

PDF hosted at the Radboud Repository of the Radboud University Nijmegen

The following full text is a publisher's version.

For additional information about this publication click this link.

<http://hdl.handle.net/2066/23374>

Please be advised that this information was generated on 2021-01-17 and may be subject to change.

Work related risk factors for musculoskeletal complaints in the nursing profession: results of a questionnaire survey

Josephine A Engels, Joost W J van der Gulden, Theo F Senden, Bep van't Hof

Abstract

Objectives—To determine the prevalence of musculoskeletal complaints of the back, arms or neck, and legs among nurses, and to investigate the relation between these complaints and various work related and personal variables.

Methods—A questionnaire survey was carried out in four nursing homes in The Netherlands.

Results—The response was 95% and resulted in 846 completed questionnaires. It was found that a large proportion of the subjects regularly had back complaints (36%) but also had arm or neck (30%) and leg complaints (16%). Almost all respondents (89%) considered nursing work as physically strenuous. Most of them complained of working under time pressure (69%), increased work pressure (70%), and having no opportunity to take a break from the work (70%). The physical variables which seem to trouble the subjects most were lifting (65%), working in awkward postures (47%), and stooping (34%). Moreover, 53% of the subjects responded that the ergonomic lay out of the ward was disagreeable. Most of the work related variables under study seemed to be associated with musculoskeletal complaints. For all types of complaints the strongest associations were found with having to lift heavy loads. Apart from physical stress various aspects of work pressure showed strong associations with the occurrence of musculoskeletal complaints. The variables on the ergonomics of the ward showed less clear associations with musculoskeletal complaints than were found for physical stress and work pressure.

Conclusions—From these results it may be concluded that future research of health risks of nursing work should have a wider focus than the relation between physical workload and low back pain.

(*Occup Environ Med* 1996;53:636-641)

Keywords: musculoskeletal complaints; physical stress; work pressure; nurses

As shown in several studies, nursing work seems to be associated with low back pain¹⁻¹⁰ with prevalences found between 42% and 62%.^{3 6 7} Depending on the type of work per-

formed and the normally considerable workload in nursing, complaints may also be expected in other regions of the body, for instance in the legs or arm and neck region.¹¹ However, for musculoskeletal problems at other anatomical sites (arms and neck, legs) it is far less easy to find prevalence rates in the scientific literature. In the study of Stubbs *et al*⁵ nurses with back pain were asked to indicate the anatomical site more precisely in a pictogram. The upper back and neck was pointed out as the site of the problem by 4%, and the buttocks and legs by 10% of the subjects with back pain. In a study on nurses in which complaints of the cervical back were examined, apart from thoracic and lumbar spine problems, a prevalence rate of 16% was found.¹² In another study among nursing personnel Lagerström *et al*¹³ found prevalences of symptoms of the neck 48%, shoulder 53%, hand 22%, and knee 30%. Severe symptoms established on a nine point scale had lower prevalences on all sites, ranging from 18% for the shoulders to 7% for the knees.

Because empirical data are sparse so far, we decided to investigate the musculoskeletal complaints of the back, arms and neck, and the legs in relation to several work related variables in nursing work. Apart from physical stress and ergonomics of the ward we were also interested in aspects of work pressure which might influence occurrence of the musculoskeletal complaints. As stated by Hagberg¹⁴ this and other aspects of the work organisation may be important exposure variables in ergonomic epidemiology. We could not find other studies in which the broad range of work related variables was evaluated as a potential risk factor for musculoskeletal complaints as they emerge in the nursing profession.

In short, the aims of this study were:

(1) To investigate whether nurses have other musculoskeletal complaints besides those of the low back (especially of the legs or the arms, shoulders, and neck).

(2) To find the relation between complaints of the back, arms and neck, and the legs and their respective work related risk factors.

The study was conducted among nurses working in nursing homes for the elderly. The work load for this category is relatively high on account of the infirmities of their patients.¹⁵

Subjects and methods

SELECTION OF SUBJECTS

Nurses working in Dutch nursing homes take

Department of Occupational Medicine, University of Nijmegen, The Netherlands
J A Engels
J W J van der Gulden
Th F Senden

Department of Epidemiology and Biostatistics, University of Nijmegen, The Netherlands
B van't Hof

Correspondence to:
Dr J A Engels, Department of Occupational Medicine, University of Nijmegen, PO Box 9101, 6500 HB Nijmegen, The Netherlands.

Accepted 1 April 1996

care of disabled or geriatric elderly patients. The work of these nurses consists of the daily care for the patients, (washing and dressing them, assisting with visiting the toilet, and with eating and drinking); other tasks are wound care, household activities, and administration.¹¹

The entire nursing staff of four nursing homes ($n = 890$) was invited to participate in a questionnaire survey, which dealt with health, work, and relevant personal characteristics. All the questions on perceived hindrance of working conditions and of musculoskeletal complaints were based on a validated Dutch questionnaire intended for health surveys among working populations.¹⁶ Research on the reliability and the validity of this questionnaire was carried out among 3400 employees in different occupations. The internal consistency of the questions on health complaints, established with Cronbach's α , was 0.85. The correlations found between health complaints and work related factors indicate validity.¹⁷

Several questions were designed to obtain more detailed information about the site and severity of the complaints in the back, arms and neck, and legs. The questions about musculoskeletal complaints were worded: do you suffer regularly from—for example, back complaints (yes/no)? If yes, do you experience these complaints in (a) the lower back or (b) the upper back? Specific items about certain aspect of nursing work in nursing homes were added. Work related questions dealt with work pressure, having difficulties with adopted postures (stooping, standing, etc), or with lifting, and also with criticisms of the ergonomic layout of the ward. Additional questions were on personal characteristics such as age, sex, having managerial tasks or not, duration of employment, and the number of working hours a week. Ten nurses had completed the questionnaire earlier, and they judged the questions included to be relevant and understandable.

Most questionnaires were distributed and completed in group meetings during the working day. Nurses not able to attend a group meeting—for example, owing to sick leave—were sent a questionnaire by post; a reminder was sent to them within two weeks. Collection and processing of completed questionnaires was done anonymously.

ANALYSIS

For the question "do you have regular back, arm or neck, or leg complaints", the answer was yes or no. Those who answered yes were selected as cases. Three series of cases were formed—namely, subjects with complaints about their back ($n = 304$), arm or neck ($n = 257$), and legs ($n = 133$). Each of the case groups was compared with the same control group, made up of nurses selected from the same study group ($n = 362$) who had no musculoskeletal complaints. The sum total of the number of cases and controls is more than 846, which is due to the fact that several subjects had more than one complaint. Comparisons were made to establish the exis-

tence of links between particular work related variables and the occurrence of musculoskeletal complaints. To start with we checked whether the variables sex, age, body mass index, height, job description, duration of employment, and number of working hours a week had any relation with both musculoskeletal complaints and work related variables. Adjusted prevalence odds ratios (PORs) with 95% confidence intervals (95% CI) were then calculated as measures of association.¹⁸ Univariate logistic regression analysis was used to correct for confounding, the actual confounder(s) and one independent variable were entered each time into the model. For example, the association between arm or neck complaints and "hampered by lifting heavy burdens" was estimated by the POR adjusted for the confounding variables age and duration of employment. In the same way PORs were calculated for the associations between complaints about the arms or neck and all other work related variables, taking the same confounders into account. As a last step, all independent variables that showed significant associations together with the relevant confounding variables were included in a multivariate logistic regression model. Work related variables that failed to maintain a significant association with musculoskeletal complaints were eliminated from the models. For the variables that contributed significantly in the definitive model, PORs with 95% CIs were calculated. These analyses were carried out separately for all three kinds of musculoskeletal complaints. All analyses were conducted with SPSS-PC+ 4.1 software.¹⁹

Results

GENERAL ASPECTS

The overall response was 95%: 846 questionnaires out of 890 could be used for analysis. Most of the respondents, who's mean (SD) age was 29.0 (8.0) years, were women (89.8%, table 1). Sixty three per cent were state enrolled nurses, 18% were state enrolled nursing students, and 19% had other functions—for example, kitchen assistant. Sixteen per cent of the subjects answered yes to having managerial tasks. The mean (SD) duration of employment in their profession was 9.2 (6.9) years. They worked 32.7 (8.7) hours a week.

MUSCULOSKELETAL COMPLAINTS

Only 43% of the respondents turned out to have no musculoskeletal complaints at all. Complaints about the back in general were mentioned by 36%; 34% of the respondents had low back complaints. A comparable proportion of subjects (30%) had arm or neck problems which were mostly located in the shoulder and the neck region. Leg problems were mentioned by 16% and seemed chiefly to centre on the knees (table 2). These musculoskeletal problems had mostly developed gradually (> 70%). High percentages of the subjects had sought medical care: 61% of those with arm or neck complaints, 51% of those with back complaints, and 47% of those

Table 1 Some personal characteristics of the respondents with or without musculoskeletal complaints

Characteristics	All n = 846	No complaints n = 362	Complaints of:		
			Back n = 304	Arm or neck n = 257	Leg n = 133
Sex (%):					
Female	89.8	89.7	88.4	92.6	94.7
Male	9.9	10.2	11.5	7.4	5.3
Age (y, mean (SD))	29.0 (8.0)	28.9 (8.1)	28.2 (7.4)	30.2 (8.4)*	29.0 (8.1)
Body mass index (kg/m ² , mean (SD))	23.5 (9.6)	23.5 (11.7)	23.2 (6.9)	22.9 (3.5)	23.8 (9.2)
Height (cm, mean (SD))	168.9 (10.3)	168.6 (10.8)	170.0 (9.3)	168.2 (7.2)	168.5 (11.4)
Function (%):					
Managerial	15.6	17.6	11.5	12.5	15.8
Non-managerial	83.3	81.8	87.2*	86.4	84.2
Duration of employment (y, mean (SD))	9.2 (6.9)	9.0 (6.9)	9.0 (6.5)	10.3 (7.1)*	9.8 (7.0)
Working h / week (mean (SD))	32.7 (8.7)	31.8 (8.9)	33.6 (8.5)*	33.1 (8.4)	33.7 (8.2)*

*P < 0.05 with v without musculoskeletal complaints.

with leg complaints. Of the subjects with back complaints 40% were at times unable to work for this reason. The percentages of sick leave attributable to other musculoskeletal complaints seemed also to be substantial (table 3).

About three out of four respondents with musculoskeletal complaints indicated some relation between their work and their health problems. A similar proportion said that they had never had the musculoskeletal complaint mentioned until they started work in the health care profession. About 70% answered that the problems eased off during holidays and spare time.

WORK ENVIRONMENT AND TASKS

Almost all respondents (89%) found their work physically strenuous. Variables suggested as the causes of severest distress are lifting (65%), working in awkward postures (47%), and stooping (34%). Fifty three per cent of the subjects responded that the ergonomic layout of the ward was poor. Especially the limited space between beds seemed to be a problem (mentioned by 41%). Aspects of work pressure seemed also to be relevant: 69% of the

subjects complained about working under time pressure, and 70% stated that the work pressure had increased as time went on, and that they were not in a position to take a break whenever they needed one. About 50% mentioned that the work was too tiring, and that they ought to slow down work. Fewer complaints (30%) were made about unexpected situations interfering with their work.

ASSOCIATIONS

Musculoskeletal complaints were analysed in closer detail to find whether there were any differences between subjects with and without complaints in relation to seven personal characteristics (table 1). Sex, body mass index, height, and job description did not show clear associations with any of the musculoskeletal complaints. The following significant associations were found for the other characteristics: Age with arm or neck complaints, non-managerial tasks with back complaints, duration of employment with arm or neck complaints, and the number of working hours a week with both back and leg complaints (table 1). These variables were also significantly associated with most of the work related variables under study. Therefore, it was decided to adjust for them in further analyses. On theoretical grounds we decided to correct also for sex. Table 4 shows the adjusted PORs, computed for each of the sites of the musculoskeletal complaints. For most work related variables under study an increased POR was found. For all three kinds of complaints the most outstanding results were those for being hindered by lifting heavy loads. For back complaints strong associations were also found with being troubled by stooping and with working in an awkward position. For arm or neck complaints ought to slow down at work and being troubled by working in the same position for a long time seemed to be the most aggravating work related variables. For leg complaints strong associations were found with being troubled by standing and ought to slow down at work (table 4).

As different work related variables may be strongly interrelated, all the variables found to be associated with musculoskeletal complaints were entered in a multivariate model. Specific analyses have been conducted for each of the sites. Table 5 shows the results of the analyses for all significant variables corrected for each

Table 2 Prevalence and location of musculoskeletal complaints (%)

Location	Prevalence
Back (n = 304):	35.9
Upper back	7.9
Lower back	33.8
Arm or neck (n = 257):	30.4
Neck	22.9
Shoulder or upper arm	19.5
Elbow or under arm	2.3
Wrist or hand	5.7
Leg (n = 133):	15.7
Hip or upper leg	6.9
Knee or lower leg	10.2
Ankle or foot	3.7

Table 3 Severity of complaints itemised for nurses with complaints of the back, arm or neck, or leg region (%)*

Severity of complaints	Complaints of:		
	Back (n = 304)	Arm or neck (n = 257)	Leg (n = 133)
Daily activities could no longer be performed as usual	33.6	27.2	22.6
Had to stop work	39.8	33.1	21.8
Had to take medicines	24.7	33.1	23.3
Were under treatment by doctor, physiotherapist, or specialist	51.3	61.1	47.4

*Percentage of those subjects who had back complaints, arm or neck complaints, or leg complaints, respectively.

Table 4 Adjusted prevalence odds ratios (POR) * (95% CI) for back, arm or neck, or leg complaints in relation to several work related factors in nursing (univariate analyses)

Work related factors	Back (n = 304)			Arm or neck (n = 257)			Leg (n = 133)			Controls (n = 362)
	n	POR	(95% CI)	n	POR	(95% CI)	n	POR	(95% CI)	n
Physical stress:										
Physically strenuous	283	2.26	(1.25 to 4.09)	238	2.56	(1.37 to 4.80)	127	3.91	(1.52 to 10.08)	307
Hampered by:										
Standing	61	3.07	(1.88 to 5.01)	44	2.75	(1.60 to 4.72)	38	4.90	(2.84 to 8.47)	27
Walking	68	1.81	(1.20 to 2.73)	50	1.48	(0.96 to 2.30)	48	3.41	(2.14 to 5.43)	51
Awkward posture	192	3.56	(2.56 to 4.96)	147	3.46	(2.44 to 4.92)	79	3.16	(2.08 to 4.78)	112
Work long in same posture	48	2.80	(1.62 to 4.82)	41	3.50	(1.97 to 6.23)	20	2.76	(1.44 to 5.15)	21
Stooping	158	4.12	(2.92 to 5.81)	114	3.00	(2.09 to 4.31)	66	3.68	(2.49 to 5.64)	76
Reaching out far	77	2.51	(1.65 to 3.81)	68	2.81	(1.83 to 4.32)	39	3.03	(1.85 to 4.98)	42
Lifting heavy burdens	249	4.72	(3.27 to 6.81)	212	5.61	(3.77 to 6.88)	107	4.36	(2.70 to 7.02)	173
Ergonomics:										
Poor ergonomic layout of ward	172	1.27	(0.92 to 1.75)	144	1.24	(0.90 to 1.70)	76	1.29	(0.86 to 1.95)	183
Long walking distances	84	1.20	(0.81 to 1.64)	63	0.96	(0.66 to 1.40)	47	1.68	(1.09 to 2.58)	89
No height adjustable beds	46	2.17	(1.29 to 3.64)	34	1.82	(1.06 to 3.11)	22	2.63	(1.42 to 4.85)	27
Distance between beds	135	1.34	(0.97 to 1.84)	122	1.51	(1.09 to 2.11)	66	1.61	(1.07 to 2.42)	133
Insufficient equipment	84	1.35	(0.94 to 1.95)	74	1.51	(1.04 to 2.20)	39	1.49	(0.94 to 2.35)	78
Work pressure:										
Difficult work rate	121	2.32	(1.64 to 3.28)	108	2.72	(1.89 to 3.90)	58	2.74	(1.79 to 4.20)	80
Working under time pressure	236	1.90	(1.33 to 2.72)	198	2.12	(1.45 to 3.10)	108	2.45	(1.49 to 4.02)	226
Unability to interrupt work	223	1.19	(0.84 to 1.69)	194	1.35	(0.93 to 1.96)	108	1.93	(1.18 to 3.15)	248
Work too tiring	192	3.13	(2.26 to 4.34)	151	2.73	(1.94 to 3.83)	89	3.82	(2.49 to 5.87)	123
Ought to slow down at work	212	3.43	(2.46 to 4.79)	178	3.65	(2.57 to 5.19)	98	4.16	(2.66 to 6.50)	143
Increased work pressure	229	1.83	(1.28 to 2.60)	189	1.64	(1.14 to 2.36)	106	2.43	(1.52 to 3.89)	227
Work disturbed by unforeseen events	115	1.83	(1.30 to 2.58)	94	1.82	(1.28 to 2.61)	63	2.57	(1.68 to 3.92)	91

*PORs relative to subjects without any musculoskeletal complaints, when relevant, adjusted for age, sex, duration of employment, working hours/week, and having managerial tasks.

Table 5 Adjusted prevalence odds ratios (PORs) * (95% CI) for back, arm or neck, or leg complaints in relation to several work related factors in nursing (multivariate analyses)

Work related factors	Back (n = 304)			Arm or neck (n = 257)			Leg (n = 133)			Controls (n = 362)
	n	POR	(95% CI)	n	POR	(95% CI)	n	POR	(95% CI)	n
Physical stress:										
Standing	—	—	—	—	—	—	38	2.47	(1.17 to 5.24)	27
Walking	—	—	—	—	—	—	48	2.49	(1.33 to 4.65)	51
Awkward posture	192	1.99	(1.30 to 3.04)	147	1.74	(1.10 to 2.75)	79	1.87	(1.06 to 3.30)	112
Stooping	158	2.22	(1.46 to 3.40)	114	1.63	(1.03 to 2.59)	—	—	—	76
Lifting heavy burdens	249	2.20	(1.38 to 3.50)	212	3.33	(2.04 to 5.45)	—	—	—	173
Work pressure:										
Difficult work rate	—	—	—	108	1.68	(1.05 to 2.70)	—	—	—	80
Ought to slow down at work	212	1.94	(1.20 to 3.14)	178	2.71	(1.62 to 4.53)	98	2.37	(1.20 to 4.68)	143
Work disturbed by unforeseen events	—	—	—	—	—	—	63	2.43	(1.40 to 4.22)	91

*PORs relative to subjects without any musculoskeletal complaints, adjusted for age, sex, duration of employment, working hours/week, and having managerial tasks and for all other work related factors that showed significant associations in univariate analyses.

other as well as for the relevant confounders. The trends found are similar but the associations are less strong. Again both variables referring to physical work load as well as to aspects of work pressure are found to be associated with each of the three types of musculoskeletal complaints under study. However, aspects of ergonomics do not show significant associations in the multivariate analysis.

Discussion

In this study we tried to get a better insight into the occurrence of several musculoskeletal complaints and the relation between these complaints and work related factors which are inherent in the nursing profession. The questionnaire used for obtaining information from the subjects on perceived hindrance of working conditions and of musculoskeletal complaints was a modified version of a questionnaire which has been frequently applied in The Netherlands.¹⁷ This version proved to be a useful instrument to recognise work related problems and hindrance in nursing work when it was tested in a pilot study.

The response rate in our study was 95%, so that bias resulting from selective non-response should be almost negligible. As the study was

initiated to identify possible risk indicators, the approach chosen was based on a maximal achievable contrast between subjects with complaints (cases) and those without complaints (controls). Therefore, in the analyses on factors at work relating to three categories of complaints, a control group was selected from nurses who were not troubled by any musculoskeletal complaints. Correction for confounding was achieved by introducing certain variables into the logistic regression analyses.

Our study showed that the prevalence of arm or neck complaints (30%) was almost as high as that of low back complaints (34%). Also, 16% of the respondents had leg trouble. In a recent study of nurses, Lagerström *et al*¹³ investigated musculoskeletal symptoms in different body regions. All prevalence data tended to be even higher than the ones found in our study. This could be due to the type of questioning: Lagerström *et al* asked for information on ongoing musculoskeletal symptoms according to the NORDIC questionnaire.²⁰

The proportion of subjects with regular back complaints found in this study (36%), is slightly lower than the prevalence of (low) back pain found in previous studies among

nurses (ranging from 42% to 59%).^{1 6 7 21 22} This could be due to different definitions of low back pain or low back complaints in the various studies (ranging from "back pain within the previous 12 months"^{3 22} to "back pain within the previous month"²¹), but also to a variation in type of work performed (general hospital *v* nursing home) or to differences in age or duration of nursing careers of the population under study.

Arm or neck complaints did associate positively with duration of employment. This, however, showed no association with back and leg complaints. In other studies^{3 23} no association was found between duration of employment and back complaints. It is possible that the absence of an association with back and leg complaints is due to a healthy worker effect. Subjects with back or leg complaints might tend to drop out of the nursing profession early, because of these complaints. Drop out due to arm or neck complaints is possibly less frequent because these afflictions might be less disabling.

Complaints about the back and legs were found to be positively associated with the number of hours worked a week. Except for the study of Mandel and Lohman,²³ in which no association between low back pain and working full time or part time was not found, no other studies investigated this variable.

Age, height, and body mass index were also taken into account as potential risk factors. Age was only found to be associated with arm or neck complaints. In the study of Lagerström *et al*¹³ age was also associated with neck and shoulder symptoms. No unambiguous conclusions about the role of aging in relation to low back pain can be drawn from other studies. Owen and Damron²⁴ reported that as nurses age, they are more likely to undergo back injuries. Several other authors have also found positive associations between age and (low) back pain in this profession.^{22 25 26} However, in some other studies it was found that age was not significantly associated^{12 13 23} or that it was even weakly negatively associated with (low) back pain.⁸ It has to be born in mind that the association between age and back complaints is likely to be confounded by, for example, grade and nursing speciality, bearing children, or duration of employment.¹⁰ Body mass index and height seemed not to be associated with any of the musculoskeletal complaints. This was also found in other studies.^{12 23 27}

For most of the variables under study (both those referring to physical work load aspects of work pace) significantly increased PORs were found for all three sites of complaint. Oddly enough, there seems to be little difference between the three sites in the links with work related variables. This could partly be due to the fact that the case groups showed some overlap. Of the subjects with musculoskeletal complaints, 53% had symptoms in more than one region. Specific relations might be obscured because of this overlap.

The relation between psychosocial variables known to be disincentives (such as monoto-

nous work and job dissatisfaction) and low back pain have been investigated by other authors. Positive associations were found in some studies.^{8 28 29} In one of these studies "higher degree of worry" and "fatigue at the end of the day" were found to be associated with low back pain. However, the number of nurses in this study was no more than 65.²⁸ In our study we were particularly interested in items about aspects of work pressure. Not only back complaints but also arm or neck and leg complaints seemed to be positively associated with most of the variables of pace of work.

Criticism about the ergonomic lay out of the wards did not show the same strong associations with musculoskeletal complaints as did aspects of physical stress and work pressure in the multivariate analysis. However, the ergonomic aspects still hold good as a point of interest for further investigation in view of the findings of other researchers^{2 3 10 15} and also because a considerable percentage of all subjects (53%) responded that the ergonomic lay out is poor.

Clear associations were found between several aspects of physical workload and musculoskeletal complaints at each of the three sites. It is not possible to draw conclusions about the nature of the associations found. It is likely that the work related variables promote the health effects under study, but on the other hand it is also acceptable that subjects with latent or existing complaints respond sooner to adverse working conditions than others. In cross sectional studies causal interpretations of associations found are impossible. However, it is reasonable to conclude that in any case variables like hampered by standing or hampered by walking cause or increase leg complaints. We reported previously¹¹ that up to 25% of an average nurse's work day was done with the back in a stooped, bent, arched, or otherwise contorted position, whereas only 15% of the day was spent sitting. Bary and Stubbs³⁰ found that 22% of a nurse's working day was spent in a stooped position. Several studies subscribe to the assumption that working in a stooped, twisted, or awkward position is a risk factor for the onset of low back complaints.^{6 10 31} Furthermore, most of the subjects in our study answered that they had never experienced their particular musculoskeletal complaints before taking up work in health care and also that their complaints diminished during holidays. They assumed that a relation existed between their work and their musculoskeletal complaints. Their answers suggest that nursing work initiates or aggravates some of their musculoskeletal complaints.

Either way, for occupational health care, both patterns of the relation between work related factors and musculoskeletal complaints are relevant. Improvements in working conditions should help to prevent work disability but also facilitate the return of nurses who have been unable to work for some time owing to musculoskeletal complaints.

Two things may be concluded from this study. Firstly, apart from low back complaints, arm or neck and leg problems seemed to be

associated with awkward postures, stooping, and lifting in nursing work. It seems worthwhile to pay more attention to symptoms at these anatomical sites in future studies. This applies also to intervention studies, which often focus on the prevention of complaints at one particular anatomical site, mainly low back pain. In such studies confirmation should be sought that for instance alternative lifting techniques or other changes in working conditions do not pose a threat to other parts of the anatomy—for example, shoulders or knees.

Secondly, our study shows that, apart from the physical workload experienced, aspects of work pressure and psychological workload are associated with complaints at other anatomical sites besides the (low) back. When occupational aspects are taken into account in prevention programmes, aspects of work efficiency and dealing with pace of work should not be forgotten in the attempts to reduce musculoskeletal complaints.

We thank the management and staff of the nursing homes where this study was conducted for their permission and help, and in particular the nurses who participated in this study. We also thank Professors J J Kolk and R A Binkhorst for their valuable comments. This study was funded by the Prevention Foundation (Praeventie Fonds), the Netherlands.

- 1 Harber P, Peña L, Hsu P, Billet E, Greer D, Kim K. Personal history, training and worksite as predictors of back pain of nurses. *J Occup Med* 1994;25:519-26.
- 2 Jensen RC. Back injuries among nursing personnel related to exposure. *Appl Occup Environ Hyg* 1990;5:38-45.
- 3 Estryn-Béhar M, Kaminski M, Peigne E, Maillard MF, Pelletier A, Berthier C, et al. Strenuous working conditions and musculoskeletal disorders among female hospital workers. *Int Arch Occup Environ Health* 1990;62:47-57.
- 4 Smedley J, Egger P, Cooper C, Coggon D. Manual handling activities and risk of low back pain in nurses. *Occup Environ Med* 1995;52:160-3.
- 5 Stubbs DA, Buckle PW, Hudson MP, Rivers PM, Worringham CJ. Back pain in the nursing profession: I Epidemiology and pilot methodology. *Ergonomics* 1983;26:755-65.
- 6 Pheasant S, Stubbs D. Back pain in nurses: epidemiology and risk assessment. *Applied Ergonomics* 1992;23:226-32.
- 7 Burdorf A. *Assessment of postural load on the back in occupational epidemiology*. Rotterdam: Erasmus University; 1992. (Thesis.)
- 8 Skovron M-L, Mulvihill M, Sterling R, Nordin M, Tougas G, Gallagher M, et al. Work organization and low-back pain in nursing. *Ergonomics* 1987;30:359-66.
- 9 Harber P, Billet E, Lew M, Horan M. Importance of non-patient transfer activities in nursing-related back pain: I Questionnaire survey. *J Occup Med* 1987;29:967-70.
- 10 Buckle P. Epidemiological aspects of back pain within the nursing profession. *Int J Nurs Stud* 1987;24:319-24.
- 11 Engels JA, van der Gulden JWJ, Senden ThF, Hertog CAWM, Kolk JJ, Binkhorst RA. Musculoskeletal complaints and physical workload among the nursing staff in nursing-homes. *J Occup Med* 1994;36:338-46.
- 12 Venning P, Walter S, Stitt L. Personal and job-related factors as determinants of incidence of back injuries among nursing personnel. *J Occup Med* 1987;29:820-5.
- 13 Lagerström M, Wenemark M, Hagberg M, Wigaeus Hjelm E. Occupational and individual factors related to musculoskeletal symptoms in five body regions among Swedish nursing personnel. *Int Arch Occup Environ Health* 1995;68:27-35.
- 14 Hagberg M. Exposure variables in ergonomic epidemiology. *Am J Ind Med* 1992;21:91-100.
- 15 Garg A, B Owen. Reducing back stress to nursing personnel: an ergonomic intervention in nursing-homes. *Ergonomics* 1992;35:1353-75.
- 16 Dijkstra A, Grinten MVD, Schlatmann M, de Winter CR. *Functioning in the work situation*. Leiden: Dutch Institute of Preventive Health Care, 1986. (In Dutch.)
- 17 König-Zahn C, Furer JW, Tax B. *Measuring health status. Physical health, social health, part 2*. Assen: van Gorcum, 1994. (In Dutch.)
- 18 Checkoway H, Pearce NE, Crawford-Brown DJ. *Research methods in occupational epidemiology*. New York: Oxford University Press, 1989.
- 19 Nie N, Hull C, Jenkins J, Steinbrenner K, Bent DH. *Statistical package for social science (SPSS), 2th ed*. New York: McGraw Hill, 1970.
- 20 Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sorensen F, Andersson GBJ, et al. Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms. *Appl Ergonomics* 1987;18:233-7.
- 21 Arad D, Ryan MD. The incidence and prevalence in nurses of low-back pain: a definitive survey exposes the hazards. *Australian Nurses Journal* 1986;16:44-8.
- 22 Leighton DJ, Reilly T. Epidemiological aspects of back pain: the incidence and prevalence of back pain in nurses compared to the general population. *Occup Med* 1995;45:263-7.
- 23 Mandel JH, Lohman W. Low-back pain in nurses: the relative importance of medical history, work factors, exercise and demographics. *Res Nurs Health* 1987;10:165-70.
- 24 Owen BD, Damron CF. Personal characteristics and back injury among hospital nursing personnel. *Res Nurs Health* 1984;7:305-13.
- 25 Niedhammer I, Lert F, Marne MJ. Back pain and associated factors in French nurses. *Int Arch Occup Environ Health* 1994;66:349-57.
- 26 de Zwart BCH, Frings-Dresen MHW, van Dijk FJH. Physical workload and the ageing worker: a review of the literature. *Int Arch Occup Environ Health* 1995;68:1-12.
- 27 Ryden LA, Molgaard CA, Bobbit S, Conway J. Occupational low-back injury in a hospital employee population: an epidemiologic analysis of multiple risk factors of a high-risk occupational group. *Spine* 1989;14:315-20.
- 28 Svensson H-O, Andersson GBJ. The relationship of low-back pain, work history, work environment, and stress. A retrospective cross-sectional study of 38- to 64-year-old women. *Spine* 1989;14:517-22.
- 29 Houtman ILD, Bongers PM, Smulders PGW, Kompier MAJ. Psychosocial stressors at work and musculoskeletal problems. *Scand J Work Environ Health* 1994;20:139-45.
- 30 Baty D, Stubbs DA. Postural stress in geriatric nursing. *Int J Nurs Stud* 1987;24:339-44.
- 31 Riihimäki H. Low-back pain, its origin and risk indicators [review]. *Scand J Work Environ Health* 1991;17:81-90.