

Field Study

Human resource factors associated with workplace safety and health education of small manufacturing businesses in Korea

Kyoung-Ok Park

Department of Health Convergence in Ewha Womans University, Seoul, Republic of Korea

Abstract: Objectives: Human resources (HR) are essential indicators of safety and health (SH) status, and HR can be key sources of workplace safety management such as safety and health education at work (SHEW). This study analyzed significant HR factors associated with SHEW of small manufacturing businesses in Korea. **Methods:** The secondary data of the 2012 Korea Occupational Safety and Health Trend Survey were used to achieve this research purpose. A total of 2,089 supervisors or managers employed in the small manufacturing businesses completed the interview survey. Survey businesses were selected by multiple stratified sampling method based on industry code, business size, and region in Korea. The survey included workplace characteristics of HR and SHEW. **Results:** SHEW was significantly related to business size, occupational injury incidence in the previous year, foreign and elderly worker employment, presence of site supervisors, and presence of SH committees ($p < .05$). SHEW for office workers, non-office workers, and newcomers was associated with business size, presence of site supervisors, and presence of SH committees in logistic regression analysis ($p < .001$). Businesses with 30-49 workers conducted SHEW 3.64 times more than did businesses with 5 to fewer than 10 workers. The companies that had occupational injuries in the previous year conducted SHEW 1.68 times more than the others. The businesses that had site supervisors and committees conducted SHEW 2.30 and 2.18 times more, respectively, than others. **Conclusions:** Site supervisors and SH committees were significant HR factors that improved SHEW in small manufacturing businesses.

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Introduction

It is well documented that major causes of occupational injury death are related to preventive characteristics such as safety and health (SH) educational and managerial factors rather than to risk characteristics such as hazardous work environments or conditions¹. Safety and health education at work (SHEW) is a fundamental and effective strategy to improve safety behaviors and to prevent injuries at workplace level².

Concerning SH managers' mediating roles in delivering effective SHEW and of encouraging workers' safety behaviors, SH human resources (HR) development and management are more important than ever³. In recent national statistics of occupational accidents, approximately 65% of occupational accidents in Korea were found to be related to educational and managerial factors and human errors⁴. Government policies on SH manager assignment and training have effectively decreased the rate of occupational injuries. This means that occupational accidents are significantly associated with HR factors and regulations for workplace SH⁵⁻⁷.

The significance of safety and health HR factors is emphasized more due to recent changes in industry structure and workforce compositions in Korea⁴. More than 95% of all businesses were small firms with fewer than 50 workers and 56.6% of total workers registered in national record were employed in small businesses in Korea⁸. Vulnerable employees such as the elderly and foreign workers are more likely to work in difficult and hazardous conditions in small businesses. They are at high risk of occupational injury because most of them lack communication and decision-making skills to appropriately react to hazardous working conditions. In reality, 81.5% of occu-

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Correspondence to: KO. Park, Ph.D., MCHES, Department of Health Convergence, Ewha Womans University, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul 03760, Republic of Korea (e-mail: kopark@ewha.ac.kr)

pational injuries occurred in small businesses, although less than 60% of total Korean workforce have been employed in small businesses⁸). However, it is difficult for small businesses to strengthen HR for SHEW and SH management because they have weak and unstable infrastructures. Therefore, diverse SH policies and programs have been developed to support SH of small businesses⁹).

Neal and colleagues have suggested a workplace SH model to prevent occupational injury¹⁰). Among the situational factors included in the SH model, HR and organizational systems for workplace SH are associated with increased workers' safety knowledge and motivation, more engagement of workers in safety behaviors, and reduced workplace accidents. Safety and health HR can significantly strengthen workplace education and communications, thus improving workers' safety awareness, knowledge, skills, motivation, and intentions¹¹⁻¹³).

There are three general regulations (assignment of site supervisor, assignment of SH supervisor, and organization of SH committee) related to SH human resources and organizations in Korean Occupational Safety and Health Act¹⁴). Assignment of SH supervisor and organization of SH committee have been applied to medium and large-sized businesses with at least 50 or more employees. However, there is no mandatory for small businesses. Assignment of site supervisor is currently the only regulation related to SH human resources. It is applied to all businesses, regardless of size. Site supervisors are supervisors for small working groups and they check group productivity, work schedule or condition, and workplace SH status. They have taken SH supervisors' roles in small businesses. In Korea, there are four SHEW regulations for office worker, non-office workers, new workers, and job changes/special jobs¹⁴). Time of SHEW is, generally assigned as every three months (such as three hours every three months) for office workers. Specific hours of SHEW are different by types of industry, worker, and job.

SHEW regulations are applied to all businesses, although HR managing SHEW are not guaranteed for small businesses. SH professionals agree that modified guidelines of HR development and support are needed for small businesses in Korean occupational safety management and policy⁹). As the basic engine of workplace SH management, SH human resources are responsible for developing planned and enduring SHEW, increasing the comprehensive effectiveness of SH management activities, and building better organizational safety environments and cultures^{3,15}).

Some small businesses might also have SH committee and SH supervisor for their practical needs. However, others do not have such supervisor or committee for their SH. Due to weak HR and SHEW conditions under the same SH policies for small business in Korea, it is important to determine significant HR factors associated with SHEW to develop effective HR support strategies in prac-

tical perspectives. Thus, the purpose of this study was to identify significant HR factors associated with SHEW of small manufacturing businesses in Korea.

Subjects and Methods

Subjects

Data of the 2012 Korea Occupational Safety and Health Trend Survey (KOSHTS) were used to identify significant HR factors associated with SHEW in this study. A total of 2,089 survey responses from supervisors or managers taking the roles of SH supervisors at small manufacturing businesses with fewer than 50 employees were analyzed in this study.

KOSHTS had been conducted by the Korea Occupational Safety and Health Agency (KOSHA) to monitor health and safety conditions of Korean businesses to develop SH policies at both government and business levels⁸). A total of 2,089 (69.6%) cases were from small businesses with fewer than 50 employees among a total of 3,000 manufacturing responses. They were selected by stratified random sampling method in terms of industry code, region, and size in the manufacturing sector (Korea industry classification codes 200-237) for the 2012 KOSHTS.

Methods and measures

For the 2012 KOSHTS, face-to-face interviews were conducted with supervisors or managers at survey sites from June to August in 2012. All interviewers had been trained for KOSHTS in advance. After the interviewers contacted managers or supervisors by phone and obtained consent, they visited survey sites for interviews. Voluntary response and confidentiality were explained to the survey participants along with survey background and methods. These interviews were conducted using a standardized questionnaire developed by KOSHA. Interviewers carefully followed the directions of the survey interview manuals to maintain survey consistency and neutrality⁸). The author received organizational approval from KOSHA to use 2012 KOSHTS data for academic publication.

HR and SHEW factor parts of KOSHTS were employed in this research. HR factors were identified as major HR characteristics at work negatively or positively associated with SHEW based on related literature review. HR factors of this analysis included business size (5-9, 10-29, or 30-49 workers), any occupational injury in the previous year (yes or no), employment of vulnerable workers (part-time, elderly age 55 or older, and foreign immigrants), presence of site supervisors (yes or no), and presence of SH committees at work (yes or no). Labor union was excluded from this study because only 1.6% of the survey businesses had it, although labor union could be a significant HR factor.

Among types of SHEW regulations in Korea¹⁴, SHEW for office workers, non-office workers, and new workers were included in this research. SHEW for job changes and special jobs was excluded because it was primarily applied in construction businesses. It was not applicable to most manufacturing businesses in regular basis.

Data analyses

All survey responses were coded and analyzed in IBM SPSS Version 24.0. Coding accuracy was confirmed. After descriptive statistics such as frequency, percentage, mean, and standard deviation, Chi-square test was used to explain SHEW differences by HR factors.

Logistic regression analysis was performed to identify significant HR factors for SHEW along with their odds ratios (ORs). There was little probability of multicollinearity in the analysis. Multicollinearity is associated with high correlations between predictors and it has been recommended to avoid using highly correlated variables and even to avoid moderate intercorrelations when possible¹⁶. All absolute values of correlation coefficients between independent variables were less than 0.25 in this study. In particular, correlation coefficients between business size, SH committee, and site supervisor (key independent variables) ranged from 0.18 to 0.22.

Results

Characteristics of HR factors and SHEW

For HR factors, 37.7% of survey businesses had 5 to fewer than 10 workers, 40.1% had 10 to fewer than 30 workers, whereas 22.6% had 30 to 49 workers. The majority of small businesses (77.8%) had fewer than 30 workers. Of surveyed businesses, 15.0% had occupational injuries in the previous year. Regarding vulnerable employees, 79.1%, 60.0%, and 20.9% of survey businesses employed part-time, elderly, and foreign immigrant workers, respectively. For HR factors related to injury prevention at work, 75.3% of the surveyed businesses had assigned site supervisors, whereas 14.6% had organized SH committees for SH management in their workplaces.

Concerning compliance with government SHEW regulations, SHEW compliance for non-office workers was the highest at 72.7%, followed by SHEW for new workers (at 67.7%). Among survey businesses, 54.4% answered that they kept SHEW regulation for office workers.

Differences of SHEW by HR factors

χ^2 values and SHEW distributions by HR factors for office, non-office, and new workers are shown in Table 1. SHEW regulation compliance for office workers was significantly different by business size, occupational injuries in the previous year, employment of foreign and elderly workers, presence of site supervisors, and presence of SH

committees ($p < 0.001$). Businesses were more likely to be in compliance with SHEW regulations for office workers when they had higher numbers of workers, experienced any occupational injuries in the previous year, employed foreign and elderly workers, assigned site supervisors, or had SH committees. Compliance with government SHEW regulations for non-office workers was also higher among businesses that had higher numbers of workers, experienced any occupational injuries in the previous year, employed foreign and elderly workers, assigned site supervisors, or had SH committees ($p < 0.001$). Businesses were also more likely to comply with SHEW regulations for new workers if they had higher numbers of workers, experienced any occupational injuries in the previous year, did not employ part-time workers, employed foreign and elderly workers, assigned site supervisors, or had SH committees.

Overall patterns of compliance with SHEW regulations for office workers, non-office workers, and new workers by HR factors were similar to each other. The only difference in SHEW compliance was found by part-time workers. SHEW regulation compliance for new workers was significantly greater in the businesses employing part-time workers than that in others ($p < 0.05$). However, there was no significant difference in compliance with SHEW regulations for office and non-office workers by employment of part-time workers.

HR factors associated with SHEW

Results of logistic regression analysis revealed that business size, occupational injuries in the previous year, presence of site supervisors, and presence of SH committees were significant HR factors associated with SHEW regulation compliance for office workers (Table 2). Businesses with 30-49 workers were 3.64 times more likely to be in compliance with government SHEW regulations for office workers than did businesses with 5 to fewer than 10 workers, the reference indicator (RI). The ORs for assignment of site supervisors and the presence of SH committees were greater than 2.00. Similar to SHEW for office workers, business size, occupational injury in the previous year, and having assigned site supervisors and SH committees were significantly associated with SHEW regulation compliance for non-office workers (Table 3).

Slightly different from SHEW for office workers, regulation compliance with SHEW for new workers was associated with business size, employment of foreign workers, assignment of site supervisors, and presence of SH committees (Table 4). Businesses with 30-49 workers were 1.88 times more likely to follow government regulations for new workers than RI business size. Businesses that employed foreign workers were 1.58 times more likely to follow SHEW regulations for new workers than those that did not employ foreign workers. ORs for businesses with SH committees and businesses with assigned site supervi-

Table 1. SHEW by organizational HR factors

HR factors	SHEW for office workers		SHEW for non-office workers		SHEW for new workers	
	No	Yes	No	Yes	No	Yes
Business size (worker)	$\chi^2=167.69^{***}$		$\chi^2=107.49^{***}$		$\chi^2=66.51^{***}$	
5 ~ 9	474 (60.8)	306 (39.2)	306 (39.2)	474 (60.8)	325 (41.7)	455 (58.3)
10 ~ 29	369 (44.1)	468 (55.9)	203 (24.3)	634 (75.7)	257 (30.7)	580 (69.3)
30 ~ 49	110 (23.3)	362 (76.7)	62 (13.1)	410 (86.9)	93 (19.7)	379 (80.3)
Occupational injury incidence in the previous year	$\chi^2=35.17^{***}$		$\chi^2=17.93^{***}$		$\chi^2=11.11^{***}$	
No	858 (48.3)	917 (51.7)	516 (29.1)	1259 (70.9)	599 (33.7)	1176 (66.3)
Yes	95 (30.3)	219 (69.7)	55 (17.5)	259 (82.5)	76 (24.2)	238 (75.8)
Part-time workers	$\chi^2=3.03$		$\chi^2=3.66$		$\chi^2=6.48^*$	
No	738 (44.6)	915 (55.4)	436 (26.4)	1217 (73.6)	512 (31.0)	114 (69.0)
Yes	215 (49.3)	221 (50.7)	135 (31.0)	301 (69.0)	163 (37.4)	273 (62.6)
Foreign immigrant workers	$\chi^2=22.63^{***}$		$\chi^2=45.25^{***}$		$\chi^2=43.75^{***}$	
No	665 (49.5)	679 (50.5)	433 (32.2)	911 (67.8)	502 (37.4)	842 (62.6)
Yes	228 (38.7)	457 (61.3)	138 (18.5)	607 (81.5)	173 (23.2)	572 (76.8)
Elderly workers	$\chi^2=11.38^{***}$		$\chi^2=21.70^{***}$		$\chi^2=9.26^{**}$	
No	419 (50.1)	417 (49.9)	275 (32.9)	561 (67.1)	302 (36.1)	534 (63.9)
Yes	534 (42.6)	719 (57.4)	296 (23.6)	957 (76.4)	373 (29.8)	880 (70.2)
Site supervisor	$\chi^2=114.65^{***}$		$\chi^2=160.53^{***}$		$\chi^2=126.48^{***}$	
Not assigned	340 (66.0)	175 (34.0)	252 (48.9)	263 (51.1)	270 (52.4)	245 (47.6)
Assigned	613 (38.9)	961 (61.1)	319 (20.3)	1255 (79.7)	405 (25.7)	1169 (74.3)
SH committee	$\chi^2=47.50^{***}$		$\chi^2=64.86^{***}$		$\chi^2=35.17^{***}$	
Not organized	884 (49.6)	899 (50.4)	537 (30.1)	1246 (69.9)	631 (35.4)	1152 (64.6)
Organized	69 (22.5)	237 (77.5)	34 (11.1)	272 (88.9)	44 (14.4)	262 (85.6)

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 2. HR factors associated with SHEW for office workers

Variables	β	S.E.*	p	Odds ratio	95% CI [†]	
Business size ₂ (10-29, RI [‡] : 5-9)	0.46	0.11	0.00	1.59	1.29	1.96
Business size ₃ (30-49, RI: 5-9)	1.30	0.14	0.00	3.64	2.77	4.79
Part-time workers (RI: No)	-0.15	0.12	0.22	0.87	0.69	1.09
Foreign immigrant workers (RI: No)	0.12	0.10	0.22	1.13	0.93	1.38
Elderly workers (RI: No)	0.02	0.10	0.80	1.03	0.84	1.24
Occupational injury in the previous year (RI: No)	0.52	0.14	0.00	1.68	1.27	2.21
Site supervisor (RI: None)	0.83	0.11	0.00	2.30	1.84	2.94
SH committee (RI: None)	0.78	0.15	0.00	2.18	1.62	2.93
Constant	-1.11	0.12	0.00	0.33		

*S.E.: Standard error, [†]CI: Confidence interval, [‡]RI: Reference indicator

sors to follow SHEW for new workers were significantly greater than 2.00.

Discussion

As a national survey of workplace SH in Korea, the

2012 KOSHTS showed that the majority of small manufacturing businesses (77.8%) had fewer than 30 workers, which indicates that it is difficult for small businesses to develop HR structures for workplace SH on their own given their sizes and productivities. In addition, vulnerable people such as the elderly and foreign workers were

Table 3. HR factors associated with SHEW for non-office workers

Variables	β	S.E.*	<i>p</i>	Odds ratio	95% CI [†]	
Business size ₂ (10-29, RI [‡] : 5-9)	0.46	0.11	0.00	1.59	1.29	1.96
Business size ₃ (30-49, RI: 5-9)	1.29	0.14	0.00	3.64	2.77	4.79
Part-time workers (RI: No)	-1.45	0.12	0.22	0.87	0.69	1.09
Foreign immigrant workers (RI: No)	0.12	0.10	0.22	1.13	0.93	1.39
Elderly workers (RI: No)	0.02	0.10	0.80	1.03	0.84	1.24
Occupational injury in the previous year (RI: No)	0.52	0.14	0.00	1.68	1.27	2.21
Site supervisor (RI: None)	0.83	0.11	0.00	2.30	1.84	2.86
SH committee (RI: None)	0.78	0.15	0.00	2.18	1.62	2.94
Constant	-1.11	0.12	0.00	0.33		

*S.E.: Standard error, [†]CI: Confidence interval, [‡]RI: Reference indicator

Table 4. HR factors associated with SHEW for new workers

Variables	β	S.E.*	<i>p</i>	Odds ratio	95% CI [†]	
Business size ₂ (10-29, RI [‡] : 5-9)	0.20	0.11	0.08	1.22	0.98	1.52
Business size ₃ (30-49, RI: 5-9)	0.63	0.15	0.00	1.88	1.40	2.50
Part-time workers (RI: No)	-0.25	0.12	0.04	0.78	0.62	0.99
Foreign immigrant workers (RI: No)	0.46	0.11	0.00	1.58	1.28	1.97
Elderly workers (RI: No)	0.09	0.10	0.36	1.10	0.90	1.34
Occupational injury in the previous year (RI: No)	0.18	0.15	0.22	1.20	0.90	1.61
Site supervisor (RI: None)	0.92	0.11	0.00	2.51	2.03	3.11
SH committee (RI: None)	0.79	0.18	0.00	2.20	1.56	3.11
Constant	-0.40	0.12	0.00	0.67		

*S.E.: Standard error, [†]CI: Confidence interval, [‡]RI: Reference indicator

more likely to be employed in small businesses under poor SH conditions and resources, even though they needed more training for injury prevention at work¹⁷⁾. According to previous KOSHTS data, proportions of the elderly and foreign workers increased in the manufacturing sector, and their occupational injury rates were also higher than those for total workers⁸⁾. Lee and colleagues reported that the injury-induced death rate of the foreign immigrant workers was more than two times than that of native Korean workers¹⁸⁾. Since HR factors were positively associated with occupational injury prevention and site supervisors were assigned more than SH committees in this study, site supervisors could serve as primary mediators of governmental and social support for improving workplace SH. Compliance with SHEW regulations was the highest in SHEW for non-office workers, followed by SHEW for new workers and office workers. This result was consistent with government SHEW policies focusing on manual workers' awareness and behavior improvement for injury prevention in Korea.

Results of logistic regression analyses in this study revealed that business size and occupational injury in the previous year were significant HR factors associated with all three SHEWs. Business with 30 or more workers had distinct ORs greater than 3.0 in SHEW for office and

non-office workers compared to the businesses with 5 to fewer than 10 workers. Workplace injury incidence in the previous year was also a significant injury-related HR factor associated with SHEW, although the OR was not large. Based on this result, it might be easy to increase organizational awareness of occupational safety and obtain support for accident control in businesses with more than 30 workers and those that had experienced occupational injuries in recent years. However, smaller businesses with little accident experience such as new businesses might have low organizational perceptions of safety management and SHEW with little information about government or social support for workplace SH. Considering those conditions, developing and providing SH support packets might be needed to build occupational safety structures for new businesses. Encouraging initial engagement of SH management and SHEW in new businesses may determine, or at least largely affect, their organizational perceptions to SH management. Song and colleagues suggested that cooperating with nongovernmental organizations might be helpful to increase welfare for vulnerable workers and SH in small businesses¹⁷⁾.

Assignments of site supervisors and SH committees were positive HR factors improving SH management. They had significant relationships with all three types of

SHEW compliance for office, non-office, and new workers. Their ORs were more related to SHEW regulation compliance than those with negative HR factors, which was consistent with Eaton and Nocerino's findings³⁾. Coyle and Leopold referred to SH management factors as external and internal factors¹⁹⁾. They included manager involvement, SH communication, written agendas, and SH committees as significant internal factors associated with workplace SH effectiveness based on their study of 48 joint committees in British manufacturing plants. Two of those significant internal factors were also consistent with the positive HR factors found in this study. Presence of site supervisors had slightly greater ORs than did presence of SH committees for all three types of SHEW. HR structures for safety and health at work are fundamental and practical bases for all SH management actions, including SHEW and employees' SH concerns. Lee and Park¹⁾ reported that SH committees and organizational SH regulations were significant workplace safety and health management factors associated with government SHEW regulation compliance, consistent with results of this study. Improved SHEW by safety and health HR structures and their activities can contribute to establishing workplace safety cultures²⁰⁾. Vinodkuman and Bhasi reported that SHEW positively affected workers' safety participation and workplace safety climate in their research conducted in a large chemical industry complex in India²⁾. In particular, as a stable and concrete indicator of organizational and individual safety and health behaviors, safety climate was closely related with positive HR factors for safety and health at work because safety climate was closely associated with organizational HR support like executives, supervisor, and coworker support in related literature²¹⁻²⁴⁾.

In this study, HR factors were associated with each other at low levels as absolute values of correlation coefficients between HR factors were less than 0.25. Although statistical findings were not reported in the results, the businesses that had more workers, employed elderly and foreign workers, and had recently experienced occupational injuries were significantly associated with positive HR factors such as site supervisors and committees. High injury incidence and employment of vulnerable workers, as significant indicators of dangerous working conditions, also need to be discussed to increase organizational awareness of accident prevention. Previous studies reported that occupational injuries served as reminders and boosters of occupational safety awareness²⁵⁾. That is, by sustained awareness of occupational accidents at both organization and worker levels, SH managements including SHEW were more likely to be implemented than before they had such injuries.

SHEW is a fundamental mediator between positive and negative HR factors because major positive HR structures such as site supervisor and SH committee manage SHEW

to control negative HR factors in small businesses. Significant associations between HR factors and SHEW were well identified in this research. It should be considered that these businesses and their structures are too small to maintain stable SH activities including SHEW. Monitoring is particularly difficult for most manufacturing businesses with 30 or fewer workers. Kim and Park observed that site supervisors did not have sufficient management knowledge and skills for workplace SH⁷⁾. In relationship to such limitation, Eaton and Nocerino discussed the impact of organizing SH committees for better SH effectiveness regardless of business size³⁾. Considering the comprehensive suggestions from previous studies, it is better to empower positive HR structures by unionizing site supervisors and SH committees of small businesses. Such SH human resources from small businesses can share their SH conditions, needs, or problems with each other and can also receive practical feedback and support in the unionized meetings and opportunities organized by the government. For example, site supervisors should recognize SH status of their companies and share their needs in union communities with other site supervisors with similar industry backgrounds together instead of working as individual business HRs for SH at work. Site supervisors and SH committees have been important HR resources for controlling occupational accidents in business units because they are nearly only safety and health HR particularly in small businesses. They are also familiar with their working conditions and their workers.

This study has several limitations. One limitation was the study design. Causal relationships of workplace HR factors and SHEW were limited because the present research was based on cross-sectional survey data. Another limitation was that all HR factors and SHEW were dependent on survey participants' recalls and subjective perceptions, although those were representative responses from a nationwide survey in Korea. The third limitation of this study was related to study variables. Although SHEW is a fundamental strategy to manage organizational environment, behavior, or communication for SH at workplace level, among diverse SHEW factors, only SHEW implementation (yes or no) was available from the KOSHTS data. Any detailed SHEW contents or methods were not included in the KOSHTS data. SHEW is also one strategy for workplace SH. Other diverse factors such as controlling environmental hazards, monitoring occupational diseases, or increasing social support should be considered from comprehensive perspectives.

Conclusion

Significant HR factors associated with SHEW in small manufacturing businesses were identified in this study using the secondary data of 2012 KOSHTS. SHEW was significantly related to business size, occupational injury

incidence in the previous year, foreign and elderly worker employment, presence of site supervisors, and presence of SH committees. SHEWs for office workers, non-office workers, and newcomers were associated with business size, presence of site supervisors, and presence of SH committees. Businesses with 30-49 workers conducted SHEW significantly more than businesses with 5 to fewer than 10 workers. Site supervisors and committees at work were significant HR factors that improved SHEW. As future research and administrative challenges, it is valuable to consider how to support HR structures under the condition that small manufacturing businesses have vulnerable working populations and weak organizational resources.

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References

- 1) Lee MS, Park KO. Workplace safety education and management factors associated with the organizational safety culture in Korean manufacturing companies. *Korean Public Health Research* 2006; 32(1): 75-83. (in Korean)
- 2) Vinodkumar MN, Bhasi M. Safety management practices and safety behavior: Assessing the mediating role of safety knowledge and motivation. *Accident Analysis & Prevention* 2010; 42(6): 2082-2093.
- 3) Eaton AE, Nocerino T. The effectiveness of health and safety committees: Results of a survey of public-sector workplaces. *Industrial Relations: A Journal of Economy and Society* 2000; 39(2): 265-290.
- 4) Korea Ministry of Employment and Labor. 2014 Occupational injury analysis. Government Complex Sejong (Korea) 2015. (in Korean)
- 5) Kang JC, Chang SR. Promoting effectiveness of occupational health and safety education program. *Journal of the Korean Society of Safety* 2005; 20(1): 143-147.
- 6) Brosseau LM, Li SY. Small business owners' health and safety intentions: A cross-sectional survey. *Environmental Health* 2005; 4(1): 23.
- 7) Kim SB, Park JK. A study on the role of safety and health of supervisors in small to medium-sized industries. *Journal of the Korean Society of Safety* 2013; 28(2): 84-87. (in Korean)
- 8) Occupational Safety and Health Research Institute (OSHRI). Analysis report of 2012 Occupational Safety and Health Trend Survey. Government Complex Sejong: Korea Occupational Safety and Health Agency; 2014. (in Korean)
- 9) Yoon JD, Han CH. A study to revitalize of the honorary industrial safety inspector system- In construction industry. *Journal of the Korean Society of Safety* 2007; 22(4): 72-82. (in Korean)
- 10) Neal A, Griffin MA, Hart PM. The impact of organizational climate on safety climate and individual behavior. *Safety Science* 2000; 34(1): 99-109.
- 11) Christian MS, Bradley JC, Wallace JC, et al. Workplace safety: A meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology* 2009; 94(5): 1103-1127.
- 12) Nahrgang JD, Morgeson FP, Hofmann DA. Safety at work: A meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. *Journal of Applied Psychology* 2011; 96(1): 71-94.
- 13) Lee JG, Ryu SW, Seo SK. A study on necessity of safety education for improving the worker's safety awareness. *Journal of the Korean Society of Safety* 2011; 26(6): 90-96. (in Korean)
- 14) Korea Ministry of Government Legislation. Occupational Safety and Health Act. [Online]. 2016[cited 2017 May 5]; Available from: URL: <http://www.law.go.kr/lsSc.do?menuId=0&subMenu=1&query=%EC%82%B0%EC%97%85%EC%95%88%EC%A0%84%EB%B3%B4%EA%B1%B4%EB%B2%95#undefined>
- 15) Park KO. Organizational factors associated with safety and health managers' educational needs in Korean manufacturing industry. *Korean Public Health Research* 2016; 42(1): 41-52. (in Korean)
- 16) Howell DC. *Fundamental statistics for the behavioral sciences* (8th ed.). Belmont (CA): Wadsworth CENGAGE Learning; 2014. p. 266.
- 17) Song YY, Kim HG, Yi G, et al. Support system on the occupational safety and health for migrant workers. *Korean Journal of Occupational Health Nursing* 2007; 16(1): 67-77. (in Korean)
- 18) Lee SW, Kim KS, Kim TW. The status and characteristics of industrial accidents for migrant workers in Korea compared with native workers. *Korean Journal of Occupational and Environmental Medicine* 2008; 20(4): 351-361. (in Korean)
- 19) Colye JR, Leopold JW. How effective are health and safety committees? *Occupational safety and health* 1981; November: 20-22.
- 20) Cheyne A, Cox S, Oliver A, et al. Modeling safety climate in the prediction of levels of safety activity. *Work & Stress* 1998; 12(3): 255-271.
- 21) DeJoy DM, Schaffer BS, Wilson MG, et al. Creating safer workplaces: Assessing the determinants and role of safety climate. *Journal of Safety Research* 2004; 35(1): 81-90.
- 22) Huang YH, Ho M, Smith GS, et al. Safety climate and self-reported injury: Assessing the mediating role of employee safety control. *Accident Analysis & Prevention* 2006; 38(3): 425-433.
- 23) Neal A, Griffin MA. A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *Journal of Applied Psychology* 2006; 91(4): 946-953.
- 24) Wu TC, Chen CH, Li CC. A correlation among safety leadership, safety climate and safety performance. *Journal of Loss Prevention in the Process Industries* 2008; 21(3): 307-318.
- 25) Moon K, Lee J, Oah S. The effects of safety leadership of

manager and safety climate in the organization on the workers' safety behaviors. *Journal of the Korean Society of Safety* 2013; 28(3): 66-72. (in Korean)

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