Predictors of Changing Level of Work Ability Index Among Employees of Public and Industrial Sector

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Abstract

AIM: The aim of the study is to evaluate work ability index with individual and work condition factors; and comparatively evaluate the predictors of WAI levels in the field of individual and workplace factors all within the public administration sector and industrial sector employees.

METHODS: The longitudinal survey included 500 respondents (the total sample = 300, response rate was 60%, and mean age 40.78) in two cohorts: 171 (57%) employees of the public administrative and health sectors (cohort 1) and 129 (43%) workers of the manufacturing sector (cohort 2). The men comprised 152 (51%) of the study population. The work ability index (WAI) questionnaire was used to evaluate the work ability and its predictors.

RESULTS: Decreased level of WAI predicted among all respondents: Larger number of diseases (p < 0.001) and more days of sick leave (p < 0.001). Unexpected protectors for increased level of WAI among public service employees were: Higher mental demands of work (β = 0.220, 95%CI, 0.723–1.301, p < 0.001), as among industry sector workers higher physical demands of work (β = 0.198, 95%CI, 0.824–1.234, p < 0.001), and higher mental demands of work (β = 0.137, 95% CI, 1.888–2.050, p < 0.001), too.

CONCLUSION: The determinants of WAI are mental capacity and physical endurance, and a high level of education. The number of chronic illnesses, long sick leave, lower levels of education or reduced levels of continuing lifelong education and worse self-prognosis of work over the next 2 years all significantly affect the decrease or loss of working capacity.

Introduction

In European countries a great deal of attention has been paid to improving work capacity throughout the work experience. The Finnish Concept of Promoting and Maintaining Workability is equivalent to workplace health promotion. This model assumes that other factors, along with health, impact an employee's ability to work, such as his/her competences, relations with others, the health environment or psycho-social factors, and promoting ability to work, improves both the well-being of individual employees and effectiveness of the functioning of their workplace [1]. Work capacity is related to physical, environmental, and psychosocial factors and is influenced by individual characteristics and occupations. The work ability index (WAI) is associated with individual characteristics, lifestyle, demands at work, and physical condition [1], [2], [3]. Ability to work is most often defined as the relationship between a person's resources and requirements specific to a particular type of work. This is the result of interaction between job requirements in terms of physical and mental strain, capacities, and skills of the employee, as well as his/her health condition and own evaluation of functioning in a given organizational and social situation [4]. Despite the fact that ability to work depends on many and varied factors, it is considered that an employee's physical and mental health are the key factor. Excellent ability to work is closely related to the possibility to increase the quality of work, improve quality of life, and well-being among employees, thereby decreasing the likelihood of their early retirement, decreasing absenteeism, and presenteeism (ineffective presence at work), as well as increasing motivation and productiveness in employees of all ages [5]. Occupational stress is an inevitable consequence of modern living, but significant disorders of mental and somatic health are its undesirable outcome. High levels of stress professionally affect not only the productivity and creativity of workers but also health, absenteeism, loss of working ability, early retirement, and quality of life [6], [7].

The instrument which is used most frequently for evaluating ability to work is the WAI, developed in the Finnish Institute of Occupational Health in Helsinki. It takes into account specific psychosocial and physical factors related to performing a given type of work, as well as the employee's mental and physical resources and his/her health condition [1], [8], [9]. The WAI is used to evaluate employees' ability to work in terms of the type of work performed and the related strains.

This makes it possible to compare abilities to work depending on the employee's age. WAI is determined on the basis of a questionnaire completed by the employee; the questionnaire covers seven dimensions: (1) An individual's current work ability compared with their lifetime best; (2) work ability in relation to the demands of the job; (3) number of diagnosed illnesses; (4) estimated impairment due to diseases/illnesses or limiting conditions; (5) amount of sick leave taken during the past 12 months; (6) own prognosis of work ability in 2 years' time; and (7) estimate of their mental resources [8].

Employees working in the field of public administration and health services and workers in the manufacturing and industrial sectors are exposed to different work environments and job requirements. While the administrative workers are more psychologically, the workers in industry are more physically stressed. Surveys conducted on a sample of workers in Poland reveal the fastest decline in work activity in public administration and healthcare workers [10]. Some studies have found that a decline in the index of work capacity in the young employee population is a practical means of predicting long-term sickness but cannot predict the onset of illness [11]. The WAI can serve as a fairly good means of identifying candidates for long-term sick leave [12]. A study among construction workers found that physical exertion was a key risk factor for workers' illness and the decline in the WAI [13]. The aim of study is to evaluate WAI with individual and work condition factors; and comparatively evaluate the predictors of WAI levels in the field of individual and workplace factors all within the public administration sector and industrial sector employees.

Methods

The longitudinal survey included 300 respondents in two cohorts of respondents, 171 (57%) employees of the public services of the administrative and health sectors (cohort 1) and 129 (43%) workers of the manufacturing sector (cohort 2) according to the cross-sectional study design. The study was conducted from August 1, 2018, to December 31, 2018, in the Municipality of Kalesija, Tuzla Canton, Bosnia and Herzegovina. We assessed the association between individual factors and working conditions and levels (recent) of WAI, comparatively in both cohorts.

Study population

The study population included sample of workers randomly selected (n = 500), and respondents who did not answer the entire questionnaire items were excluded, 200. The total sample of study included 300

out of 500 workers, response rate was 60%. The men comprised 152 (51%) of the study population, more than women 149, but not significantly. The mean age of the employees was 40.78 ± 10.44 years (standard deviation, SD) and the mean length of service 13.28 ± 10.02 years (SD), as shown in Table 1. The first cohort was represented by health professionals (n = 63), teaching staff (n = 101), and employees of administration, the judiciary, and administrative services (n = 7). The manufacturing workers who made up the second cohort were: Textile workers (n = 24), workers in the metal industry (n = 34), workers in the wood industry (n = 51), and workers in the manufacturing industry (n = 20). The criteria for inclusion of workers were 19–65 years of age and at least 1-year work experience. Exclusion criteria were workers who refused to participate in the survey.

Table 1: Numerical screening data of age, length of service, sick leave, WAI score, and stress score in all respondents (n = 299)

Characteristics of subjects	Mean ± SD*	Minimum	Maximum
Age (years)	40.78 ± 10.44	19.00	65.00
Length of service (years)	13.28 ± 10.02	1.00	44.00
Sick- leave (days)	9.38 ± 23.71	0.00	300.00
WAI score	40.88 ± 5.85	15.00	49.00

*SD: Standard deviation.

We assessed work ability and WAI score groups' relationship to: Aging and gender (particularly excellent and poor WAI among older and female employees); and the marital status, education level of employees, working field of working activity, current work ability compared with lifetime best, mental and physical demands of job, work impairment due to disease, sick leave during past 12 months, work ability prognosis for 2 years, and mental functional capacities, too.

This research data contain elements that could lead to identification of respondents: The number of sex participants, including year of birth (age) as indirect identifiers of human research participants as indirect sensitive data. Data collection was performed by means of an anonymous and voluntary participation of all respondents in a questionnaire surveys. The ethical approval for this research was obtained from the each appropriate research committee at the Tuzla University School of Medicine, with confirmation of the consent of the employers and written consent of all respondents.

WAI questionnaire

The survey study was conducted by WAI Questionnaire which was used before in Bosnia and Herzegovina and has been adapted and translated in Bosnian language [14], [15]. The internal consistency of each seven items of WAI questionnaire in our study sample was excellent (Cronbach, alpha = 0.79). WAI measures seven aspects: Current work ability compared with lifetime best; WA in relation to the physical and mental demands; current number of common chronic diseases; sick leave taken in the past 12 months; the workers own prognosis of his or her work ability in

2 years' time; and the workers mental resources to accomplish his or her job. WAI is derived as the sum of the ratings on these seven items. The range of the summative index is 7–49. Originally, the cut of points for the levels of work ability was based on the 15th percentile, median, and 85th percentile of the distribution of the index in the total population at baseline: Poor 7–27; moderate 28–36; good 37–43, and excellent 44–49. For the analyses here, we combined good and excellent work ability into one category. This multi-factorial nature of work ability should be taken into account in health promotion programs aimed at maintaining and promoting the participation of the labor force and improvement of the performance at work. 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 [16], [17].

Statistical analysis

We performed data analysis using IBM SPSS Statistics for Windows, Version 19.0, IBM Corp., and Armonk, NY. The descriptive statistics are presented by means and standard deviations, or relative numbers and percentages for categorical data. To examine differences between cohorts and individual and WAI working condition determinants, we used Pearson Chi quadrate test. Determinations of correlation between WAI and other individual, demographics, and WA working condition determinates were computed non-parametric Spearman's correlation test. Logistic regression analysis ANOVA was used to provide multivariate association (predictive or protective potential) between levels of WAI among workers levels of WAI as dependent variable and, gender, age and each WAI scales (as independent variables, predictors) per both cohorts. All $p < 0.05$ were regarded as statistically significant.

Results

Between individual characteristics of respondents the mean by standard deviation (SD) were for: Age 40.78 ± 10.44 years; length of service 13.28 ± 10.02 years; sick leave 9.38 ± 23.71 days; and WAI score 40.08 ± 6.17 (Table 1).

Table 2 shows the study sample consisted of more male 152 (51%) than 147 (49%) women, but there was no gender statistically deference. The total number of respondents aged from 19 to 54 was 271 (91%) and between them older employees aged ≥55 were only 28 (9%). Respondents from public service sector have higher level of education than industry workers (medium: High level, 29%: 71% vs. 87%:3%, $p = 0.001$). As unexpected, there were not significant

differences of categories of WAI between public service and industry sector respondents. However, significantly higher prevalence of higher level of current WA compared with life time best on the scale from 1 to 10 ($p = 0.020$) found, for example, higher prevalence of maximal level ten in industry sector than in public service respondents 43.7%: 33.9% ($p = 0.020$). Public service employees expressed much more frequent use of long sick leave 100–365 days (almost 3 times) than industry workers, 2.9% versus 0.8% ($p = 0.008$).

Table 2: Characteristics of a sample per working activity (n = 299)

Characteristics of respondents	No (%) per Cohorts 1 and 2		p-value
	Public service 171 (57.2)	Industry 128 (42.8)	
Gender			33.696
Male 152 (50.8)	62 (36.3)	90 (70.3)	0.001
Female 147 (49.2)	109 (63.7)	38 (29.7)	
Age-groups (years)			30.998
18–34, 87 (29.1)	29 (16.9)	58 (45.3)	0.001
35–44, 97 (32.4)	68 (39.9)	29 (22.7)	
45–54, 87 (29.1)	57 (33.3)	30 (23.4)	
55–64, 28 (9.4)	17 (9.9)	11 (8.6)	
Marital status			
Married, 227 (75.9)	139 (81.3)	88 (68.7)	7.464
Single 58 (19.4)	24 (14.0)	34 (26.6)	0.058
Divorced 9 (3.0)	5 (2.9)	4 (3.1)	
Widowed 5 (1.7)	3 (1.7)	2 (1.6)	
Educational level			142.385
Low, 13 (4.4)	0 (0.0)	13 (10.2)	0.001
Medium, 161 (53.8)	50 (29.2)	111 (86.7)	
High, 125 (41.8)	121 (70.8)	4 (3.1)	
Work ability determinates			
Work ability score groups			0.135
Poor, 9 (3.0)	5 (2.9)	4 (3.2)	0.987
Moderate, 47 (15.7)	28 (16.4)	19 (14.8)	
Good, 132 (44.2)	75 (43.9)	57 (44.5)	
Excellent, 111 (37.1)	63 (36.8)	48 (37.5)	
Current work ability compared with lifetime best			
From minimal 1	0 (0.0)	0 (0.0)	18.121
2	0 (0.0)	2 (1.6)	0.020
3	4 (2.3)	1 (0.8)	
4	4 (2.3)	2 (1.6)	
5	3 (1.9)	4 (3.1)	
6	12 (7.0)	5 (3.9)	
7	7 (4.1)	11 (8.6)	
8	45 (26.3)	15 (11.7)	
9	38 (22.2)	32 (25.0)	
to maximal 10	58 (33.9)	56 (43.7)	
Sick leave groups			
None at all 214 (71.6)	131 (76.6)	83 (64.8)	13.869
At the most 9 days 29 (9.7)	8 (4.7)	21 (16.4)	0.008
10–24 days 31 (10.4)	16 (9.4)	15 (11.7)	
25–99 days 19 (6.3)	11 (6.4)	8 (6.3)	
100–365 days 6 (2.0)	5 (2.9)	1 (0.8)	

p-value, Pearson Chi-Square.

We found negative significantly correlation between decrease mental functional capacity and WAI (correlation = −0.231, p = 0.009); negative significantly correlation between influence of diseases and WAI (correlation = 0.012, p = 0.017); and negative significantly correlation between higher number of diseases and negative significantly correlation between sick leaves and WAI in public sector employees (correlation = −0.097, p = 0.274). There is positive correlation between mental demands of work and WAI in public sector employees, too. We found positive significantly correlations between educational level and WAI (correlation = 0.189, p = 0.013); and physical demands of work and WAI (correlation = 0.464, p = 0.001) among industry service workers. There was negative correlation between: Influence of diseases and WAI (correlation = 0.225, p = 0.003); number diseases and WAI (correlation = 0.620, p= 0.001); and negative significantly correlation between sick leaves and WAI (correlation = −0.394, p = 0.001) in industry service workers, too. There was negative correlation between WAI

and mental resources (p = 0.006), influence of diseases, number of diseases, and sick leaves (p = 0.001) (Table 3).

Table 3: Correlation between WAI, working factors, and resources selected by working activities (public service or industry sector) in all respondents (n = 299)

Education level, working factors, resources, diseases influence, and sick leave	Spearman correlation	p-value
Public service employees		
Educational level	0.015	0.863
Mental resources	−0.231	0.009
Physical demands of work	0.094	0.289
Mental demands of work	0.232	0.009
Influence of diseases	−0.012	0.017
Number of diseases	−0.662	0.001
Sick leaves	−0.097	0.274
Industry sector workers		
Educational level	0.189	0.013
Mental resources	−0.101	0.188
Physical demands of work	0.464	0.001
Mental demands of work	0.080	0.096
Influence of diseases	−0.225	0.003
Number of diseases	−0.620	0.001
Sick leaves	−0.394	0.001
All respondents		
Educational level	0.031	0.592
Mental resources	−0.158	0.006
Physical demands of work	−0.063	0.278
Mental demands of work	0.028	0.626
Influence of diseases	−0.226	0.001
Number of diseases	−0.638	0.001
Sick leaves	−0.261	0.001

Table 4 shows that predictors of decreased level of WAI among all respondents were larger number of diseases (β = −0.351, 95%CI, −0.805−0.186, p < 0.001); more days or longer duration of sick leave (β = −0.183, 95%CI, −1.198–0.862, p < 0.001); and low level of education (β = −0.046, 95%CI, −0.913−0.032, p < 0.035). On other site, protectors (factor responsible for increased level of WAI) are: Preserved mental capacity (β = 0.126, 95%CI, −1.112–0.931, p < 0.001); unexpected higher physical demands of work (β = 0.336, 95%CI, 0.687−1.100, p < 0.001); and higher mental demands of work (β = 0.499, 95%CI, 1.070–1.454, p < 0.001) too. Good prognostic factors of increased level of WAI are: Larger numbers from 1 to 10 of current WA compared with life time best (β = 0.299, 95%CI, 0.900–1.138, p < 0.001), and positive prognosis of WA in 2 next years (β = 2.688, 95%CI, 0.962–1.186, p < 0.001).

Decreased level of WAI among public service employees predicted: Working activity, work in health-care sectors (β= −2.791, 95%CI, 9.984−2.633, p < 0.001), larger number of diseases (β = −0.384, 95%CI, −1.187−0.937, p < 0.001); more days or longer duration of sick leave (β = −0.182, 95%CI, 1.123–0.238, p < 0.001). Protectors for increased level of WAI were: preserved mental capacity (β = 0.120, 95%CI, 0.678–1.358, p < 0.001); and unexpected higher mental demands of work (β = 0.220, 95%CI, 0.723–1.301, p < 0.001). Good prognostic factors of increased level of WAI are: Larger numbers from 1 to 10 of current WA compared with life time best (β = 0.352, 95%CI, 0.948–1.113, p < 0.001), and positive prognosis of WA in 2 next years (β = 0.120, 95%CI, 0.678–1.358, p < 0.001) (Table 4).

Using logistic regression model, we found that decreased level of WAI score among industry sector workers was associated with following predictors: Older age (β = −0.041, 95%CI, −0.042−0.004, p < 0.020); larger

number of chronic diseases (β = −0.322, 95%CI, −1.118−0.864, p < 0.000); and more days or longer duration of sick leave (β = −0.160, 95%CI, −1.304–0.810, p < 0.001). Protectors of increase level WAI are: Higher physical demands of work (β = 0.198, 95%CI, 0.824–1.234, p < 0.001), and higher mental demands of work (β = 0.137, 95%CI, 1.888–2.050, p < 0.001). Good prognosis of work ability found for: Prognosis of WA in 2 next years (β = 0.278, 95%CI, 0.955–1.236, p < 0.001), larger numbers from 1 to 10 of current WA compared with life time best (β = 0.266, 95%CI, 0.821–1.128, p < 0.001), and preserved level of mental resources (β = 0.137, 95%CI, 1.888–2.050, p < 0.001), as shown in Table 4.

Table 4: Results of the multiple linear regression analyses for all respondents, for respondents from public service sector and for respondents from industry sector as dependent variables; demographic factors and work environment factors obtained (independent variables)

Predictors of work ability	β	p-value	95% confidence interval	
All respondents R=0.972: R1 (adjusts) =0.969. p<0.000				
Age	0.028	0.056	−0.032	0.000
Working place	−0.452	0.209	−3.248	0.714
Occupation	0.440	0.221	−0.743	3.204
Working activity	−0.104	0.221	−0.743	3.204
Marital status	−0.002	0.881	−0.275	0.236
Educational level	−0.046	0.035	−0.913	−0.032
Current work ability compared with lifetime best	0.299	0.001	0.900	1.138
Physical demands of work	0.336	0.001	0.687	1.100
Mental demands of work	0.499	0.001	1.070	1.454
Number of chronic diseases	−0.351	0.001	−0.805	−0.186
Sick leave during the last year	−0.183	0.001	−1.198	0.862
Prognosis of work ability in 2 next years' time	0.268	0.001	0.962	1.186
Mental resources	0.126	0.001	−1.112	−0.931
Public service respondents R = 0.986: R1 (adjusts) = 0.972. p < 0.000				
Age	−0.015	0.501	−0.035	0.017
Working place	−2.791	0.001	−9.984	−2.633
Occupation	2.753	0.001	2.540	9.900
Marital status	−0.002	0.915	−0.381	−0.342
Educational level	−0.042	0.183	−1.233	−0.238
Current work ability compared with lifetime best	0.352	0.001	0.948	1.313
Physical demands of work	0.056	0.078	−0.085	1.612
Mental demands of work	0.220	0.001	0.723	1.301
Number of chronic diseases	−0.384	0.001	−1.187	0.937
Sick leave during the past year	−0.182	0.001	1.123	0.238
Prognosis of work ability in 2 next years' time	0.258	0.001	0.891	1.225
Mental resources	0.120	0.001	0.678	1.358
Workers in industry sector R=0.970: R1 (adjusts) =0.941. P<0.000				
Age	−0.041	0.020	−0.042	−0.004
Working place	0.645	0.057	−0.075	5.233
Occupation	−0.634	0.062	−5.173	0.124
Marital status	−0.012	0.447	−0.462	−0.205
Educational level	−0.024	0.154	−1.033	0.165
Current work ability compared with lifetime best	0.266	0.001	0.821	1.128
Physical demands of work	0.198	0.001	0.824	1.234
Mental demands of work	0.137	0.001	1.888	2.050
Number of chronic diseases	−0.322	0.001	−1.118	0.864
Sick leave during the past year	−0.160	0.001	−1.304	−0.810
Prognosis of work ability in 2 next years' time	0.278	0.001	0.955	1.236
Mental resources	0.137	0.001	1.888	2.050

β: Beta coefficient in regression ANOVA analysis of potential predictors.

Discussion

Studying and assessing work ability using a standardized WAI questionnaire in a work environment is very valuable for planning and improving human health [18]. The results of the WAI survey, which included the administrative staff of the education sector in Brazil, showed that it decreased work ability drives individuals to leave work either temporarily or even permanently [19]. Aware of this, our study allowed us to identify among our respondents an average age of 40.78 years and

an average length of service of 13.28 individual factors and risk factors associated with a decline in the index of work capacity of public administration and industrial workers in the industrial sector.

Numerous studies have indicated that female employees have significantly lower WAI than male workers, which have been particularly observed in health-care providers [20], [21], [22]. However, we did not confirm this hypothesis, which is consistent with the results of a Polish survey that included both administrative and manufacturing workers [3]. The total WAI score in our subjects is in the category of good working ability score that is 40.88 ± 5.85 (SD), and there is a real possibility of preventive action by eliminating or reducing risk factors according to already established algorithms of WAI [8].

Similar results were obtained by the study authors, which included Dutch office workers [13]. The authors of the previous research conclude a significant correlation between WAI, individual and demographic characteristics of employees, and the previous underlying concept of work ability assessment has been predominantly oriented toward work ability assessment by age [23], [24], [25], [26], [27]. In all of our respondents, the predictor of declining WAI is a low level of education in industrial workers and a reduced level of continuing lifelong education in public sector employees (p = 0.035). In public sector employees, a significant predictor of WAI decline is type of work activity (p = 0.001). Multiple regression analysis also confirmed that being a health-care provider decreases the WAI score (p = 0.001). Only in productive workers did increasing life expectancy be associated with a decline in WAI (β = 2.753, 95% CI, 2.540–9.900; p = 0.001). Similar results were found by the authors of a study that included workers in Poland [3], or the results of an international survey of a population of public sector employees that excludes the impact of aging on WAI [23], [24].

In all respondents, especially manufacturing workers, significant protectors of WAI are preservation of physical fitness and mental capacity to work, while mental sector functioning is especially important for public sector employees. This has been confirmed in the results of numerous authors previously [26], [27], [28], [29], [30], [31]. Inversely, our study found that increased physical and mental work demands had a positive effect on increased WAI, that is, development of workers' skills and competencies. Perhaps this is specific to our local workplace opportunities and relates to the need for well-defined work tasks as an imperative for increasing the competencies of workers and their performance in the workplace, as they are contrary to the endorsements of other authors [32], [33].

The number of chronic illnesses, long sick leave, current self-assessment of work capacity, and self-forecast work loss over the next 2 years is the most important determinants of decreased or loss of WAI in all of our respondents, which is in agreement with the studies of other authors [23], [24], [34], [35], [36], [37].

Effective treatment of chronic health conditions should be given priority to reduce the rate of sick leave and loss of working capacity with better organization of work and definition of work tasks of workers.

Conclusion

The determinants of WAI are mental capacity and physical fitness, and a high level of education. The number of chronic illnesses, long sick leave, lower level of education, or reduced level of continuing lifelong education and worse self-prognosis of work over the next 2 years all significantly affect the decrease or loss of working capacity. In industrial workers, aging increases the risk of reduced work activity.

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