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Original

Relationship between Dimensions of Safety Climate and Unsafe Behaviors of the Construction Industry Workers

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Abstract

Background: Construction industry has been ranked among the most dangerous industries worldwide due to the high number of accidents. The safety climate can be considered as a stimulus to reduce unsafe behaviors and thus reduction the accidents. This study was carried out to investigate the relationship between the dimensions of the safety climate and unsafe behavior of the construction workers in Tehran, Iran. **Methods:** The present study is a descriptive cross-sectional research on 90 construction workers. Unsafe behaviors recorded using the American National Standards Institute method and interviews with the workers. The Safety Climate was measured using the UK health care Safety Climate Questionnaire. The descriptive statistics (mean and standard deviation) were used to summarize the findings and the Pearson's correlation coefficient was used to show the relationship between the variables. The SPSS software was used to analyze the data. **Results:** The mean and standard deviation of safety climate score and unsafe behavior were (3.98+ 0.27) and (45.93 + 17.3), respectively. There was a significant relationship between unsafe behaviors and staff knowledge (r = -0.31 and P = 0.004). We also found relationship between unsafe behavior and safety climate score (r = -0.21 and P = 0.043). **Conclusion:** The employees' knowledge was one of the most important components of workplace safety. Also, this component assigned itself the highest score, and increasing the score in this dimension of the safety climate can lead to reduction unsafe behavior. Finally, according to the results, as the safety climate among employees increases, unsafe behaviors will decrease, and productivity would be increase.

Keywords: Unsafe behavior; Safety climate; Construction workers; Workplace safety

Introduction

The construction industry is considered as one of the important indicators of economic performance in the world, especially in developing countries. [1] In recent years, the construction industry has become one of the most dangerous industries in the world due to the high number of accidents and safety injuries as well as their growing trend. [2-4] According to the International Labour Organization (ILO), 60000 people die as a result of occupational accidents or work-related diseases – more than 2.3 million deaths per year. [4-6] In the United States, the highest incidence of fatal occupational accidents is related to the construction industry, on average, fatal occupational accidents occur every 115 minutes and accidents leading to disability occur every 10 seconds

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.[4, 7, 8]Also in 2018, the number of casualties increased 7.15% in the in the Korean construction industry, compared with the previous year, and the total number of industrial accidents in the construction industry was the second highest in 2018. [9]

In general, safety is considered as a major concern for all industries and organizations, which can be the source of many direct and indirect costs. The results of previous research show that increasing the level of safety and reducing accidents leads to increased productivity in the construction industry. [10, 11] It is complex to investigate safety issues in the construction industry due to rapid changes in the work environment, specific hazards and organizational issues. [12] Unfortunately, either the safety risks in the construction industry are not assessed or considered with a lower level of risk than the reality. [13] Also, most occupational and work-related accidents and injuries in the construction industry occur due to lack of safety programs and due to human error and unsafe behavior. [14]

The safety climate plays a prominent role in improving the safe behaviors of members of an organization, and can be a stimulus to improve safe behaviors and lead to positive results and reduce accidents. [18-15] The results of the study on 203 participants show that the safety climate had significant impact on 49.8% of unsafe behaviors. [19]

The concept of "safety climate" is generally defined as "identifying main causes of safety accidents due to human behavior". Safety climate was first studied by Zohar in 1980. [20, 21] Safety climate is defined as a multidimensional factor that can be a common understanding of employees of policies, procedures, actions and the overall importance and priority of safety in the workplace, so as to provide an overview of workplace safety conditions at a particular time. [22 -24] Numerous studies have been conducted since 1980 to date on the effect of safety climate on safety behavior. [2] According to the results reported by many researchers, with increasing safety climate, the probability of accidents decreases and there is a significant relationship between safety climate and the occurrence of accidents among construction workers .[10, 17, 21, 25] The results of studies show that the climate of safety is accepted

As a prominent indicator of risks in construction projects. [20, 26, 27] According to the results of many studies, there is a positive correlation between safety climate and safety behaviors and there is a negative correlation between these two variables with occupational accidents. [21, 22, 28] Safety climate is considered as a strong factor for predicting safety outcomes in industries and countries. Safety climate has been considered in recent decades as a key factor in examining safety outcomes in various industries and work environments. [7, 29]

Much research has been carried out on the importance of safety climate and its measurement in the construction industry. [30] Research on safety climate is of great importance for the following reasons: 1- Safety climate is known as a characteristic of safety efficiency and predicting the occurrence of occupational accidents, which studying and identifying the effective factors on it can reduce the occurrence of occupational accidents 2- Identifying safety problems before accidents and the accident analysis process can be a good guide for managers to develop safe plans. 3- Research on safety climate is less expensive than other methods of accident prevention and analysis of workers' perceptions about safety. 4- And the important point is that the safety climate can provide useful information about safety management from the perspective of workers. [31] This study was carried out aimed to investigate the relationship between the dimensions of safety climate and unsafe behavior of people working in a construction workplace due to the importance of safety climate in construction workplaces to reduce occupational accidents and create a safer work environment. Paying less attention to previous

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studies to the employees of the construction workplace is the reason for choosing this job group for the present study.

Methods

Participants

This study is a descriptive cross-sectional study and was carried out on 90 people working in a construction workplace in Tehran.

Tools and Data collection

Convenience sampling method, checklist for recording unsafe behavior and interviewing people were used to collect data.

Two questionnaires were used to collect data in this study: demographic information questionnaire including age and work experience, and self-report safety climate questionnaire, which included 8 dimensions. These questionnaires were delivered to individuals and how to answer the questions were taught and completed in the presence of the researcher. Inclusion criteria were at least 5 years of work experience, no physical or mental disability, and exclusion criteria were improper completion of questionnaires, and entry and exit were optional during the study. It should be noted that the participants did not know the intention of the researcher, otherwise, the participants would change their behavior in answering the questions.

In this study, a questionnaire presented by the Health and Safety Executive (HSE: The Health and Safety Executive (HSE) is a UK government agency responsible for the encouragement, regulation and enforcement of workplace health, safety and welfare, and for research into occupational risks in Great Britain) in 2001 was used to assess the safety climate and its dimensions. [17, 21, 32] The questionnaire has 37 items in 8 dimensions of safety climate, including management commitment to safety and safety issues priority, staff knowledge and obedience to safety rules, staff attitude towards safety issues, employee participation and commitment to safety rules, workplace safety, Immediate readiness at workplace is a priority for product safety and risk aversion. The present questionnaire is a set of questions that can be used to assess the safety climate and its related characteristics.

This questionnaire was validated by Jafari et al. in 2013 with a content validity ratio (CVR) of 78.5 and a content validity index (CVI) of 0.82 in our country. [33] The distribution of safety climate scores was calculated and considered based on a 5-point Likert scale with a minimum score of 1 (strongly disagree) and a maximum score of 5 (strongly agree).

Sampling Safety Behaviors technique was used to evaluate unsafe behaviors. For this purpose, a list of unsafe behavior that occurred in the study area was prepared according to the list of unsafe behavior developed by the American National Standards Institute (ANSI), the type and nature of work, existing rules and regulations, accident reports and existing cultural conditions, finally the average score of unsafe behavior was calculated according to the list. [34]

The observations were made in the morning shift from 8 am to 4 pm, and it was tried to make the time of each observation as short as possible, about 3 to 5 seconds, so that the observer could observe the behavior and determine whether it was safe or unsafe according to the list, while participants do not change their behavior. [33, 34] Data was entered into SPSS 21 for analysis, and Pearson correlation test was performed. The significance level is considered to be 0.05.

Results

Mean and standard deviation of work experience and age were obtained (11.44 $\pm$ 6.3) and (35.5 $\pm$ 8.1), respectively, according to the data analysis. Also, the mean and standard deviation of unsafe behavior and safety climate were calculated (45.93 $\pm$ 17.3) and (3.98$\pm$0.27), respectively. Table 1 shows the average and standard deviation of the dimensions of the employees' safety climate.

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Pearson correlation test was performed to evaluate the relationship between the dimensions of the safety climate and unsafe behavior, age and work experience. Table 2 shows the results.

As shown in Table 2, the results show that a significant relationship was observed between work experience, age and unsafe behavior with the dimensions of safety climate and safety climate score. Positive correlation was observed (P = 0.029 and r = 0.23) and (P = 0.048 and r = 0.20), respectively, between work experience and age with safety climate score and negative correlation (P = 0.043 and r = -0.21) was observed between unsafe behavior and safety climate score. Among the dimensions of safety climate, the dimension of management commitment for safety and priority of safety issues were correlated (P = 0.001 and r = 0.34) and (P =0.001, r=0.33) were the most effective dimensions in relation to work experience and age, respectively. Also, knowledge of employees and obedience to safety rules was the most effective dimension in relation to unsafe behavior (P = 0.004 and r = -0.31). A significant relationship was observed with (P = 0.001 and r = 0.34) between work experience and employee participation and commitment to observe safety rules.

As shown in Table 3, the results of Pearson correlation statistical analysis between work experience and age with unsafe behavior showed a negative correlation between work experience and age with unsafe behavior.

Discussion

The results of this study show that there is a significant relationship between the dimensions of the safety climate and some demographic factors such as age and work experience, which was consistent with the results of a study conducted by Jafari et al. (2013), [33] but it is not consistent with Heydari's study which pointed out that the relationship between age and safety climate factors has not been proven in studies. [35]

Table 1. Grouping questions related to each dimension, mean and standard deviation of safety climate dimensions

Dimensions of safety climate	Grouping questions	Standard deviation ± mean
Management commitment to safety and prioritizing safety issues	1-2-3-4-5-6-7-8-9-10	2.95±0.97
Employee knowledge and obedience to safety rules	11-12-13-14-15-16-17	3.98±0.76
Employees 'attitudes towards safety issues	18-19-20-21	3.93±1
Employee participation and commitment to safety regulations	22-23-24-25-26	3.95+0.85
Safety - Business	27-28-29	3.61+0.88
Immediate preparation at workplace	30-31-32-33	3.20±0.88
Safety priority over products	34-35	3.50±1.04
Ignoring the risks	36-37	3.14+1.03

Table 2. Results of Pearson correlation test between age, work experience and unsafe behavior with safety climate dimensions

Component	Management commitment to safety and prioritizing safety issues	Employee knowledge and obedience to safety rules	Employees' attitudes towards safety issues	Employee participation and commitment to-observe safety rules	Work environment Safety	Immediate readiness at workplace	Safety priority over products	Ignoring the risks	Climate safety score
Work Experience	r = 0.34 P = 0.001	r = 0.20 P = 0.05	r = 0.21 P = 0.049	r = 0.29 P = 0.005	r = -0.12 P = 0.249	r = 0.04 P = 0.701	r = -0.03 P = 0.78	r = -0.14 P = 0.166	r = 0.23 P = 0.029
Age	r = 0.33 P = 0.001	r = -0.22 P = 0.04	r = 0.08 P = 0.449	r = 0.06 P = 0.559	r = 0.08 P = 0.407	r = 0.06 P = 0.515	r = 0.11 P =0.265	r = 0.16 P = 0.126	r = 0.20 P = 0.048
Unsafe behavior	r = 0.15 P = 0.13	r = -0.31 P = 0.004	r = 0.11 P = 0.279	r = -0.19 P = 0.068	r = -0.04 P = 0.680	r = 0.06 P = 0.558	r = 0.12 P =0.249	r = 0.06 P = 0.550	r = -0.21 P = 0.043

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Table 3. Results of Pearson correlation test between age and work experience with unsafe behavior

Demographic component	Unsafe behavior
Work Experience	r = -0.21 p = 0.047
Age	r = -0.19 p = 0.064

The correlation results between most dimensions of safety climate and unsafe behavior were not significant, and only a significant relationship was observed in the relationship between unsafe behavior and staff knowledge, which was consistent with the study of Tirger et al. [36] Limitation on the number of samples can be one of the reasons for the lack of significant relationship between unsafe behavior and other dimensions. [1]

Given that there is a positive correlation between the dimension of management commitment to safety and the priority of safety issues with age and work experience, it can be concluded that with increasing work experience, people prioritize commitment to safety issues. There was also a significant relationship between the dimensions of employees' attitudes toward safety issues and employee participation and commitment to safety rules with work experience. These results are consistent with the results of research by Jafari et al. [33] There is a negative correlation between the knowledge dimension of employees and obedience to safety rules with unsafe behavior and age. According to this result, although older people have less knowledge about safety issues but perform less unsafe behavior for other reasons such as work experience. [37] A negative correlation was observed between work experience and workplace safety, which could be due to the conservatism of inexperienced people in observing safety issues.

According to the results of examining the relationship between the dimensions of the safe climate, there is a significant relationship between most dimensions of the safe climate, which means that improving each dimension of the safe climate is effective in improving the level of the climate and even improving one dimension may improve other dimensions. These results were consistent with the results of research by Zare et al. [38] Also, by measuring the relationship between unsafe behavior and the demographic components of work experience and age, it was observed that increasing work experience reduces the rate of unsafe behavior, which can lead to increased work experience. There was a limitation in the number of samples in this study, and it is suggested that more samples be used to improve the results and be more accurate in future studies.

Conclusion

According to the results of this study, the component of employees' knowledge and obedience to safety rules is more important in the safety of the workplace. In this dimension of the safety climate can lead to a reduction in unsafe behavior. Finally, according to the results, by raising the safety climate among employees, we can see a decrease in unsafe behavior and increase productivity. It is suggested that safety culture be considered as one of the parameters for future studies according to the impact of safety culture and attitude on the occurrence of unsafe behavior and accidents.

Conflict of interests

The authors declare that they have no conflict of interests.

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Authors Contribution

All authors have the same contributions to the conception, design of the work, interpretation of data for the work, and final approval of the article.

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