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Original

The Role of Safety Climate on Work-Related Musculoskeletal Discomfort and Productivity

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Abstract

Background: Musculoskeletal disorders (MSDs) are among the most common occupational disorders. WMSDs are known as an influential factor in work productivity. Also, the safety climate plays an important role in the occupational health of individuals. The purpose of this study was to investigate the relationships between WMSDs, work productivity and safety climate. **Methods:** This quantitative, theoretical and descriptive study was performed on 344 employees. The samples were randomly selected. Data were gathered by means of the Body Map, Safety Climate, and Work Productivity questionnaires. This study was conducted on different types of jobs from three types of industries. STATISTICA software was used for all data analyses (SPSS Version 23) with a significant level of P <0.01. **Results:** One-way analysis of variance was used to examine the significant differences between industries and jobs, which indicated that there is a statistically significant difference. Correlations between the WMSDs, work productivity, and safety climate was tested using the parametric Pearson correlation coefficient that showed a significant negative correlation between WMSDs with work productivity and safety climate. Positive correlations were found between safety climate and work productivity. **Conclusion:** In general, safety climate and work productivity are important for the health and safety of employees, and this study showed that it might be also important for employees in construction industries.

Keywords: Safety climate; Work-Related Musculoskeletal Disorders; Work productivity

Introduction

Work productivity is an crucial factor in social health. It plays an important role in identifying the key factors that are ascribed to how healthy or unhealthy the workers is.[1] Work productivity is "the worker's ability to produce goods or deliver services that are expected of his or her occupation or job".[2] Another definition of productivity is "the number of output units given the usual or fewer input hours" .[3, 4] Recently, the worker's ability or capacity to produce or deliver services while suffering from WMSD has been of specific concern in the occupational health researches.[3]

These disorders can cause a decrease in the quality of life and work productivity among workers. WMSDs are one of the main causes of

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occupational health problems, with consequences for workers, employers, and society.[5, 6] WMSDs are the most common type of physical injury reported in the workforce.[7-9] Today, these disorders affect the lives of millions of people and have been known as the most common causes of pain and disability throughout the world.[10, 11] WMSDs result in loss of work time, increased healthcare costs, injuries and are also regarded as the leading cause of work absenteeism.[12, 13] The economic burden of MSDs do not only affect the individuals but organizations and communities as well.[13]

Based on evidence, posits that workplace physical factors are the main antecedents to WMSDs[14], but today, there is increasing evidence that psychosocial stressors at work can serve as additional risk factors for WRMSDs.[15] High workload, work pressure, the monotony of work, low job clarity, autonomy, social support, and job security are examples of psychosocial factors that increase WMSDs symptoms.[16] Hauke et al. study estimated that adverse psychosocial working conditions increase the risk of WMSDs in various body regions by 15-59%.[17] Although some studies indicated that physical job demands are a significant risk factor in the development of WMSDs[18], some studies fail to control for physical demands when examining the effects of psychosocial stressors.[19, 20]

A key factor that may affect the occupational health of work population is the organization of work, particularly the safety climate. Safety climate refers to individuals' perceptions of safety policies, procedures, and practices within their unit or organization.[21] Associations of work safety climate with occupational safety and injury have been examined in many industries, including construction.[22] This study examined the role of safety climate in the WMSD symptoms and also the impact of WMSDs on work productivity.

Methods

Participants and procedure

A quantitative, theoretical and descriptive study was conducted. Data were obtained from 344 full-time employees with different types of jobs from three types of industries: Construction (building), Construction (high way) and Construction (power plant)) in Iran. The causes of choosing these industries were having high risks; having a large number of jobs, and also having jobs with a high workload. All employees were male with different jobs who had been working for a minimum of one year in their jobs. Their average age was between 22-72 years. Researchers explained the aim of the research to the employees face to face, and then distributed the self-reporting questionnaires to all the employees who showed interest in participating.

Measures

1- Physical job demands

Participants responded to demographic variables and WRMSD symptoms. Standardized Body Map questionnaire on musculoskeletal symptoms was used to determine the prevalence of musculoskeletal symptoms. This Questionnaire assesses 27 body segments.[23]

2- Safety Climate Questionnaire

The NOSACQ-50 questionnaire[1] was used to measure safety climate. This questionnaire consists of 50 questions across seven dimensions:

1) Management safety commitment and ability (9 items); 2) Management safety empowerment (7 items); 3) Management safety justice (6 items); 4) Employees' commitment to safety (6 items); 5) Employees' safety priority and absence of risk acceptance (7 items); 6) Learning, communication and trust (8 items); and 7) Trust in efficacy of safety systems (7 items).

The validity of NOSACQ-50 was confirmed by the ability of this questionnaire to detecting significant differences. The standardized

[1] Nordic Safety Climate questionnaire

Cronbach's (α= 0.79 in the present study) was used to evaluate the consistency of items.

3- Work Productivity Questionnaire

Work productivity was measured using the 23-item scale developed by Jamalizadeh et al. (α= 0.87).

Ethical aspects

The participation of individuals in this study was completely optional and in each section of the study, who were willing to leave, there were no barriers to exit. To ensure the participants, questionnaires were unnamed.

Data analysis

SPSS version 23 was used for analyses. Descriptive are presented as mean (SD) and percentage. One-way analysis of variance was used to examine the significant differences between industries and jobs. Then, correlations between the MSDs, work productivity, and safety climate were tested using the parametric Pearson correlation coefficient.

Results

Characteristics of participants in the three industries are summarized in Table 1. Means and standard deviations of age, marital status, education, and job experience are presented. All participants were male (100%). individual's Job categories distribution in the three industries is shown as the percentage of respondents. The participant job categories are summarized in Table 2. As seen from the results, in the Construction (high way), the largest percentage of jobs is Worker, Heavy Machinery Driver, Foreman, Conservator, Welder and Mechanic Man, respectively. In the construction (building), the largest percentage of jobs is Worker, Foreman and Mechanic Man, respectively. And in the Construction (power plant), the largest percentage of jobs is Worker, Welder, Foreman, and Heavy Machinery Driver, respectively.

Table 3 compares the means of MSDs, safety climate and work productivity between three industries, which indicates that there is a statistically significant difference. Moreover, by comparing the mean of MSDs, safety climate, and work productivity among participants in each job categories, significant differences were found. The results of this comparison are presented in Table 4. The results of Pearson correlation analysis among different jobs in three industries showed a significant negative correlation between MSDs and safety climate. Also, there were negative correlations between MSDs with work productivity and positive correlations between safety climate with work productivity. These results are presented in Table 5.

Table 1. Sample characteristics

Industrial variable	construction (high way)	Construction (building)	construction (power plant)
Age (%)			
Mean(SD)	38.13	43.31	35.32
≤ 42	32.35	31.51	36.18
43-52	28.52	25.18	28.50
≥ 53	35.41(7.76)	34.9(5.82)	38.6(9.43)
Marital status (%)			
Married	62.17	65.30	59.20
Single	37.29	34.70	40.80
Education (%)			
≤Diploma	63.42	58.13	59.56
Bachelors	27.60	24.53	15.51
Masters	8.98	17.34	24.73
Work experience (%)			
Mean(SD)	35.16	29.53	36.15
1-10	41.35	44.26	39.88
11-20	23.49	26.21	23.97
21-37	10.2(6.01)	11.85(8.22)	9.18(5.7)

Table 2. Percentage of job categories in three industries

Industrial Job categories	Construction (high way)%	construction (building)%	Construction (power plant)%
Executive Director	2.10	1.29	2.13
Executive Supervisor	4.20	5.16	6.51
Conservator	7.68	6.40	6.27
Cook	2.80	2.27	0.00
Care Taker	4.58	2.56	4.34
Technical Office Supervisor	3.90	4.68	4.71
Mechanic Man	7.12	10.74	6.51
Foreman	9.78	18.56	8.22
Welder	7.54	9.60	8.68
Worker	20.27	26.88	26.04
Material Supervisor	2.63	1.82	2.94
Heavy Machinery Driver	12.58	3.84	8.10
Quality Assessment/Quality Control	2.14	1.30	2.17
Installation Maintenance Supervisor	2.07	0.64	4.34
Machinery Maintenance Supervisor	3.51	1.94	2.90
Surveyor	4.92	1.92	4.62
Office Clerk	2.80	1.18	2.48

Table 3. Comparison of mean difference of MSDs, safety climate and work productivity between the three industries (One-way analysis of variance)

Variables Mean Difference	MSDs (In the three industries)	Safety Climate (In the three industries)	Work Productivity (In the three industries)
p-value	0.001	0.001	0.001

A significant level of P <0.01

Table 4. Comparison of mean difference MSDs, safety climate and work productivity between the jobs (One-way analysis of variance)

Variables Mean Difference	MSDs (In the jobs)	Safety Climate (In the jobs)	Work Productivity (In the jobs)
p-value	0.001	0.001	0.001

Significant level of P <0.01

Table 5. Intercorrelations between variables (Pearson correlation coefficient)

Variables	Safety Climate (Correlation Coefficient)	Work Productivity (Correlation Coefficient)
MSDs	-0.624	-0.592
Safety Climate		0.821

Significant level of P <0.01

Discussion

The present study explored the relationships between the safety climate, work productivity, and employees' WMSDs. Inconsistent with the present findings, Golubovich et al.[24] found that there was no direct significant relationship between safety climate and WRMSDs. But they found that safety climate indirectly affects the WRMSD complaints. They found that poor safety climate is a stressor that elicits emotional strain (e.g., frustration) among employees; and frustration serves as a mediator linking poor safety climate with employees' WMSD complaints. Consistent with this research predictions, they found that safety climate was negatively related to WMSD symptoms (r=-0.624). The results of this study showed that as the employees' awareness of safety is greater and managers contribute employees

to safety discussions, they increase their safe behavior and reduce their WRMSD. Consistent

with these results, Arcury et al. 2012 [25] found that employees who perceived a less safe climate were at increased risk of experiencing WMSD symptoms. The results of Bailey et al. study 2015[26] is consistent with this study as it identified safety climate as precursors to MSDs. Work safety climate is important to the occupational health of construction industries employees, and these results are important for improving the occupational health of construction industries employees, as well as improving occupational safety in construction industries activities. Also, attention to work safety climate is considered important for improving occupational safety and reducing WMSDs across industries.[27-29]

In this study, Strong support was found for the effect of WMSDs on work productivity, whereby high productivity at work is associated with WMSDs, and these, in turn, predict organizational productivity. Nur et al. (2017)[30] found that Muscle activity significantly predicts work productivity, as muscle activities reduce work productivity. Muscle fatigue is an initiating risk factor of WMSDs .[31] Also, it has been pointed out that the accumulation of muscle fatigue causes WMSDs.[32] Some studies suggested that WMSDs reduce work productivity[33]. The findings of Taylor et al. study have revealed that some aspects of productivity were related to musculoskeletal problems.[34] Moreover, it has been suggested that discomfort might have a negative impact on several aspects of an individual's productivity, such as concentration, cognitive capacity, rationality/mood, mobility, stamina, and agility, as well as physical aspect.[35]

A study on the federal workers' claims on WMSDs by Feuerstein et al. (1998) [36] found that WMSDs were costly to the health care programs and time consuming. Pransky et al. (2000)[37] indicated that workers with low back pain and upper extremities injuries were found to have their performance affected and have had related negative consequences.

Consistent with Escorpizo R, 2008[38], this study found a direct relationship between work productivity and WMSDs. Work productivity is an important variable in the discussion of WMSD.

Finally, these findings indicate that individuals that have poor safety perception may need extra support from the organizations like Safety training to increase awareness, and improve safety attitude.

Conclusion

This study considered a particular occupational health concern about the work safety climate, in a population of employees at substantial risk. This study provided a test that indicated a negatively relationship between safety climate and WMSDs, and also between WMSDs and work productivity. Also there was a positively significant relationship between safety climate and work productivity. In general, safety climate and work productivity are important for the health and safety of work populations, and this study showed that it might be also important for the employees in construction industries. Future research with a longitudinal design could examine the possibility of reciprocal relationships between dimensions of safety climate, emotional stressor, two types of work productivity (perceived and observed work productivity) and WMSDs. Interventions to improve the work safety climate in construction industries are also needed. It is better to focus on construction industries workers, but more importantly, there is a need to address the attitudes and behaviors of construction industries employers.

Conflict of interest

The authors of this study state no conflict of interest.

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