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Sociodemographic and organizational factors associated with musculoskeletal symptoms among intensive care unit professionals

Fatores sociodemográficos e organizacionais para o surgimento de sintomas musculoesqueléticos em intensivistas

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ABSTRACT | Background: The heavy and complex work routine in the intensive care unit (ICU) involves high workload, long working hours, high levels of tension, exposure to extreme situations and to hazards of different nature. **Objective:** To investigate the influence of sociodemographic and organizational factors on the development of musculoskeletal pain, tension and fatigue among ICU professionals. **Methods:** We interviewed 128 professionals from seven public hospitals in João Pessoa, Paraiba, Brazil. The data were analyzed using a logistic regression model, and differences between professional categories by means of the likelihood ratio, the Wald and χ^2 tests, with significance level set to <0.05. **Results:** The risk to develop musculoskeletal symptoms differed as a function of the participants' professional category. The odds of nursing technicians to simultaneously develop musculoskeletal pain, fatigue and tension were 4.968 times higher (p=0.023) compared to physicians, nurses and physical therapists. This difference was mediated by factors such as sex, body mass index and number of ICU jobs. Nursing technicians were the most exposed group, and thus they require more attention as concerns workplace health interventions. **Conclusions:** The participants had long working hours, and differed in regard to the most frequent musculoskeletal complaints as a function of the specificities inherent to the activities of each professional category.

Keywords | occupational health; occupational hazards; intensive care units.

RESUMO | Introdução: O trabalho intenso e complexo das unidades de terapia intensiva (UTI) envolve alta carga e longas jornadas de trabalho, contato direto com situações limite, elevado nível de tensão e exposição a riscos de diversas naturezas. **Objetivo:** Avaliar a interferência dos fatores sociodemográficos e organizacionais no surgimento de dor, tensão e fadiga musculoesquelética em profissionais nas UTIs. **Métodos:** Entrevistaram-se 128 profissionais de sete hospitais da rede pública da cidade de João Pessoa, Paraíba. Os dados foram analisados usando o modelo de regressão logística, e as diferenças entre as categorias profissionais, pelo teste de Wald, razão de verossimilhança e teste de χ^2, considerando como nível de significância <0,05. **Resultados:** Identificou-se que as categorias profissionais são distintas em relação aos riscos para o surgimento de sintomas musculoesqueléticos. Os profissionais técnicos de Enfermagem apresentaram chance 4,968 (p=0,023) vezes maior de ter simultaneamente as queixas musculoesqueléticas de dor, fadiga e tensão se comparados aos profissionais médicos, enfermeiros e fisioterapeutas, mediadas por fatores como gênero, índice de massa corpórea e quantidade de UTIs em que atuam, sendo, dessa forma, os profissionais mais expostos e que requerem mais atenção para intervenções de saúde no trabalho. **Conclusões:** Têm-se profissionais com altas cargas horárias semanais, distintos em relação às queixas musculoesqueléticas de maior frequência decorrentes das especificidades inerentes de cada atividade.

Palavras-chave | saúde do trabalhador; riscos ocupacionais; unidades de terapia intensiva.

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INTRODUCTION

Musculoskeletal injury (MSI) is the most common work-related health problem, affecting millions of workers[1]. It is a cause of much concern, not only due to its effects on the health of each affected worker, but also as a function of its economic impact for employers and governments, and social costs.

For many years, the attention on workers' health focused on MSI derived from work-related musculoskeletal disorders (WMSDs). However, in many cases the presence of previous warning signals, such as fatigue, pain and muscle tension, is passed over. These symptoms are a warning which points to the need to recognize physical limitations, and to set a time to rest for the symptoms to regress. When this request for rest is unattended, it leads to physical and mental exhaustion and abnormal changes of the physiological function of the body functions[2].

The risk for occurrence of these disorders is associated with several factors, such as poor ergonomic design of buildings and worksites (height and extension); inadequate working conditions (as, e.g., of temperature and lighting); insufficient room for work activities, which might thus lead to inadequate postures and unsafe displacement; lack of mechanical aids, such as windlasses, carts or electric adjustable beds; tasks which pose too high demands, are repetitive, too long and without rest breaks; insufficient number of workers; and unavailability of adequate personal protective equipment[2-4].

Work in the hospital setting is characterized by highly specific aspects, including workload, direct exposure to extreme situations, high levels of tension, and risk for oneself and others. The need for continuous service delivery — which demands shift work — make long working hours and having a second job common occurrences among healthcare workers, especially due to financial issues[5]. These characteristics might impair the quality of the professionals' actions.

In addition to intensive, the routine in the intensive care unit (ICU) is complex, aggressive and exhausting, both for patients and the multidisciplinary staff. ICUs are the hospital areas intended for the care and treatment of critically ill patients with life-threatening diseases, therefore, having the technology and human resources needed to provide continuous and integrated care. However, from the occupational — and even the care delivery — perspective, ICUs are insalubrious environments, due to the continuous inclusion of new technologies and work processes, and lack of training of professionals in regard to prevention and precaution measures, which increase their vulnerability and contribute to the development of work-related health problems[5,6].

Given the characteristics of work in ICU, and the risk to which professionals are exposed, the aim of the present study was to investigate the influence of sociodemographic and organizational factors on simultaneous development of pain, tension and fatigue among ICU professionals.

METHODS

STUDY SETTING

The present cross-sectional and descriptive study involved an epidemiological survey among ICU professionals. Nine adult ICUs, from seven public hospitals in João Pessoa, Paraiba, Brazil, were included. We selected adult ICUs only to ensure homogeneity in terms of layout, technological equipment, routine and organization of work.

SAMPLE

The study population comprised healthcare professionals allocated to the selected units, from both sexes, and without any age limit. Eligible subjects were physicians, nurses, physical therapists and nursing technicians available to respond the applied questionnaire.

VARIABLES AND INSTRUMENTS

Independent variables were sociodemographic—age, sex and body mass index (BMI) — and organizational — professional category, weekly working hours, number of ICU jobs, and length in the job — characteristics. The dependent variables were categorized according to the simultaneous occurrence of musculoskeletal symptoms — pain, tension and muscle fatigue — considering their appearance during the working hours.

ETHICAL ISSUES

The present study is a part of a larger research project entitled *Occupational risk associated with environmental comfort in intensive care units*, which was approved by the ethics committee of Center of Health Sciences, Federal

University of Paraiba (CAAE: 44388515.4.0000.5188). The eligible subjects were informed as to the study aims and procedures; the ones who agreed to participate were requested to sign an informed consent form.

DATA COLLECTION

We applied an adapted version of the *Health Care Establishment* questionnaire, developed by Örebro Department of Occupational and Environmental Medicine[7]. The questions were designed to collect information on identification data, health conditions and well-being, occupational aspects, and self-perceived symptoms.

The questionnaire was applied during the participants' regular working hours, instructions having been previously provided by an interviewer. One and the same interviewer applied the questionnaire to all the subjects to avoid duplication of the orientation provided. The participants' anonymity was ensured.

DATA ANALYSIS

The data were tabulated using software Microsoft Excel, and then analyzed as follows:

- sample characterization by means of measures of central tendency and dispersion;
- hypothesis testing by means of the Wilcoxon and χ^2 tests to detect similarities and differences per professional category;
- calculation of *odds ratio* (OR) for simultaneous complaints of musculoskeletal pain, tension and fatigue by means of logistic regression analysis; this method allows calculating the OR of occurrence of one and the same event in different groups, one of which is selected as reference for the purpose of comparison.

The significance of the obtained OR was calculated by means of the likelihood ratio (LR), the Wald and χ^2 tests. All the analysis were performed with software R version 3.2.4. The significance level was set to 0.05.

RESULTS

SAMPLE CHARACTERISTICS

The sample comprised 128 healthcare professional. Sociodemographic (age, sex and BMI) and organizational (weekly working hours and number of ICU jobs) characteristics were analyzed (Table 1). The average age of the participants was 35.5±8.2 years old, ranging from 20 to 50. They were predominantly female (80.5%), and the largest proportion was of nursing technicians (53%).

About 46.8% of the sample worked more than 45 hours per week in direct patient care at the analyzed ICUs. Most participants (73%) had up to 10 years in the job, and 93.6% worked in up to 2 ICUs.

About of the 48% of the participants had normal BMI, according to the classification formulated by the Brazilian Association for Study of Obesity and Metabolic Syndrome[8]. The remainder of the sample was categorized as overweight (36%), class I (10%), class II (4%) and class III (2%) obesity.

MUSCULOSKELETAL COMPLAINTS

Musculoskeletal pain, tension and fatigue were frequent in all the analyzed professional categories (Table 2). Musculoskeletal pain was the most common symptom in all the categories, the nursing technicians in particular (76.81%). Muscle tension was more prevalent among nurses (61.5%), and muscle fatigue among physical therapists (69.6%) and physicians (60%).

STATISICAL ANALYSIS

To investigate possible association between simultaneous presence of the three investigated musculoskeletal symptoms and sociodemographic and work organization factors we analyzed similarities in exposure to risk as a function of the professional category by means of OR estimated on logistic regression analysis (Table 3).

There was not any significant difference in the odds of pain, tension or fatigue between physicians, nurses and physical therapists. Contrariwise, we found significant difference for the nursing technicians. Given the similarities in OR and significance level between the former three categories (Table 3) and that the corresponding subsamples were small (Table 1) — which could interfere with the hypothesis testing results — we decided to perform a new set of tests clustering these three professional categories together.

Therefore, in odds analysis we compared the following two groups, with similar sample size:

- Group 1 (G1): physicians, nurses and physical therapists;
- Group 2 (G2): nursing technicians.

Table 1. Sociodemographic and organizational characteristics, João Pessoa, 2015 (n=128).

Variables	Category	n	%
Sex	Female	103	80.5
	Male	25	19.5
BMI	Normal weight	61	48.0
	Overweight	46	36.0
	Class I obesity	13	10.0
	Class II obesity	5	4.0
	Class III obesity	3	2.0
Occupation	Physicians	10	7.8
	Nurses	23	18.0
	Physical therapists	26	20.3
	Nursing technicians	69	53.9
Weekly working hours	Up to 20 h	2	1.6
	Up to 30 h	31	24.2
	30 to 45 h	35	27.3
	45 to 50 h	30	23.4
	50 to 60 h	30	23.4
Number of ICU jobs*	1	77	61.1
	2	41	32.5
	3	5	4.0
	4	2	1.6
	5	1	0.8
Years in the job	0 to 10	93	73.0
	11 to 20	25	20.0
	21 to 30	7	5.0
	More than 30	3	2.0

BMI: body mass index; ICU: intensive care unit; *missing data in two instances.

Table 2. Musculoskeletal symptoms among ICU professionals, João Pessoa, 2015 (n=128).

Symptoms	Professionals			
	Physicians	Nurses	Physical therapists	Nursing technicians
Pain	40.0%	57.7%	56.5%	76.8%
Tension	30.0%	61.5%	47.8%	56.5%
Fatigue	60.0%	50.0%	69.6%	62.3%

ICU: intensive care unit.

The relative frequency of the analyzed complaints is described in Figure 1. As is shown, the frequency of pain, tension and fatigue was 16.4, 6.6 and 6.3% higher for the nursing technicians, respectively.

The frequency of musculoskeletal pain, tension and fatigue was not independent from variable professional category. The results of the χ^2 test (=0.012), Wald test (=0.008) and LR (=0.007) showed significant difference between the groups. The odds of nursing technicians to exhibit these three symptoms were 2.794 times higher compared to all other professional categories.

Occurrence of pain was not independent from either tension or fatigue. The odds for reporting muscle tension were 6.249 higher, and the ones of muscle fatigue 3.333 higher for the participants who complained of pain. The odds to report muscle fatigue were 4.505 times higher among the participants who complained of muscle tension (Table 4).

We analyzed the odds of occurrence of musculoskeletal complaints according to the analyzed sociodemographic and organizational variables per professional category. The results showed that none of such variables behaved as a statistically significant risk factor for occurrence of musculoskeletal symptoms in the analyzed population (Table 5).

DISCUSSION

The results evidenced difference in the occurrence of the investigated symptoms according to the participants' professional category. This is to say, the frequency differed among physicians, nurses and physical therapists by comparison to nursing technicians.

Table 3. Odds of musculoskeletal complaints per professional category, João Pessoa, 2015 (n=128).

Professionals	*Odds ratio**	p-value (Wald test)
Physicians	Reference	Reference
Physical therapists	1.950	0.386
Nurses	2.045	0.345
Nursing technicians	4.968	0.023

*H_0: *odds ratio*=1.

None of the analyzed sociodemographic and organizational characteristics were directly related to the occurrence of musculoskeletal complaints. This finding agrees with the results of Lee et al.'s study, in which variable shift (daytime/nighttime shift) was the single factor which exhibited statistically significant difference between symptomatic and asymptomatic ICU nurses[9]. Therefore, it is safe to assume that such factors might mediate in the development of musculoskeletal complaints, since sex, number of jobs, BMI and weekly working hours significantly differed among the analyzed professional categories.

Work in the hospital setting might cause several musculoskeletal disorders among healthcare professionals. We found difference in the most frequent complaints between the analyzed categories of employees. Muscle fatigue was more frequent among physicians and physical therapists, muscle tension among nurses, and muscle pain among nursing technicians. The specific characteristics inherent to each professional group influence the work demands to which they are exposed. Nurses perform continuous managerial patient care tasks, which demand permanent attention to the vital function of patients. In turn, nursing technicians perform activities such as patient lifting and transfer, which are strongly associated with body pain, especially on the neck, lower back and knees[10].

Occurrence of pain, fatigue and tension were associated with the participants' professional category. The nursing technicians exhibited 2.794 higher odds of occurrence of these symptoms compared to the other professions. Now we need to understand the possible reasons of this difference.

Several studies showed that musculoskeletal diseases are the main cause of sick leave among nursing professionals[11,12]. According to the United Kingdom Health and Safety Executive (HSE), one every four nursing professionals require sick leave due to work-related muscle injuries, low back pain being the most frequent, as a result of cumulative trauma[6]. In the present study, most of the analyzed sample of ICU employees reported musculoskeletal pain. The insidious development of this type of symptom might be due to inadequate posture during work activities, high demands posed by bed-ridden patients, lack of rest breaks[13], and effort-reward imbalance[9].

Observation of the work routine of ICU nursing technicians showed that the activities assigned to them, and which performance demands attention, are related to the patients' hygiene and transfer (change of position, transfer between gurneys) to perform tests or on the occasion of discharge. While performing these activities,

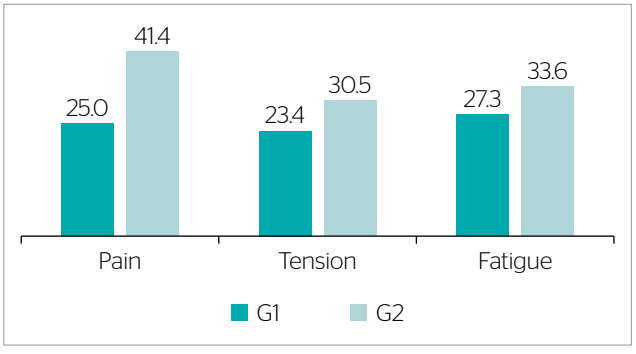

Figure 1. Musculoskeletal complaints per professional category (%), João Pessoa, 2015 (n=128).

Table 4. *Odds ratio* for musculoskeletal complaints, João Pessoa, 2015 (n=128).

Complaints	*Odds ratio*	p-value		
		Likelihood ratio	Wald test	χ^2 test
Pain and tension	6.249	3.5×10^{-6}	1.3×10^{-5}	1.2×10^{-5}
Pain and fatigue	3.333	0.002	0.002	0.003
Tension and fatigue	4.505	5.9×10^{-5}	0.000	0.000

Table 5. *Odds ratio* and logistic model results, João Pessoa, 2015 (n=128).

	Musculoskeletal complaints	p-value*
Age	0.993	0.817
Sex	0.594	0.291
Body mass index	1.043	0.289
Years in the job	1.015	0.715
Number of ICU jobs	0.748	0.287
Weekly working hours	1.234	0.112

*Wald test; ICU: intensive care unit.

the professionals should adopt an adequate body posture to spare muscles and joints from overload during movements. Some of the factors which might contribute to biomechanical overload, and consequent development of pain and other musculoskeletal symptoms, are patient sedation, overweight, difference in the height of gurneys, and of technicians working together.

In addition to the overload resulting from the performance of tasks, long working hours and night work — i.e., opposed to the physiological body functioning — might impair the workers' performance and safety, as well as the quality of care delivery[14]. In addition, night work makes having a second job easier, which however represents a further risk factor which leads to cumulative tiredness and physical fatigue.

About 38.9% of the participants worked in more than one ICU, 66% of them in all three shifts, and 46.8% too long hours (more than 45 hours per week). These findings agree with the ones reported by Lima et al.[15], 44 weekly hours, and Chiou et al.[4], 50±0.18 hours per week, for a Taiwanese population. In all these cases, the working hours exceed the ones established by labor regulations and professional associations.

As a result of overload and lack of rest breaks, these professionals return to work still complaining of the very same symptoms which led to a sick leave in the first place[11], and which thus become recurrent. Although in the present study we did not find statistically significant correlation between weekly working hours and development of musculoskeletal symptoms, this variable has other consequences which should be considered, such as increase of medical errors[15,16].

The analyzed sample comprised young individuals, with five years in the job, on average. These factors should be taken into account in the interpretation of the data. The reason is that according to Heiden et al.[17], the frequency of at least one musculoskeletal symptom among ICU professionals significantly increases after age 35 years old, which was the average age of the participants in the present study.

A favorable aspect resulting from the review of several studies conducted with nursing professionals is the considerable interest in the occupational aspect of the profession, mainly as concerns scientific research, which phenomenon is less common for other fields of the health sciences[18]. Such interest should ideally lead to beneficial actions for the health of ICU professionals, including efficacious methods for postural awareness during the performance of work activities, in addition to all other preventive methods to reduce ergonomic hazards.

CONCLUSION

Some of the participants had very long weekly working hours, more than 45 hours, which increases their exposure to work overload. The frequency of the analyzed musculoskeletal complaints varied as a function of the specificities of the activities inherent to each professional category. The odds for nursing professionals to simultaneously complain of musculoskeletal pain, fatigue and tension were 4.968 times higher (p=0.023) compared to the other categories of workers. This finding might serve as grounds to call the attention of hospital managers and professionals to the relevance of postural care at work and of adjusting the nursing technicians' workstations. It might also serve as guide for future studies in this field.

Sociodemographic variables, such as age, sex and BMI, did not behave as direct risk factors. This finding might derive from lack of association between the analyzed sociodemographic variables, e.g., between age and BMI, or between age and sex. Similarly, neither the considered organizational variables — number of ICU jobs, weekly working hours and years in the job — behaved as direct risk factors.

Considering the variability in the routine tasks proper to each profession, we suggest for future studies to address each professional category separately to obtain more thorough and encompassing results on the association between occurrence of musculoskeletal symptoms and activities performed by nursing technicians, and between muscle fatigue and the physical therapists' tasks. Thus, it will be possible to draw the profile of the activities inherent to these professions, and eventually also to perform ergonomic analysis of work. Such studies might allow identifying more efficacious approaches to possible corrections, ergonomic adjustments and fostering awareness on the risks to which these professionals are exposed along the performance of their work activities.

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