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Assessment of work ability in aging fire fighters by means of the Work Ability Index Preliminary results

by

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Abstract

Aim: *The aim of the study was to assess the work ability of aging fire fighters in a municipal professional fire-fighting department by means of the Work Ability Index (WAI) questionnaire and subsequently to determine the most relevant factors that contribute to a poor work ability among the study group.*

Methods: *On the occasion of the annual medical examination all professional fire fighters aged 45 years or older were asked to fill in the WAI questionnaire, which was developed by the Finnish Institute of Occupational Health (FIOH), and consisted of 7 items, shown to be relevant for the work ability of aging workers. A WAI score was calculated according to the instructions of the FIOH. Age, education, marital status and presence of musculoskeletal, cardiovascular and respiratory disease were considered as independent variables. Kruskall-Wallis test and logistic regression were used in the statistical analysis.*

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Results: *Up to now 236 (83.7%) subjects filled in the questionnaire. Mean age was 51.5 years (range 45-61; SD ± 4.1). Mean WAI was 40.6 (SD ± 5.4) showing an increasing SD with increasing age. Age (OR 1.3), presence of musculoskeletal disease (OR 7.7), cardiovascular disease (OR 3.8) and respiratory disease (OR 4.5) were significantly correlated with a poor work ability.*

Conclusion: *The WAI questionnaire was easily applicable within daily occupational health practice. The results indicated an increasing interindividual variability of work ability with advancing age. Among the variables considered up to now, age and the presence of musculoskeletal, cardiovascular and respiratory disease significantly decreased work ability, musculoskeletal disease being the most important influencing factor.*

Keywords

Ageing, fire fighters, occupational health, older workers, work ability index.

Introduction

Fire-fighting and rescue work involves high physical and mental demands under unpredictable and dangerous conditions. In order to cope with their demanding work tasks without overstrain and health risks, fire fighters need to have a good health and their physical and mental capacity has to be above average. As job demands on physical work capacity remain high during their whole career (1), aging fire fighters are confronted with specific challenges regarding work ability and physical fitness (2).

In a municipal professional fire fighting department, entirely consisting of male subjects, 282 (63.5%) of the 444 fire fighters were 45 or older (by date of January 1st 2001). The high number of older fire fighters made it no longer evident that younger fire fighters would take over physically more demanding tasks. The issue of work ability and physical fitness of the older fire fighters came up for discussion. In order to draw a representative picture of the current situation of the older fire fighters, it was decided to assess their work ability and physical fitness. The issue of this paper is restricted to the assessment of their work ability.

Work ability is a complex factor to measure. Its assessment should be based on both objective findings and on workers' subjective estimations of their resources in relation to work demands. The Work Ability Index (WAI) has been developed in the early 80's by researchers of the Finnish Institute of Occupational Health (FIOH) as an instrument for use in occupational health care. In the assessment, the physical and mental demands of work as well as the worker's health status and resources are taken into account (3). Its conceptual definition represented the question "how good are workers at present and in the near future and how able are they to do their job with respect to work demands, health, and mental resources?" (4). The purpose for constructing the Work Ability Index was to define a comprehensive indicator of work ability on the basis of questionnaire data. The index was designed to be used in comparisons between many occupational groups on the basis of data obtained by questionnaire (4), and one of its main characteristics was that subjectively perceived work ability was related to the subjects' job demands (5).

The Work Ability Index covers seven items, each of which is evaluated with the use of one or more questions. **Table 1** summarizes the seven items comprised in the WAI. The WAI is calculated by adding up the estimated points for each item. The range of the index is between 7 and 49 points. Work ability is considered to be poor if the WAI score ranges from 7 to 27, moderate in the range of 28 to 36, good in the range of 37 to 43 and excellent if the WAI score ranges from 44 to 49.

Depending on these WAI categories the objective of measures to be taken should be to restore, improve, support or maintain work ability for poor, moderate, good or excellent WAI respectively.

TABLE 1
Items covered by the Work Ability Index and the range of the scoring

Item	Scoring range
1. Current work ability compared with the lifetime best	0-10
2. Work ability in relation to the demands of the job	2-10
3. Number of current diseases diagnosed by a physician	1-7
4. Estimated work impairment due to diseases	1-6
5. Sick leave during the past year (12 months)	1-5
6. Own prognosis of work ability two years from now	1, 4, 7
7. Mental resources (referring to the worker's life in general, both at work and during leisure time)	1-4
Total score	**7-49**

The WAI has already been translated into 13 languages, and studies have been initiated in many countries to define the work ability of aging workers (6). The questionnaire used in this study was the Dutch version, in which some changes have been made to facilitate its use in Flanders (7).

The aim of this study was to assess the work ability of aging fire fighters in a municipal professional fire-fighting department and to establish "baseline" work ability data for future follow up. It was decided to use the WAI questionnaire as a part of the medical examination. Although data collection is still in progress and additional variables are currently being collected, an attempt was made to identify the most relevant factors among the independent variables collected up to now, explaining the presence of a poor work ability.

Methods

Two hundred and thirty six professional fire fighters (83.7% of the target population), aged 45 years or more, took part in a cross-sectional questionnaire study.

On the occasion of their annual medical examination they were asked to fill in the WAI questionnaire. During the preliminary examination by the occupational health nurse the subjects were informed about the purpose of the WAI questionnaire. Subsequently they filled in the questionnaire in a separate room. During the medical examination by the occupational health physician the questionnaire was checked and related health issues were discussed.

The work ability index was calculated according to the instructions of the FIOH (3). Apart from the 7 items comprised in the WAI, following variables were considered: age, marital status, education, and the presence of musculoskeletal, cardiovascular and respiratory disease. Other types of diseases (ten in total) were also asked for but were less frequent (<10 subjects per type of disease). They were not taken into consideration in the analysis.

The ordinal data (age, WAI and item scores) were tested for normal distribution. Where appropriate the ordinal variables were categorized: three age groups and four WAI categories. The marital status variable was dichotomised into a group of subjects living single and a group of subjects living together with a partner. The education variable comprised

six groups, ranging from primary school to university. In evaluating the presence of musculoskeletal disease no distinction was made in the etiology of this disease (traumatic, degenerative or reumatic). Respiratory diseases included upper respiratory tract problems. Presence of a certain type of disease was evaluated regardless of the number of pathologies: for the disease variables presence of disease could mean presence of one or more diseases of the same system.

To test the difference in WAI or item score between different groups of a categorized variable (age, marital status, education, presence of disease) the Kruskal-Wallis test was used.

Logistic regression analysis was performed to identify the independent variables (collected up to now) that explain the presence of a "poor" WAI. The ordinal dependent variable (WAI) was dichotomised into a group with a "poor" WAI score (less than 37) and a group with a "good" WAI score (37 or higher). Both univariate and stepwise logistic regression were performed on the considered variables (age, marital status, education, the presence of musculoskeletal, cardiovascular and respiratory disease) before entering the significant variables into the final multivariate model. The analyses were performed using MedCalc® software (version 6.1).

Since data collection is still in progress and additional variables will be included in the regression model, the presented results should be considered as preliminary.

Results

All of the adressed subjects filled in the questionnaire. Medical examinations still progressing, 100% participation rate can be expected in due course.

The age of the subjects ranged between 45 and 61 years, with a mean age of 51.5 years (SD ± 4.1). Age as a continuous variable was not normally distributed.

In **Figure 1** the plot distribution of the WAI according to age is shown, suggesting an increasing variability with advancing age. Striking were the high WAI scores found in the subjects aged over 58 years (n = 5), four of them being excellent.

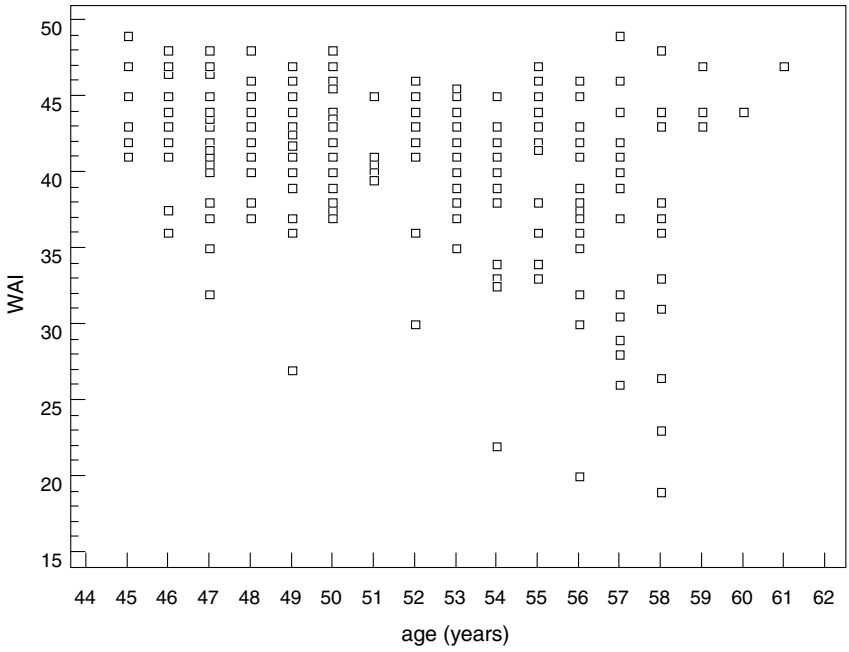

Fig. 1: Work Ability Index (WAI) in fire fighters and age (n = 236).

The overall mean WAI was 40.6 (SD ± 5.4), ranging from 19 to 49. As age increased the mean WAI decreased (**Table 2**). The increasing standard deviations in the older age groups illustrated the increased variability with advancing age. The three age groups differed significantly on WAI score ($p < 0.001$).

No statistically significant differences in WAI were found between subjects living together and single subjects, nor between the different education groups.

In **Table 3** the proportions of the different WAI categories are given by age group. As age increased the proportions of subjects with excellent and good WAI decreased while the proportions of subjects with moderate and poor WAI increased.

In **Table 4** the mean scores for the separate items of the WAI are given by age group. Overall a decrease in scoring for all items with increasing age could be observed. For item 1 (current work ability compared with life time best), item 4 (estimated work impairment due to diseases), item 5

TABLE 2
Work Ability Index (WAI) of fire fighters in different age groups

Age group (years)	n	%	Mean WAI*	± SD
45-49	91	38.6	42.3	3.6
50-54	76	32.2	40.7	4.9
55-61	69	29.2	38.2	6.9
Total	236	100	40.6	5.4

*p < 0.0005
According to the Kruskal-Wallis test.

TABLE 3
Proportion of Work Ability Index (WAI) categories in fire fighters by age group

			Age group (years)					
WAI category	Total		45-49		50-54		55-61	
	n	%	n	%	n	%	n	%
Excellent (44-49)	75	31.8	35	38.5	22	28.9	18	26.1
Good (37-43)	122	51.7	51	56.0	44	57.9	27	39.1
Moderate (28-36)	31	13.1	4	4.4	8	10.5	19	27.5
Poor (7-27)	8	3.4	1	1.1	2	2.6	5	7.2

TABLE 4
Mean scores for the separate items of the Work Ability Index in fire fighters by age group

Age group (years)	Item 1**	Item 2	Item 3	Item 4*	Item 5*	Item 6**	Item 7
45-49	8.38	8.56	5.29	5.66	3.94	7.00	3.51
50-54	7.82	8.26	5.17	5.49	3.96	6.68	3.34
55-61	7.22	8.16	4.86	5.22	3.46	5.91	3.33
Total	7.86	8.34	5.12	5.48	3.81	6.58	3.40

* p < 0.01 ** p < 0.0001
According to the Kruskal-Wallis test.

(sick leave during the past year) and item 6 (own prognosis of work ability two years from now) the differences between the age groups reached statistical significance. The most predominant differences were found for items 1 and 6.

Presence of musculoskeletal, cardiovascular and respiratory disease was reported by 49.2% (n = 116), 17.4% (n = 41) and 10.6% (n = 25) of the subjects respectively and resulted in a statistically significant decreased WAI (**Table 5**).

TABLE 5
Work Ability Index (WAI) in fire fighters and presence of musculoskeletal, cardiovascular and respiratory disease

Presence of		Mean WAI	± SD
Musculoskeletal disease**			
	yes (n = 116)	38.0	5.7
	no (n = 120)	43.0	3.8
Cardiovascular disease**			
	yes (n = 41)	37.2	6.7
	no (n = 195)	41.3	4.8
Respiratory disease*			
	yes (n = 25)	37.4	5.8
	no (n = 211)	41.0	5.3

* $p < 0.01$ ** $p < 0.0001$
According to the Kruskal-Wallis test.

TABLE 6
Correlates of "poor" Work Ability Index score (<37) – final multivariate logistic regression model (n = 236)

Variable		Multivariate analysis	
		OR	95% CI
Age (years)		1.3**	1.2-1.5
Musculoskeletal disease			
	no	1	
	yes	7.7**	2.9-20.7
Cardiovascular disease			
	no	1	
	yes	3.8*	1.5-9.8
Respiratory disease			
	no	1	
	yes	4.5*	1.5-13.6

* $p < 0.01$ ** $p < 0.0001$

Table 6 shows the results of the final logistic regression model. Four variables shown to be significantly associated with poor work ability, were put into the final logistic regression model: age, presence of musculoskeletal, cardiovascular and respiratory disease. Age and presence of musculoskeletal disease were the most influencing factors, while the effect of cardiovascular and respiratory disease was less prominent.

Discussion

The WAI questionnaire was easily applicable within daily occupational health practice. Incorporating the WAI questionnaire into the medical examination routine did not generate major organisational problems and allowed to achieve a full participation rate of the subjects examined up to now. Discussing age related topics enhanced the subjects' interest in health related issues. This phenomenon has also been described by other researchers (8).

Our results indicated an increasing interindividual variability of work ability with advancing age. This was also observed in a recent 11-year follow-up study (9). Since general measures are unable to meet with the wide variety in work ability in older workers individual measures for improving or maintaining work ability should be promoted.

In the subjects aged over 58 years (n = 5) only high WAI scores were found (four of them being excellent). These high scores could be attributed to the "healthy worker effect": only the fittest kept on working after the age of 58.

Despite the increased variability and the healthy worker effect our results indicated age to have a significant negative influence on work ability. The highly significant OR (1.3) for a poor WAI of the age variable in the final logistic regression analysis confirmed the significant decrease in WAI as age increased. The relationship between age and poor work ability has been observed earlier in a 4-year follow-up study (10, 11). However, in the subsequent 11-year follow-up study (12) age no longer explained the improvement or decline in work ability: changes in certain work and life-style variables were found to be more significantly associated with a decreased work ability. Introducing additional (life-style) variables into our model could possibly decrease the observed effect of age on work ability.

Since in our study population WAI decreased with advancing age the overall decrease in scoring for all items with increasing age could be expected. The significant decrease with advancing age of the scoring on the subjective estimation of present work ability compared with the lifetime best (item 1), the scoring on the own prognosis of work ability after two years (item 6), the scoring on estimated work impairment due to diseases (item 4) and the scoring on sick leave during the past year (item 5) could be an indication that with increasing age the subjective factors become more important than the objective ones (number of diagnosed diseases – item 6) in estimating one's own work ability.

The prevalences of musculoskeletal, cardiovascular and respiratory disease in our study population were similar to those found in other studies on aging workers (13). The presence of one (or more) of these diseases significantly decreased work ability, the presence of musculoskeletal disease being the most important influencing factor. The final logistic regression model confirmed these findings. Because ergonomic improvements are not so obvious to apply within the setting of firefighting, an increased effort in promoting physical exercise seems to be the most relevant preventive measure.

Unfortunately, the cross-sectional design of the current study did not allow to draw solid conclusions. Only future follow-up studies should allow to confirm these preliminary findings.

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