



The Effect of Mental Workload on Occupational Accidents Among Nurses in Hospitals of Kerman, Iran

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Abstract

Background and Objectives: Nurses due to the nature of their job faced with significant mental workload. This can cause nursing occupational accidents. The aim of this study was to explore the effects of mental workload on occupational accidents in teaching hospital nurses.

Methods: This cross-sectional descriptive-analytic study was conducted from May to December 2017 in 3 teaching hospitals in Kerman (Iran). A total of 350 nurses were selected by random sampling method. Data were gathered by Nursing Occupational Accidents Questionnaire and NASA-TLX Index, and analysed by independent *t* test, one-way analysis of variance (ANOVA) and logistic regression using SPSS v.18.

Findings: In the research mental demand and frustration dimensions had the highest and lowest mean among NASA-TLX Index, respectively. Traumatic low back pain when changing the position or displacement of patients (64%), and Skin contact with blood or other body fluids (62%) were the most common accidents that were most frequent in nurses. Also there was a significant statistical relationship between overall workload and occupational investigated accidents.

Conclusion: The high workload is a characteristic of nursing job. Therefore, hospital managers should avoid excessive work pressure by identifying various causes of mental workload factors in their hospital environment and take an important step in controlling this type of accident.

Keywords: Nurses, Occupational accident, Mental workload, Hospital, Inpatient department, Patient

Background and objectives

Accident is an unplanned and destructive event occurring due to unsafe actions, unsafe conditions or the combination of these two factors. Accidents which occur in the workplace are called work-related accidents.¹

These accidents, in addition to the disability and physical consequences, cause the loss of capital and equipment and consequently economic losses. Based on the International Labour Organization (ILO) report the cost of occupational accidents and injuries can be equal to 1-6.8% of the gross domestic product (GDP) of countries. Hospital is considered as a high-risk workplace because of several dangers such as biological, chemical, physical, ergonomics, psychosocial and organizational hazards

threatening the health of nurses.^{2,3} Nurses are at risk to work-related accidents and injuries because of the usual physical and mental demands that are associated with their duties. These accidents often affect their health and economics. Illness absenteeism and individual deprivation due to work-related injuries, lead to reduced productivity and financial compensation that make significant costs for employers.⁴ 177 000 cases of injuries and nonfatal diseases in 2014, in nursing recorded, that this incidence was considerably higher than other industries.⁵

Each year an approximately 8.7% occupational accident occur for every 100 permanent nurses and in fact nurses ranked seventh in the most frequent casualties due to occupational accidents among other occupations.⁶ Compensation of damages caused by occupational accidents in hospitals is very high, so that, an average of US\$7707 is imposed on the hospital for each accident. If an occupation accident causes a nurse to leave, the total

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cost of a health-care organization for replacing a nurse is estimated between \$25 000 and \$28 000.^{7,8}

Working and organizational conditions are elements that potentially contribute to the occurrence of occupational accidents.^{9,10} Among the working conditions, it seems that excessive workload with effect on physical and psychological abilities in nurses facilitate the occurrence of absenteeism, occupational accidents, medical error and fatigue.¹¹ Workload is a subjective and multidimensional concept that represents the amount of resources needed to achieve both qualitative and quantitative performance criteria in a task, which varies with requirements and demands of the job, external support and past experiences.¹² The high level of workload causes physiological changes, cognitive decline (attention and concentration), increased muscle tension and problems to individual coordination, which often have negative effects on individual's performance and in the result it can have negative outcomes on the provision of health services.^{13,14} Jobs with high mental workload can cause memory impairment, damage to mental processes, irritability and reduced learning from fatigue that can be considered as risk factors for occupational accidents.^{3,15}

Bagheri Hosseinabadi et al, in a study on 616 nurses of four public hospitals located in four different provinces in Iran, showed that with increase in mental workload, needle stick injuries increase by 35%.¹⁶

Knowledge and recognition of the causes of occupational accidents are necessary to provide preventive methods for managing and reducing occupational accidents, improving nurses' health and reducing the damage caused by accidents. According to the mentioned contents, it is evident that the study of occupational accidents, workload and factors affecting on workload can identify the challenges ahead and develop programs that reduce workload and occupational accidents of nurses. The present study aimed to explore the effects of mental work load on occupational accidents in Kerman teaching hospitals nurses (Iran).

Methods

The present study was a descriptive-analytic study that was performed on the 350 nurses of 3 teaching hospitals affiliated to Kerman University of Medical Sciences (Afzalipour, Shafa, Bahonar and Shahid Beheshti hospitals) who were selected by random sampling from May to December 2017.

A total of 303 nurses as sample size was determined based on total of nurses in hospitals (1423 nurse) and the Cochran formula (with a probability ratio of 0.5, confidence interval of 0.95 and error level of 5%). In order to ensure

minimum sample size, 350 nurses were selected.

Also, in the present study, inclusion criteria were having at least BSc in nursing, full time job and at least one year of experience in the current sections and exclusion criterion was having physical and mental health problems.

The data were collected by Demographic and Organizational Questionnaire, Nursing Occupational Accidents Questionnaire and NASA-TLX index.

A) Demographic and Organizational data: A demographic questionnaire was used to collect nurses' demographic and organizational data including gender, age, marital status, work experience, employment status and job shift.

B) Nursing Occupational Accidents Questionnaire: Due to the lack of a registered database on nurses' occupational accidents in Iran's hospitals, the researchers used the results of previous studies and utilizing the experiences of nursing managers to determine the type of occupational accidents as an appropriate indicator for occupational accidents in nurses. In the present study due to the wide scope of occupational accidents, the occupational accidents that had the most occurrences in previous studies were selected. Occupational accidents were investigated in 11 main questions including sharps injuries, needle sticks injuries, skin contact with blood or other body fluids, jumping foreign object in eye, drug and chemical splash in the eyes, body fluid splash in the eyes, drug or chemical poisoning, slip and trip and fall injuries, trauma due to the fall of heavy objects on part of the body, Traumatic back pain in patient handling tasks and Damaged or injured by the patient or patient attendants. A dichotomy questionnaire (yes/no) was prepared to determine accidents occurred in the past 6 months. The content validity of the checklist was confirmed by a 3-part faculty member and reliability was confirmed by performing a test-retest and calculating Cronbach alpha ($\alpha = 0.86$).

C) NASA-TLX index: Perceived mental workload was one of the important explanatory variables in this study. There are different ways to examine the different dimensions of mental workload in nurses, in this study, the NASA-TLX index, was used. This method is a multi-dimensional tool that allows task-based mental workloads score to be aggregated based on a weighted average of the rankings of six subgroups or factors. These six subgroups include: mental demand, physical demand, temporary demand, performance, effort and level of frustration. The twenty one-step bipolar scales are used to get the rank of this dimension, which results in a score between 0 and 100. The overall workload is computed by combining these six dimensions.¹⁷ The validity and reliability of this questionnaire has been approved in different languages including Persian.^{18,19}

After obtaining a university license and presenting it to hospitals in Kerman, the researchers went to hospitals during morning and afternoon shifts of weekdays (Saturday to Thursday). After explaining the goals of the study individually and obtaining written consent from them, a questionnaire was provided to them. It was also assured people that the questionnaires were without name and the information would remain completely confidential.

Ethical Statement

This study was approved by the Ethics Committee of Kerman University of Medical Sciences (Ethics Code No. IR.KMU.REC.1393.0280).

Statistical Analyses

Descriptive statistics were used to report the results. Kolmogorov-Smirnov test and Levene's test was used to check the normality of the data as well as equality of variances. Independent *t* test and one-way ANOVA were used to determine the relationship between Individual-organizational variables and nurses' workload (significance level of $P < 0.05$). Accident predictor workload dimensions were determined by using multivariate logistic regression test. Data were analysed through SPSS version 19 software.

Results

In this study, 109 (31.2%) nurses were male and 241 (68.8%) female. 51.9% nurses had job experience over the past 5 years, and the results show that women experience more workload than men ($P = 0.028$). In addition, there was a significant statistical relationship between mental workload with education level, shift status, employment status (Table 1).

Among the different dimensions of workload, Mental Demand and Frustration dimensions with the average score of 67.17 and 49.29 had the highest and lowest score, respectively. Mean (SD) of workload in the research population was 75.64 ± 14.42 (Table 2).

About 64% (224) of nurses had experienced Trauma due to the fall of heavy objects on part of their body, and 62% (217) experienced skin contact with blood or other body fluids. Drug or chemical poisoning (11.1%) and drug and chemical splash in the eyes (12%) were the most frequent events among nurses (Table 3).

Table 4 shows the predictor factors of occupational accidents. All of the dimensions of workload had a significant statistical relationship ($P < 0.05$) with all the events studied in this study. Among the dimension of workload, there was a significant correlation between temporal demand and the accidents such as sharps

injuries, needle stick injuries, skin contact with blood or other body fluids, entrance of foreign object in the eye, drug or chemical poisoning and traumatic back pain caused by displacement or change of patient's condition.

Discussion

In this present study, the mean of mental workload in nurses was 64.75. The results of this study are consistent with the previous studies results.²⁰⁻²² Among the different dimensions of workload, the mean score of mental demand (67.17 ± 23.13) was the highest. Based on the results of the Arghami et al's study, nurses had perceived mental pressure more than other NASA-TLX subscales²⁰ which were consistent with the results of the present study, but in Rafiei et al's study on the measurement of mental workload of emergency department nurses, Frustration, temporal and mental pressure had the highest score of mental workload respectively²¹ which is not consistent with the result of this study.

The difference between these results may be due to differences between the work environmental of the nurses in emergency department and other departments.

Based on the results of this study, among the various personal and organizational factors, gender, level of education, shift work, and employment status are the predictors of mental workload of nurses. Generally, the total workload of female nurses was higher than male nurses. Also, the average of workloads in nurses with undergraduate education was higher than nurses with a higher education level than bachelor's degree.

The average workload of shift nurses was higher than nurses with fixed shifts. Also, in the case of employment status, the average workload of nurses with formal contract was lower than the contract nurses, which these differences were statistically significant ($P < 0.05$). Although the role of mediation and other hidden roles that have an impact on workload^{23,24} have been mentioned in past studies, but the details of tasks and factors affecting their workload, such as the findings of this study, have not been extracted. The result of this study showed that various factors can affect nursing workload, which can be classified into individual, organizational and occupational characteristics. According to a study conducted in a large teaching hospital, nurses working in a circulating work system had more drowsiness than those who worked only in the morning shift and their mistakes were twofold.²⁵ The results of a study on the relationship between mortality rate and workload of nurses in the intensive care unit showed that patients whose nurses had a high workload had a higher mortality rate than those taken care of by nurses with less workload.²⁶ According to the results of this study, traumatic back pain

Table 1. Frequency Distribution of Demographic Characteristics of Nurses

Variable	Grouping	No. (%)	NASA-TLX		P Value
			Final Score		
Age	≤30	96 (27.3)	64.68 ± 14.23		0.842 ^a
	31-40	156 (44.6)	65.21 ± 13.94		
	≥41	98 (28.1)	63.94 ± 15.42		
Sex	Male	109 (31.2)	61.1 ± 14.84		0.028 ^b
	Female	241 (68.8)	68.33 ± 14.03		
Marital status	Single	85 (24.2)	62.01 ± 14.95		0.086 ^b
	Married	265 (75.8)	65.57 ± 14.15		
Level of education	Bachelor and less	330 (94.3)	66.61 ± 14.74		0.001 ^b
	More than bachelor	20 (5.7)	59.68 ± 12.65		
Work experience	2-5 year	168 (48.1)	65.11 ± 23.48	0.17 [*]	0.664 ^a
	6-10 year	140 (40)	64.88 ± 14.33	-2.21 ^{**}	
	More than 10 year	42 (11.9)	62.52 ± 14.98	-1.72	
Shift status	Shift work	250 (71.5)	70.01 ± 13.01	3.35	<0.001 ^b
	Fixed	100 (28.5)	62.6 ± 14.42	0.41	
Employment status	Official	121 (34.6)	62.6 ± 14.42	3.83	0.004 ^b
	Contractual	229 (65.4)	70.01 ± 13.01	2.88	

^a One-way ANOVA.^b Independent *t* test.* *p* < 0.05** *p* < 0.01**Table 2.** Mean score of mental work load in nurses

Dimensions	Mean ± SD	Minimum	Maximum
Frustration	49.29 ± 27.91	0	100
Effort	52.85 ± 25.54	0	100
Performance	54.12 ± 28.37	0	100
Temporal Demand	56.01 ± 22.92	0	100
Physical Demand	48.38 ± 22.19	0	100
Mental Demand	67.17 ± 23.13	0	100
Total	64.75 ± 14.42	21	100

detected during change of the patient's condition (64%), blood and body fluid exposures (62%), sharps injuries (58.9%) and needle sticking in the body (58%) were the most commonly accidents experienced by nurses. The study of Aghakhani et al as the prevalence and causes of occupational injuries in nurses working in teaching hospitals, showed that the greatest damage was due to biological hazards and Blood and body fluid exposures, and 90.5% of nurses experienced this accident and then being contact with needle tip (60%), random radiation exposure (46.9%) and respiration of disinfectant vapours (46.7%) had the highest contribution to occupational injury in nursing staff respectively. In the meanwhile, the traumatic back pain was the fifth one (41.5%) when

changing the patient's condition.²⁷

In general, skin contact with liquids and needles in the body are the most important occupational biological hazards in various studies.^{28,29} In this study, ergonomic hazards, traumatic back pain during change of patient's condition or displacement is the most commonly encountered hazard. In the study of Arab et al,³⁰ ergonomic hazards along with psychosocial and organizational hazards are mentioned as the most important occupational hazards within nurses. The issue of accidents in hospitals is very important so decision making in the field of safety and identification and control of existing risks in health and medical units is one of the most important and inevitable tasks of management.³¹ According to Pretagostini et al, to increase hospital safety, attention to prospective risk management approaches will be very important.³² The results of this study and similar studies in this field can be very helpful in managing the risk of hospital accidents.

The studies that investigate the relationship between different types of hospital accidents with workload are very limited. In this study, the relationship between different dimensions of workload with different types of hospital accidents was investigated for the first time. According to the results of this study, there is a significant relationship between total workload and all the accidents investigated in this study. There is a meaningful relationship between the accident related to cutting with sharp and pointed objects with mental, temporal dimensions, and chance of

Table 3. Frequency Distribution of Occupational Accidents in Nurses

Type of Occupational Accident	Accident history	
	No	Yes
	No. (I)	No. (I)
Sharps injuries	144 (41)	206 (59)
Needle stick injuries	147 (42)	203 (58)
Skin contact with blood or other body fluids	133 (38)	217 (62)
Jumping foreign object in the eye	297 (85)	53 (15)
Drug and chemical splash in the eyes	308 (88)	42 (12)
Body fluid splash in the eyes	269 (77)	81 (23)
Drug or chemical poisoning	311 (89)	39 (11)
Slip and trip and fall injuries	273 (78)	77 (22)
Trauma due to the fall of heavy objects on part of the body	291 (83)	59 (16)
Traumatic back pain in patient handling tasks	126 (36)	224 (64)
Damaged or injured by the patient or patient attendants	347 (99)	3 (0/9)

Table 4. Determine the Predictor Factors of Occupational Accidents

Occupational accidents	Workload Dimensions	OR	CI	P Value
Sharps injuries	Mentally	1.059	1.019 – 1.099	0.044
	Temporal demand	1.021	1.007 – 1.035	0.023
	Effort	1.031	1.013 – 1.049	0.047
	Final score	1.029	1.012 – 1.047	0.031
Needle stick injuries	Mentally	1.061	1.022 – 1.098	0.037
	Temporal demand	1.033	1.018 – 1.049	<0.001
	Final score	1.041	1.001 – 1.079	0.048
Skin contact with blood or other body fluids	Temporal demand	1.051	1.028 – 1.073	0.038
	Final score	1.045	1.025 – 1.068	<0.001
Jumping foreign object in the eye	Mentally	1.049	1.013 – 1.087	0.041
	Temporal demand	1.084	1.069 – 1.099	0.034
	Final score	1.074	1.043 – 1.112	0.006
Drug and chemical splash in the eyes	Performance	0.974	0.955 – 0.993	0.007
Body fluid splash in the eyes	Final score	1.068	1.028 – 1.114	0.008
Drug or chemical poisoning	Temporal demand	1.035	1.011 – 1.058	0.024
	Frustration	1.019	1.012 – 1.036	0.012
	Effort	1.021	1.003 – 1.039	0.022
	Performance	0.969	0.954 – 0.984	0.001
	Final score	1.052	1.017 – 1.091	0.004
Slip and trip and fall injuries	Performance	0.969	0.948 – 0.989	0.042
	Final score	1.043	1.007 – 1.082	0.02
Trauma due to the fall of heavy objects on part of the body	Mental demand	1.015	1.004 – 1.044	0.02
	Final score	1.043	1.004 – 1.086	0.027
	Physical demand	1.194	1.108 – 1.286	0.001
Traumatic back pain in patient handling tasks	Temporal demand	1.086	1.031 – 1.152	0.002
	Final score	1.043	1.021 – 1.066	<0.001
Damaged or injured by the patient or patient attendants	Final score	1.082	1.045 – 1.119	0.034

injuries by sharp objects with mental, temporal demand, effort dimension are equal to 1.059, 1.021 and 1.031 respectively.

Among the dimensions of workload, the mental and temporal dimensions had the most significant relationship with accidents. The results of the study of Aghakhani et al²⁷ showed that the high volume of nursing work (61.1%) and fatigue caused by long hours of work (35.6%) were the most common causes of occupational injuries in hospitals. In various studies, the causes of work-related accidents have been investigated,³³⁻³⁵ but in these studies, workload has not been considered as an intermediary factor affecting occupational accidents. Considering that identification and evaluation of individual-social and occupational factors affecting workload can be effective in planning of managers and relevant authorities, it is suggested that in future studies, individual-social factors and occupational factors affecting workload should be studied. In the study of Taheri et al, a significant difference between the mean score of mental demand and temporal demand was reported in nurses with a history of being in contact with needle and without it, but it did not have any meaningful relationship with other dimensions of workload. In other words, in the 6 scale of Nasa-TLX workloads, only the mental need and work time scale had a significant relationship with being in contact with needle of nurses,³⁶ which is consistent with the present study. From the point of view of cognitive ergonomic science, usually incidents of human error, especially in intellectual works, do not occur due to individual ignorance, but the momentary inaccuracy and concentration of the individual was reduced, so they do not interfere in decision making with what they know or study, or even what they do several times, which in terms of cognitive ergonomics, these states can be interpreted as mental workload.³⁷ Therefore, by eliminating or reducing the mental workload, can reduce the prevalence of these events, but by reducing the psychosocial stresses of the work environment, it can increase the employee's job satisfaction, which will increase the patient's safety and satisfaction.

Considering the limited studies on occupational accidents in nurses in Iran, this study tried to consider a set of occupational injuries that were not all reported in previous studies.

Considering that there was no recorded and comprehensive information of occupational accidents in Iranian hospitals, we have used a cross-sectional study and self-report method to collect information, which could be the limitations of this study.

Conclusion

From the result of this study, it is concluded that a high workload is a characteristic of nursing jobs. Employees of health centres, especially nurses working in hospitals, in addition to physical needs, are often exposed to other factors such as psychological needs, time pressure, lack of control over the speed of work, etc, which play a decisive role in mental workload and the incidence of accidents. The factors affecting workload are much interwoven. The results of this study showed that there is a significant relationship between different dimensions of workload with different types of hospital accidents. Therefore, hospital managers should avoid excessive work pressure by identifying various causes of mental workload factors in their hospital environment and take an important step in controlling this type of accident. In workplaces, in order to maintain and improve health, safety and increase employee productivity, effectiveness of work and ultimately increase organizational efficiency, a preventive approach should be taken to prevent the imposition of significant costs from occupational accidents.

Abbreviations

ILO: International Labour Organization; GDP: gross domestic product; ANOVA= analysis of variance.

Authors' Contributions

MBHA and SES designed the study and approved the final version. SES, MHB and SV prepared the manuscript. MBHA, ET and GZ participated in data analysis. SES and MBHA the data and participated the writing manuscript.

Competing Interests

There are no conflicts of interest.

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References

1. Takala J, Hämäläinen P, Saarela KL, et al. Global estimates of the burden of injury and illness at work in 2012. *J Occup Environ Hyg.* 2014;11(5):326-337. doi:10.1080/15459624.2013.863131
2. Masoudi Alavi N. Occupational hazards in nursing. *Nurs Midwifery Stud.* 2014;3(3):e22357. doi:10.17795/nmsjournal22357
3. Sarsangi V, Salehiniya H, Hannani M, et al. Assessment of workload effect on nursing occupational accidents in

- hospitals of Kashan, Iran. *Biomedical Research and Therapy*. 2017;4(8):1527-1540. doi:10.15419/bmrat.v4i08.226
4. Vecchio N, Scuffham PA, Hilton MF, Whiteford HA. Work-related injury in the nursing profession: an investigation of modifiable factors. *J Adv Nurs*. 2011;67(5):1067-1078. doi:10.1111/j.1365-2648.2010.05544.x
 5. Bureau of Labor Statistics. Employer-Reported Workplace Injury and Illnesses. 2014. <http://www.bls.gov/news.release/osh.nr0.htm>.
 6. Gershon RR, Stone PW, Zeltser M, Faucett J, MacDavitt K, Chou SS. Organizational climate and nurse health outcomes in the United States: a systematic review. *Ind Health*. 2007;45(5):622-636. doi:10.2486/indhealth.45.622
 7. Morgan A, Chow S. The economic impact of implementing an ergonomic plan. *Nurs Econ*. 2007;25(3):150-156.
 8. Harolds L, Hurst H. Preventing Workplace Injuries Among Perinatal Nurses. *Nurs Womens Health*. 2016;20(1):99-108. doi:10.1016/j.nwh.2015.12.003
 9. García-Herrero S, Mariscal MA, García-Rodríguez J, Ritzel DO. Working conditions, psychological/physical symptoms and occupational accidents. Bayesian network models. *Saf Sci*. 2012;50(9):1760-1774. doi:10.1016/j.ssci.2012.04.005
 10. Robazzi ML, Mauro MY, Secco IA, et al. Changes in health due to overwork among health workers / [Health changes from overwork among health sector workers]. *Rev Enferm UERJ*. 2012;20(4):526-532.
 11. Myny D, Van Hecke A, De Bacquer D, et al. Determining a set of measurable and relevant factors affecting nursing workload in the acute care hospital setting: a cross-sectional study. *Int J Nurs Stud*. 2012;49(4):427-436. doi:10.1016/j.ijnurstu.2011.10.005
 12. Jaafarpour M, Khani A, Mahmodian MR. Evaluation of the quality of nursing work life and its association with job burnout in Isfahan University of Medical Sciences. *Int J Epidemiol Res*. 2015;2(1):30-39.
 13. Neill D. Nursing workload and the changing health care environment: a review of the literature. *Administrative Issues Journal*. 2011;1(2):132-143.
 14. Hoover A, Singh A, Fishel-Brown S, Muth E. Real-time detection of workload changes using heart rate variability. *Biomed Signal Process Control*. 2012;7(4):333-341. doi:10.1016/j.bspc.2011.07.004
 15. Samaei SE, Khosravi Y, Heravizadeh O, Gholinia H, Pourshariati F, Amrollahi M. The effect of emotional intelligence and job stress on burnout: a structural equation model among hospital nurses. *International Journal of Occupational Hygiene*. 2017;9(2):52-59.[persian].
 16. Bagheri Hosseinabadi M, Khanjani N, Etemadinezhad S, Samaei SE, Raadabadi M, Mostafae M. The associations of workload, individual and organisational factors on nurses' occupational injuries. *J Clin Nurs*. 2019;28(5-6):902-911. doi:10.1111/jocn.14699
 17. Hart SG. NASA-task load index (NASA-TLX); 20 years later. *Proc Hum Factors Ergon Soc Annu Meet*. 2006;50(9):904-908. doi:10.1177/154193120605000909
 18. Malekpour F, Mohammadian Y, Malekpour A, Mohammadpour Y, Sheikh Ahmadi A, Shakarami A. Assessment of mental workload in nursing by using NASA-TLX. *Journal of Urmia Nursing and Midwifery Faculty*. 2014;11(11):892-899. [Persian].
 19. Mohammadi M, Mazloumi A, Nasl Seraji J, Zeraati H. Designing questionnaire of assessing mental workload and determine its validity and reliability among ICUs nurses in one of the TUMS's hospitals. *Journal of School of Public Health and Institute of Public Health Research*. 2013;11(2):87-96. [Persian].
 20. Asgari H, Mohebbi I, Khalkhali H. Analytical survey on relation between workload with occupational burnout dimensions in ICU nurses. *Journal of Urmia Nursing and Midwifery Faculty*. 2016;14(1):30-38. [Persian].
 21. Rafiee N, Hajimaghsoudi M, Bahrami MA, Ghasemi N, Mazrooei M. Evaluation nurses' mental work load in Emergency Department: case study. *Quarterly Journal of Nersing Management*. 2015;3(4):43-50. [Persian].
 22. Yousef Zade A, Mazloumi A, Abbasi M, Akbar Zade A. Investigating the relationship between cognitive failures and workload among nurses of Imam Khomeini and Vali-e-Asr hospitals in Tehran. *Journal of Health and Safety at Work*. 2016;6(2):57-68. [Persian].
 23. Hassanzadeh-Rangi N, Khosravi Y, Farshad AA, Jalilian H. Workload in Train Driving Job: Affecting Factors and Improvement Recommendations. *Iranian Journal of Ergonomics*. 2017;5(1):60-72. doi:10.21859/joe-05018
 24. Karvonen H, Aaltonen I, Wahlström M, Salo L, Savioja P, Norros L. Hidden roles of the train driver: A challenge for metro automation. *Interact Comput*. 2011;23(4):289-298. doi:10.1016/j.intcom.2011.04.008
 25. Gold DR, Rogacz S, Bock N, et al. Rotating shift work, sleep, and accidents related to sleepiness in hospital nurses. *Am J Public Health*. 1992;82(7):1011-1014. doi:10.2105/ajph.82.7.1011
 26. Tarnow-Mordi WO, Hau C, Warden A, Shearer AJ. Hospital mortality in relation to staff workload: a 4-year study in an adult intensive-care unit. *Lancet*. 2000;356(9225):185-189. doi:10.1016/s0140-6736(00)02478-8
 27. Aghakhani N, Baghei R, Alinejad V, Cheraghi R. Prevalence and factors of occupational accidents in nurses of educational and treatment centers of Urmia University of medical sciences, Urmia, 2016. *Journal of Urmia Nursing and Midwifery Faculty*. 2017;15(4):270-280. [Persian].
 28. Arghami S, Kamali K, Radanfar F. Task performance induced work load in nursing. *Journal of Occupational*

- Hygiene Engineering. 2015;2(3):45-54. [Persian].
29. Khalouei A, Iranpour A, Hamzehnezhadi S, Rahmani Keramat E. Study on epidemiology of needle stick injury among nursing personnel of Kerman University hospitals. Kerman, Iran in (2006-2007). Pars Journal of Medical Sciences. 2010;7(3):43-51. [Persian].
30. Arab M, Hoseini M, Panahi Tosanloo M, Khalili Z. Nursing Occupational Hazards of the Emergency Department in Teaching Hospitals affiliated to Tehran University of Medical Sciences. Journal of Hospital. 2015;14(2):35-48. [Persian].
31. Saranto K, Bates DW, Mykkänen M, Härkönen M, Miettinen M. Whose Voices are Heard in Patient Safety Incident Reports? NI 2012 (2012). 2012;2012:356.
32. Pretagostini R, Gabbrielli F, Fiaschetti P, et al. Risk management systems for health care and safety development on transplantation: a review and a proposal. Transplant Proc. 2010;42(4):1014-1016. doi:10.1016/j.transproceed.2010.03.100
33. Varvani Farahani P, Hekmat Pou D, Amini H. Determination of the numerical scores of occupational hazards and their predisposing factors among nurses working in educational hospitals in Arak city. J Nurs Educ. 2013;1(2):53-61. [Persian].
34. Lu H, While AE, Barriball KL. Job satisfaction among nurses: a literature review. Int J Nurs Stud. 2005;42(2):211-227. doi:10.1016/j.ijnurstu.2004.09.003
35. Mosadeghrad AM. Relationship between nurses' knowledge about ergonomics and their job injuries. Journal of Shahrekord University of Medical Sciences. 2004;6(3):21-32. [Persian].
36. Taheri MR, Khorvash F, Hasan Zadeh A, Mahdavi Rad M. Assessment of mental workload and relationship with needle stick injuries among Isfahan Alzahra hospital nurses. Medical Journal of Mashhad University of Medical Sciences. 2016;58(10):70-577. doi:10.22038/mjms.2016.6765
37. Morrow D, North R, Wickens CD. Reducing and mitigating human error in medicine. Rev Hum Factors Ergon. 2005;1(1):254-96. doi:10.1518/155723405783703019

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