Published in final edited form as:
Cad Saude Publica. 2012 September ; 28(9): 1632–1642.

Physical and psychosocial risk factors for musculoskeletal disorders in Brazilian and Italian nurses

Michele Carugno[1], **Angela Cecilia Pesatori**[1,2], **Marco Mario Ferrario**[3], **Andrea Lepos Ferrari**[4], **Fábio Jose da Silva**[4], **Aline Caldas Martins**[5], **Vanda Elisa Andres Felli**[4], **David Coggon**[6], and **Matteo Bonzini**[3]

[1]Department of Occupational and Environmental Health, University of Milan, Milan, Italy

[2]Fondazione IRCCS Ca'Granda-Ospedale Maggiore Policlinico, Milan, Italy

[3]Department of Clinical and Experimental Medicine, University of Insubria, Varese, Italy

[4]Hospital Universitário, Universidade de São Paulo, São Paulo, Brasil

[5]Escola de Enfermagem, Universidadede São Paulo, São Paulo, Brasil

[6]MRC Lifecourse Epidemiology Unit, University of Southampton, Southampton, U.K.

Abstract

As part of the international CUPID investigation, we compared physical and psychosocial risk factors for musculoskeletal disorders among nurses in Brazil and Italy. Using questionnaires, we collected information on musculoskeletal disorders and potential risk factors from 751 nurses employed in public hospitals. By fitting country specific multiple logistic regression models, we investigated the association of stressful physical activities and psychosocial characteristics with site-specific and multisite pain, and associated sickness absence. We found no clear relationship between low back pain and occupational lifting, but neck and shoulder pain were more common among nurses who reported prolonged work with the arms in an elevated position. After adjustment for potential confounding variables, pain in the low back, neck and shoulder, multisite pain, and sickness absence were all associated with somatizing tendency in both countries. Our findings support a role of somatizing tendency in predisposing to musculoskeletal disorders, acting as an important mediator of the individual response to triggering exposures, such as workload.

Keywords

Nursing Staff; Cross-cultural Comparison; Musculoskeletal Diseases; Absenteeism

INTRODUCTION

Musculoskeletal disorders (MSDs) are an important cause of morbidity in Western countries [1] where they have been a major focus for research. Moreover, in the last decade the body of evidence on MSDs has extended to include also epidemiological investigations conducted in the so called "developing" countries [2-4].

Many studies have highlighted the important role of stressful physical activities in the generation and progression of MSDs. At the same time, psychosocial risk factors – such as job satisfaction, somatizing tendency, and mood – are receiving growing attention as

Correspondence: M. Carugno, Department of Occupational and Environmental Health, University of Milan., via San Barnaba 8, Milan 20122, Italy. michele.carugno@gmail.com.

Europe PMC Funders Author Manuscripts

determinants of MSDs, and appear at least equally important [5-8]. In addition, some studies have started to explore whether culturally determined health beliefs play a role in generating and maintaining musculoskeletal symptoms. These studies have suggested marked variations in the prevalence of common musculoskeletal complaints and associated disability among workers carrying out similar jobs but in dissimilar settings (different countries) [9,10]. It is hypothesized that in many cases, chronic musculoskeletal symptoms and disability could be "psychologically mediated responses to triggering exposures" [11] conditioned by individual characteristics and cultural circumstances. Nurses employed in hospital are particularly liable to work-related MSDs: their work frequently involves heavy lifting, often with the back in awkward postures, and sometimes entails forceful movements of the upper limbs. Low back, neck, and shoulder pain have been shown to be highly prevalent among nurses [12].

In order to study psychosocial and cultural influences on MSDs, we recruited two populations of nurses and nursing technicians (from now on called nurses as a whole) from Brazilian and Italian cities, as part of the international CUPID (Cultural and Psychosocial Influences on Disability) study.

Our aim was to compare the prevalence of MSDs among nurses in the two locations, and their associations with physical and psychosocial risk factors.

METHODS

We conducted a cross-sectional survey focusing on nurses from large public hospitals in Brazil and Italy. Between May 2008 and March 2010, we recruited nurses who were employed in medical wards at São Paulo University Hospital (Brazil), and Milan and Varese University Hospitals (Italy), from now on called Brazilian and Italian nurses, respectively, for the sake of brevity. To be included subjects had to have worked for at least 1 year in their current job.

The study protocol was approved by each Institutional Review Board, and written informed consent was obtained from all participants. Each subject completed a self-administered questionnaire in their native language. The questionnaire had been compiled for the CUPID study, originally in English, and then translated into Portuguese and Italian. To check the accuracy of the translations each questionnaire was independently back-translated to English. The back-translated versions were then compared to the original to identify any inconsistencies, and re-submitted to the central coordinator of the CUPID study (DC) who suggested adjustments. In addition, as described previously [3], the Portuguese version of the questionnaire was pre-tested in a sample of nurses before applying it in the main study.

Among other things, questions covered demographic characteristics, hours worked per week, duration of employment, whether the nurse's job involved specific physical activities in an average working day, job satisfaction, tendency to somatize, mental health (mood), pain at specific anatomical sites, and related disability and sickness absence.

Exposure Assessment

We categorized hours worked per week using a cut-off at 38 hours (a full-time working week). We assessed job satisfaction by asking participants directly how satisfied they were with their job as a whole: answers were then grouped to form a dichotomous variable (satisfied vs. dissatisfied). To measure somatizing tendency we used elements of the somatic subscale of the Brief Symptom Inventory [13], asking about distress caused by nausea, faintness, dizziness, weakness, numbness, chest pain, and breathing difficulties in the previous week; participants were then classified according to the number of these symptoms

(zero, one, two or more) causing at least moderate concern. We assessed mental health using questions from the relevant section of the Short Form-36 questionnaire [14]. The sums of scores from individual questions were grouped to approximate thirds of their distribution in the whole study sample (poor, intermediate, or good mental health).

The CUPID questionnaire focused on six anatomical sites: low back, neck, shoulder, elbow, wrist/hand and knee. For each site, we identified one or more physical activities in an average working day as stressful. These included: lifting weights of ≥25 kg by hand (low back) and work with hands above shoulder height for ≥1 h (neck and shoulders).

Outcome Definition

Pain at different anatomical sites was assessed by means of specific questions regarding location and duration of pain, whether the pain had made one or more everyday activities (such as getting dressed, doing normal household jobs, etc.) difficult or impossible, and whether it had led to absence from work; to avoid misunderstanding regarding pain location, each anatomical site was depicted in an image. The simplest outcome measures were the presence or absence of pain in the past month at each of the six anatomical sites of interest. Pain was then defined as "disabling" if it had made at least one of the specified everyday activities difficult or impossible in the past month. We also investigated whether pain had occurred in three or more sites in the past month (multisite pain), and whether sickness absence had occurred in the past year because of musculoskeletal pain. When considering regional pain, we focused only on those anatomical sites which are most likely to be stressed by the typical activities of nurses employed in hospital wards: low back, neck, and shoulder. However, when investigating multisite pain and sickness absence, all anatomical sites were taken into account.

Statistical Analysis

We first compared the occupational and psychosocial characteristics of nurses in the two locations, by means of descriptive statistics, Pearson's chi-squared test, and Mann-Whitney U test for ordinal variables. We then fitted location-specific multiple logistic regression models to assess the associations of risk factors with pain, disabling pain, multisite pain, and sickness absence; for categorical variables with more than two levels, a test for trend was performed. All statistical tests were two-sided; a p value <0.05 was considered statistically significant. The statistical analysis was performed using Stata/MP 11.1.

RESULTS

A total of 969 nurses were invited to take part in the study. Questionnaires were returned by 195 Brazilian nurses (participation rate: 96%) and 585 Italian nurses (participation rate: 76%). However, we excluded two Brazilian and 27 Italian nurses because they had been employed in their current job for less than one year. Thus, our analysis was based on 751 subjects.

Table 1 summarizes the main characteristics of the study sample by location. Gender distribution was similar in the two locations (84% females) but Italian nurses were younger (50% aged <40 vs. 39%) with a shorter duration of employment. 72% of participants reported an average working week of 38 hours or less, with a higher proportion of Italian nurses (26% vs. 19%) working more than 38 hours/week. Both lifting weights of 25 kg or more and working with the hands above shoulder height for an hour or longer were more frequent among Italian participants. 92% of Brazilian nurses declared they were satisfied with their current job, as compared with 83% of Italian nurses. In both locations more than 30% of the study participants reported two or more somatic symptoms causing at least

moderate concern (somatizing tendency). Mood was poorer among Brazilian nurses, with more than 65% of the participants having intermediate or poor mental health, while the corresponding proportion among Italian nurses was 55%.

Table 2 shows the prevalence of regional pain among participating nurses by location. Rates of low back pain (LBP) in the past month were similar (45% in São Paulo vs. 49% in Milan/Varese), but there was a higher prevalence of related absence in the past year in the Italian cities. Italian nurses reported more neck pain, although the difference was not statistically significant. Brazilian nurses reported more shoulder problems, with significant differences for shoulder pain in the past month (42% in São Paulo vs. 33% in Milan/Varese, p=0.04) and shoulder pain causing absence in the past year (12% in Brazil vs. 7% in Italy, p=0.04). The frequency of multisite pain was different in the two locations, with a higher proportion of Brazilian nurses reporting ≥ 3 painful anatomical sites in the past month (42% vs. 30%); however the percentages of participants reporting no painful sites at all were very similar (23% in São Paulo vs. 25% in Milan/Varese).

Table 3 gives results from multiple logistic regression analyses, exploring associations between the main risk factors investigated and pain at different anatomical sites in the past month. The reference category for each of the risk estimates in this table was no pain at the investigated site during the past month. All regression models included sex, age, hours worked per week, site-specific stressful physical activity, job satisfaction, somatizing tendency, and mood; associations are summarized by odds ratios (ORs) and corresponding 95% confidence intervals (95%CIs). With regard to LBP, our analysis showed a lower risk in men than women, which reached statistical significance among Italian nurses (OR=0.51, p=0.02). Increasing age category was clearly associated with higher risk of LBP in the Italian nurses; and a similar pattern was apparent in the Brazilian nurses, although none of the ORs was statistically significant. Working for more than 38 hours per week carried an increased risk among Italian nurses only (OR=1.83, p=0.01). No significant association was found between LBP and lifting weights of 25 kg or more in an average working day, although ORs in both locations were greater than one. Job dissatisfaction also carried an increased risk (OR=1.52 in São Paulo and OR=2.27 in Milan/Varese), but this reached statistical significance only in Italy (p=0.002). We found a strong relationship between somatizing tendency and risk of LBP, with ORs ranging from 1.49 among Brazilian nurses reporting one symptom causing at least moderate concern in the past week to 2.99 among Italian nurses reporting two or more distressing symptoms: in both locations associations were statistically significant (p-trend=0.02, and p-trend<0.001 in São Paulo and Milan/Varese respectively). No association was found with mood.

As regards neck pain (NKP) in the past month, associations with gender and age were similar to those for LBP. No association was observed with hours worked per week, but stressful physical activity (working with hands above shoulder height for one hour or longer) was associated with a significantly elevated risk in both Brazilian and Italian nurses (ORs: 5.45, p=0.01 and 2.11, p=0.001, respectively). No significant association was observed with job satisfaction, although in both locations ORs exceeded one. A positive association with somatizing tendency was observed also for NKP, with a clear trend in risk among the Italian nurses (p<0.001). As for LBP, no association was observed with poor mental health.

Shoulder pain (SHP) was also more common at older ages. In addition, there was a positive association with stressful physical activity (work with hands above shoulder height for ≥1 h), with similar ORs in the two locations (1.72, p=0.4 in São Paulo and 1.89, p=0.01 in Milan/Varese). Job dissatisfaction was strongly associated with SHP in São Paulo (OR 8.06, p=0.01). In Milan/Varese, there was also a positive association, but it was not statistically significant (OR=1.53, p=0.1). Somatizing tendency was a risk factor for SHP as for pain at

other sites, with ORs ranging from 1.21 (Italian nurses reporting one symptom causing at least moderate concern in the past week) to 4.78 (Brazilian nurses reporting two or more distressing symptoms).

Associations with disabling pain in the past month were generally similar to those for any pain at the same anatomical site (Table 4). Thus, age, hours worked per week, job dissatisfaction, and somatizing tendency were associated with disabling LBP. Working with hands above shoulder height for an hour or longer in an average working day was significantly associated with disabling NKP in both São Paulo (OR=5.44, p=0.01) and Milan/Varese (OR=2.17, p=0.001). In both locations somatizing tendency was positively associated with disabling NKP (p=0.02 and p<0.001 for São Paulo and Milan/Varese, respectively) and disabling SHP (p<0.001 for both locations). A 64% increased risk of disabling SHP was observed among Italian nurses working more than 38 hours per week. And job dissatisfaction carried an OR of 5.59 (p=0.05) for disabling SHP among Brazilian nurses.

Further analyses (Table 5) confirmed somatizing tendency to be a strong risk factor for reporting pain at three or more sites in the past month (reference category: pain at two or fewer sites) in both Brazilian (OR=2.37 for one symptom causing at least moderate concern, OR=3.15 for two or more symptoms, p-trend=0.004) and Italian (OR=1.89 for one symptom, OR=3.51 for two or more symptoms, p-trend<0.001) nurses. Positive associations were also found between somatizing tendency and sickness absence in the past year, both in São Paulo (OR=1.91 for one symptom, OR=3.14 for two or more symptoms, p-trend=0.01) and in Milan/Varese (OR=1.55 for one symptom, OR=2.32 for two or more symptoms, p-trend=0.001).

DISCUSSION

Our study evaluated MSD prevalence in two occupational groups from different socio-cultural backgrounds, both performing very similar job tasks (nursing staff from medical wards in large public hospitals in Brazil and Italy), and compared, across different locations, the relation of risk factors to pain, disability and sickness absence.

In our population, MSD prevalence tended to be higher than that previously reported from similar occupational settings in other countries [15].

Despite possible differences in working conditions, systems of remuneration and workforce beliefs, we observed no major inconsistencies between the Italian and Brazilian nurses studied in LBP prevalence or related disability and sickness absence.

After adjustment for the effect of other individual and psychosocial risk factors, physical activity (lifting weights of ≥25 kg by hand) was not significantly associated with LBP or disabling LBP in either the Brazilian or Italian nurses.

The prevalence of NKP and SHP was similar to the observed prevalence of LBP in both locations. An increased risk of neck and shoulder pain was observed for subjects working with the hands above shoulder height for at least one hour/day.

Somatizing tendency appeared to be a relevant risk factor for all the outcomes investigated, and particularly for disabling pain, multisite pain and sickness absence. These associations were seen in both locations, despite possible differences in cultural and social backgrounds, and are consistent with findings in other studies [15,16].

Major strengths of our study are: a relatively high participation rate, comparison of the same occupational group in two locations characterized by different social and cultural backgrounds, and the ability to evaluate not only pain prevalence but also – as suggested by recent investigations [17,18] – its consequences (disability and sickness absence).

The participation rate was 96% among Brazilian and 76% among Italian nurses, being higher or just slightly lower than response rates obtained elsewhere in the CUPID study [12,15]. Important response bias is therefore unlikely. While non-responders may have differed somewhat from responders in their prevalence of musculoskeletal symptoms, it seems unlikely that the differences would be so great as to seriously bias prevalence estimates. Moreover, when considering associations between musculoskeletal symptoms and risk factors, important bias is even more unlikely. These response rates were achieved while ensuring the anonymity of participants and in strict collaboration with the occupational physicians at the investigated hospitals.

Applying the same study protocol and standardized measurements of exposures and outcomes, we were able to investigate and compare the associations of prevalent MSDs with potential risk factors in São Paulo (located in a rapidly developing country in which MSDs in occupational settings were extensively investigated only recently [19,20], usually without taking into account psychosocial risk factors) and in Milan and Varese (both located in a country characterized by a higher median income, and a more stable economic environment). Moreover, the relation of somatizing tendency to MSDs had not previously been investigated in Brazil.

The main limitations of our study arise from its cross-sectional design: as is well known, the contemporary collection of data on both risk factors and health limits conclusions that can be drawn about causal relationships. We have therefore presented our findings with caution, without interpreting them as causal relationships, and referring to ‘related’ or ‘associated’ factors [21]. The direction of cause and effect in cross-sectional associations with MSDs is uncertain [22]. In our study the lack of significant association between physical activity and LBP could be a consequence of healthy worker selection, arising because nurses with MSDs tend to move (or be moved) to other hospital units where there is less frequent lifting and moving of patients. In addition, the observed association between job satisfaction and pain could be influenced by a tendency for nurses to perceive a higher workload and feel less satisfied if they are experiencing frequent musculoskeletal pain (reverse causation).

Reverse causation may also have played a role in the observed association between somatization and pain prevalence. Workers with MSDs might be prone to describe their “general health” more negatively. The items involved in the somatizing tendency measurement included both nonspecific symptoms (such as dizziness, chest pain, nausea, breathing difficulties), and two neurological symptoms that could in some circumstances arise from musculoskeletal disease (“feeling weak in parts of your body” and “numbness or tingling in parts of your body”). When we repeated analyses excluding these two questions, the associations of somatizing tendency with low back pain (São Paulo), shoulder pain (both locations), multisite pain (São Paulo) and sickness absence (Milan/Varese) lost their statistical significance, but odds ratios were generally only slightly reduced and in other cases remained statistically significant (data not shown).

Our study relied on self-reported information, and this could have led to misclassification of some exposures. For example, a worker who was currently suffering from musculoskeletal pain might be more aware of stressful physical activities, and report them more frequently. The effect of any such misclassification would be to inflate ORs, and it would not explain the absence of significant associations between LBP and lifting.

Europe PMC Funders Author Manuscripts

To address some of the above mentioned limitations we are planning to follow up workers for at least one year and to re-measure MSDs and other outcomes at the end of this period. This will allow us to evaluate prospectively the effect of the evaluated risk factors on the risk of developing new MSDs and the persistence of MSDs already present at baseline.

In conclusion, our findings support a possible role of somatizing tendency in predisposing to MSDs. The influence of psychosocial and cultural characteristics on MSD prevalence is well described in the earlier literature [5,23], suggesting that they are important mediators of the individual response to triggering exposures (such as workload) [11]. Among such characteristics, somatizing tendency is likely to play an important role, with effects across different cultural environments.

REFERENCES

1. Smith, A.; Jones, A. Work-related musculoskeletal disorders are fast becoming the greatest health and safety challenge for Europe [news release]. 2000. [cited 2012 January 17]; Available from: http://osha.europa.eu/en/campaigns/ew2000/global_news/39_html
2. De Souza Magnago TS, Lisboa MT, Griep RH, Kirchhof AL, De Azevedo Guido L. Psychosocial aspects of work and musculoskeletal disorders in nursing workers. Rev Lat Am Enfermagem. 2010; 18(3):429–35. Epub 2010/08/20. [PubMed: 20721433]
3. Ferrari AL, Baptista PC, Felli VE, Coggon D. Translation, adaptation and validation of the “Cultural and Psychosocial Influences on Disability (CUPID) Questionnaire” for use in Brazil. Rev Lat Am Enfermagem. 2010; 18(6):1092–8. Epub 2011/02/23. [PubMed: 21340273]
4. Rocha FL, Marziale MH, Hong OS. Work and health conditions of sugar cane workers in Brazil. Rev Esc Enferm USP. 2010; 44(4):978–83. Epub 2011/02/19. [PubMed: 21329112]
5. Bongers PM, Kremer AM, ter Laak J. Are psychosocial factors, risk factors for symptoms and signs of the shoulder, elbow, or hand/wrist?: A review of the epidemiological literature. Am J Ind Med. 2002; 41(5):315–42. Epub 2002/06/20. [PubMed: 12071487]
6. Hoogendoorn WE, van Poppel MN, Bongers PM, Koes BW, Bouter LM. Systematic review of psychosocial factors at work and private life as risk factors for back pain. Spine. 2000; 25(16): 2114–25. Epub 2000/08/23 . (Phila Pa 1976). [PubMed: 10954644]
7. Palmer KT, Calnan M, Wainwright D, Poole J, O’Neill C, Winterbottom A, et al. Disabling musculoskeletal pain and its relation to somatization: a community-based postal survey. Occup Med (Lond). 2005; 55(8):612–7. Epub 2005/09/22. [PubMed: 16174664]
8. Palmer KT, Reading I, Linaker C, Calnan M, Coggon D. Population-based cohort study of incident and persistent arm pain: role of mental health, self-rated health and health beliefs. Pain. 2008; 136(1-2):30–7. Epub 2007/08/11. [PubMed: 17689865]
9. Alexopoulos EC, Burdorf A, Kalokerinou A. A comparative analysis on musculoskeletal disorders between Greek and Dutch nursing personnel. Int Arch Occup Environ Health. 2006; 79(1):82–8. Epub 2005/09/01. [PubMed: 16133523]
10. Madan I, Reading I, Palmer KT, Coggon D. Cultural differences in musculoskeletal symptoms and disability. Int J Epidemiol. 2008; 37(5):1181–9. Epub 2008/05/31. [PubMed: 18511493]
11. Coggon D. Occupational medicine at a turning point. Occup Environ Med. 2005; 62(5):281–3. Epub 2005/04/20. [PubMed: 15837843]
12. Harcombe H, McBride D, Derrett S, Gray A. Prevalence and impact of musculoskeletal disorders in New Zealand nurses, postal workers and office workers. Aust N Z J Public Health. 2009; 33(5): 437–41. Epub 2009/10/09. [PubMed: 19811479]
13. Derogatis LR, Melisaratos N. The Brief Symptom Inventory: an introductory report. Psychol Med. 1983; 13(3):595–605. Epub 1983/08/01. [PubMed: 6622612]
14. Ware JE Jr. Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care. 1992; 30(6):473–83. Epub 1992/06/11. [PubMed: 1593914]

15. Matsudaira K, Palmer KT, Reading I, Hirai M, Yoshimura N, Coggon D. Prevalence and correlates of regional pain and associated disability in Japanese workers. Occup Environ Med. 2011; 68(3): 191–6. Epub 2010/09/14. [PubMed: 20833762]
16. Harcombe H, McBride D, Derrett S, Gray A. Physical and psychosocial risk factors for musculoskeletal disorders in New Zealand nurses, postal workers and office workers. Inj Prev. 2010; 16(2):96–100. Epub 2010/04/07. [PubMed: 20363815]
17. Hooftman WE, Westerman MJ, van der Beek AJ, Bongers PM, van Mechelen W. What makes men and women with musculoskeletal complaints decide they are too sick to work? Scand J Work Environ Health. 2008; 34(2):107–12. Epub 2008/05/13. [PubMed: 18470439]
18. Shaw WS, Linton SJ, Pransky G. Reducing sickness absence from work due to low back pain: how well do intervention strategies match modifiable risk factors? J Occup Rehabil. 2006; 16(4):591–605. Epub 2006/11/07. [PubMed: 17086499]
19. Fonseca Nda R, Fernandes Rde C. Factors related to musculoskeletal disorders in nursing workers. Rev Lat Am Enfermagem. 2010; 18(6):1076–83. Epub 2011/02/23. [PubMed: 21340271]
20. Fernandes Rde C, Carvalho FM, Assuncao AA. Prevalence of musculoskeletal disorders among plastics industry workers. Cad Saude Publica. 2011; 27(1):78–86. Epub 2011/02/23. [PubMed: 21340106]
21. Sanderson S, Tatt ID, Higgins JP. Tools for assessing quality and susceptibility to bias in observational studies in epidemiology: a systematic review and annotated bibliography. Int J Epidemiol. 2007; 36(3):666–76. Epub 2007/05/02. [PubMed: 17470488]
22. Linton SJ. Do psychological factors increase the risk for back pain in the general population in both a cross-sectional and prospective analysis? Eur J Pain. 2005; 9(4):355–61. Epub 2005/06/28. [PubMed: 15979015]
23. Linton SJ. Occupational psychological factors increase the risk for back pain: a systematic review. J Occup Rehabil. 2001; 11(1):53–66. Epub 2001/11/15. [PubMed: 11706777]

Europe PMC Funders Author Manuscripts

Europe PMC Funders Author Manuscripts

Table 1

Characteristics of Participating Nurses by Location [ab]

Characteristic	São Paulo (n = 193) N	%	Milan/Varese (n = 558) N	%	Total (n = 751) N	%
Sex						
Female	169	87.6	464	83.2	633	*84.3*
Male	22	11.4	90	16.1	112	*14.9*
Missing	2	1.0	4	0.7	6	*0.8*
	P = 0.1					
Age						
19-29	30	15.5	93	16.7	123	*16.4*
30-39	46	23.8	185	33.2	231	*30.8*
40-49	81	42.0	174	31.2	255	*34.0*
≥ 50	32	16.6	81	14.5	113	*15.1*
Missing	4	2.1	25	4.5	29	*3.9*
	p = 0.04					
Job duration						
1-5 years	21	10.9	113	20.3	134	*17.8*
> 5 years	172	89.1	445	79.8	617	*82.2*
	p = 0.003					
Hours worked per week						
≤ 38 hours	148	76.7	395	70.8	543	*72.3*
> 38 hours	36	18.7	144	25.8	180	*24.0*
Missing	9	4.7	19	3.4	28	*3.7*
	p = 0.05					
Lifting weights of ≥ 25kg by hand						
No	97	50.3	205	36.7	302	*40.2*
Yes	94	48.7	342	61.3	436	*58.1*
Missing	2	1.0	11	2.0	13	*1.7*
	p = 0.001					
Work with hands above shoulder ≥ 1h						

Europe PMC Funders Author Manuscripts

	São Paulo (n = 193)		Milan/Varese (n = 558)		Total (n = 751)	
Characteristic	**N**	**%**	**N**	**%**	**N**	**%**
No	167	86.5	409	73.3	576	*76.7*
Yes	23	11.9	138	24.7	161	*21.4*
Missing	3	1.6	11	2.0	14	*1.9*
		p < 0.001				
Job satisfaction						
Satisfied	178	92.2	461	82.6	639	*85.1*
Dissatisfied	15	7.8	94	16.9	109	*14.5*
Missing	0	0.0	3	0.5	3	*0.4*
		p = 0.002				
Somatizing tendency [c]						
0	92	47.7	245	43.9	337	*44.9*
1	40	20.7	108	19.4	148	*19.7*
≥ 2	58	30.1	199	35.7	257	*34.2*
Missing	3	1.6	6	1.1	9	*1.2*
		p = 0.2				
Mental health						
Good	62	32.1	242	43.4	304	*40.5*
Intermediate	49	25.4	163	29.2	212	*28.2*
Poor	78	40.4	142	25.5	220	*29.3*
Missing	4	2.1	11	2.0	15	*2.0*
		p = 0.0002				

[a] *p* = chi-squared test after excluding subjects without available information; for ordinal variables, Mann-Whitney U test was performed.

[b] Percentages may not add to 100.0 because of rounding.

[c] Number of symptoms in past week causing at least moderate concern.

Europe PMC Funders Author Manuscripts

Table 2

Prevalence of Regional Pain among Participating Nurses by Location [a,b,c]

	Sao Paulo (n = 193)		Milan/Varese (n = 558)		
Regional Pain	**N**	**%**	**N**	**%**	***P***
LBP in past month	87	*45.1*	274	*49.1*	*0.3*
NKP in past month	78	*40.4*	259	*46.4*	*0.2*
SHP in past month	80	*41.5*	185	*33.2*	*0.04*
Disabling LBP in past month	66	*34.2*	194	*34.8*	*0.9*
Disabling NKP in past month	41	*21.2*	161	*28.9*	*0.04*
Disabling SHP in past month	84	*43.5*	221	*39.6*	*0.3*
LBP causing absence in past year	24	*12.4*	95	*17.0*	*0.1*
NKP causing absence in past year	12	*6.2*	58	*10.4*	*0.09*
SHP causing absence in past year	23	*11.9*	40	*7.2*	*0.04*
Number of painful sites in past month					
0	44	*22.8*	137	*24.6*	
1	34	*17.6*	130	*23.3*	
2	34	*17.6*	121	*21.7*	
≥ 3	81	*42.0*	170	*30.5*	*0.03*

[a] LBP: low back pain; NKP: neck pain; SHP: shoulder pain.

[b] *p* = chi-squared test; for “Number of painful sites in past month”, Mann-Whitney U test was performed.

[c] Percentages may not add to 100.0 because of rounding.

Europe PMC Funders Author Manuscripts

Table 3

Associations between Risk Factors and Pain in the Past Month by Location [a]

	Low Back Pain		Neck Pain		Shoulder Pain	
	São Paulo	Milan/Varese	São Paulo	Milan/Varese	São Paulo	Milan/Varese
Risk Factor	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**Sao Paulo OR (95%CI)**	**Milan/Varese OR (95%CI)**
Sex						
Female	1	1	1	1	1	1
Male	**0.82** (0.28-2.37) *p* = 0.7	**0.51** (0.30-0.88) *p* = 0.02	**0.65** (0.21-2.02) *p* = 0.5	**0.38** (0.21-0.69) *p* = 0.001	**1.10** (0.35-3.51) *p* = 0.9	**0.64** (0.35-1.18) *p* = 0.2
Age						
19-29	1	1	1	1	1	1
30-39	**1.65** (0.59-4.59)	**1.15** (0.66-2.00)	**1.74** (0.58-5.25)	**1.42** (0.80-2.51)	**1.04** (0.33-3.33)	**1.81** (0.93-3.49)
40-49	**1.85** (0.71-4.80)	**1.57** (0.89-2.78)	**2.45** (0.90-6.67)	**1.88** (1.05-3.35)	**2.33** (0.84-6.44)	**3.09** (1.60-5.95)
≥ 50	**1.25** (0.40-3.88) *p = 0.6*	**2.06** (1.03-4.10) *p* = 0.02	**1.59** (0.48-5.25) *p* = 0.3	**1.68** (0.85-3.36) *p* = 0.06	**2.42** (0.72-8.14) *p = 0.04*	**5.07** (2.41-10.66) *p* < 0.001
Hours worked/week						
≤ 38 hours	1	1	1	1	1	1
> 38 hours	**1.02** (0.44-2.36) *p* = 1.0	**1.83** (1.18-2.84) *p = 0.01*	**1.05** (0.44-2.52) *p = 0.9*	**1.19** (0.77-1.85) *p = 0.4*	**0.87** (0.34-2.21) *p* = 0.8	**1.22** (0.77-1.92) *p = 0.4*
Physical activity [b]						
No	1	1	1	1	1	1
Yes	**1.15** (0.59-2.23) *p = 0.7*	**1.31** (0.88-1.96) *p = 0.2*	**5.45** (1.62-18.28) *p = 0.01*	**2.11** (1.35-3.32) *p = 0.001*	**1.72** (0.52-5.68) *p = 0.4*	**1.89** (1.20-2.97) *p* = 0.01
Job satisfaction						
Satisfied	1	1	1	1	1	1
Dissatisfied	**1.52** (0.42-5.52) *p* = 0.5	**2.27** (1.34-3.86) *p = 0.002*	**2.18** (0.59-8.02) *p = 0.2*	**1.45** (0.86-2.45) *p = 0.2*	**8.06** (1.58-41.21) *p = 0.01*	**1.53** (0.91-2.58) *p = 0.1*
Somatizing tendency [c]						

Europe PMC Funders Author Manuscripts

	Low Back Pain		Neck Pain		Shoulder Pain	
	São Paulo	Milan/Varese	São Paulo	Milan/Varese	São Paulo	Milan/Varese
Risk Factor	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**Sao Paulo OR (95%CI)**	**Milan/Varese OR (95%CI)**
0	1	1	1	1	1	1
1	**1.49** (0.65-3.42)	**2.60** (1.57-4.31)	**1.32** (0.56-3.11)	**1.52** (0.92-2.52)	**2.76** (1.12-6.80)	**1.21** (0.70-2.10)
≥ 2	**2.42** (1.14-5.14) *p = 0.02*	**2.99** (1.93-4.65) *p < 0.001*	**1.33** (0.61-2.93) *p = 0.4*	**3.02** (1.94-4.69) *p < 0.001*	**4.78** (2.03-11.27) *p < 0.001*	**1.85** (1.17-2.91) *p = 0.01*
Mental health						
Good	1	1	1	1	1	1
Intermediate	**0.98** (0.43-2.25)	**0.85** (0.54-1.36)	**0.65** (0.27-1.55)	**0.98** (0.62-1.55)	**0.28** (0.10-0.77)	**0.76** (0.47-1.23)
Poor	**0.98** (0.45-2.12) *p = 1.0*	**0.96** (0.59-1.56) *p = 0.8*	**0.77** (0.35-1.70) *p* = 0.5	**0.81** (0.49-1.33) *p = 0.4*	**1.31** (0.56-3.03) *p* = 0.5	**0.83** (0.49-1.40) *p* = 0.4

[a] Multivariate logistic regression models adjusted for all the variables presented in the table; for categorical variables with more than two levels, a test for trend was performed.

[b] Stressful occupational activity in an average working day defined as lifting weights of ≥ 25 kg by hand (low back) or work with the hands above shoulder height for ≥ 1 hour (neck and shoulder).

[c] Number of symptoms in past week causing at least moderate concern.

Europe PMC Funders Author Manuscripts

Table 4

Associations between Risk Factors and Disabling Pain in the Past Month by Location [a]

	Low Back Pain		Neck Pain		Shoulder Pain	
	São Paulo	Milan/Varese	São Paulo	Milan/Varese	São Paulo	Milan/Varese
Risk Factor	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Sex						
Female	1	1	1	1	1	1
Male	**1.00** (0.32-3.14) $p = 1.0$	**0.51** (0.27-0.95) $p = 0.04$	**0.48** (0.09-2.57) $p = 0.4$	**0.43** (0.20-0.90) $p = 0.03$	**0.74** (0.22-2.48) $p = 0.6$	**0.38** (0.20-0.72) $p = 0.003$
Age						
19-29	1	1	1	1	1	1
30-39	**3.66** (1.01-13.32)	**1.48** (0.78-2.79)	**0.86** (0.19-3.94)	**1.89** (0.95-3.75)	**3.17** (0.95-10.60)	**1.86** (1.00-3.44)
40-49	**4.51** (1.33-15.28)	**2.24** (1.19-4.24)	**2.33** (0.65-8.30)	**2.59** (1.31-5.14)	**4.47** (1.48-13.49)	**2.57** (1.38-4.79)
≥ 50	**3.36** (0.84-13.43) $p = 0.08$	**3.31** (1.59-6.89) $p < 0.001$	**2.01** (0.47-8.64) $p = 0.1$	**1.35** (0.60-3.02) $p = 0.2$	**3.96** (1.10-14.23) $p = 0.02$	**3.07** (1.49-6.30) $p = 0.001$
Hours worked/week						
≤ 38 hours	1	1	1	1	1	1
> 38 hours	**1.27** (0.51-3.16) $p = 0.6$	**1.64** (1.04-2.60) $p = 0.03$	**0.46** (0.13-1.62) $p = 0.4$	**0.84** (0.51-1.39) $p = 0.5$	**0.83** (0.32-2.14) $p = 0.7$	**1.64** (1.04-2.58) $p = 0.03$
Physical activity [b]						
No	1	1	1	1	1	1
Yes	**1.01** (0.49-2.08) $p = 1.0$	**0.96** (0.63-1.46) $p = 0.8$	**5.44** (1.64-18.00) $p = 0.01$	**2.17** (1.35-3.49) $p = 0.001$	**2.50** (0.71-8.84) $p = 0.2$	**1.24** (0.79-1.96) $p = 0.4$
Job satisfaction						
Satisfied	1	1	1	1	1	1
Dissatisfied	**2.21** (0.57-8.59) $p = 0.3$	**1.88** (1.11-3.18) $p = 0.02$	**1.45** (0.30-7.03) $p = 0.6$	**1.70** (0.98-2.94) $p = 0.06$	**5.59** (1.04-29.93) $p = 0.05$	**1.46** (0.86-2.47) $p = 0.2$
Somatizing tendency [c]						

Europe PMC Funders Author Manuscripts

	Low Back Pain		Neck Pain		Shoulder Pain	
	São Paulo	Milan/Varese	São Paulo	Milan/Varese	São Paulo	Milan/Varese
Risk Factor	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
0	1	1	1	1	1	1
1	**1.39** (0.56-3.49)	**2.49** (1.44-4.31)	**1.97** (0.66-5.92)	**2.26** (1.25-4.08)	**3.16** (1.30-7.65)	**2.48** (1.46-4.20)
≥ 2	**3.66** (1.62-8.24) $p = 0.002$	**3.67** (2.29-5.89) $p < 0.001$	**3.36** (1.26-8.96) $p = 0.02$	**4.21** (2.56-6.94) $p < 0.001$	**6.89** (2.89-16.40) $p < 0.001$	**3.84** (2.43-6.08) $p < 0.001$
Mental health						
Good	1	1	1	1	1	1
Intermediate	**0.67** (0.27-1.69)	**0.95** (0.58-1.55)	**0.46** (0.15-1.40)	**0.84** (0.50-1.39)	**0.66** (0.26-1.69)	**0.88** (0.55-1.42)
Poor	**1.07** (0.46-2.47) $p = 0.8$	**1.18** (0.70-1.99) $p = 0.6$	**0.46** (0.31-2.09) $p = 0.7$	**0.83** (0.47-1.47) $p = 0.5$	**1.17** (0.49-2.79) $p = 0.7$	**1.07** (0.64-1.79) $p = 0.9$

[a] Multivariable logistic regression models adjusted for all the variables presented in the table; for categorical variables with more than two levels, a test for trend was performed.

[b] Stressful occupational activity in an average working day defined as lifting weights of ≥ 25 kg by hand (low back) or work with the hands above shoulder height for ≥ 1 hour (neck and shoulder).

[c] Number of symptoms in past week causing at least moderate concern.

Table 5

Associations of Selected Risk Factors with Multisite Pain and Sickness Absence by Location

	Multisite Pain [a,c]		Sickness Absence [b,c]	
	São Paulo	Milan/Varese	São Paulo	Milan/Varese
Risk Factor	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**	**OR (95%CI)**
Job satisfaction				
Satisfied	1	1	1	1
Dissatisfied	**2.55** (0.63-10.35) *p = 0.2*	**1.50** (0.86-2.63) *p = 0.2*	**3.56** (0.83-15.28) *p = 0.09*	**1.39** (0.80-2.41) *p = 0.2*
Somatizing tendency [d]				
0	1	1	1	1
1	**2.37** (0.98-5.73)	**1.89** (1.04-3.44)	**1.91** (0.71-5.16)	**1.55** (0.85-2.83)
≥ 2	**3.15** (1.40-7.08) *p = 0.004*	**3.51** (2.12-5.80) *p < 0.001*	**3.14** (1.27-7.80) *p = 0.01*	**2.32** (1.39-3.87) *p = 0.001*

[a] Pain at three or more sites in past month (reference category: pain at two or fewer sites).

[b] Sickness absence in past year because of any pain.

[c] Multivariable logistic regression models adjusted for sex, age (categorical), hours worked per week, stressful physical activity (categorical: 0,1,2,3,4/+), mental health (categorical: poor, intermediate, good); for categorical variables with more than two levels, a test for trend was performed.

[d] Number of symptoms in past week causing at least moderate concern.