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Brazilian version of the Patient Rated Wrist Evaluation (PRWE-BR): Cross-cultural adaptation, internal consistency, test-retest reliability and construct validity

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ABSTRACT

Study design: Clinical measurements.
Purpose: Perform the translation and cross-cultural adaptation of the Patient Rated Wrist Evaluation (PRWE) into a Brazilian version (PRWE-BR), and assess its internal consistency, test-retest reliability and construct validity.
Methods: PRWE-BR was developed using standardized guidelines. Sixty-one patients with different wrist injuries were recruited. They were submitted to two assessments, 2–7 days apart. Reliability was measured by internal consistency (Cronbach's alpha) and test-retest reliability (Intraclass Correlation Coefficient). Construct validity was determined via hypothesis testing (Spearman's correlation) of correlations with subscales of SF-36 and DASH.
Results: PRWE-BR and its subscales achieved high internal consistency (Cronbach's alpha ≥ 0.85) and excellent test-retest reliability (ICC ≥ 0.90). Construct validity was established by confirmation of 85.7% of our previously formulated hypotheses.
Conclusions: PRWE-BR is a valid and reliable tool for the assessment of pain and dysfunction in Brazilian patients with injuries involving the wrist joint.
Level of evidence: N/A

Introduction

Orthopedic wrist injuries are fairly common in clinical practice, resulting in pain and dysfunction that can persist for a substantial period of time.[1] Usually therapists rely on the assessment of objective measures, such as goniometry and dynamometry, but it is known that those measures are not able to capture the patient's perception of the outcomes.[2] For that reason, it is recommended that therapists should integrate patient rated outcome measures to their clinical practice assessment tools.[3,4]

The majority of currently available patient rated outcome measures are developed in English speaking countries, and must be submitted to a standardized process of cross-cultural adaptation and measurement properties testing prior to its use in other language and cultural context.[5,6]

There are some upper extremity assessment questionnaires available in Brazilian Portuguese, such as the Disabilities of the Arm, Shoulder and Hand (DASH), the Patient Rated Tennis Elbow Evaluation (PRTEE), the Boston Carpal Tunnel Questionnaire (BCTQ), the Michigan Hand Questionnaire (MHQ) and the Shoulder Pain and Disability Index (SPADI).[7–11] Nevertheless, until the present moment there is no specific instrument to assess outcomes after injuries on the wrist joint. The Patient Rated Wrist Evaluation (PRWE) is a 15 item joint-specific instrument originally developed with the purpose of assessing pain and function in patients with distal radius fractures.[12] The PRWE allows patients to rate their levels of pain (5 items) and disability (10 items) on a 0–10 scale. A detailed description of the development process, scoring instructions and testing of the measurement properties of PRWE are available elsewhere.[13]

Recent studies point out PRWE as one of the most common upper extremity patient rated outcome measures in clinical practice, usually applied in patients with distal radius fractures, but also

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in several other wrist and hand injuries.[3] Regarding its measurement properties, PRWE has shown excellent reliability, validity and responsiveness.[14,15] MacDermid and colleagues concluded that PRWE is more sensitive to detect small changes in clinical outcomes of patients with wrist injuries when compared to other questionnaires, such as SF-36 and DASH.[16] Also, PRWE is easier and faster to fill out when compared to the DASH, considering it has fewer items.[15,17]

The PRWE is available in several languages, including Danish, Hindi, Korean, Italian, German, Swedish, Dutch, Japanese and Chinese.[17–27] Besides those languages, there are reported translations in Czech, French, Hungarian, Russian, Ukranian and Norwegian.[28,29]

Purpose of the study

The aim of the present study is to perform the translation and cross-cultural adaptation of the Brazilian version of the Patient Rated Wrist Evaluation (PRWE-BR), and assess the following measurement properties: internal consistency, test-retest reliability and construct validity.

Methods

Initially, we established contact with the author of the original version, who gave us permission to conduct the cross-cultural adaptation of PRWE. The present study was approved by the local research Ethics Committee (HCFMRP/USP – number 32330/2012).

Translation and cultural adaptation process

Translation and cross-cultural adaptation of PRWE was conducted according to the guidelines proposed by Beaton,[6] through six documented stages, as follows.

The first stage involved the forward translation of the original PRWE, performed by two native Brazilian Portuguese speakers. One of the translators was a physical therapist with fluency in the English language, aware of the purpose of our study. The second translator was an English teacher; lay on the subject of the questionnaire. Both translators were instructed to provide alternative translations to all terms considered difficult to translate, and also to use a vocabulary that would be easily understood by a 12-year old Brazilian person.[5] The second stage was the synthesis of both initial translations, performed by an expert committee composed of five experienced individuals in the field of interest, being four hand therapists and one hand surgeon. After that stage, the synthetic version was submitted to two back translations, performed by two independent native English speakers, who did not had any contact with the original questionnaire prior to their back translation. The expert committee gathered once again in possession of the original questionnaire, its translations and back translations to consolidate the pre-final version of the instrument, and minor cultural adaptations were performed. All decisions were achieved in consensus. The pre-final version was then submitted to pretesting on 30 native Brazilian Portuguese speakers, being 15 health professionals and 15 patients with wrist injuries. The respondents were asked to read the instructions and items carefully, and state their comprehension through a check box containing the answers "yes" and "no". A comprehension level of at least 80% was established for all items and instructions (e.g., in case any item or instruction was not understood by more than 20% of respondents, it would be reformulated and tested on a new sample until it reached our established level of comprehension).[7]

Testing of the measurement properties of PRWE-BR

Subjects

Sixty-one patients with orthopedic wrist injuries, treated by conservative or surgical methods and referred to physical therapy were prospectively recruited during this stage. Inclusion criteria were to be a Brazilian Portuguese native speaker, with age of at least 18 years old and ability to fill out the questionnaires without great assistance. All patients included in our study were out of their immobilization apparatus (casts or orthoses) for at least one week prior to the assessment, and where undergoing treatment for their injury (either weekly physical therapy sessions or monthly appointments for follow up on their home based rehabilitation program). Exclusion criteria were wrist injuries of rheumatologic or neurological background and concomitant injuries on other upper extremity joints.

Outcome measures

PRWE. As presented earlier, the Patient Rated Wrist Evaluation (PRWE) is a 15 item joint-specific instrument originally developed with the purpose of assessing pain and function in patients with distal radius fractures.[12] The pain subscale (PRWE-P) is composed of five items, being four of them related to the intensity and one about the frequency of pain. The function subscale (PRWE-F) comprises the ten remaining items; six of those about specific activities and four about usual activities. Each item is scored on a 0–10 scale. The total score (100 points) is achieved by adding the pain subscale score (sum of the first 5 items) to the function subscale score (sum of the 10 remaining items divided by two). The higher score indicates the worst level of pain and/or dysfunction perceived by the patient.[12–14]

DASH. The Disabilities of the Arm, Shoulder and Hand (DASH) is a region-specific questionnaire widely used as an outcome instrument in patients with upper limb injuries.[30] It has 30 items rated on a Likert scale of five points, with a total score ranging from 0 to 100. Larger scores indicate worst perceptions of pain and disability on the upper limb. The DASH is considered a reliable, valid and responsive tool tested in several populations, including patients with distal radius fractures.[31] For the purpose of our study, we used the Brazilian version of DASH.[7]

SF-36. The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) is a self-report quality of life assessment questionnaire. It has 36 items, divided in eight subscales: physical functioning, role physical, bodily pain, general health perceptions, vitality, social role functioning, emotional role functioning and mental health.[32] Each scale is scored in a range from 0 to 100. The lower score represents the worst degree of disability for that particular scale. The SF-36 is currently available in several languages, including Brazilian Portuguese.[33] For the purpose of our study, we collected scores for the following subscales: physical functioning (PF), role physical (RP), bodily pain (BP) and mental health (MH).

Data collection protocol

At baseline assessment, patients who fulfilled our inclusion criteria and agreed to participate were instructed about the purpose of the study and signed an informed consent term. We collected information about their age, gender, hand dominance, type of injury, injured side, cause of injury, treatment method and surgical procedures. Then, patients randomly filled out the three outcome measures: PRWE-BR, DASH and SF-36.

Patients returned after two to seven days for the second assessment. Those who were unable to return were given a prepaid envelope with a copy of PRWE-BR, with clear instructions to fill out the questionnaire during the predetermined interval (2–7 days) and return it via mail.

Data analysis

The translation and cross-cultural adaptation stage was mainly composed of descriptive and qualitative data. We calculated the mean scores for all patient rated outcome instruments applied during the measurement properties testing stage.

The floor and ceiling effects for PRWE-BR total score and its subscales were determined. By definition, floor and ceiling effects occur when a significant amount of respondents acquire scores in both extremes of a scale, which would present a problem when assessing the responsiveness of the instrument.[34] Considering the maximum and minimal possible scores of PRWE-BR (0–100 for the total score; 0–50 for the pain and function subscales), we considered floor effects if the total score was between 0 and 10, and in the subscales between 0 and 5. Ceiling effects were considered if the total score ranged from 90 to 100 and in the subscales, 45–50. We calculated the percentage of individuals with scores in those ranges, and established a tolerance level of 15% of occurrence for floor and ceiling effects.[19,34]

Test-retest reliability and internal consistency

By definition, test-retest reliability is the ability of an instrument to obtain the same results over time when applied in a sample of stable individuals.[34] Patients filled out the PRWE-BR on two different occasions, with 2–7 days of interval, a period we considered short enough to assume our patients remained stable. We calculated the Intraclass Correlation Coefficient ($ICC_{2,1}$ agreement)[35] between those two measurements in order to assess test-retest reliability of all items, both subscales and the total score of PRWE-BR. ICC values range from 0 to 1; values closer to 1 indicate higher correlation.[35] The interpretation of ICC values was conducted according to the classification proposed by Fleiss,[36] as follows: ICC < 0.40 = poor reliability; 0.40 < ICC < 0.75 = moderate reliability; ICC > 0.75 = excellent reliability.

Internal consistency is defined as the degree of interrelationship between the items of an instrument.[34] We calculated Cronbach's alpha as a parameter of internal consistency for both subscales and the total score of PRWE-BR.[37] Cronbach's alpha can range from 0 to 1, with higher values indicating greater interrelatedness between items. According to the literature, values ranging from 0.70 to 0.95 are considered more adequate for this parameter.[34]

Construct validity

Validity is a measurement property that intends to show if an instrument really measures what is supposed to measure.[34] Ideally, when testing the validity of a new instrument – such as a cross-culturally adapted version of a questionnaire – is desirable to compare it with a gold standard reference in the constructs measured, a concept known as criterion validity.[34] Since there are no gold standard patient rated outcome measures, validity can be assessed by correlations with other instruments that measure the same constructs via hypothesis testing.[34] We assessed the construct validity of PRWE-BR based on previously formulated hypotheses of correlations between the three outcome measures. Nonparametric Spearman's correlation coefficient was used to analyze construct validity. The values were interpreted based on Dancey and Reidy[38] classification system: 0.1–0.3 = weak correlation; 0.4–0.6 = moderate correlation; ≥0.7 = strong correlation. Due to the differences in scoring methods amongst the

questionnaires, we formulated both direct and inverse correlations. After the collection of data reported in the validation of PRWE and its different versions,[14,15,17,18,20–22,24–27] we formulated the following hypotheses considering the magnitude and direction of correlations:

a) *strong direct correlation* ($r_s \geq 0.7$) between the total score of PRWE-BR and the DASH;
b) *moderate inverse correlation* ($-0.4 \leq r_s \leq -0.6$) between the total score of PRWE-BR and the physical functioning subscale of SF-36 (SF-36 PF);
c) *moderate inverse correlation* ($-0.4 \leq r_s \leq -0.6$) between the pain subscale of PRWE-BR (PRWE-BR-P) and the bodily pain subscale of SF-36 (SF-36 BP);
d) *moderate inverse correlation* ($-0.4 \leq r_s \leq -0.6$) between the function subscale of PRWE-BR (PRWE-BR-F) and the role physical subscale of SF-36 (SF-36 RP);
e) *moderate inverse correlation* ($-0.4 \leq r_s \leq -0.6$) between the total score of PRWE-BR and the bodily pain (SF-36 BP) and role physical (SF-36 RP) subscales of SF-36;
f) *weak inverse correlation* ($-0.1 \leq r_s \leq 0.3$) between the total score of PRWE-BR and the mental health subscale of SF-36 (SF-36 MH);
g) "*The total score of PRWE-BR will present a stronger correlation with the DASH when compared to the role physical and bodily pain subscales of SF-36*"

We determined that the construct validity of PRWE-BR would be considered satisfactory in case 75% of our previously formulated hypotheses were confirmed, according to criteria described in the literature.[39]

Statistical analysis

All statistical analyses were conducted using the Statistical Analysis Software, version 9.0 (SAS 9.0™) and R 3.0.1. for Windows™. The values for significance were set at $p < 0.05$.

Results

Translation and cross-cultural adaptation

The PRWE was developed with quite simple and universal terms, so only minor cultural adaptations were performed to our Brazilian version in order to broaden the understanding possibilities of some items.

Due to the fact that the Brazilian population is used to the metric system, we modified the item "carry a 10 lb object in my affected hand" so that the weight would be expressed in kilograms (5 kg). To provide a better and more comprehensive understanding, we added the term "organization" to the item "household work (cleaning, maintenance)". It was discussed that household work includes an organizational task (moving furniture and objects and placing them back after the cleaning process) that could be overlooked by the respondents. Also in order to assure a better understanding, the word "leisure" was added to the item "recreational activities". The term "leisure" is more familiar to the Brazilian population when compared to "recreation". We chose to maintain both words so that the item would still be true to the original version. All changes were approved by the author of the original PRWE.

All items, except "when it is at its worst" achieved 100% comprehension amongst the respondents during the pretesting stage. Two volunteers (6.6% of our sample) had difficulties understanding the referred item. After a brief explanation, both

individuals successfully understood what the question meant, but since they weren't able to understand without assistance we considered as a failure. Nevertheless, all items and instructions were adequately understood by more than 80% of respondents. Thus, we considered the pretesting stage completed since we fulfilled our pre-established criteria, without any need for reformulation of items and instructions. After the completion of the cross-cultural adaptation process, all written reports were sent to the author, which gave us her approval. A recently published study included a report of our cross-cultural adaptation, as well as other studies with the same purpose that were conducted in other countries.[28]

Testing of measurement properties

The characteristics of the sample recruited during the testing of measurement properties of PRWE-BR are shown in Table 1. The majority of patients included in our study were males (59%), with mean age of 39.46 years old (SD 15.27), right-handed (90%), sustained a distal radius fracture (59%) to the dominant limb (61%) and were injured/had surgery for an average of 13.33 weeks (SD 8.30). The main mechanism of injury was almost equally divided between falling with an outstretched hand (40.9%) and car/motorcycle accidents (39.3%). The majority was submitted to some sort of surgical treatment (82%), being the most common method the open reduction with internal fixation (64%).

All patient rated outcome measures were answered without missing items. A few respondents referred minor difficulties

Table 1
Descriptive summary of subjects

	n = 61
Recruited	n = 61
Age	Mean 39.46 years (SD 15.27), minimum 19, maximum 72
Gender	25 (41%) female/36 (59%) male
Dominance	55 (90%) right-handed/6 (10%) left-handed
Injured side	35 (57%) right side | 26 (43%) left side
Dominant limb injured	37 (61%) Yes | 24 (39%) No
Time since injury/surgery	Mean 13.33 weeks (SD 8.30), minimum 2, maximum 36
Diagnosis	
Distal radius fracture (DRF)	36 (59%)
Scaphoid fracture	4 (6.5%)
DRF + scaphoid fracture	3 (4.9%)
DRF + ulna fracture	5 (8.1%)
Kienböck's disease	4 (6.5%)
Carpal ligament injury	2 (3.2%)
Scaphoid malunion/nonunion	2 (3.2%)
Scaphoid fracture + ligament injury	4 (6.5%)
Wrist synovial cyst	1 (1.6%)
Cause of injury	
Fall with outstretched hand	25 (40.9%)
Car/motorcycle accident	24 (39.3%)
Fall from great heights	3 (4.9%)
Work related injury	4 (6.5%)
Atraumatic causes[a]	5 (8.1%)
Treatment method	
Conservative	11 (18%)
Surgical	50 (82%)
Open reduction, internal fixation (ORIF)	32 (64%)
Arthrodesis	4 (8%)
Resection of the first carpal row	3 (4.9%)
External fixation	2 (3.2%)
Other procedures[b]	9 (18%)

[a] Injuries due to idiopathic or degenerative causes, such as Kienböck's disease or synovial cyst.
[b] Other procedures, including Kirschner wire osteosynthesis and ligament reconstruction.

Table 2
Outcome data summary

	Baseline assessment		Second assessment	
	Mean	SD	Mean	SD
PRWE-BR-P	25.74	10.61	24.52	11.45
PRWE-BR-F	25.67	12.50	24.23	13.28
PRWE-BR	51.41	21.45	48.75	23.36
DASH	36.76	18.38	–	–
SF-36 PF	69.59	24.05	–	–
SF-36 RP	20.49	32.75	–	–
SF-36 BP	51.18	20.33	–	–
SF36 MH	67.02	19.23	–	–

SD – standard deviation; PRWE-BR – total score of the Brazilian version of PRWE; PRWE-BR-P – Pain subscale of PRWE-BR; PRWE-BR-F – Function subscale of PRWE-BR; DASH – Disability of the Arm, Shoulder and Hand questionnaire; SF-36 PF – Physical functioning subscale of SF-36; SF-36 PRF – Role physical subscale of SF-36; SF-36 BP – Bodily pain subscale of SF-36; SF-36 MH – Mental health subscale of SF-36.

regarding the different scoring methods of the questionnaires. The mean values and standard deviations of all outcome measures at baseline and at the second assessment are presented in Table 2. There were no floor or ceiling effects for the total score of PRWE-BR. We observed ceiling effects (individuals with scores >45) in 1.6% of respondents on the PRWE-BR-P and 3.2% on PRWE-BR-F. Floor effects (scores <5) occurred in 1.6% of volunteers on PRWE-BR-P and 4.9% for PRWE-BR-F. Still, these percentages are below the tolerance threshold, previously set at 15%.

Internal consistency and test-retest reliability

The internal consistency of PRWE-BR and its subscales was high, with Cronbach's alpha ranging from 0.85 to 0.92 (Table 3). Fifty eight out of the 61 patients filled out the questionnaire twice, and their data was considered for test-retest analysis. The three patients lost to follow up were due to unanswered/not mailed questionnaires. The ICC values for the total score (0.90), pain and function subscales (0.90 and 0.92 respectively) demonstrated excellent reliability (Table 3). Analysis of items individually showed that the least reliable item was "how often do you feel pain?" (0.77), and the most reliable "using toilet paper with my affected hand" (0.95). Apart from item 5, all items achieved ICC ≥ 0.81.

Construct validity

PRWE-BR showed high direct correlation with the Brazilian DASH ($r_s = 0.7$) and high inverse correlation with SF-36 PF ($r_s = -0.7$). The pain subscale of PRWE-BR (PRWE-BR-P) showed moderate inverse correlation with the SF-36 BP subscale ($r_s = -0.4$), the function subscale (PRWE-BR-F) showed moderate inverse correlation with the SF-36 RP subscale ($r_s = -0.4$), as well as the total score of PRWE-BR regarding the SF-36 BP and SF-36 RP subscales ($r_s = -0.48$ and $r_s = -0.43$, respectively). A weak inverse correlation ($r_s = -0.32$) was found between the total score of PRWE-BR and the SF-36 MH subscale (Table 4).

All described correlations were statistically significant ($p \leq 0.01$), resulting in the confirmation of 85.7% of our previously formulated hypotheses.

Table 3
Internal consistency (Cronbach's alpha) and test-retest reliability (ICC) of PRWE-BR and its subscales

	Cronbach's alpha (95% CI)	ICC (95% CI)
PRWE-BR-P	0.85 (0.77–0.90)	0.90 (0.84–0.94)
PRWE-BR-F	0.89 (0.84–0.93)	0.92 (0.87–0.95)
PRWE-BR total score	0.92 (0.88–0.94)	0.90 (0.83–0.94)

ICC – Intraclass Correlation Coefficient; 95% CI – 95% confidence interval; PRWE-BR-P – Pain subscale of PRWE-BR; PRWE-BR-F – Function subscale of PRWE-BR.

Table 4
Construct validity of PRWE-BR[a]

	DASH	SF-36 PF	SF-36 RP	SF-36 BP	SF-36 MH
PRWE-BR-P	–	–	–	−0.4 (p < 0.01)	–
PRWE-BR-F	–	–	−0.4 (p < 0.01)	–	–
PRWE-BR	0.7 (p < 0.01)	−0.7 (p < 0.01)	−0.4 (p < 0.01)	−0.4 (p < 0.01)	−0.3 (p = 0.01)

PRWE-BR − Brazilian version of the Patient Rated Wrist Evaluation; PRWE-BR-P − Pain subscale of PRWE-BR; PRWE-BR-F − Function subscale of PRWE-BR; DASH − Disability of the Arm, Shoulder and Hand questionnaire; SF-36 PF − Physical functioning subscale of SF-36; SF-36 PRF − Role physical subscale of SF-36; SF-36 BP − Bodily pain subscale of SF-36; SF-36 MH − Mental health subscale of SF-36; p − p-value for statistical significance.
[a] Spearman's correlation coefficients.

Discussion

The PRWE-BR achieved excellent test-retest reliability, with ICC values for the total score and subscales ≥0.90. Such reliability values are consistent with those reported in the original version and in some of the different cross-culturally adapted versions found in the literature (Table 5).[14,17–20,22,25,26] The lowest ICC for the total score was reported in the Hindi version, with ICC = 0.81.[19] According to the authors, it is likely that the patients who participated in their study experienced an improvement in their status, which led to a lack of the stability needed for test-retest analysis.[19] It is imperative that individuals remain clinically stable during test-retest reliability analysis, but is fairly difficult to guarantee such stability. Parameters such as pain and difficulty performing activities may present daily changes, especially during the acute phase of wrist injuries. To minimize the effects of this natural fluctuation in clinical status, a short interval between assessments is recommended.[34] Considering that only one subject of our sample was experiencing the acute phase of injury (2 weeks after synovial cyst excision), we considered that our interval was short enough to ensure minimal clinical stability for the majority of participants.

The internal consistency of PRWE-BR was estimated through Cronbach's alpha, the main parameter also chosen in several versions of PRWE worldwide. Table 6 shows the internal consistency of PRWE-BR and its subscales compared to other cross-cultural adaptation studies, demonstrating great similarity amongst the findings for that particular measurement property.[17–22,24–27]

Regarding the construct validity, the PRWE-BR presented a strong correlation with the Brazilian version of the DASH ($r_s \geq 0.7$) as expected since both questionnaires assess the constructs of pain and dysfunction in the upper limb. Similar correlations were found during the measurement properties testing of the original version[15] as well as in other cross-cultural adaptations of PRWE.[17,20,21,24–26] During the analysis of correlations with the different subscales of SF-36 that measure similar constructs of the PRWE-BR (SF-36 PF,

Table 5
Test-retest reliability of PRWE-BR in comparison to other studies (ICC values)

	Total score	Pain subscale	Function subscale
Present study	0.90	0.90	0.92
MacDermid (1998)[a]	0.90	0.90	0.88
Imaeda (2010)	0.92	0.86	0.93
Brink (2009)	0.89	0.88	0.88
Schonnemann (2013)	0.88	–	–
Mehta (2012)	0.81	0.76	0.85
Hemelaers (2008)	0.94	0.86	0.95
Kim (2013)	0.96	0.96	0.95
Navarro (2011)	0.93	–	–

PRWE-BR − Brazilian version of the Patient Rated Wrist Evaluation; ICC − Intraclass Correlation Coefficient.
[a] Results from Group 1 (patients with DRF who were still enrolled in therapy).

Table 6
Internal consistency of PRWE-BR in comparison to other studies (Cronbach's alpha)

	Total score	Pain subscale	Function subscale
Present study	0.92	0.85	0.89
Imaeda (2010)	0.95	0.90	0.95
Fairplay (2012)	0.96	–	–
Wilcke (2009)	0.94	–	–
Navarro (2011)	0.97	0.93	0.97
Schonnemann (2013)	0.94	–	–
Wah (2006)[a]	–	0.92	0.95
Mehta (2012)	0.89	0.86	0.92
Brink (2009)	0.92	0.89	0.91
Hemelaers (2008)	0.89	0.81	0.85
Kim (2013)	0.94	0.93	0.95

PRWE-BR − Brazilian version of the Patient Rated Wrist Evaluation.
[a] Based on the second assessment.

SF-36 RP and SF-36 BP), we found moderately inverse correlations ($-0.4 \leq r_s \leq -0.6$), considering that SF-36 measures the constructs of pain and dysfunction in a more generic way, with items that include both upper and lower limbs. Other studies also used SF-36 as an outcome measure when assessing construct validity, with findings that resemble ours.[14,21,22,27] The correlation between PRWE-BR and the mental health subscale of SF-36 was confirmed to be weak ($r_s = -0.3$), in concordance with the results found in the original version of PRWE.[14] The majority of our previously formulated hypotheses were confirmed, except for the one between PRWE-BR and the physical functioning subscale of SF-36 (SF-36 PF), which we believed it would be an inverse correlation of weak magnitude ($-0.4 \leq r_s \leq -0.6$). However, we found a strong inverse correlation ($r_s = -0.7$) between those measures. We believe the reason for this finding is that the SF-36 PF subscale is composed of many items that assess lower limb function. It is possible that the volunteers who participated in our study scored higher in that particular subscale due to the presence of comorbidities (e.g., concomitant lower limb trauma, degenerative lesions of the hip, knee or ankle, among others), which were not accounted for during the baseline assessment.

No significant occurrence of flooring and ceiling effects was observed in our sample, as well as in other versions that analyzed the same effects.[17,19,20,22,26] The low percentage of responses at the extremes of the scales indicates that the PRWE-BR is capable of detecting relevant changes in the patient's perception of outcomes.[34]

Minor cultural adaptations were needed to develop the PRWE-BR, being the most distinguished the alteration of the item "carry a 10 lb object in my affected hand", in which the weight of the object was changed to kilograms. The same modification was also performed in other versions of PRWE.[18–20] Some versions of PRWE contain more significant modifications because of conflicts with their cultural context. For instance, the two Swedish versions of PRWE altered the item "turn a door knob using my affected hand" due to the fact that door knobs are unusual in Sweden.[17,24] However, each of the versions expressed different solutions to this problem: the authors of the first version[24] opted to change the referred item to "open a tight or new jar", while the second version[17] chose to modify the item to "turning a tap or key". The same cultural mismatch related to the design of door opening devices was described in the Danish and Italian versions of PRWE.[18,21] Another item that was subject to modification in some cross-culturally adapted versions of PRWE is "cut meat using a knife in my affected hand."[18–20] For instance, given that the vast majority of the Indian population is adept to vegetarianism, the referred item on the Hindi version of PRWE was altered to "cut vegetables using a knife in my affected hand."[19]

During the pretesting stage of the cross-cultural adaptation process of PRWE-BR, the item to which the volunteers reported greater difficulty of comprehension was "when it is at its worst", that belongs to the pain subscale. The same item was also reported as the most problematic in other versions of the PRWE that were compiled in a recent study.[28] The authors suggest that the referred item should be addressed in case there is a revision of the PRWE questionnaire, in order to solve this comprehension setback.[28]

Our study was concluded with some limitations, being the main one related to the sample size. Our subjects were recruited by convenience, and there was no prior sample size calculation. Despite our promising findings, we believe that a larger sample would provide more robust data, as well as allow a more profound and refined analysis of our results. There is a particular type of validity analysis that is highly dependent on sample size – factor analysis. According to the literature, a minimum of 100 individuals are needed in order to conduct this analysis.[34] Factor analysis is an important part of validity testing, defined as structural validity.[34] We found only two cross-culturally adapted versions of PRWE submitted to factor analysis – the Chinese and Japanese versions.[26,27] The authors of the Japanese version concluded through exploratory factor analysis that the function subscale of PRWE could be further divided in two subscales: specific activities and usual activities.[26] Due to time restraints, we did not conduct the analysis of the responsiveness of PRWE-BR. Responsiveness is defined as the ability of an instrument to detect important clinical changes through time.[40] Even though our study showed some limitations, we consider that the PRWE-BR has measurement properties similar to the original version and the majority of the different versions available in the literature.

It should be noted that in 2004 the PRWE questionnaire was modified to also encompass the evaluation of individuals with hand injuries, becoming known as Patient Rated Wrist/Hand Evaluation, or PRWHE.[15] The structure of the questionnaire was slightly altered with the inclusion of two optional items related to aesthetics, which are not considered in the final score of the instrument. Given that the instructions for completion and the scoring method remained unchanged, the author ensures that the measurement properties of the PRWE can be extrapolated to the PRWHE.[13]

We understand that evaluating a cross-culturally adapted instrument is an ongoing procedure, and that the present study laid the cornerstone of that process. Based on this assumption, we suggest further studies on PRWE-BR, with the purpose of increasing its coverage and evaluating the measurement properties yet unknown.

Conclusions

We conclude that the PRWE-BR is a valid and reliable tool for the assessment of pain and dysfunction in Brazilian patients with injuries involving the wrist joint, with measurement properties similar to the original version of PRWE and several cross-culturally adapted versions available in the literature.

Acknowledgments

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