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Cross-cultural adaptation, reliability, and validity of the work role functioning questionnaire 2.0 to Persian

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\textbf{ABSTRACT}

\textbf{Purpose:} To translate and cross-culturally adapt, the Work Role Functioning Questionnaire 2.0 to Persian (WRFQ-Pr), and evaluate reliability and validity.

\textbf{Material and Methods:} Standardized protocols were followed including forward-backward translation then synthesis/consolidation. Subsequent pilot investigation of the draft WRFQ-Pr (\(n = 50\), male = 68\%, age = 33.5 ± 7.3 years) tested the alternative wording and determined face and content validity through readability, understandability, interpretation, and cultural relevance. Participants (\(n = 288\)) were recruited from a convenience sample to assess: construct validity through exploratory factor analysis (EFA) using Promax rotation and maximum least squares extraction; and internal consistency using Cronbach’s \(\alpha\) coefficient. Test-retest reliability was evaluated from the intraclass correlation coefficient (ICC\(_{2,1}\)).

\textbf{Results:} The forward-backward translation was achieved with eight items (1,3,4,5,9,11,12,22) modified and reformulated due to idiomatic issues. Internal consistency for the subscales ranged from \(\alpha = 0.87\)–0.95, and the test-retest reliability was ICC\(_{2,1}\) = 0.92 (CI: 0.89–0.95). The EFA showed a four-factor solution, being identical to the original version, however items 20–22 loaded with items 23–26 in one factor, which was re-named “flexibility and social demand.” One item (#26) did not load above the required 0.30 threshold and was removed from the WRFQ-Pr. No floor or ceiling effects were found.

\textbf{Conclusions:} The WRFQ translation and cross-cultural adaptation to Persian (WRFQ-Pr) was performed successfully. The determined properties of reliability and validity are comparable to those of the original English version.

\textbf{IMPLICATIONS FOR REHABILITATION}

- The WRFW can simultaneously evaluate the health status of the worker, the existence of impairments, the involved factors in creating ability/disability at work, and the outcome of the interventions.
- There is no instrument available for the Persian-speaking population to evaluate related disability at work and the condition of return to work after a rehabilitation intervention.
- The WRFQ was translated and culturally adapted into Persian.
- The WRFW-Pr demonstrated excellent internal consistency, test-retest reliability and a four-factor structure.

\textbf{Introduction}

As a consequence of economic and social situations the retirement age has increased notably [1] with considerable variation in different countries. In the European Union Member States, the general retirement age is 65 years but some counties, such as Spain, Germany and France have increased their retirement age from 65 to 67 years, while in Britain and Ireland the goal is 68 years. In Iran, the retirement age is 60 years for men and 55 for women [2]. Many workers remain at their previous occupations or adopt new positions to compensate for personal costs. This has resulted in an increasing population of older persons within the active workforce that have concurrent health problems. These factors can influence their work efficiency and performance [3,4], where the interaction with health status is a concern for a patient’s medical review, and for adjunct potential investigations [5]. Good health status in the work setting is import from the individual and medical perspectives as it can enable workers to feel more in control of their working life and lead to increased productivity, less instances of sickness and absenteeism, a less stressed workforce, improvements in employee mental health and well-being, and greater motivation [6]. Conversely, the promotion of a sustainable, healthy and productive working life attracts increased attention from the political and medical perspectives [7].

The rapid acquisition of information and accurate data on patients’ work can assist practitioners to document the potential physical and psychosocial risk factors associated with work-related musculoskeletal disorders (MSDs) [5,8]. Work functioning self-report questionnaires are becoming increasingly necessary in the
working environment in order to evaluate the effectiveness of health services, interventions aimed at work rehabilitation, the management and the prevention of work ability/disability, and the monitoring of the impact of mental and physical health problems [3,5]. Although work outcomes are a socially and economically important set of endpoints, there are many challenges in their assessment, but little consensus on the most appropriate measures. The quantified measurement of work outcomes is required, and should be developed or translated into different languages and cultures, due to the need to meet the evaluation requirements of employees, employers, and health care groups. Further, such questionnaires also provide the necessary information for rehabilitation, return to work, business decision making, and policy development [5,9].

Several generic questionnaires are designed for the work setting. For example, the “Work Ability Questionnaire” (WAI) [10] evaluates the worker’s health status and workplace conditions. Other questionnaires measure the degree to which mental and physical health problems interfere with work ability and related disability. Questionnaires that perform this function include the Endicott Work Productivity Scale (EWPS) [11], the Work Limitations Questionnaire (WLQ) [12], and the Work Role Functioning Questionnaire (WRFQ 2.0), herein referred to as the WRFQ [3,5]. These questionnaires were developed based on twentieth century work models, however today’s modern twenty first century changing work practices, work places, workforces and new technologies have raised new challenges [13,14]. Of the three instruments mentioned, the WRFQ, which originated from the “Work Limitations Questionnaire (WLQ)” [12], can simultaneously evaluate the health status of the worker, the existence of impairments, the involved factors in creating ability/disability at work, and the outcome of the interventions [15,16]. Essentially this instrument is used to evaluate work function and any related mental or physical health effects. Further, the WRFQ provides assistance related to assessing workers during their initial return to work after a period of absenteeism, and to screen individuals with a low level ability or capacity. Such screening assists in the management and treatment of the injury and facilitates a return to the work setting. This consequently leads to increased productivity for the affected organization. The WRFQ version 2.0 has considered the changing nature of work and the related new dimensions determined as “flexibility demands” and is representative of today’s twenty first century work practices, workplaces and work forces [14].

Recently the WRFQ was successfully translated, adapted and validated for use in different languages such as French-Canadian [15], Brazilian-Portuguese [17], Dutch [3], Norwegian and Danish [18] and other European languages such as Spanish [19]. All of these versions have shown suitable high levels of psychometric properties in their different respective populations.

In Iran, as with many Western countries, the legal working age population is 18–60 years. In Iran, the number of individuals in the working population aged 18–60 has decreased, as workers continue to remain in their positions after the maximum legal working age, reducing the opportunity for younger individuals to supersede these positions. Further, native Persian-language or generic cross-culturally adapted health-related work questionnaires are not available, neither are there validated scales to assess the impact of any health problems on work functioning. To our knowledge, because of the lack of such instruments in the Persian language, occupational physicians’ are limited to assessing a workers quality of “return to work.” Such instruments will provide assistance with circumstances of assessing workers during their initial return to work after a period of absenteeism.

The aim of this study was the translation and cultural adaptation of the WRFQ 2.0 to Persian (WRFQ-Pr) and the evaluation of the essential psychometric properties of reliability and structural validity including face, content and construct.

Materials and methods

Work role functioning questionnaire (WRFQ 2.0)

The WRFQ is a generic role-specific measure consisting of 27 items and four subscales: 1) work scheduling and output demands, 2) physical demands, 3) mental and social demands and 4) flexibility demands [5,7]. It assesses the perceived difficulties in meeting work demands among employees given their physical health or emotional problems [3,15]. The WRFQ items are scored on a 0–4 point Likert scale which measures the amount of work time in the past four weeks that a worker had difficulty performing the work demands due to physical or mental problem. Items are scored as follows: 0 = difficult none of the time (0%), 1 = difficult most of the time, 2 = difficult half of the time (50%), 3 = difficult some of the time, 4 = difficult none of the time (0%). There is also a default response option for non-applicable item-questions, “Does not apply to my job.” Subscale scores are summed separately by adding the answers in the subscale, divided by the number of completed items in the subscale. This is multiplied by 25 to obtain percentages where higher scores indicate better work functioning. The scores on “Does not apply to my job” were transformed to missing values. If more than 20% of items are missing, no score can be calculated and the score is set to missing. A total score is calculated by summing all the calculated subscale scores [3,7,19].

Translation and cross-cultural adaptation

To initiate the study, permission from the developer of the original questionnaire was obtained. The WRFQ translation and cross-cultural adaptation into Persian was completed using published guidelines and papers [9,20]. The translation sequence was forward, synthesis, backward, consolidation, and pre-final version testing [20]. In the pilot testing, equivalence between the original and Persian versions was ensured.

Forward translation used two independent native Persian speakers: a physiotherapist familiar with the measured concepts and questionnaire translation experience; and a professional translator with no WRFQ’s measured concepts knowledge. Translation synthesis was achieved by consensus agreement between the two translators and two research team members. This followed analysis and discussion of discrepancies between the two provided translations. Backward translation used two further independent and blinded translators who highlighted challenging wordings or uncertainties [21].

An “expert committee” was formed from volunteers from six separate occupational professions; an ergonomist, methodologist and physiotherapist from the overseeing University, a psychometrician expert in industrial outcome measurement development from an independent academic organization, and an occupational physician from the textile industry; the translators were from two separate language organizations. This committee discussed discrepancies between the original and translated versions to reach consensus and produce a pre-final WRFQ-Pr. This version accounted for semantic, idiomatic and conceptual equivalence, with uncertainties clarified by contacting the original questionnaire developers [20,22].
A pilot test was conducted in order to evaluate the equivalency and comprehensibility of the translated version. A convenience sample of general native Persian speaking participants with musculoskeletal complaints \( n = 50 \), male = 68\% age = 33.5 ± 7.3, range 18–60 years) was recruited. In order to test the alternative wording and check the face and content validity through readability, understandability, interpretation, and cultural relevance, a simple 10 min cognitive interview was subsequently conducted. Based on the recorded interview, any suggested changes were discussed and applied by the expert committee. A final semantic adjustment was made based on the evidence from this stage [23] which was verified and confirmed by the developer.

**Participants**

After completing the cross-cultural adaptation, the reliability and validity was addressed within a larger sample of workers with musculoskeletal disorders \( n = 288 \). These participants were recruited consecutively from a sample of convenience taken from several textile companies and organizations. The participants were from diverse occupational settings including office, industrial, and weaving and spinning workers who engage in manual, non-manual and a combination of both within their work setting. Inclusion criteria were: the presence of a work related musculoskeletal health problem for a minimum of one month, working at least 8-h per day, age between 20–60 years, and good Persian language reading and comprehension, as determined by the ability to read the information sheet and then subsequently the questionnaire. The expert panel occupational physician confirmed the health status of the participants. The ethics committee of the University of Social Welfare and Rehabilitation Sciences (USWR) approved the study (IR.USWR.REC.1398.060).

**Psychometric properties evaluation**

**Face validity**

The face validity of the Persian WRFQ was evaluated to ascertain appropriateness and relevance of the content ensuring feasibility, readability, and clarity of language for the participants. It was performed by the expert committee members through qualitative analysis of the participant’s comments, which were provided in the pilot stage of the research. Each participant’s comment was considered individually by the expert panel and a consensus was obtained.

**Reliability**

The test-retest reliability was evaluated in a new cohort \( n = 60 \) male = 56.3\% age = 34.8 ± 8.2 years using the intra-class correlation coefficient (ICC2,1). The participants completed the questionnaire on the second occasion at a one week interval in similar working conditions. An ICC2,1 value >0.8 was considered evidence of excellent reliability [24,25]. Internal consistency was calculated from Cronbach’s alpha (\( \alpha \)) coefficient for the total score of the WRFQ and its subscales. The value \( \alpha \) between 0.70–0.95 is considered high, with values >0.95 considered excessive being suggestive of redundancy and potential non-validity [26,27].

**Floor or ceiling effects**

The floor and ceiling effects were calculated by the percentage frequency of the highest and lowest score achieved by participants. If more than 15\% of the participants achieve this score, then ceiling and floor effects were considered present [9,26].

**Construct validity**

Construct validity was evaluated using exploratory factor analysis (EFA) with Promax rotation and loading suppression at 0.3 with maximum likelihood extraction (MLE) [27]. The factor extraction had three a-priori requirements: Eigenvalues >1.0, variance >10\% and the scree plot inflexion point or “elbow.”

**Statistical analysis**

Characteristics of the study participants are described using frequencies, percentages, means and standard deviation (SD). All statistical analysis were calculated using the statistical package for social science version 16 (SPSS 16) for windows. Statistical significance was set at \( p < 0.05 \).

**Results**

**Cross-cultural adaptation process**

The forward translation process was challenging in terms of certain items due to idiomatic issues, particularly for eight specific items: item 1 (get going easily), item 3 (extra breaks or rests), item 4 (stick to a schedule), item 5 (work fast enough), item 9 (feeling sense of accomplishment), item 12 (stay), item 22 (control my temper). Item 11 (“pounds”) was changed to its equivalence as “kilograms.”

These items were discussed in more depth between the translators and the members of the research team to achieve a consensus. In order to maintain the intention of the original concept and the questionnaire, the original author was contacted to assist in the clarification and in reaching a consensus version.

During the backward translation process, some discrepancies were observed. Due to an instructional discrepancy, some items needed to be modified and reformulated to obtain semantic and idiomatic equivalence between the original and the Persian version.

The expert committee specifically addressed the translation of items 1, 3, 9, 10, and 22, and achieved a consensus version following extensive discussion and consideration of alternatives. This produced a pre-final Persian-version in which a total of nine items were reformulated and revised (items 1, 2–5, 9–12 and 22). Table 1 shows the original items of the WRFQ, those noted as difficult to be translated to Persian, and the adjusted items based on consensus, and the item level responses of the WRFQ.

**Results of the pretesting**

The pre-final WRFQ questionnaire was administered to a new cohort \( n = 50 \), male = 68\% age = 33.5 ± 7.3, range 18–60 years). The participants interviewed during this stage reported some difficulties in understanding the content of some questions, which led to further item modifications. A total of 23\% of participants suggested the sentence “During the past four weeks” should be highlighted in the questionnaire’s instructions. Further, that the sentence “It was difficult for me to …” improves clarity if it is incorporated at the beginning of all items. They reported that it was difficult to answer a new question and remember each time that the statement referred to their difficulty in carrying out certain activities. Following further discussion with the research committee the expression “It was difficult for me to …” was included at the beginning of each item.

For item 8, “Make satisfied those ones who judge my work” four participants (8\%) wanted to define those who judge the work such as supervisor, coworkers, customer or head of the
Table 1. Item level responses and applied adjustment on the Persian WRFQ’s 2.0 instructions ($n = 50$).

<table>
<thead>
<tr>
<th>Items* (original version)</th>
<th>Persian version changes</th>
<th>Sub scale</th>
<th>$N$ missing or not applicable</th>
<th>Response $N$ (%) Mean</th>
<th>Item to subscale correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Get going easily at the beginning of the workday.</td>
<td>“Get going” changed to “going out */&quot;</td>
<td>WSOD</td>
<td>1/0</td>
<td>0</td>
<td>8(16) 10(20) 21(42) 11(22) 2.70</td>
</tr>
<tr>
<td>2. Start on my job as soon as I arrived at work.</td>
<td>–</td>
<td>WSOD</td>
<td>0/0</td>
<td>2(4)</td>
<td>5(10) 8(16) 23(46) 12(24) 2.76</td>
</tr>
<tr>
<td>3. Do my work without stopping to take extra breaks or rests</td>
<td>Removed the word &quot;Breaks&quot;</td>
<td>WSOD</td>
<td>0/0</td>
<td>2(4)</td>
<td>3(6) 9(18) 26(52) 10(20) 2.78</td>
</tr>
<tr>
<td>4. stick to a routine or schedule</td>
<td>“Stick to” changed to “follow up” */</td>
<td>WSOD</td>
<td>0/0</td>
<td>0</td>
<td>3(6) 14(28) 21(42) 12(24) 2.84</td>
</tr>
<tr>
<td>5. work fast enough</td>
<td>“Work fast” changed to “Get enough speed”</td>
<td>WSOD</td>
<td>0/0</td>
<td>0</td>
<td>4(8) 17(34) 23(46) 6(12) 2.62</td>
</tr>
<tr>
<td>6. Finish work on time.</td>
<td>–</td>
<td>WSOD</td>
<td>0/0</td>
<td>0</td>
<td>3(6) 14(28) 21(42) 12(24) 2.84</td>
</tr>
<tr>
<td>7. Do my work without making mistakes.</td>
<td>–</td>
<td>WSOD</td>
<td>0/0</td>
<td>0</td>
<td>1(2) 15(30) 17(34) 17(34) 3.00</td>
</tr>
<tr>
<td>8. satisfy the people who judge my work</td>
<td>–</td>
<td>WSOD</td>
<td>1/0</td>
<td>0</td>
<td>2(4) 13(26) 21(42) 14(28) 2.94</td>
</tr>
<tr>
<td>9. feel a sense of accomplishment in my work</td>
<td>“accomplishment” changed to “achieved something great” */</td>
<td>WSOD</td>
<td>1/3</td>
<td>1(2)</td>
<td>5(10) 7(14) 20(40) 14(28) 2.87</td>
</tr>
<tr>
<td>10. feel that I have done what I am capable of doing</td>
<td>–</td>
<td>WSOD</td>
<td>0/0</td>
<td>0</td>
<td>4(8) 9(18) 24(48) 13(26) 2.92</td>
</tr>
<tr>
<td>11. lift, carry, or move objects at work weighing more than 10 pounds</td>
<td>“10 pounds” changed to “5kg”</td>
<td>PD</td>
<td>0/4</td>
<td>2(4)</td>
<td>2(4) 4(8) 5(10) 34(68) 3.34</td>
</tr>
<tr>
<td>12. Sit, stand, or stay in one position for longer than 15 min while working.</td>
<td>“Stay in one position” changed to “work in a stable position”</td>
<td>PD</td>
<td>0/0</td>
<td>1(2)</td>
<td>3(6) 5(10) 10(20) 31(62) 3.34</td>
</tr>
<tr>
<td>13. repeat the same motions over and over again while working</td>
<td>–</td>
<td>PD</td>
<td>0/0</td>
<td>1(2)</td>
<td>2(4) 4(8) 16(32) 26(52) 3.31</td>
</tr>
<tr>
<td>14. Bend, twist, or reach while working.</td>
<td>–</td>
<td>PD</td>
<td>0/1</td>
<td>1(2)</td>
<td>2(4) 4(8) 16(32) 26(52) 3.31</td>
</tr>
<tr>
<td>15. Use hand-held tools or equipment (for example, a phone, pen, keyboard, computer mouse, drill, sander or hairdryer).</td>
<td>–</td>
<td>PD</td>
<td>1/5</td>
<td>2(4) 2(4) 9(18) 8(16) 24(48) 3.11</td>
<td>0.25</td>
</tr>
<tr>
<td>16. keep my mind on my work</td>
<td>–</td>
<td>MD</td>
<td>0/0</td>
<td>2(4)</td>
<td>5(10) 9(18) 12(24) 22(44) 2.94</td>
</tr>
<tr>
<td>17. work carefully</td>
<td>–</td>
<td>MD</td>
<td>1/0</td>
<td>1(2)</td>
<td>2(4) 12(24) 15(30) 20(40) 3.02</td>
</tr>
<tr>
<td>18. concentrate on my work</td>
<td>–</td>
<td>MD</td>
<td>0/0</td>
<td>1(2)</td>
<td>3(6) 10(20) 20(40) 16(32) 2.94</td>
</tr>
<tr>
<td>19. work without losing my train of thought</td>
<td>–</td>
<td>MD</td>
<td>1/0</td>
<td>0</td>
<td>6(12) 10(20) 26(52) 8(16) 2.72</td>
</tr>
<tr>
<td>20. Easily read or process information when working.</td>
<td>–</td>
<td>MD</td>
<td>0/2</td>
<td>0</td>
<td>1(2) 16(32) 10(20) 17(34) 2.98</td>
</tr>
<tr>
<td>21. Speak with people in-person, in meetings or on the phone.</td>
<td>–</td>
<td>MD</td>
<td>1/3</td>
<td>0</td>
<td>1(2) 11(22) 14(28) 19(38) 3.13</td>
</tr>
<tr>
<td>22. control my temper around people when working</td>
<td>“Control my temper” changed to “Keep calm” */</td>
<td>MD</td>
<td>1/5</td>
<td>0</td>
<td>2(4) 10(20) 15(30) 17(34) 3.07</td>
</tr>
<tr>
<td>23. Set priorities in my work.</td>
<td>–</td>
<td>FD</td>
<td>0/0</td>
<td>1(2)</td>
<td>4(8) 7(14) 19(38) 19(38) 3.02</td>
</tr>
<tr>
<td>24. Handle changes in my work.</td>
<td>–</td>
<td>FD</td>
<td>0/0</td>
<td>1(2)</td>
<td>3(6) 9(18) 19(38) 18(36) 3.00</td>
</tr>
<tr>
<td>25. Process incoming information, for example emails, in time.</td>
<td>Added “office letters”</td>
<td>FD</td>
<td>0/6</td>
<td>1(2)</td>
<td>0 13(26) 18(36) 13(26) 2.93</td>
</tr>
<tr>
<td>26. Perform multiple tasks at the same time.</td>
<td>–</td>
<td>FD</td>
<td>0/1</td>
<td>2(4)</td>
<td>4(8) 6(12) 24(48) 13(26) 2.86</td>
</tr>
<tr>
<td>27. To show initiative in my work.</td>
<td>–</td>
<td>FD</td>
<td>0/1</td>
<td>2(4)</td>
<td>5(10) 9(18) 16(32) 17(34) 2.84</td>
</tr>
</tbody>
</table>

*Items marked: */Difficult to translate.*

WSOD: work scheduling and output demands; PD: physical demands; MD: mental demand; FD: flexibility demands.
company. For emphasis, clarity and defining we were able to add these descriptions in parentheses. However, in subsequent discussion within the expert panel and with the original author this comment was not accepted because it was felt that it may limit other item questions.

Item 9 “the great things” was not clear for 65% of subjects. The workers were not able to answer this question without asking for clarification. They requested what was meant by the expression “something great.” Following discussion within the research team it was decided to extend this item in Persian to what may indirectly be translated in English to “… get a ‘greater’ [larger/bigger] success which satisfies me,” instead of the “something great.”

Item 11, was mentioned by 11 participants (22%), to be problematic to answer because 5 kg is a low weight in relation to their occupational manual handling that involved moving or lifting. These participants suggested a weight minimum of 8 kg. Following discussing in the research team we decided not to change this item, as a weight of 5 kg is considered as a basic minimal load in manual handling. Further, this item (move, lift, or carry objects more than 5 kg) was assigned as “not applicable to my job” by four participants (8%), because of the low level of load. Most of the workers mentioned that 5 kg was not felt to be a load that was sufficiently high enough for them not to be able to move, i.e., they can manage their duties with this load in all situations even in the presence of pain.

The Persian wording of item 14 was also changed to clarify the meaning of the word “reach” into “bend, twist, reach, and grasp.”

Item 15 “Use hand tools and appliances e.g., phone, pen, keyboard, mouse, drill, sander, or hairdryer,” was found difficult to complete by seven participants (14%). The participants lacked confidence in their response, as they did not know what most of these instruments were in relation to their specific workplace, as they were mostly considered for use at home or other places. In this regard the phrase was clarified by adding “… in your workplace.”

For item 25, workers were sometimes answering “not applicable to my job” because the example provided did not sufficiently describe their specific tasks. It was decided to provide additional examples such as “official letters” to ensure their duties were covered.

The proportion of participants using the response category “not applicable to my job” was <10% for all WRFQ subscales. After completing the questionnaires, we requested the participants provide their own ideas and input about the usefulness, completeness and satisfaction of the questionnaire, and its length. Overall, the vast majority of workers (>90%) found the questionnaire acceptable. With respect to the usefulness, 93% were in agreement; the overall item-response completeness/compentence was high (85%); and for the WRFQ length, 90% of participants were in agreement.

Participants

The demographic characteristics of the participants (n = 288) are provided in Table 2. There was a higher proportion of male participants (n = 169, 58.7%, age = 35.10 ± 8.69 years) than female (n = 119, 41.3%, age = 33.9 ± 37.26 years).

<table>
<thead>
<tr>
<th>Total</th>
<th>Men</th>
<th>Woman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age : mean (SD)</td>
<td>34.62 (8.4)</td>
<td>35.10 (8.7)</td>
</tr>
<tr>
<td>Education, N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>61 (21.2)</td>
<td>48 (28.40)</td>
</tr>
<tr>
<td>Middle</td>
<td>185 (64.2)</td>
<td>103 (60.94)</td>
</tr>
<tr>
<td>High</td>
<td>42 (14.6)</td>
<td>18 (10.65)</td>
</tr>
<tr>
<td>Job type, N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual</td>
<td>95 (32.9)</td>
<td>67 (39.7)</td>
</tr>
<tr>
<td>Non-manual</td>
<td>99 (34.4)</td>
<td>35 (20.7)</td>
</tr>
<tr>
<td>Mixed</td>
<td>94 (32.6)</td>
<td>67 (39.6)</td>
</tr>
<tr>
<td>Working hours/week, mean (SD)</td>
<td>54.6 (9.1)</td>
<td>56.9 (8.07)</td>
</tr>
<tr>
<td>Disease type, N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>170 (59.1)</td>
<td>104 (61.5)</td>
</tr>
<tr>
<td>Mental</td>
<td>47 (16.3)</td>
<td>30 (17.8)</td>
</tr>
<tr>
<td>Both</td>
<td>71 (24.6)</td>
<td>35 (20.7)</td>
</tr>
</tbody>
</table>

Evaluation of the psychometric properties

Face validity

Face validity of the WRFQ-Pr translation was considered good by the expert committee. They considered the content of the questionnaire to be complete and relevant in order to assess the health-related functioning at work. This decision was based upon the committee discussions and the pilot study participants’ feedback where any raised comments or queries were discussed by the committee and a consensus decision was made.

Factor structure

The EFA with Promax rotation and MLE was applied to the 27 items. The Kaiser-Meyer-Olkin (KMO) measure (0.92) exceeded the acceptable limit (0.5) [28] which verified the sampling adequacy for the analysis and the Bartletts’s test of sphericity was significant [χ² (351) = 2488.17, p < 0.001] ensuring that the correlations between items were sufficiently large for factorial analysis. A combination of the three a-priori consideration of scree plot (inflexion present at the fifth point), Eigenvalues >1, factor loadings and interpretation of the factors revealed a four factor structure (Figure 1).

The factor loading for the four-factor solution is shown in Table 3. In contrast to the original version, item 26 did not load in any factors so it was decided to remove it from the questionnaire. The new four obtained subscales, are categorized as “work scheduling and output demands” which included items 1–10, “physical demands” which included items 11–15, “mental demands” which included items 16–19, and both “flexibility demands” and “social demands” which included items 20–26. Our results showed that Factors 1 and 2 were the same as the original version. For factor 3, the mental demands section (items 16–19) was maintained but the social demands section (items 20–22) loaded with the flexibility demand items (item 23–27). Consequently, we renamed this factor “flexibility and social demand” and deleted the “social demand” from the “mental and social demand” factor. The WRFQ-Pr now included four factors as noted below:

Factors:
1. “Work scheduling & output demands” (items 1–10)
2. “Physical demands” (items 11–15)
3. “Mental demands” (items 16–19)
4. “Flexibility and social demands” (items 20–26)
Reliability

Scale and item internal consistency

Descriptive statistics of the subscales of the WRFQ-Pr are presented in Table 4. The mean score of the subscales ranged from 57.4 for the flexibility and social demand factor to 71.4 for the mental demands factor. The participants indicated relatively high work functioning in all subscales, with the highest in mental demands.

The lowest limitation response categories (difficult all of the time) were not obtained in all the subscales. The percentage of...
Table 4. Description and Cronbach's alpha coefficient for each Pr-WRFQ subscale (n = 288).

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Valid n (miss/not appl)</th>
<th>Mean (SD)</th>
<th>n (%) at Floor (0%)</th>
<th>n (%) at Ceiling (100%)</th>
<th>Cronbach's alpha</th>
<th>Range of item-to-total correlation</th>
<th>Range of correlation with other scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work scheduling &amp; output demands</td>
<td>277 (11)</td>
<td>67.07 (22.43)</td>
<td>5 (1.7%)</td>
<td>16 (5.6 %)</td>
<td>0.93</td>
<td>0.63–0.82</td>
<td>0.34–0.68</td>
</tr>
<tr>
<td>Physical demands</td>
<td>283 (5)</td>
<td>68.35 (24.94)</td>
<td>6 (2.1%)</td>
<td>28 (9.7%)</td>
<td>0.87</td>
<td>0.60–0.80</td>
<td>0.29–0.62</td>
</tr>
<tr>
<td>Mental demands</td>
<td>283 (5)</td>
<td>71.48 (25.46)</td>
<td>6 (2.1)</td>
<td>17 (6.4 %)</td>
<td>0.95</td>
<td>0.80–0.93</td>
<td>0.47–0.68</td>
</tr>
<tr>
<td>Flexibility &amp; social demands</td>
<td>273 (15)</td>
<td>57.41 (25.94)</td>
<td>1 (3 %)</td>
<td>64 (22.2 %)</td>
<td>0.88</td>
<td>0.53–0.79</td>
<td>0.29–0.48</td>
</tr>
<tr>
<td>Total score</td>
<td>273 (15)</td>
<td>65.39 (19.10)</td>
<td>1 (3 %)</td>
<td>2 (7 %)</td>
<td>0.94</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Discussion

In this study, we translated and cross-culturally adapted the original English version of the WRFQ into Persian (WRFQ-Pr), and determined the psychometric properties of test-retest reliability, internal consistency and face, content and construct validity as acceptable. As a result, the WRFQ-Pr is very close to the original version in terms of comprehension and linguistics and can be used with confidence in Persian speaking Iranian subjects. Due to possible cross-cultural differences in the wording of items in different languages, it is important to follow a rigorous standardized procedure for providing and assessing the translation, cross-cultural adaptation and validation procedures prior to establishing a new version of any questionnaire. Once established, validated and pilot-tested, the consensus version of the WRFQ-Pr could be confirmed and subsequently administered in clinical and work settings.

During each stage of the adaptation process challenges emerged that were based on the participants, the research team, and the original author’s comments. All critical and relevant suggestions were considered by the expert panel and the participants before changes were made. These were then trialed in a test population with the purpose of optimizing the comprehensibility and subsequent clinical application of the questionnaire.

The lay-out of the WRFQ-Pr questionnaire was changed in comparison to the original English version, due to the expression of “... it is difficult ...” being added at the beginning of all items. Similar to the modifications made in our study, Gallasch et al. [17] in their Brazilian-Portuguese WRFQ adaptation changed the questionnaire lay-out. In contrast, in other versions in Dutch [3,7], Turkish [29], French-Canadian [15] and European Spanish [19], the original lay-out and questionnaire’s instructions remained unchanged. Our lay-out change was specifically in response to the participants’ feedback that it was difficult to recall the statement at the beginning of the items which led to the added wording. We feel that from the expert opinion, participant feedback and findings in the results that the ultimate accuracy of the response rate will be consequently increased and consequently so will the clinical and overall application.

During the forward and backward translation, several items were changed as a direct consequence of linguistic difficulty. Seven items were translated to an equivalent phrase in Persian. For example the English phrase “Get going easily” was translated to the Persian equivalent of “Going out to work” because of the uncertainty in the understanding by the Iranian participants. The terms “break” and “rest” are equivalent in Persian and we used these phrases and included them both in item 3. The phrase “Stick to routine” is also difficult to translate into Persian and after discussion with the original author the “follow up” phrase was accepted as the most approximated meaning. The phrase “sense of accomplishment” was also not familiar in Persian so the consensus statement was that of “get a greater/bigger success which satisfies me at my work.” In item 11 the “pound” measure of weight was change to “kilogram” because the metric system of measure is used in Iran. Lastly, in item 22 the phrase “control my temper” was considered at depth and after considerable discussion within the research team and with the original author it was changed to the Persian equivalent of “keep calm.”

Some overlap is visible with the item translation to other language versions such as Dutch [3], French-Canadian [15], Turkish [29], Norwegian and Danish [18] and Brazilian-Portuguese [17]. For example, Abma et al. [3], in the Dutch version and Irmak et al., in Turkish version [29] also reported difficulty in the translation of the phrases “get going easily” and “control your temper.” Likewise the “pound” was reformulated to “kilogram” [3]. In the French-Canadian version the phrases “sense of accomplishment” and “control your temper” were also changed and reformulated [15]. In the Norwegian, Turkish [29] and Danish version [18], as with the Persian and other version, the “10 pounds” was replaced with “5 kilograms.” Also the Items 1, 10, 20 and 22 proved difficult to translate and adapt in the Norwegian and Danish versions [18] as well as in the Dutch version [18]. In the Brazilian-Portuguese version no need was found to alter the meaning of the questions or to remove or add sentences [17].

During the pretest stage suggestions were provided by the participants, some of which were accepted and others not. They had suggested adding the “person who can judge their work,” but the research team vetoed this as it created limitations in the available responses. Also 8 kg was suggested instead of the existing 5 kg in item 11, which was also not accepted. In item 15, the phrase of “in the workplace” was added because the subjects stated they didn’t know that the mentioned instruments are related to their workplace as they were more familiar in the home context or in other locations.

The mean score of participants for all subscales was above 57, indicating relative good performance in job demands. This may limit the discriminant validity of the questionnaire in the same...
way as reported for the Brazilian [17], Canadian [15], Norwegian and Danish [18] and Spanish [19] versions. The percentage of “floor and ceiling” scores for a scale can be considered a criterion of content validity. The absence of floor and ceiling effect for all subscales (<15%) with the exception of the flexibility and social demands subscale (22%), indicated the ability of the questionnaire to distinguish between high and low scores in the target populations of workers with a health condition. These results are relatively in accordance with other studies which found ceiling effects for the mental demands and social demands subscales [3,15,19].

The ceiling effect was not found for the Norwegian and Danish [18] versions, and was not reported in the Brazilian version [17]. The increased percentage of ceiling scores for the flexibility and social demand scales may be related to a lower effect of musculoskeletal disorders on the Iranian workers’ ability to handle the social aspects of their work, and show flexibility from a cultural or personal perspective. Some participants also noted during the pre-testing that the 5 kg cut-off was considered too low and their suggestion of the 8 kg level was made, but not accepted by the research team, as the former complied with recognized work standards. It appears that the underestimation or adaptation of the workers to their flexibility demands in Iran may be a cause of this effect.

To our knowledge, no published studies have assessed the factor structure of the WRFQ, based on different target populations, though in some studies, the construct validity of the WRFQ was confirmed by testing hypotheses. In our study, we found a four-factor structure, but this structure differed from the original version by separating the social demands from the physical demands and social demands factor and the move to the flexibility demands factor. Two factors of the work scheduling and output demands, (items 1–10), and physical demands (items 11–15) were maintained as per the original version. Items 20–21 in the Persian version were considered as social demands and were incorporated into musculoskeletal disorders. However, in the WRFQ-Pr, the EFA analysis showed they are loaded with the items 23–26 under the original flexibility demands. We labeled the new modified factor as flexibility and social demand (items 20–26). It seems that item 20 “Easily read or process information when working,” item 21 “Speak with people in-person in meetings or on the phone,” item 22 “Control my temper around people when working” all have on the one hand a social nature, and on the other a flexibility nature. Consequently, considering them labeled as flexibility and social demand does appear logical for the WRFQ-Pr. The original WRFQ has been translated into several languages and the internal consistency tested and verified for the Dutch (0.70–0.91) [3], Spanish (0.81–0.95) [19], French-Canadian (0.66–0.92) [15], Norwegian and Danish (0.79–0.85) [18], Turkish (0.62–0.88) and Brazilian-Portuguese (0.57–0.93) [17] versions. The results of the internal consistency assessment on the WRFQ-Pr showed high reliability with the Cronbach’s alpha >0.87 but ≤0.95 for all subscales, a finding which was equitable to the other versions.

Our results for the test-retest reliability showed the questionnaire had high stability over time (ICC = 0.92, CI = 0.89–0.95). This is consistent with other published findings. Abma et al. [7], found a moderate reliability (ICC = 0.66) in a general population for the Dutch Version, and a low value for flexibility demands (0.29) [7]. In the Brazilian-Portuguese version a satisfactory value was found for mental demands (R = 0.68) and excellent reliability for all other subscales (0.82–0.91) [17]. In the Spanish version, there was good test-retest reliability (ICCs range =0.77–0.93 for all subscales) and excellent total score reliability (ICC = 0.94) [19].

In other published versions including the French-Canadian [15], Turkish [29] and Norwegian [18] versions, the test-retest reliability were not assessed.

**Strengths and limitations**

A limitation of the study was that the majority of participants had a low to middle level of education (85%). Though a heterogeneous sample was intended and sought this was not achieved to the desired level for education. This was predominantly due to the lower educational requirement for the majority of worker occupational positions within the Iranian textile industry. This may limit the generalizability of the results for those with high educational levels and their potential respective occupations. This is an aspect that should be considered in future research in order to achieve the selection of a heterogeneous sample. A further limitation was that the selection of subjects was limited to only those with a physical health problem, and not mental health issues. Consequently the findings are only applicable to this group.

Strengths of the study include the efficient adaptation, that the work force was inclusive of both genders and representative occupations and the psychometric findings were comparable to previous cultural and linguistic adaptations. A convenience sample of workers with different job types (manual, non-manual and a combination) were used in this study, ensuring the sample is representative of the population with these required occupational tasks in the textile industry.

**Conclusion**

The results obtained in this study together with the results of other studies, indicates the reliable and valid performance of the WRFQ-Pr. This research assures that the WRFQ-Pr can be used by researchers, physicians, rehabilitation providers and experts in the field of work disability prevention as a clinically applicable questionnaire. Further, the WRFQ-Pr has the capacity to detect change in those returning to work. This enables the effect of medical care in “return to work” programs to be evaluated and to determine the worker’s ability to meet their work demands given their health and work status. Consequently, this questionnaire can be implemented effectively in both the work and rehabilitation program settings.

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