Scand J Rehab Med 26: 51–58, 1994

FACTORS INTERACTING WITH PERCEIVED WORK-RELATED COMPLAINTS IN THE MUSCULOSKELETAL SYSTEM AMONG HOME CARE SERVICE PERSONNEL

An explorative multivariate study

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ABSTRACT. The interrelationships between reported complaints, certain sociodemographic data and ergonomic, physical and psychosocial aspects of the work-environment were investigated in a cross-sectional study of home care service personnel using a questionnaire. Ninety-seven out of 160 randomly selected women took part in pre-tests (presented here), post-tests and one year exercise program. Significant correlations existed between musculoskeletal complaints, other (somatic and psychosomatic) symptoms and anxiety/threat for differently, mainly work-related negative changes. The group of subjects could be divided into three subgroups. A "complaint group" was identified with a high prevalence of musculoskeletal and other somatic/psychosomatic symptoms. This group had the most negative ratings on the ergonomic and physical work-environment indices. A "young group" had the most negative perception of the psychosocial work-environment. The "healthy group" generally perceived the situation best. The present preliminary study could indicate that work-related interventions/rehabilitation programmes undertaken for the complaint group must be designed in another way and with other goals than those directed towards the other two identified groups.

Key words: women, homecare, work-related, pain, musculoskeletal, psychosocial, ergonomic, myalgia.

INTRODUCTION

During recent years the home care service in Sweden has played an increasingly important role in taking care of the elderly and other individuals with care needs. Home care service takes place both at home and at institutions. The employees within this occupational sector have reported high frequencies of complaints deriving especially from the musculoskeletal system. Many of the employees who consult the occupational health service report that their complaints in the musculoskeletal system are related to their work and, in fact, a high reported frequency of occupational illness exists for this group of workers (10). These circumstances might contribute to the difficulty of retaining personnel within the home care service. Prospective studies should be used when determining the aetiology of musculoskeletal complaints. However, these are expensive, time-consuming and complicated to organise within an occupational sector with a high incidence of complaints and large turn-over rate of personnel. In an earlier cross-sectional study, based on the same subjects as the present one, it was suggested that high continuous muscle activity between active contractions might precede muscle pain (8) – a suggestion consistent with other of our studies (11, 9). A cluster analysis—based on different clinical findings, different measures of strength, endurance and surface-electromyography of the shoulder flexors as well as certain sociodemographic data – was able to determine subgroups, with markedly different prevalences of complaints from the musculoskeletal system (8). This heterogeneity calls for an investigation of the multivariate relationships between complaints from the musculoskeletal system and different aspects of the work-environment.

During the last decade there has been an increasing interest and awareness in Sweden of early (work-related) rehabilitation of individuals with complaints deriving from the musculoskeletal system. The focus has been on both the economic costs to the society and the suffering of the person with complaints. Early intervention and return to work have been stressed as being important factors in preventing chronic pain development (18). One necessary prerequisite for early

and effective rehabilitation (i.e. before the individual has started taking frequent/chronic sick leave) is a better understanding of how the different aspects of the work environment (both from ergonomic/physical and psychosocial points of view) correlate with complaints deriving from the musculoskeletal system. Furthermore, it is reasonable to assume that the important work-related factors and their relationship to the complaints varys to some extent between different occupations. Hence, cross-sectional studies can yield a greater insight into how to design effective and early rehabilitation programmes within different occupations.

The aim of the present cross-sectional study was to analyse which (mainly work-related) factors were associated with complaints from the musculoskeletal system among female home care personnel.

MATERIAL AND METHODS

Subjects

To take part in the study the subjects had to fulfil the following criteria: working in the central home care service district of Umeå, Sweden, working at least 50% of full-time, and not being on chronic sick-leave. A group of 160 randomly selected individuals (all women) from the central home care service district of Umeå were offered the opportunity of participating in a programme which included both a number of pre and post tests and a one year exercise programme. Individuals on chronic sick-leave were not included since the exercise programme was directed towards still working persons (i.e. combined primary and secondary intervention). Out of this group of 160 women, 54 women declined the offer. The rest were examined by a physician and 9 of them were discarded due to physical unfitness. Thus, the present study was based on 97 women. The non-participants ($n=63$) were significantly younger (36.7 ± 13.5 year) than the participants ($n=97$) (40.7 ± 12.6 years).

Questionnaire

The subjects filled in the questionnaire after a short instructions from the test leader and were able to get help from the test leader. The questionnaire was designed to yield information on sociodemographic variables such as age, time of employment, number of children, physical activity during leisure and anthropometric variables such as weight and height. Broca-index (3) was calculated as weight/(height-1) ($kg \cdot m^{-1}$). Many items were designed so as to yield data about complaints from nine anatomical regions of the body; i.e. the 7 day prevalence of complaints from neck, shoulders, upper back, low back, elbows, hands, hips, knees and feet. Subjects who indicated such complaints rated the intensity usually perceived throughout the 7 day period of the complaints using a 100 mm long visual analogue scale (VAS) (ranging from the end-points none to maximal). The subjects also reported the duration of the complaints from the last 7 days. Included in the questionnaire were also questions concerning the perception of the work-environment, in particular, aspects of the ergonomic, physical and psychosocial work-environment. Generally the answers to each question included 4 or 5 alternatives. Based on these different questions in the questionnaire a number of indices were constructed. These indices were constructed by rational considerations and were created with the purpose of covering different aspects of the working environment.

Musculoskeletal complaint-index (MSC-index): Number of anatomical regions (out of the total nine) with perceived musculoskeletal complaints during the recent 7 days. The nine anatomical regions were: neck, shoulders, elbows, wrists/hands, upper back, low back, hips, knees and ankles/feet. The anatomical regions were shown on a drawing and were identical to the regions used in the questionnaire of the Nordic Council of Ministers (19). The MSC-index was intended to reflect the degree of generalisation of the musculoskeletal complaints.

Other Symptoms-index (OS-index): The number of other somatic and psychosomatic complaints, for instance feeling tired, headache, insomnia, signs of gastritis etc. Nine items were used in constructing this index.

Ergonomic-index: The existence of eight different traditional negative ergonomic factors (cf. 13) concerning working positions, work equipment, lifts, monotony/stress, and sitting working postures.

Physical work environment-index: Six physical factors other than ergonomic ones in the work environment such as: lighting, fumes, noise, demands of eyesight, indoor "climate" and dust.

Anxiety-index: The perceived anxiety associated with the work situation concerning: intimidation, illness/disease, damage of equipment in the work situation, reorganisation of work, and economy measures at the work place. Six items were used for this index.

Social-index: Two questions concerning the quality of relations with fellow-workers during work and leisure.

Leadership-index: The degree/quality of communication with the work manager/s concerning support based on four viables.

Influence-index: The degree of perceived control of the work situation: ability to make use of own ideas, possibility of development in work, influence on working pace, influence on working tasks, influence on work and decision-making concerning breaks. This index was constructed from eight questions.

Knowledge-index: If the subjects perceived themselves to be sufficiently knowledgeable concerning medical and psychological issues was measured using 3 items. The index also contained a question about whether the subject needed instruction in the performance of the work.

Satisfaction-index: Included seven questions about satisfaction with work and whether the subject was applying for another job.

Appreciation-index: Included three questions about whether the subject felt her work was appreciated by workmates, managers, patients and society.

The constructed indices were coded so that high values represented a negative (bad) situation.

Statistics

All statistics were performed using the statistical package Number Cruncher Statistical System (NCSS version 5.01) (16).

Regression variable selection was used to identify a certain

number of independent variables correlating with one or more dependent variable/s.

Multiple stepwise regression was used when establishing covariations (correlations) between a dependent variable and different independent variables. The stepwise approach means that the single variable explaining most of the variance is introduced first in the model, followed by the second best independent variable etc. until no significant increase in the variance explained is achieved. Standard estimates (i.e. beta coefficients) are given indicating the weight between independent variables. Stepwise multiple regression procedures were used in order to be able to describe patterns of covariance and the relative influence/weight among different (independent) variables.

Factor analysis was used to detect if a number of variables reflect a smaller number of underlying factors (23). Factors with Eigenvalues ≥ 1.00 (Kaiser's criterion) were considered as nontrivial factors. A varimax rotation of the factor solution was made and the rotated factor loadings ≥ 0.50) together with communalities are presented in the tables. The factor loading expresses the degree of correlation between the item and the factor. Factor loadings ≥ 0.50 (ignoring the sign) are considered to be of large or moderate importance and considered to be significant. The communality expresses the part of the variance that is related to the retrained factors for each variable.

Cluster analysis was done for classifying the subjects into subsets containing subjects with similar characteristics. The cluster analysis in the NCSS package is based on the K-means algorithm, in which the objective is to divide N observations with P-dimensions (variables) into K clusters so that the within-cluster sum of squares is minimised (14). Variables were included by rational reasoning, with the objective of including both important background variables and the constructed indices.

Linear discriminant analysis was used to investigate if the clusters were significantly different and which of the variables or indices separated the clusters. For the significant variables *post hoc* tests (Fisher's LSD test) were made, determining the significant differences between the clusters (groups).

RESULTS

Sociodemographic data

The mean employment time was 87 ± 84 months. Sixty-seven per cent of the subjects had worked less than 5.5 years. The subjects worked on average 32 ± 5 hours out of 40 hours per week. Sixty-nine per cent of the women were married and 73% had children. The mean weight was 65.7 ± 11.2 kg and the mean stature was 1.65 ± 0.07 m among the participating women. Using Brocaindex 1.1 as the lower limit for overweight (15) it was found that 20.6% of the women could be considered to be overweight. The most common physical activities during leisure time were walking, cycling, fishing, dancing and similar light activities which were performed approximately 2 hours a week. Only 9% exercised at least 3 hours a week in athletically profiled activities. The proportions of regular smokers and snuff-takers were 30% and 2%, respectively.

Complaints from the musculoskeletal system

The neck and shoulder regions were the anatomical regions with the highest prevalence of complaints (36% and 35%) (Fig. 1). Twenty-two percent reported complaints from the lower back region. Less than 20% reported complaints from any of the remaining six regions and 37% of the subjects did not report any complaints at all from the musculoskeletal system during the recent 7 days. For most of the nine anatomical regions the intensity of complaints was on the lower (less intense) half of the visual analogue scale (VAS). Those who reported complaints in hands, knees, and feet had the highest mean durations out of the recent 7 day period.

Factor analysis

Since several of the constructed indices and the sociodemographic variables might be interrelated, a factor analysis was made with the purpose of gaining insight into this interplay. The indices together with relevant sociodemographic variables (age, duration of employment, working hours/week, physical activity during leisure (a high value meaning a high level of physical activity) and Broca-index) were used in this analysis (Table I). Hence, indices or variables that loaded on the same factor were highly associated. The variance explained with the six factors shown in Table I was 66%. Only the variable working hours/week loaded on factor F_1 (Table I). It can also be concluded that MSC-index, OS-index, anxiety-index and ergonomic-index (weakly: factor loading $= 0.50$) loaded within factor two (F_2). Thus, widely perceived complaints in the musculoskeletal system were associated with a high prevalence of other symptoms. A high age and a negative perceived physical work environment loaded on the third factor (F_3). The fourth factor (F_4) was formed by physical activity level during leisure. In the fifth factor (F_5) it was found that a long duration of employment was positively correlated with the perception of insufficient knowledge. The sixth factor (F_6) included indices reflecting the psychosocial work-environment: social-index, leadership-index and satisfaction index.

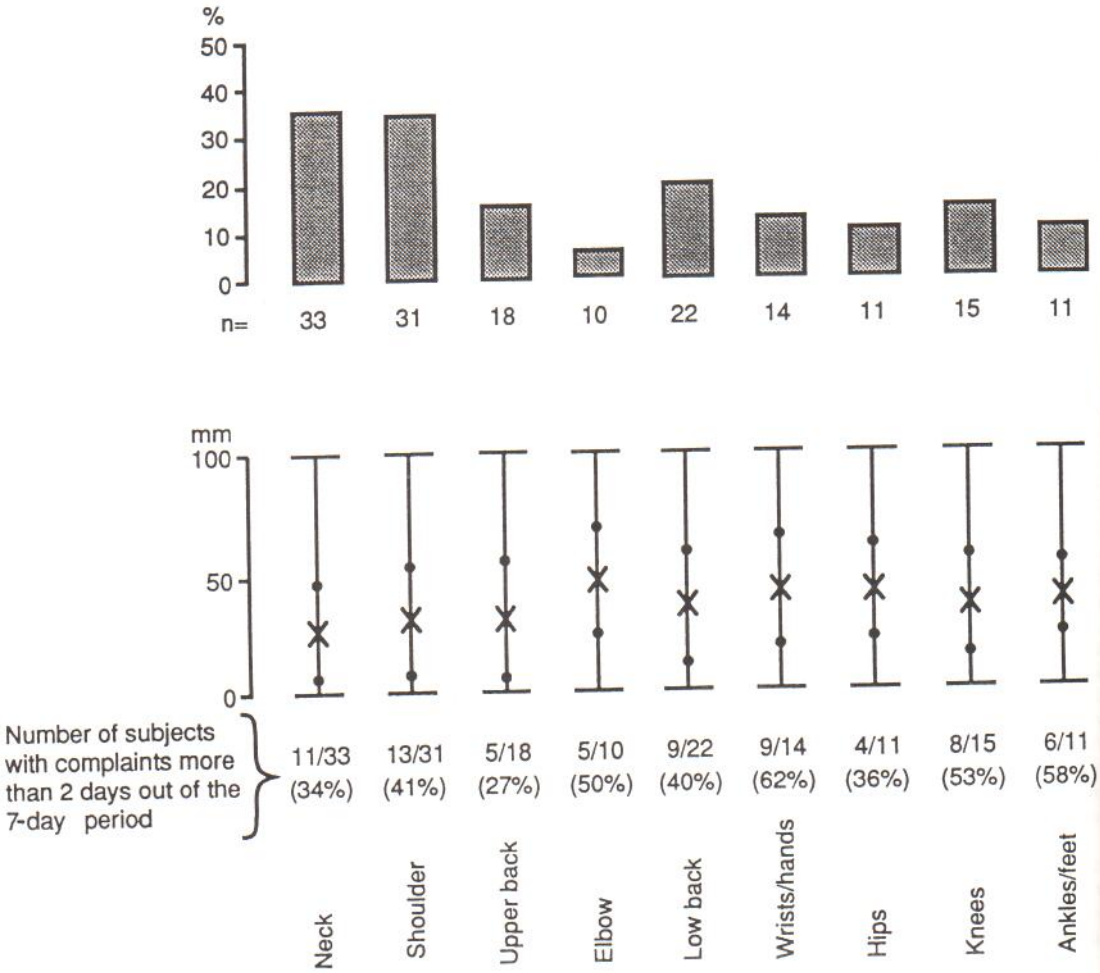

Fig. 1. The prevalence of musculoskeletal complaints (% and *n*) in nine different anatomical regions during the recent 7 days (*top*) for 97 female home care service personnel. For those subjects with reported complaints the mean (denoted x) and ± one standard deviation (denoted •) of the intensity (using VAS) are shown (*middle*). The 100 mm long VAS used had the end points: 0 = none and 100 = maximal. The proportion (*n*) of the subjects with complaints that had had complaints > 2 days out of the recent 7 days are also shown (*bottom*).

Covariations with MSC-index

Regression variable selection procedure and stepwise multiple regression were used for determining correlations between MSC-index (dependent variable) and sociodemographic variables and the constructed indices. For *MSC-index* two significant variables were found: anxiety-index (standard estimate = 0.25) and Broca-index (standard estimate = 0.30) reached significance (R^2 (adjusted) = 0.13; $p \leq 0.05$).

Subsamples among the subjects (the cluster analysis)

In the next part of the study the subjects were classified into subsamples with relatively similar characteristics (Table IIa,b). Thus, a cluster analysis was performed using the constructed indices together with the relevant sociodemographic variables (see above) for the subjects with no missing values (i.e. 93 out of 97 subjects). Three groups (clusters) were determined and, on the basis of this analysis, a discriminant analysis and *post hoc* tests were performed. These analyses showed a heterogeneity among the subjects and it was possible to classify 92% of the subjects (i.e. 88 out of 93 subjects) into correct subgroups using the significant variables/indices listed in Table IIa.

Group 1 was characterised by high values on both MSC-index and OS-index (in the following labelled *the complaint group*). Group 1 also had the highest

Table I. *Rotated factor loadings of the factor analysis for the sociodemographic variables and the indices of 97 female home care personnel*

The rotated factor loadings ≥ 0.50 are marked. Eigenvalues and the variance explained for factors F_1–F_6, respectively, as well as communalities are presented.

Variables and Index	F_1	F_2	F_3	F_4	F_5	F_6	Communality
Working hours/week	**0.87**	0.11	−0.09	0.12	−0.07	0.05	0.80
Musculoskeletal complaint-index	0.01	**0.64**	0.14	−0.48	0.14	−0.07	0.69
Other symptoms-index	0.14	**0.79**	−0.14	−0.15	−0.16	−0.03	0.71
Ergonomic-index	−0.15	**0.50**	0.26	0.38	−0.08	0.22	0.54
Anxiety-index	−0.02	**0.67**	0.09	0.13	−0.05	0.09	0.48
Age	−0.08	−0.16	**0.55**	−0.38	−0.41	−0.36	0.78
Physical work environment-index	−0.09	0.25	**0.79**	0.14	−0.03	0.24	0.77
Physical activity during leisure	0.18	−0.06	0.08	**0.76**	0.12	0.11	0.65
Duration of employment	0.20	−0.03	0.22	−0.17	**−0.78**	−0.15	0.75
Knowledge-index	−0.14	0.33	−0.18	0.10	**−0.60**	0.18	0.56
Social-index	0.17	−0.14	0.30	−0.39	0.37	**0.59**	0.77
Leadership-index	−0.19	0.17	−0.15	0.30	0.04	**0.62**	0.57
Influence-index	−0.18	0.10	0.12	0.05	0.02	**0.77**	0.66
Satisfaction-index	0.26	−0.06	−0.01	0.08	−0.05	**0.69**	0.57
Appreciation-index	−0.45	0.12	−0.46	−0.04	−0.10	0.38	0.59
Eigenvalue	2.74	2.12	1.50	1.34	1.17	1.01	
Percentage of variance explained (cumulative)	18.3	32.4	42.4	51.4	59.2	65.9	

ratings on all indices except those belonging to factor six (Table I).

Group 2 was a young group – the two other groups were on average 17 years older. This group (in the following labelled *the young group*) generally had the most negative ratings concerning the indices belonging to factor F_6 (i.e. leadership-index, satisfaction-index and influence (Table I)). On the other indices this group had ratings intermediate between group 1 and group 3.

Group 3 had lower ratings than the complaint group but somewhat higher than the young group on MSC-index. For all the other indices group 3 exhibited the lowest ratings on all the constructed indices. This group will be labelled as *the healthy group*.

DISCUSSION

One problem with the present cross-sectional study is the large number of drop outs (approximately 40%), and the presented results must therefore be viewed as preliminary. Greater studies of home care personnel with better epidemiological design are desirable and in progress. The main reason for the high incidence of drop outs is probably the fact that the offer to the home care service personnel included the intervention during one year. In retrospect it had been better first to offer participation in a cross-sectional study and then, and after the analysis of this study, offer participation in the intervention. The group of non-participants was significantly younger than the participants. Preliminary results (unpublished results from the occupational health service; Eliasson, 1990) also indicate that the group of non-participants had relatively more full-time employees and lower sick-leave than the group of participants. Hence, from the cluster analysis point of view it is a risk that the relative sizes of the healthy and the young groups were underestimated. The cluster analyses and the subsequent discriminant analyses showed that the subjects were not a homogeneous group. A large group (39%; based on 93 out of 97 subjects) of individuals with wide-spread complaints in the musculoskeletal system and elsewhere (i.e. OS-index) was identified (*the complaint group*) by the cluster analysis. This group of individuals generally had the highest (i.e. negative) scores on the constructed indices, except for those belonging to factor six (i.e. the psychosocial factor). The complaint group was still working but a large number of complaints will reasonably increase the risk of having problems with performing the manual tasks as home care personnel. Hence, this group could be considered as a risk group from the high and/or frequent and, perhaps also chronic, sick leave point of views. The complaint group had on average 2-3 hours shorter working time per week than the two other groups which might indicate that our interpretation of the risk situation is correct and that interventions and/or work-related

Table IIa: *Results from the cluster and discriminant analyses concerning female home care personnel*

Means for the variables and indices are given for the three groups (clusters). F-values are given in the right column and the significant variables/indices are denoted by *. The analysis is based on 93 out of the 97 female home care service personnel.

Variable and Index	Group 1- (complaint)	Group 2- (young)	Group 3- (healthy)	F-value
Age (years)	46.8	28.7	45.9	11.4*
Duration of employment (months)	100.0	51.3	101.2	0.3
Working hours/week (hours)	30.4	33.8	32.4	5.9*
Physical activity during leisure	1.8	2.7	2.0	6.0*
Musculoskeletal complaint-index	2.7	0.9	1.3	3.7*
Other symptoms-index	10.5	9.6	7.9	9.3*
Ergonomic-index	7.6	6.8	5.0	10.2*
Anxiety-index	11.0	10.7	9.6	0.5
Physical work environment-index	2.9	1.4	0.9	5.3*
Knowledge-index	10.2	9.6	8.5	5.2*
Social-index	4.7	4.4	3.9	6.5*
Leadership-index	8.8	10.6	7.8	7.8*
Influence-index	16.4	16.9	13.8	0.7
Satisfaction-index	2.8	3.6	2.4	6.3*
No. of subjects (%)	38.7	44.1	17.2	
Wilk's lambda	0.10			

Table IIb. *The results of post hoc tests (Fisher's LSD test) are shown for the significant variables in Table IIa, determining the significant differences between the three groups*

* Denotes significant difference and "ns" denotes non significant difference.

Variable and Index	Group 1 vs. group 2	Group 1 vs. group 3	Group 2 vs. group 3
Age (years)	*	ns	*
Working hours/week (hours)	*	*	ns
Physical activity during leisure	*	ns	*
Musculoskeletal complaint-index	*	*	ns
Other symptoms-index	ns	*	*
Ergonomic-index	ns	*	*
Physical work environment-index	*	*	ns
Knowledge-index	ns	*	*
Social-index	ns	*	ns
Leadership-index	*	*	*
Satisfaction-index	*	ns	*

rehabilitation had been performed, for instance, by the occupational health service. Another alternative could be that subjects belong to the complaint group had reduced their working time on their own.

The healthy group had the same average age as the complaint group but exhibited a low prevalence of musculoskeletal complaints and low scores on the other work-related indices. Thus, it seems reasonable to assume that this group formed a "healthy worker" group.

The young group was characterised by being on average approximately 17 years younger than the two other groups and by higher educational level than the others, which is reasonably an effect of the successively higher education which has been available during recent decades. The young group rated the most negative situation on the indices (leadership-index, influence-index and satisfaction-index) belonging to factor six. One explanation for this could be that being young and/or having a relatively high educational level is associated with increasing expectations of the quality of the leadership and the degree of influence at the work-place. Another interpretation, which can not be confirmed in cross-sectional studies, would be that the indices of factor six in fact were aetiological factors for developing musculoskeletal complaints even

though MSC-index had not yet increased. The cluster analysis indicated that significant covariations between musculoskeletal complaints and different aspects of the psychosocial work environment (in a broad sense) existed. Linton & Kamwendo (20), Linton (21), Tola et al. (26) and Holmström et al. (17) have presented results indicating that a perceived poor psychosocial work-environment was related to an increased risk for neck and/or low back pain. Results consistent with the findings of the present study concerning the psychosocial work-environmnent have also been reported by others (1, 2, 4, 5, 6, 24, 25, 27).

A high prevalence of complaints was found in the present study, especially for the neck, the shoulders and the low back. These are higher than those reported for employees at hospitals in what appears to be rather similar working tasks (28). However, they were lower than those reported for female assembly workers (7). Our primary intention was to perform the analysis with complaints in the musculoskeletal system as the only dependent variable. However, the factor analyses identified a more complicated situation since those subjects reporting musculoskeletal complaints also had an increased prevalence of other physical symptoms. Other studies have reported similar results (12, 22). The positive correlation between OS-index and MSC-index can be interpreted in at least two ways: a general sickness/sensitivity of the individual and/or the two indices being effect variables both reflecting shortcomings in the work environment. The latter interpretation would partly imply that a positive correlation (i.e. loading on the same factor) should exist with the ergonomic and/or the physical work environment. This was partly found since factor two contained the ergonomic index. However, the ergonomic-index loaded only weakly on factor two and the result has to be confirmed in epidemiologically better based studies. Moreover, ergonomic-index and physical work environment index had a low degree of correlation (i.e. loaded on different factors). Factor two (F_2) also contained the anxiety-index, which covered different aspects of the work environment in a broad sense with the unifying concept threat/worries with negative direct consequences for the individual. The fact that anxiety-index, MSC-index and OS-index loaded on the same factor can only to a small extent have been due to the fact that the anxiety-index contained on item dealing with the perceived work-related health risks.

To summarise: defining MSC-index or complaints from any of the individual anatomical regions as the only effect-variable/s will underestimate the "problem" according to the factor analysis. The "problem" instead appears to be of a greater magnitude including other symptoms, worries/threats and to some extent a negative perception of the ergonomic situation.

The cluster analysis could indicate that different mechanisms act in the three subgroups, which in turn points towards a need to perform differentiated programmes of intervention. The work-related intervention/rehabilitation programmes for the complaint group ought to be designed in another way and with other goals than those directed towards the other two groups. Since the members of the complaint group generally scored high on several of the constructed indices the interventions regarding musculoskeletal complaints must be multidisciplinary and not with focus exclusively on any single aspect of the work environment. In the young group it seems reasonable to also focus the intervention on the issues covered by the four indices belonging to factor six. The situation met by the occupational health service when trying to initiate intervention and early work-related rehabilitation is obviously very complicated and calls for multidisciplinary interventions involving broad aspects of the work-environment as indicated by the present study.

ACKNOWLEDGEMENT

The present study was supported by grants from the Swedish Work Environment Fund (project number 89/1067).

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