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Cross-Cultural Adaptation and Psychometric Evaluation of the Dutch Version of the Work Rehabilitation Questionnaire (WORQ-VL)

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Abstract

Purpose The Work Rehabilitation Questionnaire (WORQ) was developed to evaluate work functioning in vocational rehabilitation, but was not yet available in Dutch. The goal of this study is twofold: a description of the cross-cultural adaptation process (part 1) of the WORQ to be used in Flanders (The Dutch speaking part of Belgium, WORQ-VL) and a presentation of the first psychometric testing of the WORQ-VL (part 2). *Methods* For part 1, the guidelines for cross-cultural adaptation of self-report measures by Beaton et al. were used to structure the cross-cultural adaptation. For part 2, a cross-sectional study was conducted in patients with musculoskeletal disorders [sample A: hand and wrist rehabilitation (n = 21) and sample B: fibromyalgia patients (n = 93)] who completed the WORQ-VL. Internal consistency and factor structure were examined in the total sample, whereas convergent and discriminant validity of the WORQ-VL were researched in sample A. *Results* First results on the convergent validity and discriminant validity (small sample size) and internal consistency of the WORQ-VL are promising. The exploratory factor analysis revealed seven factors which were labeled as 'cognition', 'physical', 'mood', 'activities of daily living', 'sensory', 'emotional' and 'social'. The best evidence was found for the 'physical' subscale of the WORQ-VL: strong correlations were found with the 'physical functioning' and 'role limitations—physical' subscales of the Short-Form Health Survey, respectively $r = -.84$ and $r = -.59$, $p < .01$. As expected, predominantly weak correlations were found with hand grip strength, kinesiophobia, hand-related aesthetics and satisfaction (ranging between $r = -.38$ and $r = .34$, $p > .05$). *Conclusions* The WORQ-VL is a user-friendly and valuable ICF-based self-report questionnaire to evaluate work functioning. Future studies are highly needed to examine the value of the WORQ within different patient populations and settings in order to examine further the added value of this self-report measure.

Keywords Work Rehabilitation Questionnaire · WORQ · Psychometrics · Vocational rehabilitation · Return to work

Introduction

Numerous studies have stressed the importance of return to work (RTW) after an injury or disease from an individual, organizational and societal viewpoint [1, 2] and its complex and multi-faceted nature with multiple stakeholders [3, 4]. As a result of this increasing awareness, multiple programs aimed at enhancing work participation have been developed including vocational rehabilitation (VR) [5, 6]. VR refers to a multi-professional evidence-based approach that is provided to working age individuals with health-related impairments, limitations or restrictions with work functioning and whose primary aim is to optimize work participation [7]. VR was put forward as a solution to address the difficulties with (re-) entering the labor market and sustained work participation [5, 8].

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A comprehensive bio-psychosocial approach is essential to capture the complexity of the RTW process [9] in which the emphasis is not only on the biomedical issues of disability, but also and perhaps more prominent on the psychosocial and work-related factors and their interaction. The International Classification of Functioning, Disability and Health (ICF) [10] possesses the ability to encompass these facets, acting as an overarching universal framework to describe and document functioning in VR.

The value of the ICF within the domain of RTW has been emphasized [7, 9, 11] although the precise and direct application of ICF remains a challenge [7, 11]. To enhance this implementation within VR settings, the core set VR was developed. This core set identifies relevant ICF categories to describe the functioning of persons engaged in VR ("lived experiences of persons in VR") and factors involved in the RTW process [7, 12]. Another suggestion to enhance the use of the ICF within VR settings consists of developing and using ICF-based questionnaires [9]. In 2014, the Work Rehabilitation Questionnaire (WORQ) was therefore introduced building on the core set for VR as a tool to assess work functioning [13].

The WORQ addresses multiple needs within the domain of RTW and the VR process. Firstly, a well-planned VR program should start with a comprehensive and accurate description of the patient's functioning requiring a holistic approach by taking into account all factors that may have an impact on VR outcomes (e.g. return to work after VR) [14]. Secondly, the WORQ can be used (independent of the health condition or setting) at any time point within the continuum of the RTW process: as a starting point to determine VR goals or at the end of the VR program to monitor work-related functioning over time [15]. Thirdly, interprofessional communication can be facilitated due to the ICF-based nature of the questionnaire [15]. Finally, the WORQ offers an opportunity for rehabilitants to be actively involved in their RTW process, which is essential when a shift has to be made from being unemployed to being employed [16]. As suggested by Selb [15] the WORQ can be used as an "ice-breaker" or a tool to open up a conversation on different topics. Use of the WORQ helps to create an environment in which the experiences and opinions of the patients are explicitly recognized and the stage for behavior change (i.e. RTW) is set.

The cross-cultural adaptation of the WORQ has been achieved in different languages such as German, Brazilian-Portuguese, French, Russian and Taiwanese, but to date there is no Dutch version. To date, there are only three studies examining the psychometric properties of the WORQ [13, 17, 18] and two teaching case studies [15, 19]. The preliminary findings on the WORQ are very promising with regard to validity, reliability and feasibility [20]. Nevertheless a call for future studies was made to further explore the value of the WORQ in different patient populations and settings [15]. Given the advocated potential of the WORQ as described above, there is a need for a Dutch version of the WORQ that can be employed in rehabilitation settings and hospitals. Hence, the objectives of this study were (1) to perform and describe the cross-cultural adaptation of the self-report version of the WORQ into Dutch (WORQ-VL), (2) to report on its usability and (3) to examine the psychometric properties (internal consistency, convergent validity, divergent validity, multi-dimensionality and a preliminary test–retest reliability analysis) of the WORQ-VL using data of two convenience samples of musculoskeletal disorders.

Methods

The current study consists of two parts: the description and course of the cross-cultural adaptation (part 1) and the psychometric findings on the WORQ-VL (part 2).

Part 1: The Cross-Cultural Adaptation

The guidelines for cross-cultural adaptation of self-report measures as described by Beaton [21] were used to structure the cross-cultural adaptation process of the WORQ. This process consists of five phases: translation, synthesis, back translation, expert committee review, and pretesting.

Part 2: The Psychometric Testing of the WORQ-VL

Formal testing of the psychometric properties of the adapted questionnaire remains highly recommended [21]. In this second part, the psychometric properties of the WORQ-VL (i.e. reliability, discriminant and convergent validity) were examined within a group of patients with musculoskeletal disorders.

Study Population

Two convenience samples of patients in the Ghent University Hospital who were aged between 18 and 65 years (economically active age group) were recruited. Sample A consists of participants who started a hand and wrist rehabilitation program; sample B consists of fibromyalgia patients following a treatment in the Multidisciplinary Pain Center. Data collection took place from January 2017 until July 2017. Participants of sample A completed the WORQ-VL at the beginning of the rehabilitation program; the second administration of the WORQ-VL took place 1 week after the first administration. Exclusion criteria were: (1) lack of comprehension of Dutch, and (2) cognitive impairment, dyslexia or aphasia.

Instruments

The patients of both samples were asked to fill in the two parts of the WORQ-VL. Part 1 consists of 17 questions concerning background information on the work situation and socio-demographic information. Part 2 of the WORQ-VL comprises 40 questions related to functioning in VR and 2 questions evaluating the time needed to complete self-care and therapy. A numeric rating scale going from 0 (no problem) to 10 (complete problem) was used for the 40 questions. A WORQ-VL total score was calculated as the sum score of the 40 functioning questions, ranging from 0 to 400 [13].

To test its usability, five statements based on the questionnaire used in the original WORQ study [13] were used (e.g. 'The questionnaire, including the NRS scoring mechanism, was easy in use'). A 5-point Likert scale ranging from 'strongly agree' to 'strongly disagree' was used to score the first four statements. The fifth statement queried the completion time of the WORQ-VL. Finally, the patients could report their general findings and thoughts concerning the WORQ-VL.

The construct validity (more specific the convergent and discriminant validity) of the WORQ-VL was tested by means of the following instruments: the Michigan Hand Outcomes Questionnaire-Dutch Language Version (MHQ-DLV) [22], the Disabilities of the Arm, Shoulder, and Hand—Dutch Language Version (DASH-DLV) [23] and the Tampa Scale for Kinesiophobia (TSK) [24]. The results of the hand grip strength measurement using the E-Link Dynamometer (Biometrics Ltd) were also available. These instruments were used in daily clinical practice as part of the rehabilitation protocol. Additionally the patients were asked to complete the Short-Form Health Survey—Dutch Language Version (SF-36) [25].

The MHQ-DLV is a multidimensional, hand-specific self-report questionnaire containing 37 core questions. The MHQ-DLV covers six domains, namely (1) overall hand function, (2) overall activities of daily living, (3) pain, (4) work performance, (5) aesthetics, and (6) patient satisfaction with hand function. The DASH-DLV is a 30-item self-report questionnaire assessing the upper extremity disability, with a focus on physical function, containing 21 physical function, 6 symptom and 3 social or role function items. The DASH also consists of two optional four-item scales to assess the performance in sports/music and work. The TSK is a 17-item self-report questionnaire assessing subjective ratings of fear of movement or (re)injury. The SF-36 measures health-related quality of life across eight domains (e.g. role limitations due to physical health problems; social functioning).

Statistical Analysis

Descriptive statistics were used to describe sample A and B. Internal consistency was calculated using Cronbach's alpha, which can be considered as acceptable when above 0.70 [26]. A preliminary test–retest reliability analysis was conducted using intraclass correlation coefficients and their 95% confidence intervals. An interval of 1 week was chosen because of its appropriateness in health status questionnaires and to minimize recall bias [27]. Intraclass correlation coefficients between 0.75 and 0.9 can be considered as good, whereas a value greater than 0.90 can be considered as excellent [28].

Factor validity was assessed using exploratory factor analysis in order to uncover underlying dimensions or factors of the 40 functioning items of the WORQ-VL. The normality or symmetric nature of the data was tested based on the Shapiro–Wilk test, histogram and Q–Q plots. The Kaiser–Meyer–Olkin test for sampling adequacy was used, requiring values ≥ 0.50 as the absolute minimum and ideal values being ≥ 0.80 [29]. The method for factor extraction was based on the distribution of the data with maximum likelihood and principal axis factoring for respectively normal and non-normal distribution of the data. The oblimin rotation technique was used allowing factors to be correlated. The following empirical criteria were used to determine the number of factors to be extracted: the Kaiser's criterion (eigenvalue > 1), the scree test criterion, and a minimum of 60% of the total variance needs to be explained by the factor solution. Internal consistency and test–retest reliability scores were calculated for the best factor solution.

Construct validity of the WORQ-VL (i.e. discriminant and convergent validity) was assessed by examining the correlation between the total score of the WORQ-VL and self-report questionnaires (TSK, MHQ-DLV, DASH-NL, SF-36, and grip strength). Moreover, building on the results of the exploratory factor analysis (groups of functioning domains, subscales) additional hypotheses were defined and tested.

Cohen's criteria were used to interpret the correlations with values of ≥ 0.10, ≥ 0.30 and ≥ 0.50 indicating respectively weak, moderate and strong correlations [30]. Construct validity was considered good when at least 75% of the results were in accordance with the hypotheses of absent or weak correlation (discriminant validity) and strong correlation (convergent validity) [26].

The internal consistency analysis and exploratory factor analysis were performed on the total sample (sample A and B) whereas the usability, test–retest reliability and construct validity were examined in the smaller study sample (sample A).

Data entry and analysis were performed using the statistical software SPSS version 24.0. The statistical level of significance was set at an alpha level of 0.05.

Results

Part 1: Cross-Cultural Adaptation of the WORQ

Three experts conducted a forward translation independently. Each translator was bilingual with Dutch as the native language. The first translator is a psychologist with expertise in VR and ICF and knowledge of the WORQ. The second translator is a psychology assistant and had no prior knowledge of the WORQ. The third translator is an occupational therapist and also had no knowledge of the WORQ. Each translator produced a translation in a written report with the rationale for their choices and a list of challenging phrases or uncertainties. The forward translations were compared and analyzed until there was a consensus. During this process, a fourth expert (with a background in occupational therapy and expertise in ICF) acted as a mediator and documented how difficulties were resolved to obtain a final translation. The final translation was back-translated in English by an independent professional translator without awareness of the WORQ concept nor a medical background. The results of the back-translation were evaluated and discussed in a group consisting of the three initial translators, the aforementioned mediator, two rehabilitation physicians, and one methodologist. The individual translated versions and the back-translation were discussed until group consensus was reached. This resulted in a provisional version of the WORQ-VL by checking semantic, idiomatic, experiential, cultural, and conceptual equivalences. The rationale and critical reasoning were described in a separate report.

Based on the usability findings of sample A (pre-testing), small but relevant adjustments were made to part 1 of the provisional version of the WORQ-VL. These adjustments were discussed with the members of the expert committee and only withheld if positive advice was given (e.g. "(vocational) rehabilitation program" was used instead of "vocational rehabilitation program"). By placing the word "vocational" within parenthesis, individuals who are following a generic medical rehabilitation program could more easily fill in the question because attention for RTW is often embedded within the general rehabilitation program. Other items were adapted so that they correlate more with the specific Flemish context e.g. to take into account country-specific legislative framework of the organizations who support people with work disabilities in their trajectories to a suitable job and specific school systems. These difficulties were not reported for part 2. Given the need to take into account the specific context in part 1, the name "WORQ-VL" (VL stands for 'Vlaams' and is the Dutch translation for Flemish) was chosen as it can be expected that a specific version of part 1 for the Netherlands will be necessary. This resulted in the final version of the WORQ-VL, which can be retrieved on the following website: https://www.myworq.com.

Part 2: Psychometric Testing

Description of the Samples

Sample A consists of 21 patients from the Hand and Wrist Rehabilitation program. Sample B contains 93 fibromyalgia patients following a treatment in the Multidisciplinary Pain Centre. The participants' characteristics are described in Table 1. The participants of sample A had diverse unilateral or bilateral hand and/or wrist injuries, such as repetitive strain injuries, tendon injuries, one- or multiple-finger amputations, etc., which made it difficult to distinguish subgroups. Through the process of data collection, there were no dropouts and the participants responded to all items (response rate 100%). The participants of sample B were diagnosed with fibromyalgia. The most frequently reported comorbidities along with fibromyalgia were: chronic fatigue syndrome (n = 22), Ehlers-Danlos Syndrome (n = 10) and arthrosis (n = 8).

Usability

90% of the participants agreed or strongly agreed that all questions were clear and easy to understand and that the questionnaire, including its NRS scoring mechanism, was easy to use. 85% agreed or strongly agreed that the WORQ-VL items are meaningful in the process of RTW. However, 38% reported the need for more assistance or explanation when completing part 1. These difficulties were addressed during the cross-cultural adaptation process and required that the specific Flemish setting was taken into account.

The average time needed to administer the WORQ-VL was 19.2 min (SD 4.9). In comparison to part 1 (sociodemographic and background information), less time was needed to administer part 2 with an average time of 7.1 min (SD 1.7). 86% of the participants found that the WORQ-VL had a good length.

The score distributions of the 40 functioning WORQ-VL items were examined. Both item 39 and 40 show a minimal floor effect of 15.8%. Ceiling effects were detected in 9 items, with values exceeding 30% on items 13, 28 and 31, and the largest ceiling effect (50.9%) on item 28. No floor or ceiling effects were detected in the WORQ-VL total score.

Appropriateness for conducting an exploratory factor analysis was confirmed by the Kaiser–Meyer–Olkin Test for Sampling Adequacy, with a value of 0.86, and a statistically significant Bartlett's test of sphericity ($\chi^2 = 0.86$, $df = 780$, $p < .001$). All p-values of the Shapiro–Wilk Test showed values less than 0.05, meaning that the null

Table 1 Characteristics of the participants (n = 114)

Characteristics	Sample A n = 21 (%)	Sample A and B n = 114 (%)
Age, mean (SD), years	39.3 (10.7)	43.4 (11.5)
Gender		
Male	12 (57%)	31 (27%)
Female	9 (43%)	83 (73%)
Diagnosis		
Hand and wrist injuries	21 (100%)	21 (18%)
Fibromyalgia	0 (0%)	93 (82%)
Number of comorbidities		
0 comorbidity	–	22 (19%)
1 comorbidity	–	37 (33%)
2 comorbidities	–	24 (21%)
> 2 comorbidities	–	10 (9%)
Unknown[a]	21 (100%)	21 (18%)
Highest level of education		
Primary school	0 (0%)	6 (5%)
Secondary education	13 (62%)	57 (50%)
Higher education	8 (38%)	51 (45%)
Marital status		
Married	7 (34%)	62 (54%)
Cohabiting	8 (38%)	24 (21%)
Never married	3 (14%)	16 (14%)
Divorced	3 (14%)	12 (11%)
VR type (multiple answers possible)		
Physical training	19 (90%)	61 (54%)
Cognitive training	2 (10%)	24 (21%)
Case management	0 (0%)	11 (10%)
Work evaluation	1 (5%)	1 (1%)
Workplace adjustments	2 (10%)	3 (3%)
Work status		
Currently working	5 (24%)	31 (27%)
Full time	1 (5%)	10 (9%)
Part time	4 (19%)	18 (16%)
Modified or light duty	0 (0%)	3 (1%)
Currently not working	16 (76%)	83 (73%)
Looking for a new job	3 (14%)	34 (30%)
Mean duration of sickness absence (SD), years	0.9 (0.5)	4.4 (4.3)

[a]No access was provided to the medical files of the Hand and Wrist Rehabilitation participants

hypothesis that the scores are not significantly different from a normal distribution could be rejected. Because the visual inspection of the histograms and the QQ-plots also indicated non-symmetric data, an exploratory factor analysis using the principal axis factoring method was conducted. A seven-factor structure provided the best model-fit considering the interpretability of the factors and their statistic properties as presented in Table 2.

More specifically, all items had factor loadings ≥ 0.30, no item communality after extraction dropped below 0.2, the mean value of communalities was 0.61 and the factor-structure accounted for 67% of the variance. The eigenvalues and the percentage of variance each factor accounts for, can be found in Table 3. The seven WORQ-VL factors were provisionally labelled as (1) 'Cognition' (9 items), (2) 'Physical' (8 items), (3) 'Mood' (3 items), (4) 'ADL (activities of daily living)' (5 items), (5) 'Sensory' (5 items), (6) 'Emotional' (3 items), and (7) 'Social' (7 items). The labelling for factor 1, 2 and 5 was obvious considering the cognitive, physical and sensory nature of the items, respectively. Factor 6 refers to emotions which are elicited by a specific object, person or event, whereas factor 3 refers to mood (longer lasting than emotions and more diffuse). Factor 4 refers to activities of daily life (ADL) with items of basic activities of daily living (such as putting on clothes, cfr. item 35: 'getting dressed'), instrumental activities of daily living (more complex skills, such as driving a car, cfr. item 34: 'driving a car or any form of transportation') and hand-focused ADL (based on hand-related activities such as fine hand use, cfr. item 26: 'using communication devices') and the importance of hand function for performing delicate movements in ADL [31]. Factor 7 (social) includes elements of communication (cfr. item 24: 'understanding body gestures, symbols and drawings') but also functioning within society in a broader sense.

The reliability analysis for internal consistency, as presented in Table 3, provided further evidence for the seven-factor solution with Cronbach's α values ranging from 0.74 to 0.90. The Cronbach's α for the 40 functioning items of the WORQ-VL (total score) was 0.95. In neither the total score of the WORQ-VL nor the factors, internal consistency could be significantly improved by deleting items.

Test–Retest Reliability

The second measurement was performed with an average interval of 7.4 days (SD 1.8) after the first measurement. One participant was excluded from the analysis because the test–retest interval was too long (29 days) due a schedule misunderstanding. As presented in Table 3, the intraclass correlation coefficient for the WORQ-VL total score was 0.85 and the intraclass correlation coefficients for the seven factors ranged from 0.71 to 0.91, indicating a good test–retest reliability.

Construct Validity

In terms of convergent validity, we hypothesized that strong correlations would be found between certain WORQ-VL factors and the MHQ-DLV, DASH-DLV and SF-36 (for an overview of the 11 hypotheses with regard to convergent validity, cfr. Table 4). Table 4 presents the

Table 2 Exploratory factor analysis: pattern matrix (n = 114)

No.	Item	Factor 1 Cognition	Factor 2 Physical	Factor 3 Mood	Factor 4 ADL	Factor 5 Sensory	Factor 6 Emotions	Factor 7 Social	Comm.[a]
	% Var.[b]:	35%	10.3%	7.6%	3.9%	3.7%	3.3%	3.2%	
	Eigenvalue:	14.0	4.1	3.0	1.6	1.5	1.3	1.1	
20	Making decisions	**0.68**							0.67
18	Focussing attention on a specific task or e.g. filtering out distractions such as noise	**0.64**							0.68
19	Reading	**0.61**				0.35			0.70
9	Thinking clearly	**0.54**							0.64
10	Analyzing and finding solutions to problems in day to day life	**0.54**					−0.37		0.63
21	Starting and completing a single task such as making your bed or cleaning up your desk or workplace	**0.49**		−0.31	0.35				0.67
23	Handling stress, crises or conflict	**0.46**					−0.31		0.65
3	Remembering to do important things	**0.38**							0.50
17	Learning a new task (e.g., learning a new game, learning how to use the computer, learning how to use a tool, etc.)	**0.36**							0.38
31	Walking a long distance (more than 1 km)		**0.88**						0.89
32	Moving around including crawling, climbing, and running		**0.67**						0.58
28	Lifting and carrying objects weighing more than 5 kg		**0.59**		0.34				0.62
14	General endurance when performing physical activities		**0.58**						0.63
30	Walking a short distance (less than 1 km)		**0.52**			0.44			0.70
13	Bodily aches or pains		**0.52**	0.44					0.70
1	Not feeling rested and refreshed during the day		**0.48**	0.44					0.69
15	Muscle strength		**0.35**		0.34				0.53
7	Your temper			**0.74**			−0.30		0.79
6	Being irritable			**0.67**			−0.38		0.74
2	Sleeping, such as falling asleep, waking up frequently during the night or waking up too early in the morning			**0.41**					0.44
35	Getting dressed				**0.64**	0.39			0.66
29	Fine hand use such as handling objects, picking up, manipulating and releasing objects using the hand, fingers and thumb				**0.54**			0.30	0.40
27	Lifting and carrying objects weighing up to 5 kg		0.36		**0.53**				0.59
22	Carrying out your daily routine or day to day activities		0.38		**0.46**				0.70
34	Driving a car or any form of transportation				**0.37**				0.39
40	Seeing and recognizing a person you know across the road (distance of about 20 meters or 66 feet)					**0.67**			0.69
39	Seeing and recognizing an object at arm's length					**0.64**			0.62
11	Hearing					**0.40**			0.41
12	Keeping your balance while maintaining a position or during movement					**0.39**			0.44
16	Skin problems, such as broken skin, ulcers, bedsores and thinning of skin					**0.37**			0.29
4	Your usual daily activities because you felt sad or depressed						**−0.79**		0.78

Table 2 (continued)

No.	Item	Factor 1 Cognition	Factor 2 Physical	Factor 3 Mood	Factor 4 ADL	Factor 5 Sensory	Factor 6 Emotions	Factor 7 Social	Comm.[a]
5	Your usual daily activities because you felt worried or anxious						**−0.79**		0.74
8	Your self-confidence			0.32			**−0.47**		0.63
26	Using communication devices such as using a telephone, telecommunication devices, and computers							**0.58**	0.63
38	Having sufficient money to cover your cost of living							**0.58**	0.55
25	Starting and maintaining a conversation							**0.58**	0.71
37	Your relationships with people							**0.54**	0.60
36	Looking after your health such as maintaining a balanced diet, getting enough physical activity and seeing your doctor as needed							**0.53**	0.49
24	Understanding body gestures, symbols and drawings	0.32						**0.35**	0.55
33	Using transportation as a passenger					0.32		**0.33**	0.50

The values in bold represent the highest factor loading of the items on the corresponding/assigned factor

Extraction method: principal axis factoring, rotation method: Oblimin with Kaiser normalization, rotation converged in 43 iterations

Factor loadings < 0.30 were omitted to increase the readability

[a]Communalities after extraction

[b]Percentage of variance the factor accounts for

Table 3 Reliability: internal consistency analysis (n = 114) and test–retest reliability (n = 20)

Subscales	Internal consistency (Cronbach's α)	Test–retest reliability[a]	
		ICC (95% CI[b])	p-value
Factor 1: cognition	0.90	0.81 (0.59–0.92)	.000
Factor 2: physical	0.89	0.85 (0.65–0.94)	.000
Factor 3: mood	0.75	0.86 (0.69–0.94)	.000
Factor 4: ADL	0.74	0.79 (0.49–0.91)	.000
Factor 5: sensory	0.78	0.91 (0.78–0.96)	.000
Factor 6: emotions	0.86	0.71 (0.37–0.88)	.000
Factor 7: social	0.87	0.78 (0.52–0.91)	.000
WORQ-VL (sum score)	0.95	0.85 (0.62–0.94)	.000

[a]Test–retest reliability sample = 20, average test–retest interval = 1 week

[b]95% confidence interval: lower bound – upper bound

correlations between the WORQ-VL, the factor scores and the other included instruments, using Spearman's rank correlation coefficient because of the non-normal distribution of the WORQ-VL data. The expected strong correlation of the 'Physical' subscale of the WORQ-VL and the SF-36 'Physical functioning' ($r = -.84$, $p < .01$) and 'Role limitations—physical' ($r = -.59$, $p < .01$) subscales was confirmed. The ADL scales of the WORQ-VL and MHQ-DLV correlated moderately ($r = -.49$, $p < .05$) whereas the 'Mood' and 'Emotions' subscales of the WORQ-VL with the 'SF-36 mental health' scale correlated strongly respectively $r = -.58$ ($p < .01$) and $r = -.58$ ($p < .01$). As expected, the 'cognition' factor of the WORQ-VL correlated strongly with the SF-36 mental health scale ($r = -.57$, $p < .01$) and the SF-36 vitality subscale ($r = -.52$, $p < .05$). However, the WORQ-VL 'Social' subscale and the SF-36 'Social functioning' subscale correlated not significantly ($r = -.26$, $p > .05$). The correlation of the WORQ-VL factor 'Emotions' and the SF-36 subscale role limitations—emotional was also not confirmed ($r = -.39$, $p > .05$). The total score of WORQ-VL was not significantly correlated to neither the work subscale of the MHQ ($r = .25$, $p > .05$) nor the work subscale of the DASH ($r = .28$, $p > .05$).

Although not hypothesized, moderate to strong significant correlations were found between the WORQ-VL and all SF-36 subscales ($r = -.43$ to -0.71), except for the 'Role limitations—emotional' ($r = -.01$, $p > .05$) and 'General health' ($r = -.39$, $p > .05$) subscales. The ADL-factor of the WORQ-VL correlated strongly with the SF-36 subscale 'physical functioning' ($r = -.60$, $p < .01$) and moderately with 'role limitations—physical' ($r = -.44$, $p < .05$). The WORQ-VL factor 'physical' also correlated strongly with both bodily pain ($r = -.61$, $p < .01$). A strong correlation was also found between the WORQ-VL factor 'social' and the SF-36 subscale 'general health' ($r = -.73$, $p < .01$).

With regard to the discriminant validity of the WORQ-VL (4 hypotheses, cfr. Table 4), all WORQ-VL subscales showed predominantly weak correlations with the

Table 4 Construct validity (n = 21) using Spearman's rank correlation coefficient

	Factor 1 Cognition	Factor 2 Physical	Factor 3 Mood	Factor 4 ADL	Factor 5 Sensory	Factor 6 Emotions	Factor 7 Social	WORQ-VL (sum score)
SF[a]-36								
Physical functioning	−0.40	**−0.84****	−0.51*	−0.60**	−0.22	−0.17	−0.38	−0.71**
Role limitations—physical	−0.45*	**−0.59****	−0.37	−0.44*	−0.23	−0.39	−0.40	−0.64**
Role limitations—emotional	−0.30	0.25	0.05	0.22	−0.32	**−0.39**	−0.35	−0.01
Vitality (energy/fatigue)	**−0.52***	−0.49*	−0.51*	−0.33	−0.41	−0.53*	−0.41	−0.65**
Mental health	**−0.57****	−0.15	**−0.58****	−0.18	−0.28	**−0.58****	−0.15	−0.43*
Social functioning	−0.58**	−0.35	−0.34	−0.11	−0.41	−0.31	**−0.26**	−0.43*
Bodily pain	−0.31	−0.61**	−0.50*	−0.42	0.02	−0.23	−0.15	−0.50*
General health	−0.41	−0.31	−0.10	0.09	−0.57	−0.16	−0.73**	−0.39
MHQ-DLV[b]								
Overall hand function	−0.10	−0.23	−0.21	−0.33	−0.11	−0.19	−0.05	−0.28
Overall ADL	−0.02	−0.42	−0.21	**−0.49***	0.09	−0.07	0.05	−0.31
Work	−0.12	0.36	0.27	0.26	0.18	−0.15	−0.03	**0.25**
Pain	−0.27	−0.18	−0.03	0.09	0.04	−0.27	−0.36	−0.14
Aesthetics	*−0.04*	*−0.07*	*0.21*	*−0.20*	*−0.10*	*0.00*	*0.05*	*−0.08*
Satisfaction	*−0.18*	*−0.37*	*−0.34*	*−0.29*	*−0.11*	*−0.29*	*−0.22*	*−0.38*
MHQ total score	−0.05	−0.02	0.05	−0.15	0.05	−0.10	−0.02	−0.05
DASH[c]								
Disability/symptom	0.18	0.57*	0.62**	0.65**	−0.05	0.20	0.17	0.56*
Optional: sports/music	−0.08	0.44	0.31	0.56*	−0.47	0.13	−0.14	0.31
Optional: work	0.03	0.28	0.45	0.50*	−0.20	0.05	−0.14	**0.28**
TSK[d]	*0.19*	*−0.08*	*−0.31*	*−0.15*	*0.18*	*0.26*	*0.20*	*−0.03*
E-link dynamometer (injury side)	*0.00*	*0.26*	*0.31*	*0.04*	*0.29*	*−0.02*	*0.34*	*0.17*

Correlations in bold correspond to an expected high correlation (11 hypotheses convergent validity)

Correlations in italic correspond to an expected non or weak correlation (4 hypotheses discrimant validity)

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

[a]Short-Form Health survey 36 Dutch Language Version

[b]Michigan Hand Outcomes Questionnaire, Dutch Language Version

[c]Disabilities of the Arm, Shoulder, and Hand

[d]Tampa Scale for Kinesiophobia

MHQ 'Satisfaction' (r = − .11 to − 0.37) and 'Aesthetics' (r = − .20 to 0.21) subscales, the TSK (r = − .31 to 0.26) and the E-Link Dynamometer (r = − .02 to 0.34). Finally, the WORQ-VL also showed no significant correlations with the MHQ 'Satisfaction' (r = − .38, p > .05) and 'Aesthetics' (r = − .08, p > .05) subscales, the TSK (r = − .03, p > .05) and the E-Link Dynamometer (r = .17, p > .05). In total, 73.3% of the hypotheses on the construct validity were confirmed.

Discussion

All steps of the guidelines of Beaton [21] for cross-cultural adaptation of a self-report questionnaire were successfully completed and resulted in the WORQ-VL. The exploratory factor analysis showed 7 factors and the psychometric properties are promising. However, some aspects need to be discussed.

Regarding the cross-cultural adaptation, some adjustments were necessary in part 1 due to country differences in e.g. social security systems [32] and specific content of VR programs [9]. Consequently, a context-specific section on socio-demographics and work-related information was needed. These difficulties were not reported for part 2, showing a universal version is adequate. These findings are in line with the cross-cultural adaptation of the WORQ into French [18] and suggest that the functioning part of the WORQ has potential to compare work functioning across VR settings, countries and health conditions. Comparison by means of the WORQ will allow to elaborate our knowledge of the VR process and stimulate evidence-based VR practice. As shown in their review, the ICF field needs to mature and

ICF-based measurements such as the WORQ can help to exploit the full potential of the ICF [33].

Based on the results from the usability questionnaire, that was only completed in the group of patients following hand and wrist rehabilitation, the WORQ-VL seems usable, feasible and has a good face validity. The results of the preliminary test–retest reliability analysis (also within this smaller sample) of the WORQ-VL and its subscales are positive. An adequate time interval is essential when examining test–retest reliability of self-report measures [34], the average time interval in this study was 7.4 days. Moreover, it can be assumed that patients were stable (beginning of the rehabilitation program) when looking at the construct measured by the WORQ-VL. The subscale 'Emotions' had the weakest intraclass correlation coefficient, almost reaching the level of 0.75, which is the cut-off for good test–retest reliability [28]. A logical explanation may be found in the fact that emotions tend to be shorter in duration, whereas mood seem to be longer lasting.

A further inspection of the ceiling effects revealed that the 7 items with the largest ceiling effect were part of the 'Physical' subscale (consisting of 8 items). This is very plausible, considering that all participants had a musculoskeletal disorder and 54% of them reported that physical training is a (or the main) part of their rehabilitation.

Based on the results of the exploratory factor analysis, 7 underlying factors within part 2 of the WORQ-VL were withheld with a good internal consistency and a good preliminary test–retest reliability. These results indicate that the WORQ-VL consists of more than one functioning domain as suggested by Finger et al. [20]. This seems logical because the items were selected based on the VR core set and can be linked to different components within the ICF framework going from e.g. mental functions to mobility and self-care. The use of subscale scores might be useful in addressing specific groups or functioning domains: high scores on the subscale 'mood' might for instance indicate a need for psychological therapy as part of the VR program. Since some VR programs have a high financial cost, the WORQ can potentially help to identify at an early stage for which patients an intensive VR program is essential and help to compose a tailored VR program.

Evidence for the convergent validity of the WORQ-VL and the factors/subscales was only partly provided (7 of the 11 hypotheses were confirmed, 63.6%). Given the sample characteristics (hand and wrist injuries), it's not surprising that the best evidence was found for the 'Physical' subscale (both hypotheses were confirmed). Against our expectations, no satisfying correlation was found between the WORQ-VL 'Social' subscale and the SF-36 'Social (role) functioning' subscale. An explanation may be found in that the corresponding SF-36 items ask specifically about the impact of either physical or emotional problems on social activities [35], whereas the WORQ-VL 'Social' subscale should be seen in a broader societal perspective, including elements of communication, relationships, health and financial management and moving around in society depending on others. The expected correlations of the 'mood' and 'emotions' subscales with mental health were also confirmed, whereas the correlation of 'emotions' subscale with 'role functioning—emotional' was not significant. As hypothesized the ADL subscales of the MHQ and WORQ-VL were significantly correlated, as well as the cognition subscale of the WORQ and the SF-36 vitality scale (asking about energy and fatigue).

No evidence was found for a relationship between the WORQ-VL and the MHQ 'Work performance' and DASH 'Work' subscales. Even though this was against the expectations, it has to be noted that a closer inspection of these MHQ and DASH subscales showed that eight participants replied the corresponding questions with regard to their household instead of their work performance, although being a homemaker was not their profession.

Although not hypothesized, the strong correlation of the WORQ-VL 'social' factor with the SF-36 'General health' subscale can be seen as an indication that a better self-perceived general health is related to higher work functioning. Although the SF-36 'physical functioning' scale has the highest correlation in our sample with the sumscore of the WORQ, this subscale was not significantly related to the sumscore of the WORQ in the study of Finger et al. [13]. A possible explanation might be the different composition of the patient groups: hand and wrist injuries vs patients following a VR program respectively.

Evidence for the discriminant validity (all four hypotheses were confirmed) was provided as the WORQ-VL and its subscales show no significant relationship with concepts of hand-related satisfaction and aesthetics (MHQ), kinesiophobia (TSK) and hand grip strength (E-Link Dynamometer).

First psychometric analyses were conducted in a sample of patients with musculoskeletal disorders. Given the central role of the person in the VR process, assessment of "the lived experience" is essential. This applies to patients with musculoskeletal disorders, but equally for patients with other disorders. Due to the generic nature of the WORQ-VL and the growing importance of patient-reported outcomes within health care [36], it is assumable that this questionnaire is a valuable tool in other patient populations as well. Dependant on the specific disorder, certain functioning domains may deserve extra attention within the VR process.

Limitations of the Study and Future Research

Although the results of the preliminary test–retest reliability analysis of the WORQ-VL are promising, these analyses need to be repeated in larger study samples. The

methodological quality of this analysis needs to be considered as poor due to the sample size lower than 30 and cannot be considered a robust examination of test–retest reliability [37].

This study examined several factor-structures, but only reported and discussed the seven-factor structure. The rationale for rejecting other factor-structures was thoroughly documented and justified, and can be requested by contacting the authors. It needs to be examined whether the same factor structure is found in similar and different patient groups (e.g. patients with a mental health condition, patients with acquired brain injury).

ICF-based documentation tools linked to the rehabilitation cycle have been developed, among which the ICF categorical profile [38]. ICF-based measurement instruments, such as the WORQ, can facilitate the completion of the categorical profile at the beginning and the end of the VR program. To ensure that the WORQ-VL can be used at any time point in a VR program, the responsiveness of the total scale and its subscales needs to be examined so that an evolution in self-perceived functioning can be detected [20].

A recent review [39] showed that higher self-efficacy has consistent positive associations with RTW for workers with psychological or upper-body musculoskeletal injuries. Therefore, it seems interesting to see whether the WORQ (self-perceived functional abilities and difficulties) and/or certain subscales are associated with measurement of self-efficacy (since the latter is a modifiable factor with a large impact on RTW) [40].

Depending on further experiences with the WORQ-VL, it can be examined whether a brief version is needed or if this would imply a loss of information. When looking at the average time needed to complete part 2 of the WORQ-VL and the high percentage of patients reporting a good length of the WORQ, our results indicate no high need for a shorter questionnaire. On the other hand, usability findings were reported on a small sample and need to be confirmed in larger samples.

Furthermore, and perhaps in a more advanced stage, future research can be directed to investigate the predictors of RTW in multiple patient groups following a well-specified VR program. For example, it has been shown that, for people with work-related major forearm, wrist or hand injuries, better self-perceived vitality, measured by the SF-36, is a good predictor for early readiness for RTW [41]. A similar WORQ-VL study could be set up to investigate whether certain subscales (and/or the total score) can act as predictor(s) of RTW. Notwithstanding the value of the WORQ, as illustrated in this paper, it is advised to use measurement strategies (i.e. self-report, clinician-based and capacity evaluation) complementary to each other to obtain a comprehensive picture of the capacity of a worker with chronic musculoskeletal pain complaints to perform work activities [42]. Future studies can study the added value of the WORQ as self-report measure in comparison with for instance functional capacity evaluations.

Conclusion

First results on the WORQ-VL show that the questionnaire seems usable, feasible and shows good face validity within a sample of patients following hand and wrist rehabilitation. Seven underlying dimensions (distinct and internally consistent subscales) of the WORQ-VL were found as a result of the exploratory factor analysis (total sample), which were labelled based on their content. Evidence for internal consistency and discriminant validity was also found for the WORQ-VL and the factors resulting from the exploratory factor analysis. Although 7 of the 11 hypotheses with regard to the convergent validity were confirmed (63,6%), these results also seem promising. Future studies with a larger sample size on the value of the WORQ-VL are needed to confirm these results and the potential of the WORQ as an instrument to give an overview of the self-perceived functional problems and abilities which are relevant in a VR setting. As shown in the recent review on the use of ICF [11], challenges with the application of the ICF call for further research on its utility across different assessment instruments. Using the ICF-based WORQ as a part of the assessment within VR in different countries may contribute to a holistic picture of the rehabilitant and the RTW process and facilitate the involvement of the patient.

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Compliance with Ethical Standards

Conflict of interest The authors declare no conflict of interest.

Ethical Approval The study was approved by the Ethics Commission of the Ghent University Hospital and was granted the number B670201731223.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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