

## Research Paper

# Investigating the Association of Mental Workload, Occupational Fatigue and Job Stress in Emergency Nurses in Iran



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## ABSTRACT

**Background:** Mental workload (MW) and occupational fatigue (OF) are among the harmful factors in the working environment of the emergency nursing profession, which can be related to the quality of care provided and job stress (JS) in emergency nurses. Accordingly, this study investigates the relationship between MW, MF and JS in emergency nurses in 2023 in Ardabil, Iran.

**Materials and Methods:** This cross-sectional study was conducted by measuring OF, JS and MW of emergency nurses in hospitals of Ardabil Province, Iran. Information was collected through a checklist that recorded the demographic information in addition to the NASA task load index, JS by Orly and Giordano and the Swedish OF inventory questionnaires. The statistical analysis was conducted by the SPSS software, version 22.

**Results:** The mean mental state of the participants was  $16.7 \pm 3.6$ . Meanwhile, 40% of nurses had a high mental load. The mean condition of the OF was high ( $49.02 \pm 4.2$ ; 23.2%). Regarding JS, 45.5%, 25.9% and 28.6% were the high, medium, and low levels, respectively. A direct and significant relationship was detected between MW, JS and OF ( $P < 0.05$ ).

**Conclusion:** The mean MW, JS and OF among emergency nurses were high. Almost half and about a quarter of the emergency nurses are under JS and OF, respectively. Therefore, to improve emergency nurses' health conditions, and productivity, and create safe conditions in emergencies, the control and management of this harmful occupational factor should be under continuous monitoring.

### Keywords:

Mental workload (MW), Occupational fatigue (OF), Job stress (JS), Nurse, Emergency

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## Introduction

Employees in any job are faced with a wide range of harmful factors [1, 2] and a significant part of this exposure is related to psychological factors, which are given less attention in developing countries [3]. Mental workload (MW) is a term used to describe how many cognitive and physical resources an operator uses to perform a task [4]. MW is a multidimensional and complex structure that is influenced by the external needs of the task, the environment, organizational and psychological factors and administrative and cognitive abilities [5]. Heavy MWs and long working hours are two key factors that lead to fatigue [6]. MW is a prominent variable in some jobs that require a high level of attention, motivation, judgment, and evaluation. MW is an intangible concept that cannot be directly measured or that cannot be considered an accurate value [7]. The high level of MW and occupational fatigue (OF) [8] lead to various consequences, such as human error and other mental functional disorders, and also a lengthening of reaction time and an increase of errors among nurses [9]. Nursing is one of the professions that face high MWs, physical fatigue and mental load. High MW has been reported as one of the main sources of job stress (JS) by nurses [10]. A high MW can have negative consequences for nurses and patients. The direct effects of a high MW on patient care may be related to not having enough time to perform care tasks, which increases the mortality of patients [11]. Studies show that MW and JS among nurses have increased during the COVID-19 pandemic [12]. During the pandemic and due to the nature of their work, emergency nurses have been more effective than other hospital employees in terms of workload, JS, fatigue, and satisfaction level [13-15]. Any occupational and social stress involves many costs for society [11]. To evaluate and estimate the MW, there are various methods, among which we can refer to the SWAT, Cooper Harper and the NASA task load index (NASA-TLX) methods [12, 13]. The NASA-TLX questionnaire method is one of the most well-known tools among MW estimation methods. Study results by Zhang et al. show that the use of the NASA-TLX is a suitable tool for examining the MW among nurses [16]. This index examines six subscales of mental need, physical need, time need, performance, effort, and frustration. Average indicators are reported as overall MW pressure [17]. The main cause of the OF in nurses and other jobs is exposure to long-term stress. Many researchers have looked for the signs and symptoms of OF in the work environment and relate its severity to the imbalance in the

ratio between the job requirements and the employee's ability [18]. Somantri et al. and Yarmohammadi et al. have investigated the level of job fatigue among nurses. Their results showed that the level of fatigue of nurses was moderate [19, 20]. The researchers investigated the effects of JS on clinical nurses. The results showed that stress is severe in nurses with sleep disorders and digestive problems and its side effects on mental health. The main stress factors' in hospital nurses in the physical environment were MW, the ambiguity of tasks, and responsibility [21, 22]. The study of Sundberg et al. analyzed the relationship between the sense of coherence and the amount of mental load in nurses. Longer work experience and lower levels of cohesion are associated with a greater risk of mental overload [8]. The study by E Wilczek-Rużyczka et al. showed that a high mental load among nurses leads to burnout in these people [23]. Therefore, due to the importance of emergency nursing jobs in medical centers and the maintenance of human resources, this study investigated the relationship between MW, OF and JS in emergency nurses in hospitals of Ardabil Province, Iran.

## Materials and Methods

This was a cross-sectional correlational study, conducted over one year. In this study, 140 emergency nurses from hospitals in Ardabil Province, Iran, participated through the census method. This province has ten public hospitals under the management of the [Ardabil University of Medical Sciences](#), two hospitals owned by the [Iranian Social Security Organization](#) and two private hospitals.

From each hospital, 10 emergency nurses were evaluated regarding OF, JS and MW. The statistical analysis was done by the SPSS software, version 22. The criteria for entering the research included full consent to participate in the study and work experience of at least five years in the hospital and at least one year is work in the emergency section. Meanwhile, the exclusion criteria were having a history of psychiatric illness. The 28 questionnaires that were not more than 10% of items answered were removed from the study. The questionnaire used in this study included four main sections as follows: Questions related to demographic information, questions about MW with the letter A (from 1 to 6), OF with the letter B (from 1 to 20), and JS was marked with the letter C (from 1 to 14).

## MW evaluation by the NASA-TLX

The NASA-TLX questionnaire has been extensively used in studies related to human performance [5]. This

method gives us a general score of MWs based on the weighted mean of six factors. The questionnaire contains items on mental demand, physical demand, time demand, individual performance, effort, and frustration. The first three factors are related to the workload demands imposed on the person and the next 3 factors are related to the level of interaction with the work. Each of these factors is ranked 0-20 in the questionnaire. Meanwhile, scores 0 and 20 represent the lowest and highest workload, respectively. A comparison of both scores of 6 parameters determines the weight of each parameter and gives us a conclusion about MW [5]. The study by Mohammadi et al. on the validity and reliability of the MW evaluation questionnaire showed a Cronbach  $\alpha$  of 0.897 for this tool [24].

### OF evaluation

Elizabeth Osberg designed the SOFI questionnaire, and the validity and reliability of this tool have been investigated (Cronbach  $\alpha$  coefficient  $>0.80$ ) in different occupations [25]. This questionnaire has 20 items that measure the intensity of physical OF in different jobs based on a 7-point Likert scale and reports acute OF in a short period and with the most details [25]. Based on the study of Javadpour et al. the overall Cronbach  $\alpha$  coefficient of the SOFI-20 questionnaire is obtained at 0.95. Meanwhile, the Cronbach  $\alpha$  coefficient of different dimensions of the SOFI-20 questionnaire is obtained in the range of 0.69 to 0.887 [26].

### JS assessment

Orly and Giordano designed a JS questionnaire and Bokharaeian et al. [27] confirmed the validity and reliability of this tool via the Cronbach  $\alpha$  coefficient at 0.93, 0.83, 0.89, and 0.87. This questionnaire has four items (rushing, competitive, being greedy and doing work without planning) and 14 sub-items that measure the intensity of JS based on a 5-point Likert scale [27].

### Results

Based on the collected demographic information (Table 1), a total of 112 individuals participated in this study. The minimum and maximum ages of the participants were 30 and 50 years, respectively, with a mean of  $36.8 \pm 4.18$  years. Among them, 57% were male nurses, and the rest were female. Also, the participants' working experience was between 6 and 25 years, with a mean of  $12.92 \pm 4.24$  years.

Table 2 and Figure 1 demonstrate that the converted quartile points related to the MW index score for low, moderate and high levels were 29.5%, 30.4% and 40%, respectively.

Adaptation of quartile points related to the OF index score in low, moderate, and high levels were 25%, 51.8% and 23.2%, respectively. In addition, these changes for the JS were 28.6%, 25.9%, and 45.5% at low, moderate, and high levels, respectively.

Table 3 demonstrates a significant relationship between JS and MW ( $0.496$ ,  $r=0.001$ ,  $P<0.001$ ) and the OF and MW ( $r=0.619$  and  $P<0.001$ ). Furthermore, a direct and significant relationship between MW variables with JS and OF ( $P<0.001$ ) was endorsed by the Spearman correlation coefficient test.

Table 4 shows a significant relationship between work experience and the examined dimensions (WM, OF, and JS;  $P<0.05$ ). In addition, the significance of this relationship between age, MW, and fatigue ( $P<0.05$ ). Gender and education level examination does not show significant results ( $P>0.05$ ).

### Discussion

Health is the primary factor for sustainable development, and psychological problems associated with work environments affect the person's quality of life. Therefore, it is necessary to prevent diseases and improve health, which requires management of the challenges in workplaces [3]. Thus, this study investigated the JS, OF and MW levels among emergency nurses working in hospitals in Ardabil Province, Iran. The results show that 40% of emergency nurses have a high workload, 45.5% have high JS, and 23.2% have high job fatigue. In addition, there is a significant relationship between JS and workload ( $0.496$ ,  $r=0.001$ ,  $P<0.001$ ). There is a significant relationship between OF and workload ( $r=0.619$  and  $P<0.001$ ). Sohrabi et al. showed that nurses experience many JS that lead to job burnout [28]. Shahn et al. in a survey reported level of burnout among nurses was high and was accompanied primarily by stressors in the workplace [29]. In addition, Fallahi et al. investigated MW for traffic control operators, and their study results showed that the mental fatigue of operators increased when their MW increased during peak traffic hours. However, Charles et al. concluded that we cannot determine single criteria to distinguish MW clearly [4, 30]. Moreover, in the present research, there was a significant relationship between workload and OF among emergency nursing personnel, and the results of these

**Table 1.** Participants' demographic information

Participant	Min	Max	Mean±SD
Age (y)	30	50	36.80±4.18
Age Categories			No. (%)
	30-35		48(42.9)
	36-40		46(41.1)
	41-45		13(11.6)
	46-5		5(4.5)
	Total		112
Participant	Min	Max	Mean±SD
Work experience (y)	6	25	12.92±4.24
Categories (y)			No. (%)
	1-10		40(35.7)
	11-20		69(61.6)
	21-30		3(2.7)
Gender	Male		57(50.9)
	Female		55(49.1)
Education (degree)	Male	Bachelor	55(96.49)
		Master	2(3.51)
	Female	Bachelor	51(92.73)
		Master	4(7.27)

studies with articles by Fallahi et al, and Sohrabi et al. are consistent. In addition, the NASA-TLX mental load questionnaire was used in both studies. Sarmi et al. investigated the relationship between the feeling of fatigue and the severity of medical errors in nurses of an educational hospital, and they pointed out the effect of

the OF on the frequency and severity of medical errors and expressed the increase of the OF and mental load among nurses. In addition, Somantri et al. mentioned that nurse fatigue is a risk to both nurse and patient care. Their study results show that the Mean±SD scores were 56.55±15.56, 42.83±19.46 and 51.07±16.98 for acute

**Table 2.** Frequency of the MW, OF and JS in the first and third quartile

Variables	Min	Max	Meant±SD	No. (%)		
				Low	Moderate	High
MW	12	22	16.7±3.6	33(29.5)	34(30.4)	45(40)
OF	40	55	49.02±4.2	28(25)	58(51.8)	26(23.2)
JS	25	37	30.83±3.7	32(28.6)	29(25.9)	51(45.5)

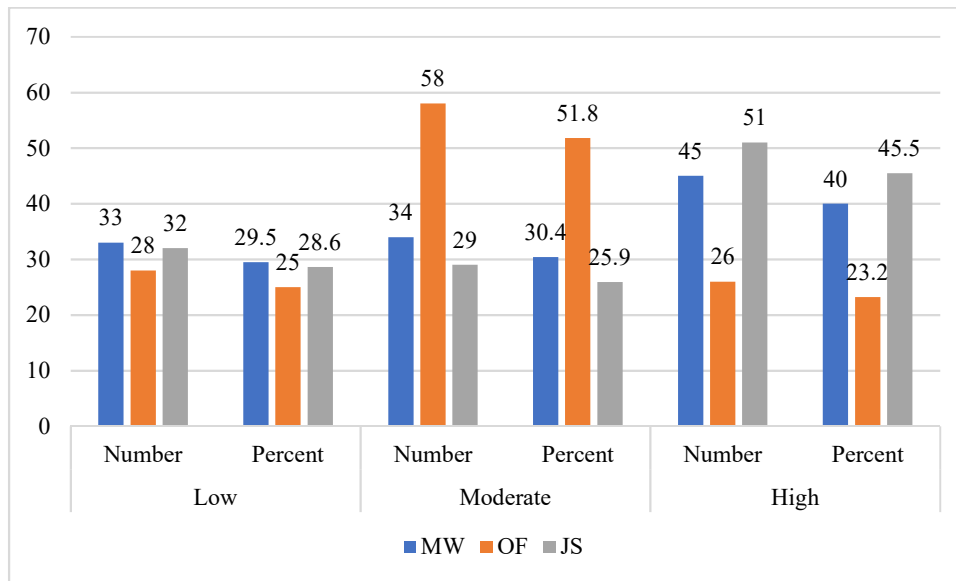


Figure 1. Frequency of the MW, OF and JS in the first and third quartile

fatigue and nurses with fewer work experiences have exposure to lower acute fatigue levels, which tends to increase gradually [19, 31]. These results are consistent with the results of the present study. The study of Lu et al. showed that occupational stress is high among nurses, which is consistent with the present study. The obtained results were related to the high workload, low workforce and the nature of nurses' jobs. In addition, in the conducted survey by Laksmi et al. among emergency nurses, the results show that the majority of nurses had normal anxiety reactions and moderate stress. The elements associated with anxiety are the completeness of hospital facilities (P=0.000) and the presence of comorbidities (P=0.007). Therefore, this can be considered to take strategic steps to avoid nurses' psychosomatic difficulties [9, 15]. Lopez et al.'s study investigating factors related to JS in different work shifts of nurses working in hospitals showed that the highest level of traumatic stress was ob-

served in the mid-shift nurses [14]. Bakhshi et al. study examining job fatigue levels among 203 nurses showed that by using the job fatigue questionnaire, 11.8% had relatively serious job fatigue, which was consistent with the present study [10]. The investigation of Cordero-Guevarai et al. showed that the mental load in nurses is high, and there is a significant relationship between the dimensions of MW with age, type of contract and shift work [11]. In addition, Taheri et al.'s study, based on the questionnaires of nurses' MW, showed that the MW of participants is high, which is consistent with the present study. In Sepehr et al.'s study, the relationship between psychological burden and JS was investigated by NASA-TLX and JS questionnaires. The results showed that the mean mental load of employees is mean and JS is high. The relationship of mental load was significantly related to JS (correlation coefficient=0.293, P=0.022), which is consistent with the results of the present study

Table 3. Correlation between MW, OF and JS (n=112)

Correlations		MW	OF	JS
MW	Correlations coefficient	1.000	0.619	0.496
	Sig.		0.000	0.000
OF	Correlations coefficient	0.619	1.000	0.358
	Sig.	0.000		0.000
JS	Correlations coefficient	0.496	0.356	1.000
	Sig.	0.000	0.000	

**Table 4.** Relationship between demographic information and MW, OF and JS

Variables	Tests	MW	OF	JS
Gender	Kruskal-Wallis H	2.695	1.770	1.331
	df	1	1	1
	Sig.	0.101	0.183	0.249
Age	Kruskal-Wallis H	8.961	8.698	6.355
	df	3	3	3
	Sig.	0.03	0.034	0.096
Work experiences	Kruskal-Wallis H	33.185	30.242	30.085
	df	2	2	2
	Significance	0.000	0.000	0.000
Educations	Kruskal-Wallis H	2.013	0.759	1.026
	df	1	1	1
	Sig.	0.156	0.384	0.311

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[32, 33]. Accordingly, the present study is in the same direction compared to the results of other studies in the investigated field. The nature of nurses' jobs and the high workload under the stress caused by the emergency led to the exposure of these groups to a wide range of mental disorders, which ultimately led to adverse effects on their job performance and lifestyle.

## Conclusion

The employees of an organization are part of the organization's assets, so maintaining their mental and physical health can have a significant impact on the organization's productivity. The present study shows that MW, OF and JS of the emergency nursing staff in the studied group are higher than the mean. Nurses are under psychological pressure. These people are more exposed to psychological injuries due to high MWs and JS. There is also a significant relationship between JS and OF with MW. Therefore, to maintain the mental and physical health of nurses, it is necessary to manage and control these factors in the work environment, so that they can be reduced. These measures can be done in the field of training to control JS and reduce MW in the workplace.

## Study limitations

This study had several limitations. The mental state of the participants at the time of completing the question-

naires may affect their answers. The executive limitation included the interference between completing the questionnaire and the stages of patient treatment by nurses. Therefore, the questionnaire was completed when the nurses had enough time to answer the questions. This study was conducted in one of the provinces of Iran. The researchers suggest repeating the study on a larger scale to be able to generalize the findings with more certainty.

## Ethical Considerations

### Compliance with ethical guidelines

The present study has been registered in the Ethics Committee of [Ardabil University of Medical Sciences](#) (Code: IR.ARUMS.REC.1402.371).

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### Authors' contributions

All authors equally contributed to preparing this article.



## Conflict of interest

The authors declared no conflict of interest.

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