

The Relationship Between Mental Workload and Fatigue in Emergency Department Nurses

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Abstract

BACKGROUND/AIMS: Workload is main factor affecting fatigue. Fatigue is one of the most important issues in work environments which causes reduce the quality of work, increases errors and accidents.

The aim of the study is determination of the relationship between mental workload and fatigue in emergency department nurses.

MATERIALS AND METHODS: In this cross-sectional descriptive-analytic study, the relationship between mental workload and fatigue in nurses who are working in Ble, Mergasor and Ashti General three hospitals in the emergency department were investigated. Total 65 voluntary nurses were composed the sample of the study. Data collection tools consisted of three demographic characteristics, fatigue (CIS20R) and mental workload (NASA-TLX) questionnaires. Data were gathered between December 2018 and January 2019, after the ethics committee approval. Descriptive statistics, correlation coefficient and One-way ANOVA tests were used in analysis of the data.

RESULTS: In the present study, despite the lack of a statistically significant relation between the mental workload and fatigue, different degrees of mental workload and fatigue were found among the nurses of the emergency department'

CONCLUSION: Mental workload and fatigue can negatively affect the nurses' satisfaction and their performance, and consequently affect the implication of nursing process or in other word the provision of safe care for patients negatively.

It is recommended that implement comprehensive, systematic and continuous education programs to increase the level of tolerance and resilience of emergency department nurses.

Keywords: Mental workload, fatigue, nurses, emergency department

INTRODUCTION

Fatigue is one of the most important issues in work environments. Fatigue is a very complex concept that includes psychological and physiological factors. Fatigue is associated with a reduced capacity and motivation to work. Although fatigue may have different causes, it affects performance and motivation quite similarly and reduces mental and physical performance.¹ When an individual is tired, their normal behavior might change and they may make a small error. At the same time, fatigue interacts with physical, mental and emotional

performance, causing a significant decrease in energy and leading to weakness.^{1,2} In general, fatigue causes blurred feelings, reduced physical activity, disrupts the balance of the nervous system and reduces work efficiency. Fatigue can also be effective in developing or exacerbating various disorders, including mental illness, cardiovascular disease, slowness of the mind, weakness, memory loss, muscle aches, forgetfulness and imbalance.³

Workload is one of the main factors affecting fatigue. Workload can be defined as the demand on the operator to achieve a certain level of

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performance or the overall amount of work that must be done by a person or group of people in a given time interval. Workload and long working-hours are the main factors in fatigue. The overall concept of workload originates from a range of human factors and is essentially related to the mental abilities of the individual.^{3,5} Mental workload refers to the portion of operator information processing capacity or resources that are actually required to meet the system's demands. Mental workload may be viewed as the difference between the capacities of the information processing system that are required for task performance to satisfy performance expectations and the capacity available at any given time.^{1-4,6}

Individuals working in occupations with a high workload might have to struggle with decreased performance, memory loss, damage to their thinking process, irritability, and decreased learning due to fatigue and inappropriate scheduling.⁶ Due to the critical nature of the job and the necessity of the safety of the patients, the relationship between work-related fatigue and error is very important in individuals who work in hospitals. Nurses are subject to extreme mental workloads because they are always making important decisions which have a direct effect on people's lives.^{6,7}

Nursing is believed to be at the forefront of stressful hospital and medical careers.⁸ In a 2010 study, the Canadian Association of Nurses found that nurses experience significant levels of fatigue.⁹ Nursing, especially in emergency departments, is by nature a stressful profession, as it is highly complex, active, and dynamic.^{5,9,10} Emergency departments are difficult places to work due to their demanding working conditions, heavy workloads, psychological stress, lack of resources, and inadequate support.^{5,10,11} Nurses in emergency departments report increasing role overload because of critical staff shortages, time constraints, focus on the survival of the patients and increased patient numbers and acuity, the presence of stressors, possible conflicts with their team, and the deficiencies of the facilities. Such overload could compromise staff satisfaction with their working environment, which might lead to more dissatisfaction.^{5,12,13} All of these factors have adverse effects on the nature of the nursing job by compromising decision making, creativity, and problem-solving ability, all of which are essential aspects of patient care in the health care system.¹⁴

Therefore, given the criticality of the tasks of nurses in the emergency department and the need for high accuracy and alertness during the care of patients with special conditions, the researchers decided to conduct this study aimed at determining the relationship between mental workload and fatigue.

The research questions included were the following:

- What is the rate of fatigue and its dimensions among emergency department nurses?
- What is the rate of mental workload and its dimensions among emergency department nurses?
- What is the relationship between mental workload and the fatigue dimensions in emergency department nurses?
- What is the relationship between mental workload and the demographic characteristics of emergency department nurses?

- What is the relationship between fatigue and the demographic characteristics of emergency department nurses?
- The aim of this study was to determine the relationship between mental workload and fatigue in emergency department nurses.

MATERIALS AND METHODS

Study Design: The research design was a cross-sectional and descriptive-analytic study.

Study Setting: The study was performed on nurses who were working in Ble, Mergasor and Ashti General, in the emergency department, in Iraq. The data were gathered between December 2018 and January 2019.

Sample Selection: The study population comprised 65 nurses employed in the emergency departments of three hospitals. All of the nurses filled out a questionnaire and all of the nurses voluntarily took part in this study.

Data collection tool: The study data were collected using a questionnaire based on a literature review.²⁻¹⁸ The questionnaire contained three sections. The first section consisted of questions regarding the nurses' demographic characteristics. The other two sections were the The Checklist Individual Strength Questionnaire 20R (CIS20R) and National Aeronautics and Space Administration - Task Load Index (NASA-TLX) Scale.

- The CIS20R questionnaire was used to assess fatigue. This questionnaire consists of 20 questions containing four factors, namely: mental fatigue, concentration, motivation and physical activity. The mental fatigue factor includes eight questions (numbers: 1, 4, 6, 9, 12, 14, 16, and 20); the concentration factor includes five questions (3, 8, 11, 13 and 19); the motivation factor includes four questions (2, 5, 15 and 18); and finally, the physical activity factor includes three questions (7, 10, and 17). Each of these factors is assessed through a 6-point scale. According to the CIS questionnaire, the overall fatigue scores can be in a range from 20 up to 120. The higher the total is, the higher the overall fatigue is. The CIS is a 20-item fatigue questionnaire developed by the Dutch research team of Vercoulen in 1994. The questionnaire has been translated into multiple languages including Turkish. Ergin and Yıldırım¹⁵ found that the internal consistency reliability of the CIS-T was Cronbach's $\alpha=0.87$ and the interclass correlation coefficient reliability was $r=0.92$. The item-discriminant validity ranged from $r=0.10$ to 0.63 .¹⁵ The reliability and validity of the CIS20R questionnaire were evaluated by Habibi et al.³ for emergency service personnel in Iran. They obtained a reliability of 0.86 for this questionnaire.

- The NASA-TLX workload index is used to assess mental workload; this scale is one of the most well-known tools for assessing the mental workload from an individual perspective. NASA-TLX uses a visual scale of 0 to 100 divided into 10 units. Six subscales of mental needs, physical needs, time requirements, performance, effort and frustration are evaluated. Each subscale is defined in the questionnaire and the subjects are asked to study the definitions before answering the questions. The minimum score of each subscale is zero and the maximum score is 100, which the respondent determines, based on the score attributed to each individual subscale. The mean of the subscales is reported as the amount of work load, which is a number between 0 and 100. Average scores below 50 are acceptable and scores above 50

are considered unacceptable. The NASA-TLX is a widely used, subjective, multidimensional assessment tool which rates the perceived workload in order to assess a task, system, or team's effectiveness or other aspects of performance. It was developed by the Human Performance Group at NASA's Ames Research Center over a three-year development cycle which included more than 40 laboratory simulations.¹⁶

The face validity and reliability of the NASA-TLX method was confirmed ($\alpha=0.897$) for intensive care unit (ICU) nurses in Iran. According to these results, it was suggested that the NASA-TLX method and the performance obstacles and facilitators questionnaire to assess the workload of ICU nurses can be used.¹⁷

Data Collection

The nurses were informed about the study. The nurses were required to complete the questionnaire while they were at work in the emergency department. The implementation of the data collection forms lasted about 30 minutes.

Ethical Aspect

Ethics committee approval was obtained from the Near East University (approval number: 678, date: 22.11.2018) and written permission was obtained from the General Health Directorate of Erbil. Verbal/written consent was obtained from the nurses before distributing the questionnaire.

Statistical Analysis

Statistical analysis was carried out using the SPSS 21.0 limited version of the Statistical Package for the Social Sciences (IBM Corp., Armonk, NY, USA) by applying descriptive analysis and normality tests. Normal distribution was analyzed with the Kolmogorov–Smirnov test. The relationship between variables was evaluated with Pearson correlation analysis. One-Way ANOVA was used to compare variables of more than two characteristics. The Levene test was used to assess the homogeneity of variances. In this study, $P<0.05$ was accepted as the statistical significance level.

RESULTS

The mean age of the participants was 28.95 years. 50.8% of the participants had 1–3 years of working experience. 52.3% of the participants were male. The majority of the nurses had a degree (64.6%).

The subjective feeling of fatigue score (23.41 ± 12.27) and reduction of motivation score (7.04 ± 4.38) obtained the highest and lowest rates respectively. Total fatigue was estimated to be 53.79 ± 18.42 .

The performance score (62.69 ± 14.73) and the temporal demand score (45 ± 16.65) obtained the highest and lowest rates respectively. The total mental workload was estimated to be 55.26 ± 6.98 .

Based on the Spearman correlation coefficient, there was no significant relationship between the mental workload and fatigue dimensions in the emergency department nurses.

Eta's statistical index showed a very weak correlation between the variables of gender, level of education and hospital workplace, with the mean scores of mental workload among the emergency department nurses. Also, based on the Pearson correlation test results, there was no statistically significant correlation between age and years of working in the emergency department with the mean scores of mental workloads.

Based on the above table, it shows a very weak correlation between the variables of gender, level of education and hospital workplace, with the mean scores of fatigue among the emergency department nurses. Also, based on the Pearson correlation test results, there was no statistically significant correlation between age and years of working in the emergency department with the mean scores of fatigues.

DISCUSSION

The focus of the present study was to determine the relationship between mental workload and fatigue in emergency department nurses. This study was conducted on 65 nurses with varying gender, levels of education and hospital workplaces. The majority of the nurses had a degree (64.6%). In relation to the dominance of males in the sample of

Table 1. Descriptive characteristics of the nurses (n=65)

Variables	Frequency (n)	Percent (%)	
Age (mean: 28.95)	≤25	6	9.2
	26–30	44	67.7
	≥31	15	23.1
Years working in emergency department (mean: 3.51)	1–3	33	50.8
	4–6	26	40
	7–9	6	9.2
Gender	Male	34	52.3
	Female	31	47.7
Level of education	Preparatory of nursing	15	23.1
	Diploma	42	64.6
	Bachelor	8	12.3
Workplace hospital	Ble General Hospital	25	38.4
	Ashti General Hospital	20	30.8
	Mergasur General Hospital	20	30.8
n: number.			

Table 2. Mean scores of Checklist Individual Strength (CIS) and its dimensions among emergency department nurses (n=65)

CIS and its dimensions	Mean ± SD (min)
CIS-Subjective feeling of fatigue	23.41±12.27
CIS-Reduction of concentration	15.41±5.24
CIS-Reduction of motivation	7.04±4.38
CIS-Reduction of physical activity	7.89±5.39
CIS total score	53.79±18.42

SD: standard deviation, n: number.

Table 3. Mean scores of mental workload and its dimensions among emergency department nurses (n=65)

Mental workload and its dimensions	Mean ± SD (min)
Mental demand	60±13.11
Physical demand	58.84±12.83
Temporal demand	45±16.65
Performance	62.69±14.73
Effort	53.53±14.29
Frustration	51.53±18.15
Mental workload total score	55.26±6.98

SD: standard deviation, n: number.

this study, it can be stated that the reason for this may be related to the nature of the emergency department and the need for more male staff in these units (Table 1). Johnston et al.⁵ stated in their review article that research on emergency department nurses frequently reported different demographic profiles from other nursing populations, with a greater proportion of male staff, more advanced qualifications and longer clinical experience. However, this was culturally specific as data from Taiwan, China, Brazil and Iran primarily included female nurse staff populations limited.⁵

The results of the present study showed that total fatigue was 53.79±18.42. Also, in the present study, the subjective feeling of fatigue score (23.41±12.27) was the highest rate (Table 2). Based on the results of the present study, it is concluded that the mean of the overall fatigue score is in the medium range. These results are consistent with the results of Motamedzade et al.¹⁸ (the total mean of their fatigue score was 58.40±11.90). Among the fatigue dimensions, mental fatigue had the highest mean in comparison with the other dimensions. However, in the study of Teixeira et al.¹⁹, 42% of the participants had severe fatigue. Additionally, in the study of Guntupalli et al.²⁰, 20.8% had severe fatigue.

Other studies have mentioned many reasons for fatigue in nurses, including severe illness, patients' death, high workloads, role ambiguity, frequent exposure to stressful situations and occupational stress, organizational positions such as authority, social support, autonomy and workload.^{11,18,21,22}

Several studies have indicated that factors, including shift-work and long-term work, play a role in nurses' subjective feelings of fatigue.^{23,24} The results of the Kagamiyama and Yano²⁴ study revealed rotating shift-work was one of the important factors in the high degree of subjective fatigue among nurses, due to the fact that after a night-shift, they have a disrupted sleep rhythm which can cause the subjective feeling of fatigue in nurses.

The effects of long working-hours has been an important issue for those researchers involved in ergonomics studies over the past few decades.^{23,25} Nursing shortages have been associated with increased nurse workloads. In his study, Bae²⁵ found that 15.6% of hospital nurses in two American states worked more than 40 hours per week. Studies have shown that there is a relationship between long hours of work and cumulative fatigue.^{24,26,27} Long hours of work increased the exposure to psychological and physical demands and may induce fatigue and stress in the affected workers.²⁸ The results of one study showed that

Table 4. The relationship between mental workload and the fatigue dimensions in emergency department nurses (n=65)

Mental workload	Subjective feeling of fatigue		Reduction of concentration		Reduction of motivation		Reduction of physical activity		CIS total score	
	p	r	p	r	p	r	p	r	p	r
	0.82	-0.87	0.317	0.12	0.58	0.06	0.62	-0.05	0.82	-0.02

Spearman correlation coefficient, CIS: Checklist Individual Strength Questionnaire, n: number.

Table 5. The relationship between mental workload and the demographic characteristics of emergency department nurses (n=65)

Mental workload	Pearson's chi-squared test				Eta test		
	Age		Years of working in emergency department		Gender	Level of education	Hospital
	r	p	r	p	r	r	r
	0.13-	0.26	0.02	0.83	0.03	0.16	0.17

n: number.

Table 6. The relationship between fatigue and the demographic characteristics of emergency department nurses (n=65)

Mental workload	Pearson's chi-squared test				Eta test		
	Age		Years of working in emergency department		Gender	Level of education	Hospital
	r	p	r	p	r	r	r
	0.07	0.57	0.11	0.37	0.10	0.07	0.08

n: number.

the average percentage of feelings of subjective fatigue “before going to work” increased with the increase in the length of weekly working-hours.²⁷ Therefore, improving each of these factors can help reduce the pressure and mental fatigue of nurses. The mental workload is the amount of effort that the mind makes while discharging our duty. Activities that require concentration, control measures and speed of action usually increase the mental and physical load significantly in those who perform them.²⁹

Nowadays, the intense competition for scarce resources in the health system makes a quantitative and qualitative measurement of the nurses’ workload necessary. In hospital emergency departments, the staff and especially nurses bear the burden of a heavy workload due to the fact that it is the frontline department in a hospital and they face cases that often have severe and acute medical conditions. This heavy workload and urgent patient care have a major impact on the nurses’ performance.^{12,14,21}

The results of the present study showed that the performance score (62.69 ± 14.73) and mental demand score (60 ± 13.11) were at higher rates than the others dimensions. The total mental workload score was 55.26 ± 6.98 (Table 3).

High performance pressure in comparison to the other dimensions of the workload in the current study indicates that the emergency department nurses are not satisfied with their performance in carrying out their assigned tasks in line with their determined purpose. The results of previous studies have shown that solutions such as an appropriate association between nursing managers and nursing staff could have a positive effect on nurses’ performance and their efficiency.^{30,31} In the present study, the high mental stress also indicates the severity, complexity, and the need to have great accuracy in performing the assigned tasks in the emergency department. In previous studies, it was found that the doctors’ and nurses’ highest workload in the emergency department was related to mental or psychological stress.³⁰⁻³³

The results of the present study showed no significant relationship between the mental workload and fatigue dimensions in emergency department nurses (Table 4).

In the present study, there is no correlation between the level of fatigue and its dimensions with the mental workload in nurses. Our result was not consistent with the results of Van Bogaert et al.³² In their study, it was determined that workload, as a major component of the health service, plays a decisive role in undesirable consequences such as emotional exhaustion, depersonalization, and burnout.

Workload is one of several predictors of fatigue, and mental workload is associated with all of the dimensions of fatigue, which includes both the mental and physical ones, so it can be said that high and low workloads are associated with fatigue.^{33,34}

In the present study, the lack of a significant correlation between the level of fatigue and mental workload among emergency department nurses may be due to the difference in measurement instruments used, especially the fatigue measurement instrument.

The evaluation tool for fatigue in the current study was more specialized and included more dimensions of fatigue than those instruments used in other studies. Therefore, the type of assessment tools used may explain the differences in outcomes.

It should be mentioned that in the Barbosa et al.³⁴ study that a significant correlation was not found between these two variables among doctors. Moreover, in the Bakhshi et al.³⁵ study, there was no significant association between mental workload and fatigue among the nurses.

The results of the present study revealed a very weak correlation between the variables of gender, level of education and hospital workplace with the mean scores of mental workload and fatigue among emergency department nurses. Also, there was no statistical correlation between age and years of working in the emergency department with their mean scores of mental workload and fatigue based on a Person correlation test (Tables 5 and 6).

CONCLUSION

In the present study, despite the lack of a statistically significant relation between the mental workload and fatigue, different degrees of mental workload and fatigue were found among the nurses of the emergency department.

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MAIN POINTS

- Mental workload and fatigue can negatively affect the satisfaction and performance of emergency department nurses, and consequently negatively affect the implementation of the nursing process, or in other words, the provision of safe care for patients.
- It is important to implement comprehensive, systematic and continuous education programs to increase the levels of tolerance and resilience of emergency department nurses.
- It is recommended that future researchers investigate the practical experiences of nurses in emergency departments regarding those factors affecting the level of mental workload or fatigue.

ETHICS

Ethics Committee Approval: Ethics committee approval was received for this study from Near East University (approval number: 678, date: 22.11.2018).

Informed Consent: Given by the nurses who participated in this study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: K.I.S., Ü.D.Y., Design: K.I.S., Ü.D.Y., Supervision: Ü.D.Y., Data Collection and/or Processing: K.I.S., Analysis and/or Interpretation: K.I.S., Literature Review: K.I.S., Ü.D.Y., Writing: K.I.S., Ü.D.Y.; Critical Review: Ü.D.Y.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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