration (3%). This confirms that the questionnaire is user friendly and that its length is appropriate for the population studied. According to research, the self-administered MHQ could be completed in 10 minutes and is of acceptable length for patients to complete it in clinical settings (Chung et al., 1998). The most commonly missed question involved 'holding a cooking pan'. Men were more likely not to answer this question, possibly due to cultural differences seen in Poland where women are expected to take care of the household and prepare meals. As reported in the Turkish adaptation process, we have not reported patients' misunderstanding of the aesthetic section between the first and remaining questions (Öksüz et al., 2011).

A notable advantage of the MHQ over other questionnaires is that hand dominance is taken into consideration since the involvement of the dominant hand can markedly affect daily living activities. In addition, there are specific sections evaluating pain and satisfaction with hand function. The MHQ also considers aesthetic effect and personal factor, albeit the conditions studied in this research do not have a significant effect on hand aesthetics until muscle atrophy can be observed in the advanced stages of disease.

A similar article involving the Polish adaptation of wrist evaluation questionnaires, including the MHQ, was performed in parallel by Czarnecki et al. (2015). We would like to emphasize that our team obtained a translation agreement from Michigan University, and our final version of the Polish MHQ is available on their official website (http://mhq.lab.medicine.umich.edu/mhq).

Our sample was a convenience sample and therefore a selection bias cannot be excluded. Patients who responded to the questionnaire might not be a true representation of the population affected by the disease. The mean time during which patients experienced their conditions is long and indicates that patients who agreed to answer the questionnaire were likely in the advanced stage of their respective diseases.

This study developed and validated the MHQ for the purpose of evaluating patients using Polish as their primary language. The study demonstrated properties similar to the original version, validating the belief that the use of this questionnaire in medical practice in Poland is justified. Future work should be aimed at testing the reliability of this questionnaire with different hand conditions.

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