

사고사망자의 심층적 실증분석을 통한 예방적 개입점 발견 연구

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Finding on Preventive Intervention of Fatal Occupational Injuries Through Empirical Analysis of Accident Death

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Abstract : The 7,993 cases of Survey Report of Fatal Industrial Accidents conducted jointly by the MEOL and the KOSHA for the recent seven years(2007-2013) were categorized according to personal and occupational characteristics, industry types, business sizes, job types, activities at the time accident, types of accidents, material agents(assailing materials), unsafe conditions, and unsafe acts. And it is found that among the 72.2 percent of fatal occupational accidents in the construction and manufacturing industries are caused by falling, sticking, bumping and being caught under objects & overturning. For this study, through the empirical analysis on causes of fatal industrial accidents, was used to identify high risk groups based on total data of 7,993 victims of occupational accidents. An annual fatal occupational injury (FOI) rate per 10,000 workers was about 0.47‰. The middle-aged group and the elderly group showed the highest FOI rates per 10,000 workers (0.73‰, 0.80‰), and the daily workers showed the highest FOI rate (1.46‰), and the craft and related trades workers showed the highest FOI rate (2.17‰). In case of industry type the mining industry (7.26‰) showed the highest FOI rate, followed by the sewerage, waste management, materials recovery and remediation activity industry (3.91‰) and the construction industry (2.71‰). The primary high risk target group that requires a strategy designed to reduce fatal occupation injuries caused by falling and bumping & contact(collision) is the construction industry, and the secondary high risk target group in the construction industry is classified as the equipment, machine operating and assembling workers in the construction industry, those aged 50 years old and above need the prevention measures against bumping & contact(collision) and being caught under an object & falling(objects), while those aged less than 50 years old need prevention measures against falling(persons).

Key Words : fatal occupational injuries, risk groups, accidents, falling, construction

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1. Introduction

According to the analysis results on the current status of industrial accidents in 2014, the trend of accident deaths by year, and the investigation results of causes of industrial accidents in 2014. It is found that among the causes of fatal occupational accidents, a higher percentage compared with the total fatal occupation injuries are caused by falling, sticking, bumping and being caught under objects &

overturning every year. And is heavily concentrated in the construction and manufacturing industries¹⁻⁴.

Given this trend of industrial accidents, it has been adopted as their core goal by both the Ministry of Employment and the Korea Occupational Safety and Health Agency to reduce the fatal occupation injury (FOI) rate per 10,000 workers to 0.3‰ in the 4th 5-Year Industrial Accident Prevention Plan (2015 to 2019). In previous studies, analysis of the fatal occupational injury was mostly performed by

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the general characteristics and one-dimensional method through the year or the structured questionnaires³⁻⁷⁾, or there was a limit to the finding of high-risk groups in studies that did not have the FOI rates per 10,000 workers according to personal and occupational characteristics⁸⁻⁹⁾. Therefore, the necessity of this study, it is very important and necessary to select and concentrate through finding of high risk groups for fatal occupation injuries by classifying them into more specific and detailed subcategories for a more effective prevention and reduction of fatal occupational accidents.

2. Material and Methods

For this study, a database was established by 7,993 cases of fatal occupational injuries occurring from January 1, 2007 to December 31, 2013 in relation to personal and occupational characteristics, industry types, workplaces scale, job types, employment types, accident types, causes of accidents, material agents (assailing materials), unsafe conditions and acts.

One of the sources of information available for an in-depth analysis of fatal occupation accidents was the Survey Report of Fatal Industrial Accidents conducted jointly by the Ministry of Employment and the Korea Occupational Safety and Health Agency, which provides the most helpful data in identifying the causes of fatal occupational accidents^{1,2,11)}.

In addition, other sources were the disaster survey table and the medical coverage (compensation) approval letters, which are written at the Korean Workers' Compensation and Welfare Service in relation to the compensation approval criteria in case an accident happens. The statistical analysis method using SPSS version 18 (SPSS Inc., Chicago, IL, USA), in this study, an in-depth analysis was conducted through the technical statistics, chi square method and multi-dimensional model for exploratory technique¹⁰⁾ to identify the specified and subdivided high risk groups for fatal occupational accidents for a selection and concentration strategy.

3. Results

A The number of fatal occupational injuries occurring for the past seven years from accident occurrence year 2007 to 2013, based on the occurrence year of accidents, stood

Table 1. The distribution of fatal occupational injuries from 2007 to 2013

Years	Number of employees (1,000 persons)*	Number of fatal occupational injuries (%)	Fatal Occupational Injury rate per 10,000 workers(‰)
2007	23,433	1,165 (14.6)	0.50
2008	23,577	1,245 (15.6)	0.53
2009	23,506	1,162 (14.5)	0.49
2010	23,829	1,204 (15.1)	0.51
2011	24,244	1,140 (14.3)	0.47
2012	24,681	1,076 (13.5)	0.44
2013	25,066	1,001 (12.5)	0.40
Total	168,337	7,993 (100.0)	0.47

* The number of employed persons is analyzed by reprocessing data of economically active population survey (National Statistics Korea)¹¹⁾

at 7,993 deaths. An annual average number of 1,142 fatal occupational accidents happened every year. An annual FOI rate per 10,000 workers was about 0.47‰, which had fluctuated until 2011 and afterwards showed a declining tendency. The months with the highest FOI rates per 10,000 workers were July and August (0.31‰, 0.33‰) during summer season. Among age groups, the middle-aged group and the elderly group showed the highest FOI rates per 10,000 workers (0.73‰, 0.80‰). In case of employment types, the daily workers showed the highest FOI rate per 10,000 workers (1.46‰). In case of business sizes, the workplaces with 1 to 4 full time workers showed the highest FOI rate per 10,000 workers (0.99‰). In case of job types, the craft and related trades workers showed the highest FOI rate per 10,000 workers (2.17‰). In case of industry types, the mining industry (7.26‰) showed the highest FOI rate per 10,000 workers, followed by the sewerage, waste management, materials recovery and remediation activity industry (3.91‰) and the construction industry (2.71‰).

According to the distribution chart of fatal occupation accidents of the craft and related trades workers, the annual average year percentage of the craft and related trades workers against the total fatal occupational accidents was 43.7% (37.3% (the lowest)-49.2% (the highest)). In case of employment types, the daily workers showed the highest percentage (63.8%). In case of business sizes, the workplaces with 1 to 4 employees took up the highest percentage (25.4%), In case of age groups, the middle-aged workers from 50 to 59 years old showed the highest percentage (35.9%). In case of employment periods, those workers with a continued employment period of less than

6 months showed the highest percentage (27.3%). In case of business types, the non-residential construction businesses showed the highest percentage (37.2%). In case of the causes of accidents, the falling from temporary structures including scaffolds or from other structures including cross-beams or steel frames showed the highest percentage (28.4%). In case of material agents, the temporary & building structure showed the highest percentage (18.5%), followed by the scaffolding & workplate (14.4%) and the transport and lifting machinery (10.3%). In case of activities at the time of accidents, the installation or dismantlement of buildings or other structures showed the highest percentage (15.6%), followed by the installation or dismantlement of temporary structures (11.9%) and the finishing work (11.7%).

In case of the distribution chart of fatal occupation accidents

of elementary workers, the annual average percentage of the elementary workers against the total fatal occupational accidents was 21.7% (17.9% (the lowest)-25.4% (the highest)). In case of the employment types, the daily workers showed the highest percentage (47.8%), followed by the regular workers (44.9%). In case of the workplace sizes, the workplaces with 1 to 4 employees showed the highest percentage (34.3%), In case of age groups, the elderly workers aged more than 60 years showed the highest percentage (34.3%). In case of employment periods, those workers with a continued employment period of less than 6 months showed the highest percentage (40.2%). In case of business types, the building construction businesses showed the highest percentage (12.0%), followed by the engineering businesses (11.5%) and the restaurant businesses (10.8%). In case of the causes

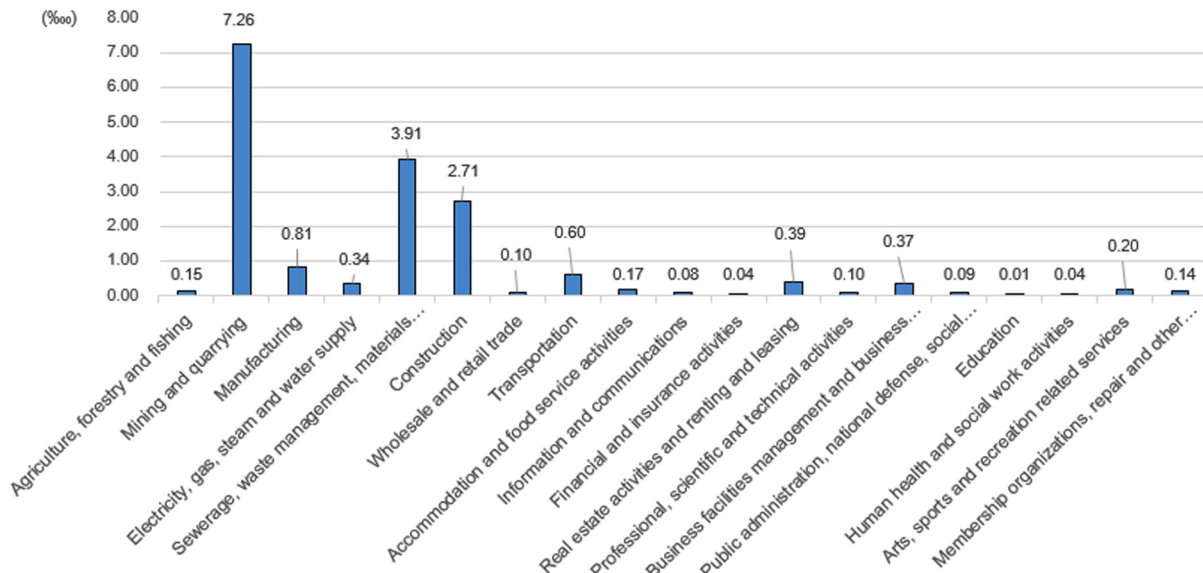


Fig. 1. The fatal occupational injury rate 1per 10,000 workers of total 7,993 accident death by the industry types.

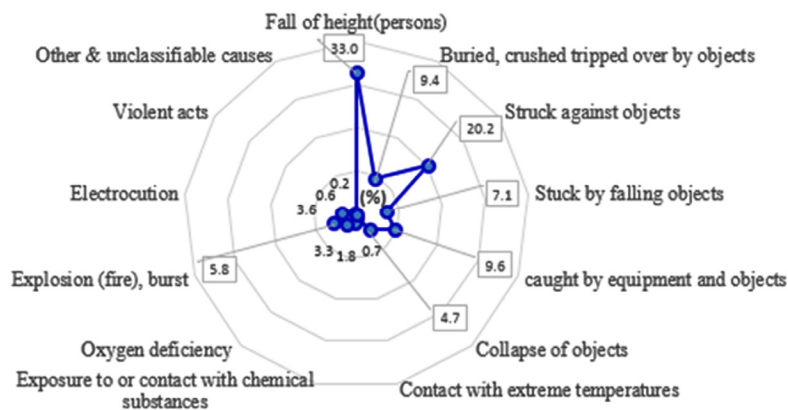


Fig. 2. The accident type distribution of total 7,993 accident death workers.

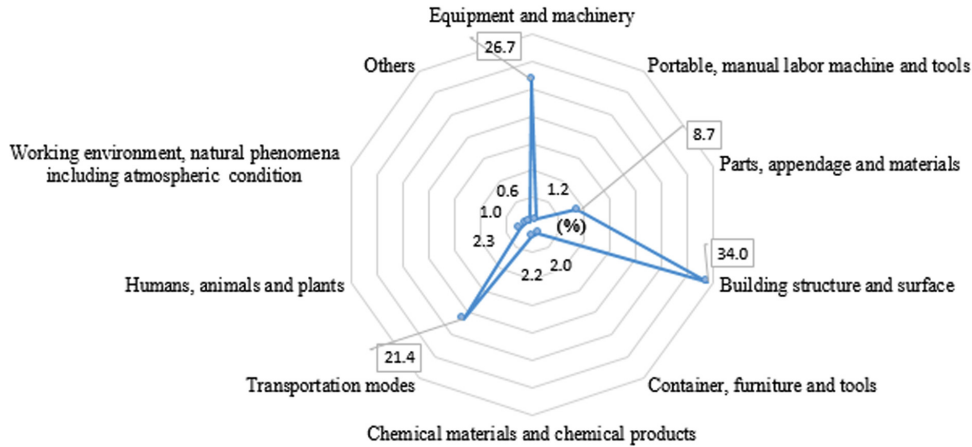


Fig. 3. The causal objects distribution of total 7,993 accident death.

of accidents, the collision or contact showed the highest percentage (30.3%). In case of material agents, the land transportation modes including vehicles and forklifts showed the highest percentage (34.0%). In case of activities at the time of accidents, the driving of transportation and shipping modes showed the highest percentage (30.2%). In case of unsafe conditions and unsafe acts, the operational defect of vehicles and the simple disoperation and malfunction of equipment & machinery, etc. respectively showed the highest percentages (25.6%, 24.0%).

In case of the distribution chart of fatal occupation accidents at the workplaces with less than 1 to 4 workers than 6 months, the annual average percentage of the workplaces with less than 5 workers against the total fatal occupational accidents was 27.1% (22.4% (the lowest)-40.3% (the highest)). In case of the employment types, the daily workers showed the highest percentage (47.8%), followed by the regular workers (46.1%). In case of age groups, the middle-aged workers aged 50 to 59 years old showed the highest percentage (28.7%). In case of business types, the comprehensive construction businesses including non-residential buildings, office or commercial buildings, detached houses, and multi-household houses showed the highest percentage (21.8%), followed by the specialized construction businesses (20.8%). In case of occupational groups, the construction & mining and related trades workers (21.5%). In case of the causes of accidents, the collision or contact showed the highest percentage (20.3%). In case of material agents, the land transportation modes including motor bicycles and cargo transport trucks showed the highest percentage (26.0%). In case of unsafe acts, the failure to

Table 2. The distribution of total 7,993 accident death

Division	Number of employees (1,000 persons)*	Number of fatal occupational injuries (%)	Fatal Occupational Injury rate per 10,000 workers(‰)
Sex			
Male	98,072	7,704 (96.4)	0.79
Female	70,265	298 (3.6)	0.04
Age			
< 30	27,672	583 (7.3)	0.21
30 ≤ age < 40	40,992	1,203 (15.1)	0.29
40 ≤ age < 50	45,986	2,128 (26.6)	0.46
50 ≤ age < 60	33,725	2,477 (31.0)	0.73
≥ 60	19,962	1,602 (20.0)	0.80
Workplaces scale			
1 ~ 4	21,892	2,164 (27.1)	0.99
5 ~ 9	17,027	1,100 (13.8)	0.65
10 ~ 29	22,328	1,728 (21.6)	0.77
30 ~ 49	9,892	699 (8.7)	0.71
50 ~ 99	11,117	838 (10.5)	0.75
100 ~ 299	13,601	833 (10.4)	0.61
300 ≤	16,712	631 (7.9)	0.38
Employment types			
Regular	77,053	4,003 (51.5)	0.52
Daily	23,367	3,411 (43.9)	1.46
Temporary	24,653	321 (4.1)	0.13
Time	10,364	41 (0.5)	0.04
Job Types			
Managers	2,920	245 (3.1)	0.84
Professionals	31,822	246 (3.1)	0.08
Clerks	26,655	213 (2.7)	0.08
Service	17,775	55 (0.7)	0.03
Sales	20,188	53 (0.7)	0.03
Agriculture ets	11,410	162 (2.0)	0.14
Craft	16,057	3,491 (43.7)	2.17
Equipment and Machine	19,311	1,791 (22.4)	0.93
Elementary	20,614	1,737 (21.7)	0.84

* The number of employed persons is analyzed by reprocessing data of economically active population survey (National Statistics Korea)¹¹⁾

properly wear protective gears and the disoperation and malfunction of vehicles, etc. respectively showed the highest percentages (20.7%, 19.6%).

4. Discussion

In this study, through the empirical analysis on causes of fatal industrial accidents, was used to identify high risk groups based on data of a total of 7,993 victims of occupational accidents from 2007 to 2013, including personal and occupational characteristics, accident causes, material agents (assailing materials), and unsafe conditions and acts, and this study suggests the following phase-specific approach for high risk groups to reduce the fatal occupation injuries based on the analysis results,

First, the major causes of fatal occupation injuries that we need to focus on to reduce fatal occupational injuries by a significant level are falling (persons) and bumping & contact (collision) absolutely to the accidental death and disaster should concentrate on the collision (human) and contact (collision) disaster^{5,7,13}. The primary high risk target group that requires a strategy designed to reduce fatal occupation injuries caused by falling and bumping & contact (collision) is the construction industry, and the secondary high risk target group in the construction industry is classified as the equipment, machine operating and assembling workers. As the tertiary target groups among the equipment, machine operating and assembling workers in the construction industry, those aged 50 years old and above need the prevention measures against bumping & contact (collision) and being caught under an object & falling (objects), while those aged less than 50 years old need prevention measures against falling (persons)^{5,12}. And the cause of accidents that we need to focus on for the elementary workers, another secondary high risk target group in the construction industry, turns out to be falling (persons) that occurs among elementary workers with the employment status as daily workers regardless of the number of regular workers at workplaces¹³, and we need to concentrate capabilities to prevent it.

Second, another industry to concentrate our prevention efforts as a primary high risk target group is the manufacturing industry, and we need to focus on the prevention of being caught by or hooked on objects (constriction), falling (persons), and bumping & contact

(collision)^{7,8}. The secondary target groups in the manufacturing industry are classified by job types, and among the two high risk target groups that we need to concentrate on, one is the bumping & contact (collision) of sales service workers, while the other is being caught by or hooked on objects (constriction) of the equipment, machine operating and assembling workers with a continued employment period of less than 6 months and with a continued employment period of more than 20 years⁸. Also, the tertiary high risk groups that we need to concentrate on is the prevention of fire and explosion in case of the manager, expert and related workers at workplaces with more than 50 employees and the prevention of bumping & contact (collision) in case of the manager, expert and related workers at workplaces with less than 50 employees. It is necessary to concentrate resources and capabilities to prevent of falling (persons) at workplaces with less than 50 employees in case of the craft and related trades workers and to prevent being caught by or hooked on objects (constriction) in case of the elementary workers^{5,8,14}.

Lastly, in order to reduce fatal occupational injuries in the accommodation and restaurant industries, it is needed to concentrate on the prevention of bumping & contact (collision) in those workers whose employment status are irregular workers, such as daily, temporary or hourly workers.

In summary, the highest risk groups of FOI rate per 10,000 workers were analyzed ‘mining industry’, ‘the sewerage, waste management, materials recovery and remediation activity industry’, ‘the construction industry’, ‘the craft and related trades workers’, ‘the daily workers’, ‘the workplaces with 1 to 4 workers’, and ‘aged 50 years and above’. Especially were ‘Equipment & machine operating and assembling workers’ in the manufacturing, ‘craft and related trades workers’ and ‘daily workers’ in the construction, ‘equipment & machinery’, ‘struck by objects’ and ‘stuck and caught in objects’ in causal objects, ‘building structure and surface’ and ‘fall of persons’ in accident type. In the female case, ‘elementary workers’, ‘struck against objects’ by accident type, ‘equipment & machinery’ by causal objects. ‘daily workers’ showed the highest FOI rate per 10,000 workers. Among the total 7,993 accident deaths, the most frequent accident type were ‘falling of height (persons)’ and ‘struck against objects’ and ‘building structure and surface’, ‘equipment and machinery’, ‘transportation modes’ in the most frequent causal objects.

Some suggest, due to the lack of labor force and the increase in the aging population, it is expected that the fatal occupational injury will increase due to the entry of new labor market and frequent turnover. Therefore, the government needs more comprehensive preventive measures and legal protection. It is essential to train customized education & training programs and safety work guide-manual according to the job types and aging workers by each industry.

Conflict of Interest

The authors declare that there are no conflicts of interests regarding the publication of this article.

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