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Association of musculoskeletal disorders and workload with work schedule and job satisfaction among emergency nurses

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ABSTRACT

Background: The emergency department is a highly demanding work environment, considered by high workload and stress. The impact of work-related factors on musculoskeletal disorders (MSDs) in emergency nurses (ENs) are not yet well understood. We investigated the association of MSDs and workload with work schedule (permanent day and night work) and job satisfaction in ENs.

Method: Data were collected through a questionnaire including individual and work-related factors, workload (National Aeronautics and Space Administration-Task Load Index [NASA-TLX]) and MSDs (Standardized Nordic Questionnaire) from 380 ENs in five hospitals.

Results: The findings revealed that work schedule and job satisfaction levels were significantly associated with the MSDs in different body regions. Work schedule was significantly related to physical demand, performance, frustration, and overall workload, whereas it was not to the mental and temporal demands and effort. Job satisfaction level was negatively associated with mental demand and frustration. A high prevalence of musculoskeletal problems, particularly in knees, upper back, lower back, neck and shoulders were found.

Conclusion: MSDs are highly prevalent among ENs involved in night work and with low job satisfaction levels. The results are discussed in terms of their implications for emergency hospital nurses. The findings can help to better understand the working conditions and emphasize the need for ergonomic interventions in order to reduce MSDs and workload. Also, the study findings highlight the importance of mental aspects of workload in this occupational group.

1. Introduction

The emergency department (ED) is a demanding environment, with both high physical and mental workload [1]. Given the unique characteristics of the patients it serves, the ED is one of the most challenging areas in hospitals. This high demanding work environment has a proven effect on sleep quality and quantity of physicians and nurses, which may increase medical errors significantly [2]. Further, the aforementioned combination increases likelihood of mental burnout and fatigue in emergency nurses (ENs) [3–6]. Meanwhile, physically demanding tasks such as lifting patients onto a bed, getting them in and out of bed, constant bent-forward, and twisted postures are performed by ENs; therefore, musculoskeletal disorders (MSDs) are among the physical complaints ENs may face over time [7,8].

Work-related MSDs are known as resulted symptoms of occupational risk factors such as constant pain in body structures including: bones, nerves, tendons, joints, ligaments, and even the circulatory system [9,10]. A number of investigations found that despite common underreporting, MSDs are one of the main causes of nurses' sick leaves, and inability to continue their work [10,11]. Furthermore, various enhancer factors such as: socio-demographic aspects, psychological and physical situations can help MSDs to develop [10,12–14]. So, prevention of musculoskeletal disorders can easily result in high productivity, job satisfaction and safety at work [10].

On the other hand, night work is a well-recognized occupational health hazard in hospital systems. Approximately 20 per cent of the

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working population work night shifts (i.e., work hours outside 07:00 h to 18:00 h) [15]. Night work is known to contribute to sleep deprivation, circadian rhythm disruption, and medical errors [16–18]. The results of a recent study conducted among ENs in the United States suggested that sleep quality is associated with patient safety incidents [2].

Although numerous studies have been conducted among hospital nurses, to the authors' knowledge, the association between MSDs and workload with work schedule (permanent day and night work) and job satisfaction have not been explored sufficiently among ED nurses. In one of the few attempts to address this issue, Attarchi et al. (2014) investigated the association between shift working and MSDs among Iranian nurses. They reported that night work was positively associated with an increased likelihood to suffer from musculoskeletal disorders [19].

With specific reference to ENs, this occupational group has a crucial role in health care quality and patient safety in hospital settings. Therefore, on the basis of the above-mentioned literature, the purposes of this study were to: a) examine the association of MSDs with work schedule (permanent day and night work) and job satisfaction; b) evaluate the association of workload with work schedule (permanent day and night work) and job satisfaction.

2. Material and methods

2.1. Study design and setting

This cross-sectional study was carried out among ENs of five hospitals in Tehran, Iran between January and April 2017.

2.2. Sample

All the ENs employed in the five hospitals were invited to participate in this study, as a census method. They were categorized into two groups: nurses who worked during the day and nurses who permanently worked at night. The work schedule times for day and night works were from 7.00 am to 19.00 pm and from 19.00 pm to 7.00 am, respectively. ENs in both groups conducted the same duties. Less than one year of work experience, having physical disabilities or mental illnesses, and working mixed shifts means rotating day and night were defined as exclusion criteria. None of the participants met the exclusion criteria.

2.3. Data collection

An anonymous self-report questionnaire, that took 20 min to complete, was used to collect the data. The questionnaire comprised of four sections covering the following items was used for data collection: a) demographic information consisting of questions on age (years), weight (kg), height (cm), marital status (married/single), taking exercise (yes/no), b) work-related items consist of work experience (years), work schedule (permanent day and night work), and job satisfaction c) workload, and d) MSDs.

Job satisfaction level was assessed based on the survey question: "How much are you satisfied with your job? low, moderate, or high", it should be noted that its validity and reliability were approved in previous studies by Dianat et al. [13,20].

The prevalence of MSDs was described as any perceived pain or discomfort from the nine body areas (neck, shoulders, upper back, lower back, elbows, wrists/hands, hips/thighs, knees, and ankles/feet) lasting for more than one day during the previous 12 months. The standardized Nordic Musculoskeletal Disorders Questionnaire for different body regions was used to evaluate reported cases of symptoms in this study [21]. The questionnaire was already translated into Persian language and has an established validity and reliability in previous studies [22,23]. Additionally, the locations of these anatomic regions were demonstrated using a body map. The response alternatives were: No/Yes. Those nurses who reported MSDs in any of their body areas were asked to show the pain severity in each of the different body regions, using a Likert scale of 1 as very low pain to 5 as very high pain.

The National Aeronautics and Space Administration-Task Load Index (NASA-TLX) was applied to evaluate the workload. NASA-TLX is a well-recognized subjective workload assessment tool, developed by Hart and Staveland [24]. It is a multidimensional instrument, which assesses six subscales of workload, including mental demand, physical demand, temporal demand, performance, effort, and frustration. According to the instructions, for each dimension, a number between 0 and 100 is selected regarding the perceived workload. An overall workload score is calculated based on a weighted average of ratings on 6 dimensions. The validity and reliability of the Persian version of the NASA-TLX have been investigated in a previous study [25].

2.4. Data analysis

Demographic data and work-related factors of the study population were tabulated. Independent samples two-tailed *t*-test and chi-square analyses were utilized. Since the number of the ENs categorized with high job satisfaction was small, to perform a meaningful statistical analysis, the high and the moderate levels were combined to create moderate/high job satisfaction level. The results are expressed as means (M) ± standard deviation (SD) for continuous variables and frequency (percentage) for categorical variables. We considered a P-value of 0.05 as statistically significant. We used SPSS software version 11.5 (SPSS Inc., Chicago, IL, USA) for statistical analysis.

2.5. Ethical considerations

The study protocol was approved by the Ethics Review Committee of the Tabriz University of Medical Sciences (TBZMED.REC.1396.801/E). All study participants signed an informed written consent form. They were not paid for their participation in the study.

3. Results

Of the 495 ENs, 380 (response rate: 76.8%) completed the study questionnaires. Table 1 presents demographic and work-related characteristics of the study population. The mean age and work experience were 34.15 ± 6.72 and 10.41 ± 3.65 years, respectively. Most of participants were female (n = 255, 67.2%). The majority of them were married (n = 311, 81.9%) and more than half of the nurses (n = 195, 51.3%) were involved in day work.

As shown in Table 1, (n = 146, 38.3%), (n = 197, 51.9%) and (n = 37, 9.8%) of the study participants had low, moderate, and high level of job satisfaction, respectively.

Fig. 1 shows the prevalence of MSDs in different body regions

Table 1
Demographic information and work-related characteristics of the study nurses (n = 380).

Age (years)	Mean ± SD	34.15 ± 6.72
Body Mass Index (kg/m^2)	Mean ± SD	25.17 ± 3.02
Work experience (years)	Mean ± SD	10.41 ± 3.65
Gender	Female (%)	67.2
Smoking	Yes (%)	6.9
Education level	Bachelor (%)	84.9
	Master (%)	15.1
Marital status	Married (%)	81.9
Exercise	Yes (%)	10.3
Job satisfaction	Low (%)	38.3
	Moderate (%)	51.9
	High (%)	9.8
Work schedule	Night work (%)	48.7
	Day work (%)	51.3

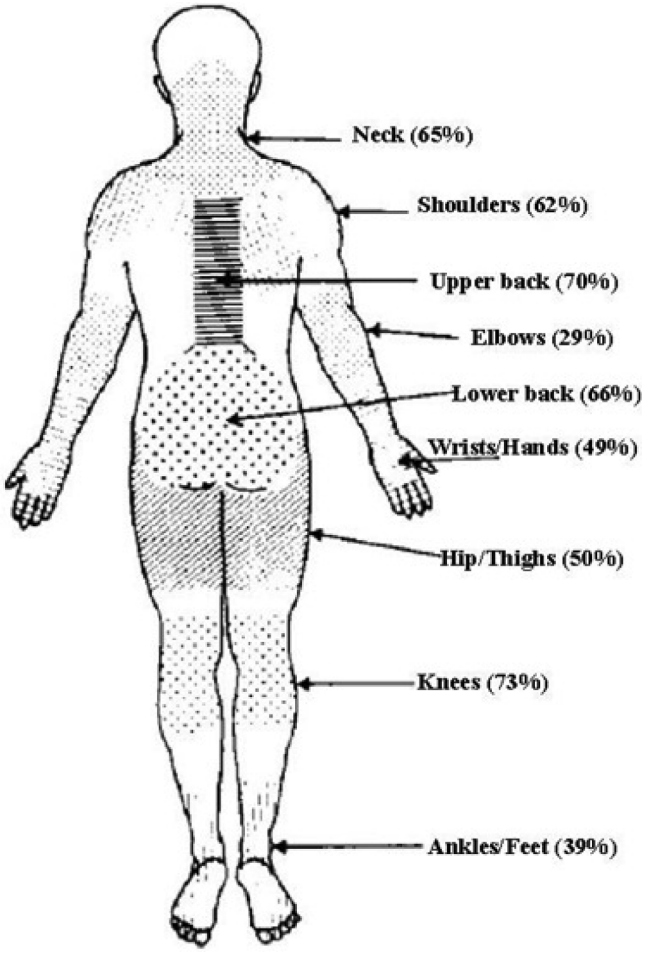

Fig. 1. Generic body diagrams and prevalence of MSDs in nine body regions.

during the 12 months preceding the data collection as reported by the participants. The most commonly affected body regions were: knees (n = 277, 73%), upper back (n = 266, 70%), lower back (n = 251, 66%), neck (n = 247, 65%), and shoulders (n = 236, 62%).

Tables 2 and 3 show the association of work schedule (permanent day and night work) and job satisfaction levels with prevalence and severity of musculoskeletal symptoms among ENs. The prevalence of symptoms for the wrists/hands ($P < 0.001$), upper back ($P = 0.002$), hips/thighs ($P = 0.03$), knees ($P < 0.001$), and ankles/feet ($P = 0.004$) areas were significantly lower in day work nurses (Table 2). Moreover, pain severities in night work nurses were significantly higher in upper back ($P < 0.001$), lower back ($P = 0.002$), knees ($P = 0.017$), and ankles/feet ($P < 0.001$) (Table 2). As shown in Table 3, the prevalence of symptoms in all body regions except hips/thighs were related to job satisfaction scores. The pain severity rating for the upper back also increased with low job satisfaction level ($P = 0.004$).

Tables 4 and 5 indicate the association of work schedule (permanent day and night work) and job satisfaction levels with workload subscales among ENs. As shown in Table 4, the physical demand ($P = 0.016$), performance ($P = 0.012$), frustration ($P < 0.001$), and overall workload ($P = 0.046$) scales differed significantly between day and night work cohorts. The mean scores for mental demand ($P = 0.042$) and frustration ($P < 0.001$) increased significantly in participants with low job satisfaction scores compared to moderate/high scores (Table 5).

4. Discussion

This is the first study, which has been conducted among ENs. The results have possible implications not only for emergency nurses' health and welfare, but also for patient safety outcomes. The findings of the present study add to the understanding of the association of musculoskeletal disorders (prevalence and severity) and workload with work schedule and job satisfaction among emergency nurses from five Iranian hospitals.

The prevalence of self-reported MSDs was found to be high in our study population, where the most commonly affected body regions were the knees, upper back, lower back, neck, and shoulders. Further, our data showed that night work was significantly associated with an increased prevalence of MSDs symptoms in wrists/hands, upper back, hips/thighs, knees, and ankles. The results additionally confirmed that prevalence of MSDs symptoms in all body regions except the hips/thighs were influenced by job satisfaction. Moreover, it was revealed that job satisfaction was just influenced by the mean severity of symptoms in the upper back. Taken together, these findings emphasize the importance of enhancing job satisfaction in this occupational group to prevent developing MSDs.

The scores of the NASA-TLX dimensions indicated that effort is more problematic than other dimensions. The mean score for dimension measuring the effort in our study participants was very high in comparison with the other dimensions. It is also interesting to note that the mean score for the physical demand dimension was lower than the other dimensions of NASA-TLX, among the respondents. Based on the results of the present study, there was a significant association of work schedule (permanent day and night work) with physical demand, performance, frustration and overall workload. Indeed, day work nurses had higher scores in physical demand and performance while

Table 2
Prevalence and severity of MSDs reported among ENs in association with work schedules.

Body region	Prevalence of MSDs symptoms (%)			Pain severity (scale 1–5)		
	Day work[1]	Night work[2]	P-value[a]	Day work[1]	Night work[2]	P-value[b]
Neck	62.0	68.7	0.230	3.04 ± 0.81	3.10 ± 0.93	0.607
Shoulders	57.0	68.0	0.063	2.73 ± 1.10	2.93 ± 0.86	0.231
Elbows	25.3	34.0	0.102	2.55 ± 1.08	2.80 ± 1.05	0.264
Wrists/Hands	35.4	63.3	< 0.001	3.14 ± 1.29	3.49 ± 1.16	0.094
Upper back	62.0	78.7	0.002	2.97 ± 1.13	3.50 ± 0.97	< 0.001
Lower back	60.8	71.3	0.055	3.14 ± 1.21	3.62 ± 0.90	0.002
Hips/thighs	44.2	56.7	0.033	3.05 ± 0.96	3.28 ± 1.18	0.191
Knees	63.3	83.3	< 0.001	3.12 ± 0.93	3.44 ± 1.06	0.017
Ankles/Feet	31.6	48.7	0.004	3.17 ± 0.94	3.72 ± 1.08	< 0.001

[1] Day work included the following assignments: 7:00 am to 7:00 pm.
[2] Night work included the following assignments: 7:00 pm to 7:00 am.
[a] Chi-square.
[b] Independent samples *t*-test.

Table 3
Prevalence and severity of MSDs reported among ENs in association with job satisfaction levels.

Body region	Prevalence of symptoms			Pain severity (scale 1–5)		
	Low[1]	Moderate/high[2]	P-value[a]	Low[1]	Moderate/high[2]	P-value[b]
Neck	72.9	60.5	0.028	3.20 ± 0.95	2.97 ± 0.85	0.073
Shoulders	71.2	56.8	0.012	2.87 ± 1.00	2.80 ± 0.98	0.662
Elbows	35.6	25.8	0.042	2.52 ± 1.15	2.77 ± 0.99	0.322
Wrists/hands	57.6	43.6	0.017	3.02 ± 1.32	3.50 ± 1.16	0.114
Upper back	84.7	61.1	< 0.001	3.48 ± 1.05	3.06 ± 1.06	0.004
Lower back	83.1	55.3	< 0.001	3.43 ± 1.02	3.34 ± 1.09	0.461
Hips/thighs	52.5	48.9	0.541	3.03 ± 1.07	3.27 ± 1.08	0.174
Knees	86.4	64.7	< 0.001	3.21 ± 1.07	3.33 ± 0.95	0.594
Ankles/Feet	52.5	32.1	< 0.001	3.60 ± 0.96	3.34 ± 1.05	0.401

[1] Low job satisfaction level.
[2] Moderate/high job satisfaction level.
[a] Chi-square.
[b] Independent samples *t*-test.

Table 4
Mean and Standard deviation (Mean ± SD) of workload subscales among ENs in association with work schedules.

NASA-TLX	Work schedule		P-value[a]
	Day work	Night work	
Mental demand	80.37 ± 19.90	83.73 ± 20.48	0.146
Physical demand	70.63 ± 24.71	63.33 ± 28.77	0.016
Temporal demand	67.59 ± 24.42	72.73 ± 24.76	0.079
Performance	82.91 ± 15.59	76.66 ± 15.98	0.012
Effort	83.16 ± 16.62	86.80 ± 18.36	0.069
Frustration	74.93 ± 25.33	85.05 ± 23.98	< 0.001
Overall workload	75.82 ± 18.80	79.66 ± 14.61	0.046

[a] Independent samples *t*-test.

Table 5
Mean and Standard deviation (Mean ± SD) of workload subscales among ENs in association with job satisfaction levels.

NASA-TLX	Job satisfaction		P-value[a]
	low	Moderate/high	
Mental demand	85.06 ± 19.22	80.11 ± 20.79	0.042
Physical demand	67.28 ± 26.20	66.94 ± 26.98	0.913
Temporal demand	72.54 ± 22.91	68.57 ± 25.64	0.171
Performance	81.86 ± 14.84	78.63 ± 16.36	0.089
Effort	85.76 ± 18.04	84.42 ± 17.10	0.513
Frustration	90.67 ± 20.99	73.15 ± 26.97	< 0.001
Overall workload	79.92 ± 12.86	76.32 ± 19.17	0.171

[a] Independent samples *t*-test.

frustration and overall workload were higher in night work ones.

The results of the study indicated that job satisfaction was significantly related to mental demand and frustration, whereas it was not related to the other dimensions and overall workload.

Our findings provided further evidence that MSDs are highly prevalent among the ENs involved in night work and with low job satisfaction levels. As the current study showed, besides the prevalence of MSDs, the severity of lower and upper back, knees, ankles and feet pain symptoms were significantly higher among night work ENs than day work ones, which might reflect the nature of night work, and therefore this might root in poor sleep and circadian rhythm disruption in this occupational group [26–28]. Furthermore, it seems that the shortage of practical nurses for night work was one of the strongest possible reasons for high rates of MSDs among night working ENs in comparison with day work nurses, which may be attributed to the increase in MSDs among night work nurses. Interestingly, although there was less physical demand in night work nurses (as shown in Table 4), the prevalence of MSDs in night nurses was higher than in day nurses.

It can be justified that although night work nurses generally had low amount of physical activities at work in comparison with day work ENs, they are confronted with sudden and often heavy physical efforts like changing the posture or manual handling of patients. The fact is that they had to deal with these situations alone due to the shortage of practical nurses at night; therefore, this evidence is new to the literature. As MSDs are one of the main reasons for sick leave and absenteeism among health care workers [10,29], our evidence is of great importance and can be used by hospital managers for improving the health status of ENs.

Takahashi et al. (2009) indicated that nursing home care workers after taking a nap at least once in every two night shifts felt less pain in their arms and legs. Additionally, two other studies have reported a significant relationship between night working and neck, upper back, knees symptoms, and occupational injuries among nurses [30,31], which is in agreement with our results. Attarchi et al. (2014) also evaluated the association between night working and MSDs among nurses in Iran and reported a significant higher prevalence of low back and ankle symptoms among night work nurses compared to nurses working with fixed days. This different prevalence of MSDs in body regions, as compared with results of our study, can possibly be attributed to the nature of work in different wards of hospitals, arrangement of work schedules, and job demands, for nurses.

The results of the current study confirmed a negative relationship between MSDs prevalence in all body regions, with the exception of hips/thighs, and job satisfaction level of the studied nurses. It is noteworthy that nurses with moderate/high job satisfaction levels had a lower frequency of MSDs than those with less job satisfaction status. These findings provided additional evidence that pain can be associated with mental and physical discomfort and finally lead to dissatisfaction. This result is similar to the observation of Hoogendoorn et al. (2001) who indicated that low job satisfaction level is a risk factor for low back pain in workers [32]. This is an area, which has received little attention in the literature, particularly in EN wards, and therefore this evidence is new to the literature. Goetz et al. (2013) provided evidence of job satisfaction in relation to different aspects of working conditions among general practitioners [33], which can consequently lead to the increase of musculoskeletal disorders and occupational injuries. Therefore, our emphasis is on the need for ergonomic interventions (such as ergonomic training programs for patient handling, workstation redesign, mechanical lifting equipment, job organization, fatigue reduction, etc.) for improving working conditions in this occupational group. Although most preventive strategies at the workstation are focused to control ergonomic risk factors in former studies [34–41], improving the psycho-social work environment might have an effect on decreasing MSDs.

The findings of the present study provided further evidence that among the six subscales of NASA-TLX workload, the scales of performance, frustration, and overall workload were associated with increased risk of musculoskeletal disorders among night work nurses than among nurses with fixed day work. In contrast, the physical demand score of day work nurses in our study was significantly higher than the score for night work nurses. This is perhaps not surprising, as the day work nurses possibly had to handle more physical tasks like manual handling of patients during days in comparison with night work nurses. This is, partially consistent with the findings of Gonçalves et al. (2001), who suggested that nurses on day work were more physically active on the job, spending only 13% of the time sitting, while on night work, about 46% of their time was being spent sitting [42].

Interestingly, the findings of the current study revealed that ENs with low job satisfaction related the low job satisfaction to exposure to high mental demand and frustration, which highlights the importance of the mental aspects in this working group. This is not consistent with findings by Boultinghouse et al. (2010) who reported no relationship between job satisfaction and mental workload among physicians [43]. On the other hand, in a review study conducted by Lea et al. (2012), it was shown that an excessive workload contributed to decreasing job satisfaction and increasing work-related stress among community paramedics [44]. These results provide additional evidence that, in addition to the methods and tools used in different studies, some factors such as sample community, cultural backgrounds, and racial-ethnic differences can also affect the relationship between job satisfaction and workload, and, therefore, this can result in the contradictory findings.

In considering the findings of this study and their implications, it is important to take into account the limitations of the study. In this study there is the risk of self-report bias due to using survey data. Every assessment of both the MSDs and workload is done based on a self-reporting method and bias is inevitable but high attempts were made to gain precise answers by participants through explanations of each question by the examiners.

5. Conclusion

This is the first study explored the association of MSDs and workload with work schedule and job satisfaction among ENs. The results of this study suggest that the occurrence of musculoskeletal disorders, particularly in the knees, upper and lower back regions were found to be high among the studied ENs. The findings showed that night working and reduced job satisfaction are associated with the development of MSDs in different body regions as well as workload. Considering the role of ENs in hospital settings, improved working conditions of this occupational group has the potential to significantly affect patient safety and quality of care. These findings emphasize the need of ergonomic interventions (such as ergonomic training programs for patient handling, workstation redesign, lifting equipment, job organization, etc.) to improve the working conditions of ENs. Other recommendations are, therefore, to increase the number of practical nurses during night shifts.

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