La Medicina del Lavoro

Original article

Med. Lav. 2024; 115 (6): e2024040
DOI: 10.23749/mdl.v115i6.15991

Reliability and Validity of the Turkish Version of the Work-Related Questionnaire for Upper Extremity Disorders (WORQ-UP)

Meltem Koç[1], Cansu Dal[2,*], Emin Kürşat Bulut[3], Banu Bayar[1], Kiliçhan Bayar[1]

[1]Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Mugla Sitki Kocman University, Mugla, Türkiye
[2]Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, Mugla Sitki Kocman University, Mugla, Türkiye
[3]Faculty of Medicine, Department of Orthopedics, Nigde Omer Halisdemir University, Nigde, Türkiye

Keywords: Upper Extremity; Musculoskeletal Disorders; Work-Related Questionnaire for Upper Extremity Disorders; WORQ-UP

Abstract

Background: *The Work-Related Questionnaire for Upper Extremity Disorders (WORQ-UP) is a patient-reported outcome measure to identify work-related limitations in individuals with upper extremity musculoskeletal disorders. This study aims to adapt the WORQ-UP into Turkish and evaluate its validity and reliability.* **Methods:** *The Turkish WORQ-UP, along with the previously validated Turkish Quick Disabilities of the Arm, Shoulder, and Hand (Quick-DASH), were administered to 136 patients at the Department of Orthopedics in Nigde Omer Halisdemir Education and Training Hospital. The Quick-DASH evaluates upper extremity disorders by assessing physical function, pain, and psychosocial impact. The Turkish WORQ-UP was administered twice within 7-14 days to determine test-retest reliability. Reliability was evaluated using internal consistency measures and the intraclass correlation coefficient (ICC). The Spearman correlation coefficient was calculated between the Turkish WORQ-UP and the Quick-DASH to assess validity, and explanatory (EFA) and confirmatory factor analysis (CFA) was performed.* **Results:** *In the reliability analysis, items 11, 12, 13, 15, and 16, which did not meet the criterion of item-total score correlation coefficient >30, were excluded, resulting in a 12-item Turkish WORQ-UP with satisfactory validity and reliability outcomes. The Cronbach's alpha and ICC were calculated as 0.895 and 0.879, respectively, while the SEM and MDC were determined to be 0.93 and 1.85. In the EFA, the Kaiser-Meyer-Olkin measure (0.895) and Bartlett's tests were both significant ($p < 0.001$). Additionally, the CFA indicated an acceptable fit with two factors. The goodness of fit indices, including $\chi 2/df = 2.09$, CFI = 0.934, TLI = 0.918, and RMSEA = 0.08, confirmed the adequacy of the model. The 12-item Turkish WORQ-UP showed a significant and moderately strong correlation ($r = 0.754$; $p < 0.001$) with Quick DASH.* **Conclusion:** *The Turkish version of WORQ-UP with 12 items had proper psychometric properties to identify work-related limitations in individuals with upper extremity musculoskeletal disorders.*

1. Introduction

Musculoskeletal disorders are highly prevalent in Europe, ranking as the foremost occupational diseases and affecting a significant workforce across diverse industries [1]. These conditions have profound personal and societal implications, including limitations in daily activities, increased healthcare expenses, income loss, and work disability. Companies also grapple with adverse consequences such

Received 30.04.2024 – Accepted 12.11.2024
*Corresponding Author: Cansu Dal; E-mail: ptcansudal@gmail.com

as decreased productivity and heightened absenteeism [2]. Upper-extremity musculoskeletal disorders have emerged as a significant health concern among the working population, with many cases linked to occupational factors, both physical and psychosocial [3]. Addressing and minimizing exposure to these work-related factors could prevent many disorders. Research on the epidemiology of these disorders has identified various contributing factors, with global prevalence rates ranging from 2% to 53% for point prevalence and 2% to 41% for 12-month prevalence [6]. In 2019, in France, over 80% of officially recognized occupational diseases were upper-extremity musculoskeletal disorders, totaling more than 40,500 cases. In England, a significant portion of the population reported pain or sensory symptoms in the upper extremities or neck, with one-week prevalence rates of 24% for neck pain, 36% for upper limb pain, and 27% for sensory symptoms [7]. In Turkiye, the prevalence of musculoskeletal pain is high among computer-using office workers, with 82.6% reporting pain in the past 12 months, particularly in the neck (32.7%), upper limbs (25.3%) and lower back (24.7%) [8].

The primary occupational factors contributing to upper extremity musculoskeletal disorders include a fast-paced work environment, repetitive motion patterns, inadequate recovery time, lifting heavy loads, engaging in forceful manual activities, maintaining awkward postures for extended periods, exposure to mechanical pressure, the use of vibrating hand tools, and job-related stress [9-13]. These factors can lead to persistent symptoms for patients, impacting their ability to perform basic daily activities and potentially resulting in job loss, symptoms of depression, and disruptions within the family [14]. Prolonged sickness absence is also associated with lower quality of life ratings over time, highlighting the importance of early intervention and considering the role of work in the diagnosis and treatment of upper extremity disorders [15]. Therefore, the Work-Related Questionnaire for Upper Extremity Disorders (WORQ-UP), a patient-reported outcome measure (PROM), was developed in 2017 to assess the work-related limitations faced by individuals with upper extremity musculoskeletal disorders. The Disabilities of the Arm, Shoulder, and Hand (DASH), or quick DASH questionnaires, are frequently used by clinicians and researchers to assess disability after upper limb injuries. However, the DASH does not include occupational impairments; it assesses general upper limb function [16].

The 17-item WORQ-UP was developed in consultation with patients from the target population and experts in the field, including physiotherapists, insurance physicians, occupational health physicians, rehabilitation physicians, and orthopedic surgeons. Its validity and reliability study was conducted with patients with musculoskeletal disorders of the upper extremities attending an orthopedic outpatient clinic at Amphia Hospital in the Netherlands. This questionnaire is a standardized tool for documenting or eliciting work-related limitations in patients with upper extremity conditions. It facilitates consistent communication between healthcare professionals and allows the specific nature and extent of the patient's work-related limitations to be recorded [17, 18].

The WORQ-UP has demonstrated strong measurement properties in terms of internal consistency and a four-factor structure: exertion, dexterity, tools and equipment, and mobility. The WORQ-UP can be valuable in work-related rehabilitation scenarios by assessing the degree and severity of a patient's work limitations. This information allows adjustments to the patient's treatment and rehabilitation plan, ensuring a more patient-centered approach [17, 18]. Therefore, this study aims to translate and culturally adapt the WORQ-UP into Turkish and to assess its validity and reliability in patients with upper extremity musculoskeletal disorders.

2. Methods

2.1. Study Design and Participants

This observational measurement study adopted a test-retest and validity design, following the guidelines outlined in the reporting of reliability and agreement studies (GRRAS) and Consensus-based standards for the selection of health measurement instruments (COSMIN) [19, 20]. Written permission was obtained from the original developer of the WORQ-UP for its translation into Turkish. Ethical

approval was secured from the Health Sciences Ethics Committee of Mugla Sitki Kocman University (Protocol No: 230152, Decision No: 3). The study complied with the Declaration of Helsinki. Participants were fully briefed on the study, and those who volunteered to participate signed an informed consent form.

The study was conducted on individuals seeking treatment at the orthopedic outpatient clinic of Nigde Omer Halisdemir Education and Research Hospital in Türkiye between February 2024 and April 2024.

The inclusion criteria were as follows:

- Aged between 18 and 65 years.
- Diagnosed with an upper extremity musculoskeletal disorder.
- At least one year of experience in a job involving the use of upper limbs/extremities and currently employed.
- Proficient in Turkish with a minimum literacy level.
- Signed informed consent document.

The exclusion criteria were as follows:

- Diagnosed with cervical spine disease or neurological disorders (e.g., multiple sclerosis, vestibular disorders, stroke).
- Previous upper extremity trauma (e.g., bone fracture, surgery).
- Ongoing psychological problems such as depression, anxiety, and bipolar disorders (information obtained from medical reports by the orthopedic doctor).

2.2. Translation and Cultural Adaptation of the WORQ-UP

The standard "forward-backward" procedure outlined by Beaton was applied to translate the questionnaire from English to Turkish [21]. Two native Turkish speakers (A.C.P and C.D), proficient in English and familiar with the relevant test terminology, translated the original English version into Turkish. These translators collaborated to merge the individual Turkish translations into a single version. The resulting Turkish version was independently translated back into English by two native English translators (T.K. and E.K.) who were not associated with the study. A committee comprising four translators and Turkish linguists compared the final translation with the initial one, ensuring the equivalence of the original and Turkish versions of the WORQ-UP. Item 6, initially "Performing rapid and repetitive arm movements (e.g., sorting the post or doing assembly line work)," has been replaced with "Performing rapid and repetitive arm movements (e.g., placing products on shelves)".

- In item 16, initially, "Using heavy equipment that causes vibration (e.g., a hammer drill or demolition hammer)" was replaced with "Using heavy equipment that causes vibration (e.g., a concrete breaker)."

Lastly, 20 healthy individuals were surveyed to assess the clarity of the Turkish translation. After completing the test, each participant was questioned about difficulties in understanding. Their interpretations of each item were documented, leading to the creation of the final version of the Turkish WORQ-UP. The subsequent phase involved investigating its validity and reliability.

2.3. Data Collection and Psychometric Properties of the Turkish WORQ-UP

Data were collected through face-to-face interviews with 136 participants using a 17-item Turkish WORQ-UP and an 11-item Quick-DASH. On average, the entire data collection form took 10 to 15 minutes to complete. Patients completed the questionnaire themselves and then returned it to the coordinator. The coordinator carefully checked for missing items. If any items remained unanswered, the coordinator asked the patient to complete them. Therefore, no data were missing from the questionnaire.

The Turkish WORQ-UP's reliability was gauged through test-retest reliability and internal consistency tests. To evaluate internal consistency, Cronbach's alpha was interpreted [22]. For the test-retest reliability, a subset of 40 patients who initially

completed the questionnaire were re-interviewed within 7-14 days, and the Turkish WORQ-UP was re-administered.

Criterion validity evaluates how well the cumulative scores of a measurement align with the scores of another measure, guided by theoretical assumptions about the construct being assessed. In the original study, the WORQ-UP demonstrated strong positive correlations with the Quick DASH [17]. Therefore, Quick DASH was utilized to affirm the construct validity of the Turkish WORQ-UP. Our hypothesis assumed a positive and significant correlation between the Turkish WORQ-UP and Quick DASH. Subsequently, construct validity was investigated by performing factor analysis to determine the items' factor loadings and subgroups.

2.3.1. WORQ-UP

The 17-item original version of the WORQ-UP encompasses a range of work-related tasks that may be impacted by musculoskeletal issues in the upper extremities. These tasks are categorized into four primary domains: exertion, dexterity, handling tools and equipment, and mobility. Participants must assess the difficulty they experience while performing these work-related tasks due to complaints about their upper extremities. Responses are rated on a five-point Likert scale ranging from 1 (not at all) to 5 (extremely/I can't do this), with the option of selecting 0 (not applicable) if a specific activity is not relevant to their job. The WORQ-UP scoring system ranges from 0 to 85 points. A lower score indicates that the individual experiences fewer difficulties while working, whereas a higher score reflects increased difficulty encountered during work [17, 18].

2.3.2 Quick DASH

The DASH is a self-administered outcome instrument to measure upper-extremity disability and symptoms. The Quick-DASH is a condensed version of the original 30-item DASH questionnaire comprising 11 items. It evaluates upper extremity disorders by assessing physical function, pain, and psychosocial impact. Scores on the Quick-DASH range from 0 to 100, with lower scores indicating lesser disability and higher scores indicating more significant disability. Research has demonstrated that the Quick-DASH maintains excellent reliability and validity compared to the original 30-item DASH while being convenient for respondents due to its reduced length [23].

2.4. Sample Size and Statistical Analysis

In validation studies, international guidelines recommend a respondent-item ratio of 5:1 to 10:1 (e.g., 50 participants for a 10-item survey), 15:1, or 30:1 when determining the sample size. The 5:1 or 10:1 ratio is commonly utilized [24]. Therefore, the goal was to enroll a minimum of 85 and a maximum of 170 participants for the 17-item WORQ-UP.

The data were analyzed using SPSS version 22.0. The normality of continuous variables was assessed visually and analytically. Descriptive statistics were used to present categorical variables as numbers (n) and percentages (%), while continuous variables were expressed as mean ± standard deviation or median (interquartile range). A significance level of $p < 0.05$ was considered statistically significant.

Internal consistency and test-retest reliability were examined to evaluate instrument reliability. Cronbach's alpha value higher than 0.70 [25] and item-rest correlation higher than 0.30 [26] indicate homogeneity and internal consistency. Test-retest reliability of the Turkish WORQ-UP was determined using the intraclass correlation coefficient (ICC) between the initial and subsequent evaluations. An ICC ranging from 0.75 to 1 suggests excellent reliability, 0.4 to 0.75 indicates moderate reliability and less than 0.4 indicates poor reliability [27]. Reproducibility was assessed using the measurement of the standard error ($SEM=SD\sqrt{[1-ICC]}$) and Minimal Detectable Change ($MDC = 1.96 \times SEM \times \sqrt{2}$) [28].

Both construct and criterion validity were assessed to evaluate instrument validity. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were utilized for construct validity. A Kaiser-Meyer-Olkin (KMO) value above 0.5 and a significant Bartlett's test with a p-value below 0.05 were considered appropriate for factor analysis.

Factor extraction was performed using maximum likelihood extraction and Oblimin rotation. Criteria such as Scree Plot inflection, Eigenvalue greater than 1.0, and variance exceeding 10% were used to determine factors [29]. In the subsequent stage, model fit was evaluated through Confirmatory Factor Analysis (CFA) of the factors identified in EFA. CFA was conducted using Jamovi Statistical Software (Version 1.6.23.0). Various indices were examined to assess model fit, including Chi-square statistics ($\chi 2$), root mean square error of approximation (RMSEA), comparative fit index (CFI), and normed fit index (NFI) [30]. Criterion validity was determined by calculating Spearman's correlation coefficients (r) between the total score of Turkish WORQ-UP and the Quick DASH. Correlation coefficient (r) values categorized as "weak" (.00–.19), "mild" (.20–.39), "moderate" (.40–.59), "moderately strong" (.60–.79), and "strong" (.80–1.0) relationships [31].

3. Results

3.1. Characteristics of Participants

A total of 136 patients who met the inclusion criteria were enrolled in the study. Most patients (94.1%) were right dominant, and most participants (52.9%) reported correct upper extremity disorders. Among the participants, 72 (52.9%) had shoulder injuries, 19 (14%) had elbow or forearm disorders, and 45 (33.1%) had hand or wrist disorders. The mean and standard deviation of the Turkish WORQ-UP total score were 36.1 (13.2), and for the Quick DASH, they were 31.3 (8.7) (Table 1).

Table 1. Characteristics of participants (n = 136).

	Median (IQR)
Age (years)	**41.00 (25)**
Gender	**n (%)**
Female	64 (47.1%)
Male	72 (52.9%)
Dominant upper extremity	8 (5.9%)
Left	128 (94.1%)
Right	
Affected upper extremity	64 (47.1%)
Left	72 (52.9%)
Right	
Smoker	43 (31.6%)
Yes	93 (68.4%)
No	
Trauma Region	72 (52.9%)
Shoulder or humerus disorders	19 (14%)
Elbow or forearm disorders	45 (33.1%)
Hand or wrist disorders	
	Mean (S.D.)
Turkish WORQ-UP (0-85)	36.1 (13.2)
Quick DASH (0-100)	31.3 (8.7)

IQR: Interquartile Range. SD: Standard Deviation. WORQ-UP: The WOrk-Related Questionnaire for UPper extremity disorders. Quick DASH: Quick Disabilities of the Arm, Shoulder, and Hand.

3.2. Initial Reliability and Validity Analysis for 17-Item Turkish WORQ-UP

The test-retest analysis showed that the ICC values for individual items of the 17-item Turkish WORQ-UP ranged from 0.829 to 0.896, with a total score ICC value of 0.864. These ICC values indicate excellent test-retest reliability. The 17-item Turkish WORQ-UP also demonstrated high internal consistency with a Cronbach's alpha coefficient of 0.864. Deleting items resulted in Cronbach's alpha values ranging from 0.849 to 0.871, indicating strong relationships among the questionnaire items. However, items 11, 12, and 13 did not meet the >0.30 criterion for item-rest correlations (Table 2). These items were interpreted as being unrelated to the questionnaire.

The suitability of the data for factor analysis was confirmed with a KMO value of 0.840 and Bartlett's test of sphericity ($\chi 2 = 1224.018$, $p < 0.001$). The Principal Component Analysis for the 17-item Turkish WORQ-UP revealed a four-factor solution. The E.V. for the factors were as follows: factor 1=6.00, factor 2=2.53, factor 3=1.77, and factor 4=1.25. The four factors accounted for 68.08% of the total variance, with the first, second, third, and fourth factors explaining 35.32%, 14.93%, 10.44%, and 7.38% of the total variance, respectively. However, for these structures to be considered genuine factors, they needed to meet the criteria of E.V.> 1.0, along with explaining > 10% of the variance.

Table 2. Reliability Statistics of Turkish WORQ-UP.

	Reliability Statistics of Turkish WORQ-UP with 17-Item		Reliability Statistics of Turkish WORQ-UP with 14-Item	
	Item-rest correlation	Cronbach's α If item dropped	Item-rest correlation	Cronbach's α If item dropped
Item1	0.687	0.849	0.740	0.859
Item2	0.669	0.849	0.697	0.861
Item3	0.608	0.852	0.635	0.864
Item4	0.498	0.857	0.519	0.870
Item5	0.627	0.851	0.668	0.862
Item6	0.618	0.852	0.650	0.864
Item7	0.588	0.854	0.629	0.865
Item8	0.509	0.856	0.507	0.870
Item9	0.562	0.854	0.599	0.866
Item10	0.646	0.849	0.651	0.863
Item11	**0.279**	0.867	Item11 was deleted	
Item12	**0.295**	0.866	Item12 was deleted	
Item13	**0.167**	0.871	Item13 was deleted	
Item14	0.426	0.860	0.411	0.874
Item15	0.320	0.867	**0.287**	0.885
Item16	0.374	0.862	**0.278**	0.881
Item17	0.507	0.856	0.458	0.873

**Values not meeting the item-rest correlation (<0.30) are shown in bold. WORQ-UP: The WOrk-Related Questionnaire for UPper extremity disorders.*

Therefore, the fourth factor, which explained only 7.38% of the total variance, was not accepted (Table 2).

When examining the fit indices for the four-factor solution in the CFA, the results did not show acceptable outcomes. The ratio of chi-square to degrees of freedom ($\chi 2/df$) yielded a value of 2.43, below the threshold of 5, indicating a satisfactory fit. However, other fit indices (RMSEA = 0.103, CFI = 0.856, and TLI = 0.831) did not reach acceptable values. Upon removing items 11, 12, and 13 with inappropriate item-rest correlation, the CFA revealed acceptable values for the three-factor structure of the 14-item Turkish WORQ-UP. The CFA results for a 14-item, three-factor Turkish WORQ-UP were $\chi 2/df$ = 2.12, RMSEA = 0.09, CFI = 0.914, and TLI = 0.894. Upon reevaluating the reliability and validity results for the 14-item Turkish WORQ-UP, Cronbach's alpha was 0.877, and the test-retest ICC was 0.890. However, the total-item correlation value for items 15 and 16 of the 14-item Turkish WORQ-UP did not meet the criterion of > 0.30.

3.3. Final Reliability and Validity Analysis for 12-Item Turkish WORQ-UP

After removing items 11, 12, 13, 15, and 16 from the 17-item Turkish WORQ-UP, the 12-item Turkish WORQ-UP demonstrated reliability. The item-rest correlation coefficients of all items were above 0.30. The Cronbach's alpha, ICC, SEM, and MDC values for the total score of the 12-item Turkish WORQ-UP were 0.895, 0.901, 0.936, and 1.85, respectively. The outcomes of internal consistency and homogeneity are outlined in Tables 3 and 4.

The criterion validity of the 12-item Turkish WORQ-UP was evaluated through correlation analysis with Quick DASH, demonstrating a significant and moderately strong correlation ($r = 0.754$; $p < 0.001$) between the two assessment tools, indicating the criterion validity of the 12-item Turkish WORQ-UP (Table 5).

The 12-item Turkish WORQ-UP showed a two-factor structure in the EFA and explained 62.54% of the total variance (Factor 1: E.V. = 1.74 and 47.91%; Factor 2: E.V. = 1.74 and 14.57%) (Table 5). In the EFA, the KMO measure (0.895) and Bartlett's tests were both significant ($\chi2= 904.551$; $p < 0.001$). The CFA results for a 12-item and two-factor Turkish WORQ-UP were $\chi2/df = 2.09$, RMSEA = 0.08, CFI = 0.934, and TLI = 0.918. According to the CFA results, the excellent fit of the model confirmed the factor structures. The first factor (Items 1, 2, 3, 4, and 5) was labeled as "function," and the second factor (Items 6, 7, 8, 9, 10, 11, 12) was labeled as "dexterity".

Table 3. Reliability Statistics of Turkish WORQ-UP with 12-Item.

	Reliability Statistics of Turkish WORQ-UP with 12-Item	
	Item-rest correlation	**Cronbach's α If item dropped**
Item1	0.770	0.878
Item2	0.718	0.880
Item3	0.669	0.883
Item4	0.475	0.893
Item5	0.682	0.882
Item6	0.688	0.882
Item7	0.672	0.883
Item8	0.535	0.890
Item9	0.662	0.883
Item10	0.623	0.887
Item11	0.459	0.893
Item12	0.392	0.898

WORQ-UP: The WOrk-Related Questionnaire for UPper extremity disorders.

4. Discussion

This study aimed to translate and culturally adapt the WORQ-UP into Turkish and evaluate its psychometric properties. The results indicate that the 12-item Turkish WORQ-UP is a valid and reliable tool for assessing work-related limitations in patients with upper extremity injuries. To date, only a Persian version of the WORQ-UP has been developed, and the findings of this study have been compared with the results of both the original WORQ-UP [17, 18] and the Persian version [32].

In the current study, the mean total score of the Turkish WORQ-UP was 36.1, and for the Quick DASH, it was 31.3. Although no established cut-off values exist for either questionnaire, scores approaching the total maximum suggest that patients experience work-related limitations due to upper extremity problems.

The KMO and Bartlett's tests confirmed that the sample size of the current study was adequate for factor analysis. The Turkish WORQ-UP was administered to 136 participants, compared to 150 in the original survey and 181 in the Persian version [17, 32]. The original WORQ-UP demonstrated a four-factor structure in EFA, with factors labeled as effort, hand skills, tools and equipment, and mobility. This four-factor structure was deemed

Table 4. Reliability and criterion validity results of the 12-item Turkish WORQ-UP.

12-Item Turkish WORQ-UP	Cronbach alfa	Test-retest reliability ICC (95 % CI)	SEM	MDC	Spearman Correlation with Quick DASH
Total Score	0.895	0.879 (0.790–0.888)	0.936	1.85	0.754
Factor 1 (function)	0.893	0.812 (0.765–0.855)	0.477	0.96	
Factor 2 (dexterity)	0.836	0.814 (0.722–0.868)	0.572	1.49	

WORQ-UP: The WOrk-Related Questionnaire for UPper extremity disorders. Quick DASH: Quick Disabilities of the Arm, Shoulder, and Hand. SEM: Standard Error of Measurement. MDD: Minimal Detectable Change

Table 5. Principal Component Analysis of 12-Item Turkish WORQ-UP.

Total Variance Explained						
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.757	47.971	47.971	5.757	47.971	47.971
2	1.749	14.577	62.548	1.749	14.577	62.548
3	.963	8.022	70.570			
4	.683	5.690	76.261			
5	.558	4.652	80.913			
6	.529	4.407	85.319			
7	.435	3.621	88.941			
8	.352	2.936	91.876			
9	.319	2.660	94.536			
10	.267	2.228	96.764			
11	.205	1.707	98.470			
12	.184	1.530	100.000			

Extraction Method: Principal Components Analysis.

appropriate. However, although the initial 17-item Turkish WORQ-UP also exhibited a four-factor structure, it was ultimately reduced to three factors because the fourth factor explained less than 10% of the total variance. The remaining items revealed a two-factor structure after excluding items 11, 12, 13, 15, and 16 due to reliability issues. The WORQ-UP includes various activities requiring upper extremity effort. The differences in results between the Turkish version and the original may be attributed to the less frequent performance of these five items in Turkey.

According to the COSMIN guidelines, a minimum of 30 participants is recommended for investigating test-retest reliability and measurement error [22]. Therefore, in this study, test-retest reliability was assessed with 40 individuals. The original study examined test-retest reliability with 28 patients from a sample group of 150 individuals [17]. It can be concluded that the test-retest reliability analyses in the current study were conducted with sufficient participants. In the original study, the ICC value for test-retest reliability of the WORQ-UP was reported to be 0.88 (0.75 to 0.94) [17], and in the Persian version, it was 0.85 (0.69 to 0.92) [32]. In the present study, the ICC value for the 12-item Turkish WORQ-UP was determined to be 0.87 (0.79–0.88). Consequently, it can be inferred that the results are consistent with the original study and the Persian version, suggesting that WORQ-UP exhibits stability over time.

In the original study, although Cronbach's alpha value for the total score was not reported, it was found to be 0.970 in the Persian version, while in the current study, it was found to be 0.899 [32]. Additionally, in the original study, Cronbach's alpha values for the subgroups were 0.88, 0.74, 0.87, and 0.66, respectively, whereas in the current study, they were found to be 0.893 and 0.836 [17,18]. Consistent with these studies, it can be observed that the 12-item Turkish WORQ-UP demonstrates internal consistency. Item-rest correlation coefficients, another important reliability indicator, ranged from 0.484 to 0.710 for the 12-item Turkish WORQ-UP [17,18]. The literature suggests that for Cronbach's alpha to be higher than 0.70 [25] and for the item-rest correlation to be adequate, the minimum correlation coefficient required is 0.30 [26]. Therefore, when the five items with inadequate item-rest correlations were removed, the item homogeneity of the 12-item Turkish WORQ-UP was demonstrated. It

was proven that all items were associated with the questionnaire.

Although the criterion validity of WORQ-UP was not investigated in the original study, the current study, similar to the Persian version, examined the relationship between Quick DASH and WORQ-UP. A moderately strong correlation ($r = 0.754$; $p < 0.001$) was found between Quick DASH and WORQ-UP in the current study, similar to the Persian version (0.630; $p < 0.001$) [32]. Quick DASH is commonly used to assess activity limitations following upper extremity injuries; however, it does not encompass specific activities like WORQ-UP. Therefore, establishing the Turkish validity and reliability of WORQ-UP, which includes more specific work-related activities, can be highly beneficial for clinicians and researchers in this field as an alternative to Quick DASH.

One strength of this study is the utilization of CFA and the validation of the obtained factor structure. As emphasized in the original work, WORQ-UP can assess the severity of work-related limitations in vocational rehabilitation cases and identify changes in work limitations over time. The omission of this aspect from the current study is a limitation. This limitation underscores the necessity for future research to evaluate the sensitivity and reproducibility of this PROM. Such investigations would contribute to a more comprehensive understanding of the WORQ-UP's utility in vocational rehabilitation settings and its capacity to capture changes in work-related limitations.

5. CONCLUSIONS

The 12-item Turkish version of WORQ-UP has demonstrated suitable psychometric properties for identifying work-related limitations in individuals with upper extremity musculoskeletal disorders. WORQ-UP showed a significant and moderately strong correlation with the Quick DASH, confirming its effectiveness in assessing work-related limitations in patients with upper extremity injuries. The total score or clinical subscores of WORQ-UP can guide clinical decision-making and intervention planning in occupational rehabilitation or health. Further studies are needed to evaluate the psychometric properties of WORQ-UP in other health conditions, particularly in populations with mental health issues or multiple comorbidities, and in preventive activities.

Funding: This research received no external funding.

Institutional Review Board Statement: Participants provided informed consent. This study was approved by the Health Sciences Ethics Committee of the Mugla Sitki Kocman University (Protocol No: 230152, Decision No: 3)

Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Declaration of Interest: The authors declare no conflict of interest.

Author Contribution Statement: M.K. and C.D. designed and directed the research, C.D and E.K.B collected the necessary data for the research, M.K., B.B. and K.B. checked the data, M.K. performed the statistical analyses. M.K., C.D. and B.B. checked the results and made the necessary edits. All authors took part in writing the article.

Declaration on the use of A.I.: No A.I. program was used throughout the research.

REFERENCES

1. de Kok J, Vroonhof P, Snijders J, Roullis G, Clarke M, Peereboom K. Work-related MSDs: prevalence, costs and demographics in the E.U. European Agency for Safety and Health at Work (EU-OSHA). 2019: Page 18.
2. Rapicault C, Roquelaure Y, Bodin J, Fouquet N, Bertrais S. Development and validation of a work-related risk score for upper-extremity musculoskeletal disorders in a French working population. *Scand J Work Environ Health*. 2023;49(8):558-568. Doi: 10.5271/sjweh.4119
3. Roquelaure Y, Ha C, Rouillon C, et al. Risk factors for upper-extremity musculoskeletal disorders in the working population. *Arthritis Rheum*. 2009;61(10): 1425-1434. Doi: 10.1002/art.24740
4. Nambiema A, Bodin J, Stock S, et al. Proportion and Number of Upper-Extremity Musculoskeletal Disorders Attributable to the Combined Effect of Biomechanical and Psychosocial Risk Factors in a Working Population. *Int J Environ Res Public Health*. 2021;18(8):3858. Doi: 10.3390/ijerph18083858
5. Nambiema A, Bodin J, Fouquet N, et al. Upper-extremity musculoskeletal disorders: how many cases

can be prevented? Estimates from the COSALI cohort. *Scand J Work Environ Health*. 2020;46(6):618-629. Doi: 10.5271/sjweh.3911
6. Huisstede BM, Bierma-Zeinstra SM, Koes BW, Verhaar JA. Incidence and prevalence of upper-extremity musculoskeletal disorders. A systematic appraisal of the literature. *BMC Musculoskelet Disord*. 2006;7:7. Doi: 10.1186/1471-2474-7-7
7. Walker-Bone K, Palmer KT, Reading I, Coggon D, Cooper C. Prevalence and impact of musculoskeletal disorders of the upper limb in the general population. *Arthritis Rheum*. 2004;51(4):642-651. Doi: 10.1002/art.20535
8. Aytutuldu KG, Birinci T, & Tarakcı E. Musculoskeletal pain and its relation to individual and work-related factors: a cross-sectional study among Turkish office workers who work using computers. *Int J Occup Saf Ergon*. 2022;28(2); 790-797. Doi: 10.1080/10803548.2020.1827528
9. National Research Council, The National Academy of Sciences. Musculoskeletal disorders and the workplace: low back and upper extremity musculoskeletal disorders. Washington (D.C.): National Academy; 2001.
10. Punnett L, Wegman DH. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. *J Electromyogr Kinesiol*. 2004;14(1):13-23. Doi: 10.1016 /j.jelekin.2003.09.015
11. Bernard BP. Musculoskeletal disorders and workplace factors: a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper-extremity, and low back. Cincinnati (O.H.): U.S. Health and Human Services; 1997.
12. Bongers PM, Kremer AM, ter Laak J. Are psychosocial factors, risk factors for symptoms and signs of the shoulder, elbow, or hand/wrist?. A review of the epidemiological literature. *Am J Ind Med*. 2002;41(5):315-342. Doi: 10.1002/ajim.10050
13. Bongers PM, Ijmker S, van den Heuvel S, Blatter BM. Epidemiology of work-related neck and upper limb problems: psychosocial and personal risk factors (part I) and effective interventions from a bio behavioural perspective (part II). *J Occup Rehabil*. 2006;16(3):279-302. Doi: 10.1007/s10926-006-9044-1
14. Morse TF, Dillon C, Warren N, Levenstein C, Warren A. The economic and social consequences of work-related musculoskeletal disorders: the Connecticut Upper-Extremity Surveillance Project (CUSP). *Int J Occup Environ Health*. 1998;4(4):209-216. Doi: 10.1179 /oeh.1998.4.4.209
15. Ekberg K, Wildhagen I. Long-term sickness absence due to musculoskeletal disorders: the necessary intervention of work conditions. *Scand J Rehabil Med*. 1996;28(1):39-47.
16. Beaton DE, Wright JG, Katz JN. Upper Extremity Collaborative Group. Development of the QuickDASH: comparison of three item-reduction approaches. *J Bone Joint Surg Am*. 2005;87(5):1038-1046. Doi: 10.2106 /JBJS.D.02060
17. Aerts BRJ, Kuijer PPFM, Beumer A, Eygendaal D, Frings-Dresen MHW. Development of a novel Work-Related Questionnaire for UPper extremity disorders (WORQ-UP). *Int Arch Occup Environ Health*. 2017;90(8):823-833. Doi: 10.1007/s00420-017-1246-7
18. Aerts BR, Kuijer PP, Beumer A, Eygendaal D, Frings-Dresen MH. WOrk-Related Questionnaire for UPper extremity disorders (WORQ-UP): Factor Analysis and Internal Consistency. *Arch Phys Med Rehabil*. 2018;99(9):1818-1826. Doi: 10.1016/j.apmr.2018 .03.013
19. Kottner J, Audige L, Brorson S, et al. Guidelines for Reporting Reliability and Agreement Studies (GRRAS) were proposed. *Int J Nurs Stud*. 2011;48(6):661-671. Doi: 10.1016/j.ijnurstu.2011.01.016
20. Mokkink LB, Terwee CB, Gibbons E, et al. Inter-rater agreement and reliability of the COSMIN (Consensus-based Standards for the selection of health status Measurement Instruments) checklist. *BMC Med Res Methodol*. 2010;10:82. Published 2010 Sep 22. Doi: 10.1186/1471-2288-10-82
21. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* (Phila Pa 1976). 2000; 25(24): 3186-3191. Doi: 10.1097/00007632-200012150 -00014
22. Mokkink LB, Prinsen CA, Bouter LM, Vet HC, Terwee CB. The COnsensus-based Standards for the selection of health Measurement Instruments (COSMIN) and how to select an outcome measurement instrument. *Braz J Phys Ther*. 2016;20(2):105-113. Doi: 10.1590/bjpt-rbf.2014.0143
23. Beaton DE, Wright JG, Katz JN. Upper Extremity Collaborative Group. Development of the QuickDASH: comparison of three item-reduction approaches. *J Bone Joint Surg Am*. 2005;87(5):1038-1046. Doi: 10.2106 /JBJS.D.02060
24. Tsang S, Royse CF, Terkawi AS. Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. *Saudi J Anaesth*. 2017;11(Suppl 1): S80-S89. Doi: 10.4103/sja.SJA _203_17
25. Cronbach LJ, & Shavelson RJ. My Current Thoughts on Coefficient Alpha and Successor Procedures. *Educ Psychol Meas*. 2004;64(3):391-418. Doi: 10.1177/001316 4404266386

26. Field A. Discovering Statistics Using SPSS. 2nd ed. London: Sage, 2005.
27. Enderlein G, Fleiss, JL. The Design and Analysis of Clinical Experiments. Wiley, New York – Chichester – Brislane – Toronto – Singapore 1986. Doi: 10.1002/bimj.4710300308
28. Weir JP. Quantifying test-retest reliability using the intraclass correlation coefficient and the SEM. *J Strength Cond Res*. 2005;19(1):231-240.
29. Tinsley HE, Workman KR, Kass RA. Factor analysis of the domain of client expectancies about counseling. *J Couns Psychol*. 1980;27(6):561.
30. The jamovi project. Jamovi (Version 1.6.23.0) [Computer Software]. Avaible Online: https://www.jamovi.org (accessed on 10.04.2024)
31. Schober P, Boer C, Schwarte LA. Correlation Coefficients: Appropriate Use and Interpretation. *Anesth Analg*. 2018;126(5):1763-1768. Doi: 10.1213/ANE.0000000000002864
32. Shariyate MJ, Beumer A, Kachooei AR. Validity and Reliability of the Persian Version of WOrk-Related Questionnaire for UPper Extremity Disorders (WORQ-UP). *J Hand Surg Asian Pac Vol*. 2023;28(1):102-107. Doi: 10.1142/S2424835523500030