

Effects of Work Shifts and Mental Workload on Chronic Fatigue among Female Nurses in Intensive Care Units

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Abstract

Background: The present study aimed to investigate the effects of work shifts and mental workload on chronic fatigue among female nurses in Intensive Care Units of selected hospitals in Shiraz.

Methods: The participants in this cross-sectional study were 118 female nurses working in Intensive Care Units of three hospitals in Shiraz with an average age of $304.8 \pm$ years. SP (Samn-Perelli) Mental fatigue scale and NASA task load index were rated for two weeks at the beginning and end of each work shift. The Checklist Individual Strength (CIS) questionnaire was completed to assess the fatigue during the last two weeks.

Results: Mean score of chronic fatigue was 69.2 ± 13 . Mental fatigue and mental workload per shift were significantly correlated with work shifts ($P=0.001$). Mental workload ($P=0.006$, $r=0.24$) and mental fatigue caused by work shifts ($P=0.001$, $r=0.42$) were also significantly correlated with chronic fatigue.

Conclusion: The results of the study showed that mental workload and work shifts influence the nurses' fatigue in Intensive Care Units. Therefore, using intervention strategies to reduce mental work load and modification of shift work system in this group seems to be necessary.

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Introduction

During the progress of civilization, humans lived and worked day and night based on changes in their life cycle.¹ Modern industrial societies, the advent of artificial lightening, continuous industrial processes and work shifts disturbed this natural rhythm.²⁻⁵ Besides, the performance of important sectors such as health and treatment is almost impossible without work shift patterns since the health care sector covers a period of 24 hours each day and 365 days each year.⁶ In the health care sector, nursing more than any other job needs different work shifts. Intensive Care Unit nurses are exposed to multiple risks including high mental workload, fatigue, stress and exhaustion.⁷ This leads to increased fatigue due to different shift work patterns, mandatory overtime, unforeseen shifts and other sub-tasks.^{8,9} Shift work is a potential problem for physical,

mental and social health, and also for job performance and patient safety. Moreover, fatigue is associated with shift work.¹⁰⁻¹² Scientific literature has introduced fatigue as a workplace hazard which is a serious threat to the health of nurses and patients.^{13,14} In many studies on shift work and fatigue, fatigue has been defined in various ways. As Mann stated, fatigue is rooted in a physiological mechanisms associated with sleep, sleep deprivation and Circadian rhythm. In this way, the following operational definition has been used for fatigue: "the inability to function at the desired level due to incomplete recovery from the demands of prior work and other waking activities".¹⁵ We are also dealing with fatigue that occurs over a period of several days called a long-term or chronic fatigue.¹⁶ On the other hand, in the studies which have assessed fatigue in nurses, especially Intensive Care Unit nurses, little attention has been paid to workload; however, the relationship between workload

and fatigue is complicated and needs further research.¹⁷ Workload is one of the important factors influencing the patient safety and treatment quality and thus the quality of services provided by nurses.¹⁸ There are different stressors in the intensive care unit that, along with additional and monitoring tasks, influence the ability of nurses to manage workload and reduce their ability to detect and respond to emergency situations.¹⁹ Therefore, in addition to shift working, workload can be investigated as an influencing factor on fatigue. Due to the sensitivity of Intensive Care Units as well as the nature of nursing work in these units and the knowledge gap about this group of workers in terms of evaluating their work shifts and workload, the present study aimed to investigate the effects of work shifts and mental workload on fatigue in female nurses working in intensive care units of selected hospitals in Shiraz.

Materials and Methods

Sample and Design

This cross-sectional study was conducted in intensive care units (ICU) of three hospitals including governmental-educational, governmental non-educational and private ones in Shiraz in 2014. The samples consisted of 118 shift-worker female nurses working in Intensive Care Units; census method was used to select the participants. The exclusion criteria were pregnancy, recent acute health problems and reluctance to participate in the study. For homogeneity purposes, Cardiac Care Unit (CCU), Neurology ICU and internal ICU in all the three hospitals were selected.

Data Collection Tools

Four questionnaires including demographic characteristics, Samn-Perelli mental fatigue scale, NASA-TLX mental workload index and individual ability assessment questionnaire (Checklist of Individual Strength) were used as assessment tools.

A) Demographic characteristics: The participants completed demographic questionnaire including questions such as age, marital status, work experience, type of employment, and type of unit and hospital.

B) Subjective fatigue: The participants rated their level of fatigue before and after each shift using the 7 point Samn-Perelli (SP) fatigue scale (Samn and Perelli 1982, 1=wide awake, 2=very alert, 3=normal level of alertness, 4=mild fatigue, 5=moderate fatigue, 6=sever fatigue, 7=completely fatigue). At the time of analysis, points were categorized into 4 groups: 1-3 sufficiently alert, 4 mild fatigue, 5-6 moderate to severe fatigue and, 7 sever fatigue.²⁰ In a study by Gander,²¹ the sensitivity of the scale to fatigue caused by sleep-wake history and circadian phase was reviewed and approved in a pilot study.

C) Workload: Workload was evaluated using the NASA-Task Load Index (NASA-TLX). The participants completed the NASA-TLX at the beginning and end point of each shift (Hart and Staveland, 1988).²² The evaluation consisted of scales divided into twenty equal intervals, marked between labels at each end from 'low' to 'high' or 'good' to 'poor'. There were six sub-scales or dimensions: mental demand, physical demand, time constraints, performance, effort and frustration. The final score was obtained using the non-weighted scoring method (i.e. sum of the scores of all six dimensions).²³ In Safari and colleagues' study in the Intensive Care Unit, Cronbach's alpha was obtained as 0.83.²⁴

D) Chronic fatigue: The participants completed the Checklist of Individual Strength (CIS) at the end of work. The CIS consisted of 20 statements rated on a 7-point scale, from zero (not at all) to 6 (yes completely), and assessing the degree of fatigue experienced during the previous 2 weeks. The total score was derived by adding individual items after negatively weighting fatigue-absent items. The higher total scores indicated greater levels of subjective fatigue, reduced motivation, more difficulty concentrating and lowered activity.²⁵ In Habibi and colleagues' study, Cronbach's alpha was 0.86.²⁶

Ethical Considerations

Ethics approval for the study was obtained from the Ethics Committee of Shiraz University of Medical Sciences; a written informed consent was obtained from participants after entry to the research environment.

Data Analysis

In order to analyze the data, Statistical Package of Social Science (SPSS) software version 19 was used. Descriptive statistics were applied for reporting means and percentage of variables of the study. Repeated Measure analysis with Bonferroni correction factor was run to compare fatigue and mental workload in different shifts; also, Pearson correlation test was used to determine the relationship between variables such as mental workload, type of hospital and unit with chronic fatigue.

Results

Mean age and work experience of the study participants was respectively 30 ± 4.8 and 5.65 ± 4.2 years. 53.5% of the participants were single. 45.8% of the participants were working in the governmental educational hospital, 25% in the governmental non-educational hospital and 29.2% in the private hospital. Mental fatigue in morning and evening shifts was moderate and low, respectively. In night shifts and long shifts, mental fatigue was moderate to high.

Table 1 shows that the difference in mental fatigue was significant in different shifts while the difference was not significant in different units. Also, the difference in mental fatigue in different shifts of each hospital and between different hospitals was statistically significant. Using Bonferroni correction, it was found that mental fatigue in non-educational hospitals was significantly different from that of private and educational hospitals.

Table 2 shows that the difference in mental workload during different shifts was significant while it was not statistically significant in different units and hospitals.

Table 3 shows that there was a significant relationship between chronic fatigue and mental fatigue ($r=0.42$, $P=0.001$) and mental workload ($r=0.24$, $P=0.006$) while the type of hospital and unit had no correlation with chronic fatigue ($P>0.05$).

Table 1: Mean and standard error for mean mental fatigue during different shifts in different hospitals

Type of unit	shift	Mental fatigue	P value*	Type of hospital	shift	Mental fatigue	P value*
CCU	Morning	4.5±0.01	0.001	Governmental educational	Morning	5.7±0.15	0.001
	Evening	4.8±0.12			Evening	5±0.16	
	Night	6.6±0.07			Night	6.8±0.08	
	Long	6.6±0.54			Long	6.9±0.24	
Neurology ICU	Morning	5.4±0.01	0.001	Governmental non-educational	Morning	5±0.01	0.001
	Evening	4.7±0.12			Evening	4.5±0.12	
	Night	6.7±0.07			Night	6.6±0.08	
	Long	6.75±0.50			Long	6.7±0.52	
Internal ICU	Morning	5.2±0.01	0.001	Private	Morning	5.3±0.07	0.001
	Evening	4.6±0.12			Evening	4.7±0.10	
	Night	6.7±0.07			Night	6.6±0.06	
	Long	6.9±0.30			Long	6.7±0.5	

*Repeated Measure test, $P<0.05$; ‡Repeated Measure test and Bonferroni correction

Table 2: Mean and standard error for mean mental workload during different shifts in different hospitals

Type of unit	Shift	Mental workload	P value	Type of hospital	Shift	Mental workload	P value
CCU	Morning	71.8±1.4	0.001	Governmental educational	Morning	70.3±1.7	0.001
	Evening	65.0±1.7			Evening	61.0±2.0	
	Night	68.5±1.5			Night	65.0±1.7	
	Long	76.5±1.7			Long	74.5±8.9	
Neurology ICU	Morning	70.8±1.4	0.001	Governmental non-educational	Morning	71.1±1.5	0.001
	Evening	63.0±1.7			Evening	64.6±1.8	
	Night	70.8±1.5			Night	67.0±1.6	
	Long	75.3±1.7			Long	75.8±7.9	
Internal ICU	Morning	71.2±1.4	0.001	Private	Morning	71.9±1.2	0.001
	Evening	64.0±1.7			Evening	65.0±1.4	
	Night	64.7±1.5			Night	70.0±1.3	
	Long	72.6±1.6			Long	74.2±12.8	

Repeated Measure test in $P<0.05$

Table 3: Correlation of chronic fatigue with some occupational variables

Variable	Correlation coefficient	P value†
Mental workload	0.24	0.006
Mental fatigue	0.42	0.001
Type of hospital	-	0.7
Unit	-	0.52

†Pearson correlation, $P<0.01$

Discussion

The aim of the present study was to investigate the effects of different work shifts and mental workload on fatigue in female nurses working in Intensive Care Units. The study results showed that different patterns of shift work caused varying degrees of mental fatigue. Also, mental workload showed significant differences in different work shifts. Results of the correlation test showed that mental workload and fatigue caused by work shifts were significantly associated with chronic fatigue, while the type of hospital and type of unit were not associated with chronic fatigue.

According to Table 1, night, long time, morning and evening shifts had the highest mental fatigue, respectively. The duration of night and long shifts was 12 hours; the duration of morning and evening shifts was 6 hours. The difference between mean mental fatigues resulting from different work shifts was statistically significant. In a study by Fletcher, alertness was shown to be more for shifts less than 8 hours compared with shifts more than 8-hours.¹³ In other studies, it was found that factors including length of shifts and work hours per week influenced fatigue.^{11,27} Although in the present study morning shift was less than 8 hours, a high amount of fatigue was reported. In Ingre's study, it was noted that day shift had at least two key characteristics that may cause fatigue: start time and duration. Commencing work too early in the morning is linked with short sleep duration and higher sleepiness.²⁸ However, in this study, workload was high in the morning; one of the reasons for fatigue in the morning shifts could be related to this factor. According to Table 1, mean mental fatigue in different units was not significantly different while the difference was significant in different hospitals. Non-educational hospitals had a higher level of mental fatigue than private and educational hospitals. According to surveys, high mental fatigue seems logical in non-educational hospitals due to certain conditions such as lack of interns and residents and incompetent assistant's team; also, the difference in the sample size could be regarded as another reason.

Table 2 shows that long time, morning, night and evening shifts had the highest mental workload, respectively. Due to one additional hour to change shifts, night shifts and long shifts were 13 hours and morning shift and evening shifts were 7 hours. The relationship between workload and increased length of work shift was confirmed. In his study, Bulk showed that mental workload is an important factor influencing fatigue in a 12-hour shift system.²⁹ Moreover, in addition to long work shifts in ICUs, other factors influence mental workload, which have been identified as barriers of performance. Studies have shown that these factors affect mental and physical workload in nurses and should be considered in mental workload assessment which include: nurse-to-patient

ratio, availability of transport team for carrying or transporting the patient, secretarial tasks and Charge Nurse Duties, number of admissions at each shift, visiting hours and number of unstable patients and patients in need of treatment in every shift.³⁰⁻³²

Table 3 shows that mental workload is significantly associated with chronic fatigue. This finding is in agreement with the results of some previous studies.^{33,34} Nurses do various tasks with high physical and psychological requirements. Since these tasks can raise the level of stress and fatigue, nurses will experience more difficult workload and fatigue.³⁴ According to Table 2, mental workload is not associated with the type of unit and hospital. Up to now, no study has been carried out to compare mental workload in different units and hospitals. The authors believe that although diseases vary among patients in each unit, all of them are in need of intensive care.

The limitations of this study were accuracy and honesty of nurses to answer the questions as well as cultural issues which were controlled as much as possible. The cross-sectional design of the study and the sample size were the other limitations of the study. It is hoped that in other studies on this area the role of these limitations will reduce.

Conclusion

Overall, the findings of the present study showed that different work shifts and mental workload influenced chronic fatigue. The type of Intensive Care Unit and type of hospital were not significantly associated with chronic fatigue. Patients in Intensive Care Units are in need of care and high attention. Nursing jobs in Intensive Care Units are inherently sensitive, requiring monitoring and are highly stressful and, more than any other job, need different patterns of shift work; this condition is dominant in all units and hospitals. To reduce nursing workload, holding teaching sessions for managers, head nurses and shift worker nurses to introduce Circadian principles, sleep hygiene techniques and correct patterns of shift work seems to be necessary.

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Conflict of Interest: None declared.

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