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Occupational and individual factors related to musculoskeletal symptoms in five body regions among Swedish nursing personnel

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Abstract The relationship between individual factors, physical and psychosocial exposure at work, and musculoskeletal symptoms in the neck, shoulders, low back, hands, and knees was studied among female nursing personnel working at a Swedish hospital. The personnel had participated in a course in work technique (patient transfer and handling principles). Prior to the course, the subjects had filled in a questionnaire ($n = 688$). The aim of this cross-sectional study was to elucidate whether different individual and work factors are related to musculoskeletal symptoms in a specific body region. Due to the cross-sectional design, however, causality cannot be discussed. Univariate analyses and multiple logistic regression analyses were performed and yielded similar results. The latter analyses showed that in the present hospital setting, individual factors together with physical and psychosocial work factors were related to symptoms in the neck, low back, and hands; individual factors and psychosocial work factors were related to symptoms in the shoulders; while only individual factors were related to symptoms in the knees. The results of the present study showed that various individual factors and physical and psychosocial work factors were related to musculoskeletal symptoms in the different body regions. Thus, the identification of risk factors might have far-reaching implications for the way in which effective health programs for prevention should be designed in the hospital setting.

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Introduction

It has been pointed out that the rapid rise in sick leave and premature retirement from work due to musculoskeletal disorders during recent decades has not yet been explained convincingly (Wickström 1994). There are several indications in the literature that musculoskeletal symptoms are of multifactorial origin (Tan 1991; Bongers et al. 1993; Houtman et al. 1994).

Although the epidemiological studies concerning musculoskeletal disorders are heterogeneous in study design and in measurements of risk factors, there have been suggestions that heavy physical work is a risk factor for back symptoms (Wickström 1978) and that static repetitive work is a risk factor for neck and shoulder symptoms (Armstrong et al. 1993). The relation between psychosocial risk factors and musculoskeletal disorders is not quite clear. However, in one review, low control and lack of social support at work were factors related to musculoskeletal disorders (Bongers et al. 1993).

Among nursing personnel, musculoskeletal symptoms are a major cause of high absenteeism. Hospital work can be physically strenuous, but usually with less repetitive load than, for example, work on an assembly line (Kilbom 1994) and less lifting than work in warehouses (Ljungberg et al. 1989). Work-related back injuries are common among nursing personnel, and Swedish statistics showed that state-registered nurses and auxiliary nurses had a 6 times greater risk of back accidents from over-exertion as compared with other employed women (Engkvist et al. 1992).

In the hospital setting, there are several studies concerning both physical and psychosocial risk factors for musculoskeletal symptoms (Jensen 1990; McAbee

1988). However, most of these studies have focused on risk factors in relation to low back symptoms and back accidents (Venning et al. 1987; Ljungberg et al. 1989; Videman et al. 1989; Gundewall et al. 1993). To our knowledge, very few studies have reported risk factors in relation to neck, shoulder, or other musculoskeletal disorders in the hospital setting (Punnett 1987).

The objective of the present study was to investigate how different individual, physical, and psychosocial work factors are related to musculoskeletal symptoms in a specific area of the body, among female nursing personnel.

Materials and methods

Study population

In the present questionnaire study, data from a hospital in a medium-sized town in the northern part of Sweden were used. During a period of 2 years, all nursing personnel employed at the hospital participated in a training course in work technique (according to The Stockholm Training Concept; see Rygghälsovårdsgruppen 1987). The study population consisted of 821 employees who had participated in the training at the hospital and who, prior to this, had anonymously filled in a questionnaire. Of the personnel who had responded to the questionnaire, 688 (84%) had answered all questions which were chosen from the questionnaire as variables in the analyses.

The female nursing personnel belonged to three work categories: registered nurses (RNs), state registered nurses (SENs), and auxiliary nurses (ANs). ANs were the largest group, while RNs had the highest mean age (Table 1). Since there were only a few men working as nursing personnel, these were excluded from further analyses. The subjects worked at different clinics, mainly in medical, geriatric, or surgical wards.

Methods

All participants answered a questionnaire before attending the training course (no one refused). The questionnaire was handed over personally to the participants by the hospital administrative personnel. It contained about 100 questions regarding individual factors, psychosocial and physical exposure at work, and musculoskeletal symptoms. These data were used on a cross-sectional basis to study the association between different musculoskeletal symptoms and 11 determinants in the questionnaire.

The symptom variables concerned ongoing musculoskeletal symptoms according to the Nordic Questionnaire (Kourinka et al. 1987). A ten-point scale from 0 to 9 with the verbal endpoints "not at all" and "very much" was used for each of the symptoms; neck, shoulders, low back, hands, and knees. In the analyses the symptom variables were dichotomized into: symptoms (1–9) or no symptoms (zero). Six or more on the scale was considered to be "severe symptoms" (Table 2).

Table 1 Work category and mean age of the female subjects ($n = 688$)

Work category	% of subjects	Mean age (SD)	Age × range
Registered nurses (RNs)	24	45 (11)	21–64
State registered nurses (SENs)	37	35 (11)	18–61
Auxiliary nurses (ANs)	39	39 (9)	20–61

The general inclusion criteria for the determinants of symptoms in the neck, shoulders, low back, hands, and knees in the analyses were:

1. Risk factors identified from previous epidemiological studies
2. Presumed risk factors
3. The authors' (M.L., M.H.) own experience of work at hospitals.

Eleven variables that were potentially related to the outcome variables were selected from the questionnaire, as follows:

a) *Individual and life-style factors*:

1. Age (continuous variable)

2. Body mass index [BMI: weight in kilograms/the square of height in meters (two classes $\leqslant 26/>26$)]

3. Physical fitness (i.e., perceived physical fitness as compared to others of the same age) (two classes: low or somewhat low/average, high, or very high)

4. Smoking (two classes: yes/no)

b) *Physical exposure at work*:

5. Type of ward (two classes: medical and geriatric/surgical and other departments). In the medical and geriatric departments the patient handling is usually more physically strenuous than in the others; 35% of the subjects worked in medical, 14% in geriatric, 17% in surgical, and 34% in other wards (i.e., eye ward, children's ward, and different policlinics).

6. Work category [three categories: registered nurses (RNs), state registered nurses (SENs), or auxiliary nurses (ANs)].

c) *Psychosocial factors at work*:

7. Work commitment (two classes: yes very, yes rather/not very, not at all)

8. Support and help from superiors (two classes: always, mostly/mostly not, never)

The psychosocial work load was further analyzed according to the Job Strain model of Karasek and Theorell (1990). Each question had four categories (yes, often/yes, sometimes/no, rarely/no, almost never).

9. Work demand was a sum of four questions (possible score range: 4–16; two classes: $<3/\geqslant 3$). There were in fact five questions concerning work demands in the questionnaire, but in order to obtain a more distinct quantitative demand variable one question concerning conflicting demands was omitted. The Cronbach alpha coefficient for work demand was 0.7.

10. Stimulation at work (or intellectual discretion) was a sum of four questions (possible score range: 4–16; two classes: $<2.5/\geqslant 2.5$). The Cronbach alpha coefficient for stimulation at work was 0.5, which must be considered low (Theorell 1993).

11. Work control (i.e. authority over decisions) was a sum of two questions (possible score range: 2–8; two classes: $<2/\geqslant 2$). The Pearson correlation coefficient for control at work was 0.6.

The variable "number of years employed at the hospital" was highly correlated with "age," as could be expected. Therefore only "age" was included in the analyses, in order to avoid multicollinearity problems.

Table 2 Prevalence (%) of self-reported ongoing musculoskeletal symptons in the three work categories (n = 688)

Localization of ongoing self-reported symptoms	RNs (n = 165)		SENs (n = 255)		ANs (n = 268)		Total	
	Symptoms	Severe symptoms	Symptoms	Severe symptoms	Symptoms	Severe symptoms	Symptoms	Severe symptoms
Neck	44	15	46	14	59	22	48	16
Shoulders	48	17	54	17	60	22	53	18
Low bck	52	14	55	15	65	22	56	16
Hands	17	3	22	4	30	7	22	4
Knees	27	7	31	5	35	9	30	7

Table 3 Percentage of subjects in the "risk" categories of the determinant variables in the three work categories[a] (n = 688)

Individual and work	RNs (n = 165)	SENs (n = 255)	ANs (n = 268)	Total
Body mass index	14	22	27	20
Physical fitness	24	30	29	27
Smoking	20	38	39	31
Type of ward	46	49	52	49
Work commitment	5	15	31	15
Support from superiors	17	11	14	14
Work demand	24	18	22	21
Stimulation at work	14	29	56	30
Work control	11	19	22	17

[a] For criteria for "risk" values see Methods in Materials and methods

The percentage of subjects, divided into the three work categories, who reported "risk" values in nine of the dichotomized determinant variables is shown in Table 3.

Statistical analyses

Frequency distributions were examined for both symptom variables and potentially associated variables. Point estimates of the odds ratios with approximate 95% confidence intervals (CI) were calculated.

Univariate logistic regression analyses controlled for age (and age stratified $< 45/\geqslant 45$ in the prevalence rate ratios analyses) were performed according to the Mantel-Haenszel method (Fleiss 1981). Additionally, multiple logistic regression analyses were performed. A logit link function was used in the model with the module PROC PROBIT in the SAS statistical software (SAS Inst. Inc. 1989). The criterion for one variable to be entered into the multivariate model was that it should have a significant ($P < 0.05$) influence in the model even after entering other variables. If two variables both could be entered one by one, but not together, the one that contributed most to the log likelihood fit of the model was kept.

Linear effects and interaction effect

Continuous variables were assessed separately in the univariate analysis and categorized in order to check the assumption of a linear gradient as suggested by Concato et al. (1993). The variables in the final multivariate models were also used to analyze interaction effects.

Assessment of model fit

Separate analyses were performed to evaluate whether the partial drop outs influenced the results. The model fit was assessed by an index plot of standardized deviance residuals. $\Delta\hat{\beta}$ statistics were used to assess the influence of each observation on the estimated log odds ratio (Collet 1991).

Power calculations

Power calculations were performed with EPI INFO (Dean et al. 1990). When exposed and nonexposed subjects were of equal numbers and there was a prevalence of musculoskeletal symptoms of approximately 50% for exposed subjects and about 20% for nonexposed subjects, the study could detect odds ratios as low as 1.67 with 80% power and a confidence interval of 95%. Further, when the prevalence of symptoms was as low as 7% among exposed subjects and about 5% among nonexposed subjects, given the same prerequisite as before, the odds ratio was 2.44.

Results

The highest prevalence of symptoms was observed in the neck, the shoulders, and the low back. Of the three work categories, the ANs had the highest prevalences of ongoing symptoms in all five body regions (Table 2).

Neck symptoms

In the multiple logistic regression analyses age (continuous variable), perceived low physical fitness, low commitment to work tasks, and less frequent help and support from superiors were related to ongoing neck symptoms (Table 4).

The same individual factors as for neck symptoms were also related to severe neck symptoms, as, too, were high work demands and an interaction effect between type of department and age. This interaction effect indicated that, with increasing age, working in a medical or a geriatric ward was related to an increased risk of reporting severe neck symptoms.

Table 4 Individual factors and physical and psychosocial work factors related to neck symptoms and severe neck symptoms analysed with univariate and multiple logistic regression analyses (n = 688)

Individual and occupational factors	Univariate analysis: symptoms Odds ratio; 95% CI	Multivariate analyses: symptoms Odds ratio; 95% CI (intercept: − 1.79)	Univariate analysis: severe symptoms Odds ratio; 95% CI	Multivariate analyeses: severe symptoms Odds ratio; 95% CI (intercept: − 6.19)
Age[a]	1.32; 1.16–1.51[b]	1.31; 1.14–1.52	1.30; 1.09–1.55[b]	1.07; 0.81–1.44
High body mass index	1.41; 0.96–2.07		1.43; 0.90–2.29	
Low physical fitness	1.43; 1.02–2.01	1.42; 1.00–2.02	1.82; 1.18–2.80	1.68; 1.09–2.59
Smoking	1.04; 0.74–1.44		1.09; 0.71–1.68	
Type of ward[c]	1.17; 0.85–1.59		1.95; 1.29–2.95	2.77; 0.56–13.97
Work category				
RN versus AN	1.58; 1.05–2.39		1.42; 0.85–2.36	
SEN versus AN	1.25; 0.88–1.78		1.02 0.62–1.66	
Low work commitment	1.67; 1.10–2.60	1.65; 1.07–2.54	1.35; 0.80–2.29	
Low support from superiors	2.08; 1.32–3.26	2.03; 1.28–3.16	1.54; 0.91–2.61	
High work demand	1.38; 0.95–2.00		1.82; 1.14–2.92	1.82; 1.14–2.92
Lack of stimulation	1.06; 0.96–1.48		1.40; 0.91–2.16	
Low work control	1.39; 0.92–2.10		1.31; 0.77–2.22	
Interaction effect: age × type of ward				1.48; 1.02–2.14

[a] Odds ratio per 10 years
[b] Stratified for age (continuous variable)
[c] Geriatric and medicl versus surgical and other types of wards

Table 5 Individual factors and physical and psychosocial work factors related to shoulder symtoms and severe shoulder symptoms analyzed with univariate and multiple logistic regression analyses (n = 688)

Individual and occupational factors	Univariate analysis: symptoms Odds ratio; 95% CI	Multivariate analyses: symptoms Odds ratio; 95% CI (intercept: − 2.37)	Univariate analyses: severe symptoms Odds ratio; 95% CI	Multivariate analyeses: severe symptoms Odds ratio; 95% CI (intercept: − 4.91)
Age[a]	1.22; 1.07–1.40[b]	1.23; 1.08–1.42	1.20; 1.00–1.43[b]	1.22; 1.02–1.46
High body mass index	1.21; 0.85–1.86		1.57; 1.00–2.46	
Low physical fitness	1.75; 1.23–2.49	1.75; 1.25–2.49	2.25; 1.50–3.39	2.22; 1.47–3.36
Smoking	1.00; 0.72–1.40		1.08; 0.72–1.63	
Type of ward[c]	1.20; 0.89–1.64		1.55; 1.05–2.30	
Work category				
RN versus AN	1.46; 0.97–2.21		1.31; 0.79–2.19	
SEN versus AN	1.39; 0.98–1.98		1.13; 0.71–1.81	
Low work commitment	1.48; 0.96–2.27		1.27; 0.76–2.12	
Low support from superiors	1.45; 0.92–2.27		1.31; 0.29–5.93	
High work demand	1.30; 0.89–1.88		1.68; 1.07–2.64	1.65; 1.05–2.59
Lack of stimulation	1.12; 0.80–1.56		1.22; 0.81–1.84	
Low work control	1.73; 1.15–2.62	1.73; 1.13–2.67	1.54; 0.94–2.51	

[a] Odds ratio per 10 years
[b] Stratified for age (continuous variable)
[c] Geriatric and medicl versus surgical and other types of wards

Shoulder symptoms

In the multiple logistic regression analyses, shoulder symptoms were related to age, to low perceived physical fitness, and to low work control (Table 5). Severe shoulder symptoms were related to age, to low perceived physical fitness, and to high work demands.

Low back symptoms

In the multiple logistic regression analyses, low back symptoms were related to low perceived physical fitness, to work category (AN versus RN), and to little help and support from superiors. Severe low back symptoms were only related to low perceived physical fitness (Table 6).

Table 6 Individual factors and physical and psychosocial work factors related to low back symtoms and severe low back symptoms analyzed with univariate and multiple logistic regression analyses (n = 688)

Individual and occupational factors	Univariate analysis: symptoms Odds ratio; 95% CI	Multivariate analyses: symptoms Odds ratio; 95% CI (intercept: − 1.63)	Univariate analysis: severe symptoms Odds ratio; 95% CI	Multivariate analyses: severe symptoms Odds ratio; 95% CI (intercept: − 3.68)
Age[a]	1.00; 0.87–1.15[b]		1.06; 0.89–2.27[b]	
High body mass index	1.19; 1.12–2.98		1.42; 0.87–2.32	
Low physical fitness	1.80; 1.27–2.57	1.79; 1.26–2.54	1.60; 1.04–2.46	1.60; 1.04–2.46
Smoking	1.17; 0.84–3.47		1.07; 0.87–1.65	
Type of ward[c]	1.04; 0.78–1.40		1.16; 0.78–1.75	
Work category				
RN versus AN	1.74; 1.16–2.64	1.70; 1.13–2.56	1.68; 1.01–2.80	
SEN versus AN	1.12; 0.77–1.62		1.12; 0.68–1.82	
Low work commitment	1.30; 0.84–3.01		1.35; 0.80–2.29	
Low support from superiors	1.79; 1.14–2.80	1.80; 1.13–2.83	1.63; 0.96–2.77	
High work demand	1.20; 0.82–1.74		1.51; 0.94–2.41	
Lack of stimulation	1.09; 0.78–1.53		1.13; 0.72–1.76	
Low work control	1.05; 0.70–1.59		1.05; 0.60–2.2	

[a] Odds ratio per 10 years
[b] Stratified for age (continuous variable)
[c] Geriatric and medicl versus surgical and other types of wards

Table 7 Individual factors and physical and psychosocial work factors related to hand symptoms and severe hand symptoms analyzed with univariate and multiple logistic regression analyses (n = 688)

Individual and occupational factors	Univariate analysis: symptoms Odds ratio; 95% CI	Multivariate analyses: symptoms Odds ratio; 95% CI (intercept: − 1.37)	Univariate analysis: severe symptoms Odds ratio; 95% CI	Multivariate analyses: severe symptoms Odds ratio; 95% CI (intercept: − 4.22)
Age[a]	1.43; 1.22–1.68[b]	1.42; 1.19–8.28	1.22; 0.83–1.81[b]	
High body mass index	1.17; 0.75–1.84		1.20; 0.55–2.62	
Low physical fitness	1.46; 0.99–2.16		1.93; 0.90–4.16	
Smoking	1.04; 0.70–1.53		1.03; 0.46–2.30	
Type of ward[c]	1.43; 0.99–2.08		3.03; 1.31–7.05	2.84; 1.25–6.49
Work category				
RN versus AN	1.70; 1.06–2.72		1.03; 1.06–7.54	
SEN versus AN	1.62; 1.03–6.12		1.65 0.62–4.48	
Low work commitment	1.03; 0.62–1.72		1.11; 0.41–3.00	
Low support from superiors	1.34; 0.80–2.22		2.05; 0.85–4.96	
High work demand	1.35; 0.88–2.08		1.80; 0.81–4.03	
Lack of stimulation	1.62; 1.09–2.39	1.62; 1.09–2.39	1.93; 0.92–4.07	
Low work control	1.15; 0.94–2.41		1.07; 0.40–2.86;	

[a] Odds ratio per 10 years
[b] Stratified for age (continuous variable)
[c] Geriatric and medicl versus surgical and other types of wards

Hand symptoms

In the multiple logistic regression analyses, hand symptoms were related to age, and to lack of stimulation at work. Severe hand symptoms were only related to type of ward (Table 7).

Knee symptoms

Knee symptoms were related to age. This relation was seen both for a curvilinear (second order) and for a linear relation to knee symptoms. Severe knee symptoms were related to age and to a high body mass index (Table 8).

Comparison between the results of the multiple and the univariate analyses

The comparison between the results from the multiple logistic regression analyses and from the univariate logistic analyses showed similar outcomes. For each

Table 8 Individual factors and physical and psychosocial work factors related to knee symptoms and severe knee symptoms analyzed with univariate and multiple logistic regression analyses (n = 688)

Individual and occupational factors	Univariate analysis: symptoms Odds ratio; 95% CI	Multivariate analyses: symptoms Odds ratio; 95% CI (intercept: − 1.98)	Univariate analysis: severe symptoms Odds ratio; 95% CI	Multivariate analyses: severe symptoms Odds ratio; 95% CI (intercept: − 4.74)
Age[a]	1.21; 1.13–1.55[b]	1.28; 1.12–1.47	1.05; 1.23–2.04[b]	1.46; 1.11–1.92
(Age − mean age)^2 [a]		1.02; 1.01–1.03		
High body mass index[b]	1.21; 0.80–1.83		1.16; 1.69–5.91	3.16; 1.69–5.87
Low physical fitness	1.14; 0.78–1.65		2.34; 1.27–4.30	
Smoking	1.06; 0.75–1.51		1.09; 0.56–2.13	
Type of ward[c]	1.23; 0.88–1.72		1.09; 0.76–2.01	
Work category				
RN versus AN	1.23; 0.80–1.90		1.09; 0.53–2.30	
SEN versus AN	1.49; 0.94–2.08		1.03 0.50–2.13	
Low work commitment	1.46; 0.93–2.30		1.35; 0.64–2.84	
Low support from superiors	1.04; 0.65–1.67		1.09; 0.44–2.70	
High work demand	1.14; 0.75–1.72		1.62; 0.81–3.21	
Lack of stimulation	1.05; 0.74–1.50		1.35; 0.68–2.68	
Low work control	1.12; 0.61–1.90		1.65; 0.63–4.31	

[a] Odds ratio per 10 years
[b] Stratified for age (continuous variable)
[c] Geriatric and medicl versus surgical and other types of wards

body region, except for the low back, one variable more was significant in the univariate analysis than in the logistic regression analyses (i.e., neck and hand symptoms/work category; severe shoulder symptoms/type of department; severe knee symptoms/perceived physical fitness) (Tables 4–8).

Analyses of missing data and assessment of model fit

The determinant variable with the greatest number of missing answers was work demands (36 answers missing). The other variables had less than 30 missing answers. Those who did not answer the four questions about work demands had more symptoms in the low back as compared to those who had answered these questions. In addition, 30 subjects did not answer all five questions about ongoing musculoskeletal symptoms. These subjects had a higher mean age (mean age: 49 years; SD: 9) and a higher body mass index, and were more often ANs than the subjects who had answered these questions.

The mean age of the participants was 39 years (SD 11) and that of all missing subjects, 40 years (SD 12; n = 133). The difference in mean age was not significant. All missing subjects were placed in a special category and analyzed in the model, to see whether this would change the parameter estimates (i.e., odds ratios). The changes were small in all analyses and did not alter the structure or the significance of individual variables in the final models.

Concerning the assessment of model fit, no extreme values were found in any of the analyses (SAS Inst. Inc. 1989). There were three to five subjects in each analysis who had a tendency towards high values on $\Delta\hat{\beta}$ statistics. However, each of these values was within − 2 to 2 (the highest value was −1.82).

Comparison between odds ratio and prevalence rate ratio

In the univariate analysis, both prevalence rate ratios and prevalence odds ratios were calculated (not presented in the tables). In general, the prevalence rate ratios were lower than the odds ratios [for example, for neck symptoms and physical fitness the prevalence rate ratio was 1.29 with a 95% confidence interval (CI) of 1.01–1.65, and the odds ratio was 1.43 with a 95% CI of 1.02–2.01; and for neck symptoms and smoking the prevalence rate ratio was 1.02 with a 95% CI of 0.81–1.27, and the odds ratio was 1.04 with a 95% CI of 0.96–2.07].

Discussion

In this study the multiple regression analyses indicated that, in the present hospital setting, individual factors together with physical and psychosocial work factors were related to symptoms in the neck, low back, and hands. Furthermore, individual factors and psychosocial work factors were related to symptoms in the shoulders, while only individual factors were related to symptoms in the knees (for an overview see Table 9).

Some review articles have reported relations between musculoskeletal disorders and single risk factors in the

Table 9 Overview of the individual factors and physical and psychosocial work factors that were related to musculoskeletal symptoms in five body regions

Neck	Shoulders	Low back	Hands	Knees
Age[a]	Age[b]	Low fitness[b]	Age[a]	Age[b]
Low fitness[b]	Low fitness[b]	Work category[a]	Type of ward[c]	High BMI[c]
Type of ward[c]	High demands[c]	Low support[a]	Low stimulation[a]	
Low support[a]	Low control[a]			
Low commitment[a]				
High demands[c]				

[a] Factor related to symptoms
[b] Factor related to symptoms and to severe symptoms
[c] Factor related to severe symptoms

hospital setting (McAbee 1988; Tan 1991). There is, however, a general agreement that these disorders are of mulitfactorial origin and that in the real work situation several factors simultaneously influence an employee. Thus, multivariate analyses of the risk factors in relation to musculoskeletal disorders provide a more profound understanding of the situation at the work site than do analyses of relations between single variables and musculoskeletal symptoms.

In our study, low perceived physical fitness, being an AN as compared to an RN, and reporting little support and help from superiors were factors related to low back symptoms. Our results are comparable to those of a Finnish study, where major risk indicators for back injuries were poor patient handling skill, low number of repetitions in the sit-up test, and high physical work load scores (Videman et al. 1989). Work category has been shown previously to be a risk factor for low back pain, mainly because of differences in work tasks among the employees. In comparison with an RN, an AN has a physically more strenuous work situation and has had less training in, for example, patient handling (Videman et al. 1989). Low support from superiors was also related to low back symptoms in our study, while in another recent Swedish study among hospital personnel this factor was related to neck and shoulder symptoms. In that study, low control and high demands were related to low back symptoms (Ahlberg-Hultén et al. 1993).

Of the studies which have addressed multiple risk factors for nursing personnel, few have been concerned with musculoskeletal disorders in regions other than the back. In one recent French study, however, back and neck pain was studied longitudinally (Niedhammer et al. 1994). As in our study, high age and psychosocial factors were associated with neck pain, and physical work load with chronic back pain. In the present study, shoulder symptoms were related to age, low perceived fitness, high demands, and low control at work. It is notable that this combination of the two psychosocial work factors, high demands and low control, is reported to be related to ill-health effects (Karasek and Theorell 1990).

In the present study, working in a medical or a geriatric ward (i.e., physically strenuous types of wards) and age were interacting factors for severe neck symptoms. Thus, with increasing age, those who worked in a medical or a geriatric ward reported more neck symptoms than others. In spite of the fact that age is usually an accepted risk factor for musculo-skeletal symptoms, at least among women (Nisell and Vingård 1992), age is not always a risk factor among nursing personnel (Estryn-Behar et al. 1990). This could be explained as a "healthy worker effect," i.e., those who have musculoskeletal symptoms leave their hospital work and go to less physically strenuous working conditions. Concerning back accidents, studies have pointed out that younger nurses are more at risk (Engkvist et al. 1992), probably because of inexperience in patient handling.

Interestingly, no occupational factors were related to knee symptoms, only age and high body mass index (severe symptoms). These factors have been seen in relation to knee symptoms in clinical work. It is also plausible according to biological knowledge that age and greater body weight are factors related to severe symptoms of the knees (Rissanen et al. 1990).

In the present study, symptoms in the hands were related to lack of stimulation at work and to type of ward, indicating that those reporting symptoms in their hands seemed to work at physically strenuous wards and lacked satisfactory training at work. These results are difficult to explain and might be random. Hand symptoms have been associated with high force, which might be a factor involved in work with hospital equipment (Punnett 1987) and in work with patient handling. The Cronbach alpha coefficient for stimulation at work was low. The effect of a low internal consistency is that we cannot fully determine what that variable really represents. Concerning the psychosocial questions used in the present study, Karasek and Theorell (1990) and many other researchers have presented empirical data supporting the validity and reliability of their Job Strain model (Theorell et al. 1991; Bongers et al. 1993).

One limitation in the present study was the use of data on self-reported musculoskeletal symptoms collected from questionnaires. The symptoms recorded in the present study were obtained from the standardized Nordic questionnaires for the estimation of musculoskeletal symptoms. This questionnaire has been compared to a medical interview and the concordance of the results was claimed to be satisfactory (Wenemark et al. 1992).

As stated above, within the univariate analysis, both prevalence odds ratio and prevalence rate ratios were calculated; this was because of the difficulties in interpreting prevalence odds ratios in cross-sectional studies, especially when the disease is rather common (Axelson et al. 1994). In the present study the purpose was to identify which types of determinants are related to different body regions, and not to achieve estimates of the relative incidence rates. Odds ratios are higher than prevalence rate ratios. The pattern of significant determinants, however, is similar. Multiple logistic analyses were used here since they calculate odds ratios, and this would lead to higher comparability between the univariate and multivariate analyses. One obvious outcome in the present study was that the odds ratios and prevalence rate ratios in both the univariate and the logistic regression analyses were fairly low. Most odds ratios were below 2, and none was higher than 3.2. Also, with the given prevalences and the distribution of exposed subjects, the power calculations indicated that odds ratios of 1.67–2.44 could be detected, depending upon how the diseased were distributed among exposed and nonexposed subjects.

The cross-sectional design is a further limitation of the present study, which makes it impossible to discuss causality in the model. The purpose of the study was, however, not to make causal inferences, but to study the situation for the nursing personnel who have ongoing musculoskeletal symptoms. Further, prospective data have been collected and will be analyzed, after which the results from the present study might be validated. The different individual factors that emerged for the five different body regions in the present study indicated that neck, shoulder, and low back symptoms were related to low perceived physical fitness. As we do not know which came first, the symptoms or the low physical fitness, two interpretations are possible. It may be that those who have symptoms in these body regions reduce their physical activity due to pain, but it is also possible that persons with low physical fitness have an increased risk of developing low back symptoms.

In the present study, physical work factors were related to symptoms in the neck, low back, and hands. There is some evidence, based on intervention studies, that the prevalence of low back disorders may be reduced by training in patient transfer techniques (Lagerström et al. 1994) and by the use of mechanical devices for lifting (Wickström et al. 1993), thus decreasing the physical work load. The relative physical work load may also be decreased by fitness training, as shown by others (Wigaeus Hjelm et al. 1993; Gundewall et al. 1993). Thus, training in work technique and increased physical fitness may be preventive for musculoskeletal symptoms among nursing personnel.

In the present study, psychosocial work factors were related to musculoskeletal symptoms in four body regions. The preventive measures at the work site should therefore also address these issues. In a broader perspective, the psychosocial factors could be regarded as a problem at the hospital organization level. In another study from a Swedish hospital it was shown that the work organization, for example type of care, was important for the prevention of back injuries (Ljungberg et al. 1989). Another study showed that different psychological factors were involved in upper and in lower areas of the back (Westgaard and Jansen 1992). In a Norwegian study, reduction of pain was achieved when interventions were focused on psychosocial coping for neck and shoulder pain, and musculoskeletal relaxation for reduction of low back pain (Mykletun et al. 1994). It may be concluded that the identification of risk factors in the hospital setting might have far-reaching implications for the way in which effective health programs for prevention of musculoskeletal disorders should be designed at the work site.

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