Musculoskeletal symptoms and job strain among nursing personnel: a study over a three year period

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Abstract

Objectives—To examine the variation of symptoms from the neck, shoulders, and back over a three year period among female nursing personnel and the relation between job strain and musculoskeletal symptoms.

Methods—At a county hospital the female nursing personnel answered a questionnaire at baseline and then once a year over a period of three years. There were 565, 553, 562, and 419 subjects who answered the questionnaire at the first, second, third, and fourth survey, respectively. Of the study group, 285 nursing personnel answered the questionnaire on four occasions. Ongoing symptoms of the neck, shoulders, and back were assessed by means of a 10 point (0-9) scale with the verbal end points "no symptoms" and "very intense symptoms." Cases were defined as nursing personnel reporting ongoing symptoms, score >6, from at least one of the body regions. For assessments of job strain, a Swedish version of Karasek and Theorell's model was used.

Results—Of the 285 subjects, 13% were defined as cases at all four assessments, and 46% varied between cases and not cases during the study period. In the repeated cross sectional surveys the estimated rate ratio (RR) for being a case was between 1.1 and 1.5 when comparing the group with job strain and the group without job strain. For the combination of job strain and perceived high physical exertion the estimated RR was between 1.5 and 2.1. When the potential risk factors were assessed one, two, or three years before the assessment of symptoms the estimated RR for becoming a case was between 1.4 and 2.2 when comparing the group with job strain and the group without job strain.

Conclusion—Almost half of the healthcare workers varied between being a case and not, over a three year period. The analysis indicated that job strain is a risk factor for musculoskeletal symptoms and that the risk is higher when it is combined with perceived high physical exertion.

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An association between psychosocial job factors and musculoskeletal disorders has been shown in several studies.¹⁻⁷ Theorell *et al*⁸ found that high mental demands were associated with self reported muscle tension and musculoskeletal symptoms. In a cross sectional study among homecare workers an association between low decision latitude and symptoms from the neck, shoulders, and low back was found. For those with a high physical load the association was strengthened.⁹

The combination of high mental demands and low decision latitude, job strain, has been pointed out as an important factor, both for cardiovascular diseases and also for other negative health outcomes.¹⁰ In a cross sectional study among men and women employed in different occupations, job strain was associated with musculoskeletal symptoms.¹¹ A recently published cross sectional study among healthcare workers indicated an association between job strain and low back symptoms.¹²

Most investigations of the association between job factors and musculoskeletal symptoms have been cross sectional. In cross sectional studies the information on job factors and symptoms are assessed at the same point in time and the direction of the association is not clear. The self reported assessment of potential risk factors for musculoskeletal symptoms may be affected by self reporting biasing factors. Subjects with symptoms may overreport the poor job factors and those with no symptoms may underestimate the exposure.¹³ Furthermore, musculoskeletal symptoms may increase, decrease, or pass off.¹⁴ The variability of symptoms is an important factor when designing, conducting, and interpreting epidemiological studies.

The first aim of this study was to investigate the variation of musculoskeletal symptoms over a three year period. How large is the turnover from symptoms to no symptoms, and vice versa, in yearly repeated surveys? The second aim was to investigate the relation between job strain and musculoskeletal symptoms. Will an association be found both if all data are collected at the same point in time and when the job factors are assessed before the assessment of symptoms?

Subjects and methods

An education and training programme for healthcare personnel was performed at a county hospital in the north of Sweden.¹⁵ All personnel on wards with patients who required daily care—for example, help to move from the bed to a chair and daily hygiene, participated in

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the programme. The personnel were educated for one day once a year in patient transfer technique, physical fitness exercise, and stress management. The registration to the programme was made collectively for all personnel at one ward.

The participants in the education and training programme completed a self administered questionnaire once a year. At the first three assessments the subjects completed the questionnaire before the yearly course day. At the fourth assessment, the subjects filled in a questionnaire without a subsequent course. The study period was 1991–4; thus it was three years between the first and the fourth assessment.

At the repeated cross sectional surveys, the data analysed were based on 565, 553, 562, and 419 subjects, respectively. Non-nursing male personnel were excluded from the study group because they were so few. Two participants refused to fill in the questionnaire at the first survey. At the first, second, third, and fourth assessments, 16, 17, 15, and 16 subjects, respectively did not answer the questions concerning ongoing musculoskeletal symptoms and were dropped from the analysis. The decrease in number of subjects in the last assessment compared with the years before was mainly due to changes of working places, reorganisations, and staff cuts. Because of turnover of personnel, retirement, child care leave, notices of leaving, and staff cuts, only 50% of the initial study group (285 workers) answered the questionnaire four times; the first, second, third, and fourth assessments. The first cross sectional survey is referred to as the baseline assessment.

Questionnaires were distributed by the Occupational Health Service.

Name and department were preprinted on the questionnaires. The questionnaires contained about 100 questions on individual factors, physical exposure at work, psychosocial factors, patient handling, and musculoskeletal symptoms.

Most of the participants were employed as registered nurses (table 1). Of the workers, 70% were working a shift schedule involving days, evenings, and weekends, 22% worked only night shifts. The work involved three or more patient transfers per working day for 77% of the subjects. The wards were well equipped with modern lifting devices. All patients' beds were equipped with draw sheets and plastic, which were used for patient transfers in the bed. For patient transfers between the bed and a trolley or a wheelchair, hoists fixed to the

ceiling or separate hoists were used. The hoists were constructed with a U shaped sling which was put under the patients during the transfers.

SYMPTOMS

Neck, shoulder, and back symptoms were assessed by a modified version of the Nordic musculoskeletal questionnaire.¹⁶ The items were "Have you had any symptoms in the past 12 months?" and "Do you have any ongoing symptoms?". The question about symptoms during the past 12 months had two response alternatives: yes and no. Ongoing symptoms were assessed by a 10 point (0–9) scale with the verbal end points "no symptoms" and "very intense symptoms". Cases were defined as nursing personnel who reported ongoing symptoms, score >6, from at least one of the body regions.

JOB STRAIN

For assessments of job strain a Swedish version of Karasek and Theorell's model was used.^{10 17} The index of "mental demands" included five items: excessive work, conflicting demands, time to do work, fast and hard work; score variation 5–20, the higher the score the higher the demands. "Decision latitude" included six items: learning new things, high levels of skill and creativity, repetitious job, and authority to decide what to perform and how to perform the job; score variation 6–24, the lower the score, the lower the decision latitude. The Cronbach α coefficient was used for estimating the internal consistency among the questions. The coefficient can be interpreted as a correlation coefficient, it ranges in value from 0 to 1.¹⁸ For the demand index the coefficient was 0.69 and 0.51 for decision latitude. The internal consistency for decision latitude can be considered as low, which may lead to an underestimation of the association with musculoskeletal symptoms.

High demands were defined as a score >14 (the highest 30%), based on the first survey, low decision latitude as a score <16 (the lowest 37%), based on the first survey. The combination of high mental demands and low decision latitude was defined as job strain.

PERCEIVED EXERTION

A modified scale that rated perceived exertion was used to assess perceived physical exertion during a normal working day.^{19 20} The range was set from 0, resting, to 14, maximal exertion. In the first survey, 66% rated up to hard (score <8) and 21% rated hard (score=9) perceived physical exertion. High exertion, defined as a score >10, was reported by 13%.

TREATMENT OF DATA

In the repeated cross sectional analysis the study group was dynamic—that is, all employees answering the questionnaire on each occasion were included in the analysis. In the follow up analysis the study group was a closed cohort; no employees entered the study group. The turnover from case to non-case, or from non-case to case, between baseline and the one, two, and three years of follow up were assessed.

Table 1 The study group

Repeated cross sectional surveys	n	Registered nurses (%)	State enrolled nurses (%)	Auxiliary nurses (%)	Others (assistants and pupils) (%)	Mean age (y)	Frequency $\geq$ 45 years (%)
First	565	39	35	25	2	40	37
Second	553	41	34	23	2	42	43
Third	562	42	37	19	2	42	45
Fourth	419	44	39	13	5	43	49
Closed cohort Baseline (first survey)	285	47	32	19	2	43	49

Table 2 Prevalence of neck symptoms, shoulder symptoms, upper back symptoms, lower back symptoms and symptoms from at least one of the body regions

Body region	Episodes of symptoms the past 12 months (%)	Ongoing symptoms, score 2-9 (%)	Ongoing symptoms, score 6-9 (%)
Neck	53	40	18
Shoulders	60	50	20
Upper back	30	24	8
Lower back	64	49	16
Neck, shoulders, upper back, lower back	84	69	33

Ongoing symptoms from the neck, shoulders, and back were assessed by means of a 10 point (0-9) scale: first survey, n=565.

In the cross sectional analysis the risk factors and the symptoms were reported at the same point in time. In the follow up the symptoms were assessed one, two, and three years after the potential risk factors were assessed. Considered as potential risk factors were age (≥ 45 years or < 45 years), occupation (not registered nurse or registered nurse) patient transfers (≥ 3 per working day or < 3 per working day), high physical exertion, and job strain. In the cross sectional analysis the rate ratio (RR) was used to describe the relative occurrence of cases between exposed and unexposed nurses. In the follow up analysis RR was used to describe the relative occurrence of cases at the time for the follow up between exposed and unexposed nurses at baseline. In the follow up analysis all subjects defined as cases at baseline were excluded.

The data were divided into subgroups to consider modification of effect, and to control for confounding. Mantel-Haenszel weighted statistics were calculated to combine the subgroup specific estimated RR into a single overall estimate.²¹ Because of missing data, numbers varied between estimates of the prevalence and the estimated RR.

Results

SYMPTOMS

The prevalence of symptoms at the first survey varied according to the definition and the body regions (table 2). The prevalence of episodes of symptoms during the past 12 months was 10%–15% higher than with ongoing symptoms, score 2–9 (table 2). The highest prevalence, 20%, for ongoing symptoms, score > 6 , was for shoulder symptoms (table 2). Ongoing neck or shoulder symptoms, score > 6 , and no symptoms from the back were reported by 13% of nurses, 10% reported only back symptoms, and 10% reported neck, shoulder, and back symptoms.

Table 3 Prevalence of cases* in cross sectional surveys repeated yearly

Cross sectional surveys repeated yearly	Subjects in the repeated surveys (n)	Prevalence of cases in the repeated surveys (%)	Prevalence of cases in the closed cohort (n=285) (%)
First survey	565	33	34
Second survey	553	35	35
Third survey	562	36	35
Fourth survey	419	36	35

* Cases were defined as nursing personnel reporting ongoing symptoms, score ≥ 6 from at least one of the body regions.

The prevalence of cases, defined as nursing personnel reporting ongoing symptoms, score > 6 , from at least one of the body regions, was stable at the four assessments (table 3). In the repeated cross sectional surveys the prevalence of cases was between 33% and 36%, and in the closed cohort between 34 and 35% (table 3). In the closed cohort, 13% were defined as cases at all four assessments, 46% varied between cases and non-cases, 41% were defined as non-cases at all four assessments. If the definition had been a rating between two and nine, 36% would have varied between cases and non-cases, 27% varied between reporting episodes of symptoms during the past 12 months or not. The frequency of turnover from case to non-case or vice versa, was 10%–14% between baseline and the one, two, and three year follow up, (table 4). Of those who were defined as cases at baseline, 69% were defined as cases at the one year follow up, 62% at the two year follow up, and 67% at the three year follow up.

POTENTIAL RISK FACTORS

At the first survey, 13% reported high physical exertion, 18% at the fourth survey, 10% reported job strain at the first survey, 20% three years later. Of those who reported high physical exertion at the first survey, 54% (33/61) also reported high mental demands, and 30% (18/61) reported job strain. The combination of no patient transfers at work and high exertion was only reported by one subject.

The highest associated with being a case was the combination of job strain and high physical exertion (table 5). In the repeated cross sectional surveys the estimated adjusted RR for being a case was between 1.1 and 1.5 when comparing the groups with and without job strain (table 6). When comparing the high exertion group with the others, the estimated adjusted RR was between 1.4 and 1.8 (table 6). For the combination of job strain and exertion the estimated RR was between 1.5 and 2.1 (table 6).

In the follow up analysis the estimated RR for becoming a case was between 1.4 and 2.2 when comparing the groups with and without job strain (table 7). When comparing the high exertion group with the others the estimated RR was between 1.3 and 1.6 (table 7). Only one subject in the closed cohort reported job strain, high perceived exertion, and no symp-

Table 4 Frequency of cases* both at baseline and at the follow up, frequency that became cases, and frequency that became non-cases at the one, two, and three year follow ups, n=285

Years	Frequency of cases both at baseline and at the follow up assessment (%)	Frequency that became cases at the follow up assessment (%)	Frequency that became non-cases at the follow up assessment (%)
Baseline, 1 year follow up	24	12	10
Baseline, 2 year follow up	21	14	13
Baseline, 3 year follow up	23	13	12

* Cases were defined as nursing personnel reporting ongoing symptoms, score ≥ 6 from at least one of the body regions.

Table 5 Estimated crude RR for being a case. * (Based on data from the first survey)

Potential risk factor	n	Frequency exposed (%)	Frequency of cases exposed (%)	RR (95% CI)
Age (≥ 45 y)	565	37	43	1.3 (1.0 to 1.6)
Occupation (not registered nurse)	565	61	67	1.2 (1.0 to 1.6)
Transfers (≥ 3 /working day)	565	77	77	1.0 (0.8 to 1.3)
Physical exertion (rating >hard)	565	13	20	1.7 (1.3 to 2.3)
Job strain (demands score ≥ 14 , decision latitude score ≤ 16)	505	10	16	1.7 (1.2 to 2.4)
Job strain and physical exertion	505	4	8	2.3 (1.4 to 3.6)

*Cases were defined as nursing personnel reporting ongoing symptoms, score ≥ 6 , from at least one of the body regions.

Table 6 Cross sectional surveys repeated yearly: estimated adjusted RR for being a case* with the potential risk factor job strain (demands score ≥ 14 , decision latitude score ≤ 16)

Cross sectional surveys repeated yearly	n	Frequency of exposed (%)	Frequency exposed of the cases (%)	RR(95% CI)†
First	505	10	17	1.5 (1.1 to 2.1)
Second	506	11	15	1.1 (0.8 to 1.6)
Third	506	16	24	1.5 (1.2 to 2.0)
Fourth	372	18	21	1.1 (0.8 to 1.6)
Physical exertion (>hard)				RR (95% CI)‡
First	505	12	19	1.5 (1.1 to 2.1)
Second	506	15	23	1.5 (1.2 to 2.1)
Third	506	16	24	1.4 (1.1 to 1.8)
Fourth	372	20	31	1.8 (1.4 to 2.4)
Job strain and physical exertion§:				RR (95% CI)§
First	505	4	8	2.1 (1.4 to 3.3)
Second	506	4	8	2.0 (1.3 to 3.0)
Third	506	6	9	1.5 (1.0 to 2.3)
Fourth	372	6	10	1.6 (1.0 to 2.5)

* Cases were defined as nursing personnel reporting ongoing symptoms, score ≥ 6 , from at least one of the body regions.

† Adjusted for age, occupation, and physical exertion by the method of Mantel Haenszel.

‡ Adjusted for age, occupation, and job strain by the method of Mantel Haenszel.

§ Adjusted for age and occupation by the method of Mantel Haenszel.

Table 7 Follow up analysis: estimated RR* for becoming a case† at the one, two, or three year follow ups

Year	Frequency that became a case at the follow up	RR (95% CI) for becoming a case when comparing the groups with and without job strain	RR (95% CI) for becoming a case when comparing high with not high exertion group
Baseline, 1 year follow up	19%	2.2 (0.8 to 6.0)	1.3 (0.5 to 3.3)
Baseline, 2 year follow up	22%	1.4 (0.5 to 4.0)	1.4 (0.6 to 3.3)
Baseline, 3 year follow up	24%	1.5 (0.6 to 3.5)	1.6 (0.8 to 3.4)

Those who were defined as cases at the baseline were excluded from the analysis: the potential risk factors were assessed at the baseline; n=172.

* RR adjusted for age and occupation by the method of Mantel Haenszel.

† Cases were defined as nursing personnel reporting ongoing symptoms, score ≥ 6 , from at least one of the body regions.

toms in the baseline assessment. No follow up analysis concerning the combination of perceived exertion and job strain could be conducted.

Discussion

STUDY GROUP

When generalising from this study it is important to note that the study period was a dynamic time at the hospital. An education and training programme for the employees was ongoing and also the healthcare system was reorganised, leading to staff cuts at the hospital. An evaluation of the training and education programme has been presented elsewhere and was not the aim of this study.¹⁵

The proportion of nursing personnel who reported job strain increased over the three year period. The increased prevalence of job strain may have been associated with staff cuts,

reorganisations, and new work requirements. There was no difference in the frequency of symptoms at the first survey between the group who ended their employment and those who remained in the study.

SYMPTOMS

The prevalence of ongoing symptoms was stable over the study period. In the closed cohort the proportion who developed new symptoms was the same as the proportion who recovered from symptoms. Almost half of the nursing personnel varied between being a case or not during the study period. The case group was not stable either if the definition of cases was ongoing symptoms or if the definition was episodes of symptoms the past 12 months. A case definition of absence from work due to musculoskeletal symptoms might have produced different prevalence and associations.¹⁴ The cases in this study were healthy enough to work although they reported ongoing symptoms. The symptoms reported may not have been known to the occupational healthcare service, or the employers, or may not have led to absence from work. A high proportion of the cases had both neck or shoulder symptoms and symptoms from the back. A larger study group would have been necessary if the intentions had been to separate the risk factors for neck or shoulders and the back.

RISK ANALYSIS

Job strain can be assessed by different methods. In the present study each subject answered questions and was given a score of demands and decision latitude. According to this two dimensional model job strain occurs when the demands are high and the decision latitude low. The Cronbach α coefficient for the indices was rather low. It has been proposed that specific index construction may be necessary for the healthcare sector. Working with human suffering and sickness involves special psychological work factors and requirements.²² Job demands in nursing are probably a mix between physically demanding job tasks and mental demands. In occupations involving care and patient handling perhaps the perception of mental and physical demands are hard to separate. Transferring a patient, who may be old, confused, and anguished, involves both physical and mental requirements.

All nursing personnel in the study were working in the same hospital and with patients who required daily care. The participants had rather similar work: taking care of people requiring health care. The demands and decision latitude model has been mainly developed for the purpose of comparing different occupations. The individual biasing factors become stronger when comparing people in the same work sector.^{10 23} If the average rating for a specific occupational group is used, the importance of individual biasing factors decreases. To reflect differences between people in the same occupation it would be useful to develop more precise questions about the work. The questions used are rather general. Furthermore, psychosocial job factors involve

more dimensions than just demands and a decision latitude.²⁴ Many of the women in the study group were threatened by reorganisations and unemployment. However, the assessments did not reflect this.

Perceived physical exertion was assessed by one item in the questionnaire. The question was intended to assess perceived physical exertion, but may have reflected a mix of physical and psychological work factors. Reporting high exertion was associated with whether or not the work involved patient transfers, but also with reported mental demands. According to previous studies cardiovascular load or individual physical capacity were probably not reflected by the modified scale that rated perceived exertion used as an item in the questionnaire.^{20 25}

The cross sectional analyses provides information about the association between job factors and symptoms. During the data process both univariate and multivariate analyses were conducted. To facilitate interpretation, stratified univariate analyses and weighted estimates of RR were presented in the paper. In cross sectional studies of musculoskeletal symptoms it has been recommended not to estimate the RR by logistic regression.²⁶ The high prevalence of musculoskeletal symptoms and the influence of exposure on the duration of the problems make the interpretation of the odds ratio uncertain and difficult. Our longitudinal data examined if those who reported relatively poor job factors one, two, or three years ago more often reported ongoing musculoskeletal symptoms. The analyses of the follow up data are simplistic partly because of the study design. The data are collected once a year and there is no information about the exposure factors or the symptoms between the assessments. The estimated RR can hardly be translated to a risk for getting symptoms, just a risk to report symptoms at a special point in time.

The association between job strain and symptoms was clear in the baseline assessment and in the survey two years later. In the second and fourth surveys the association was more uncertain. If only the first survey had been performed, the conclusion would have been a rather strong association between job strain and ongoing symptoms. Had we only done the study a year later, our conclusion would have been more uncertain. In the follow up, the 95% confidence intervals were wide, but there was a tendency to an association.

Different models of the pathways between psychological job factors and musculoskeletal symptoms are possible. The work technique in the case of patient transfers may decrease when the employees perceive job strain and high exertion, and this may lead to increased load on the musculoskeletal system. Furthermore, the muscle tension may increase when the employees perceive job strain, or the job strain increases the perception of symptoms.²

Conclusion

Almost half of the healthcare workers varied between being and not being a case over a three year period. The analysis indicated that job

strain is a risk factor for musculoskeletal symptoms and that the risk is higher when it is combined with perceived high physical exertion.

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