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Anxiety and depression predict musculoskeletal disorders in healthcare workers

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ABSTRACT

There is a high incidence of musculoskeletal disorders (MSD) among healthcare workers (HCW). Our aim was to determine whether MSD are associated with pre-existing anxiety and/or depression. A case-control study was carried out in female HCW (56 cases/55 controls). Cases were HCW with a first-time clinical diagnosis of MSD within the previous two years. Occupation, workplace, work shift, direct patient assistance, and anxiety/depression scores (Goldberg scale) were assessed. An increased risk of incident MSD (multivariate logistic regression) was found in workers with pre-existing anxiety/depression compared to those without them (OR 5.01; 95% CI 2.20-12.05; $p < 0.01$). Other significant risk factors were direct

patient assistance (OR 2.59; 95% CI 1.03-6.92; p = 0.04) and morning work shift (OR 2.47; 95% CI 0.99-6.48; p = 0.05). Preexisting anxiety/depression was associated with incident MSD in HCW, adjusting for occupational exposure risk factors.

KEYWORDS

mental health, musculoskeletal disorder, healthcare workers, neck disorder, low back pain, occupational health.

Musculoskeletal disorders (MSD) encompass a wide range of inflammatory and degenerative diseases, especially myalgia, tendonitis and tenosynovitis, entrapment syndromes, and degenerative musculoskeletal disorders. In recent years, the prevalence of MSD has risen among workers in Western countries. In United States of America, MSD cases accounted for 32 percent of all nonfatal occupational injury and illness in 2014 (1). MSD have been identified as the most common work-related diseases in the European Union (2).

MSD can be disabling, and have a major impact on the healthcare sector in United States of America (3) and Europe (4). MSD may cause long-term sickness absence in healthcare workers (5). Although there are many causes for these disorders---including occupational factors---there is evidence that suggests a relation between mental health disorders and MSD among these individuals, although this claim has been disputed (6-13). The situation is similar with regard to other potential risk factors like physical activity at work (6,8,11-15), age (6,10,11,14, 16-18), and tenure in current job (6,11). The type of occupation of the healthcare workers may influence the presence of MSD, but high prevalence of MSD has been described in different types of healthcare workers (19), such as nurses (6,20,21), nurses´aides (21,22), X-ray technologists (15), patient care staff (23) and physicians (24). It must also be noted that nearly 80% of healthcare workers are women (3), and that MSD patterns appear different in women compared to men (25,26).

In this study, we hypothesized that pre-existing anxiety and/or depression was associated with incident MSD. We also sought to assess the relation between MSD and other occupational risk

factors such as age, occupation, direct assistance provided in moving and/or transferring patients, and also tenure in current job.

METHODS

Participants and Procedure

This case-control study was conducted in the Hospital Fundación Jiménez Díaz, a tertiary-care University Hospital in Madrid, Spain, which has a staff of 2,739 and 736 beds. The study population consisted of healthcare workers, including physicians, nurses, technicians (laboratory, radiology, and physiotherapy), and nursing assistants.

Participants underwent their biennial periodic medical examinations and were consecutively recruited by the Department of Occupational Health and Prevention between October 2010 and July 2011. The study was restricted to female staff. The current study was reviewed and approved by an institutional review board (Escuela Nacional de Medicina del Trabajo/Instituto Carlos III), and all subjects participating in the study provided written informed consent to do so.

Recruitment was discontinued once 60 cases and 60 controls were included. With this number of cases and controls, the study would have a statistical power of 80% to detect a difference between both groups of at least 2 points in mean scores of anxiety and depression by the Goldberg scale (assuming a standard deviation of 4 and significance level of 0.05).

Participants were assigned to the group of cases by a complete clinical diagnostic evaluation after they answered “yes” to any of the screening questions; if they answered “no” to those

questions, and their complete clinical diagnostic evaluation corroborated it, they were assigned to the control group. The screening questions were as follows:

- Do you often experience neck or back pain?

- Do you have joint pain? If so, specify if the pain is in the hands, shoulders, elbows, feet, hips, and/or knees.

If the answer was affirmative to the two screening questions, subjects were asked the following two questions:

- Since when have you experienced this pain?

- Did you require treatment? If so, what treatment did you require?

These questions are part of the health questionnaire that forms the basis of the medical history collected in the biennial periodic medical examinations performed in our Department of Occupational Health and Prevention. The responses to these questions were reviewed in a complete clinical examination of the workers, including any necessary diagnostic methods (conventional radiography, ultrasound, MRI, CT, EMG) as determined by the occupational health physician during the aforementioned examinations.

The inclusion criteria were: first-time episodes of MSD within the previous two years, and after the previous periodic examination, female sex, age between 18 and 65 years, and healthcare position occupation (i.e., physicians, nurses, technicians and nursing assistants).

The exclusion criteria were: male sex, a MSD at their previous clinical evaluation two years before (prevalent MSD), congenital and/or chronic disease of the musculoskeletal system; chronic neurological disease; chronic rheumatologic disease; oncologic and/or psychological/psychiatric diseases.

Four cases and five controls were excluded following these criteria, yielding a total study population of 111 employees: 56 cases and 55 controls.

Measures

Pain and/or disability. The study protocol included an evaluation of recent pain and/or disability related to musculoskeletal conditions by the Nordic Musculoskeletal Questionnaire (27) for the case group. The patients did not report any MSD two years before as we confirmed by the review of their previous clinical evaluation. So, these MSD were confirmed as incident within the study biennium.

Anxiety and depression. The data on perceived anxiety and depression were retrospectively obtained from all case and control subjects' responses to the Goldberg Anxiety and Depression scales (28) two years before this study (i.e., data were obtained at their preceding occupational medical examination). This questionnaire contains 2 sub-scales, one for anxiety and the other for depression, each one with a cut-off score > 4 points.

Demographic and occupational characteristics. The other variables studied were as follows:

- Age: at the time of recruitment into the study.

- Work shift: we used both a 4-group (morning, afternoon, night, and rotating shifts), and a dichotomous categorization (either morning shifts or "other" shifts, i.e., afternoon, night, and rotating shifts).

- Occupation: physician, nurse, technicians (X-ray or laboratory technologists, and physiotherapists), and nursing assistants.

- Hospital worksite: inpatient ward, operating rooms/Intensive Care Unit (ICU), outpatient clinics, and central services (X-ray service, laboratory).

- Direct patient assistance (defined as ambulating or walking, bathing, dressing, feeding, manual transfer or positioning on bed): examined as a dichotomous variable.

- Tenure in current job.

Statistical Analysis

Statistical analysis was performed using the R program (R version 3.1.2, 2014-10-31

Copyright (C) 2014, The R Foundation for Statistical Computing). For comparisons between cases and controls, the Mann-Whitney test was used for quantitative variables, and the Chi-square and the Fisher´s exact tests for qualitative variables.

Univariate and multivariate logistic (using a backward stepwise method) regression analyses were conducted to assess the association between each variable and the development of incident MSD. These statistics were used to estimate the odds ratio and the 95% confidence interval (*CI*). The statistical significance of the variables as well as the interaction between variables was

assessed using the likelihood function. The predictive value of the logistic regression models was assessed by calculating the area under the ROC curve. For all analyses, statistical significance (α error level) was set at 0.05.

RESULTS

Table 1 shows descriptive results for the cases and controls included in the study. Both study groups did not differ in age or tenure in current job. Significant differences, on the other hand, were observed in worksites ($p = 0.039$), with more cases than controls working in central services: X-ray service, laboratory ($p = 0.02$), and the majority of these workers being X-ray technologists. In addition, more cases than controls worked the morning shift.

A complete clinical diagnostic evaluation of the cases revealed the cervical region (38.7% of cases) as the most common area for pain, followed by the lumbar region (36.0%). Pain duration was distributed bimodally, with 26.9% of cases reporting pain that lasted for less than 1 month, while 46.4% of cases had pain for 10 months. The intensity of pain related to MSD was reported as medium/high in 42.9% of the cases, and as low in 23.2% of them. Only a minority of the cases (17.8%) required an MSD-related temporary disability leave.

According to the Goldberg scale results obtained during the previous biennial medical examination, pre-existing anxiety and/or depression were significantly more common among cases than controls (Table 2): 67.9% of the cases presented anxiety and 28.6% depression, as compared to the controls (respectively, 27.3% and 5.5%, Table 3).

As seen in Table 4, the univariate logistic regression analysis revealed an increased risk of incident MSD in workers with pre-existing anxiety and/or depression (OR 1.39; 95% CI 1.19-1.67; p <0.01). The association between the risk of incident MSD and age and socio-occupational variables was also analyzed (Table 4), showing an increased risk of incident MSD in morning shift workers vs other shifts (OR 2.53; 95% CI 1.09-6.11; p = 0.03).

Finally the multivariate logistic regression analysis of the risk of incident MSD (Table 5) confirmed that workers with pre-existing anxiety and/or depression were at a greater risk of developing MSD (OR 5.01; 95% CI 2.20-12.05; p <0.01). The model also identified direct patient assistance (defined as ambulating or walking, bathing, dressing, feeding, manual transfer or positioning on bed) (OR 2.59; 95% CI 1.03-6.92; p = 0.04), and work shift (morning shift workers vs other shifts, OR 2.47; 95% CI 0.99-6.48; p = 0.05) as significant risk factors. The area under the ROC curve for this model was 0.7669.

COMMENT

Our study found that pre-existing anxiety and/or depression is associated with incident MSD in female healthcare professionals. Workers who experienced these psychological symptoms at their previous medical examination, two years before this study, had a five-fold increase risk of incident MSD episodes compared to those who did not have those symptoms (OR 5.01; 95% CI 2.20-12.05; p <0.01).

In recent years, the influence of various factors on the development of MSD has been frequently examined in the scientific literature. It appears logical that multiple factors relate to the incidence

and prognosis of MSD among the working population (29-32) and particularly among healthcare workers (8).

As for other studies of healthcare workers---the majority of which considered only nurses---some authors (6,12,13,33) reported an association between mental health and MSD. For instance, Smedley et al (12) described that nurses who reported low mood or stress at baseline were more likely to develop neck/shoulder pain later. We have found a relation between the presence of pre-existing anxiety and/or depression and subsequent appearance of incident MSD in our population of female healthcare workers. Almost half of our study subjects were nurses, although others were physicians, technicians, and nursing assistants.

The physiopathological mechanism by which anxiety and/or depression increase the risk of MSD is unclear. It has been hypothesized that stress created by anxiety and/or depression can lead to increased muscle tension and pain, alter blood flow and oxygen supply, and cause an increase in algesic substances within muscles, especially in long-duration muscle pain situations (32,34).

Most of the previous studies published on this topic (25,26) reported a different MSD pattern between women and men. This sex-based variation has been linked to differences respect to a number of biological factors, such as the distribution of hormone receptors and types of muscle fiber (35). Because of the possible differences in how MSD present in men and women, and given that the majority of our population of healthcare workers are women (3), we decided to restrict our study to female employees.

The average age of healthcare workers has increased in industrialized countries, especially in fields such as nursing (36). This change may have an important impact on the

pathologies and potential disabilities affecting these individuals (8). Our study did not identify age as a risk factor for MSD (OR 1.03; 95% CI 0.99-1.07; p = 0.12), but our sample size may have limited our ability to detect a risk associated with this important covariate. Some published studies reported similar findings (11,33,37), but that was not the case in others (6,14,16-18).

There is considerable debate on the influence of physical factors in the appearance of and change in MSD among different groups of workers, including healthcare workers (7,8,38). A relation has been found between MSD and direct patient assistance involving moving and/or assisting them with walking. The described MSD affect some parts of the body more than others (9,11,13,16,22). In contrast, a systematic review of low back pain in healthcare workers (39) revealed the scant available evidence on the relation between this type of MSD and physical factors such as moving and assisting patients. Our study detected an association between direct patient assistance and MSD (OR 2.59; 95% CI 1.03-6.92; p = 0.04).

The other risk factor for development of MSD found in our study was work shift (OR 2.47; 95% CI 0.99-6.48; p = 0.05), in that a greater number of cases than controls worked the morning, compared to the other shifts. There tends to be more care activity in the morning shift in hospitals, which in turn may relate to more physical exertion. In contrast, other studies found a higher risk of MSD in evening or nightshift workers (7,22).

We wish to emphasize that our protocol excluded patients with pre-existing MSD two years before this study, and that anxiety and depression were assessed two years before the onset of clinically corroborated MSD. That design allowed us to study the possible relation between the incidence of MSD and pre-existing anxiety and/or depression. The physical demands

(biomechanical exposures) of the job were considered by two proxy variables: occupation and direct patient assistance. There was no residual confounding by biomechanical exposures of the association between anxiety/depression and MSD. The size of our sample may have limited the possibility of detecting additional associations with secondary covariates, as may be the case with occupation. In addition, our study did not evaluate the performance of physical activities outside the workplace. The questionnaires on symptoms that the healthcare workers completed may not be the most accurate representation of the real situation of these individuals, although all the responses provided were reviewed during medical examinations performed by the occupational health physician, including appropriate diagnostic methods.

In conclusion, we identified pre-existing anxiety and/or depression as risk factors associated with incident MSD in healthcare workers. Intervention studies have been conducted on modifiable factors such as anxiety and depression and have yielded some positive results on MSD prevention (40), but the experience is still limited with worker populations (41), including healthcare workers (20). While new knowledge is being acquired on the relation between psychological and physical factors and MSD, it would be beneficial to assess and attempt to improve the psychological health of healthcare workers before they develop MSD, and also to study the ergonomic conditions under which they perform their duties.

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Table 1. Description of the study participants (cases and controls)

Variable	Value	Cases (n = 56)	Controls (n = 55)	p value
Age	years, mean ± SD	43.7 ± 9.7	40.6 ± 11.1	0.10 [a]
Tenure in current job	years, mean ± SD	7.8 ± 8.0	6.4 ± 7.3	0.09 [a]
Hospital area	Inpatients	21 (37.5%)	20 (36.4%)	0.04 [b]
	Outpatient clinics	9 (16.1%)	17 (30.9%)	
	Central services	21 (37.5%)	9 (16.4%)	
	Operating rooms/ICU	5(8.9%)	9 (16.4%)	
Occupation	Nurse	25 (44.6%)	24 (43.6%)	0.57 [b]
	Physician	8 (14.3%)	10 (18.2%)	
	Technician	11 (19.6%)	6 (10.9%)	
	Nursing assistant	12 (21.4%)	15 (27.3%)	
Work shift	Morning	45 (80.4%)	34 (61.8%)	0.04 [b]
	Other shifts	11 (19.6%)	21 (38.2%)	

Direct patient assistance	Yes	20 (35.7%)	12 (21.8%)	0.14 [b]
	No	36 (64.3%)	43 (78.2%)	

Note. ICU: Intensive Care Unit.

[a]Mann-Whitney test,[b]Chi-square association test.

Table 2.Pre-existing anxiety and/or depression scores in cases and controls (assessed with the Goldberg scale)

Variables	Cases	Controls	p value[a]
Anxiety and depression	4.8 ± 3.7	2.3 ± 1.8	<0.01
Anxiety	3.3 ± 2.3	1.8 ± 1.3	<0.01
Depression	1.5 ± 1.9	0.4 ± 0.9	<0.01

[a]Mann-Whitney test

Table 3. Description of the percentage of positive values for pre-existing anxiety and/or depression in cases and controls calculated using the Goldberg scale

Variables		Cases (%, N)	Controls (%, N)	p value[a]
Anxiety	Positive	38 (67.9%)	15 (27.3%)	<0.01
	Negative	18 (32.1%)	40 (72.7%)	
Depression	Positive	16 (28.6%)	3 (5.5%)	<0.01
	Negative	40 (71.4%)	52 (94.5%)	

[a]Fisher´s exact test

Table 4. Univariate logistic regression analysis of the risk of musculoskeletal disorders associated with pre-existing anxiety and/or depression, age, and occupational variables

Variables	OR	95% CI	p value
Pre-existing anxiety and depression	1.39	1.19, 1.67	<0.01
Pre-existing anxiety	1.60	1.27, 2.10	<0.01
Pre-existing depression	1.71	1.27, 2.48	<0.01
Age	1.03	0.99, 1.07	0.12
Direct patient assistance	1.99	0.87, 4.72	0.11
Tenure in current job	1.02	0.98, 1.08	0.35
Work shift			
Other shifts	ref.	-	-
Morning shift	2.53	1.09, 6.11	0.03
Occupation			
Physicians	ref.	-	-
Nurse	1.30	0.44, 3.95	0.63
Nursing assistant	1.00	0.30,3.38	1.00

Technician	2.29	0.60,9.38	0.23
Hospital area			
Inpatient ward	ref.	-	-
Outpatient clinics	0.50	0.18,1.37	0.18
Central services	2.22	0.84,6.19	0.12
Operating rooms/ICU	0.53	0.14,1.81	0.32

Note. ICU: Intensive Care Unit. OR = odds ratio; 95% CI = 95% confidence interval.

Table 5.Multivariate logistic regression analysis of the risk of musculoskeletal disorders

Variable	OR	95% CI	p value
Pre-existing anxiety/depression	5.01	2.20, 12.05	<0.01
Work shift	2.47	0.99, 6.48	0.05
Direct patient assistance	2.59	1.03,6.92	0.04

Note. OR = odds ratio; 95% CI = 95% confidence interval.

Area Under the Receiver Operating Characteristic (ROC) Curve (AUC) = 0.7669.

