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ORIGINAL ARTICLE

The Psychometric Analysis of the Urdu Version of the Upper Extremity Functional Index: A Translation and Cross-Cultural Adaptation Study

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Author`s Contribution

[1 2 3 4 5] Substantial contributions to the conception or design of the work for the acquisition, analysis or interpretation of data for the work, [1, 2] Drafting the work or reviewing it critically for important intellectual content, [1 2 3 4 5] Final approval of the version to be published, [1 2 3 4 5] Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Article Info.

Received: September 03, 2023
Acceptance: April 18, 2024

Conflict of Interest: None
Funding Sources: None

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Cite this article as: Zahid N, Iqbal RM, Hanif K, Tanveer A. Effects of Internet Addiction on Physical Activity, Sleep Quality, and Depression Among University Students in Lahore. JRCRS. 2024;12(2):89-95
https://dx.doi.org/10.53389/JRCRS.2024120206

A B S T R A C T

Background:The Upper Extremity Functional Index (UEFI) is frequently used to evaluate patient s with upper limb disorders, but it has not been translated and validated in Urdu.

Objective: The purpose of this project was to translate and cross-culturally adapt UEFI into Urdu (UEFI-U) while also investigating its psychometric measurements.

Methodology: The original version of the UEFI was translated and cross-culturally adapted in accordance with established international norms. At baseline, all participants were requested to fill the UEFI-U, 36-item Short Form Health Survey (SF-36), Visual analogue scale for pain (VA Spain) and Visual analogue scale for disability (VAS disability) and three weeks after receiving the intervention again requested to patient's group to respond these questionnaires along with the Global rate of change scale (GROC). The UEFI-U was assessed for factor analysis, reliability, content validity, construct validity (discriminative & convergent validity) and responsiveness.

Results: The UEFI-U had an internal consistency of 0.93, according to Cronbach's alpha. The total UEFI-U has excellent test-retest reliability, as evidenced by its ICC2,1 = 0.91. The UEFI-U has a unidimensional structure, constituting 75.18% of total variance. There was no floor or ceiling effect found for the total UEFI-U score. Pearson's correlation coefficient showed a moderate association with SF36 physical function (r=0.68), SF36 role physical (r=0.60), VAS pain (r=-0.54) and VAS disability (r=-0.57) but fair association with SF36 bodily pain (r=0.42). A significant difference (p<0.001) in UEFI-U total score was found between patients and healthy controls.

Conclusion: The findings revealed that UEFI-U is a reliable, valid, and responsive questionnaire to assess disability in Urdu-speaking population having upper extremity disorders.

Keywords: Disability, Upper Limb Pain, Reliability, Responsiveness, Translations, Validity.

Introduction

The primary cause of morbidity and functional disability among working populations of industrialized and developing states is due to upper extremity musculoskeletal disorders (UEMSDs), which include nonspecific musculoskeletal regional pain disorders, peripheral nerve entrapments, and tendon abnormalities.[1] UEMSDs are one of major contributors to occupational disorders, which are characterized by pain and discomfort at work and in daily life, occasionally irreversible functional effects, and a higher chance of work disability. Consequently, UEMSDs have a negative impact on healthcare resources and quality of life.[2, 3]

The studies that assessed the prevalence of UEMSDs in Pakistan focused on certain groups, and it was found that the prevalence of UEMSDs among dentists, computer workers, traffic police wardens, and architects ranged from 7% to 49.3%.[4-7]

Joint discomfort, soreness, weakness, feeling tingly or numb, cramps, burning, warmth and edema, stiffness, ache, or mobility restrictions are some of the common upper extremity symptoms that individuals may experience.[8]

Upper extremity musculoskeletal diseases, which impact employees of all ages, including those under 25, are the fastest-growing cause of disability in workplace. The risk of these conditions is enhanced by frequent computer usage of at least four hours. University students may also be at risk because of disorders related to extended computer use and their prevalence in young workers.[5]

In comparison to men, female employees with UEMSDs who are under the age of 49 report higher degrees of pain and disability. Both men and women who are working, experience similar deterioration of UE pain and disability with aging after age of 49. For both male and female workers, greater perceived job demands are accompanied by an increase in pain and disability.[9]

Regarding patient management with UEMSD, a precise assessment of the patient's functioning is considered to be a crucial initial step in determining prognosis, monitoring progress, and making treatment recommendations. Therefore, it is highly suggested to use patient-reported outcome measures (PROMs) that are valid and reliable to enable the subjective assessment of patients with the condition and to generate accurate data for both clinical and research settings.[10]

The Upper Extremity Functional Index (UEFI) is a PROM that is specific to region and was developed to measure the functional capability of patients having diverse upper limb musculoskeletal problems in multiple dimensions.[11] This tool was initially designed in English. [11] and has been translated into Italian,[12] Arabic[13,] Turkish[14], and Greek[15], Chinese[16]. According to the authors' knowledge, the UEFI still has not been translated and validated into Urdu.

This study's objectives were to translate & culturally adapt UEFI into Urdu using standard methods and to assess the psychometric analysis of the UEFI-U in patients having UEMSDs.

Methodology

Translation, cross-cultural adaption, and psychometric testing were all performed in this clinimetric investigation. The sample size for general psychometric testing was determined by taking into account 10 subjects for each instrument item.[17] Although the UEFI consists of 20 items, the sample size for this study was computed at 200; however, 232 people were recruited in order to achieve a large sample size. Using a convenience sampling technique, information was gathered from 232 patients from three different hospitals in Rawalpindi and Islamabad and 70 healthy participants from Margalla Institute of Health Sciences (MIHS). Following permission from **MIHS ethics review committee (ERC Ref No: MA/102/21)**, study was carried from February 2021 to January 2022. The tool has been translated into Urdu with the permission of the tool's developer. Each participant gave their written agreement after being fully informed. The recruitment process included both male and female patients between ages of 18 and 65 who had been diagnosed with upper extremity disorders (e.g Adhesive capsulitis, Carpal tunnel syndrome, lateral epicondylitis, medial epicondylitis, Olecranon bursitis, Subacromial bursitis, Bicep tendonitis, Glenohumeral osteoarthritis, De Quervain's tenosynovitis etc) and could read Urdu. Additionally, from among the MIHS students and staff, 70 healthy individuals between ages of 18 and 65 who have no prior history of upper extremity disorders were selected. Patients who had upper limb fractures or surgery within previous three months, neurological problems, tumors, systemic diseases, or pregnancy were excluded from study. Patients with recognized psychiatric illnesses were also disqualified. Unwilling Healthy participants were excluded from the study.

All participants were required to complete an information sheet for demographic data, UEFI-U, SF-36, VAS disability and VAS pain on first day. Then 46 patients were chosen at random and instructed to complete UEFI-U form once more 48 hours following initial response. According to advice of their consulting therapist, patients get regular physical therapy sessions for three weeks. The GROC scale and these questionnaires had to be completed once more by the patients after three weeks.

The UEFI is a region-specific PROM that was created to assess patients with a range of upper limb musculoskeletal issues on their functional status in many aspects. The UEFI has 20 tasks, and to indicate exactly how difficult they are, each is given a rating on a scale of 0 to 4 (0 being the most difficult, and 4 the easiest). The score ranges from 0 to 80, with 80 being best potential functional state and 0 being least functional condition.[11]

The SF-36 is a valid and reliable self-reported survey that produces results for eight different aspects of health, including general health (GH), physical functioning (PF), role limitations due to physical problems (RP), bodily pain (BP), social functioning (SF), vitality (VT), role limitations related to emotional problems (RE), mental health (MH).[18]

VAS pain is used to assess pain and frequently displays the patient's pain intensity as a point on a 100-mm horizontal line ranging from "no pain at all" to "worst pain imaginable." It is

best tool for determining severity of pain due to its validity and reliability.[19]

The VAS disability is valid and reliable tool is used to assess disability, and it usually presented like a 100-mm horizontal line with a point between "no limitation" and "worst possible restriction" to represent patient's level of disability.[20]

The GROC is a 15-point scale used to assess whether a patient sees an improvement or deterioration in their pain over time. Patients were asked to score the general state of their upper limbs from -7 ("very much worse") to +7 ("very much better") since starting treatment. The GROC is frequently employed as a standard of reference for evaluating other tools because it has been validated.[21]

Based on recommendations of Beaton et al., translation and cross-cultural adaption were done. The entire process was broken down into following steps following these guidelines.[22]

The tool was transformed from English, the original language, to Urdu, the new target language. The translation from English into Urdu was done independently by two translators. The two translators had diverse backgrounds and spoke Urdu natively. One was a Physical Therapist (T1) who was familiar with idea behind this research. The second was a certified translator who was unaware of the study but was knowledgeable about Urdu language's linguistic and cultural characteristics. The translation results were consolidated after discussion between two translators and researcher. A synthesis of these translations was made, with versions from the first translator (T1) and the second translator (T2), resulting in a common translation (T-12). Following that, the T-12 version was utilized to translate back to English. Two bilingual translators (BT1 and BT2) completed the back translations. These two translators (1st was a linguistic expert and 2nd was an English Professor) lacked any prior awareness of problems under investigation. The original questionnaire, the translations and the back translations were all compared by expert committee to address any discrepancies. The committee was comprised of researchers and two senior physical therapists. The committee then reached a consensus regarding parity between original and target version. The UEFI-U Pre-final version was eventually created. The pre-final version was given to 40 patients having upper extremity disorders. Each patient was asked to provide general feedback addressing any difficulty they may have had filling out questionnaire or to comprehend the purpose and relevance of each item. The expert committee evaluated the entire results from this phase of adaptation process, and after coming to a decision, final UEFI-U was developed and conducted to additional psychometric testing.

The Internal consistency and test-retest reliability were analyzed to assess UEFI-U reliability. The UEFI-U was administered twice, separated by 48 hours, to 40 randomly chosen patients to study test-retest reliability while minimizing recall of prior responses and differences in clinical condition.[23] Using an Intraclass correlation coefficient (ICC) & confidence intervals 95%, test-retest reliability was assessed. When ICC is less than 0.5, 0.5–0.75, between 0.76 and 0.9, or more than 0.9, it is deemed poor, moderate, good or excellent.[24] The internal consistency of UEFI-U was measured using value of Cronbach's alpha. When Cronbach alpha value is between 0.70 and 0.95, it is considered excellent.[24]

The degree of item completion, distribution of scores, and size of ceiling and floor effects must all be considered in order to evaluate content validity. If greater than 15 percent of respondents received highest or lowest score possible, respectively, floor and ceiling effects were assumed to be present.[23, 25, 26]

Factor analysis is typically performed to ascertain if components of a tool constitute one or more dimensions. The principal component factor analysis with varimax rotation was used to conduct factor analysis. The appropriateness of factor analysis was assessed using Bartlett's test of sphericity and Kaiser-Meyer-measure Olkin's of sample adequacy (KMO). The number of factors retained was determined using scree plot and Kaiser's criteria (Eigenvalue larger than 1).[17, 25, 26]

To evaluate construct validity, Pearson's correlation coefficient (r) was used to determine the association between UEFI-U, SF-36, VAS pain, and VAS disability. Values between 0.00 and 0.09, 0.10-0.39, 0.40-0.69, 0.70-0.89, and 0.90-1.00, suggest negligible, weak, moderate, strong, and very strong associations respectively.[27] An independent T-test was used to assess discriminative validity by comparing patients' overall UEFI-U scores to healthy controls. [23, 25, 26]

The patients were classified into two groups using the GROC scale: stable (GROC score < 3 to > −3) and improved (GROC score ≥ 3). Using an independent t-test; Responsiveness was examined by contrasting change scores of UEFI-U between stable and improved groups.(23, 25, 26) Using Pearson's correlation coefficients, the change scores of UEFI-U were also associated with change scores of SF-36, VAS disability and VAS pain.

The Statistical Product and Service Solution version 21 software was used to perform all statistical analyses. The means and standard deviation of continuous variables were used to illustrate them, and frequency and percentage were used to illustrate categorical variables. P-value of less than 0.05 has been used to assess statistical significance.

Results

The original UEFI has been translated and culturally adapted into Urdu following predetermined parameters. All adaptation process was fulfilled without experiencing linguistic challenges or conceptual misunderstandings while resuming original version context. During preliminary testing, ULFI-U was filled by 40 individuals having different upper limb musculoskeletal disorders. The participants completed it easily because questionnaire was simple and directly related to their presenting problems. The results of preliminary test revealed no concern about vocabulary or content used in translated Urdu version. As a result, UEFI-U was approved without any changes to original tool.

The study involved 232 patients with upper limb disorders; 63.8% of patients were female, and average age was 37.9± 14.14 years old. The demographic data and clinical features of respondents are represented in table I.

The UEFU-U internal consistency was proved, as indicated by its Cronbach alpha value of 0.93. The excellent test-retest reliability of UEFI-U was demonstrated by its $ICC_{2,1}$ = 0.91.

Table II displays the mean, standard deviation, and reliability findings for all item scores on the FRI-U.

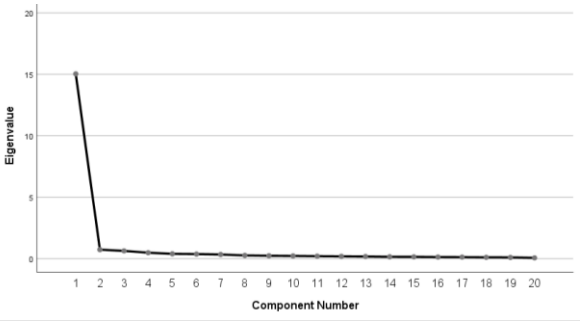

Figure 1. shows Scree plot showing one- factor solution.

There were no multiple or missing answers found. On UEFI-U total score, the ceiling and floor analysis was done. No floor or ceiling effects on total score of UEFI-U were obtained.

The KMO measure of sample adequacy value was 0.96 & significant value of Bartlett's test of sphericity was observed ($p < 0.001$). Hence, data was acceptable to employ in factor analysis. Principal Component Analysis revealed a 1-factor solution with Eigen value greater than 1 and as shown by scree plot in Figure 1, accounting for 75.18% of total variance.

Table I: Demographic data and Clinical features of Participants.

	Patients (n=232)		Healthy Participants (n=75)	
Variables	**Mean ± SD**	**n/%**	**Mean ± SD**	**n/%**
Age (years)	37.9 ±14.14		27.31 ± 3.91	
BMI	25.14 ± 4.9		24.21 ± 4.6	
Gender				
Male		84/36.2		23/32.9
Female		148/63.8		47/67.1
Educational level				
Primary		11/4.7		3/4.3
Matric		38/16.4		5/7.1
Intermediate		32/13.8		11/15.7
Graduate		122/52.6		21/30
Postgraduate		29/12.5		30/42.9
Occupation				
Employed		86/37.1		41/58.6
Unemployed		146/62.9		29/41.4
Marital status				
Single		97/41.8		26/34.7
Married		123/53		48/64
Divorced		12/5.2		-
Affected Extremity				
Right		150/64.7		N/A
Left		82/35.3		
Duration of pain in months	10.77 ± 14.35		N/A	
UEFI-U (0-80)	34.81 ± 15.77		0	
SF 36 (0-100)				
Physical function	58,7 ± 16.11		95.71±5.3	
Role physical	42.5± 20.2		95.7±4.3	
Bodily pain	38.6± 15.6		97.13±2.54	
VASpain (0-10)	4.03 ± 2.23		0	
VAS disability (0-10)	2.21 ± 0.72		0	

Table II: Mean and standard deviation of all items of UEFI.				
UEFI Items	1st MeasurementMean ± SD	2nd Measurement Mean ± SD	ICC	Confidence interval
Item 1	1.45 ± 0.81	1.47 ± 0.81	0.95	0.90--0.97
Item 2	1.37 ± 0.83	1.35 ± 0.83	0.97	0.94-0.98
Item 3	1.07 ± 1.18	1.27 ± 1.13	0.95	0.92-0.97
Item 4	1.30 ± 1.06	1.25 ± 1.08	0.97	0.95-0.98
Item 5	1.25 ± 0.92	1.30 ± 0.91	0.95	0.91-0.97
Item 6	1.15 ± 0.92	1.10 ± 0.90	0.88	0.77-0.93
Item 7	1.65 ± 1.21	1.80 ± 1.18	0.92	0.86-0.96
Item 8	1.43 ± 1.07	1.69 ± 1.18	0.91	0.84-0.95
Item 9	1.40 ± 1.05	1.45 ± 1.01	0.96	0.93-0.98
Item 10	1.45 ± 1.01	1.72 ± 1.03	0.92	0.85-0.95
Item 11	1.82 ± 1.17	1.92 ± 1.16	0.91	0.83-0.95
Item 12	1.55 ± 0.98	1.80 ± 1.04	0.84	0.78-0.91
Item 13	2.12 ± 1.28	2.32 ± 1.36	0.94	0.89-0.97
Item 14	1.30 ± 1.20	1.35 ± 1.07	0.93	0.88-0.96
Item 15	2.17 ± 1.03	2.35 ± 1.07	0.91	0.83-0.95
Item 16	1.22 ± 1.16	1.37 ± 1.16	0.95	0.91-0.97
Item 17	1.35 ± 1.00	1.40 ± 0.92	0.94	0.89-0.97
Item 18	1.60 ± 1.03	1.82 ± 1.12	0.82	0.67-0.90
Item 19	1.90 ± 1.08	2.07 ± 1.09	0.86	0.74-0.92
Item 20	0.50 ± 0.78	0.72 ± 1.03	0.83	0.68-0.91

Concurrent validity was evaluated by correlating responses to UEFI-U with results of VAS pain, VAS disability and domains of SF36 by using Pearson correlation coefficient. The UEFI-U showed a moderate correlation with SF36 physical function, SF36 role physical, VAS pain and VAS disability but fair correlation with SF36 bodily pain as shown in Table III. The result showed significant difference in UEFI-U total score comparing patients and healthy controls (P< 0.001).

Table III: Correlations among UEFI-U, SF-36, VAS pain & VAS disability		
Scales	**UEFI-U (n=232) Pearson correlation (r)**	**P-value**
SF36 (Physical Function)	0.68	<0.001
SF36(Role Physical)	0.60	
SF36 (Body Pain)	0.42	
VAS Pain	-0.54	
VAS Disability	-0.57	

Table IV: Correlations among change scores of UEFI-U, SF-36, VAS pain & VAS disability		
Scales	**UEFI-U change score (n=232) Pearson correlation (r)**	**P-value**
SF36- Physical Function change score	0.73	< 0.001
Sf36- Role Physical change score	0.62	
SF36- Body Pain change score	0.46	
VAS Pain change score	-0.49	
VAS Disability change score	-0.44	

A statistically significant difference in UEFI-U change scores between two groups (42.38±13.37 in improved group, n = 143; 23.75±11.64 in stable group, n =88; P < 0.001) was determined by independent t-test. A moderate to fair association was observed between change scores of UEFI-U and SF36 physical function, SF36 bodily pain, SF36 role physical, the VAS pain, and the VAS disability as shown in table IV.

Discussion

The goal of this project was to translate and cross-culturally adapt original English version of UEFI, and also examine its psychometric properties into Urdu. The quicker completion time of UEFI makes it ideal for use in clinical settings. The questionnaire was completed in less than 10 minutes. The age ranges from 18 - 65 with females (63%) and males (36%) which is similar to Turkish version that also recruited more females but in Arabic, Greek, and Italian studies there were more males than females.(12-15) In our investigation, internal consistency was demonstrated by a Cronbach Alpha score of 0.93. which lies within recommended range of 0.70 to 0.95 which indicates an excellent internal consistency. It was highly comparable to previous study of original UEFI (0.94), Italian UEFI (0.96), Arabic UEFI (0.96), Greek UEFI (0.93), Turkish UEFI (0.91) & Chinese UEFI (0.93).[11-16] The Intraclass correlation Coefficient (ICC) for UEFI-U was (ICC= 0.91), which is consistent with previous studies such as original UEFI (ICC= 0.94), Chinese UEFI (0.97), Italian UEFI (ICC= 0.91), Greek UEFI (ICC= 0.91)

and Arabic UEFI (ICC= 0.92) however Only Turkish version showed a lower test-retest reliability (ICC: 0.80), the time between measurements from a test and a follow-up test, which wasn't stated in Turkish edition, could be a possible explanation.[11-16] Factor analysis revealed a single-factor solution explained total variance of 75.18%, whereas previous studies did not evaluate factor analysis.

The ceiling and floor analysis were performed on total score of UEFI-U. There were no floor or ceiling effects on the total score consistent with results of earlier studies. The missing value rate for UEFI-U was 16% on item of "driving'' because some of participants didn't know how to drive while others did not have a car which compares itself to Turkish UEFI with 17.20% missing values on "driving" item and 1.10% missing value on item i.e. "doing up buttons".[14] No multiple answers were found in this study. The correlation between UEFI-U and three reference measures (SF36, VAS pain, VAS disability) was analyzed to assess concurrent validity. According to Pearson correlation coefficients, the UEFI-U showed good correlation with the SF36 physical function (r= 0.68), SF36 role physical (r= 0.60), SF36 bodily pain (r= 0.42), VAS pain (r= -0.54), Vas disability (r= -0.57). This is also in line with previously published versions.[12,14,15]

The UEFI-U was anticipated to be a good tool for identifying changes in responsiveness over time. The UEFI-U scores for the stable and improved groups, which showed 143 improved and 89 stable directed over a period of 3 weeks with similar therapy, showed statistically significant differences ($p<0.001$) in the current investigation. A moderate to fair correlation was found between change scores of UEFI-U and change scores of SF36 physical function (r=0.73), SF36 role physical (r=0.62), SF36 bodily pain (r=0.46), the VA Spain (r=-0.49), and the VA disability (r=-0.44). The responsiveness and change score validity of UEFI using other measures have not been studied previously. The strength of the study is that all the analysis has been carried out following the international guidelines. This is the first study to translate UEFI into Urdu and test its psychometric features, enabling clinicians and researchers to employ UEFI-U in Urdu-speaking populations. The limitation of the study was the inclusion of various upper extremity disorders that introduces heterogeneity into the study population because of this diversity, it is more difficult to determine how the UEFI-U specifically works for certain upper extremity conditions, another limitation is the utilization of a convenience sampling technique may introduce a bias.

Conclusion

The findings revealed that UEFI-U is a reliable, valid, and responsive questionnaire to measure disability in Urdu-speaking population having upper extremity disorders.

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