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# The patient-rated wrist and hand evaluation was successfully translated to the Slovenian language

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ABSTRACT

*Background:* The Patient-Rated Wrist and Hand Evaluation (PRWHE) is one of the widely used PROMs in the hand rehabilitation.
*Purpose:* To develop the Slovenian version of the PRWHE (PRWHE-Slo) and to evaluate its psychometric properties.
*Study design:* A single-centre observational prospective cohort study.
*Methods:* Fifty patients with distal radius fracture (DRF) were enrolled in the study. Construct validity was assessed by examining the correlations between the PRWHE-Slo and QuickDASH, EQ-5D-5L, wrist ROM, and grip strength. Reliability was evaluated by determining internal consistency (Cronbach's alpha) and test-retest reliability (intraclass correlation coefficient (ICC)). The standard error of measurement (SEM) and the minimal detectable change (MDC) were determined. The responsiveness of the PRWHE-Slo was assessed with the effect size (ES) and standardised response mean (SRM).
*Results:* The Cronbach's alpha value of 0.96 and the ICC (95% CI) value of 0.95 showed excellent internal consistency and reliability for the total PRWHE-Slo score. When assessing construct validity of PRWHE-Slo, there was a strong positive correlation between all subscales and total scores of the PRWHE-Slo and the QuickDASH (r-values ranging from 0.72 to 0.83). The unrelated dimensions such as the function subscale of the PRWHE and the mobility and anxiety/depression subscales of the EQ-5D-5L were not statistically significantly correlated. Grip strength was moderately negatively correlated with all PRWHE subscales, whereas ROM showed no statistically significant correlations with any of the PRWHE-Slo subscales. SEM and MDC for the total PRWHE-Slo score were 5.40 and 14.97, respectively. The PRWHE-Slo proved to be highly responsive in DRF patients with SRM and ES values of 1.27 and 0.91, respectively.
*Conclusions:* The psychometric analysis of this study shows the PRWHE-Slo to be reliable, valid, and responsive PROM for assessing pain and disability in patients after DRF.



## Introduction

The patient reported outcome measures (PROMs) are nowadays considered a constituent part of the rehabilitation assessment. With the aim of reliably comparing the results among different studies, widely used outcome measures are to be encouraged for the assessment. To overcome the language and cultural differences, the PROM must follow the uniform cross-cultural translation procedure to ensure the translated version assesses the same construct as the original version. The Patient-Rated Wrist and Hand Evaluation (PRWHE) is one of the widely used PROMs in the hand rehabilitation. It was first published in 1996 as the Patient-Rated Wrist Evaluation (PRWE) that was originally developed to assess the impact of wrist pain and disability on the activities of daily living in individuals with distal radius fracture (DRF).[1] It was later

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modified to the PRWHE to address various hand conditions. In 2019 the questionnaire was updated to surpass some of the cross-cultural differences and its format and language was simplified.[2]

The aim of this study was to develop the Slovenian version of the PRWHE (PRWHE-Slo) and to evaluate its psychometric properties.

### Original measure

Patient-Rated Wrist and Hand Evaluation (PRWHE).[2]

### Construct measured

The PRWHE is a region-specific PROM for wrist and hand disorders that assesses pain and disability over 2 subscales: pain and function.

### Structure

The PRWHE contains 15 items divided into 2 subscales and additional 2 items in the aesthetic subscale that are not included in the final score. The Pain subscale consists of 5 items addressing severity, intensity and frequency of pain. Other 10 items are part of the Function subscale where 6 items focus on the specific activities, and 4 items address broader usual activities.

### Scoring

Each item in both subscales is scored on an 11-point numerical scale from 0 to 10, where 0 indicates no pain or impairment and 10 represents the worst pain or inability to perform a certain activity. Pain and function scores are weighted equally by first dividing the sum of function score by 2. The sum of both subscale scores then represents the total score ranging between 0 and 100 where 0 denotes the best and 100 the worst functional outcome.

### Current language and cultural context

The translated version of PRWHE-Slo is intended to be used by native Slovenian speakers with wrist and hand disorders where cultural context is similar to the context where questionnaire was originally developed. Potential issues related to cross-cultural differences are further reduced by basing our translation on the revised streamlined version of the PRWHE from 2019.[2]

### Cross-cultural translation process

The permission to conduct the cross-cultural adaptation of the PRWHE was attained from MacDermid. Translation and cross-cultural adaptation process followed the guidelines proposed by Beaton et al.[3]

### Contributors

Three physical and rehabilitation medicine (PRM) specialists, 1 PRM resident, 2 occupational therapists (OT), 15 healthy volunteers, 15 patients with DRF, and 3 certified bilingual translators were involved in the translation process.

### Forward translation

PRWHE was independently translated from its original English version into Slovenian by 2 native Slovenian bilingual translators. One of them was a PRM resident and the other was a professional translator without medical background. Both translations were compared and merged by the above-mentioned translators and the expert committee composed of 3 bilingual PRM specialists and 2 bilingual OTs. The first Slovenian version of the PRWHE was obtained and in the next stage backward translated.

### Backward translation

Backward translation was performed independently by 2 certified native English translators without medical background, blinded to the original version of PRWHE and not participating in the study protocol.

### Reconciliation and harmonization

The expert committee reviewed both forward and backward translations and compared them with the updated original version of the PRWHE. Potential discrepancies were discussed until consensus was reached. At the end of this stage the pre-final Slovenian version of the PRWHE-Slo was obtained.

### Adaptation of items

During the translation process only the item “turn a doorknob with your affected hand” needed to be modified where the word “doorknob” was changed to “turning a key,” since doorknobs are not common in the Slovenian cultural context. The same adaptation was made in the Swedish cross-cultural adaptation.[4] The expert committee also discussed a possible modification to “open a door handle” which was used in the Finnish translation.[5] The final consensus was reached to use a phrase “turning a key” since turning a key best simulates the movement of forearm rotation. This warrants more similarity between the original PRWHE and the PRWHE-Slo whereas at the same time cultural differences are considered.

### Cognitive debriefing or pilot testing

The comprehensiveness of the pre-final Slovenian version of the PRWHE was tested on 15 healthy volunteers from a rehabilitation team (physiotherapists, OTs) and 15 participants from the target population. Since we decided to use the revised version of the original PRWHE, which contains a simplified format and more language clarity, completing the questionnaire did not represent any challenges. All participants considered the introduction, instructions and questions to be clear. After pilot testing, no modifications were needed and the final version of the PRWHE-Slo was obtained and is presented in Fig. 1.

### Validation sample

Fifty native Slovenian speaking patients with DRF treated conservatively or surgically, aged 18 years and above were enrolled in the study. Patients with accompanied injuries or neurological disorders of the upper extremities and those with cognitive incompetence or language barriers were excluded from the study. After the first assessment 1 patient declined the follow-up. Data of 49 patients was available for the analysis, of which 41 (83.7%) were females. The mean age of the participants was 60.4 years (SD 11.6, range 19-80), they were on average 8.5 weeks after the injury (SD 2.3, range 5-21 weeks), 77.6% were treated conservatively, 89.8% were right-handed, and 38.8% had the dominant side injured.

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SAMOOCENJEVALNI VPRAŠALNIK ZA ZAPESTJE/ROKO (PRWHE-Slo)

Ime in priimek: Datum:

Sledeča vprašanja nam bodo pomagala razumeti, koliko bolečin in težav ste imeli v zadnjem tednu zaradi okvare zapestja/roke. **Obkrožite odgovor, za katerega menite, da je najbolj primeren.**

Ocenite **jakost bolečine** v zapestju/roki v zadnjem tednu. **Nič (0)** pomeni, da niste občutili bolečine in **deset (10)** pomeni, da ste imeli najhujšo bolečino, ki ste jo kdaj doživeli.

| **OCENITE BOLEČINO:** | **Ni bolečine (0)** | | | | | | | | | | **Najhujša bolečina (10)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. v mirovanju | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2. pri ponavljajočih se gibih v zapestju/roki | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3. pri dvigu težkega bremena | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4. ko je najizrazitejša | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 5. Kako pogosto občutite bolečino? | 0 **(nikoli)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 **(vedno)** |

**SPECIFIČNE AKTIVNOSTI**

Ocenite, **koliko težav** ste imeli pri izvajanju spodaj naštetih opravil v zadnjem tednu. **Nič (0)** pomeni, da niste imeli nobenih težav in **deset (10)** pomeni, da je bilo tako težko, da aktivnosti sploh niste zmogli opraviti.

| | **Nimam težav** | | | | | | | | | | **Ne zmorem opraviti** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6. Zapenjanje gumbov na srajci | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 7. Rezanje mesa (ali zelenjave) z nožem | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 8. Obračanje ključa v vratih z okvarjeno roko | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 9. Uporaba okvarjene roke za odriv pri vstajanju s stola | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 10. Prenašanje težkega bremena v okvarjeni roki | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11. Uporaba toaletnega papirja z okvarjeno roko | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**OBIČAJNE AKTIVNOSTI**

Ocenite, koliko težav ste imeli pri izvajanju spodaj naštetih aktivnosti v zadnjem tednu.
Pod "običajne aktivnosti" mislimo na opravila, ki ste jih običajno izvajali, **preden** so se pojavile težave z zapestjem/roko.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12. Osebna nega (oblačenje, umivanje) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 13. Hišna opravila (čiščenje, vzdrževanje) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 14. Delo (služba ali drugo običajno vsakodnevno delo) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 15. Rekreacija | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**DRUGE SKRBI:**

1. Koliko Vam pomeni izgled vaše roke? ▫ NIČ ▫ NEKOLIKO ▫ ZELO
2. Koliko Vas je motil izgled zapestja/ roke v zadnjem tednu? 0 (nič) 1 2 3 4 5 6 7 8 9 10 (zelo)
3. Vas še kaj skrbi? _____

**Fig. 1.** PRWHE-Slo Slovenian version of Patient-Rated Wrist and Hand Evaluation.

## Procedures for validation

The study was conducted from April to October 2019 at the Institute for Physical and Rehabilitation Medicine (IPRM) at the University Medical Centre (UMC) Maribor, Slovenia. The study protocol was approved by the ethics committee of UMC Maribor (UKC-MB-KME-52/19) and performed in accordance with the Helsinki declaration. Written informed consent was obtained from all the participants before the enrolment in the study.

Patients were assessed on 3 occasions. The average intervals between the baseline and the second assessment, and the baseline and the third assessment were 3 days (range 2-7) and 28 days (range 26-30), respectively. At the baseline assessment the demographic data was collected and patients completed the PRWHE-Slo and the Slovenian versions of Quick DASH[6] and EQ-5D-5L.[7] Grip strength and active range of motion (ROM) were measured following the standardized procedures already used in previous study.[8] Grip strength was measured on both sides using a Jamar hand dynamometer (Sammons Preston Rolyan Inc) and the average value

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**Table 1**
Comparison of reliability and responsiveness of the PRWHE subscales across translations

| Measurement property | PRWHE subscale | Current study | Original[1] | Hindi[8] | Spanish[9] | Finnish[5] | Thai[10] |
|---|---|---|---|---|---|---|---|
| Internal consistency | Pain | 0.89 | | 0.86 | 0.89 | 0.93 | 0.91 |
| (Cronbach's alpha) | Function | 0.97 | | 0.92 | 0.95 | 0.98 | 0.96 |
| | Total | 0.96 | | 0.89 | 0.96 | 0.98 | |
| Test-retest reliability | Pain | 0.91 | 0.89 | 0.76 | 0.93 | | 0.95 |
| (ICC 95% CI) | Function | 0.94 | | 0.85 | 0.94 | | 0.96 |
| | Total | 0.95 | 0.93 | 0.81 | 0.94 | 0.99 | 0.96 |
| SEM | Total | 5.40 | | 5.40 | 7.61 | | |
| MDC | Total | 14.97* | | 12.5** | 13.74* | | |
| ES | Total | 0.91 | | 2.16 | | 0.83 | |
| SRM | Total | 1.27 | | 2.66 | | 1.22 | 0.94 |
| Number of patients | | 49 | 53[a] | 50 | 40 | 119[a, c] | 292[a] |
| | | | 38[b] | | | 10[b] | 61[b] |
| | | | | | | | 54[c] |

PRWHE = Patient-Rated Wrist and Hand Evaluation; SEM = standard error of measurement; MDC = minimal detectable change; ES = effect size; SRM = standardized response mean; CI = confidence interval.
[a] number of patients for Cronbach's alpha and construct validity assessment.
[b] number of patients for ICC evaluation.
[c] number of patients to assess responsiveness.
* 95% confidence level.
** 90% confidence level.

of the 3 trials on the affected side was expressed as a percentage of the value obtained on the contralateral side. The sum of the 6 active movements of the wrist and forearm (extension, flexion, supination, pronation, ulnar and radial deviation) was measured with a standard goniometer. The summated ROM of the affected wrist was also expressed as a proportion of the same movements measured and summed on the contralateral side. The data collected at baseline was used to evaluate the reliability with internal consistency calculating Cronbach's alpha and the construct validity where convergent and divergent validity were assessed. We hypothesized that the PRWHE-Slo would have strong positive correlation with the QuickDASH, since they measure similar constructs, moderate negative correlation with the EQ-5D-5L, weak negative correlation with some of the EQ-5D-5L subscales (mobility, anxiety/depression), wrist ROM, and grip strength because they measure different constructs.

For assessing the test-retest reliability the participants were asked to once again complete the PRWHE-Slo after 3 days on average, and the data was used to calculate the intraclass correlation coefficient with 95% confidence interval (ICC (95% CI)). The value obtained was used to calculate the standard error of measurement (SEM). The SEM was further used to calculate the minimal detectable change (MDC) using the following formula: MDC = SEM x 1.96 x $\sqrt{2}$. The MDC is defined as a valid change in score beyond measurement error.

The responsiveness of the PRWHE-Slo was assessed with the effect size (ES) and standardised response mean (SRM) using the data obtained from the baseline measurements and the same measurements repeated at the end of the rehabilitation programme, on average after 28 days. To assess the SRM the mean score improvement of the PRWHE-Slo was divided by the standard deviation (SD) of score improvement, and ES was calculated with Cohen's *d*.

## Validation results

Table 1 demonstrates reliability and responsiveness results, whereas Table 2 demonstrates construct validity results in comparison with previous translations of the PRWHE.

## Conclusion

The psychometric analysis of this study shows the PRWHE-Slo to be reliable, valid and responsive PROM for assessing pain and disability in patients after DRF. The internal consistency with the Cronbach's alpha value of 0.96 and the ICC (95% CI) value of 0.95 showed excellent reliability for the total PRWHE-Slo score, which is comparable with previous translations and the original PRWE.[1,5,9]

The longitudinal precision of the PRWHE-Slo is comparable to the results of other studies,[8,9] with SEM equal as in Hindi translation, whereas Hindi MDC was a little lower since 90% CI was used in calculation.[8] According to the results of our study, the change in total PRWHE score for 15 points represents a change that does not occur due to chance.

With SRM and ES values of 1.27 and 0.91, respectively, the PRWHE-Slo proves to be highly responsive when evaluating change in patients with DRF, which is comparable to the Finnish study on a similar cohort of patients with a larger sample size.[5] The Hindi study showed even higher SRM (2.66),[8] whereas Thai SRM was 0.94,[10] which still denotes large responsiveness.

When assessing construct validity of PRWHE-Slo, there was a strong positive correlation between all subscales and total scores of the PRWHE-Slo and the QuickDASH ($r$ from 0.72 to 0.83) as expected. Interestingly, the total score of the PRWHE-Slo showed equally strong negative correlation with total EQ-5D-5L index and pain/discomfort subscale of the EQ-5D-5L ($r$ -0.78), which could indicate great impact of the wrist and hand pain and disability on the subjective perspective of general health status in our cohort. Moderate negative correlation was reported between PRWE Spanish and the EQ-5D index, but they did not analyze correlations to single EQ-5D domains.[9]

As we hypothesized, the unrelated dimensions as the function subscale of the PRWHE and the mobility and anxiety/depression subscales of the EQ-5D-5L were not statistically significantly correlated, whereas the pain subscale and the total score of the PRWHE-Slo showed statistically significant weak correlations with the above-mentioned EQ-5D-5L domains. The Thai study showed similar weak correlations of the PRWHE with EQ-5D-5L anxiety/depression and mobility domains and interestingly a weak correlation was found also among the PRWHE pain subscale and EQ-5D-5L usual activities domain.[10]

Grip strength in our study was moderately negatively correlated with all PRWHE subscales which can be comparable to the results of the original[1] and Hindi study,[8] whereas ROM showed no statistically significant correlations with any of the PRWHE-Slo subscales. These correlations were weak in the Hindi study[8] and nevertheless

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**Table 2**
Comparison of construct validity of the PRWHE subscales across translations.

| Correlated measure | PRWHE subscale | Current study | Original[1] | Hindi[8] | Spanish[9] | Finnish[5] | Thai[10] |
|---|---|---|---|---|---|---|---|
| QuickDASH | Pain | 0.81* | | | | | |
| | Function | 0.72* | | | | | |
| | Total | 0.83* | | | 0.79 | 0.88 | |
| EQ-5D-5L mobility | Pain | 0.37* | | | | | 0.13 |
| | Function | 0.16 | | | | | |
| | Total | 0.32* | | | | | 0.09 |
| EQ-5D-5L self-care | Pain | 0.65* | | | | | 0.4 |
| | Function | 0.69* | | | | | |
| | Total | 0.72* | | | | | 0.56 |
| EQ-5D-5L usual activities | Pain | 0.61* | | | | | 0.29 |
| | Function | 0.67* | | | | | |
| | Total | 0.69* | | | | | 0.51 |
| EQ-5D-5L pain/discomfort | Pain | 0.75* | | | | | 0.57 |
| | Function | 0.71* | | | | | |
| | Total | 0.78* | | | | | 0.56 |
| EQ-5D-5L anxiety/depression | Pain | 0.35* | | | | | 0.3 |
| | Function | 0.28 | | | | | |
| | Total | 0.34* | | | | | 0.31 |
| EQ-5D-5L | Pain | -0.75* | | | | | |
| | Function | -0.67* | | | | | |
| | Total | -0.78* | | | -0.40 | | |
| Grip strength | Pain | -0.43* | -0.44 | 0.35 | | | |
| | Function | -0.56* | | 0.64 | | | |
| | Total | -0.52* | -0.58 | 0.6 | | | |
| ROM | Pain | -0.13 | -0.35 | 0.03 | | | |
| | Function | -0.28 | | 0.25 | | | |
| | Total | -0.20 | -0.44 | 0.17 | | | |

PRWHE = Patient-Rated Wrist and Hand Evaluation; QuickDASH = shortened version of the Disabilities of the Arm, Shoulder and Hand Questionnaire; EQ-5D-5L = EuroQol quality of life questionnaire; ROM = sum of active wrist and forearm range of movement.
* $P$ value < .05.

moderate in the original study.[1] This again proves how the objective measurements like ROM do not reflect one's functioning.

*Precautions/limitations*

Our study does have some limitations which should be acknowledged. First of them is a relatively small sample size. Although our initial hypotheses were confirmed, a larger sample size would provide more precise estimates. Secondly, our results were obtained from patients with DRF, treated conservatively or surgically, and therefore cannot be generalized to other wrist disorders. Nevertheless, this can also be considered as one of the strengths of the study since the psychometric analysis provides evidence for the PRWHE-Slo to be used with confidence in the cohort of Slovenian speaking patients with DRF. Also, short test-retest interval (2 to 7 days) could lead to some degree of memory bias if patients remembered their previous responses. The reason for choosing a short time frame between the first and the second assessment was the subacute status of the enrolled patients where changes in their health status could occur rapidly.

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