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A Study on Work Ability among Aging Workers in Korea

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Objective and Background: The objective of this study was to evaluate the association of individual characteristics, work-related factors, lifestyle factors, and health problems with work ability among aging workers in Korea.

Method: In this cross-sectional survey, the study population consisted of 1,594 workers who had participated in a voluntary health promotion center and private workplace. Participants completed the work ability index.

Results: The mean WAI score was 37.4, while the mean age of the sample was 43.25. In the age group over 50 showed 36.26. The majority of participants rated their work ability as 'good' to 'excellent', one-third moderate and about 7.5% poor. Work ability decreased significantly with age among the men. The younger group had higher scores on the work ability index than the age group over 50, except for mental resources. By work characteristics, work ability was analyzed to be the lowest in the case of work handling heavy stuff. Lastly, as a result of health factors analysis, the good management and retention of current health status can be the measure helpful to the improvement of work ability.

Conclusion and Application: According to the results, it can be a basic principle to devise and enforce preventive measures on the factors for which improvement or action is possible, together with workplace-level systematic approach, in order to improve work ability. For such measures to be realized, it is necessary to check trends in change for several years.

Keywords: Work ability, Work Ability Index (WAI), Aging worker, Individual characteristics, Work-related factors

1. Introduction

Looking into the future population estimation of KOSTAT (2013), Korean population will increase to 52.16 million in 2030, but will decrease to 43.96 million in 2060, due to low birth rate. Economically active population is also forecast to decrease with 37.04 million (72.9% of total population) in 2016 as the peak. The elderly population will surpass the number of children in 2017, and ten economically active people should support ten people (eight elderly people and two children) in 2060. As such, the problems of low birth rate and aging are reported to emerge as social phenomena from 2020 (YonHap News Agency, 2013). After 2030 when many of the baby boom generation (born in 1955-1963) retire from work, the problem of lacking skilled workers will become serious, and the retirement age will be extended to

60-65 years of age, centered on public institutions, and the aging of labor force is predicted. The problem of imbalance between work requirement (load) and work ability will take place, due to the aging of economically active population, and various factors can affect such an imbalance, in addition to the age (main cause), according to Ilmarinen et al., 1991.

In Korea, data on the aging of general population is produced in large quantities; however, survey and research are limited to specific business types and jobs at workplace level, and therefore, the data to devise comprehensive measures lacks. In this regard, literature study on global trend in work ability is necessary, and an approach to present a variety of factors affecting aging through comprehensive fact-finding survey nationwide is needed.

Looking at the aging at domestic workplaces, as the employment rate of elderly people increased, the mean age of workers rose by 5.1 years from 38.9 in 1990 to 44.0 in 2013, according to Jung (2013). The mean age of Korea's shipbuilding industry went up from 40.3 in 2002 to 43.3 in 2012, and the mean age of the workers of a shipbuilder rises year by year, according to NEWSis (2013). The aging of the biggest population group, baby boom generation (born in 1955-1963), critically affected. And, also the mean age of total workers increased, as retirement age was extended, and the reemployed middle-aged and elderly class for low-waged irregular jobs increased, after their retirement, according to Asia Business Daily (2013). Despite the aging of economically active population, the retirement age of private companies with 300 and more of employees is 56 on average and the desired retirement age of wage workers is 64, and a huge gap exists between the two retirement ages. According to the 2011 Supplementary Survey of Economic activities, the mean age of principal job retirement was 53, while 59% of the population aged 55-79 hope to work in the future (Kim and Cho, 2012).

As a result of industrial accident analysis, the accident rate of elderly workers was 27.6% in 2001, but it rose to 46.4% in 2011, and musculoskeletal disease took up most (MOEL, 2012). The disease develops, due to repeated performance of the same work for a long time or work handling heavy stuff. Such a musculoskeletal disease occurs from the difference between work ability and work load, since work requirements do not change, although work ability decreases, as workers are getting older. However, various researches on the difference level are necessary. In this regard, measures for working environment improvement, change in production mode and improvement of quality of life to prevent elderly workers' industrial accidents are required. Also, a method by evaluating work ability of elderly workers in consideration of work-related characteristics is demanded for the preservation of high quality labor force. Now is the time that objective basis data on work ability, according to various factors, is needed.

This study checked international level of the work ability of Korean population group, and analyzed the effect of various factors on work ability. This study aims to present measures to maintain, increase and improve the work ability of workers including elderly workers, as well as to identify the health status of the elderly workers (50 years old and over).

2. Method

2.1 Participants

1,709 people in total voluntarily participated in the questionnaire survey, and this study targeted 1,594 people, excluding some questionnaire respondents, due to omission of answers to some questions. 55.1% of males and 44.9% of females consisted of the total questionnaire respondents. Total mean age was 43.25 (standard deviation (SD): 10.39). By age group, the respondents in their 50s (50-59) were the most at 31.0%, followed by their 30s (30-39) at 28.9%, and their 40s (40-49) at 25.5%. The elderly workers of 50 and over took up 35.5%.

2.2 Apparatus

Surveyor's name, survey date and survey table number need to be written in the basic item of the questionnaire. Also, the questionnaire includes gender, age, height, weight, marriage status and educational level, which can be individual factors. Total work experience and the current job work experience, which can be work-related factors, are surveyed, as well as work-related characteristics and work type. As lifestyle factors, the status of exercise, smoking and alcohol drinking are included in the questionnaire. In addition, the items related with overall health status, which can be health factors, are included. Above all, this study used WAI (Work Ability Index) that can be calculated using seven items including current work ability and mental quality. WAI was developed by the Finnish Institute of Occupational Health, and is the index to monitor work ability, namely, how well a worker can perform work. WAI is utilized for the purpose of offering a preventive alternative and helping early rehabilitation by checking work ability reduction at early stage, according to the aging of the middle-aged and elderly class. The WAI questionnaire checklist used in this study was the question items showing 81% of consistency in the study of Yang (2011). Personal consent of the questionnaire participants on the use of the items included in the questionnaire was received upon the questionnaire survey.

2.3 Procedure

The purpose and how to answer the questionnaire survey were explained, after the questionnaires were distributed to the survey-targeted workers. The workers were supposed to answer in the self-writing mode. If a worker completes the answers to the questions, a surveyor - an industrial health expert (nurse, etc.) - checks whether there was any omitted items in the answering process through interview with the respondent concerned, and the omitted ones were answered through supplementary questions. The questions related with disease were answered through specific interview as well. To check work ability of the elderly workers, the questionnaire survey was conducted, according to the voluntary participation of the questionnaire respondents targeting the workplaces with 50 employees and less.

3. Results

3.1 WAI and work ability class

As a result of collected data search result on WAI, it is difficult to assume normal distribution, and therefore, a nonparametric statistical analysis, Kruskal-Wallis test, was used. For correlation analysis, Spearman correlation, which is a nonparametric statistical analysis that can apply to non-normal distribution group, was used. Many studies related to WAI conducted the questionnaire analysis using such a method. For work ability class, this study carried out a chi square analysis. Above all, confidence test on whether there was no problem in using the WAI and relevant questions was carried out, before WAI was evaluated. Generally, Cronbach's alpha is used for confidence test, and the Cronbach's alpha in this study was 0.74, which was higher than 0.72, the mean value of ten European countries, as well as higher than general 0.6-0.7. This shows that the questionnaire survey result is very reliable.

Table 1 shows the analysis result of WAI and work ability class, and the mean WAI of the total respondents was 37.4 (SD: 6.155), and was at good level overall. Good level was 48.2%, moderate level was 30.9%, excellent level was 13.4% and poor level was 7.5% as to work ability by class. Overall good and excellent levels were 61.6%. The mean WAI of the elderly workers was 36.26 (SD: 6.558), and that of the group aged 50 and younger was 38.03 (SD: 5.829), and therefore, the elderly workers were analyzed to be significantly low. The good and excellent levels of the elderly workers were 52.7%, and those of the group aged 50 and younger showed 66.0%. With all these, the measures to maintain and increase the work ability of the elderly workers are required.

Table 1. Results of WAI and work ability class by age group

Age group	WAI			Work ability class			
	Mean	Median	S.D.	Poor	Moderate	Good	Excellent
Total	37.4	38.0	6.155	120 (7.5)	492 (30.9)	768 (48.2)	214 (13.4)
~ 50	38.03	39.0	5.829	62 (6.0)	288 (28.0)	528 (51.4)	150 (14.6)
50 ~	36.26	37.0	6.558	58 (10.2)	204 (36.0)	240 (42.4)	64 (11.3)

3.2 Individual characteristics

Table 2 shows the distribution of WAI by individual factors, and significant differences were found in all items. As a result of WAI analysis by gender, male's mean WAI was 36.7 (SD: 6.77), and female's mean WAI was 38.2 (SD: 5.20), and thus, female's work ability was significantly higher than the male's statistically. By age, the mean WAI of the respondents in their 20s was the highest at 38.5 (SD: 5.81), and that of the age group of 60s was the lowest at 34 (SD: 5.82). As respondents were older, the mean WAI was analyzed to show statistically significant decrease. As a result of analysis, according to height, the mean WAI was the highest at 38.0 (SD: 6.02) in the group with slightly taller height (50-75 percentile) than mean height, and it was the lowest at 36.6 (SD: 6.03) in the shortest group in height (25 percentile and lower). As for educational level, the graduates of high school and lower showed 35.6 (SD: 6.44), which was lower than the graduates of university and higher at 39.1 (SD: 5.31). This implies that WAI increases, as educational level is higher. In the survey on marital status, the WAI of singles (non-married) or married people was higher than that of the divorced group.

Table 2. Results of WAI by individual characteristics

Variable	Categories	N	WAI			*P*-value
			Mean	Median	S.D.	
Gender	Male	878	36.7	38.0	6.77	0.000**
	Female	716	38.2	39.0	5.20	
Age	20s (20~29)	161	38.5	39.0	5.81	0.000**
	30s (30~39)	461	38.3	39.0	5.72	
	40s (40~49)	406	37.6	39.0	5.94	
	50s (50~59)	494	36.6	37.5	6.60	
	60s (60~69)	72	34.0	34.25	5.82	
Height status	~ 25%tile	259	36.6	37.5	6.03	0.000**
	25~49%tile	437	36.7	38.0	6.37	
	50~74%tile	468	38.0	39.0	6.02	
	75%tile ~	428	37.9	39.0	6.04	
Educational level	High School or less	784	35.6	36.5	6.44	0.000**
	College + University	803	39.1	40.0	5.31	
Marital status	Single	326	38.4	39.0	5.81	0.000**

Table 2. Results of WAI by individual characteristics (Continued)

Variable	Categories	N	WAI			*P*-value
			Mean	Median	S.D.	
Marital status	Married	1,186	37.2	38.0	6.10	0.001**
	Divorced/Widowed	40	35.5	36.5	7.23	

**p <0.01

3.3 Work-related factors

Table 3 shows the relationship between work-related factors and work ability, and statistically very significant differences were demonstrated in all items such as work experience, work characteristics and work type. As a result of analysis on work experience, the mean WAI of the group with five years and less of work experience was the highest at 38.7 (SD: 5.77), and that of the group with 25-30 years of work experience was the lowest at 35.5 (SD: 7.06). As the years of work experience was long, WAI showed a downtrend, but the mean WAI rather increased to 36.7 (SD: 6.49) in the case of the group with 30 years and more of work experience. This can be judged that the elderly workers with long years of work experience rated themselves higher than their own work ability, due to anxiety towards retirement. According to work characteristics, the mean WAI in the case of carrying out repetitive work was 37.1 (SD: 6.09), and that of work handling heavy stuff was 35.7 (SD: 6.66), and other work was 39.2 (SD: 5.51). The work ability in the work handling heavy stuff was analyzed to low, and also repetitive work ability was lower than other work. As a result of work type, the mean WAI of the group working mainly with standing posture was 35.0 (SD: 7.03), and that of the group working mainly with sitting posture was 38.6 (SD: 5.40): the work ability with standing posture was analyzed to be low.

Table 3. Results of WAI by work-related factors

Variable	Categories	N	WAI			*P*-value
			Mean	Median	S.D.	
Work experience	~ 5 yrs.	247	38.7	39.0	5.77	0.000**
	5~10 yrs.	300	38.2	39.0	5.50	
	10~15 yrs.	250	38.2	39.25	5.70	
	15~20 yrs.	226	37.7	38.0	5.67	
	20~25 yrs.	173	36.2	36.5	6.22	
	25~30 yrs.	169	35.5	37.0	7.06	
	30 yrs. ~	156	36.7	37.25	6.49	
Work characteristics	Repetitive work	900	37.1	38.0	6.09	0.000**
	Exerted force work	266	35.7	37.0	6.66	
	Other work	428	39.2	40.0	5.51	
Work types	Mainly standing	342	35.0	36.0	7.03	0.000**
	Sitting and standing	557	37.4	38.0	6.03	
	Mainly sitting	695	38.6	39.0	5.40	

**p <0.01

3.4 Lifestyle factors

Table 4 shows the relationship between lifestyle factors and work ability, and significant differences were found in all items except BMI. As a result of examining the status of exercise and work ability, the mean WAI was the highest at 38.8 (SD: 5.94) in the group regularly exercising, and the group not undertaking exercise was the lowest at 36.7 (SD: 6.09). This means that regular exercising helps the retention and improvement of work ability. According to the survey result on smoking, the mean WAI of the group of non-smoking people was 38.2 (SD: 5.71), while that of the group of smoking people was 36.5 (SD: 6.74), and the former smoking people's group was low at 34.9 (SD: 6.47). In the survey on the status of alcohol drinking, the non-drinking group's mean WAI was 38 (SD: 5.99), which was higher than the alcohol drinking group (37.1 and SD: 6.28) and the former alcohol group (36 and SD: 5.74). As such, the work ability of the groups of non-smoking or non-alcohol drinking people was better, and thus, a measure to recommend giving up smoking or non-alcohol drinking is required.

Table 4. Results of WAI by lifestyle factors

Variable	Categories	N	WAI			*P*-value
			Mean	Median	S.D.	
BMI	Under Weight (~18.5)	64	38.5	39.75	5.66	0.053
	Normal (18.5~24.9)	1,135	37.6	38.5	6.09	
	Over Weight (25~29.9)	367	36.8	37.5	6.38	
	Obesity (30~)	23	35.7	38.0	6.90	
Exercise	Regular	371	38.8	40.0	5.94	0.000**
	Irregular	732	37.1	38.0	6.21	
	Non	486	36.7	37.75	6.09	
Smoking	Non-Smoking	1,017	38.2	39.0	5.71	0.000**
	Smoking	411	36.5	37.5	6.74	
	Former-Smoking	157	34.9	35.0	6.47	
Alcohol drinking	Non-Drinking	617	38.0	39.0	5.99	0.002**
	Drinking	866	37.1	38.0	6.28	
	Former-Drinking	108	36.0	37.0	5.74	

**p <0.01

3.5 Health problems

Table 5 shows the relationship between health factors and work ability, and significant differences were found in all items. As a result of investigating overall health status and WAI, the mean WAI of the group that answered the health status was very bad was 25.8 (SD: 6.94), but the group that answered the health status was very good was very high at 43.3 (SD: 3.74) (Figure 4-21). The health status compared with one year ago also showed the similar result. The mean WAI of the group that answered much worse was 28.1 (SD: 7.33), but that of the group that answered very good was 43.5 (SD: 3.87), which showed a significant difference. This means that the current health status very significantly affect WAI. Consequently, managing and retaining the current health status can be a measure to be helpful to the improvement of work ability.

Table 5. Results of WAI by health problems

Variable	Categories	N	WAI			*P*-value
			Mean	Median	S.D.	
Health status	Very bad	37	25.8	23.0	6.94	0.000**
	Bad	270	31.9	32.0	5.98	
	Moderate	758	37.2	38.0	4.96	
	Good	370	40.4	41.0	4.17	
	Very good	159	43.3	44.0	3.73	
Health status for compared with 1 year ago	Much worse	61	28.1	28.0	7.33	0.000**
	Worse	432	34.4	35.0	6.02	
	No change	899	38.7	39.0	5.21	
	Better	161	40.3	41.0	4.50	
	Much better	41	43.5	44.0	3.87	

**$p < 0.01$

4. Discussion and Conclusion

This study conducted a fact-finding survey targeting 1,594 workers to identify Koreans' work ability level. Especially, this study analyzed individual factors (gender, age, marital status, education level), work-related factors (work experience, work characteristics and work type), lifestyle factors (BMI, status of exercise, smoking and alcohol drinking), and health factors (health status and health status compared with one year ago) that affect work ability. Above all, the measures to maintain and improve the work ability of the elderly workers aged 50 and over were proposed in this study.

As a result of work ability survey, the mean WAI of the total questionnaire respondents (N=1,594) was 37.4, and was analyzed to be the good level, and this value was about the median value of the existing studies. According to literature study on the mean WAI of the existing studies, it was 35.9-38.5 as a result of survey for ten years by Kumashiro et al. (2011), and the mean WAI value of Bang et al. (2010) was the lowest at 28.8. And also, various mean WAI values were found in order as follows: 31.2 (Ghaddar et al., 2011), 36.6 (Kim and Kim, 2008), 36.8 (Kloimüller et al., 2000), 37.9 (Mok et al., 2013), 38.7 (Cotrim et al., 2011), 40 (Lee and Chang, 2012), 41 (Baek and Chang, 2005), 40.9 (Alavinia et al., 2007), 41.1 (Choi, 2011), 41.7 (Monteiro et al., 2011), 42 (Kang et al., 2005), 43 (Bridger and Bennett, 2011).

The work ability by class in this study was as follows: Good level was 48.2%, Moderate level 30.9%, Excellent level 13.4%, and poor level 7.5%. Overall, the good and excellent levels were analyzed to be 61.6%. As a result of literature study on work ability class, the good+excellent ratio increased as follows in order, starting from 51.9% of Kim and Kim (2008): 57% (Kloimüller et al., 2000), 66.4% (Mok et al., 2013), 67.7% (Cotrim et al., 2011), 77.5% (Lee and Chang, 2012), 83.6% (Baek and Chang, 2005), 83.9% (Alavinia et al., 2007), 84.4% (Choi, 2011), 85.6% (Monteiro et al., 2011) and 86.1% (Kang et al., 2005).

As a result of work ability-affecting factors analysis, WAI and work ability class showed differences, according to the questionnaire respondent's gender, age and work characteristics. According to individual factors, females had higher work ability than males, and a trend that WAI gradually diminished was clearly demonstrated, as worker's age increased. In terms of work ability class, the ratio of good level rapidly fell along with age increase, meanwhile, the moderate level increased in reverse. Consequently, intensive

management of the group with moderate or good level of work ability class is necessary. As educational level was higher, work ability also rose. Also, the work ability of singles (non-married) was analyzed to be higher than the married people.

As a result of work-related factors analysis, there was a trend of work ability decline along with the increase of work experience, but, the work ability of the group with 30 year or more of work experience rather slightly rose. It is judged that they rated their work ability higher than their own in reality, due to anxiety towards retirement. As Lee and Chang (2012) pointed out, the cause can be the weak social welfare foundation. By work characteristics, work ability was analyzed to be the lowest in the case of work handling heavy stuff. And, by work type, work ability was the lowest in the case of physical work with standing posture.

According to lifestyle factors analysis, the work ability of the group regularly carrying out exercise was high, and the work ability of the group of non-smoking or non-alcohol drinking people was better. Regular exercise and offering the programs for giving up smoking and non-alcohol drinking can be measures to retain or improve work ability. Lastly, as a result of health factors analysis, the good management and retention of current health status can be the measure helpful to the improvement of work ability, since current health status is closely related with WAI.

For the elderly workers to continue to work productively, how to maintain and improve such work ability is important. In Finland, work ability is the concept widely defined as being determined with the interaction result of the factors related to working environment or working conditions, in addition to individual quality and drive. Consequently, it is emphasized that all the related people with the elderly workers should conduct individual role and responsibility basically to promote the retention and improvement of elderly worker's work ability. The elderly workers are responsible for the retention of their own health and physical functions. In addition, the business owners and managers play a pivotal role in workplace culture reorganization to support the elderly workers to perform productive work. For the elderly workers to stably work, cooperation of all workers including young people is also necessary.

However, disease information sensitive to personal information can be omitted in surveying WAI in this study, and the standard point of categorization of work ability class can be different according to respondents' demographic characteristics. Also, work ability can vary, since differences exist in economic, cultural, social and welfare levels in each country. Because, the questionnaire survey targeted specific place visitors, there is a limitation in that the survey did not include the entire Korean population. Despite such a limitation, the confidence level of the answers to the question items was higher than the mean value of European countries, and thus, the results of this study can be used as data to devise various alternatives.

According to the results in this study, it can be a basic principle to devise and enforce preventive measures on the factors for which improvement or action is possible, after classifying the factors into those possible or impossible to improve among the influencing factors, together with workplace-level systematic approach, in order to improve work ability. Of the individual factors, some can be the items impossible to improve, however, work-related factors, lifestyle factors and health factors consist of the items possible to improve. For the work-related factors, an ergonomic improvement program for working environment improvement is generally adopted, and the lifestyle and health factors are the part that can be changed at home or from community, and the above-mentioned health improvement program is generally operated. For such measures to be realized, it is necessary to check trends in change for several years.

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