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ORIGINAL ARTICLE

Is work engagement related to work ability beyond working conditions and lifestyle factors?

Auli Airila · Jari Hakanen · Anne Punakallio · Sirpa Lusa · Ritva Luukkonen

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Abstract
Purpose To examine the associations of age, lifestyle and work-related factors, and particularly work engagement with the work ability index (WAI) and its sub-dimensions.
Methods Step-wise regression analysis with a sample of Finnish firefighters ($n = 403$) was used. The outcome variables were the WAI and its six sub-dimensions. The independent variables consisted of age, lifestyle variables (alcohol consumption, BMI, smoking, physical exercise, and sleep problems), working conditions (job demands, physical workload, supervisory relations, and task resources), and work engagement. The outcome variables and all the variables related to lifestyle, working conditions, and work engagement were measured in 2009. Work ability at baseline 10 years earlier was adjusted for in the models.
Results Work engagement, age, physical exercise, sleep problems, and physical workload were associated with the WAI. All independent variables, except BMI and alcohol consumption, were associated with at least one sub-dimension of the WAI after controlling the baseline WAI. Lifestyle variables, working conditions, and work engagement were more strongly related to the subjective WAI sub-dimensions than to the two more objective WAI sub-dimensions.
Conclusions Work engagement was significantly associated with work ability even after adjusting for various factors, indicating its importance in promoting work ability. Other key factors for good work ability were frequent exercise, good sleep, non-smoking, low job demands, low physical workload, and high task resources. More specifically, this study suggests that in maintaining work ability, it is valuable not only to promote lifestyle factors or working conditions, but also to enhance employees' positive state of work engagement.

Keywords Work ability · Work engagement · Job demands · Job resources · Lifestyle factors · Firefighters

A. Airila
Department of Social Research, University of Helsinki, Helsinki, Finland

A. Airila (✉) · J. Hakanen · A. Punakallio · S. Lusa · R. Luukkonen
Finnish Institute of Occupational Health, Work Organizations, Topeliuksenkatu 41 a A, 00250 Helsinki, Finland
e-mail: auli.airila@ttl.fi

Introduction

Maintaining and improving the work ability of employees is important for increasing productivity and preventing early exit from work life. Particularly in high-demand jobs, such as firefighting, good work ability is a precondition to cope with demanding tasks in diverse work conditions (e.g., Beaton et al. 1998; Bos et al. 2004; Lusa et al. 2006). In fact, previous studies have indicated that poor work ability is related to reduced productivity at work (van den Berg et al. 2010), increased sickness absence (Ahlstrom et al. 2010; Kujala et al. 2006), and early retirement (Feldt et al. 2009; Liira et al. 2000). Individual characteristics and work-related risk factors have been extensively examined as antecedents of work ability (for a review, see van den Berg et al. 2009). However, the motivational aspects of human resources—such as work engagement—have not been studied with the same intensity, despite the fact that they are considered essential factors related to work ability (van den Berg et al. 2009). Therefore, there is a need to identify not only the possible causes of decreased work ability but also the factors that may actually improve work ability.

Work ability and its antecedents

Work ability refers to workers' ability to carry out their work in relation to the demands of the work, and their health and mental resources (Ilmarinen et al. 1997). As such, impaired work ability is believed to result from an imbalance between job demands and individual resources. Therefore, work characteristics, such as working conditions and job demands, are key determinants of work ability. In addition, individual resources, namely health and functional capacity; knowledge and skills; and values, attitudes and motivation, are related to work ability (Tuomi et al. 2001). Empirically, for example, age, alcohol consumption, obesity, work demands, and physical workload have found to be associated with decreased work ability among representative samples of working population (e.g., Ilmarinen et al. 1997), in health care (e.g., Fischer et al. 2006; Pohjonen 2001), and among municipal workers (e.g., Tuomi et al. 1991a, b). In addition, work-related injuries—which are frequent among firefighters (Poplin et al. 2011)—have been found to be related to work ability (e.g., Lusa et al. 2011).

Work ability is often measured using the work ability index (WAI) consisting of seven dimensions on the physical and mental demands of work, health, and individual resources (Tuomi et al. 1998). Although several studies using the WAI have been published, only few studies (e.g., Alavinia et al. 2009; Pohjonen 2001; van den Berg et al. 2010) have investigated the potential antecedents of the different sub-dimensions of the WAI. Hence, it is not yet clear to which sub-dimensions of work ability individual or work-related factors relate to, or what the role of different dimensions within the total score of the WAI is (see also Feldt et al. 2009). However, knowledge on the relationships between the sub-dimensions of the WAI and individual and work characteristics are essential in order to improve work ability and apply properly focused interventions in workplaces.

Work engagement

As noted, although positive feelings and motivation at work influence work ability, this aspect has received surprisingly little research attention. One such affective-motivational concept is work engagement, which has emerged as a positive psychological construct of occupational health to measure positive work-related state of mind (Bakker et al. 2008). Work engagement is a positive, fulfilling, affective-motivational state of work-related well-being, characterized by vigor, dedication, and absorption (Schaufeli et al. 2002). Vigor refers to high levels of energy and mental resilience while working; dedication is characterized by being strongly involved in one's work and experiencing a sense of significance and enthusiasm; and absorption refers to being fully concentrated and happily engrossed in one's work.

The motivational power of work engagement has proved to be important in work life both among blue- and white-collar workers, such as home-care employees (Schaufeli and Bakker 2004), hotel receptionists (Salanova et al. 2005), managers (Feldt et al. 2009), and teachers (Hakanen et al. 2006). For example, the high energy of employees and their concentration on work tasks have been linked to job performance (Halbesleben 2010) and organizational commitment (Hakanen et al. 2008). In addition, a three-year cross-lagged panel study among Finnish dentists (Hakanen et al. 2011) showed positive reciprocal effects over time (so called gain spirals) between work engagement and work–family enrichment, indicating that positive affects at work may enhance positive appraisals of work and enrich home life. Thus, for example, in fire and rescue services, these positive outcomes of work engagement may be valuable for both the individual firefighters and the whole organization in the form of better health and increased intention to stay on at work for longer. In fact, some studies suggest a positive association between work engagement and health (e.g., Hakanen and Lindbohm 2008; Parzefall and Hakanen 2010; Seppälä et al. in press). In contrast, little is known about the relationship between work engagement and work ability.

Research questions

The central aim of the present study among Finnish firefighters was to examine whether work engagement, as a motivational well-being concept, is associated with work ability, after adjusting for age, lifestyle and work-related factors, and the baseline work ability 10 years earlier. Consequently, the research questions were as follows: (i) Are age, lifestyle factors, and working conditions associated with the WAI?; (ii) Does work engagement relate to the WAI even after adjusting for age, lifestyle factors, and working conditions?; and (iii) Are age, lifestyle factors, working conditions, and particularly work engagement associated with the different sub-dimensions of the WAI?

Methods

Participants and procedure

The data consists of a questionnaire study among Finnish firefighters conducted in 1999 (baseline WAI was measured) and 2009 (other variables of the present study were

measured). The study focused on both the physical and mental conditions of fire and rescue work, and the well-being of professional firefighters. A 10-year interval between data collections was based on practical decisions and financial arrangements and could not be influenced by the researchers. In 1999, 1,124 questionnaires were posted, and 72% ($n = 794$) returned the questionnaire. In the follow-up 10 years later, 68% ($n = 721$) returned the questionnaire. The research process is reported in detail elsewhere (Lusa et al. 2006, 2011). The study was approved by the Ethics Committee of the HUS Hospital District and was performed according to the Helsinki Declaration. Each subject gave written informed consent before participation.

Work ability index

Work ability was measured twice (in 1999 and 2009) by the WAI questionnaire (Tuomi et al. 1998) that is the most widely used questionnaire, and a validated measure of work ability (van den Berg et al. 2009). Furthermore, satisfactory test–retest reliability of the index has been observed (de Zwart et al. 2002). The index consists of seven dimensions, namely: (1) the subjective estimation of current work ability compared with lifetime best (0–10 points); (2) subjective work ability in relation to job demands (2–10 points); (3) the number of current diseases diagnosed by a physician (1–7 points); (4) the subjective estimation of work impairment due to diseases (1-6 points); (5) sick leave during the past year (1–5 points); (6) own prognosis of work ability 2 years from now (1, 4 or 7 points); and (7) psychological resources (1–4 points). The WAI index ranges from 7 to 49 points, and a higher score indicates better work ability. In this study, we used the continuous sum score of the WAI. In addition, the sub-dimensions of the WAI were used as separate dependent variables. Furthermore, in our study models, the impact of baseline WAI and its sub-dimensions 10 years earlier in 1999 were controlled for.

Because of the large amount of missing data ($n = 199$) in estimated work impairment due to diseases (sub-dimension 4), this item was excluded from the analyses. The high number of drop-outs in this particular item is explained, at least partly, by technical reasons: the question was divided into two columns in the questionnaire and situated after a question concerning different types of cancer rather than directly after other diseases included in the WAI questionnaire. Thus, the total WAI score was calculated without sub-dimension 4. Therefore, the slightly modified WAI index in the present study had a range from 6 to 43 points. However, the correlation between the total WAI score and the modified index was extremely high: 0.99 both in 1999 and 2009. Cronbach's alphas for the modified WAI were 0.70 in 1999 and 0.78 in 2009.

Lifestyle variables

Alcohol consumption, body mass index (BMI), smoking, physical exercise, and sleep problems were studied as indicative of lifestyle. Alcohol consumption was measured using a single-item question on the frequency of alcohol consumption with an eight-point scale (1 = never, 8 = daily or almost daily). BMI was calculated by dividing body weight (kilograms) by the square of body height (meters). Smoking habits were elicited using a dichotomous (yes–no) question on current smoking. Physical exercise was assessed through a single-item question on the frequency of leisure-time exercise activity, using a three-point scale (1 = not at all, 2 = occasionally, 3 = frequently). Finally, a four-item scale of sleep problems was derived from the Basic Nordic Sleep Questionnaire (Partinen and Gislason 1995): difficulties in falling asleep during the past 3 months; sleeping well during the past 3 months; awaking too early in the morning and not being able to fall back asleep during the past 3 months; and extreme tiredness during daytime. All the items were rated on a five-point scale (1 = not at all, 5 = daily/almost daily) except sleeping well, which was measured with a three-point scale (1 = well, 3 = moderately, 5 = poorly). Cronbach's alpha was 0.79.

Working conditions

We measured working conditions with four scales: physical workload, job demands, supervisory relations, and task resources. Physical workload was measured using four items adapted from Viikari-Juntura et al. (1996). Physical workload was covered by questions on the frequency of working in four difficult work postures: (i) working on one's knees, crouched, or crawling; (ii) postures in which the back is bent; (iii) postures in which the back is twisted; and (iv) working with hand or hands over neck–shoulder level. All items were rated on a four-point scale (for example, 1 = not at all, 4 = over an hour during the shift). Cronbach's alpha was 0.79. Job demands (e.g., Tuomi et al. 1991b) consisted of three items: excessive demands of the job; responsibility of the job; and fear of failure and mistakes at work. Items were rated on a five-point scale (0 = not at all, 4 = very much). Cronbach's alpha was 0.75. Supervisory relations and task resources were adapted from the Occupational Stress Questionnaire (Elo et al. 1992). Supervisory relations were elicited using five items covering supervisory support, supervisory control, and relationships between employees and supervisors. Task resources included three items: decision making on issues concerning one's tasks; being able to use one's knowledge and skills at work; and feedback on success in work tasks. Both supervisory relations and task resources were rated on

a five-point scale (1 = not at all/practically never, 5 = very much). Cronbach's alphas were 0.84 for supervisory relations and 0.72 for task resources.

Work engagement

Work engagement was measured by using the Finnish translation of the short version of the Utrecht Work Engagement Scale, the UWES-9 (Hakanen 2009; Schaufeli et al. 2006) that is the most widely used and validated measure for work engagement (Bakker et al. 2008), consisting of nine items. The instrument has three sub-scales: vigor (e.g., "At my work, I feel bursting with energy"), dedication (e.g., "My job inspires me"), and absorption (e.g., "I am immersed in my work"). Each of the sub-dimensions was assessed using three items. The items were rated on a seven-point frequency-based scale (0 = never, 6 = daily). The scale was highly reliable (Cronbach's alpha = 0.95).

All the variables related to lifestyle, working conditions, and work engagement were measured in 2009.

Data analysis

We used exploratory factor analysis (EFA) to examine whether the different scales of working conditions could be distinguished from each other. The EFA results supported the distinctiveness of the four working condition scales, namely job demands, physical workload, supervisory relations, and task resources. In this study, we used linear regression analysis to examine whether lifestyle and work-related factors and work engagement were related to the WAI or its six sub-dimensions after the baseline WAI and the sub-dimensions of the WAI 10 years earlier were controlled for. Thus, we had totally 7 different models to analyze. Variables were entered into the models in four steps. First, the continuous variable WAI or the sub-dimension of the WAI at baseline and age was added to the model. In the second step, lifestyle variables were added and in the third step, working conditions. Finally, in the fourth step, work engagement was added to the model. A p value of <0.05 was considered to be statistically significant. We checked for multicollinearity and found no collinearity problems in our data (see Myers 1990). All analyses were conducted using PASW Statistics 18 for Windows.

Results

Characteristics of the study population

The study population consists of male firefighters who had responded to the questionnaires in both in 1999 and 2009 and were still employed in 2009 (n = 403). A total of 148 of the respondents from 1999 did not answer in 2009. The drop-outs were older (mean value 39.9 vs. 38.5), had lower education (primary school education 28.6% vs. 18.4%), smoked more often (41% vs. 26%), and had lower WAI (mean value 33.2 vs. 35.2), and their medical condition was slightly weaker (mean value 3.9 vs. 4.0) than those who responded at both times, indicating slightly better lifestyle and work ability among the sample of this study. However, when we took account the age difference by applying statistical models, there was no difference between groups.

In 2009, the average age of the study population was 48.5 (range 35–62, SD = 5.4). Of the participants, 80.9% (n = 321) had a primary or elementary school education and 19.1% (n = 76) a secondary school education. A large majority (87.7%, n = 315) had a firefighter qualification, 29.4% (n = 105) had a sub-officer qualification, and 9.8% (n = 35) a fire chief qualification. Mean work experience in fire and rescue services was 25.3 years (range 3–39, SD = 5.8). A large majority (84.3%, n = 337) of the participants did shift work.

Descriptive results

The means, standard deviations, and the Pearson correlations of the study variables are presented in Table 1. All variables, except alcohol consumption, were significantly correlated with the total WAI score. More importantly, work engagement was significantly related to the total WAI score and all its sub-dimensions except number of diseases (sub-dimension 3).

Antecedents of the total work ability index

Table 2 shows the results of the stepwise regression analyses related to total WAI. Age was negatively related to WAI. The lifestyle variables included in step 2 significantly improved the regression model. More specifically, sleep problems were negatively and physical exercise positively related to work ability. In contrast, alcohol consumption, BMI, and smoking were not related to the total WAI score. Adding working conditions (step 3) to the model further significantly improved the regression model. However, only physical workload was significantly related to the WAI. Finally, after adjusting for the WAI 10 years earlier, age, lifestyle variables, and working conditions, work engagement was added to the model (step 4). The results showed a positive relationship between work engagement and work ability. The final model explained 53% of the variance of the WAI. The total variance of the model was 31.22 and the residual variance 15.48.

Table 1 Range, means, standard deviations, and the Pearson correlations between the study variables ($n = 403$)

Variables	Range	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Independent variables 2009																				
1. Age	35–62	48.54	5.43	1.00																
2. Alcohol consumption	1–8	5.75	1.71	.01	1.00															
3. BMI	20.4–36.6	26.71	2.85	.11*	.02	1.00														
4. Smoking	0–1	0.22	0.41	−.02	.06	.02	1.00													
5. Physical exercise	1–3	2.77	0.45	−.07	.03	−.20**	−.07	1.00												
6. Sleep problems	4–19	8.98	3.25	.07	.19**	.04	−.04	−.05	1.00											
7. Job demands	0–4	0.79	0.78	.07	.06	−.00	−.03	.08	.31**	1.00										
8. Physical work load	1–3.75	1.87	0.56	.01	−.08	.02	−.05	.09	.13**	.02	1.00									
9. Supervisory relations	1–5	3.89	0.82	−.03	.00	−.08	.06	.07	−.15**	−.32**	.07	1.00								
10. Task resources	1–5	3.29	0.69	.06	−.07	−.03	.03	−.07	−.25**	−.24**	−.08	.44**	1.00							
11. Work engagement	0–6	3.73	1.42	.02	−.07	−.04	−.08	−.03	−.25**	−.33**	−.07	.38**	.62**	1.00						
Dependent variables 2009																				
12. WAI	11–42	30.48	5.57	−.33**	−.07	−.15**	−.10*	.15**	−.37**	−.30**	−.11*	.19**	.29**	.41**	1.00					
13. Current work ability	0–10	7.13	1.71	−.28**	−.05	−.19**	−.08	.21**	−.29**	−.26**	−.07	.15**	.18**	.31**	.84**	1.00				
14. Work ability in relation to job demands	3–10	7.55	1.35	−.21**	−.10*	−.07	−.08	.18**	−.44**	−.39**	−.05	.16**	.28**	.42**	.79**	.72**	1.00			
15. Number of diseases	1–7	3.42	1.70	.17**	.01	.16**	.07	−.11*	.19**	.08	.19**	−.08	−.11*	−.10	−.57**	−.28**	−.21**	1.00		
16. Sick leave	1–5	2.34	1.11	.04	−.01	.07	.08	−.11*	.19**	.06	.16**	−.07	−.16**	−.16**	−.53**	−.35**	−.30**	.32**	1.00	
17. Own prognosis of work ability	1, 4, 7	6.09	1.56	−.42**	−.05	−.10*	−.04	.05	−.19**	−.17**	−.13**	.09*	.21**	.23**	.69**	.54**	.46**	−.18**	−.22**	1.00
18. Psychological resources	1–4	3.12	0.72	−.04	−.08	−.06	−.09*	.04	−.37**	−.38**	.01	.24**	.29**	.49**	.52**	.43**	.51**	.08	−.10*	.28**

Number of diseases and sick leave are presented as reversed indicators of work ability, thus, higher value indicate more diseases, and higher frequency of sick leave

M Mean, *SD* Standard deviation

** $p < .01$. * $p < .05$

Table 2 Associations of age, life-style variables, working conditions, and work engagement with work ability index (WAI) in 2009 ($n = 403$)

Explanatory variables	Work ability index			
	b	95% CI	ΔR^2	R^2
Step 1			.39***	.39
WAI 1999	.53	0.36 to 0.70		
Age	−.14	−0.26 to −0.03		
Step 2: Lifestyle variables			.09***	.48
Alcohol consumption	−.01	−0.38 to 0.35		
BMI	−.16	−0.38 to 0.06		
Smoking	−1.38	−2.79 to 0.04		
Physical exercise	1.74	0.43 to 3.04		
Sleep problems	−.28	−0.46 to −0.10		
Step 3: Working conditions			.04**	.52
Job demands	−.73	−1.51 to 0.06		
Physical workload	−1.32	−2.40 to −0.23		
Supervisory relations	−.01	−0.80 to 0.78		
Task resources	.32	−0.81 to 1.44		
Step 4: Work engagement			.01*	.53
Work engagement	.61	0.09 to 1.13		

b unstandardized beta-coefficient from the final step; *CI* confidence interval; ΔR^2 change in explanation rate; R^2 explanation rate

* $p < .05$. ** $p < .01$. *** $p < .001$

Antecedents of the sub-dimensions of the work ability index

As can be seen from Table 3, age was negatively related to the two WAI sub-dimensions, namely current work ability and own prognosis of work ability (sub-dimensions 1 and 6). Of lifestyle variables, sleep problems and physical exercise in particular were associated with the sub-dimensions of the WAI: frequent sleep problems were negatively related to current work ability, work ability in relations to job demands, and psychological resources (sub-dimensions 1, 2, and 7). In turn, frequent physical exercise was positively associated with current work ability and work ability in relation to job demands, and negatively with sick leaves (sub-dimensions 1, 2, and 5). Smoking was negatively related to work ability in relations to job demands (sub-dimension 2). Finally, alcohol consumption and BMI were not related to any of the measured WAI sub-dimensions.

Working conditions were associated with five sub-dimensions of the WAI. More specifically, high job demands were negatively related to work ability in relation to job demands and psychological resources (sub-dimensions 2 and 7). High physical workload in turn was positively associated with a higher frequency of diseases and sick leaves (sub-dimension 3 and 5). In addition, task resources were positively related to own prognosis of work ability (sub-dimension 6), whereas supervisory relations were not related to any of the sub-dimensions of the WAI.

Finally, in the fourth step, work engagement was added to each model. As Table 3 shows, work engagement was positively related to three sub-dimensions of the WAI: good current work ability (sub-dimension 1), good work ability in relation to job demands (sub-dimension 2), and a higher level of psychological resources (sub-dimension 7). In contrast, work engagement was not related to the number of diseases (sub-dimension 3), sick leaves (sub-dimension 5), or own prognosis of work ability (sub-dimension 6).

Of the different sub-dimensions, the highest explained variances of the study models concerned work ability in relation to job demands (48%) and psychological resources (45%). In contrast, the lowest explained variances concerned sick leave (20%) and number of diseases (24%).

Discussion

This study contributes to the work ability literature by addressing two research needs raised in the field: we focused on the thus far neglected role of motivation—here work engagement—as an antecedent of the WAI (van den Berg et al. 2009), and we investigated the antecedents of different sub-dimensions of the WAI (Feldt et al. 2009). In particular, we investigated whether work engagement, as a motivational concept, is related to the work ability of Finnish firefighters after controlling for age, lifestyle variables, and working conditions, and work ability 10 years earlier. Our main results showed a positive relationship between work engagement and work ability after adjusting for various factors that prior research (e.g., van den Berg et al. 2009) has identified as significant predictors of the WAI. In addition, in this study, the different sub-dimensions of the WAI had partly different antecedents.

Work engagement and work ability

Despite the growing evidence on the positive consequences of work engagement for organizational outcomes (e.g., Hakanen et al. 2008; Salanova et al. 2005), there is still scarce research on the health- and work ability-enhancing potential of work engagement. Our results indicated that the positive state of work engagement consisting of vigor, dedication, and absorption was significantly associated with work ability. In fact, work engagement was related both to the total score of the WAI and to its three sub-dimensions even after adjusting for various individual and organizational characteristics. More specifically, our study showed that a motivated and energetic worker, who

Table 3 Associations of lifestyle variables, working conditions and work engagement with different WAI sub-dimensions ($n = 403$)

Explanatory variables	Work ability sub-dimensions											
	Current work ability		Work ability in relation to job demands		Number of diseases		Sick leave		Own prognosis of work ability		Psychological resources	
	b	95% CI	b	95% CI	b	95% CI	b	95% CI	b	95% CI	b	95% CI
Step 1												
WAI dimension 1999	0.30	0.12 to 0.48	0.31	0.18 to 0.43	0.48	0.30 to 0.67	0.26	0.12 to 0.40	0.45	0.12 to 0.79	0.21	0.10 to 0.33
Age	−0.04	−0.08 to −0.01	−0.02	−0.04 to 0.01	0.02	−0.03 to 0.06	−0.01	−0.03 to 0.02	−0.11	−0.14 to −0.07	0.00	−0.01 to 0.02
Step 2: Lifestyle variables												
Alcohol consumption	−0.07	−0.18 to 0.05	0.01	−0.07 to 0.09	−0.05	−0.20 to 0.11	−0.03	−0.11 to 0.05	−0.06	−0.16 to 0.05	−0.04	−0.08 to 0.01
BMI	−0.05	−0.12 to 0.02	−0.02	−0.07 to 0.03	0.08	−0.01 to 0.16	−0.01	−0.06 to 0.04	−0.06	−0.13 to 0.00	−0.01	−0.04 to 0.02
Smoking	−0.36	−0.82 to 0.09	−0.32	−0.64 to −0.01	0.54	−0.04 to 1.12	0.26	−0.07 to 0.59	−0.31	−0.74 to 0.11	−0.10	−0.29 to 0.08
Physical exercise	0.58	0.14 to 1.03	0.40	0.10 to 0.71	−0.49	−1.03 to 0.06	−0.51	−0.82 to −0.19	0.07	−0.33 to 0.48	0.11	−0.07 to 0.28
Sleep problems	−0.07	−0.13 to −0.02	−0.10	−0.15 to −0.06	0.07	−0.01 to 0.14	0.03	−0.01 to 0.07	−0.04	−0.09 to 0.02	−0.05	−0.07 to −0.02
Step 3: Working conditions												
Job demands	−0.25	−0.52 to 0.02	−0.24	−0.43 to −0.05	0.05	−0.28 to 0.38	0.08	−0.12 to 0.27	−0.08	−0.33 to 0.17	−0.15	−0.26 to −0.04
Physical workload	−0.33	−0.67 to 0.02	0.01	−0.24 to 0.25	0.53	0.09 to 0.97	0.34	0.09 to 0.60	−0.17	−0.49 to 0.15	−0.02	−0.16 to 0.12
Supervisory relations	−0.01	−0.26 to 0.25	−0.10	−0.28 to 0.08	−0.12	−0.44 to 0.21	−0.05	−0.23 to 0.14	−0.15	−0.38 to 0.09	0.06	−0.04 to 0.17
Task resources	−0.06	−0.42 to 0.31	0.04	−0.21 to 0.30	0.18	−0.29 to 0.64	−0.05	−0.31 to 0.21	0.34	0.01 to 0.68	−0.06	−0.20 to 0.09
Step 4: Work engagement												
Work engagement	0.25	0.08 to 0.41	0.25	0.14 to 0.37	0.00	−0.21 to 0.22	−0.04	−0.16 to 0.09	0.08	−0.08 to 0.23	0.18	0.12 to 0.25

b unstandardized beta-coefficient from the final step; *CI* confidence interval

strongly identifies with his/her work, has better work ability than his/her less engaged co-worker. This finding is in line with a study of Finnish teachers (Hakanen et al. 2006) in which work engagement was positively related to one-item self-rated work ability. The idea of the dark side of engagement, which suggests that being highly engaged can also have detrimental consequences for the individual (Bakker et al. 2011), was not supported in our study.

We also showed that work engagement was related to the sub-dimensions of the WAI that can be characterized as subjective estimations of one's work ability, namely current work ability, work ability in relation to job demands, and psychological resources. On the contrary, no significant association was found between work engagement and the more health-related dimensions of the WAI, such as number of diseases and sick leave. Obviously, work engagement may not be related to diseases diagnosed by a physician. As regards sick leaves, one study found that among Dutch managers, work engagement predicted absence frequency but not absence duration (Schaufeli et al. 2009). The WAI instrument does not differentiate between frequency and duration of sick leaves, but simply measures the number of absence days. This may explain why in our study we did not find an association between work engagement and sick leaves.

Age, lifestyle factors, and work ability

This study supported age-related diversity in work ability, as older age was negatively related to work ability. In a similar vein, older age has been associated with poorer WAI in several follow-up studies (e.g., Ilmarinen et al. 1997; Tuomi et al. 2004). More importantly, prior studies among firefighters (Punakallio et al. 2004) have reported that the WAI decreases with age. However, contrary to expectations and earlier findings (e.g., Pohjonen 2001), in our study, age was not associated with work ability in relation to job demands (WAI sub-dimension 2). Age was negatively associated only with the sub-dimensions of current work ability, and own prognosis of work ability. The non-significant results suggest that older age does not necessarily decrease the mental resources of firefighters. Similarly, Lusa et al. (2006) found that age was not strongly associated with perceived mental strain among firefighters.

Of lifestyle factors, sleep problems and lack of exercise in leisure time were strongly, and smoking to a lesser extent, associated with the WAI. Sleep problems and smoking indicated poorer, whereas physical exercise was related to better WAI. These results are in line with several previous studies that have examined the relationship between lifestyle factors and work ability (e.g., Camerino et al. 2008; Fischer et al. 2006; Lusa et al. 2002; Tuomi et al. 2004). However, in contrast to earlier findings (e.g., Fischer et al. 2006; Kaleta et al. 2006), neither alcohol consumption nor BMI was related to the WAI. The null association between alcohol consumption and the WAI may be, at least partly, explained by the healthy worker effect, that is, heavy drinkers with low work ability may have dropped out of the sample. As regards BMI, one explanation for the non-significant association may be the presence of other lifestyle risk factors in the multivariable models, which diminish the association with BMI.

Working conditions and work ability

Our results indicated that working conditions, particularly physical workload and job demands, and to a lesser extent also task resources, were related to work ability. Specifically, difficult work postures negatively associated with work ability among the firefighters. This result is in line with prior findings that have indicated a positive relationship between high physical workload and decreased work ability (Ilmarinen et al. 1997; Pohjonen 2001; Tuomi et al. 1991a, b). In addition, our finding on the association between job demands and the WAI is consistent with several previous studies (e.g., Tuomi et al. 1997, 2001). Furthermore, our result on the positive association between task resources and the WAI has also been previously reported (Tuomi et al. 2004). However, it should be noted that in our study, task resources only related to one sub-dimension (own prognosis of work ability) of the WAI.

In the current study, supervisory relations were not related to work ability. Previous studies have found mixed evidence on the role of supervisory support in work ability and health (e.g., Boxer and Wild 1993; Sugimura and Thériault 2010; Tuomi et al. 1997). In fact, the importance of supervisors in the work of firefighters may be different compared with other occupations. The working community of firefighters is compact and coherent, and the relationships between co-workers are important and highly valued (Pillai and Williams 2004). In addition, working in 24-hour shifts strengthens the relationship between co-workers who mainly operate in closely coordinated teams, which may, in turn, lessen the importance of the supervisor.

Sub-dimensions of work ability

In this study, in addition to examining the total WAI score, we also focused on its sub-dimensions, in order to identify the antecedents of each sub-dimension of the WAI. This knowledge may be helpful in focusing and planning workplace interventions aimed at better work ability among employees. Our results showed that lifestyle factors, working conditions, and work engagement were more strongly related to the more subjective dimensions of work

ability (sub-dimensions 1, 2, 6, and 7) than to the two more objective dimensions, namely number of diseases (sub-dimension 3) and sick leave (sub-dimension 5). Similarly, in their study on construction workers, Alavinia et al. (2009) found that work-related risk factors were more strongly associated with the work ability sub-dimensions (1 and 2) than with the health-related sub-dimensions (3, 4, and 5). In fact, recently, it has been suggested that the one-factor model of work ability should be dismissed (Martus et al. 2010) and replaced by a two-dimensional instrument covering subjectively estimated work ability and objective health status. Future studies should further investigate the dimensionality of the WAI and the importance of the different sub-dimensions within the total score. Practically, our results suggest that by improving lifestyle and the work-related factors included in this study, it may be possible to improve at least the more subjective estimates of the WAI.

Limitations and future research

Our study has some limitations that should be acknowledged. First, the study was based on self-report measures, which may cause systematic measurement errors (common methods variance). However, we controlled for baseline work ability in our study, which assumingly diminished the risk of common method bias (Doty and Glick 1998). Nevertheless, including more objective measures of lifestyle and work-related factors in future studies on work ability would strengthen the study design. Second, like lifestyle and other work-related variables, work engagement was only measured once, and therefore, our analysis was cross-sectional and therefore no causality between work ability and engagement can be determined. However, the study design allowed us to adjust work ability at the baseline (1999), and even after this, the relationships between independent variables and outcome variables were significant. We suggest that in the future, the effect of work engagement on work ability should be studied using a longitudinal full-panel design. Third, the present study focused on one profession only, firefighters, which may potentially threaten the generalizability of our findings. Nevertheless, although some caution is needed, we believe that the results can also be extended to other occupational sectors, because similar evidence of the positive impact of work engagement exists in various occupation sectors and countries (e.g., Hakanen et al. 2006; Salanova and Schaufeli 2008). In addition, as the positive effect of work engagement on several dimensions of the WAI was robust even in a highly physically demanding job as firefighting, we assume that the same effect is also plausible in other occupational sectors. Moreover, there was not a considerable "healthy worker" effect in our sample as the mean for the current work ability (range, 0–10) among the participants (7.1) was lower than among Finnish male employees in general (8.4; Perkiö-Mäkelä et al. 2010). However, it would be interesting to conduct a similar study using a heterogeneous sample of employees that would also enable to examine the role of socio-economic status in WAI.

Conclusions

The findings of the current study contribute to the existing research on work ability by adding a motivational, work-related well-being concept of work engagement as a potentially important antecedent of work ability and its sub-dimensions. This study showed that work engagement may play an important role in promoting work ability. In addition to work engagement, other key factors in the good work ability of firefighters were good sleep, frequent exercise, not too high physical workload and job demands, and good task resources. Thus, not only promoting lifestyle factors or working conditions but also fostering a positive and motivational state of work engagement (e.g., via increasing job autonomy and feedback) is likely to be valuable in maintaining work ability, and in turn, diminishing the risk of work disability and early exit from work.

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Conflict of interest The authors declare that they have no conflict of interest.

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