

Workplace Accident Prevention and Improvement of Work Ability in an Aging Society

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Abstract. [Purpose] This study surveyed work accidents in order to prepare for an aging of society. [Subjects] We surveyed 785 workers at 493 workplaces in the area of Seoul. [Methods] An anonymous survey was done. The collected data was analyzed using SPSS for Windows for frequency, cross-tabulation, logistic regression, and correlation. [Results] The results demonstrate the necessity of the prevention of human errors at all levels, the implementation of the recognition of dangerous factors, the reduction of subconscious risky behaviors, and fast and rational decision processes for work performance. However, it is difficult to prevent 100% of human errors. [Conclusion] It is necessary to establish a work environment that considers humans' physical and cognitive characteristics to prevent human errors from developing into accidents, and to have a program that enhances work abilities in preparation for the aging of society. Such a program would enhance physical abilities as well as cognitive abilities.

Key words: Accidents, Aging society, Work abilities

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INTRODUCTION

Korea's population above the age 65 was more than 7% in 2000, and it is expected to be 14% in 2018 and over 20% in 2026¹⁾. Developed countries are already demonstrating moves in preparation for the aging of society, and Korea also recognizes the magnitude of the economic influence arising from the progression of the aging are society. In particular, reductions in the labor supply and labor force (age 15–64) are becoming serious problems for businesses. Additionally, as senior's participation in economic activities rises, businesses face the problems of understanding the health problems of senior workers and finding solutions.

As aging is progressing faster in Korea than in any other country in the world, accidents involving workers over the age of 50 are increasing²⁾. The total number of the Korean workers aged 50 or more with experience of industrial accidents was 12,970 people in 1999 and 24,301 in 2002. Of the total number of workers with experience of industrial accidents, the percentage of workers aged 50 or more was 23.4% in 1999, 25.1% in 2000, 27.6% in 2001, and 29.7%

in 2002, an increase in every year³⁾.

A review of industrial accidents in 2006 in Korea, reported that among 11,688,797 workers at 1,292,696 workplaces, there were 89,910 victims of industrial accidents requiring treatment for four days or more (2,453 dead, 78,242 injured, 9,114 under medical care for occupational health problems) and the accident rate was 0.77%. By industry, manufacturing industry had the highest number of accidents, but recently, the service industry and sales as well as the construction industry are showing an increasing trend of accidents⁴⁾.

As workers age, not only work abilities but also individuals' physical and mental abilities decline, thus, workers' accidents and diseases increase⁵⁾. According to related studies, with aging, the average number of accidents and lost work days also rise. This is because humans' work abilities significantly fall with aging, and consequently the severity of the accidents also rises⁶⁾. Also, except for the population under the age 20, the number of workers afflicted with diseases rises with aging, significantly rising in the age group of 50 to 60 and hitting a peak after that

Table 1. Participating Workplaces

Type of Business	Workplaces in Seoul (%)	Participating Workplaces	
		Participating Workplaces (%)	Participants (%)
Manufacturing	4,484 (8.2%)	106 (21.5%)	132 (16.9%)
Construction	5,525 (10.1%)	148 (30.0%)	215 (27.4%)
Service and Others	44,690 (81.7%)	239 (48.5%)	438 (55.7%)
Total	54,699 (100%)	493 (100%)	785 (100%)

Table 2. Survey questions

1. Have you ever experienced an accident (or near miss accident)? (1) Yes (2) No
2. How many of the accidents happening around you do you think occur because of inability to recognize (perceive) dangerous factors (dangerous facilities and/or materials)? (1) 80% or more (2) 70% or more (3) 60% or more (4) 50% or more (5) Below 50%
3. How often do you think you act subconsciously in your daily life? (1) 80% or more (2) 70% or more (3) 60% or more (4) 50% or more (5) Below 50%
4. What do you think is the biggest cause of the lack of awareness of safety? (1) Indifference (Subconscious behaviors) (2) Carelessness (Not being careful) (3) Lack of knowledge (Not knowing about dangers) (4) Disregard (Knowing but not considering it unimportant or thinking lightly of dangers) (5) Etc.
5. How much of your work (duties) do you think is done well? (1) 90% or more (2) 80% or more (3) 70% or more (4) 60% or more (5) 50% or more
6. How much of your work (duties) do you feel satisfied with? (1) 90% or more (2) 80% or more (3) 70% or more (4) 60% or more (5) 50% or more
7. With aging, what do you think is the biggest difficulty in your activities (professional or social)? (1) Decline in physical abilities (2) Pressure from work (duties) (3) Lack of satisfaction and motivation (4) Pressure from adjusting to change in work or social environment (5) Decline in mental (cognitive) abilities such as memory and decision making ability
8. In your work (duties), what aspect do you think is more important, physical or mental (cognitive) aspect? (1) Physical aspect (2) Mental (cognitive) aspect (3) Both

age³⁾. Such changes in the occurrence of industrial accidents can be explained by changes in industrial structure and the labor force, and the expansion of coverage of industrial accidents as well as measures for the prevention and management of industrial accidents. Due to the aging of the workforce and diversification of the labor market, the proportion of senior citizens, foreigners, and disabled workers is steadily increasing. They are distinguished together as a group as being vulnerable in handling dangerous factors. Therefore, there are changes in the incidence and severity of industrial accidents⁷⁾.

A recent breakdown of the labor force by age group in Korea shows that workers above the age of 40 are increasing⁸⁾. Physical and cognitive skills decline with aging. Thus, it is necessary to study the kind of effects aging has on workers' accidents and work abilities. Also, for the period of time when workers' average age rises, many studies have been performed on basic safety management checklist and manuals, but there has been insufficient study of the checklists and manuals appropriate for older workers. In particular, there is a lack of research on accidents in relation to the physical and emotional changes of older workers and no study has been conducted that considers human engineering. There appears for be a

need to research considering the human engineering that is appropriate for the older workers, recognizing that workers' physical and mental abilities reduce as they age⁹⁾.

The present study was designed to study the factors that influence elderly workers' industrial accidents and work abilities at workplaces, and the effect that the individual workers' understanding of the occupation or job satisfaction has on the occurrence of industrial accidents. In particular, it surveyed the human errors that occur in the process of information processing that lead to related accidents, confidence and satisfaction in the process of work, and difficulties and problems related to the aging of society in order to present measure for preventing accidents and enhancing work abilities.

SUBJECTS AND METHODS

For 60 days from May 1st to July 30th, 2009, 785 workers from 493 work places in Seoul area responded to an anonymous survey.

Before the study, the principal investigator explained all procedures to the subjects in detail. All subjects signed an informed consent form, which was approved by the Inje University College of Health Science Human Studies

Committee.

The workplaces involved in this research are listed in Table 1. The participating workplaces amounted to 493 out of 54,699 workplaces in the entire city of Seoul.

The survey included four questions on human errors occurring in human information processing, two on the execution of duties, and two on the aging phenomenon, a total of eight (Table 2).

The collected data were analyzed using SPSS for Windows for frequency, cross-tabulation, logistical regression, and correlation.

RESULTS

The general characteristics of the participants are shown in Table 3. The participants were 724 males (92.2%) and 61 females (7.8%). By age group, 256 (32.7%) were in the 30–39 range, 249 (31.7%) were in the 40–49 range, 204 (25.9%) were 50 or over, and 76 (9.7%) were under 29.

By occupational rank, 307 were workers (39.2%), 298 were managers (37.9%), and 180 were owners (22.9%). Regarding years of work experience, 269 (34.2%) had worked for under five years, 232 (29.6%) had worked for 11–20 years, 172 (21.9%) had worked 5–10 years, and 112 (14.3%) had worked for more than 20 years.

Regarding the experience of accidents, 333 (42.4%) answered they had experienced an accident and 452 (57.6%) said they had not. Regarding the frequency of accidents that occurred due to the lack of awareness of dangerous factors, 627 (79.9%) answered 50% or more and 158 (20.1%) answered below 50%. Regarding subconscious behaviors, 536 (68%) answered 50% or more and 249 (31.7%) answered below 50%. Regarding the cause of the lack of awareness of safety hazards, carelessness ranked the highest among 300 people (38.2%), followed by indifference among 220 (28.0%), disregard among 219 (27.9%), lack of knowledge among 40 (5.1%), and others, among 6 (0.8%). Regarding the level of confidence with work, 671 (85.4%) answered 70% or more and 114 (14.6%) between 50% and 60%. Also, regarding the level of satisfaction, 639 (81.4%) answered 70% or more and 146 (18.6%) between 50% and 60%. Regarding the biggest difficulty in activities due to aging, lack of motivation ranked the highest among 246 (31.3%), followed by the pressure to adjust to the changing environment among 207 (26.4%), decline in health among 152 (19.4%), pressure from work among 113 (14.4%), and decline in cognitive abilities among 67 (8.5%). Regarding the most important consideration in work, 369 (47.0%) answered mental, 355 (45.2%) both, and 61 (7.8%) physical aspect (Table 4).

There were 333 respondents (42.4%) who had experienced accidents, 321 males (44.3%) and 12 females (19.6%). By occupational ranking they were 136 managers (45.8%), 123 workers (40.1%), and 74 owners (41.1%). The age group that ranked the highest was the 40s at 118 (47.4%), followed by the 30s 114 (44.5%), and the 50s 80 (39.2%).

Years of work experience were 10 to 20 years for 104 (44.8%), below five years for 98 (36.4%), between five to ten years for 73 (42.4%), and 20 years or more for 58

Table 3. General Characteristics of Survey Participants

Category			
Gender	Male	724 people	92.2%
	Female	61 people	7.8%
Age	Below 29	76 people	9.7%
	30–39	256 people	32.7%
	40–49	249 people	31.7%
	50 and up	204 people	25.9%
Positions	Owners	180 people	22.9%
	Managers	298 people	37.9%
	Workers	307 people	39.2%
Years of Work	Below 5	269 people	34.2%
	5–10	172 people	21.9%
	11–20	232 people	29.6%
	20 and up	112 people	14.3%
Total		785 people	100%

(51.8%) (Table 5).

With aging, recognition of accidents by subconscious behaviors was found to be relevant ($p < 0.01$), and subconscious behaviors decreased (correlation coefficient: -0.166). In other words, with aging, attention is thought to be enhanced through collection of experiences, duties are simplified, the relative amount of complex duties decreases, and subconscious behaviors decrease.

Also, in accidents, the lower the awareness of the dangerous factors, the higher the level of subconscious behaviors ($p < 0.01$, correlation coefficient: 0.0399) (Table 6).

Analysis of the relations of age, years of work, confidence regarding work, and job satisfaction revealed some similarities among all of the factors. The better the individual performed the duty, the stronger the satisfaction was ($p < 0.01$, correlation coefficient: 0.525) (Table 7). With aging, job performance and satisfaction increased ($p < 0.01$, correlation coefficient: 0.164 , 0.166).

In relation to years of work, there was a similar difference between the level of confidence ($p < 0.05$) and satisfaction ($p < 0.01$). With increase in years of work, individuals' confidence and satisfaction both increased as well (correlation coefficient: 0.081 , 0.120).

Analysis of the participants that selected lack of awareness of dangerous factors as the biggest cause of accidents showed that the higher the awareness of dangerous factors in accidents, the less frequent the subconscious behaviors were ($p < 0.01$, correlation coefficient: 0.468). The higher an individual's confidence was in his/her work abilities, the higher his/her job satisfaction was ($p < 0.01$, correlation coefficient: 0.541) (Table 8).

Thus, the human characteristic of carelessness was demonstrated to be an important factor influencing the prevention of accidents and job performance.

DISCUSSION

This study investigated the factors influencing workers' industrial accidents and work abilities as well as the effects of individual job awareness or satisfaction on such

Table 4. Frequency of Answers for Each Survey Question

Question	Response	Response Frequency (%)
1. Have you ever experienced an accident (or near miss accident)?	Yes	333 people (42.4%)
	No	452 people (57.6%)
2. How man of the accidents happening around you do you think occur because of inability to recognize (perceive) dangerous factors (dangerous facilities and/or materials) ?	80% or more	150 people (19.1%)
	70% or more	165 people (21.0%)
	60% or more	126 people (16.1%)
	50% or more	186 people (23.7%)
	Below 50%	158 people (20.1%)
3. How often do you think you act subconsciously in your daily life?	80% or more	58 people (7.4%)
	70% or more	123 people (15.7%)
	60% or more	148 people (18.9%)
	50% or more	207 people (26.4%)
	Below 50%	249 people (31.7%)
4. What do you think is the biggest cause of the lack of awareness of safety?	Indifference	220 people (28.0%)
	Carelessness	300 people (38.2%)
	Lack of knowledge	40 people (5.1%)
	Disregard	219 people (27.9%)
	Etc.	6 people (0.8%)
5. How much of your work (duties) do you think is done well?	90% or more	179 people (22.8%)
	80% or more	301 people (38.3%)
	70% or more	191 people (24.3%)
	60% or more	82 people (10.4%)
	50% or more	32 people (4.1%)
6. How much of your work (duties) do you feel satisfied with?	90% or more	159 people (20.3%)
	80% or more	268 people (34.1%)
	70% or more	212 people (27.0%)
	60% or more	83 people (10.6%)
	50% or more	63 people (8.0%)
7. With aging, what do you think is the biggest difficulty in your activities (professional or social) ?	Decline in physical abilities	152 people (19.4%)
	Pressure from work	113 people (14.4%)
	Lack of satisfaction and motivation	246 people (31.3%)
	Pressure from adjusting to change in work or social environment	207 people (26.4%)
	Decline in mental (cognitive) abilities	67 people (8.5%)
8. In your work (duties), what aspect do you think is more important, physical or mental (cognitive) ?	Physical aspect	61 people (7.8%)
	Mental aspect	369 people (47.0%)
	Both	355 people (45.2%)

Table 5. General Characteristics of accidents experienced

		Experience of Accidents	None	Total
Gender	Male	321 (44.3%)	403 (55.7%)	724(92.2%)
	Female	12 (19.6%)	49 (80.4%)	61 (7.8%)
Positions	Owners	74(41.1%)	106(58.9%)	180(22.9%)
	Managers	136(45.8%)	162(54.4%)	298(37.9%)
	Workers	123(40.1%)	184(59.9%)	307(39.2%)
Age	20s	21(27.6%)	55(72.4%)	76(9.6%)
	30s	114(44.5%)	142(55.5%)	256(32.6%)
	40s	118(47.4%)	131(52.6%)	249(31.7%)
	50s and up	80(39.2%)	124(60.8%)	204(26.1%)
Years of Work	0–5years	98(36.4%)	171(63.6%)	269(34.2%)
	5–10years	73(42.4%)	99(57.6%)	172(21.9%)
	10–20years	104(44.8%)	128(55.2%)	232(29.6%)
	20years and up	58(51.8%)	54(48.2%)	112(14.3%)

Table 6. Correlation analysis of Years of Work, Age, Insensible and Subconscious Behaviors

	Years of Work	Age	Unawareness	Subconscious Behaviors
Years of Work	1			
Age	0.344**	1		
Unawareness	0.001	-0.031	1	
Subconscious Behaviors	-0.068	-0.166**	0.399**	1

* p<0.05, ** p<0.01

Table 7. Correlation analysis of Performance, Satisfaction, Years of Work, and Age

	Confidence	Satisfaction	Years of Work	Age
Confidence	1			
Satisfaction	0.525**	1		
Years of Work	0.081*	0.120**	1	
Age	0.164**	0.166**	0.344**	1

* p<0.05, ** p<0.01

Table 8. Correlation analysis of Awareness of Dangerous Factors, Subconscious Behaviors, Job Satisfaction, and Confidence

	Confidence	Satisfaction	Awareness	Subconscious Behaviors
Confidence	1			
Satisfaction	0.541**	1		
Awareness	0.014	0.075	1	
Subconscious Behaviors	-0.091	-0.018	0.468**	1

* p<0.05, ** p<0.01

accidents. The results demonstrate that a higher frequency of accidents was associated with men than women. This result is consistent with Sunghyun Moon's study⁷⁾. Our study also showed that an increase in the frequency of accidents is proportionate to the increase in subconscious behaviors, reflecting the need for the development of near miss accident management programs. Hyungjoon Yoon and others concluded that near miss accidents occurred because of a lack of safety information or awareness¹⁰⁾.

Agnew and Suruda's study¹¹⁾ showed an increase in the rate of falls among older workers, and Small's study¹²⁾ demonstrated a relation between workers over the age of 50 and major accidents. In other words, workers' physical function characteristics change with aging, contributing to industrial accidents such as falls and occupational diseases rather than general accidents such as jamming and exaggerated movements. Additionally, Kisner and Pratt's¹³⁾ and Elizabeth William's¹⁴⁾ studies confirmed that older workers, experienced accidents more often and more severely than younger workers.

Our study shows subconscious behaviors reduce while confidence and satisfaction increase as age and years of work increase, distinguishing it from other studies. We also found greater pressure on the mental or cognitive aspects rather than the physical aspects of job performance with aging. It signifies the need for alternatives for older workers in terms of the cognitive aspect of work in preparation for an aging society.

This study surveyed 785 workers at 493 workplaces in Seoul from May 1st to July 30th, 2009 on the human causes

of accidents. The survey investigated attitudes to job performance and satisfaction related to awareness or behavior about occupational safety as well as job related pressure and significance on the job related to aging. Analysis of the general characteristics and experience of accidents showed there were similar contrasts in the respondents' gender, age, and period of work. The higher the degree of subconscious behaviors, the higher the rate of accidents, and higher job satisfaction was related to a lower the rate of accidents; if job satisfaction were enhanced, it is possible that the accident rate would be reduced.

With higher confidence about job performance, individual satisfaction became higher as well. With aging, confidence and satisfaction increased. With increase in years of work, individuals' confidence and satisfaction increased as well. The higher the awareness of dangerous factors, the lower the use of subconscious behaviors was. Those who responded with "confidence", also had high job satisfaction. Thus, it can be concluded that the human characteristic of carelessness, of all the human cognitive characteristics, is an important factor influencing the prevention of accidents and enhancement of work abilities.

We conclude that there is a need for alternative for older workers in terms of cognitive aspects of work in preparation for the aging of society. We suggest, it will be necessary to prepare a prevention mechanism for human errors at levels of information processing that enable recognition of dangers factors, reduction of subconscious behaviors, and fast and rational decision processes for the prevention of accidents among older workers. However, it is difficult to

prevent human mistakes 100%.

Nonetheless, it will be necessary to construct a work environment that considers humans' physical and cognitive characteristics to prevent humans' mistakes from developing into accidents, and a general work abilities enhancement program in preparation for aging. In other words, it will be necessary to develop a program that considers the enhancement of cognitive abilities, together with physical abilities.

In particular, in order to understand the physical and mental characteristics of older workers, muscular strength, flexibility, quickness, focus, and cognitive abilities should be researched and established as the basis of consideration of human engineering for older workers. This research was carried out within a small number of workplaces in Seoul, and it is not representative of the general situation of workplaces in Korea. In the future, further studies will be needed to broaden our understanding of general workplace situations.

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