Analysis of functional parameters related to occupational risk factors of ICU nursing activity

Análise de parâmetros funcionais relacionados aos fatores de risco ocupacionais da atividade de enfermeiros de UTI

Análisis de parámetros funcionales relacionados a los factores de riesgos laborales de la actividad de enfermeros de UTI

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ABSTRACT | Evaluating factors such as fatigue and functional aspects can identify overloads during nursing activities. The aim was to evaluate need for recovery, prevalence of musculoskeletal discomfort, working capacity and perceived exertion of Intensive Care Unit (ICU) nurses. Twenty-four nurses participated (aged 40±8 years; 10 men and 14 women). The Nordic musculoskeletal questionnaire, work ability index (WAI), need for recovery scale (NRE) and scale of perceived exertion (Borg) were applied. Gender differences were evaluated by Student's *t*-test and the prevalence by Fisher's exact test. There was a prevalence of 75% in the last 12 months, 100% of women and 42% of men (significant difference; p=0.024). Women rated work as more intense than men (p<0.05). There were no differences between NRE/WAI. The study emphasizes the importance of preventive actions focused on nursing activities and strategies for prevention of discomfort in females.

Keywords | human engineering; physical therapy specialty; occupational health; nursing; fatigue.

RESUMO | A avaliação de fatores como fadiga e aspectos funcionais pode identificar sobrecargas durante a atividade de enfermeiros. O objetivo foi avaliar a necessidade de descanso, prevalência de desconfortos musculoesqueléticos, capacidade de trabalho e esforço físico de enfermeiros de Unidade de Terapia Intensiva (UTI). Participaram 24 enfermeiros (idade 40±8 anos; 14 homens e 10 mulheres). Foram aplicados: questionário nórdico de sintomas, índice de capacidade para trabalho (ICT), escala de necessidade de descanso (ENEDE) e escala de esforço percebido (Borg). Diferenças entre sexos foram verificadas pelo teste *t* de Student e na prevalência pelo teste exato de Fisher. Verificou-se prevalência de 75% nos últimos 12 meses, sendo 100% das mulheres e 42% dos homens (diferença significante; p=0,024). As mulheres classificaram o trabalho como mais intenso em comparação aos homens (p<0,05). Não houve diferenças entre ENEDE/ICT. Ressalta-se a importância de ações preventivas focadas na atividade do enfermeiro e estratégias para a prevenção de desconforto no sexo feminino.

Descritores | engenharia humana; fisioterapia; saúde do trabalhador; enfermagem; fadiga.

RESUMEN | La evaluación de factores como fatiga y aspectos funcionales pueden identificar sobrecargas durante la actividad de los enfermeros. El objetivo fue evaluar la necesidad de descanso, prevalencia de molestias musculoesqueléticas, capacidad de trabajo y esfuerzo físico de enfermeros de UTI. Participaron 24 enfermeros (edad 40±8 años; 14 hombres/10 mujeres). Fueron aplicados: cuestionario nórdico de síntomas, índice de capacidad para el trabajo (ICT), escala de necesidad de descanso (ENEDE) y escala de esfuerzo percibido (Borg). Diferencias entre sexos fueron verificadas por el test *t* de Student y la prevalencia por el test exacto de Fisher. Se verificó la prevalencia del 75% en los últimos 12 meses, siendo el 100%

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de las mujeres y 42% de los hombres (diferencia significativa; p=0,024). Las mujeres clasificaron el trabajo como más intenso en comparación a los hombres (p<0,05). No hubo diferencias entre ENEDE/ICT. Se resalta la importancia de acciones preventivas enfocadas en la actividad de enfermería y estrategias para prevención de molestias en el sexo femenino.

Palabras clave | ergonomía; fisioterapia; salud del trabajador; enfermería; fatiga.

INTRODUCTION

There is a consensus in literature in regards to the importance of preventing occupational injuries, especially considering that the exposure to adverse work conditions may generate overload and promote the genesis of occupational disorders[1-4]. For each work process, it is fundamental to detect risk factors that are inherent to the activity. In this sense, Ergonomics can help in the reduction of the risk of occupational disorders and aggravations related to overload of a biopsychosocial nature[2], through the identification of these factors. This strategy can determine the efficacy of preventive approaches and promote health in the work environment.

The risk factors related to the different work processes determine the importance of the use of tools that guide the selection of priorities during an ergonomic intervention[4,5]. Walsh et al.[5] demonstrated that the analysis of functional deficits is fundamental, considering the impact of work-related musculoskeletal disorders (WRMD) on the worker's abilities and health. As an example, Sluiter et al.[6] and Moriguchi et al.[7] demonstrated that the evaluation of work-induced fatigue might be interesting to determine the exposure to physical and mental demands in the occupational environment.

In this context, it is highlighted that nursing is a category exposed to several risk factors, such as exhausting shifts and the consequent non-attendance to the circadian rhythm, inadequate feeding times, inadequate furniture dimension, and postural risks, among others[8-10]. A recent study[11] demonstrated that the health complaints related to the osteomuscular system represent one of the major causes of suffering experienced by nursing professionals. A prevalence of WRMD that may vary between 50 and 90%[12,13] is added to this fact. The concern about the work conditions of nursing staff at hospitals is forefront, especially the ones who work at an intensive care unit (ICU)[14], given that these conditions have attracted researchers attention due to risks posed by the environment and the activity[9].

One of the aggravations in the working environment is fatigue[14,15], which may be characterized as a multidimensional phenomenon related to a sensation of tiredness, lack of energy, and exhaustion[16]. Its etiology remains controversial, although it is associated with the reduction of commands coming from the central nervous system and/or with changes in the concentration of metabolites, electrolytes, and injury of muscular structures[17]. The interest of occupational health in fatigue arises from its adverse consequences, be those acute or chronic, and when there are insufficient recovery periods. Fatigue, in this case, may be regarded as a feedback mechanism capable of reducing motivation and, in certain cases, lead to physical and mental exhaustion[15]. As an example, a study[6] demonstrated that the high rate of work-induced fatigue presented association with a higher occurrence of accidents and health problems.

According to Chen et al.[18], an acceptable overload level may be defined as that in which the individual is capable of performing a task, in a physiologically stable state, without tiredness, fatigue or discomfort. Thus, the analysis of work-induced fatigue represents an important health measure[4]. Considering the nursing context, the study of the association of fatigue with other functional and demographic parameters may be useful to an early overload identification and to the understanding of factors involved in occupational activities.

Thereby, the present study aimed at evaluating the necessity of recovery (fatigue) and at determining the prevalence of musculoskeletal discomforts, the level of work capacity, and the physical effort perceived during the performance of nurses who work at the ICU of a public University Hospital.

METHODOLOGY

Study Design

Cross-sectional study, performed in the period of September to November 2011.

Individuals

Twenty-four workers (average 40±8 years of age) participated in this study; 14 men and 10 women. The convenience sampling was characterized by all nursing

professionals (nursing technicians and nurses) assigned to the coronary ICU (CICU, n=14) and to the adult ICU (AICU, n=10) of the Maria Aparecida Pedrossian University Hospital, of the Mato Grosso do Sul Federal University Foundation, located in Campo Grande (MS). The inclusion criteria adopted were: 1) having at least one year of experience in the post; 2) being an active public worker of this hospital. The participants were excluded from this study in case they had another occupation, if they were performing different tasks than usual, and if they were on medical leave.

The individuals that met the inclusion criteria were informed of the research objectives and its procedures, and were invited to participate in the study by signing the free and informed consent term, according to the Resolution number 196 of the National Health Council, and approved by the Ethics Committee of the Mato Grosso do Sul Federal University (protocol number 1658/2010).

Procedures

Initially, the participants answered a self-applicable questionnaire that contained information related to demographic data (age, marital status, schooling – Table 1), length of time in the job, day/night shift, and sector. The questionnaire also contained a diagram of Borg's scale, used to evaluate the physical effort perceived during task performance. All workers answered the questionnaire in his/her work environment, at a pre-established time, so as not to interfere with the work routine. On this occasion, all were instructed about the evaluation instruments that each worker should answer:

Table 1. Demographic data of the workers analyzed in this study, separated by sex

	Men	Women
Age (years)	37.1±7.5	45.3±6.4
Length of time in the job (years)	8.6±4.4	13.1±6.1
Marital status		
Married	93%	50%
Single	7%	40%
Separated	-	10%
Schooling		
High School Degree	43%	40%
Unfinished High School Degree	-	10%
Undergraduate degree	36%	40%
Unfinished undergraduate degree	21%	10%
Shift		
Morning	64%	40%
Afternoon	22%	20%
Night	14%	40%

the Nordic musculoskeletal questionnaire[19], the work ability index[20], and the need for recovery scale (NRS)[7].

Analysis of musculoskeletal discomfort

The prevalence of musculoskeletal discomfort was determined through the validated version of the Nordic symptoms questionnaire[21], filled out by each of the workers. The questionnaire was adapted with structured and semi-structured questions that dealt with personal data and musculoskeletal symptoms related to work during the 12 months prior to the study. A body diagram was used, and all participants were instructed to point at one or more body parts afflicted by discomfort. In the diagram, the body areas were subdivided in: head and neck; lumbar spine; shoulders; arm and wrists; legs, ankle and feet.

Work ability index

The work ability index (WAI) is an instrument used in occupational health services with the purpose of determining how well a worker is capable of performing tasks; it can help to identify workers and spaces that need support measures. The WAI takes into consideration the physical and mental demands of a job, health state, and the worker's resources, and it is self-applicable.

The result is based on the sum of the question results, which are divided in the following topics: current work ability; ability in relation to work demands; number of diagnosed illnesses; estimated work loss due to illnesses; number of absenteeism days; self-prognosis of ability, and mental resources. The final sum determines the classification, which can vary from 7 to 49 (7-27: low ability; 28-36: moderate; 37-43: good; and 44-49: very good).

Need for recovery scale

The need for recovery scale[6] is a version of the original English scale that carries the same name[7] translated into Portuguese and adapted to Brazilian culture. The instrument's purpose is to measure the need for recovery after one day of work, and, in this way, evaluate the fatigue induced, and the quality of recovery time. The NRS also evaluates the effects of short-term fatigue: lack of attention, irritability, social isolation, decrease of performance and of the quality of recovery time after work. The scale contains 11 questions with four alternatives each and a punctuation that

varies from 0 to 100 points. The higher the punctuation, the larger the quantity of emotional, cognitive and behavioral fatigue symptoms, and the greater the need for recovery[4].

Data analysis

For the statistical analysis, the program *Statistical Package for Social Sciences* version 17.0 was used. The data are presented in relation to the average and standard deviation; data normality was verified through the Shapiro-Wilk test. The dependent variables were: Borg's scale (PPE); WAI; NRS; discomfort prevalence. The independent variables were sex (men and women) and sector (CICU and AICU). The differences among the dependent variables (WAI, Borg's scale, and NRS), considering the comparison between the sexes, were verified by means of the Student t test for independent samples. The comparison of the prevalence of discomfort between the sexes was performed through Fisher's exact test.

From the numerical data provided by the NRS, a categorization based on the study by Moriguchi et al.[4] was performed. The process considered two NRS categories: higher than 45 points and lower than 45 points. The χ^2 test was applied in order to verify the association of the NRS with the work shift (morning, afternoon and night), length of time in the job (up to 5 years; from 5 to 15 years, and over 15 years), schooling, and WAI. A significance of 5% ($p<0.05$) was adopted in all analyses.

RESULTS

The distribution of the body areas afflicted by discomfort is presented on Table 2, in accordance with the workers' account. In relation to the prevalence of musculoskeletal discomforts, 75% of the workers reported discomfort in some area of the body in the past 12 months. Arms and wrists were the most afflicted areas, with a frequency of 26.9% of the answers, followed by the lumbar spine (21.2%), and head and neck (21.2%). When separated by sex, we verified a discomfort prevalence of 100% among women and 42% among men; a significant difference was found between the sexes (p=0.024).

In relation to the perceived physical effort (PPE), WAI, and NRS, significant differences were not found when the sectors (COU and AICU) were compared to each other ($p>0.05$). On the other hand, a significant difference was found in the rating of physical effort when the individuals were divided by sex (Table 3). Women rated their work as more intense in comparison to men ($p<0.05$). Work-induced fatigue and the WAI did not present significant differences between the sexes (Table 3).

In relation to the WAI, the descriptive analysis demonstrated a moderate rating by 17% of the workers, with 38 and 45% rating it good and very good, respectively. Among women, the WAI was rated as moderate, good and very good by 30, 40 and 30%, respectively. Among men, only 1% classified it as moderate, while 36 and 57% rated the WAI as good and very good, respectively. However, the WAI did not present significant differences between the sexes either ($p>0.05$).

No significant associations were found between the NRS and the work shift (p=0.66), length of time in the job (p=0.82), scholarity (p=0.95) and WAI (p=0.26).

Table 3. Results of the perceived physical effort influenced by work, work ability index, and need for recovery scale, between men and women

	PPE*	WAI	NRS
Men	13±3	43±3	30±10
Women	17±3	40±4	36±11

*Significant difference between the sexes: p=0.005
PPE: perception of physical effort; WAI: work ability index; NRS: need for recovery scale

Table 2. Frequency of segments affected by musculoskeletal discomfort in the past 12 months, reported by the participants of this study

Body segments	Sex				Total
	Men		Women		
	n	%	n	%	
Head and neck	3	27%	8	73%	11
Shoulders	1	20%	4	80%	5
Arm and wrists	-	-	14	100%	14
Legs	2	50%	2	50%	4
Ankle and feet	2	33%	4	67%	6
Lumbar Spine	6	54%	5	46%	11
Total	14		37		52

n: number of affected body segments reported by the workers; %: in relation to the sum of answers, for each body segment

DISCUSSION

The present study found a 75% prevalence of musculoskeletal discomfort among nurses who work at intensive care units, and it corroborates previous studies that also verified a high prevalence of the discomfort among nurses who work in hospital environments, including ICUs[22,23]. This high prevalence may be explained by factors that arise from work logistics in intensive care units. In this sense, the ICUs are characterized as places where patients in a severe or borderline condition, who still have a favorable prognosis, are hospitalized, even though they need specialized technical and human resources. Such characteristic denotes a high relevance to the nurses' health insofar as it represents the effects of work overload, and it may be associated with the genesis of WRMD[1,3]. It is important to mention that social and familial factors may also influence the worker's health. In this case, future research should consider the study of the social factors that determine health with the purpose of understanding the role of activities that happen outside of the hospital in the quality of life of nursing professionals.

In the present study, women rated work effort as more intense in comparison to men, which demonstrates that situations are experienced differently by men and women[24], and that the degree of physical effort employed at work may represent the effect of professional activities on performance, work ability, and health[25]. It is known that this work place presents conditions that initiate stress, in addition to presenting environmental risk factors, work overload, and other biopsychophysiological consequences[26]. In fact, Fonseca and Fernandes[23] highlight that the physical aspects of work overload have an important contribution in the development of WRMD, especially in the upper limbs, such as inadequate posture and repetitive tasks. Nurses who work at ICUs perform tasks that demand physical effort, such as patient handling[27], placing and removing monitors on and off shelves and cabinets, and equipment organization, besides the assignments related to patient care[26].

Significant differences were not found between the sectors analyzed (CICU and AICU) regarding the work ability index and the NRS. In a study that evaluated industrial work, significant differences were found in the NRS when two sectors were compared, a fact that may have occurred due to the peculiarities of overload, work conditions, and psychological demands between the sectors[4]. It is important to mention that our study considered two sectors (CICU and AICU) that present work processes with similar demand and overload characteristics, which would explain the absence of difference in relation to fatigue and the WAI.

In regards to sex, we did not find significant differences in the NRS rating between men and women either, corroborating the results presented by Moriguchi et al.[4] and Raffone and Hennington[28]. This finding can be explained by the fact that work is a complex interaction of tasks, functions, responsibilities, incentives, and rewards[29]. In addition, literature still shows divergence in regards to the influence of one's sex in the workers' need for recovery[4,6]. Even in spite of this divergence, it is important to emphasize that women and men present anthropometric and physiological differences besides of eventual professional differences, such as the tasks assigned to them, responsibilities, and activities outside the work environment[30]. In this case, considering the fact that women presented a higher discomfort prevalence, associated with the discovery that 30% of them present a moderate index of work ability, we emphasize the importance of health promotion measures as one of the fundamental aspects in maintaining and improving this population's work ability[31].

In the present study, the NRS had no association with the work shift, schooling, length of time in the job, and the WAI. In order to understand this discovery, it is worth highlighting that the nursing practice in hospitals, especially in ICUs, has variability as its primordial characteristic[14]. The ICU nurses must deal with adverse events such as electric breakdowns, lack of material, staff shortage, instability of the patients' condition, and conflictive professional relations[14,32]. Fatigue measurement follows the recovery principle considering the effort employed on the course of a day of work. In case the recovery is not sufficient, residual fatigue will be present the following day. In this way, a cumulative process is initiated, and if this process persists, it may cause long-term detrimental effects[7]. The need for recovery measure presents high potential in the detection of nurses' overload and in contributing to the implementation of preventive strategies. However, nursing practice in ICUs involves a complex interaction of factors, such as the management and planning of the units[32], noise, temperature, control of gases and vapors, systematic pauses for rest, and daily exposure to biological agents[33]. Therefore, the findings of the present study indicate that the application of the NRS in the context

of ICU nursing practice must be included in a broad analysis that considers the spectrum of biopsychosocial factors to which this category is exposed and that may influence recovery at work.

It is worth mentioning that these results must be regarded with caution, given that one of the limitations in our study was the reduced sample of workers, which was influenced by the number of staff members of both intensive care units analyzed here.

CONCLUSION

This study demonstrated a high prevalence of musculoskeletal discomfort in nurses who work in ICUs, and the females are the most affected. Work-induced fatigue seems to affect ICU nurses regardless of sex and sector. We recommend the delineation of new research directed to the understanding of fatigue induced by work in the ICU and its association with demographic and occupational factors.

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