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Risk factors for musculoskeletal disorders among nursing personnel in Greek hospitals

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Abstract Objectives: To investigate the relationships between physical, psychosocial, and individual characteristics and different endpoints of musculoskeletal complaints of the lower back, neck and shoulders. **Methods:** In this cross-sectional study a questionnaire survey was carried out among 351 nursing personnel (response 84%) in six general hospitals in Athens, Greece. A questionnaire was used on physical and psychosocial workload, need for recovery, perceived general health and (1) the occurrence of musculoskeletal complaints in the past 12 months, (2) chronic complaints during at least 3 months, and (3) complaints which led to sickness absence. In logistic regression analysis odds ratios (ORs) were estimated for all relevant risk factors. **Results:** Self-reported factors of physical load were associated with the occurrence of back pain (OR = 1.85), neck pain (OR = 1.88), and shoulder pain (OR = 1.87) but these factors were not associated with chronic complaints and musculoskeletal sickness absence. Physical load showed a trend with the number of musculoskeletal complaints with ORs of 2.47 and 4.13 for two and three musculoskeletal complaints, respectively. No consistent influence of psychosocial factors on complaints, chronicity, or sickness absence was observed. A perceived moderate general health was also a risk factor, and strongest associations were observed for sickness absence due to back pain (OR = 2.03), neck pain (OR = 8.31), and shoulder pain (OR = 6.84). **Conclusions:** The handling of physical loads among nurses seems to put them at risk for the occurrence of

musculoskeletal disorders. The development of these complaints into chronic complaints and associated sickness absence is strongly determined by perceived general health and almost not associated with work-related physical and psychosocial risk factors. When the influence of work-related risk factors on musculoskeletal health is being investigated, the general health status of individual workers should be taken into account.

Keywords Musculoskeletal complaints · Back pain · Nurses · Absenteeism · Occupational health · Epidemiology · Greek hospitals

Introduction

Musculoskeletal disorders have become increasingly common worldwide during the past decades. It is a common cause of work-related disability among workers, with substantial financial consequences due to workers' compensation and medical expenses (Anderson 1999). Various work-related factors have been established as predisposing the disorders. For example, frequent heavy lifting and awkward back postures for back pain, repetitiveness for neck and shoulder disorders, and psychosocial stressors for back, neck, and shoulder complaints (Bernard 1997).

In most studies only a few of these risk factors have been taken into account simultaneously (Burdorf and Sororck 1997). This makes it difficult for one to appreciate the impact of specific risk factors, since most studies did not control appropriately for concurrent risk factors. Although nursing personnel comprises a preferable choice of investigation on musculoskeletal disorders, only one study has investigated low-back pain in Greek hospitals (Vasiliadou et al. 1995). Furthermore, very few studies have been undertaken in occupational groups with respect to the simultaneous occurrence of different musculoskeletal complaints and their interrelationships (Alamanos et al. 1993).

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The first aim of this study was to investigate associations between personal characteristics, physical load, psychosocial factors and general health status with complaints of the back, neck, and shoulder. The second aim was to analyse interrelationships between these musculoskeletal complaints and their effect on associations between work-related risk factors and musculoskeletal complaints.

Methods

Study population

The study population consisted of 420 nursing staff from six large general hospitals in Athens. In every hospital two or three departments were selected, and all employees in these departments were asked to participate in the study by giving their informed consent. At least 1 year of work experience in the current position was the only criterion for eligibility for the study. The study population comprised male and female employees.

Study design and data collection

A self-administered questionnaire was distributed by the researchers between November 2000 and March 2001. The questionnaire involved information on the respondent's job and employment history, individual characteristics, physical and psychosocial risk factors at work, general health status, and the occurrence of musculoskeletal complaints. Prior to the study the questionnaire was tested for comprehensibility and relevance among nine nurses.

Individual characteristics and work history included questions on age, anthropometry, gender, family situation, level of education, duration of employment, and previous jobs. Questions on physical workload concerned manual materials handling, such as lifting and carrying heavy loads, awkward working postures in which the back is bent or twisted, and strenuous arm positions such as working with the hands above shoulder level. A four-point scale was used with the ratings 'seldom or never', 'now and then', 'often', and 'always' during a regular workday. The answers 'often' and 'always' were classified as high exposure (Elders and Burdorf 2001). The study subjects also rated their perceived exertion on a Borg-scale ranging from 6 (very light) to 20 (very heavy), with a score of 16 or higher being regarded as high perceived exertion (Borg 1990).

Psychosocial aspects at work distinguished three principal areas: demands, control, and support (Karasek et al. 1981; Karasek and Theorell 1990). *Job demands* were measured by 11 questions from the psychological demands dimension from the demand/control model of Karasek et al. (1998). The questions were scored on a four-point scale, yielding a sum score for job demands. High demands were related to items such as working fast and hard, excessive work, insufficient time to complete a duty, or conflicting demands. *Lack of control* (decision latitude) was measured by 17 questions from the decision latitude dimension of the demand/control model (Karasek et al. 1998). Six items referred to skill discretion, and 11 items to decision authority. The questions were related to creativity, skills, task variety, learning new things, and amount of repetitive work. *Lack of co-worker support* and *lack of supervisor support* was measured by 18 questions (Karasek et al. 1998). It included questions about to what degree employees support each other or have conflicts with each other. This was combined with questions about to what extent management is supportive and friendly to the employees. All psychosocial factors were expressed as percentages of the highest possible score, with 0% indicating the best possible situation and 100% the worst possible situation. In the statistical analysis, scores above the median value were considered as the presence of psychosocial risk.

The health status of each subject was ascertained with three different outcomes, i.e. perceived general health, need for recovery, and musculoskeletal complaints. *Perceived general health* status was ascertained by 13 dichotomized questions about subjective health complaints, such as respiratory complaints, stomach complaints, regular headache, and tiredness. A sum score was calculated to represent the worker's actual health situation. This scale had a good internal scale reliability (Cronbach's $\alpha = 0.86$) and test-retest reliability (Pearson's $r = 0.76$) (Van Sonsbeek 1990). *Need for recovery* was measured with 11 dichotomized questions to assess short-term health effects that reflect the worker's need for recovery at the end of a regular workday. These questions addressed items such as tiredness after work, fatigue, lack of concentration, showing interest in other people, the ability to recover from work, and the influence on work performance (Sluiter et al. 1999). For both general health endpoints, subjects with a score above the median value were considered to have a high need for recovery or a moderate/bad general health.

Musculoskeletal complaints were measured via the standardized Nordic questionnaire (Kuorinka et al. 1987). Three endpoints for each body site were defined: (1) musculoskeletal complaint of the back, neck, or shoulder was defined as pain in the past 12 months, which had continued for at least a few hours during the past 12 months, (2) chronic musculoskeletal pain in the past 12 months, referred to a complaint that was present almost every day in the preceding 12 months with a minimal presence for at least 3 months, and (3) musculoskeletal complaint which led to a period of sickness absence in the past 12 months.

Statistical analysis

We performed logistic regression analysis to evaluate the influence of individual characteristics, physical and psychosocial risk factors at work, and health status on the occurrence of musculoskeletal complaints. Prevalence odds ratios (PORs) with 95% confidence intervals (95% CI) were calculated as measure of association, adjusted for age and gender. For the initial selection of potential risk factors for musculoskeletal complaints, univariate logistic regression analysis was used with a significance level of $P < 0.10$. Subsequently, all independent variables that showed significant associations were included in the multivariate logistic regression model. The important confounders age and gender were always included in each model, regardless of their significance. These analyses were carried out separately for all three musculoskeletal complaints and their three definitions. Data analyses were conducted by means of the SPSS for Windows 10.1.0 statistical package (SPSS 1999).

Results

Response

The initial response to participation in the study was 90% (377/420 respondents). One out of six hospitals had a response rate less than 70%. The principal reasons for non-participation were: holiday or maternity leave, changing shifts, and refusals. There was no significant difference in response between departments. In total, 26 questionnaires (7%), which had insufficient data on musculoskeletal complaints or were from respondents who failed to return the questionnaire in due time (2 weeks), were excluded from the study. The total study population consisted of 351 persons (response 84%). The hospitals selected were three large general hospitals and three smaller ones, all located in the central or

greater Athens area. Two to three departments in each hospital were selected, primarily surgery departments, critical care units, and internal medicine departments.

Baseline characteristics

Table 1 shows the basic characteristics of the study population. The subjects consisted predominantly of women (81%), with ages ranging from 23 to 61 years. The main proportion consisted of highly educated nurses, with 60% having had more than 3 years of higher vocational education and only 11% without any specific education. The latter usually worked as assistant nurses. The female nurses had worked significantly more years in the current job than the men, 13.0 and 11.3, respectively. Body mass index (BMI), besides age, was also related to family situation. Living alone was significantly related to less weight and a lower BMI ($P < 0.05$). Night shift was correlated with younger age, shorter duration of employment, and with people without young children at home ($P < 0.01$).

Physical load, psychosocial load, and perceived health

The presence of self-reported risk factors for musculoskeletal complaints is reported in Table 2. Frequent lifting of materials weighing over 5 kg was often or always part of the job reported by 64% of the nurses. Pushing and pulling of loads over 50 kg in weight and carrying of loads over 25 kg was highly associated with frequent lifting. Strenuous shoulder movements, primarily repetitive movements, were reported by 46%, and awkward back posture, primarily flexion of the back, was reported by 50%. Significant and consistent correlation coefficients were found between manual handling of materials, awkward back postures, and strenuous arm positions, and perceived exertion (Spearman rank correlation coefficients $\theta = 0.17-0.25$). High job demands and low job control seemed more important psychosocial risk factors than lack of a supportive work environment. The self-reported risk factors were partly determined by personal characteristics. Lower-educated nurses experienced a significantly higher physical load and a lower job control than did highly educated nurses. Self-reported manual materials handling, awkward back postures, and strenuous arm positions showed an inverted trend with age and total working experience, with older subjects reporting less physical load. None of the psychosocial factors showed a significant trend for either age or duration of employment.

The self-reported general health showed a high need for recovery (mean score of 66.2) and a moderate perceived general health status (mean score 49.6). Perceived general health was strongly correlated with physical load, whereas need for recovery was strongly associated with perceived exertion and psychosocial factors. Women and lower-educated nurses had a significantly

Table 1 Personal characteristics and working experience among nursing personnel ($n = 351$) in six Greek hospitals

Characteristic	Men ($n = 67$)	Women ($n = 284$)
Age in years; mean (SD)	37.4 (7.4)	37.0 (7.2)
Height in cm; mean (SD)	176.9 (7.9)	163.9 (5.8)
Body mass index in kg/m^2 ; mean (SD)	26.5 (3.1)	23.8 (4.2)
Educational level (%)		
Higher	55	61
Lower	45	39
Duration of employment in years; mean (SD)	11.2 (5.6)	13.0 (7.2)
Family situation (%)		
Alone	24	29
Relatives/friends	76	71
Children/invalid persons (%)		
No	72	64
Yes	28	36

Table 2 Presence of self-reported risk factors for musculoskeletal disorders

Risk factor	n	%	Score	
			Mean	SD
Physical load				
Manual handling of materials	224	64		
Awkward back posture	161	46		
Strenuous shoulder movements	175	50		
Psychosocial load				
Job control			48.1	15.5
Work demands			57.3	14.0
Co-worker support			27.6	14.2
Supervisor support			25.9	20.3
General health				
Need for recovery			66.2	26.6
Perceived general health			49.6	25.6

higher need for recovery and lower perceived general health.

Occurrence of musculoskeletal complaints

Table 3 presents the 12-month prevalences of complaints of the back, neck, and shoulder, stratified by the three definitions of complaints. Low-back pain was the most prevalent musculoskeletal complaint, reported by 75% of the subjects. Chronic low-back pain was experienced by 39 (11%) workers, which implies that approximately 15% of all subjects with back pain reported suffering from chronic back pain. Neck and shoulder complaints were less prevalent than back pain, but prevalences of chronic pain complaints were very similar. Neck and shoulder pain resulted significantly less in a spell of sickness absence than back pain. Not surprisingly, chronic pain and sickness absence were

Table 3 Prevalence of musculoskeletal complaints of back, neck, and shoulder in the past 12 months among nursing personnel ($n=351$) in Greek hospitals

Parameter	Neck		Shoulders		Low back	
	(n)	(%)	(n)	(%)	(n)	(%)
Occurrence in the past 12 months	165	47	131	37	264	75
Chronic complaints (> 3 months)	31	9	26	7	39	11
Complaints with sickness absence	18	5	17	5	59	17

significantly associated with odds ratios for chronic neck pain of 8.09 (95%CI: 2.87–22.76), chronic back pain of 5.89 (95% CI: 2.89–12.02), and chronic shoulder pain of 4.36 (95% CI: 1.31–14.50).

Musculoskeletal co-morbidity was high among these workers. In the total population, 85% of all subjects reported at least one musculoskeletal complaint, 53% reported at least two, and 22% reported spells of all three complaints in the past 12 months. Subjects with back pain more often reported neck pain (53%) and shoulder pain (42%) than those without back pain (28% and 22%, respectively). Neck and shoulder pain was strongly associated, since 52% of subjects with neck pain also experienced shoulder pain in the past 12 months. Although musculoskeletal co-morbidity was somewhat influenced by chronicity of complaints or sickness absence, these factors did not reach the conventional level of significance. With regard to musculoskeletal sickness absence, it was observed that the probability of a period of sickness absence due to neck or shoulder complaints was significantly increased when a sickness absence

period for back complaints had also occurred in the past year.

Associations between risk factors and musculoskeletal complaints

In Table 4 the univariate analyses for musculoskeletal disorders in the past 12 months, adjusted for age, are summarized. All risk factors were dichotomized before being entered into the logistic models. All self-reported physical risk factors were significantly related to the occurrence of low back, shoulder, and neck pain. On the other hand, chronic complaints did not show any correlation with physical factors. In addition, none of the physical factors was associated with sickness absence due to musculoskeletal complaints. Psychosocial aspects were less often associated with the occurrence of musculoskeletal complaints in the past 12 months than physical load. However, high job demands and low job control were significant risk factors for chronic back pain and sickness absence due to back pain or neck pain. It is worthy of note that a high BMI was also significant for chronic back pain and absenteeism due to back and shoulder pain. High need for recovery at the end of the workday, and, especially, a perceived moderate/bad general health were significantly associated with most musculoskeletal complaints and sickness absence.

The results of the multivariate analyses on risk factors for the occurrence of back, shoulder and neck complaints are shown in Table 5. Perceived moderate/bad general health was the strongest risk factor with odds ratios varying from 2.76 to 4.33. For each musculoskeletal complaint at least one physical risk factor was important. None of the psychosocial factors re-

Table 4 Univariate associations between low back pain in past 12 months and self reported risk factors

Self-reported risk factor	Low-back pain OR (95% CI)	Shoulder pain OR (95% CI)	Neck pain OR (95% CI)
Manual material handling	2.38 (1.43 to 3.97)*	2.31 (1.40 to 3.79)*	1.70 (1.08 to 2.69)*
Strenuous back postures	1.98 (1.19 to 3.31)*	1.90 (1.22 to 2.97)*	1.78 (1.16 to 2.74)*
Strenuous shoulder movements	2.08 (1.25 to 3.46)*	2.39 (1.52 to 3.75)*	1.59 (1.04 to 2.43)*
High perceived exertion	1.13 (0.68 to 1.88)	2.31 (1.48 to 3.61)*	1.56 (1.01 to 2.41)*
High job demand	1.50 (0.92 to 2.45)	1.93 (1.24 to 2.99)*	1.84 (1.21 to 2.82)*
Lack of supervisor support	1.13 (0.69 to 1.85)	1.68 (1.08 to 2.60)*	1.45 (0.95 to 2.22)
High need for recovery	2.11 (1.24 to 3.60)*	1.95 (1.23 to 3.08)*	1.54 (0.99 to 2.39)
Moderate perceived general health	4.69 (2.69 to 8.18)*	4.20 (2.63 to 6.69)*	2.83 (1.83 to 4.36)*

* χ^2 test, $P < 0.05$

Table 5 Multivariate analysis of self-reported risk factors and prevalence of musculoskeletal complaints in the past 12 months among nursing personnel ($n=351$) in Greek hospitals

Self-reported risk factors	Low-back pain OR (95% CI)	Shoulder pain OR (95% CI)	Neck pain OR (95% CI)
Age			
< 35 years	1.00	1.00	1.00
35–40 years	1.00 (0.51 to 1.96)	1.75 (0.95 to 3.23)	0.66 (0.37 to 1.15)
40 > years	1.18 (0.57 to 2.46)	3.58 (1.86 to 6.89)*	0.98 (0.55 to 1.76)
Manual materials handling	NS	1.95 (1.06 to 3.60)*	NS
Strenuous back postures	1.85 (1.02 to 3.35)*	NS	1.88 (1.17 to 3.02)*
Strenuous shoulder movements	NS	1.87 (1.06 to 3.30)*	NS
Moderate perceived general health	4.33 (2.31 to 8.10)*	2.89 (1.70 to 4.92)*	2.76 (1.72 to 4.44)*

* χ^2 test, $P < 0.05$

mained significant after adjustment for other significant factors. Age, gender, years of employment, educational level, and supervising duties were not significant in any of the models. Also, a higher perceived exertion and need for recovery did not remain significant after adjustment for other significant factors.

The multivariate analysis on risk factors for chronic complaints and sickness absence showed different results from the analysis on musculoskeletal complaints in the past 12 months. For both endpoints self-reported aspects of physical load were not found to be of any significance. Lower educational level (OR = 2.79; 95% CI: 1.29–6.01) and high job demands (OR = 2.65; 95% CI: 1.21–5.77) were risk factors for chronic back pain, high need for recovery for chronic shoulder pain (OR = 3.04; 95% CI: 1.15–8.03), and perceived moderate/bad general health for chronic neck pain (OR = 2.51; 95% CI: 1.09–5.79). For all complaints sickness absence increased with age, with odds ratios for those of 40 years or older varying from 2.94 to 10.57. Perceived moderate/bad health was the single most important risk factor for sickness absence due to back pain (OR = 2.03; 95% CI: 1.09–3.77), neck pain (OR = 8.31; 95% CI: 1.85–37.21), and shoulder pain (OR = 6.84; 95% CI: 1.75–26.74).

The occurrence of musculoskeletal co-morbidity was elevated among those with a higher physical load, high job demands, and a perceived moderate/bad general health. Physical load showed a trend with the number of musculoskeletal complaints, with ORs of 2.47 and 4.13 for two and three musculoskeletal complaints, respectively. For perceived moderate/bad health the corresponding odds ratios were 1.92 and 3.78. Age and years of employment were not associated with an increased probability of musculoskeletal co-morbidity.

Discussion

In this cross-sectional study, we found high prevalences not only for back pain but also for neck and shoulder complaints. Musculoskeletal co-morbidity was also high, and a significant proportion of the subjects reported chronic complaints and absenteeism. Self-reported physical risk factors were important for the occurrence of musculoskeletal complaints, whereas age and perceived moderate/bad general health were strongly associated with chronicity of complaints and musculoskeletal sickness absence.

In this survey self-administered questionnaires were used for the collection of information about physical and psychosocial load and perceived health. Some differences were observed between hospitals and departments concerning aspects of physical and psychosocial load. Large hospitals had a higher patient turnover rate and more demanding cases, which was reflected in higher levels of self-reported physical and psychosocial workload. In surgery and critical-care departments higher levels of physical load and a lack of a supportive work environment were reported when they were compared with

departments of internal medicine. Interestingly, it was found that internal departments of smaller hospitals had a higher physical load and less supervisor support than larger hospitals, perhaps due to worse work organization. The consistent inverted trend between age and all measures of physical load most likely reflects coping strategies, such as changes in duties, tasks, and departments.

Our findings in Greek hospitals do not differ from those of other investigators in other countries (Engels et al. 1996; Josephson et al. 1997; Lagerström et al. 1995; Smedley et al. 1995, 1997). Most studies agree on the high prevalence of occupational back pain among nursing personnel. A Greek study found a low-back pain prevalence during a period of 6 months of 67% in a large tertiary healthcare unit in Athens (Vasiliadou et al. 1995). For other body sites, data on prevalence of musculoskeletal complaints are sparse. Lagerström and colleagues found slightly higher prevalences than in our study, with 48% for neck and 53% for shoulder complaints (Lagerström et al. 1995). However, in other reports, lower prevalences for neck (31%) and shoulder pain (43%) have also been presented (Ono et al. 2000). The sickness absence in our study is difficult to compare with absenteeism in similar studies among nursing personnel, because very different absence rates have been reported (Engels et al. 1996; Josephson et al. 1997; Lagerström et al. 1995; Smedley et al. 1995, 1997). However, all these studies confirm that sickness absence is much more frequent for back pain than for neck or shoulder pain.

As in most studies, significant relationships were found between self-reported physical risk factors and the occurrence of musculoskeletal disorders in various body sites. Our study took into account concurrent risk factors that were strongly interrelated. In the univariate analyses factors of physical load, psychosocial load, and general health were all associated with musculoskeletal complaints. Due to the moderate size of the study population, the logistic regression analysis may fail to separate the specific contributions of two risk factors that are strongly correlated. Thus, it should be noted that within the domains of physical load, psychosocial load, and general health, it was, to some extent, arbitrary as to which factors were retrieved in the multivariate logistic regression model.

The results demonstrate the importance for risk factors for the occurrence of musculoskeletal complaints to be separated from factors that determine their aggravation and consequences for disability. The occurrence of musculoskeletal complaints among nursing personnel was associated with work-related physical load, which seem to reflect the many activities in nursing practice that may lead to musculoskeletal disorders. However, physical load was not associated with chronicity of complaints and sickness absence. Work-related psychosocial factors played an inconsistent role in chronicity of complaints. The strongest impact in all outcomes under study, i.e. occurrence, chronicity, absenteeism, and co-morbidity,

was held by perceived general health. This finding may reflect the probability that subjects with moderate general health are more likely to experience musculoskeletal complaints or are more inclined to report musculoskeletal symptoms as troublesome. Alternatively, it may also reflect a subject's ability to cope when symptoms occurred. Episodes of musculoskeletal pain may affect the perceived general health. The clear differences between work-related risk factors and general health, with respect to the observed associations with different endpoints of musculoskeletal health, call for further exploration of these associations, preferably in longitudinal studies in various occupational groups and national settings.

The cross-sectional design of this study does not permit causal inference from the observed associations. The observed associations may have been biased due to different selection processes, such as workers with musculoskeletal problems having changed jobs to less demanding work within or outside the hospitals more often than those without complaints. The effects of these potential selection biases could not be evaluated, but the mean duration of employment in the current job of more than 11 years suggests that the study was conducted in a reasonably stable population. Hence, it is expected that selection bias will not have influenced the observed associations to a great extent. However, one needs prospective studies to corroborate the observed associations and the differences in risk factors for occurrence of musculoskeletal complaints and risk factors for aggravation and disability of these complaints.

The observed relationships give valuable evidence for further research and policy making. It is advisable in research projects for various risk factors and the interrelationships that are involved in the occurrence and persistence of musculoskeletal complaints to be analysed simultaneously. The study results also suggest that effective intervention strategies most likely have to take into account both ergonomic improvements (Loisel et al. 1997) and cognitive behavioural aspects.

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