

Research Paper

Psychometric Features of the Patient Evaluation Measure in Iranian Individuals With Wrist Disorders

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Reliability and validity,
Psychometrics, Wrist injuries**ABSTRACT****Objectives:** The patient evaluation measure (PEM) evaluates the hand health profile. Having an appropriate measurement tool for the assessment of hand outcomes in Iranian individuals with wrist disorders is essential for clinical and research settings. The objective of the present study was to examine the psychometric features of the PEM in Iranian individuals with wrist disorders.**Methods:** Ninety individuals with wrist disorders were recruited. Hand outcome was evaluated with the PEM, quick-disabilities of the arm, shoulder, and hand (Q-DASH), visual analogue scale-pain (VAS-P), and JAMAR hand-grip dynamometer. The PEM was translated into Persian. Face, content, and convergent validity was examined. Also, acceptability, internal consistency, test-retest reliability, and absolute reliability were calculated.**Results:** All questions had an item impact score and CVR score of >1.5 and >0.42 , respectively. All questions except for question 1 (CVI=0.76) and 10 (CVI=0.73) of section B had a CVI score of <0.79 . After changes were applied, the CVI score for these questions (question 1=0.83; question 10=0.87) reached acceptable criteria. The total score of the PEM showed a significant moderate correlation with Q-DASH ($\rho=0.51$; $P<0.001$) and VAS-P ($\rho=0.55$; $P<0.001$) and an insignificant weak correlation with grip strength ($\rho=-0.11$; $P>0.05$). Floor and ceiling effects were 0% for the total PEM score. The Cronbach's α and intra-class correlation values were 0.72-0.87 and 0.96-0.98, respectively.**Discussion:** The present study suggests that the PEM has acceptable validity and reliability for measuring performance and satisfaction in individuals with wrist disorders. This measure might contribute as an outcome measure in research and routine assessments in clinical practice.*** Corresponding Author:****Laleh Lajevardi, PhD.****Address:** Rehabilitation Research Center, Department of Occupational Therapy, School of Rehabilitation Sciences, Iran University of Medical Sciences, Tehran, Iran.**Tel:** +98 (21) 22222059**E-mail:** lajevardi.l@iums.ac.ir

Highlights

- The patient evaluation measure is appropriate for individuals with various wrist disorders.
- The patient evaluation measure has favorable translation and satisfactory face and content validity.
- The patient evaluation measure has acceptable internal consistency and test-retest reliability.

Plain Language Summary

The patient evaluation measure (PEM) is an easy-to-understand and quick questionnaire for measuring hand outcomes, such as cold intolerance, pain, dexterity, wrist movement, and subjective grip strength in patients with wrist disorders. This measure is useful for rehabilitation specialists in outpatient clinics. The findings of the present study suggest that the PEM is a valuable measure with sufficient credibility and reproducibility features for evaluating subjective hand outcomes in patients with wrist disorders.

1. Introduction

The wrist is recognized as a key joint in upper extremity functionality. Impairments in the wrist lead to pain, instability, dysfunction, and decreased quality of life (QoL) [1-3]. Approximately, 20% of referrals to emergency rooms are due to wrist injuries [4]. Assessment is considered an essential part of the intervention process for these injuries [5, 6]. Most assessment tools for wrist injuries are objective measures (i.e. sensation, strength, range of motion). Due to the complexity of hand function, these tools can not reflect the patient's subjective experience, such as pain and patient satisfaction [7, 8].

Over the past decade, assessment has shifted towards activity and participation levels. Occupational therapy, with a client-centered approach, calls for evaluation tools for evidence-based clinical decisions to maximize activity and participation in daily life [5, 6]. The importance of patient-reported outcome (PRO) measures is well-known [7, 9] and they are classified into general, regional, and specific disease groups [10]. Numerous PROs have been designed in this regard, but most of them have time-consuming administration and scoring procedures [7, 11].

The patient evaluation measure (PEM) designed by Macey et al. evaluates the treatment process and the hand's current state [12]. This measure has been used and validated for individuals with carpal tunnel syndrome [7, 13, 14], Dupuytren contracture [15], trigger finger [16], scaphoid fracture [11], and distal radius fracture [17] in English and Polish languages. Compared to the disabilities of the arm, shoulder, and hand (DASH) and Michigan hand outcome question-

naire (MHQ), the PEM has more comprehensibility and less administration time [7, 11]. Moreover, clinical and objective evaluations, such as range of motion have been reported to be less sensitive and reliable than self-report measures [18]. The subjective experience of patients can assist clinicians in designing suitable treatment approaches. The original version of the PEM is a valid and reliable tool for assessing hand outcomes. However, there are no data regarding its use for patients with the Persian language, which may limit its use in the Persian-speaking population. The purpose of this study was to examine the psychometric features of the Iranian version of the PEM in people with wrist disorders. We hypothesized that the Persian version of the PEM would show equivalent results to previous psychometric studies, with acceptable reliability and validity.

2. Materials and Methods

Participants

Ninety individuals (Mean±SD of age, range: 40.86±12.99, 19-72) with wrist disorders (fracture, nerve impairment, tendinopathy, and rheumatoid arthritis) were recruited from Shariati Hospital and rehabilitation centers in Tehran, Iran. Inclusion criteria were: (a) diagnosis of wrist disorders according to the physician or medical records; (b) no significant cognitive impairments (a score of ≥ 21 on mini-mental status examination [19]); (c) absence of neurological disorders, such as multiple sclerosis, stroke, and Parkinson's disease; and (d) ability to read and write in Persian language. Written informed consent was provided by all participants. The minimum sample size was 5-10 times more than the number of measure's items (i.e. 14 items). The recruitment ended with 90 individuals as the power exceeded 0.8 [20].

Instruments

PEM is a well-documented tool for assessing hand outcomes. This measure consists of 19 questions in three sections: (A) Treatment: five questions regarding the patient's point of view toward the therapist; (B) Hand health profile: 11 questions regarding hand health and function, such as pain, dexterity, strength, activities of daily living, and general assessment; and (C) Overall assessment: three questions regarding patient's viewpoint regarding satisfaction with the treatment process. This measure is administered for each wrist separately. Questions are scored on a 7-point Likert scale (normal to severe injury). The total score is calculated by summing the score of section B and C questions and represented as the percentage of the maximum possible score. Higher scores denote a worse outcome [12]. Acceptable validity (construct validity: $\rho=0.66-0.85$), reliability (internal consistency: Cronbach's $\alpha=0.94$), and responsiveness (effect size=0.97) has been reported for the English version.

Quick-disabilities of the arm, shoulder, and hand (Q-DASH) evaluates the extent of upper extremity disability. The Q-DASH is an 11-item questionnaire, with each item scored from 1 to 5. Each item is scored on a 5-point Likert scale. The total score (0=no disability; 100=maximum disability) is calculated with the Equation 1:

$$1. \text{ Score} = \left(\frac{\text{sum of responses}}{n} - 1 \right) \times 25$$

Higher scores reflect more severity of functional problems. The Persian version with acceptable validity and reliability was used in the present study. The Persian Q-DASH has acceptable reliability (Cronbach's $\alpha=0.90$) and validity (convergent validity: 0.67) [21, 22].

Visual analogue scale-pain (VAS-P) is a subjective measure of pain. The individuals are asked to rate the severity of their pain by marking a 10-cm line between two extremes of 0 (no pain) and 10 (maximum pain) [23]. This analogue scale has high reliability [24].

JAMAR hand-grip dynamometer is used to evaluate grip strength. The participant sits on a chair with the shoulder in adduction and neutral rotation, the arm in 90° flexion, and the forearm and wrist in a neutral position. The individual is asked to press the second handle with minimal pain. The average value of three trials (kilograms) was reported as the participant's score. Grip strength has high reliability in symptomatic and asymptomatic patients [25].

Translation process

After obtaining translation permission from the developer [12], the forward-backward translation process was done in accordance with the international QoL assessment guidelines [26]. Two independent naïve Persian translators translated the English PEM into Persian. These forward versions were discussed in a panel of authors and translators and a preliminary forward version was created. For the backward translation phase, another two translators who were unfamiliar with the original PEM translated the forward version into English. The inconsistencies between backward versions were debated. The final Persian version is provided in Appendix 1.

Procedures

Demographic and patient-related characteristics were recorded. An experienced occupational therapist administered the PEM, Q-DASH, VAS-P, and JAMAR hand-grip dynamometer in a random manner. The PEM was administered two weeks later for determining test-retest reliability. All assessments were performed in the morning. The average assessment time was 20 minutes.

Data analysis

The normal distribution of data was checked via the Shapiro-wilk test. Descriptive statistics (Mean \pm SD, and frequency) were used for demographic and patient-related characteristics. Face validity was determined with 20 patients with wrist disorders in both qualitative and quantitative methods. They were asked to provide their opinion regarding the ambiguity and comprehensibility of questions in the qualitative method. Item impact score was calculated for each question with a 5-point Likert scale with the Equation 2:

$$2. \text{ Item impact score} = \text{importance} \times \text{frequency} (\%)$$

An item impact score of ≥ 1.5 was considered acceptable for each question [27]. Content validity was examined with 20 specialists (i.e. occupational therapists, physical therapists, and physicians) with at least five years of experience in qualitative and quantitative methods. Specialists were asked to express their opinion regarding simplicity, clarity, wording, and grammar. The content validity ratio (CVR) was calculated according to Lawshe [28], with values ≥ 0.42 considered acceptable. Content validity index (CVI) values of >0.79 , $0.79-0.70$, and <0.70 were deemed acceptable, questionable, and unacceptable, respectively [29]. The acceptability of the PEM was determined by floor and ceiling (cut-off <

15%) effects. Convergent validity was explored by examining the relationship between PEM and Q-DASH, VAS-P, and grip strength by the means of Spearman rank correlation coefficient (strong: $\rho \geq 0.70$; moderate: $0.3 < \rho < 0.7$; weak: $\rho < 0.30$) [30]. Internal consistency was assessed using Cronbach's α , with a value > 0.7 deemed as acceptable [31]. Test-retest reliability was evaluated by calculating the intra-class correlation (ICC) coefficient (two-way random, absolute agreement). An ICC > 0.7 is considered acceptable [31, 32]. Absolute reliability was examined by the standard error of measurement (SEM) and minimal detectable change (MDC) values. The SEM and MDC values were estimated by the following formulas: An SEM value of $< \frac{1}{2}$ SD denotes good precision of the measure. A P-value of less than 0.05 was deemed significant in all analyses. Statistical analysis was conducted using IBM SPSS software, version 16.0.

3. Results

The study population (n=90) consisted of 41 males (45.6%) and 55.55% had left wrist disorders. The mean age \pm SD of the participants was 40.86 ± 12.99 . Detailed demographic characteristics are illustrated in Table 1.

The total score of the PEM was not normally distributed. As shown in Table 2, all questions were comprehensive and understandable, with an item impact score and CVR score of > 1.5 and > 0.42 , respectively. All questions except for questions 1 (CVI=0.76) and 10 (CVI=0.73) of section B had a CVI score of < 0.79 . Therefore, question 1 was changed from "The feeling in my hand is now" to "The tactile feeling in my hand is now" based on experts' opinions. Moreover, the Likert response score of question 10 was changed from "embarrassed & self-con-

Table 1. Demographic characteristics of participants

Variables		Mean \pm SD
Age (y)		40.86 \pm 12.99
Q-DASH score		45.46 \pm 9.99
VAS-P score		5.21 \pm 2.37
Grip strength score		14.97 \pm 5.07
Variables		No. (%)
Gender	Male	41(45.6)
	Female	49(54.4)
Education level	High school or less	10(11.3)
	Diploma	34(37.4)
	University graduate	39(43.4)
	Postgraduate	7(7.9)
Affected hand	Dominant	50(55.55)
	Non-dominant	40(44.45)
Surgery history	Yes	28(31.1)
	No	62(68.9)
Diagnosis	Fractures	33(36.67)
	Nerve disorders	28(31.11)
	Tendinopathy	23(25.56)
	Rheumatoid arthritis	6(6.66)

Q-DASH: Quick disabilities of the arm, shoulder, and hand; VAS-P: Visual analogue scale-pain

Table 2. Face and content validity of the Persian PEM

Items	Item Impact Score	Content Validity Ratio (CVR)	Content Validity Index (CVI)				
			Simplicity	Relevancy	Clarity	Total	
Section A	1	2.7	0.5	1	0.9	1	0.96
	2	2.55	0.8	0.9	1	1	0.96
	3	2.7	0.7	1	1	1	1
	4	2.7	0.7	1	1	1	1
	5	3	0.8	1	1	1	1
Section B	1	2.4	0.5	0.9	0.8	0.6	0.83
	2	2.7	0.7	1	1	1	1
	3	2.7	0.9	1	1	1	1
	4	2.7	0.7	0.96	1	1	0.96
	5	3	0.8	1	1	1	1
	6	2.85	0.7	1	1	1	1
	7	3	0.7	1	1	1	1
	8	3	0.6	1	1	1	1
	9	3	0.7	1	1	1	1
	10	1.8	0.5	0.8	0.6	0.8	0.87
	11	2.1	0.4	0.8	0.8	0.8	0.8
Section C	1	2.25	0.5	0.8	0.9	0.9	0.86
	2	2.4	0.8	0.9	0.8	0.9	0.86
	3	2.4	0.8	0.9	0.9	0.8	0.8

scious” to “feeling bad & embarrassed”. After changes were applied, the CVI score for these questions (question 1=0.83; Question 10=0.87) reached acceptable criteria. There was a significant ($P<0.001$) moderate correlation between the “Hand health profile” section of the PEM score with Q-DASH ($\rho=0.47$) and VAS-P ($\rho=0.64$). The “Hand health profile” section of the PEM showed a weak and insignificant ($P>0.05$) correlation with grip strength. The “overall assessment” section of the PEM showed a significant ($P<0.01$) weak correlation ($\rho=0.25$) with Q-DASH and an insignificant ($P>0.05$) weak correlation with VAS-P ($\rho=0.12$) and grip strength ($\rho=0.02$). The total score of the PEM showed a significant moderate correlation with Q-DASH ($\rho=0.51$; $P<0.001$) and VAS-P ($\rho=0.55$; $P<0.001$) and an insignificant weak correlation with grip strength ($\rho=-0.11$; $P>0.05$) (Table 3).

Floor and ceiling effects were 0% for the “hand health profile” and “overall assessment” sections and total PEM score, indicating sufficient acceptability. The Cronbach’s α coefficient values for the “hand health profile” and “overall assessment” sections and total PEM score were 0.72, 0.87, and 0.77, respectively. The ICCs for the “Hand health profile” and “overall assessment” sections and total PEM score was 0.98, 0.97, and 0.96, respectively. The SEM and MDC values were low for the “hand health profile” (SEM=1.01; MDC: 2.81) and “overall assessment” (SEM=0.45; MDC: 1.24) sections and total PEM score (SEM=2.43; MDC=6.72) (Table 3).

Table 3. Convergent validity and reliability of the Persian PEM (n=90)

PEM Variables	Convergent Validity						Reliability				
	Q-DASH		VAS-P		Grip strength		IC	Relative		Absolute	
	Correlation	P	Correlation	P	Correlation	P		ICC	CI	SEM	MDC
							α				
Hand health profile (Section B)	0.47	0.0001*	0.64	0.0001*	-0.11	0.27	0.72	0.98	0.96-0.99	1.01	2.81
Overall assessment (Section C)	0.25	0.01*	0.12	0.25	0.02	0.82	0.87	0.97	0.94-0.99	0.45	1.24
Total score	0.51	0.0001*	0.55	0.0001*	-0.11	0.30	0.77	0.96	0.96-0.98	2.43	6.72

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Abbreviations: Q-DASH: Quick disabilities of the arm, shoulder, and hand; VAS-P: Visual analogue scale-pain; IC: Internal consistency; ICC: Intra-class correlation; CI: Confidence interval; SEM: Standard error of measurement; MDC: Minimal detectable change; α: Cronbach’s alpha.

*Correlations were significant at P<0.01

4. Discussion

The aim of this study was to evaluate the psychometric properties of the PEM in Iranian individuals with wrist disorders. The results suggest that the PEM has acceptable reliability and validity.

The results showed that this measure has favorable translation and all questions have satisfactory face and content validity. The face and content validity of the PEM was established in a consensus meeting by hand surgeon attendees [6, 12]. Schoneveld et al. stated that the PEM has doubtful content validity [6]. However, qualitative content validity was reported as appropriate in the present study. To the authors’ best knowledge, no studies have been conducted to investigate the face and content validity of the quantitative method. Therefore, the item impact score, CVR, and CVI values presented in the present study are novel information and cannot be compared with previous studies.

The total score of the PEM showed a significant moderate correlation with Q-DASH and VAS-P. Forward et al. [17] and Hobby et al. [7] reported a significant high (ρ=0.66-0.85) correlation between the PEM and DASH scores. Higher correlation coefficients in these studies may be explained by the fact that they had a homogeneous sample (i.e. carpal tunnel syndrome or distal radius fracture). The moderate correlation between the PEM and VAS-P is justifiable due to the impact of pain on performance and satisfaction [33]. Additionally, an insignificant weak correlation was demonstrated with grip

strength, a finding consistent with the results of Forward et al. [17]. Grip strength is an objective outcome while the PEM is a subjective measure. Moreover, this finding can be explained through the fact that the PEM measures grip alongside other outcomes (i.e. feeling, cold intolerance, pain, dexterity, flexibility, activities of daily living, work, self-consciousness, and distress). Therefore, grip strength alone has a weak correlation with the PEM.

The acceptability analysis revealed no floor or ceiling effect for the PEM. Schoneveld et al. reported that no information exists for this feature of the measure [6]. Acceptable internal consistency was found for PEM, indicating the homogeneity of the PEM questions. This result was in line with previous studies [7, 11, 14, 17, 34, 35]. The ICC values obtained for the PEM reflect high reliability, which is consistent with the results of Sharma et al. [35]. The SEM and MDC values obtained in this study indicated a small measurement error and sufficient accuracy for use in therapeutic interventions.

The strength of this study was the inclusion of individuals with various wrist disorders. Future studies should be conducted on other populations with different diagnoses, such as neurological disorders.

5. Conclusion

The present study suggests that the PEM has acceptable validity and reliability for measuring performance and satisfaction in individuals with wrist disorders. This

measure might contribute as an outcome measure in research and routine assessments in clinical practice.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the ethics committee of the [Iran University of Medical Sciences](#) (IR.IUMS.REC.1394.9211255207). In order to protect the confidentiality, a code was given to each participant.

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Authors' contributions

Conceptualization, methodology: Laleh Lajevardi and Akram Azad; Investigation and resources: Golara Niketeghad; Writing the original draft: Mahsa Meimandi; Writing, review & editing: Mahsa Meimandi, Laleh Lajevardi and Akram Azad; Funding acquisition and supervision: Laleh Lajevardi.

Conflict of interest

The authors declared no conflict of interest.

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Appendix 1. The inconsistencies between backward versions were debated (The final Persian version is provided)

نسخه فارسی - مقیاس ارزیابی بیمار

Patient Evaluation Measure

نام خانوادگی:

تاریخ ارزیابی:

لطفاً دور شماره‌های را که به وضع موجود شما نزدیک‌تر است خط بکشید. هیچ پاسخ صحیح و غلطی وجود ندارد.

بخش اول: درمان

۱- در طول مداوایم همیشه همان پزشک را ملاقات کرده‌ام.

۱ ۲ ۳ ۴ ۵ ۶ ۷
هیچ‌گاه همیشه

۲- وقتی پزشک من را می‌دید، از وضعیت من آگاه بود.

۱ ۲ ۳ ۴ ۵ ۶ ۷
اصلاً صحیح نیست کاملاً صحیح است

۳- وقتی که در حضور پزشکم بودم، او به من فرصت صحبت کردن می‌داد.

۱ ۲ ۳ ۴ ۵ ۶ ۷
هیچ‌گاه هر قدر می‌خواستم

۴- هر زمان که با دکتر صحبت کردم، او به حرفهایم گوش می‌داد و من را درک می‌کرد.

۱ ۲ ۳ ۴ ۵ ۶ ۷
هیچ‌گاه همیشه

۵- اطلاعات لازم در مورد درمان و پیشرفت آن به من داده شد.

۱ ۲ ۳ ۴ ۵ ۶ ۷
هیچ‌گاه همه آنچه را که می‌خواستم

بخش دوم: وضعیت سلامت دست - وضعیت دست شما در حال حاضر چگونه است؟

۱- در حال حاضر حس لامسه دستم در حالت ... است.

۱ ۲ ۳ ۴ ۵ ۶ ۷
بی‌حسی طبیعی

۲- وقتی که دست من سرد و یا مرطوب است، درد ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
غیرقابل تحمل است وجود ندارد

۳- اغلب اوقات درد دستم ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
غیرقابل تحمل است وجود ندارد

۴- مدت زمانی که دستم درد می‌کند ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
هیچ‌وقت همیشه

۵-زمانی که دستم را برای حرکات ظریف بکار می‌برم، حرکاتش ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
فاقد مهارت است مهارت است

۶-عموما زمانی که دستم را حرکت می‌دهم ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
بدون تعطف است انعطاف‌پذیر است

۷-در حال حاضر قدرت گرفتن دست من ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
ضعیف است قوی است

۸-در حال حاضر برای انجام فعالیت‌های روزانه، دستم ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
کارایی ندارد مشکلی ندارد

۹-در حال حاضر دستم برای امور مربوط به شغلم ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
کارایی ندارد مشکلی ندارد

۱۰-وقتی که به ظاهر دستم نگاه می‌کنم ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
احساس بدی دارم و خجالت می‌کشم نگران نمی‌شوم

۱۱-بطور کلی وقتی در مورد دستم فکر می‌کنم ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
خیلی ناراحت می‌شوم حس بدی ندارم

بخش سوم: ارزیابی کلی

۱-در مجموع، مداوای من در بیمارستان ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
اصلا رضایت بخش نبوده است بسیار رضایت بخش بوده است

۲-بطور کلی وضعیت دستم در حال حاضر ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
اصلا رضایت بخش نبوده است بسیار رضایت بخش بوده است

۳-وضعیت کنونی دست من با توجه به آسیب و شرایط اولیه آن ...

۱ ۲ ۳ ۴ ۵ ۶ ۷
بدتر از چیزی است که انتظار داشتم بهتر از چیزی است که انتظار داشتم

"نسخه فارسی شده PEM توسط لاله لاجوردی^۱، گلارا نیک‌اعتقاد، اکرم آزاد، مهسا میمندی"

نکته: لطفا پس از استفاده از فرم به منبع زیر ارجاع بزنید. (lajevardi.1@iums.ac.ir)