

# Research Paper: Assessing the Factors Predicting Work-Related Musculoskeletal Disorders Among Iranian Port's Personnel Using Regression Model



Mohammad Khandan<sup>1</sup>, Alireza Koohpaei<sup>2</sup>, Mina Kohansal Aghchay<sup>2</sup>, Mohammad Hossein Ebrahimi<sup>3</sup>, Alireza Khammar<sup>4</sup>, Shahram Arsang Jang<sup>5</sup>, Mohsen Poursadeghiyan<sup>6\*</sup>

1. Department of Ergonomics, School of Health, Qom University of Medical Sciences, Qom, Iran.
2. Department of Occupational Health Engineering, School of Health, Qom University of Medical Sciences, Qom, Iran.
3. Environmental and Occupational Health Research Center, Shahroud University of Medical Sciences, Shahroud, Iran.
4. Department of Occupational Health Engineering, Faculty of Health, Zabol University of Medical Sciences, Zabol, Iran.
5. Department of Epidemiology and Biostatistics, School of Health, Qom University of Medical Sciences, Qom, Iran.
6. Research Center in Emergency and Disaster Health, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.



**Citation:** Khandan M, Koohpaei A, Kohansal Aghchay M, Ebrahimi MH, Khammar A, Arsang Jang Sh, et al. Assessing the Factors Predicting Work-Related Musculoskeletal Disorders Among Iranian Port's Personnel Using Regression Model. Iranian Rehabilitation Journal. 2017; 15(4):309-316. <https://doi.org/10.29252/NRIP.IRJ.15.4.309>

**doi:** <https://doi.org/10.29252/NRIP.IRJ.15.4.309>

## Article info:

**Received:** 19 Apr. 2017

**Accepted:** 26 Jul. 2017

## Keywords:

Mental Health, Safety culture, Musculoskeletal diseases, Port, Iran

## ABSTRACT

**Objectives:** Nowadays, ports are considered a portal for business as well as the main infrastructure for economic development worldwide. Genetic predisposition, work activity and procedures, and psychosocial preparedness are the main factors responsible for the occurrence of Work-Related Musculoskeletal Disorders (WRMSDs). The present study aimed to assess psychosocial variables affecting WMSDs in an Iranian port in 2015.

**Methods:** All workers of a port (n=60) located in the south of Iran were included in the present study. Job burnout and safety climate were assessed by MBI and SCQ, respectively. In addition, musculoskeletal disorders were reported by body map questionnaire. Data analysis was performed by ANOVA, logistic regression analysis, Pearson correlation, and t-test using SPSS V20.

**Results:** Based on the obtained data, 40 workers (66.7%) experienced musculoskeletal pain in at least one part of their bodies in the previous year. Also, job burnout score was  $76.17 \pm 8.9$  and safety climate was  $188.7 \pm 23.07$ . Logistic regression revealed that job burnout, emotional fatigue ( $P < 0.05$ ), safety attitude, and emergency management are the most important predictors of WRMSDs.

**Discussion:** Psychological factors of workplaces include job burnout, employees' attitude and safety climate that negatively affect ergonomic disorders. Since psychological and psychosocial issues are neglected in developing countries such as Iran, the researchers anticipate that the obtained results can be used as a guideline for policymakers as well as in the supportive and preventive arena for managing safety and health issues.

## \* Corresponding Author:

**Mohsen Poursadeghiyan, PhD**

**Address:** Research Center in Emergency and Disaster Health, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.

**Tel:** +98 (21) 22180160

**E-mail:** [mo.poursadeghiyan@uswr.ac.ir](mailto:mo.poursadeghiyan@uswr.ac.ir)

## 1. Introduction

Currently, ports are considered as a portal for business and as the main infrastructure for economic development worldwide. Hence, most ports are looking for achieving competitiveness and opportunities at the international level. In order to create competitive advantage, the continuous development of ports is dependent on knowledge about their performance, geographical or geopolitical location, resources, strengths, and limitations [1]. Transportation management in unusual conditions is the most important task in a port. On this basis, physical and mental disorders caused by physical activity and psychosocial, time and work pressures are anticipated.

Work-Related Musculoskeletal Disorders (WRMSDs) are one of the major causes of occupational stress, inefficiency, lack of performance, and occupational disability in the industrialized world [2-6]. Those jobs with manual handling tasks are at risk of ergonomics problems [7, 8]. WRMSDs are involved with various organs of the body like neck, shoulder, arms, and the back [9, 10]. Genetic predisposition, work activity, and procedures and psychosocial preparedness are the main factors in the occurrence of WRMSDs [2]. Although factors such as physical demand and requirements are considered as work-related risk factors to musculoskeletal system [11, 12], the bio-psycho-social pattern is of a higher priority. Workplace factors like physical work, repetitive tasks, and poor postures led to WRMSDs. However, the role of psychosocial factors in the workplace has been progressive in recent years as well as the attitudes, views, and the understanding of staffs regarding the safety issues in their organization [13]. Studies in the field of disability have shown that psychosocial factors are equally important (and sometimes even more) to physical agents [6].

Several models have presented psychosocial factors as the main cause of job stress that leads to an increasing risk of WRMSDs [13]. Human reactions to stress have a complex mechanism, and burnout is one of such reactions [14, 15]. Burnout is a term used to describe the negative changes in attitude, mood, and behavior when dealing with work-related stress. It leads to changes in behavior and professional attitude [16, 17]. Burnout is a common problem in working communities [18] and is affected by work pressure, type of occupation, conflicts, and poor working conditions [18]. It is associated with physical symptoms such as headaches and gastrointestinal signs and behavioral symptoms such as lack of performance and absenteeism that lead to early retirement and decrease the quality of work [18]. The continuous

organizational changes worldwide have led to the emergence of new terms in the field of professional safety and health [19]. One of these new terms is organizational safety climate [20]. Safety climate represents the level of a manager's interest in safety issues as well as the degree of participation of employees in their workplace risk control [21]. In fact, safety culture is a part of the organizational culture and is related to resources and safety in an organization [22]. Safety climate is the outer layer of the safety culture [23]. In an industrial setting, researchers have shown that a positive attitude towards safety, management commitment, and suitable safety climate leads to better adoption of occupational safety measures and reduced occupational accidents [21].

Given this background, the present study aimed to develop and identify bio-psychosocial variables affecting workers in a port of Iran. The researchers anticipated that the obtained results can be used as a guideline for policymakers as well as in the supportive and preventive arena in terms of safety and health issues.

## 2. Methods

The studied population included all staffs (60 persons) working in one of the ports located in the south of Iran in 2015. The employees were classified into seven occupational groups. The defined variables were analyzed and evaluated based on the standard questionnaires. In this study, a demographic questionnaire was used to collect data about age, gender, relevant work experience, number of training courses, and level of education. A valid questionnaire presented by Vinod Kumar and M. Bhasi [24, 25] was used for safety climate assessment. Its responses were presented using a 5-point Likert scale, ranging from strongly disagree to strongly agree. The Safety Climate Questionnaire (SCQ) is made up of six categories and contains 49 questions.

The SCQ categories are 1) Management commitment and actions for safety [F1], 2) Workers' knowledge and compliance to safety [F2], 3) Workers' attitudes towards safety [F3], 4) Workers' anticipation and commitment to safety [F4], 5) Safeness of work environment [F5], and 6) Emergency preparedness in the organization [F6]. The SCQ score for each test ranged from 49 to 245. The standard Maslach Burnout Inventory (MBI) tool was used for burnout assessment with 22 items [26]. The questionnaire included a 7-point Likert scale for each question (0-6). The MBI score for each test ranged from 0 to 132. A body map questionnaire was used for the assessment of musculoskeletal disorders [27].

Data analysis was performed using one-way analysis of variance, backward stepwise logistic regression analysis, post hoc test, Pearson's correlation, and t-test using SPSS software, version 20. All ethical considerations of the research were considered in accordance with the international guidelines and were approved by the Ethics Committee.

### 3. Results

Of the total 60 included subjects, 58 people (96.7%) were male and the others were female. The mean age was calculated to be  $31.58 \pm 5.7$  years with median of 30.00. Their mean experience of work was  $7.75 \pm 4.7$  years, and its median was 6.50. In the present study, seven different occupational groups were examined. Their information is shown in Table 1. Fifteen people had lower than diploma degree (25%), 22 had diploma degree (36.7%), 10 had and associate degree (16.7%), and the remaining 13 (21.7%) had licenses or higher degree. The majority of the studied population (78.3%) was married. The personnel had participated in 8.42 training courses about occupational safety.

Musculoskeletal disorders: The incidence of WRMSD was studied. According to the obtained results, 40 workers (66.7%) had experienced musculoskeletal pain in one part of their bodies during the past year. 23.4% had reported pain in two or three parts of their bodies, and 9.9% had reported pain in more than three parts of their bodies. The prevalence of musculoskeletal disorders in

different body areas of the selected staffs is shown in Table 2. Based on Table 2 both the number and percentage of the impaired population from musculoskeletal disorders have been indicated.

Burnout: Based on the obtained data, the mean and standard deviation for burnout score were  $76.17 \pm 8.9$ . In the present study, reliability by Cronbach's alpha was obtained to be 0.5. Safety climate: Our data showed that the mean and standard deviation of safety climate score was  $188.7 \pm 23.07$ . Also, the reliability of the questionnaire by Cronbach's alpha was 0.88. The obtained results by Pearson's correlation test showed that there was a significant difference between safety climate and age ( $P=0.05$ ), work experience ( $P=0.02$ ), and safety training ( $P=0.06$ ). No differences were illustrated through using ANOVA test among education levels and job groups ( $P<0.05$ ).

Relations among variables: The number of body parts with musculoskeletal disorders did not significantly differ from demographic variables ( $P>0.05$ ). However, the difference was statistically significant between job burnout and the number of body parts with musculoskeletal disorders ( $P<0.05$ ). Also, in order to evaluate the relationship between independent variables (burnout and safety climate) with musculoskeletal disorders (existence/ non-existence), as dependent variable, backward stepwise logistic regression analysis was used with the commonly-used cut-off point of 0.1 [28]. The detailed results are given in Tables 3 and 4.

Table 1. Frequency and percentage of people in different occupational groups (n=60)

Occupation Groups	Navigation	Mechanics	Fire Fighting	Emergency	Welding	Electronics	Administrative
Frequency	7	12	10	4	5	20	2
%	11.7	20	16.7	6.7	8.3	33.3	3.3

Iranian Rehabilitation Journal

Table 2. Description of WRMSDs in various parts of the body (n=60)

Part of the Body	R. Ankle	L. Ankle	R. Thighs / Hips	L. Thighs / Hips	R. Hand	L. Hand	R. Bottom	L. Bottom	R. Elbow	L. Elbow	Lower Back	R. Arm	L. Arm	Upper Back	R. Shoulder	L. Shoulder	Neck
Frequency	3	2	1	1	3	1	0	0	0	1	19	2	3	5	5	1	8
%	5	3.33	1.66	1.66	5	1.66	0	0	0	1.66	31.66	3.33	5	8.33	8.33	1.66	13.33

Iranian Rehabilitation Journal

**Table 3.** Description of job burnout, safety climate and their sub-factors (n=60)

Variables	Min.	Max.	Mean	SD	Median
Job burnout	61	100	76.17	8.903	74.50
Emotional exhaustion	9	48	22.45	11.906	18.00
Personal accomplishment	25	55	41.43	7.939	43.00
Depersonalization	5	21	8.45	4.28	7.00
Safety climate	134	239	188.70	23.073	189.5
F1	51	118	90.84	14.522	92.00
F2	16	35	30.13	3.811	31.00
F3	5	25	22.65	2.845	23.00
F4	5	25	21.65	3.047	22.00
F5	3	15	13.12	2.624	14.00
F6	5	18	10.70	3.326	11.00

Iranian Rehabilitation Journal

**Table 4.** Final model of the main factors predicting WRMSDs

Variables	B	S.E.	P	Exp. ( $\beta$ )*	CI 95%	
					U	L
Job burnout	0.283	0.114	0.013	1.327	1.661	1.061
Emotional exhaustion	-0.302	0.121	0.013	0.74	0.938	0.583
Personal accomplishment	-0.209	0.113	0.065	0.811	1.013	0.65
F3	-0.369	0.218	0.091	0.691	1.060	0.45
F6	0.230	0.139	0.098	1.258	1.652	0.959

Iranian Rehabilitation Journal

\*exp ( $\beta$ ) (the odds multiplier) was used as the odds ratio for a unit increase or decrease in the explanatory variable.

#### 4. Discussion

In analyzing the relationship between demographic characteristics and variables related to safety climate and job burnout, the results suggest that safety climate was significantly different in various age groups of employees, their work experience, and occupational safety training ( $P < 0.05$ ). This indicates that with increasing age, work experience, and numbers of training courses, job burnout would be reduced and safety climate would increase in the workplace [28].

Increasing age and job tenure will bring the element of experience. The mix of experience and personal development courses in the form of training will improve the attitude of the personnel toward the efficacy of safety and predictive systems [28]. In addition, the number of body areas that have suffered from musculoskeletal disorders were in relation with burnout ( $P < 0.05$ ). There-

fore, increasing the severity of job burnout could raise musculoskeletal disorders. The obtained result was in line with an extensive meta-analysis study conducted on 186,440 samples of 203 separate studies [29]. Based on that meta-analysis, there was a positive relationship between risks and hazards in the workplace and health problems and job burnout and a negative correlation between burnout and safe work [29].

Azari and Davudian Talab reported that job burnout and musculoskeletal disorders were directly correlated [18]. Musculoskeletal disorders and job burnout are in direct relation with the amount of work-related risk and stress [30, 31]. Occupational stress can be defined as an imbalance between job requirements and individual abilities in work [32]. High levels of stress in the workplace will lead to job dissatisfaction. Furthermore, stress may also be caused by harmful environmental factors in the workplace such as noise, inadequate lighting, low

level of ventilation, physiological stressors, aggressive behaviors, and low levels of job security [33]. Studies have shown that prolonged and/or high-level stress can cause physiological changes that may result in health problems or even death. In addition, studies have shown the associations between high stress and cardiovascular disease, immune system problems, depression and musculoskeletal disorders [33]. The importance of research in the field of safety climate can be found in various papers [23, 24, 33, 34].

Safety climate is a critical criterion for safety and is known as a predictor of work-related accidents occurrence and recognition. Hence, the measurement of factors affecting safety, especially leadership, can help to reduce accidents [32]. On the other hand, regards to being multi-factors and importance of analyzing them more accurate, it is combined with decision making models [33, 35].

Also, this psychological factor can decrease non-ergonomic behaviors, which cause musculoskeletal disorders [25]. In general, a safety climate provides useful information around safety management from the employees' viewpoint [24]. Among the various factors considered in different tools of safety climate, management commitment is one of the most vital issues. The second is workers' attitude toward safety and danger. Beside them, safety process and system importance such as training, communication and acceptance of safety orders are some other recognized aspects of safety climate around the world [24]. The findings of t-test illustrated that with equality of variances, job burnout's sub-factors (Emotional Exhaustion, Depersonalization, and Personal Accomplishment) had similar effects while safety climate's sub-factors (Workers' attitudes towards safety, and Emergency preparedness in the organization) had different effects.

By comparing safety climate among occupational groups, only Electronics and Navigation differed significantly ( $P < 0.05$ ). The final model depicted that job burnout, personal accomplishment, emotional exhaustion, workers' safety attitude, and emergency preparedness remained in analysis and that two variables of job burnout and emotional exhaustion were statistically significant ( $P < 0.05$ ). Thus, these variables can be considered as predictors of WRMSDs. This means if the score for job burnout increased, WRMSDs would increase to 1.327, but WRMSDs would decrease if emotional exhaustion increased. This indicates that while workers are exhausted emotionally, they feel overextended and do their tasks slowly with many hesitations. On the other hand, their tasks were physically, therefore lower physical activity and then lower WRMSDs. It should be considered that

it would lead to lower levels of productivity in human resources and organizations. Effective training courses in the field of safety can enhance safety attitude since it has been proved that administrative interventions like training can lead to reduced accidents [36].

## 5. Conclusion

The present study showed that psychological factors including burnout, job dissatisfaction, and employees' attitude toward safety, organization and management performance in workplaces can negatively and directly affect the prevalence of ergonomic disorders and occupational accidents in the workplace. So, by taking into account the psychological and social factors, decision-makers in the field of occupational health and safety can improve work conditions in the future.

## Acknowledgments

The study funding was provided by the researchers. Also, the authors would like to thank all honorable managers and staff of the studied port for their gracious cooperation.

## Conflict of Interest

The authors declared no conflicts of interest.

## References

- [1] Parizadi P, Asadi S, Ghelichi MM, Sheikhi H. [Survey and analysis of relative benefits opportunities of regional development in north ports of Iran using integrated TOPSIS and ELECTRE techniques (Persian)]. *Journal of Regional Planning*. 2012; 2(6):15-29.
- [2] Marzban A, Adibi M, Tavakoli M. [Importance and standing of ergonomics (human factors) and survey of amount and causes of musculoskeletal disorders prevalence among operational workers of Abadan port along with correcting actions (Persian)]. Abadan: Abadan Ports and Shipping Office; 2006.
- [3] Khandan M, Eyni Z, Manesh LA, Khosravi Z, Biglari H, Koohpaei A, et al. Relationship between musculoskeletal disorders and job performance among nurses and nursing aides in main educational hospital in qom province, 2014. *Research Journal of Medical Sciences*. 2016; 10(4):307-12. doi: 10.3923/rjmsci.2016.307.312
- [4] Khandan M, Ataemanesh L, Eyni Z, Khosravi Z, Biglari H, Koohpaei A, et al. Relationship between job content and demographic variables with musculoskeletal disorders among nurses in a university hospital, Qom Province, 2014. *Research Journal of Applied Sciences*. 2016; 11(7):547-53. doi: 10.3923/rjasci.2016.547.553

- [5] Khandan M, Sakhaei Z, Koohpaei AR. [Surveying the relationship between musculoskeletal disorders and Occupational stress among Iranian truck drivers (Persian)]. *Iran Occupational Health*. 2016; 13(2):39-49.
- [6] Azizi A, Dargahi A, Amirian F, Mohammadi M, Mohammadi S, Oghabi MA, et al. Investigation the prevalence of work-related musculoskeletal disorders (WRMSDs) among factories packaging workers in Kermanshah (2015). *Research Journal of Medical Sciences*. 2016; 10(4):319-24.
- [7] Khandan M, Koohpaei AR, Nili M, Farjami Y. Occupational musculoskeletal disorders management using Fuzzy TOPSIS Assessment of Repetitive Tasks (ART). *Work*. 2017; 56(2):267-76. doi: 10.3233/WOR-172491.
- [8] Nazari H, Hossaini Mahjoob H, Tapak L, Mortazavi S. Prevalence of work-related musculoskeletal disorders and injuries in occupational and physical therapists and its comparison. *Iranian Rehabilitation Journal*. 2017;15(1):31-6. doi: 10.18869/irip.irj.15.1.31
- [9] Khandan M, Koohpaei A. [Assessment and analysis of ergonomics conditions based on TOPSIS in a manufacturing company (Persian)]. *Iran Occupational Health*. 2016; 13(5):98-108.
- [10] Omidianidost A, Hosseini S, Jabari M, Poursadeghiyan M, Dabirian M, Charganeh SS. The relationship between individual, occupational factors and LBP (Low Back Pain) in one of The auto parts manufacturing workshops of Tehran in 2015. *Journal of Engineering and Applied Sciences*. 2016; 11(5):1074-7. doi: 10.3923/jeasci.2016.1074.1077
- [11] Kohammadi HY, Sohrabi Y, Poursadeghiyan M, Rostami R, Tabar AR, Abdollahzadeh D, et al. Comparing the posture assessments based on RULA and QEC methods in a carpentry workshop. *Research Journal of Medical Sciences*. 2016; 10(3):80-3. doi: 10.3923/rjmsci.2016.80.83
- [12] Koohpaei A, Khandan M, Vosoughi S, Khammar A, Mobinazade V, Farrokhi M, et al. Industrial workers' postures analysis by a new method named "loading on the upper body assessment" in Iran. *Annals of Tropical Medicine and Public Health*. 2017; 10(4):973-7.
- [13] Nassiri P, Koohpaei A, Zeraati H, Shalkouhi P. Research note evaluation of exposure to whole-body vibration and its health effects on train operators in tehran-andimeshk line, Iran. *Journal of Low Frequency Noise Vibration and Active Control*. 2009; 28(4):285-94.
- [14] Nassiri P, Koohpaei A, Zeraati H, Shalkouhi PJ. Train passengers comfort with regard to whole-body vibration. *Journal of Low Frequency Noise Vibration and Active Control*. 2011; 30(2):125-36.
- [15] Aminian O, Pouryaghoob Gh, Shanbeh M. [One year study of musculoskeletal disorders and their relation to occupational stress among office workers: A brief report (Persian)]. *Tehran University Medical Journal*. 2012; 70(3):194-99.
- [16] Langballe EM, Innstrand ST, Hagtvet KA, Falkum E, Aasland OG. The relationship between burnout and musculoskeletal pain in seven Norwegian occupational groups. *Work*. 2009; 32(2):179-88. doi: 10.3233/WOR-2009-0804.
- [17] Khandan M, Zamir SR, Maghsoudipour M. [Survey of workload and job satisfaction relationship in a heavy metal manufacturing company (Persian)]. *Iran Occupational Health*. 2012; 9(1):30-6.
- [18] Azari GR, Davuian-Talab AH. [Comparison of burnout and musculoskeletal disorders among computer users and office workers (Persian)]. *Archives of Rehabilitation*. 2012; 12:38-46.
- [19] Poursadeghiyan M, Abbasi M, Mehri A, Hami M, Raei M, Ebrahim MH. Relationship between job stress and anxiety, depression and job satisfaction in nurses in Iran. *The Social Sciences*. 2016; 11(9):2349-55. doi: 10.3923/sscience.2016.2349.2355
- [20] Ahola K, Kivimaki M, Honkonen T, Virtanen M, Koskinen S, Vahtera J, et al. Occupational burnout and medically certified sickness absence: a population-based study of Finnish employees. *Journal of Psychosomatic Research*. 2008; 64(2):185-93. doi: 10.1016/j.jpsychores.2007.06.022
- [21] Arassi M, Mohammadi H, Motamedzade M, Kamalinia M, Mardani D, Mohammadi Beiragani M, et al. [The association between psychosocial factors and occupational accidents among Iranian drilling workers (Persian)]. *Journal of Ergonomics*. 2014; 2(1):36-45.
- [22] Heidari M, Farshad A, Arghami S. [A study on relationship between production link worker's safety attitude and their safe act in of Arak metal industry (Persian)]. *Iran Occupational Health*. 2007; 4(3):1-9.
- [23] Mohammadi Zeydi I, Heydarnia A, Niknami S. [Safety climate measurement at workplace: Development, validity and reliability (Persian)]. *Payesh*. 2011; 10(2):157-65.
- [24] Vinodkumar MN, Bhasi M. Safety climate factors and its relationship with accidents and personal attributes in the chemical industry. *Safety Science*. 2009; 47(5):659-67. doi: 10.1016/j.ssci.2008.09.004
- [25] Khandan M, Maghsoudipour M, Vosoughi S, Kavousi A. Safety climate and prediction of ergonomic behavior. *International Journal of Occupational Safety and Ergonomics*. 2013; 19(4):523-30. doi: 10.1080/10803548.2013.11077018
- [26] Azizi L, Abadi ZF, Bashash L, Salehi M. [Exploratory factor analysis of Maslach's burnout inventory questionnaire among staffs of University of Tehran (Persian)]. *Quarterly Journal of Psychological Studies*. 2008; 4(3):73-92.
- [27] Choobineh A. [Posture assessment methods in occupational ergonomics (Persian)]. *Hamedan: Fanavaran*; 2008.
- [28] Lee PH. Is a cutoff of 10% appropriate for the change-in-estimate criterion of confounder identification? *Journal of epidemiology*. 2014; 24(2):161-7. doi: 10.2188/jea.je20130062
- [29] 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. doi: 10.1037/a0021484
- [30] Sonntag K, Stegmaier R. Creating Value Through Occupational Health Management. In: *Andresen M, Nowak C, editors. Human Resource Management Practices: Assessing Added Value*. Berlin: Springer; 2015.
- [31] Behjati Ardakani M, Zare M, Mahdavi S, Ghezavati M, Falah H, Halvani G, et al. Relation between job stress dimensions and job satisfaction in workers of a refinery control room. *Journals of Community Health Research*. 2013; 1(3):198-208.

- [32] Eid J, Mearns K, Larsson G, Laberg JC, Johnsen BH. Leadership, psychological capital and safety research: Conceptual issues and future research questions. *Safety Science*. 2012; 50(1):55-61. doi: 10.1016/j.ssci.2011.07.001
- [33] Khandan M, Maghsoudipour M, Vosoughi S. Ranking of working shift groups in an Iranian petrochemical company using ELECTRE method based on safety climate assessment results. *Journal of the Chinese Institute of Industrial Engineers*. 2011; 28(7):537-42. doi: 10.1080/10170669.2011.637241
- [34] Khandan M, Vosoughi S, Maghsoudipour M. Evaluation of safety climate factors-a macroergonomics approach: A case study in Iran. *Iranian Rehabilitation Journal*. 2012; 10:43-6.
- [35] Khandan M, Nili M, Koohpaei A, Mosafarchi S. Integrating the ergonomics techniques with multi criteria decision making as a new approach for risk management: An assessment of repetitive tasks-entropy case study. *Journal of Research in Health Sciences*. 2016; 16(2):85-9. PMID: 27497776
- [36] Ebrahimi MH, Abbasi M, Khandan M, Poursadeghiyan M, Hami M, Biglari H. Effects of administrative interventions on improvement of safety and health in workplace: A case study in an oil company in Iran (2011-2015). *Journal of Engineering and Applied Sciences*. 2016; 11(3):346-51. doi: 10.3923/jeasci.2016.346.351

