Test–retest reliability of the Work Ability Index questionnaire

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The goal of the study was to assess the test–retest reliability of the Work Ability Index (WAI) questionnaire. Reliability was tested using a test–retest design with a 4 week interval between measurements. Valid data were collected among 97 elderly construction workers aged 40 years and older. We analysed the test–retest reliability of the WAI score itself (range 7–49 points) and classification in one of the four WAI categories based on this score: poor (7–27 points); moderate (28–36 points); good (37–43 points); and excellent work ability (44–49 points). Exactly the same WAI score on both measurements was reported by 25% of the subjects and 95% of the individual differences between measurements were found to be <6.86 points (two times standard deviation). Despite the individual changes between measurements, no significant difference was reported in the mean WAI score at group level between test and retest measurements (40.4 versus 39.9). The percentage of observed agreement for the classification of subjects in one of the four WAI categories on both measurements equalled 66%. The results of this study provided evidence of an acceptable test–retest reliability of the classification of subject's work ability by means of the WAI questionnaire. At group level, the mean WAI score and classification into WAI categories were found to be a stable measure over a 4 week interval. These results give additional support for the applicability of the questionnaire in occupational health research and the daily practice of occupational health care.

Key words: Construction industry; instrument; occupational health care; occupational health research; quality assessment; WAI; work ability.

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Introduction

The concept of work ability is gaining growing attention in scientific research on occupational health, initiated by extensive research activities by members of the Finnish Institute of Occupational Health [1,2]. The concept of work ability can be defined as the ability of a worker to perform his/her job, taking into account the specific work demands, individual health condition and mental resources [1]. In the early 1980s, the Finnish scientific efforts on this topic resulted in the construction of the WAI—the Work Ability Index questionnaire [3,4]. The main goal of this self-administered questionnaire is to assess an individual's work ability [4].

In the last decade, the WAI questionnaire has been widely applied in scientific studies on occupational health. For example, WAI results at group level were used as primary outcome variables in different epidemiological studies on the identification of occupational and personal risk factors for poor work ability [5–7]. The questionnaire has further been used as a method to evaluate the effects of intervention programmes on work ability [8–10] and to identify prognostic factors for work disability [11,12].

In addition to scientific purposes, the uses of the WAI in the daily practice of occupational health care have also been recognized [4,13]. It can be applied by occupational physicians as a simple instrument to assess individual work ability in periodic health surveys, or to measure work ability at department or company level in workplace surveys. Based on the results of these surveys, and by
comparison with reference values, occupational health personnel can determine which occupational health measures are needed to promote or maintain individual work ability [4]. According to Ilmarinen and Rantanen [1], these measures can vary from adjustments in the physical and psycho-social work environment, to health and lifestyle promotion, to updating of professional skills.

Increasing interest in the application of the WAI in the fields of research and practice requires detailed information on the quality of this instrument. Assessment of the technical quality of occupational health instruments should generally address several issues, at least including evaluation of validity and reliability [14]. So far, the internal validity of the WAI questionnaire has been described by Eskelinen et al. [15] and Nygård et al. [16]. In both studies, a satisfactory relationship was observed between the subjective results of the WAI and the results from more objective measurements. Furthermore, the results of follow-up studies showed convincing evidence for the predictive value of the WAI for disability and mortality [11,12].

The reliability of work ability assessed by the WAI is not well documented. The authors could find only one internationally published study reporting a satisfactory internal consistency of the WAI among a population of hospital nurses [17]. Therefore, in order to expand our knowledge of the applicability of this instrument in occupational health research and practice, additional studies on the reliability of the WAI are desirable. The goal of this study was to assess the test–retest reliability of the WAI questionnaire.

**Subjects and methods**

**WAI questionnaire**

The WAI is a self-administered questionnaire comprising seven items as presented in Table 1 [4]. For each item, a single item score can be obtained. The final WAI score is calculated by summation of all single item scores and can range from 7 to 49 points. Higher scores on the WAI indicate better work ability. Based on this WAI score, the individual’s work ability can be classified into four categories: poor (7–27 points); moderate (28–36 points); good (37–43 points); and excellent (44–49 points) [4].

**Study subjects**

In 1998, a total of 859 employees working in the Dutch construction industry, aged 40 years and older, participated in a cross-sectional questionnaire study aimed at describing health, career prospects and preferences of elderly construction workers. The results of this particular study have been published elsewhere [18]. The self-administered questionnaire, which included the WAI questionnaire, was completed by all 859 elderly employees prior to their visit to an occupational health service for voluntary participation in a periodic occupational health survey (POHS). Four occupational health services from different regions around the country participated in the study. The same questionnaire was mailed to the home address of a random sample of 223 workers of the population under study 4 weeks later. The initial response to the questionnaire was 52% (115 respondents). In total, 18 questionnaires were found to be invalid due to missing values, late response, etc., leaving the data of 97 subjects (96 males and one female) to be used in the test–retest analyses.

The mean age of the subjects under study was 51 years, with a range from 40 to 60 years. On average, subjects were employed in the construction industry for 30 years (SD 9.7). Main job titles of the subjects were: carpenter (32%); management and administrative jobs (14%); bricklayer (13%); works foreman (11%); truck or crane driver (7%); painter (5%); tiler (3%); and others (15%).

**Data analysis**

All the analyses were performed using SPSS v. 8.0 (SPSS, Chicago, IL). Individual scores for both WAI questionnaires were calculated and subjects were classified into one of the four categories mentioned above [4]. Differences in WAI score between both measurements were graphically presented in two different ways, as described by Bland and Altman [19]. In Figure 1, test scores were plotted against retest scores. In Figure 2, for each individual, the differences between scores were plotted against the mean score of both measurements. Furthermore, descriptive analyses were performed of the mean differences between test and retest scores. The non-parametric Wilcoxon signed ranks test for paired data was applied to test for differences in the mean WAI score at group level between both points in time. All tests were considered statistically significant if $P < 0.05$.

**Table 1. Items covered by the WAI questionnaire and range of scores per item [4]**

<table>
<thead>
<tr>
<th>Item</th>
<th>Range of scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Current work ability compared with lifetime best</td>
<td>0–10</td>
</tr>
<tr>
<td>2. Work ability in relation to the demands of the job</td>
<td>2–10</td>
</tr>
<tr>
<td>3. Number of current diseases diagnosed by a physician</td>
<td>1–7</td>
</tr>
<tr>
<td>4. Estimated work impairment due to diseases</td>
<td>1–6</td>
</tr>
<tr>
<td>5. Sick leave during the past 12 months</td>
<td>1–5</td>
</tr>
<tr>
<td>6. Personal prognosis of work ability 2 years from now</td>
<td>1, 4 or 7</td>
</tr>
<tr>
<td>7. Mental resources</td>
<td>1–4+</td>
</tr>
<tr>
<td>WAI score</td>
<td>7–49</td>
</tr>
</tbody>
</table>
Results

Figure 1 presents the individual values of the WAI score on the test and retest measurements. Exactly the same score on both measurements was reported by 24 out of 97 subjects (25%). Figure 2 presents the individual differences in WAI score between both measurements against the mean score of both measurements. According to the figure, no obvious relationship was found between the difference in both measurements and the mean score of both measurements. Individual changes in WAI score over the 4 week interval varied from −14 to +9 points, with 43 people reporting a lower score and 30 people a higher score. Ninety-five per cent of the individual differences were found to be <6.86 points (two times SD). Despite the individual changes between both measurements, no significant difference was reported in the mean WAI score at group level between test and retest measurements, 40.4 ± 6.1 versus 39.9 ± 6.4 (mean ± SD), resulting in a mean difference between both measurements of −0.53 points.

As can be derived from the data presented in Table 2, the percentage of observed agreement for the classification of subjects in one of the four WAI categories on both measurements equaled 66% (64 out of 97 subjects). At the retest measurement, 13 subjects were classified one category higher, 19 were classified one category lower and one was classified two categories lower (from ‘excellent’ to ‘moderate’), compared with the classification on the first measurement.

Discussion

In this study, the reliability of a self-administered questionnaire for assessing an individual’s work ability, the WAI questionnaire, was evaluated by means of the test–retest method. The results provided evidence of an acceptable reliability of the classification of a subject’s work ability by means of this questionnaire. Moreover, at the group level, the mean WAI score and classification into WAI categories were found to be a stable measure over a 4 week interval.

Data for this study originated from a sample of a population of construction workers in The Netherlands, aged 40 years and older. Most of them were occupied...
in traditionally physically demanding construction jobs. Nevertheless, the distribution of the subjects over the different WAI categories showed a relatively healthy group of workers, with a majority characterized by a good or excellent work ability (~80% in both tests). These findings are in correspondence with the results reported in a Finnish study among ageing construction workers [11] and can possibly be explained by the effects of health-related selection, resulting in a relatively healthy working population of elderly [20]. The non-response rate in our study was relatively high. Additional analyses showed that employees with higher WAI scores on the first measurement were more likely to be respondents on the second measurement 4 weeks later. However, it is unlikely that this kind of selection has significantly influenced the test–retest results presented in this paper.

For several subjects, relatively large changes were reported in WAI score between both measurements, in some cases even resulting in a different classification in one of the four WAI categories. It is plausible that this individual variability in WAI score is caused by a true change in work ability. The WAI data were obtained with an interval of around 4 weeks, which was considered to be long enough to make the subjects forget their answers from the first test. However, a limitation of this 4 week interval was the possibility of the occurrence of positive or negative events affecting subjects’ work ability. In our study, a decrease in work ability during the 4 weeks was more common than an improvement. In previous studies, construction workers have frequently been identified as a high-risk group for the onset of health disorders, in particular the musculoskeletal system [21]. These risks were found to increase with advancing age [22]. Hence, it is conceivable that the work ability of some elderly employees decreased significantly during the test–retest interval due to the onset of new physical health disorders caused by the many years of exposure to harmful work demands or by an occupational accident at the construction site. However, the change in score between both measurements could probably also be partially explained by inaccuracies or carelessness in responding.

In conclusion, the acceptable test–retest reliability of the WAI questionnaire for the classification of employees’ work ability as observed in this study gives additional support for the applicability of this instrument in occupational health research and the daily practice of occupational health care. In general, in these settings, objective assessment of work ability at individual or group level is often difficult to achieve due to time limitations, financial costs and lack of evaluated methods. With evidence for internal validity, predictive validity and reliability now documented [11,12,15–17], subjective assessment of work ability by means of the WAI questionnaire seems to provide a good instrument.

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