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A STUDY ON THE FACTORS AFFECTING HEALTH AND ECONOMIC ACTIVITIES OF WORK ENVIRONMENT IN MANUFACTURING INDUSTRY

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Abstract-Objective: The manufacturing industry has seen the highest number of industrial disasters, making it an important task to study how industry workers understand the safety environment in order to prevent industrial accidents.
Methods: Participants were 1,123 men, who were manufacturing employees who responded to the 2015 PSWCI panel report. Participants provided self-reported health data, which were then analyzed for their changes in relation to employment condition during the course of one year. Statistical analyses were performed using SAS version 9.4.
Results: Data analysis showed that the manufacturing industry had differences in economic activity and health conditions based on employee's conditions. Dynamic change aspects of manufacturing industry condition had differences between sex and cases where going back and forth between temporary condition and unemployment status had higher percentage in male.
Conclusions: Results of this study may serve as a reference in introducing legislation to improve the safety of the work environment at manufacturing industries.
Keywords: health, economic activity, work environment, manufacturing industry, industry, manufacturing

1. INTRODUCTION

In the 2000s, Korea considered in earnest the working conditions in the manufacturing environment relating to workers' physical and psychological health. Some of the factors that influence workplace safety (knowledge, working environment, motivation, etc.) directly relate to the workers and are thus important for preventing industrial accidents. There are also external safety factors unique to the modern society's workplace, such as sleep disturbances due to shift work or night shifts, that result from the increasing number of shift workers in an unstable work environment and in work environments that are characteristic of firms are in today's workplace (1-5).

If these harmful conditions persist at the working environment, Korean society may sustain a loss of workers and corporations, which may further adversely affect its socioeconomic environment. It is thus necessary to improve the working environment (6).

This study suggested that workers' chronic diseases could act as a physical and psychological stress factor that affects their participation in economic activities. As a result, preventive research should be conducted to reduce the barriers to these workers' behaviors (7-9).

1.1 Purpose of study

The purpose of this study was to improve the working environment for Korean workers and the general labor market by using the "2015 Work Environment Survey" and to examine the effects of the working conditions of the manufacturing industry. Through a data analysis, the relation of the following three major factors with health deterioration was also analyzed: workers' length of time in manufacturing and health status (current chronic diseases, weekly average exercise, current smoking, daily smokers, current drinking, number of drinking, etc.), unhealthy work-related habits (e.g., smoking cigarettes, drinking), and positive lifestyle that enhances individual health.

1.2Preliminary research and hypothesis

Previous studies have shed light on how the manufacturing working environment is associated with deteriorated health in workers in developed countries and analyzed how this relationship differs across countries depending on regional characteristics, diseases, and poverty (10, 11). A variety of risk factors have also given rise to chronic diseases in manufacturing workers (12). In Korea, studies have confirmed the global impact of chronic diseases on the economy and recognized the need

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to prevent occupational chronic diseases, as ergonomic stress seems to have led to the increase of labor-induced musculoskeletal diseases (13).

2. MATERIALS AND METHODS

2.1 Target population

This study used survey data from Panel Study of Workers' Compensation Insurance (PSWCI) 2015. From the survey respondents (1422 men and 282 women), the study narrowed in on male participants and examined their demographic characteristics, compensation services, health and quality of life, general household items, and other pertinent information. The study population consisted of 1,123 male workers engaged in construction and manufacturing services, including those who were under age 20 (N = 40, 3.6%), 20–30 years of age (N = 150, 13.4%), 30–40 years of age (N = 297, 26.4%), 40–50 years of age (N = 377, 33.6%), and those over 60 years of age (N = 259, 23.0%)

2.2 Demographics

Among the 1,123 study subjects, this is the breakdown of the province in which they worked: Daegu / Gyeongbuk (N = 165, 14.7%), Gangwon (N = 58, 5.2%), Gyeongnam / Ulsan (N = 144, 12.8%), Gyeonggi (N=321, 28.6%), Incheon (N=124, 11.0%), Jeolla (N = 144, 12.8%), and Chungcheong (N = 140, 12.5%). No manufacturing, construction, and service respondents were employed in Seoul and Busan.

With respect to educational level, except in Gyeonggi Province (N = 207, 18.4%), the majority of respondents were high school graduates (N = 522, 46.5%), followed by those who attended some college but did not graduate (N = 209, 18.6%) and finally college graduates (N = 185, 16.5%).

In case of accident type (N = 1027, 91.5%), disease has distributed the (N = 96, 8.5%), Respondents that a disable was higher in the presence (N = 938, 83.5%). In the case of no accident (N = 185, 16.5%), it was low.

2.3 Analysis

Data analysis was performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA) and logistic regression model to evaluate the relationship between the length of time workers have been in the manufacturing industry and any chronic disease that occurred before an industrial accident. In addition, a 95% confidence interval (CI) and odds ratios (ORs) showed significant differences between the two groups ($p < 0.05$ for adjusted variables of sex, age, educational attainment, and region); the probability ratio was then calculated.

3. RESULTS

3.1 Working period and working environment (N=1,123)

Of the 1,123 male workers, 284 (36.6%) have been in the manufacturing industry for less than one month, 289 (25.7%) have been in the industry for six months to a year, 86 (7.7%) for one to three years, 44 (3.9%) and 74 (6.6%) for more than five years. This suggests that the lifespan of personnel in the manufacturing working environment is short. Further, 80% of these manufacturing employees experienced an industrial accident within one year of employment in the working environment ($p = 0.0001$). Subsequent to the industrial accident, 21.9% returned to the original job (continuous) and 0.5% returned to the original job (new); others found reemployment (33.3% continuous, 15.8% new), became unemployed family workers (1.7% new, 0.6% continuous), or simply unemployed (3.3%) and unemployed people (17.1%). When classified into two kinds, p values, 0.0004 and 0.0045 respectively, are significant [Table 1].

Table 1. Association between individual characteristics and working conditions

		n=1,123 (%)	*p-value*
Working period	Less than a month	284(36.6)	<0.0001
	One to two months	84(10.8)	
	Two to three months	49(6.3)	
	Four to five months	23(3.0)	
	Five to six months	42(5.4)	
	Six months to one year	91(11.7)	
	One to two years	53(6.8)	
	Two to three years	33(4.2)	
	Three to four years	31(4.0)	

	More than Four years	87(11.2)	
Type 3 of EA	Back to work	174(22.4)	0.0004
	Re-employment	381(49.1)	
	Self-employed	57(7.3)	
	Unpaid family workers	6(0.8)	
	Dismissal	26(3.3)	
	Economically active population	133(17.1)	
Type 4 of EA	Back to work (continue)	170(21.9)	0.0045
	Back to work (new)	4(0.5)	
	Re-employment (continue)	258(33.3)	
	Re-employment (new)	123(15.8)	
	Self-employed (continue)	44(5.7)	
	Self-employed (new)	13(1.7)	
	Unpaid family workers (continue)	5(0.6)	
	Unpaid family workers (new)	1(0.1)	
	Dismissal	26(3.3)	
	Economically active population	133(17.1)	

3.2 Health and quality of life (N=906)

Data on the health and quality of life of manufacturing men were statistically significant (p = 0.0194), but not in detail, compared with those without chronic disease (36.8%). The mean number of exercise days per week was 5–6 days, 51%, 70%, and the rest were 30 ~ 40, respectively (p = 0.0024). This was statistically significant in 43.4% and 43.1% of smoking and drinking, respectively (p = 0.0001, 0.0001). Among them, the number of smoking was not influenced by the frequency of drinking, but the frequency of drinking was 43-45% in monthly and weekly frequency (p = 0.0006) [Table 2].

Table 2. Association between industrial workers and health problems

		NO *n*=518 (%)	*YES* *n*=388 (%)	*p-value*
Current chronic disease	yes	165 (63.2)	96 (36.8)	0.0194
	no	353 (54.7)	292 (45.3)	
Exercise level (days per week)	1 day	45 (57.7)	33 (42.3)	0.0024
	2 days	43 (53.1)	38 (46.9)	
	3 days	54 (63.5)	31 (36.5)	
	4 days	21 (56.8)	16 (43.2)	
	5 days	28 (49.1)	29 (50.9)	
	6 days	7 (30.4)	16 (69.6)	
	7 days	38 (64.4)	21 (35.6)	
Current smoking	yes	279 (56.6)	214 (43.4)	<.0001
	no	239 (57.9)	174 (42.1)	
Current drinking	yes	377 (56.9)	286 (43.1)	0.0001
	no	141 (58.0)	102 (42.0)	
Frequency of drinking	< Once a month	30 (75)	10 (25)	0.0006
	Twice or thrice a month	30 (54.5)	25 (45.5)	
	Weekly or semiweekly	90 (54.2)	76 (45.8)	
	triweekly~triweekly	178 (56.5)	137 (43.5)	
	Daily	49 (56.3)	38 (43.7)	

3.3 Quality of life and general characteristics of households (N=906)

As a result of considering the quality of life of the manufacturing men and the characteristics of the individual of questionnaire, the affirmative in the perception of their own lives showed a tendency to be as high as 72% and statistically significant (P = 0.008). When negative thoughts on their behavior were high, they were 63% (P = 0.0511). In the external activities of the number of meetings (neighbors) and the number of meetings (religious gatherings), 46% and 85%, respectively, (P = 0.0143, 0.046). In addition, there was a significant difference between the two groups. In addition, they are respectively in the final education (graduation status), marital status, difficulty in performing daily living (occupational activities), and leisure activities (p = 0.0185, 0.0336, 0.0127) [Table 3].

Table 3. Association between quality of life and general characteristics of household

		NO *n*=518 (%)	*YES* *n*=388 (%)	*p-value*
Current, feel in your life	Not at all	55(10.6)	25(6.4)	0.008
	Several times	139(26.8)	85(21.9)	
	Considerable period of time	220(42.5)	205(52.9)	
	Always	104(20.1)	73(18.8)	
Second time, Feel in your life	Not at all	5(1.0)	2(0.5)	0.0511
	Not as essential	58(11.2)	32(8.2)	
	Several times	194(37.4)	177(45.6)	
	Considerable period of time	218(42.1)	157(40.5)	
	Always	43(8.3)	20(5.2)	
Meeting (Neighbor)	Not at all	216(41.7)	179(46.2)	0.0143
	One in six months	37(7.1)	33(8.5)	
	Once a month	77(14.9)	68(17.5)	
	Once a week	124(23.9)	85(21.9)	
	Always	64(12.4)	23(5.9)	
Meeting (religious gatherings)	Not at all	420(81.0)	330(85.1)	0.046
	Less than once a month	19(3.7)	18(4.6)	
	Once a month	7(1.4)	2(0.5)	
	About two or three times a month	7(1.4)	6(1.5)	
	Once a week	45(8.6)	29(7.5)	
	At least twice a week	20(3.9)	3(0.8)	
Education	School graduation	416(97.7)	308(97.7)	0.0185
	In school	3(0.7)	11(0.7)	
	Dropout	7(1.6)	3(1.6)	
Marriage	Single	20(4.5)	18(5.4)	0.0336
	Married, mate	403(91.4)	287(85.6)	
	separation	1(0.2)	0(0.0)	
	Divorce	3(0.7)	3(0.9)	
	Death of spouse	14(3.2)	27(8.1)	
Difficulties in the performance in our daily lives (work activity)	Always	37(7.1)	17(4.4)	0.0127
	Considerable period of time	90(17.4)	42(10.8)	
	Several times	61(11.8)	58(14.9)	
	Not as essential	141(27.2)	109(28.1)	
	Not at all	189(36.5)	162(41.8)	

3.4 Job characteristics (N=777)

Of the research participants examined in this study, 13.1% were non-standard wage workers, 3.7% had employees, 34.6% were self-employed workers without employees, and the rest were unpaid family workers (p = 0.0001). A total of 14.9% of experts and related workers, 10% of clerical workers, 23.4% of service workers, 10.4% of sales workers, 13% of agriculture and fisheries skilled workers, 1.4% 6.9% of workers in the source and related functions, equipment / machinery operation and assembling worker, 8% of simple laborers, 4.9% of soldiers, 13 ~ 5 times risk factors in service and sales, which is a very high 34-fold increase in workers. This is statistically significant (p = 0.0001) [Table 4].

Table 4. Association between industrial workers and occupation characteristics

		n=777 (%)	*aOR (95% CL)
Status of a job	Full-time	33(4.2)	1
	Temporary employees	102(13.1)	2.97 (2.25-3.93)
	Employer with employees	29(3.7)	2.51 (1.25-3.93)
	Self-employed without employees	269(34.6)	20.69 (9.33-45.86)
	Unpaid family workers	344(44.3)	43.83 (5.89-325.85)
p for trend	<.0001		
Occupation	Manager	11(1.4)	1
	Expert	116(14.9)	1.99(0.87-4.57)
	White-collar job	78(10.0)	0.66(0.32-1.37)
	Service	182(23.4)	13.48 (3.51-51.74)
	Salesman	81(10.4)	4.55 (1.96-10.59)
	Farming, fisheries (skilled workers)	101(13.0)	33.63 (4.22-268.16)
	Technician	54(6.9)	0.35 (0.18-0.66)
	Assembler	54(6.9)	0.18 (0.09-0.34)
	Simple laborer	62(8.0)	1.24 (0.61-2.51)
	Soldier	38(4.9)	>999.9 (<0.001->999.9)
p for trend	<.0001		

4. DISCUSSION

In the case of men in the manufacturing industry, the period of work and the working environment tend to be as high as 80% in less than one year (14). In this study, 17%, 16%, and 33% of new and persistent non-economically active population and re-employed persons are high, respectively. Second, the psychological effect on male manufacturing workers is significant in affecting their health and quality of life, and above all factors related to working environment and working conditions act, and irregular exercise and diet (15). This suggests that the stress of direct work depends on alcohol (43%) and tobacco (43%). Third, in terms of the quality of life and the general characteristics of the individual, the analysis of 906 respondents showed that 72% of respondents answered that they feel "about their own lives" and 63% in the "behavior that cannot be reversed in the thought of one's own behavior". Lastly, there were 777 workers in the premises and 13.1% in non-regular workers, 3.7% in non-regular workers, 34.6% in self-employed workers without employees, (44.3%). Therefore, it is expected that some anxiety factors can cause deterioration of health, which is known to have been reported (16). Another insecure factor is 1% of managers, which shows that the ratio of non-expertise in manufacturing is high as 23% of services, 10% of sales, and 13% of agriculture and forestry fishery, compared with 14% of experts and related workers. As a result, the risk increases by 13 to 5 times in services and sales, and by 34 times in agricultural and forestry skilled workers (p for trend = 0.0001).

5. CONCLUSIONS

As a result, the action is considered to be a factor in worsening health due to the uncertainties of workers in manufacturing a variety of working environments. In the long term, this change in exposure can be seen to have an overall impact not only on individuals but also on society. Therefore, various environment changes are required, the management plan of the workplace should be sought, and the quality of life through leisure allowance will help the production of the product. Finally, we will try to identify the relationship between industrial safety and health legislation and industrial accident disasters, and will play a role as a basic rule for prevention. However, feel the limit of the characteristics of the health and safety and health activities including the individual characteristics of the workplace and the temporal change, but I hope that the health care is managed with various factors.

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