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Original Article

Factors Related to Musculoskeletal Disorders in Nursing Workers[1]

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This cross-sectional study identified factors associated to musculoskeletal disorders in nursing auxiliaries and technicians in Salvador – Bahia. Three hundred and eight randomly selected female workers answered a questionnaire administered by an interviewer, with questions related to physical and psychosocial demands at work, individual characteristics and activities outside work. Multivariate analysis revealed that musculoskeletal disorders in neck, shoulder or upper back and musculoskeletal disorders in low back are associated to physical demand (material handling, poor back posture and work repetitiveness), psychosocial demand and precarious physical fitness. Musculoskeletal disorders in distal upper extremities are associated to physical demands (repetitiveness and force) and years of work (> 19). The results appoint the need for intervention strategies, incorporating both the organizational aspects of work and adaptations in the physical environment and in the characteristics of tasks.

Descriptors: Cumulative Trauma Disorders; Nursing; Nurses' aides.

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Fatores associados aos distúrbios musculoesqueléticos em trabalhadoras de enfermagem

Este é um estudo de corte transversal, objetivando identificar fatores associados aos distúrbios musculoesqueléticos em auxiliares e técnicas de enfermagem, em Salvador, BA. Trezentas e oito trabalhadoras, selecionadas aleatoriamente, responderam questionário aplicado por entrevistador, com questões sobre demandas físicas e psicossociais no trabalho, características individuais e atividades extralaborais. Análise multivariada revelou que distúrbios musculoesqueléticos em pescoço, ombro ou parte alta do dorso e distúrbios musculoesqueléticos em região lombar associam-se à demanda física (manuseio de carga, postura inadequada do tronco e gestos repetitivos), demanda psicossocial e condicionamento físico precário. Distúrbios musculoesqueléticos em extremidades superiores distais associam-se à demanda física (repetitividade e força) e anos de trabalho (>19). Os resultados apontam para a necessidade de estratégias de intervenção incorporando tanto os aspectos organizacionais do trabalho bem como adequações no ambiente físico e características das tarefas.

Descritores: Transtornos Traumáticos Cumulativos; Enfermagem; Auxiliares de Enfermagem.

Factores asociados a los disturbios músculo-esqueléticos en trabajadoras de enfermería

Este estudio de corte transversal identificó factores asociados a los disturbios músculo-esqueléticos en auxiliares y técnicas de enfermería en Salvador-BA. Trescientas y ocho trabajadoras, seleccionadas aleatoriamente, respondieron un cuestionario aplicado por un entrevistador, con preguntas sobre demandas físicas y psicosociales en el trabajo, características individuales y actividades extra-laborales. El análisis multivariado reveló disturbios músculo-esqueléticos en pescuezo, hombro o parte alta del dorso y disturbios músculo-esqueléticos en la región lumbar, que se asocian a la demanda física (manoseo de carga, postura inadecuada del tronco y gestos repetitivos), demanda psicosocial y acondicionamiento físico precario. Los disturbios músculo-esqueléticos en extremidades superiores distales se asocian con la demanda física (repetitividad y fuerza) y años de trabajo (> 19). Los resultados apuntan para la necesidad de presentar estrategias de intervención que incorporen tanto los aspectos organizacionales del trabajo así como las adecuaciones en el ambiente físico y en las características de las tareas.

Descriptores: Trastornos de Traumas Acumulados; Enfermería; Auxiliares de Enfermería.

Introduction

Musculoskeletal disorders (MSD) are the most common occupational disease in all countries, regardless of their degree of industrialization. MSD generate not only suffering and disability for workers and their families, but also result in high costs for society, considering losses in productivity and wages, benefits paid to workers and medical expenses[1].

Literature has appointed several factors associated with MSD. Greater evidence is related to physical demands, especially the handling of loads, inadequate posture and repetitiveness. Psychosocial demands, among which high psychological demands are highlighted, have shown the strongest evidence of association with low back MSD , although there has also been evidence of association with MSD in upper extremities. Individual characteristics and activities outside work have also been mentioned as factors associated with MSDs and, thus, should always be investigated, as they could operate

as confounding factors in the relationship between MSD and occupational factors[2].

Considering the importance of MSD as a public health problem, a study on this problem in nursing workers was defined. The choice of this population was motivated by reports on their demand for occupational healthcare services[3] and epidemiological studies conducted with nursing professionals in Brazil and other countries, which emphasize the high morbidity levels by MSD among these professionals[4-8].

This study aimed to investigate the factors associated with MSDs in the low back region, neck, shoulder, upper back and distal upper extremities in nursing technicians and auxiliaries from a public hospital in Salvador, BA.

Material and methods

A cross-sectional exploratory study has been conducted with nursing auxiliaries and technicians from a public hospital in the city of Salvador-BA. The studied hospital, a unit of the Unified Health System in Bahia, is characterized as highly complex and specialized in emergency trauma care. The hospital has 240 hospitalization beds, distributed across eight infirmaries, and 32 more ICU beds, accounting for an average of 700 surgeries per month and 300 emergency attendances per day.

At the time of data collection, the hospital staff comprised 781 nursing auxiliaries and technicians, with 115 men who were excluded because they represented only 14.7% of the total population. Thus, 666 nursing technicians and auxiliaries composed the study population. From this population, a random sample was drawn, whose minimum size, 293 individuals, was calculated considering an absolute precision degree of 5.0%, confidence level of 95.0%, expected prevalence of 50.0% and design effect of 1.2. The sample size of 320 workers was adopted considering the losses that could occur. The studied population consisted of 308 workers. There were only 12 losses or refusals.

For data collection, a questionnaire was applied to the selected employees, during work hours, in a private room. The instrument is an adaptation of the questionnaire developed and used by Fernandes[9] to study MSD among workers from a plastic industry, in which questions developed by the author and questions taken from other instruments were used, modified or not.

In the questionnaire, socio-demographic information is collected, concerning the current occupational history and the previous working life history, exposure to and psychosocial demands (through the *Job Content Questionnaire* - JCQ[10]*) and physical demands at work, data on domestic work, use of tobacco, alcohol and hormonal contraception, the perception of workers on their physical condition and, finally, information concerning symptoms of MSDs through the *Nordic Musculoskeletal Questionnaire* (NMQ)[11].

Data concerning physical demand at work was obtained through questions the workers answered on a scale of frequency, intensity or duration from 0 to 5, with anchors at the ends; about working postures, repetitive movements with the hands, exerted muscle force, load lifting and handling of patients.

An index was created, based on univariate analysis and on literature evidence of association between variables and outcome, in order to summarize the variables related to exposure to physical demands at work. For MSD in low back and neck, shoulder or upper back, the created index used variables that assessed the frequency with which the female workers adopted an inclined round posture of the back, performed heavy lifting and executed repetitive movements.

For upper distal extremities, the index included variables that evaluated the frequency with which the female workers performed repetitive movements with the hands, precise movements and the intensity of muscle force developed with the arms and hands.

Psychosocial aspects of work were measured by the JCQ[10], through scores obtained for psychological demands, control and social support.

Despite the wide use of Karasek's demand-control model in studies about psychosocial demands at work, considering the importance given to social support in research on MSD, the need has been highlighted to consider it both for demand and control variables. Therefore, the criterion was used which considers that high exposure to psychosocial demand has to meet at least two of the following conditions: high demand, low control and low support[12].

Data on symptoms of MSD were collected through the expanded version of the NMQ, an instrument widely used in epidemiological investigations of MSD all over the world.

A "Case of MSD" was defined as such in female workers who reported pain or discomfort in one or

* Portuguese version of the JCQ translated by Araújo T, 2000. (Unpublished)

more of the following body areas: toes, wrists, hands, forearms, elbows, neck, shoulder and upper back region in the last twelve months, with minimum duration of one week or a minimum monthly rate, which were not caused by acute trauma, followed by at least one of the following signs of severity: degree of severity higher than or equal to 3, on a numerical scale from 0 to 5 with anchors at the ends (no discomfort to unbearable discomfort); seeking medical care for the problem; absence from work (either official or not); change of work due to health restriction[11].

The results were analyzed together, concerning neck, shoulder and upper back regions, as those segments are considered as a functional unit. The findings for elbow, forearm, wrist, hand and fingers were also analyzed together, called the distal upper extremities.

In order to identify factors associated with MSD, non-conditional logistic regression analysis was conducted. The pre-selection of independent variables was based on biological plausibility of associations, as well as on univariate logistic regression, considering a p-value of less than 0.25 in the likelihood ratio test for coefficient significance. The "backward" method was used to select variables.

Since the final outcome of logistic regression provides the results using the odds ratio as a measure of association, and concerning its inadequacy for a cross-sectional study of a disease with high prevalence levels, the prevalence of reasons estimates and of its confidence intervals was calculated through the Delta method[13]

The team of interviewers, comprising the main author and graduate students in Medicine from *Universidade Federal da Bahia*, was previously trained to use the instrument.

The Research Ethics Committee of the Maternity Climério de Oliveira approved this research project (No. 84/2007 of May 23, 2007).

Results

The workers' mean age was 41 years and the majority worked day shifts, and did not use to do overtime (56.5% and 74.4% respectively). Approximately 34% reported working at another place. The average time in the formal or informal labor market was 19 years. Most respondents (63%) had always worked as Nursing Technician or Auxiliary, whereas 37% had worked in other functions. The average number of weekly work hours at the hospital was 32 hours, in addition to 18 hours of domestic work (Table 1).

Table 1 - Socio-demographic and occupational characteristics of nursing workers, Salvador, 2008 (n=308)

Variables	Frequency	
Age (years old, average ± sd*)	41 ± 11.1	
Marital status	n	%
Married or living with partner	155	50.3
Single	109	35.4
Have child(ren)	n	%
< 2 years old	17	5.5
≥ 2 years old	191	62.0
No child(ren)	100	32.5
Education	n	%
< High school	8	2.6
High school	239	77.6
Incomplete higher education	36	11.7
Complete higher education	25	8.1
Work shift	n	%
Daytime	174	6.5
Night	78	25.3
Mixed	56	18.2
Extra work time	n	%
Yes	78	25.6
No	229	74.4
Have another job	n	%
No	203	65.9
Yes	105	34.1
Nursing Technician / Auxiliary	87	82.9
Others	18	17.1
Total work time formal + informal (years, average ± sd)	19 ± 10.7	
Previous Occupations	n	%
Has always worked as Nursing Technician / Auxiliary	194	63.0
Other occupations	114	37.0
Health	26	22.8
Commerce	31	27.2
Education	15	13.2
Industry	12	10.5
Others	30	26.3
Hours of work in the hospital in the last week (average ± sd)	32 ± 14.5	
Hours of domestic work in the last week (average ± sd)	18 ± 15.3	

*sd: standard deviation

The prevalence of MSDs in neck, shoulder or upper back was 57.1%, in the low back region 53.9%, and in distal upper extremities 32.8%.

Concerning physical demands at work, Table 2 shows high exposure to work performed while standing or walking, to the execution of repetitive movements with hands and great muscle strength developed with arms and hands.

Table 2 - Physical demands at work of nursing workers, Salvador, 2008 (n=308)

Physical demands (0 - 5 points)	Average ± sd
Working in standing posture (0= never 5= all the time)	4.2 ± 0.9
Working walking posture (0= never 5= all the time)	4.1 ± 0.9
Working sitting posture (0= never 5= all the time)	1.4 ± 1.2
Muscular force with arms and hands (0= weak 5= very strong)	4.0 ± 1.1
Arms raised above the height of the shoulders (0= never 5= all the time)	2.3 ± 1.5
Work requires lifting of load (0= never 5= all the time)	3.6 ± 1.4
Rotated back (0= never 5= all the time)	2.6 ± 1.5
Back bent forward (0= never 5= all the time)	3.7 ± 1.3
Repetitive movements with hands (0= never 5= all the time)	4.1 ± 1.1
Very delicate and precise movements (0= never 5= all the time)	3.2 ± 1.5
Repetitive gestures (0= non-existent 5= very frequent)	3.9 ± 1.2

*sd: standard deviation

Through multivariate analysis, it was identified that MSD in neck, shoulder or upper back, and in low back region was 1.37 times more frequent among workers exposed to physical demand (heavy lifting, poor posture of the back and repetitive gestures) than among those who were not exposed. Psychosocial demands, perception of poor physical condition, years of work (≥ 19) and marital status not married also showed association with MSD in this region (Table 3).

For low back region, multivariate analysis shows that female workers who are exposed to physical demand with handling of loads and inappropriate postures have 1.44 times more MSD than non-exposed ones. MSD in low back showed also positive association with psychosocial demands, perception of poor physical fitness and obesity (Table 3).

MSD in distal upper extremities were associated with physical demand, repetitiveness and force and years of work (≥ 19) (Table 3).

Table 3 - Results of multivariate logistic regression analysis for musculoskeletal disorders (MSD) in neck, shoulder or upper back, low back and distal upper extremities in nursing workers, Salvador, 2008 (n=288)

Independent variables	PR*	CI† 95%
Neck, shoulder or upper back		
Physical demand with handling of load and poor posture	1.37	1.09 – 1.72
Psychosocial demand	1.27	1.02 – 1.57
Poor physical conditioning	1.69	1.25 – 2.28
Years of work (≥19)	1. 41	1.13 – 1.77
Marital status (single/divorced/widowed)	1.28	1.04 – 1.58
Low back		
Physical demand with handling of load and poor posture	1.44	1.12 – 1.85
Psychosocial demand	1.43	1.12 – 1.82
Poor physical conditioning	1.31	0.99 – 1.73
Obesity	1.29	1.00 – 1.65
Distal upper extremities		
Physical demand with repetitiveness and force	1.91	1.31 – 2.77
Years of work (> 19)	2.09	1.44 – 3.03

*PR: Prevalence Rate
† CI: Confidence Interval

Approximately 20 individuals were lost in the logistic regression stage due to failure to fill out the questionnaires. Among nursing technicians and auxiliaries whose comments were excluded from the final model, the distributions for MSD, socio-demographic characteristics and work time differ very little from the remaining workers (data not shown)

Discussion

The results of this study indicate the important contribution of physical demands to the development of MSD in three body regions studied. The findings for physical demand, according to the rates used here, are consistent with the literature. For MSD in low back and

neck, shoulder and upper back, the association occurred with the index that incorporates load lifting, improper back postures and repetitive gestures. For MSD in distal upper extremities, the index that incorporates precise or repetitive movements and muscle strength developed with the arms and hands was the physical demand variable that showed association.

Researchers[14] showed that physical demands at work were associated with MSD in the neck, shoulder and back among nursing professionals, and that this association was stronger in nursing auxiliaries when compared to nurses, probably due to a greater proportion of direct patient care activities among auxiliaries.

Studies with nursing workers emphasize the association between MSD, especially in the low back region, and the activity of handling patients. In this study, physical requirements related to the activities that nursing technicians and auxiliaries perform were put in question. It is known that activities related to patient handling are often accompanied by inadequate and static postures, anterior inclination of the back and asymmetric weight lifting[5], elements recognized as a risk for MSD in low back region and neck, shoulder and upper back. These were the variables considered in this study to assess physical demands, and which showed to be associated to MSD in those regions.

Although the study highlights patient handling as the main factor associated with MSD, and that inappropriate postures are significantly more frequent during patient handling than in unrelated activitiest[15], one cannot forget other various work activities of nursing auxiliaries and technicians that require great physical effort, such as organizing the equipment and furniture at the bedside, providing material for consumption at work and activities performed at the sterilized material centre.

Psychosocial factors related to work have also been identified as important in the development or worsening of MSD.

Some theories suggest how the influence of psychosocial demands on the musculoskeletal system works. It is possible that psychosocial factors directly affect the physical load, as time pressure increases the occurrence of acceleration of movements and inadequate postures. Psychosocial demands may produce increased tension in muscles and exacerbate the biomechanic request of tasks. Also, psychosocial demands may influence sensitivity to pain, and may affect attention to symptoms and increase MSD symptom reports and / or perception of their causes[16].

In this study, psychosocial demand has been associated with MSD in low back region and neck, shoulder and upper back, even after adjusting for physical demands and other co-variables. For MSD in distal upper extremities, however, no association was found with psychosocial demands at work. Dissatisfaction at work in this study showed no association with MSD in any of the three regions evaluated after adjustment according to other variables.

As it happens with this research, no other studies with nursing professionals describe association between psychosocial demands and MSD in distal upper extremities, although studies with other professional groups report that association[9,17].

Work time, conceived here as the occupational history of nursing technicians and auxiliaries as a whole, including formal and informal work ties, even in another profession not related to nursing, showed significant association with MSD in both neck, shoulder and upper back and distal upper extremities.

Similarly to this research, another study of nursing workers also found an association between work time and MSD in neck and arms, and lack of this association for low back MSD, a finding that is linked with the healthy worker effect[18]. It is suggested that workers with pain in low back region tend to leave the nursing profession earlier, due to these complaints. Abandonment due to pain in neck and arms is possibly less common because those are less disqualifying[18]. Yet, some authors[4,19] raise the hypothesis that no association between MSD in low back and work time is due to better coping strategies for physical loads, developed by more experienced professionals.

Literature also presents extra-work factors as possible contributors to MSD. Literature indicates that activities related to home or child care, which mainly women perform, may contribute to the development of MSD as they consume significant time outside paid work. Thus, female workers have less time to rest or exercise, or to perform activities that could mitigate the health costs of their paid work[20].

In this study, relationship between MSD and child care could not be assessed due to the small number of workers who reported having small children, which is explained by the workers' high average age (41 years). No association was found between MSD in any of the three body regions examined and domestic work.

Non-married marital status (single: 35.4%, divorced or separated: 11.7% or widowed: 2.3%) was one of the factors associated with MSD in neck, shoulder

and upper back. Although this finding has not been discussed, other authors[6,8] also found this association in nursing workers.

Despite being one of the individual factors most cited in literature as a major influence for the development of MSD, age in this study was not associated with MSD in low back, neck, shoulder and upper back or distal upper extremities, nor in other studies with nursing professionals[4-5,7,19].

Among individual characteristics, an association was found between obesity and MSD in low back region, although the literature does not show a significant correlation between obesity, as well as other anthropometric characteristics, and MSD[16].

Poor physical condition in this study showed an association with MSD in low back region, although with borderline statistical significance, and neck, shoulder and upper back, the region for which this variable presented the strongest association. Although activity and physical fitness are generally accepted as a way to reduce MSD, this is not clear in literature[2,16]. This cross-sectional study cannot assert the direction of the association between physical fitness and MSD.

The cross-sectional study design also appeared as a limit, due to the fact that only the survivors of the studied effect have been identified, thus subject to a selection bias, known as the healthy worker survival effect. This bias may have been minimized in this study because it is a public hospital, where most workers have a stable job and dismissal is almost non-existent.

We also tried to minimize the possibility of information bias, including the need to emphasize the independence of the study in relation to the hospital during the interviewers' training. Moreover, in order to minimize information bias, the survey was presented as referring to health conditions of workers, and the NMQ, the instrument that assesses MSD, was included in the final sections of the questionnaire[9].

Final considerations

This study showed the existence of an association between occupational demands and MSD in low back, neck, shoulder and upper back, and distal upper extremities, even when considering the influence of factors related to the individual and to outside work.

The occurrence of MSD in the three studied regions was associated with physical demand at work. Biomechanical requirements related to handling of patients, namely heavy lifting and performance of inadequate postures, commonly identified as damaging to the low back region, are also associated with MSD in neck, shoulder and upper back.

The association found between MSD in distal upper extremities and physical demand shows that attention should be paid not only to the activities related to handling and transfer of patients, but also to other activities that require precise and repetitive movements with the hands.

Psychosocial demands are associated with MSD in low back and neck, shoulder and upper back, suggesting the need for intervention strategies with a multifactor approach, incorporating the organizational aspects of work, as well as adjustments in physical environment and task characteristics.

Despite showing a weak association with MSD in low back, poor physical fitness and obesity were highly prevalent in this population, and should also be considered in the development of intervention programs to promote health for these professionals.

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