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The Relation Between Safety Climate and Prevalence of Musculoskeletal Disorders Among Employees in Manufacturing Companies in Urmia

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Abstract

Background: Employee health is one of the important factors in organizational success, and the lack of coordinated use of ergonomic principles and the safety climate in designing suitable work systems in organizations can increase the risk of occupational and work-related injuries. This study aimed to investigate the relation between safety climate and the prevalence of musculoskeletal disorders (MSDs) among employees in manufacturing companies in Urmia County.

Methods: The participants were 359 employees working in manufacturing companies. The data were collected using the Safety Climate Scale and the Nordic Musculoskeletal Questionnaire. The collected data were analyzed using descriptive statistics, t-test, ANOVA, and the chi-square test.

Results: In the present study, the most and least frequent MSDs were reported by the participants in the neck and elbow, respectively. Safety procedures obtained the highest score (3.88±0.71) and employee participation and training obtained the lowest score (3.42±0.81). The findings also showed that the participants who gained a higher safety climate score reported a lower prevalence of MSDs in the neck, hand, wrist, upper and lower back areas, and one or both thighs.

Conclusion: Safety climate is one of the important factors affecting the prevalence of MSDs. Thus, managers of manufacturing companies should constantly try to improve the safety climate in the workplace to contribute to reducing occupational injuries, especially MSDs.

Keywords: Safety climate, Musculoskeletal disorders, Implementation methods, Participation, Training

Background

Employee health is one of the factors contributing to the success and productivity of modern organizations. Thus, these organizations need to create a suitable organizational climate to have safer and healthier working environments. For this purpose, they should pay attention to the two issues which are the safety climate and human factors to identify hazards and risk factors promptly (1, 2). Human factors or ergonomics can be examined at three macro, meso, and micro levels in organizations. Macro-ergonomics addresses the design of large socio-technical systems, helps to understand more about work-related safety, health status, and other ergonomic variables, and contributes to an increase in productivity and organizational performance (3, 4). Meso-ergonomics is a systematic approach to research and theories in ergonomics and addresses the relation between variables at least at two or more levels, with dependent variables being human factors and different areas of ergonomics. The application of meso-ergonomic interventions in the workplace is important to improve and control risk factors; and improving the safety climate is one of the interventions used in this approach (5, 6). Meso-ergonomics is associated with group work processes, and the safety climate is one of the topics discussed in meso-ergonomics and is classified as a subset of it, and it has a significant effect in reducing the consequences of mechanical occupational hazards, including MSDs (3, 5). Most safety climate factors play an important role in developing MSDs. Besides, the risk of injuries and MSDs, diseases, and depression has been reported to be higher in workplaces with a poor safety climate (7, 8). Micro-ergonomics addresses human interactions with equipment, environment, software, and jobs, and its main goal is to design and manufacture products that are easy to work with and cause less injury to the user.

The safety climate of an organization is defined as employees' collaborative understanding of safety management, and it is a degree of correct and specific beliefs of employees about the issue of safety and the implementation of efficient safety management in the workplace (9-14). The safety climate consists of several dimensions and factors, including management, commitment to safety, the support of supervisors and colleagues for safety, employees' engagement in decision-making and safety activities, employees' safety competence, work pressure, work procedures, safety communication, safety education, risk management, and control; and is measured using the Safety Climate Scale (15, 16).

Previous studies have identified management commitment to safety and employee participation as the most important factors contributing to the safety climate (9). Studies have also reported a significant relation between safety climate and safety performance, especially in occupational injuries (16-19). Since psychosocial factors are effective in increasing the wear and tear of the musculoskeletal system, and with increasing stress, the mental health and subsequently the physical health of people are affected, it can be suggested that the safety climate is an important factor in the occurrence of MSDs. Moreover, an unfavorable safety climate can cause emotional fatigue and, as a result, MSDs in employees (7). The safety climate has been identified as the best guide for safety performance in the organization and support for safe behavior in the manual handling of patients and prevention of MSDs. It also has a great impact on employees' performance and safe behavior (6). Limited studies have directly or indirectly examined the relation between safety climate and MSDs (20). Piirainen et al. showed that the poor safety climate in the workplace increased perceived work-related symptoms and sickness absence (21). Other studies have shown that with an improvement in the safety climate, the number of MSDs is reduced by 15%, and work-related injuries and diseases are also reduced. Some scholars believe that the safety climate is very important in reducing the symptoms of depression and the absence of a suitable safety climate in the workplace can cause health consequences such as MSDs and work-related injuries and diseases (8). Bailey et al. and Swanberg et al. found a significant relation between safety climate and MSDs symptoms. However, Golubovich et al. did not find a significant relation between these two variables (7, 22, 23).

A literature review shows that few studies have addressed the correlation between the safety climate and the prevalence of MSDs in the world. Furthermore, most studies conducted in Iran have examined the safety climate in various manufacturing (9), hospital (24), and mining (25) industries, and no study has addressed the relation between these two variables in Iran. Thus, the present study sought to investigate the relation between the safety climate and the prevalence of MSDs among employees in manufacturing companies in Urmia County.

Methods

This descriptive study was conducted in 15 companies producing food, construction materials, and plastic products in Urmia County. The participants were selected using random sampling. Using Morgan's table and assuming the approximate number of employees in production companies of Urmia County to be 12226 persons, the sample size was estimated as 372 persons. Therefore, 400 questionnaires were distributed among employees working in different units of the companies and 359 questionnaires were received, indicating that only 89.75% of the employees completed the questionnaires.

The participants in each manufacturing company were selected in proportion to the number of employees. Thus, initially the number of participants in each company was specified. Then, taking into account the number of employees in different units, the number of participants in each unit was randomly determined using a random number table. The criteria for enrollment in the study were being employed in a manufacturing company and not being retired, and the exclusion criteria were unwillingness to participate in the study and not completing the questionnaire.

Before completing the questionnaires, the objectives of the study were explained to the participants. They were also assured that their data would remain confidential. The protocol for this study was approved by the Ethics Committee of Urmia University of Medical Sciences with the code of ethics IR.UMSU. REC.1396.326.

The data in this study were collected using the Safety Climate Scale and the Nordic Musculoskeletal Questionnaire. The Safety Climate Scale assesses the demographic data, the experience of work-related accidents, and safety training. The safety climate is measured using 45 items classified into 7 factors, including management commitment to safety and communication (16 items), participation and safety training (8 items), good safety practices (8 items), safety competence (3 items), safety procedures (4 items), accountability and responsibility (3 items), and supportive environment (3 items). The responses to the items are rated on a five-point Likert scale: strongly disagree (1), disagree (2), undecided (3), agree (4), and strongly agree (5). The mean score determined for each item ranges from 1 to 5.

The Safety Climate Scale was developed by Ghahramani and Khalkhali (14) and is used to assess the safety climate in manufacturing companies. The face and content validity and the reliability of the scale were reviewed by university professors and safety officials and employees working in manufacturing companies. The results of the quantitative content validity analysis showed that the scale has an acceptable content validity index (CVI≥ 0.78) and content validity ratio (CVR= 0.38). Factorial analysis of the scale also confirmed its construct validity. The reliability of the scale was confirmed with Cronbach's alpha of 0.96 (14). In the present study, Cronbach's alpha for the whole scale was 0.97, confirming that the instrument has acceptable reliability.

The Nordic Musculoskeletal Questionnaire is one of the valid instruments used to investigate the prevalence of MSDs and has already been used in several seminal studies. The questionnaire was developed in 1987 by Kuorinka et al. at the Nordic Institute for Advanced Training in Occupational Health. Mokhtarinia et al. translated and localized the questionnaire for use in Iran. Their findings confirmed the face validity for all the items in the questionnaire (26). The intraclass correlation coefficient (ICC) (<0.70), standard error of measurement (SEm) (0.56-1.76), and Cohen's kappa coefficient (0.78-1) were also within the acceptable range (27).

The data collected in this study were analyzed using descriptive and inferential statistics. Numerical descriptive indices such as mean, standard deviation, and frequency distribution tables and graphs were used to describe the data. Analysis of variance (ANOVA) was also run to examine the difference in the mean safety climate scores for categorical variables with more than two levels (e.g. education). In addition, t-test was used to check the difference in mean safety climate for dichotomous variables (such as gender). The chi-square test was used to investigate the relation between the safety climate scores and the prevalence of MSDs. To investigate the relation between the safety climate and MSDs, the safety climate was divided into three categories with a score of less than 154, 154 to 180, and higher than 180 based on the 33rd and 66th percentiles.

Results

As shown in Table 1, a majority of the participants were male and married. Besides, 140 participants had secondary school education and 221 of them were working in the production lines of their companies. Most of the participants were aged 31 to 39 years and the lowest number of participants were 60 years and older. The participants' mean age was 35.71±9.28 years, their service record in each job was 10.52±6.16 years, and their experience in the current job was 8.97±0.331 years.

Table 1. The participants' demographic characteristics

Variable	Categories	Frequency (%)	Variable	Categories	Frequency (%)
Gender	Female	44 (12.3%)	Occupation	Production	221 (61.6%)
	Male	315 (87.7%)		Repair	55 (15.3%)
Marital status	Single	73 (20.3%)		Office work	47 (13.1%)
	Married	285 (79.7%)		Warehouse	20 (5.6%)
Education	Illiterate	28 (7.8%)		Others	16 (4.5%)
	Primary school	30 (8.4%)	Age (year)	< 30	107 (29.8%)
	Middle school	59 (16.4%)		31-39	122 (34%)
	High school	140 (39%)		40-49	109 (30.4%)
	Academic education	102 (28.4%)		50-59	18 (5%)
				60 and older	3 (0.8)
Work experience (year)	< 1	20 (5.6%)	Experience in the current job (year)	< 1	34 (9.5%)
	1-5	86 (24%)		1-5	103 (28.7%)
	6-10	95 (26.5%)		6-10	104 (29%)
	> 10	158 (44%)		> 10	118 (32.9%)
Total			359 persons		

The findings showed that the safety procedures have the highest score (3.88±0.71) and employee participation and training had the lowest score (3.42±0.81) (ranging from 1 to 5) (Table 2). The participants reported the most MSDs in the last year in one or both knees, and MSDs were less frequently reported in the elbow (Table 3).

Table 2. The descriptive statistics for the safety climate factors

Factors	Mean	Std. Deviation
Management commitment to safety and communication	3.61	0.87
Participation and safety training	3.42	0.81
Good safety practices	3.63	0.86
Safety competence	3.75	0.79
Safety procedures	3.88	0.71
Accountability and responsibility	3.57	0.77
Supportive environment	3.63	0.94
Mean	3.64	0.68

Table 3. The descriptive statistics for MSDs in the last year

Affected area	Frequency	Percentage
Neck	57	15.9%
Shoulders	33	9.2%
Elbows	14	3.9%
Hands and wrists	29	8.1%
Upper back	62	17.3%
Lower back	52	14.5%
One or both thighs	19	5.3%
One or both knees	64	17.8%
One or both feet	29	8.1%

As can be seen in Table 4, there was a significant relation between the safety climate and the pain in the neck, elbow, and upper and lower back reported by the participants in the past year. Thus, the employees in the workplace with a poor safety climate reported a higher prevalence of pain. Although there was a significant relation between the safety climate and back pain and pain in one or both feet, there was no clear trend of decreasing or increasing the prevalence of pain in different safety climate categories.

Table 4. The chi-square results for the relation between the safety climate and the prevalence of MSDs

Affected area	Pain	Safety climate levels			Chi-square	P-value
		1	2	3		
Neck	Yes	36	22	19	8.57	0.014
	No	82	109	91		
Shoulders	Yes	22	14	11	4.78	0.09
	No	96	117	99		
Elbows	Yes	15	7	5	6.86	0.03
	No	103	124	105		
Hands and wrists	Yes	20	11	10	5.34	0.07
	No	98	120	100		
Upper back	Yes	31	15	21	9.01	0.011
	No	87	116	89		
Lower back	Yes	41	16	9	32.01	0.001
	No	77	115	101		
One or both thighs	Yes	12	6	6	3.49	0.17
	No	106	125	104		
One or both knees	Yes	31	23	21	3.16	0.20
	No	87	108	89		
One or both feet	Yes	17	7	8	6.80	0.03
	No	101	124	102		

The findings in this study revealed that the participants' gender was significantly associated with the mean scores of the safety climate, good safety practices, safety procedures, and supportive environment. Besides, the female participants had a higher mean score than the male participants. Data analysis also showed that a experience of participating in training courses was significantly correlated with the mean score for the safety climate and all factors of the safety climate. Thus, the participants attending training courses reported higher scores on the safety climate and related factors compared to the employees who did not attend the training courses. The data also indicated that the safety climate and its factors were not significantly correlated with marital status, employment status, company ownership, and a experience of work-related accidents.

The results confirmed a significant relation between the participants' education and supportive environment, and participants with higher education reported higher scores for a supportive environment. The data analysis also showed the participants' occupations were significantly associated with management commitment to safety and communication and good safety practices. Thus, the participants who worked in the production line gained higher scores on the mentioned factors than the participants engaging in other occupational groups. The results of Tukey's post hoc test indicated that the participants engaged in manufacturing jobs reported a higher level of management commitment to safety and communication than the participants who worked in the warehouse. However, there was no significant difference in the attitudes of the participants engaged in different occupational groups toward good safety practices.

The data analysis also showed that the mean scores for the safety climate, management commitment to safety and communication, employee participation and training, good safety practices, safety competence, safety procedures, accountability and responsibility, and supportive environment were different among employees in manufacturing companies. The employees working in larger manufacturing companies reported higher scores compared to those working in smaller companies. The results of Tukey's post hoc test indicated that the employees working in manufacturing companies had significant differences in terms of various factors. For example, the employees in large manufacturing companies highlighted management commitment to safety and communication significantly more frequently than the employees working in smaller manufacturing companies.

Discussion

The findings of this study suggested that the employees who reported a higher safety climate score reported a lower prevalence of MSDs in the neck, elbow, and upper and lower back. Similarly, Arcury et al. in their study of agricultural workers in North Carolina, USA, concluded that the poor safety climate in the workplace causes health consequences such as MSDs, work-related injuries, or illness (8). Bailey et al.'s study on workers working in various Australian industries also showed that safety climate is a predictor for psychosocial mechanisms that cause occupational injuries such as MSDs among employees (7). The results of these studies indicated that the existence of a poor safety climate in the workplace can lead to an increase in occupational injuries, including MSDs. Thus, a suitable safety climate can be considered one of the important factors in reducing the prevalence of MSDs. Furthermore, improving the safety climate in manufacturing companies can contribute to preventing occupational injuries such as MSDs.

According to the findings of this study, safety procedures obtained the highest score and employee participation and training obtained the lowest score. Similarly, Ghahramani reported that safety procedures obtained the highest score and employee training obtained the lowest score in Urmia manufacturing companies (9). Moreover, Moghani Bashi Mansourieh et al. found that the safety management commitment had the highest score and the staff awareness of safety had the lowest score in the staff working in rehabilitation clinics in Ahvaz (27). Thus, safety training can play a vital role in improving people's understanding of a safe environment; and providing high-quality safety training can help improve the safety climate and reduce work-related injuries (9). Moreover, since the data in the present study confirmed the lowest scores on employee participation and training, employee training can increase their engagement in safety procedures, improve the safety climate, and reduce occupational injuries. A survey of safety climate from the viewpoints of nurses working in one of the hospitals in Urmia County by Hajaghazadeh et al. indicated safety communication had the highest score and safety priority and management ability gained the lowest score (24). This finding was not consistent with the data in the present study. This disparity could be attributed to different research settings (i.e. hospitals and manufacturing companies) in the two studies.

The data in this study showed that the safety climate had a significant relation with gender, and the female participants had a higher mean score than the male participants. Similarly, Wu et al. found a significant difference between gender and safety climate among employees of universities and colleges in Taiwan (28). However, a study by Moghani Bashi Mansourieh et al. on rehabilitation staff and Kho et al.'s study on staff in intensive care units in Canada found no significant difference between gender and safety climate (27,29). Gender affects the prevalence of MSDs, and MSDs are more common in women than in men. Since most of the workstations are designed according to the anthropometric dimensions of men and as women have less muscle volume, they are more exposed to work-related risk factors and thus they are more likely to develop MSDs.

The findings of the present study also confirmed a significant relation between training and safety climate. Holding training courses improves employees' belief in management's commitment to safety issues, and people working in the organization consider their work environment safe and see it as a place where there are no safety and health concerns. Training interventions increase people's awareness of occupational hazards and ultimately strengthen communication among employees at different organizational levels. People in these organizations are obliged to inform the managers about the safety issues in the workplace, and they should show more strict reactions to people who ignore safety protocols, and this illuminates the vital role of managers in improving the safety climate in the workplace (30).

The findings of the present study indicated that the safety climate was significantly different among employees in manufacturing companies. Previous studies in different industries in the United States have shown that the prevalence of injuries was much lower in companies with a better safety climate than in companies with a poor safety climate (31, 32), as was confirmed in the present study. Other studies have shown that in manufacturing companies with a better safety climate, the management commitment to safety issues improves employees' safety performance and prevents MSDs. Management commitment to safety and awareness of problems and a positive attitude toward safety are effective in promoting safety and have a significant impact on preventing injuries (33). When employees have positive attitudes towards safety and engage in safety protocols, they will engage in safer behaviors. As a result, risks will be effectively managed, and injuries and material damage will be prevented.

This study explored the relation between safety climate and the prevalence of MSDs among workers in manufacturing companies located in Urmia County. The findings of this study are significant due to the limited number of studies in this field. However, this study was conducted with some limitations. Given the absence of the university-industry liaison and the lack of a culture of research in the industries, it was not easy to get permission from company managers to conduct the study. However, since there was a great cultural difference between the employees in the studied companies and other manufacturing companies, the findings of the study can only be generalized to the production companies in Urmia. As this study was conducted using cross-sectional data, the findings of the study represent the participants' opinions in the short term. Moreover, the data were collected using self-report instruments. Thus, at the time of completing the questionnaires, ambiguous questions were explained for further clarification.

Conclusion

The findings of this study showed that the employees who gained a higher safety climate score reported a lower prevalence of MSDs in the neck, hand, wrist, upper and lower back, and one or both thighs. Thus, the safety climate can be considered one of the important factors in the prevalence of MSDs in manufacturing companies. Accordingly, company managers should try to improve the safety climate in the workplace. Considering the low levels of employee participation and training, manufacturing companies should make more efforts to identify their organizational weaknesses and solve the existing problems.

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Conflict of interest

The authors reported no conflict of interest.

References

1. Kanten S. The relationships among working conditions, safety climate, safe behaviors, and occupational accidents: An empirical research on the marble workers. The Macrotheme Review. 2013; 2(4): 173-82.
2. Khandan M, Vosoughi S, Maghsoudipour M. Evaluation of safety climate factors-a macroergonomic approach: A case study in Iran. Iranian Rehabilitation Journal. 2012; 10(1): 43-6.
3. Karsh BT, Waterson P, Holden RJ. Crossing levels in systems ergonomics: A framework to support 'Mesoergonomic' inquiry. Appl Ergon. 2014; 45(1): 45-54. doi: 10.1016/j.apergo.2013.04.021.
4. Murphy L, Robertson M, Huang Y, Dainoff M, Jeffries S (Eds). A macroergonomic approach to examining safety climate in the trucking industry. Proceedings 19th Triennial Congress of the IEA, Melbourne 9-14 August; 2015.
5. Cole DC, Wells RP, Frazer MB, Kerr MS, Neumann WP, Laing AC, et al. Methodological issues in evaluating workplace interventions to reduce work-related musculoskeletal disorders through mechanical exposure reduction. Scand J Work Environ Health. 2003; 29(5): 396-405. doi: 10.5271/sjweh.746.
6. Fray M, Waterson P, Munro C. Macro and micro ergonomic outcomes in healthcare: Unraveling the relationship between patient handling performance and safety climate. IISE Trans Occup Ergon Hum Factors. 2015; 3(1): 58-71. doi: 10.1080/21577323.2014.989338.
7. Bailey TS, Dollard MF, McLinton SS, Richards PA. Psychosocial safety climate, psychosocial and

physical factors in the etiology of musculoskeletal disorder symptoms and workplace injury compensation claims. Work Stress. 2015; 29(2): 190-211. doi: 10.1080/02678373.2015.1031855.

8. Arcury TA, O'Hara H, Grzywacz JG, Isom S, Chen H, Quandt SA. Work safety climate, musculoskeletal discomfort, working while injured, and depression among migrant farmworkers in North Carolina. Am J Public Health. 2012; 102 Suppl 2(Suppl 2): 272-8. doi: 10.2105/AJPH.2011.300597.

9. Ghahramani A. An investigation of safety climate in OHSAS 18001-certified and non-certified organizations. Int J Occup Saf Ergon. 2016; 22(3): 414-21. doi: 10.1080/10803548.2016.1155803.

10. Dov Z. Safety climate and beyond: A multi-level multi-climate framework. Safety Science. 2008; 46(3): 376-87.doi.org/10.1016/j.ssci.2007.03.006.

11. Bamel UK, Pandey R, Gupta A. Safety climate: systematic literature network analysis of 38 years (1980-2018) of research. Accid Anal Prev . 2020; 135: 105387.doi.org/10.1016/j.aap.2019.105387.

12. Andersen LP, Nørdam L, Joensson T, Kines P, Nielsen KJ. Social identity, safety climate and self-reported accidents among construction workers. Construction Management and Economics. 2018; 36(1): 22-31. doi: 10.1080/01446193.2017.1339360.

13. Oah S, Na R, Moon K. The influence of safety climate, safety leadership, workload, and accident experiences on risk perception: A study of Korean manufacturing workers. Saf Health Work. 2018; 9(4): 427-33. doi: 10.1016/j.shaw.2018.01.008.

14. Ghahramani A, Khalkhali HR. Development and validation of a safety climate scale for the manufacturing industry. Saf Health Work. 2015; 6(2): 97-103. doi: 10.1016/j.shaw.2015.01.003.

15. Mohamed S. Safety climate in construction site environments. J Constr Eng Manag . 2002; 128(5): 375-84. doi: 10.1061/(ASCE)0733-9364(2002)128:5(375).

16. Chen Y, McCabe B, Hyatt D. Impact of individual resilience and safety climate on safety performance and psychological stress of construction workers: A case study of the Ontario construction industry. J Safety Res. 2017; 61: 167-76. doi: 10.1016/j.jsr.2017.02.014.

17. Probst TM, Goldenhar LM, Byrd JL, Betit E. The safety climate assessment tool (S-CAT): A rubric-based approach to measuring construction safety climate. J Safety Res. 2019; 69: 43-51. doi: 10.1016/j.jsr.2019.02.004.

18. Kalteh HO, Mortazavi SB, Mohammadi E, Salesi M. The relationship between safety culture and safety climate and safety performance: A systematic review. Int J Occup Saf Ergon. 2021; 27(1): 206-16. doi: 10.1080/10803548.2018.1556976.

19. Zadow AJ, Dollard MF, Mclinton SS, Lawrence P, Tuckey MR. Psychosocial safety climate, emotional exhaustion, and work injuries in healthcare workplaces. Stress Health. 2017; 33(5): 558-69. doi: 10.1002/smi.2740.

20. Bronkhorst B, Vermeeren B. Safety climate, worker health, and organizational health performance: Testing a physical, psychosocial and combined pathway. Int J Workplace Health Manag. 2016; 9(3): 270-89. doi: 10.1108/IJWHM-12-2015-0081.

21. Piirainen H, Räsänen K, Kivimäki M. Organizational climate, perceived work-related symptoms and sickness absence: A population-based survey. J Occup Environ Med. 2003; 45(2): 175-84. doi: 10.1097/01.jom.0000052957.59271.f4.

22. Swanberg J, Clouser JM, Gan W, Flunker JC, Westneat S, Browning SR. Poor safety climate, long work hours, and musculoskeletal discomfort among Latino horse farm workers. Arch Environ Occup Health. 2017; 72(5): 264-71. doi: 10.1080/19338244.2016.1216387.

23. Golubovich J, Chang CH, Eatough EM. Safety climate, hardiness, and musculoskeletal complaints: A mediated moderation model. Appl Ergon. 2014; 45(3): 757-66. doi: 10.1016/j.apergo.2013.10.008.

24. Hajaghazadeh M, Hossein Marvimilan, Farrokhi F, Orujlu S. Survey of safety climate from the viewpoints of nurses working in one of the hospitals in Urmia County, Iran, in 2014. Journal of Health and Safety at Work. 2016; 6(2): 69-78.

25. Khaleghinejad A, Ziaaldini M. Relationship between employees' safety climate and safety performance with respect to mediating effect of safety knowledge and safety motivation in Sarcheshmeh copper complex. J Health Saf Work 2015; 5(4) :69-86 [In Persian]

26. Mokhtarinia H, Shafiee A, Pashmdarfard M. Translation and localization of the extended nordic musculoskeletal questionnaire and the evaluation of the face validity and test-retest reliability of its persian version. Iran J Ergon. 2015; 3(3): 21-9.

27. Moghani Bashi Mansourieh E, Faraji Khiavi F, Ravanbakhsh M, HaghighiZade MH. Study of safety climate in rehabilitation clinics in Ahwaz city. Journal of Safety Promotion and Injury Prevention. 2015; 3(1): 43-8. [In Persian]

28. Wu TC, Liu CW, Lu MC. Safety climate in university and college laboratories: Impact of organizational and individual factors. J Safety Res. 2007; 38(1): 91-102. doi: 10.1016/j.jsr.2007.01.003.

29. Kho ME, Perri D, McDonald E, Waugh L, Orlicki C, Monaghan, et al. The climate of patient safety in a Canadian intensive care unit. J Crit Care. 2009; 24(3): 469.e7-13. doi: 10.1016/j.jcrc.2008.05.002.

30. Yeung KC, Chan CC. Measuring safety climate in elderly homes. J Safety Res. 2012; 43(1): 9-20. doi: 10.1016/j.jsr.2011.10.009.

31. Huang YH, Chen JC, DeArmond S, Cigularov K, Chen PY. Roles of safety climate and shift work on perceived injury risk: A multi-level analysis. Accid Anal Prev. 2007; 39(6): 1088-96. doi: 10.1016/j.aap.2007.02.006.

32. Smith GS, Huang YH, Ho M, Chen PY. The relationship between safety climate and injury rates across industries: The need to adjust for injury hazards. Accid Anal Prev. 2006; 38(3): 556-62. doi: 10.1016/j.aap.2005.11.013.

33. Fernandez Muñiz B, Montes Peón JM, Vázquez Ordás CJ. Safety climate in OHSAS 18001-certified organizations: Antecedents and consequences of safety behavior. Accid Anal Prev. 2012; 45: 745-58. doi: 10.1016/j.aap.2011.10.002.