

Risk factors for neck and upper limb disorders: results from 24 years of follow up

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Abstract

Objectives—To investigate associations between different potential risk factors, related and not related to work, and disorders of the neck and upper extremities occurring up to 24 years later.

Methods—The study comprised 252 women and 232 men, Swedish citizens, 42–59 years of age and in a broad range of occupations. Information about potential risk factors was available from a former study conducted in 1969. Data on disorders of the neck, shoulder, and hand-wrist disorders were obtained retrospectively for the period 1970–93.

Results—Risk factors were found to differ between the sexes. Among women overtime work, high mental workload, and unsatisfactory leisure time were associated with disorders in the neck-shoulder region. Interaction was found between high mental workload and unsatisfactory leisure time. Neck symptoms earlier in life were associated with recurrent disorders. Hand and wrist disorders were associated mainly with physical demands at work. Among men blue collar work and a simultaneous presence of high mental workload and additional domestic workload predicted disorders in the neck-shoulder region.

Conclusions—Factors related and not related to work were associated with disorders of the neck, shoulders, and hands and wrists up to 24 years later in life. These included factors related to working hours which previously have not been noted in this context. Interactions between risk factors both related and not related to work were commonly found.

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Musculoskeletal diseases are common all over the world. In Sweden about 70% of all reported work related diseases are of musculoskeletal origin, and compared with other work related disorders, they result in longer sick leaves.¹ Apart from the associated human suffering, disorders of the neck and upper extremities are costly to society.

Relations between musculoskeletal disorders in the neck and upper extremities on the one hand, and physical and psychosocial factors at work on the other, have been described in many studies.^{2–7} Physical risk factors found to

be associated with neck, shoulder, or hand and wrist disorders in cross sectional studies are heavy lifting, monotonous work tasks, static work postures,^{2,6} vibrations,³ repetitive jobs,^{4,5,7} and a high work pace.⁵ Psychosocial risk factors found to be related to disorders of the neck and shoulders are a low work content,^{5,8} low social support,^{2,9} a high perceived work load, time pressure, low job control, perceived stress,⁸ and high psychological job demands.⁹

For a better understanding of the mechanisms underlying disorders of the neck and upper extremities, longitudinal studies are required. One reason is that conditions found when symptoms are already present may be a result of, rather than the cause of, the disorder. Another reason is that back pain, and probably also disorders of the neck and upper extremities, show a varied clinical picture with multiple recurrences.¹⁰ In a follow up study over 30 years, it was found that environmental stimuli that were incomprehensible, unmanageable, and meaningless (poor sense of coherence¹¹) were associated with development of neck and shoulder symptoms in both men and women.¹² Low job satisfaction and a feeling of low success in life among women,¹³ and poor work content, poor social relationships at work, and mental overstrain among both sexes¹⁴ were found to be associated with musculoskeletal morbidity of the neck and shoulders in other follow up studies that lasted for 10 and 45 years respectively.^{14,15}

Some of the factors shown to be related to musculoskeletal disorders in previous longitudinal studies have been shown not to be related to work, and to be linked to personality. It is therefore of interest to further examine the influence of family life and leisure time while at the same time investigating conditions at work. The aim of the present study was to elucidate the association between social, psychological, and physical factors both at work and during leisure time and musculoskeletal disorders of the neck, shoulders, and hands and wrists over a subsequent period of 24 years.

Methods

STUDY POPULATION

In 1969 a survey of 2500 women and men between the ages of 18 and 65 years, living in the county of Stockholm, was undertaken (the REBUS study). The purpose was to investigate the need for medical and social services, and to determine to what extent the actual needs were fulfilled.¹⁵ All subjects underwent a medical examination, and medical diagnoses were given whenever appropriate. Musculoskeletal

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Table 1 Percentage of the study group exposed to different potential risk factors in 1969 and 1993

Potential risk factor	Women		Men	
	1969 (n=147)	1993 (n=225)	1969 (n=188)	1993 (n=211)
Blue collar work	37	29	47	33
High physical load at work	28	38	39	31
Vibrations	2	6	20	18
High mental load at work	15	36	18	25
Monotonous work	19	7	13	7
Low social support at work	20	12	16	15
Full time work	83	75	98	97
Night or shift work	11	20	8	18
Overtime work	10	31	44	43
Additional domestic work	36		10	
Low family support*	21		22	
Unsatisfactory leisure time*	39		31	

*Women n=252; men n=232.

Results are given as percentage of the people at work in 1969 and in 1993 concerning work related risk factors, and as percentage of the whole group concerning non-work related risk factors.

Table 2 Prevalence (%) of symptoms in 1969, cumulative incidence of disorders 1970–92, and prevalence of symptoms during the past 12 months leading to medical consultation or treatment for different body regions in 1993

	Prevalence 1969		Cumulative incidence 1970–92		Prevalence 1993	
	W	M	W	M	W	M
	Neck	10	2	35	19	23
Shoulder	—*	—*	31	18	24	13
Hands	—*	—*	15	10	10	8

*No data available.

Results based on 252 women (W) and 232 men (M) aged 40–59 in 1993. Cumulative incidence of neck disorders is based on 228 women and 227 men.

diagnoses required both symptoms and signs and also consequences for daily living.

In 1993 all subjects from the 1969 study who were living in Sweden and could be contacted, without diagnosed musculoskeletal disorders in 1969 (four people were excluded on account of neck diagnosis in 1969) and <59 years old in 1993, were identified and asked to participate in a re-examination (n=783). Out of the 783 eligible subjects 62% (252 women and 232 men) participated in the re-examination (the study group). The mean (SD) age of the women was 48.1 (4.3) years, and of the men 48.5 (4.5) years.

Those who refused to participate were asked some questions over the phone, about the reason for not participating and about occurrence of any neck and upper extremity disorders during the past 12 months.

Table 3 Associations between different exposures and reported medical treatment or consultation for disorders of the neck among women relative to potential risk factors in 1969

	High mental load at work	Monotonous work	Overtime work	Dissatisfactory leisure time	High mental load at work + dissatisfactory leisure time
CIR (95% CI) 1970–92 (n=228):					
Age adjusted analysis	1.3 (0.7 to 2.5)	1.7 (1.0 to 2.9)	1.8 (0.9 to 3.4)	1.9 (1.3 to 2.8)	
Multivariate analysis	0.6 (0.1 to 4.4)	1.7 (0.9 to 3.5)	1.4 (0.6 to 3.6)	1.4 (0.7 to 2.7)	2.0 (0.7 to 5.6)
PR 1993 (n=252):					
Age adjusted analysis	1.8 (1.0 to 3.5)	0.8 (0.4 to 1.7)	2.3 (1.0 to 5.0)	1.2 (0.8 to 2.0)	
Multivariate analysis	1.1 (0.2 to 4.9)		1.7 (0.6 to 4.7)	1.0 (0.5 to 2.3)	2.8 (1.1 to 7.3)

CIR=cumulative incidence ratios 1970–92, and PR=prevalence ratios 1993 relative to potential risk factors in 1969. Some values (in italic) not used for further analyses or without explanatory value in the final multivariate analyses, are entered for information.

DATA COLLECTION

Potential risk factors

In 1969 data about psychosocial and physical conditions related and not related to work were collected by a structured interview. Seventeen of the questions were of interest for the present study and the answers, all on a dichotomous scale, were analysed relative to the musculo-skeletal outcomes.

Factors related to the situation at work were high physical loads (either lifting 40 kg for women or 60 kg for men or physical exhaustion in the end of the working day), severe vibrations (whole body), high mental load (both hectic work and mental exhaustion at the end of working day), monotonous work, and poor social support at work (either little opportunity to discuss work related problems with closest superior or no consideration given to the subject's opinions).

Factors on working hours that were considered potentially harmful, were full time work, night or shift work, and overtime work.

Factors on leisure time were low family support (few or unsatisfactory social contacts with friends or relatives) and low satisfaction with leisure time (insufficient or unsatisfactory leisure time). The factor "additional domestic workload", defined as being both gainfully employed and having responsibility for children and household, was constructed to mirror the total amount of time occupied by duties.

The study group was divided into white and blue collar workers on the basis of socioeconomic status in 1969.¹⁶

Neck symptoms in 1969 were treated as a potential risk factor for recurrent disorders in the neck from 1969 onward.

Data on work related exposure in 1993 were collected by a questionnaire, with the same questions as in 1969.

Outcome

Prevalence of symptoms in 1969—Information about neck symptoms was collected by a standardised interview in 1969. A subject was regarded as a case of neck disorder if she or he reported pain, aching, or stiffness in the neck at that interview.

Cumulative incidence of disorders 1970–92—For the period between the two examinations a retrospective questionnaire was used at the re-examination in 1993. The participants were asked if they had consulted or been treated by a physician, physiotherapist,

Table 4 Associations between different exposures and reported medical treatment or consultation for disorders of the neck among men relative to potential risk factors in 1969

	High physical loads at work	Vibrations	High mental load at work	Night or shift work	Additional domestic work-load	Low family support
CIR (95% CIs) 1970–92 (n=227):						
Age adjusted analysis	1.1 (0.6 to 2.1)	1.6 (0.8 to 3.1)	0.6 (0.2 to 1.6)	0.6 (0.2 to 2.4)	2.3 (1.0 to 5.2)	1.6 (0.9 to 2.9)
Multivariate analysis		1.6 (0.7 to 3.8)			2.0 (0.7 to 5.3)	1.3 (0.6 to 3.0)
PR (95% CIs) 1993 (n=232):						
Age adjusted analysis	2.1 (1.0 to 4.4)	1.5 (0.7 to 3.5)	2.0 (0.9 to 4.6)	4.4 (2.1 to 9.5)	2.6 (0.8 to 8.2)	0.9 (0.4 to 2.3)
Multivariate analysis	1.4 (0.5 to 4.3)		1.5 (0.5 to 5.1)	3.6 (0.9 to 14.4)	1.4 (0.3 to 7.0)	

Footnote as for table 3.

Table 5 Interactions between potential risk factors and reported medical treatment or consultation for disorders of the neck relative to potential risk factors in 1969

	Women (n=252)			Men (n=232)		
	CIR (95% CI)	Excess risk due to interaction	PR (95% CI)	CIR (95% CI)	Excess risk due to interaction	PR (95% CI)
High physical load at work + additional domestic work load	2.1 (1.1 to 4.0)	1				
High physical load at work + unsatisfactory leisure time						3.2 (1.2 to 8.7)
High mental load at work + unsatisfactory leisure time	2.3 (1.1 to 5.5)	0.6	3.2 (1.4 to 7.2)	0.6		
Monotonous work + low family support	2.7 (1.1 to 6.6)	0.4				
Blue collar work + additional domestic work load			2.2 (1.1 to 5.0)	0.6		
Overtime time work + additional domestic work load			3.3 (1.3 to 8.6)	0.6		
Shift work + dissatisfactory leisure time				3.0 (1.1 to 8.6)	0.6	
						10.9 (3.0 to 39.1)
						0.4

CIR=age adjusted cumulative incidence ratios 1970–92; PR=age adjusted prevalence ratios 1993.

chiropractor, osteopath, or other such professionals because of symptoms in the neck, shoulders, or hands and wrists. If they had done so they were regarded as a case of that disorder, and asked about the year of the first consultation. When the cumulative incidence of neck disorders was calculated, those with neck symptoms in 1969 were excluded.

Prevalence of disorders 1993—Information on recent conditions (1993 study) was obtained by a medical interview about the past 12 months. The same outcome criteria as for cumulative incidence was used. The same three parts of the body were considered (neck, shoulders, and hands and wrists). The participants also answered a questionnaire on symptoms in different parts of the body during the past 12 months (Nordic questionnaire).¹⁷ These results were used only in the analyses of differences between the study group and the drop out group.

DATA ANALYSIS

In the study of relations between potential risk factors in 1969 and outcomes, prevalence data both from the 1969 and the 1993 study were used, as well as data on cumulative incidence in 1970–92. Prevalence ratios (PRs) were calcu-

lated for associations in 1969 and 1993, and cumulative incidence ratios (CIRs) were used for associations in the period 1970–92. Adjustment for age (41–49, and 50–59 in 1993) was made according to the method proposed by Mantel-Haenszel.¹⁸

In the calculations of associations the SAS statistical software (module PROC FREQ) was used.¹⁹ The precision of the point estimates of PRs and CIRs were estimated by test based 95% confidence intervals, (95% CIs).²⁰ The analyses were performed separately for each outcome as well as for women and men. Results are not reported when the number of exposed subjects in an age group was <10. Only risk factors with a lowest 95% CI of 0.8 and a point estimate of at least 1.5, are reported.

To simultaneously take age and studied risk factors into consideration (multivariate analyses), adjusted PRs and CIRs (95% CIs) were estimated, with the Cox proportional hazards model with the time variable eliminated (module PROC PHREG in the SAS statistical software).¹⁹

The presence of an interaction between risk factors related to work (A) and related to leisure time (B) in the model were analysed on

Table 6 Associations between different exposures and reported medical treatment or consultation for disorders of the shoulders among 252 women relative to potential risk factors in 1969

	High mental load at work	Overtime work	Unsatisfactory leisure time	High mental load at work + unsatisfactory leisure time
CIR (95% CI) 1970–92:				
Age adjusted analysis	1.1 (0.6 to 2.3)	1.1 (0.4 to 2.9)	1.5 (1.0 to 2.2)	
PR (95% CI) 1993:				
Age adjusted analysis	1.8 (1.0 to 3.5)	3.1 (1.6 to 6.2)	1.0 (0.7 to 1.7)	
Multivariate analysis	1.2 (0.3 to 4.4)	2.7 (1.1 to 6.9)	0.7 (0.3 to 1.7)	1.7 (0.6 to 4.8)

Footnote as for table 3.

Table 7 Associations between different exposures and reported medical treatment or consultation for disorders of the shoulders among 232 men relative to potential risk factors in 1969

	Blue collar work	High mental load at work	Night or shift work	Additional domestic workload	High mental load at work + additional domestic workload
CIR (95% CI) 1970–92:					
Age adjusted analysis	2.9 (1.4 to 6.1)	1.9 (0.8 to 4.3)	3.1 (1.4 to 7.0)	2.4 (0.9 to 6.5)	
Multivariate analysis	1.7 (0.8 to 3.6)	1.5 (0.6 to 4.1)	1.1 (0.3 to 3.6)	1.9 (0.4 to 8.0)	2.8 (0.8 to 9.3)
PR (95% CI) 1993:					
Age adjusted analysis	2.9 (1.4 to 6.1)	1.9 (0.8 to 4.3)	2.5 (1.1 to 5.9)	2.4 (0.9 to 6.5)	
Multivariate analysis	3.6 (1.1 to 11.3)	1.7 (0.6 to 4.9)	1.9 (0.5 to 7.2)	1.5 (0.4 to 5.6)	

Footnote as for table 3.

an additive scale with indicator variables, where the PR and CIR (95% CI) for subjects exposed to both types of risk factor, or only one (A+func {B bar} or func {A bar}+B) of these risk factors were calculated, with the subjects not exposed to any of these factors as a reference group. The proportion of the excess risk caused by the interaction between factors A and B was calculated as (CIR/PR (A+B)–CIR/PR (A+func {B bar})–CIR/PR (func {A bar}+B)+1)/(CIR/PR (A+B)), according to Rothman.²¹ We report the result when the proportion of excess risk was >0.3 and the lower 95% CI was ≥1.0 for the CIR/PR. The modelling strategy for the multivariate analysis was the following: (a) all factors which fulfilled the criteria already specified in the age adjusted analyses, either for CIRs or PRs, were entered into the model, (b) then interaction terms between the leisure time and work environmental conditions in the model were entered. In the final model only those interaction terms which fulfilled the criteria on the proportion of excess risk determined above were introduced.

An additional analysis was performed in which interactions were analysed between all factors studied related to work and leisure time. Each outcome was treated separately, and the analyses were done for women and men respectively. The criteria for reporting was a proportion of excess risk >0.3, with a lower 95% CI ≥1.0 for the CIR/PR values.

Differences between the study group and the drop out group for the prevalence of neck disorders in 1969, and for the prevalence of neck disorders during the past 12 months in 1993 (based on data obtained at the telephone interview) were analysed with differences of proportions, with approximate 95% CIs. Only differences with a 95% CI wholly <0 or wholly >0 are reported.

RELIABILITY TEST

The reliability of the self reported retrospective data on disorders (medical consultation and treatment) was tested by a tested and retested method among 68 of the study subjects. These subjects were selected when time allowed at the end of the investigation day. The time lag between answering the two questionnaires was on the average 15 days. Cohen's κ was used as a measure of reliability.

Results

PREVALENCE OF POTENTIAL RISK FACTORS IN 1969 AND IN 1993

The percentage of gainfully employed subjects exposed to the analysed risk factors differed between 1969 and 1993, especially among women (table 1).

Gainful employment was reported by 147 women and 188 men in 1969 and by 225 women and 211 men in 1993. Subjects without any information about work in 1969 were considered to be unexposed to work related factors. The subjects who were not, and those who were gainfully employed in 1969 did not differ in any of the important present potential risk factors.

PREVALENCE AND CUMULATIVE INCIDENCE OF DISORDERS

The prevalence of disorders in 1993 was high compared with their incidence in 1970–92 (table 2). No information on symptoms of the shoulders or the hands and wrists was available for 1969.

There was a trend towards an increase in the cumulative incidence during the past 10 years for all body parts studied.

RELIABILITY TEST

The test-retest reliability of the self reported data on disorders was high. The κ values were

Table 8 Interactions between potential risk factors and reported medical treatment or consultation for disorders of the shoulders

	Women (n=252)			Men (n=232)		
	CIR (95% CI)	Excess risk due to interaction	PR (95% CI)	CIR (95% CI)	Excess risk due to interaction	PR (95% CI)
High physical load at work + low family support	2.3 (1.0 to 5.0)	0.8				
High mental load at work + additional domestic work load				3.2 (1.0 to 10.4)	0.3	
High mental load at work + low family support	2.8 (1.1 to 6.8)	0.8				
High mental load at work + dissatisfactory leisure time			2.4 (1.0 to 5.8)	0.4		
Blue collar work + dissatisfactory leisure time				2.4 (1.0 to 5.3)	0.4	4.0 (1.5 to 10.9)

CIR=cumulative incidence ratios 1970–92; and PR=age adjusted prevalence ratios 1993.

Table 9 Associations between different exposures and reported medical treatment or consultation for disorders of the hands and wrists among 252 women relative to potential risk factors in 1969

	High physical loads at work	Additional domestic workload	Unsatisfactory leisure time	High physical loads at work + additional domestic workload
CIR (95% CI) 1970–92:				
Age adjusted analysis	2.9 (1.4 to 6.0)	1.5 (0.7 to 3.3)	1.8 (1.0 to 3.4)	
Multivariate analysis	0.9 (0.2 to 3.7)	0.4 (0.1 to 1.9)	1.6 (0.8 to 3.3)	2.6 (1.1 to 6.3)
PR (95% CI) 1993:				
Age adjusted analysis	1.6 (0.6 to 4.5)	2.0 (0.8 to 4.9)	1.6 (0.7 to 3.4)	

Footnote as for table 3.

0.72 and 0.84 for the neck, 0.86 and 0.84 for the shoulders, and 0.60 and 0.84 for hands and wrists, for women and men respectively.

ASSOCIATION BETWEEN EXPOSURE AND OUTCOME *Potential risk factors and prevalence of symptoms 1969*

No associations were found between any of the potential risk factors and the prevalence of neck symptoms in 1969 among women. No analysis of such associations was performed for men, as the number of cases was too small.

Potential risk factors and cumulative incidence of disorders 1970–92 and prevalence 1993

Neck—The only risk factors for prevalence of disorders which remained significant in the final models were the interaction between high mental load at work and unsatisfactory leisure time among women (table 3). Monotonous work among women (table 3) and night work or shift work among men (table 4) also showed high relative risk estimates but the lower limit of the 95% CIs only reached the value 0.9.

Strong relative risks for neck disorders were found for several combinations of factors related to work and leisure time (table 5). Interactions were found to be more common among the women than among the men.

Shoulders—The associations between overtime work among women (table 6) and blue collar work among men (table 7), and prevalence of shoulder disorders 1993, remained significant in the final models.

Some interactions were found between factors related to work and leisure time and shoulder disorders (table 8). The highest rela-

tive risk (PR=4.0) was found between unsatisfactory leisure time and male blue collar workers.

Hands and wrists—Among women only interactions between high physical loads at work and additional domestic workload and cumulative incidence of hand and wrist disorders remained significant in the final analysis (table 9).

Among men only a few factors were associated with hand and wrist disorders (table 10).

Several strong interactions between factors related to work and leisure time were found (table 11): the combination of additional domestic workload and low family support was associated with hand and wrist disorders in both sexes.

ASSOCIATIONS BETWEEN NECK SYMPTOMS IN 1969 AND SUBSEQUENT DISORDERS

In women symptoms in the neck in 1969 were related to neck disorders in 1993 (PR 2.4, 95% CI 1.4–4.1). No interactions were found between factors related to work and leisure time and neck symptoms in 1969.

SUBJECTS WHO DROPPED OUT

The drop outs constituted 38% of the study population, 40% of the women and 32% of the men. Fewer women in the study group (10%) than in the drop out group (17%) reported monotonous work in 1969. More men in the study group (21%) than in the drop out group (13%) reported few or unsatisfactory social contacts. Neck symptoms at the examination in 1969 were almost equally common in the study group (6%) and drop out group (5%). No significant differences for other potential risk factors were found.

A telephone interview was carried out among 173 of the drop outs, 97 women and 76 men.

There was no significant difference between the study group and the drop out group when interviewed by telephone, for neck, shoulder,

Table 10 Associations between different exposures and reported medical treatment or consultation for disorders of the hands or wrists among 232 men relative to potential risk factors in 1969

		Additional domestic work load	Unsatisfactory leisure time
CIR (95% CI) ratios 1970–92	Age adjusted analysis	2.6 (0.8 to 8.7)	1.5 (0.7 to 3.4)
PR (95% CI) 1993	Age adjusted analysis	0.8 (0.1 to 5.6)	1.8 (0.8 to 4.2)

Footnote as for table 3.

Table 11 Interactions between potential risk factors and reported medical treatment or consultation for disorders of hands or wrists

	Women (n=252)			Men (n=232)		
	Age adjusted CIR (95% CI)	Excess risk due to interaction	PR (95% CI)	Excess risk due to interaction	Age adjusted CIR (95% CI)	Excess risk due to interaction
High physical load at work+ additional domestic workload	3.6 (1.6 to 8.2)	0.8				
High physical load at work+ unsatisfactory leisure time	3.4 (1.5 to 7.7)	0.7				
Additional domestic work load + unsatisfactory leisure time	2.2 (1.0 to 4.9)	0.8				
Additional domestic work load + low family support			3.6 (1.0 to 12.3)	0.4	5.7 (1.3 to 24.8)	0.8
Blue collar work + additional domestic workload	2.6 (1.0 to 6.9)	0.7				
Full time work + dissatisfactory leisure time	2.5 (1.2 to 5.3)	0.6				

CIR=age adjusted cumulative incidence ratios 1970–92; PR=age adjusted prevalence ratios 1993.

or hand and wrist disorders during the past 12 months.

MISSING DATA

Some subjects did not answer all questions about potential risk factors at the baseline examination in 1969. For work related conditions, the number of subjects, who did not answer one or more of the questions, ranged from 20 to 61, and for leisure time factors the numbers ranged from 4 to 57. No subjects had answered none of the questions related to work or leisure time.

Discussion

The main findings in this study were that several self reported conditions, both related to work and to leisure time, were associated with the presence of disorders of the neck, shoulders, and hands and wrists up to 24 years later. Many already well known risk indicators were identified, but a new finding was that factors related to working hours were also associated with the disorders. The risk indicators differed between the sexes. Interaction between factors related to work and leisure time was commonly found.

MECHANISMS OF LONG TERM ASSOCIATIONS BETWEEN RISK FACTORS AND OUTCOME

How can conditions 25 years ago be associated with disorders many years later? One explanation may be that people tend to maintain their physical and mental load during their working life.^{12 22} This was in fact found in the present study for working conditions among men but among women more changes had occurred. The disorders found in this study may have arisen as a consequence of many years of accumulated workload. The effects of cumulative workloads have been well established for arthrosis,²² but few studies on other types of musculoskeletal disorders have been performed.²³ It might be hypothesised that repeated soft tissue injuries may not heal to restore full function, and that such tissues will be more vulnerable to injury for many years. Alternatively, increasing age may increase the susceptibility of tissues to physical loads. Further analyses, also covering intervening risk factors, will focus on the importance of more recent conditions relative to disorders of the neck, shoulders, and hand and wrist and may give the answers to some of the questions raised in this study. The lack of associations between exposure in 1969 and symptoms at the same time supports the theory that age and cumulative load, related or not related to work, are important factors when explaining disorders in the neck and upper limbs.

RISK FACTORS RELATED TO WORKING HOURS

Duration is a dimension of exposure which might influence neck and shoulder complaints.²⁴ It has been known since 1920²⁵ that sickness and accidents increase, while productivity decreases, if the weekly working hours are high. In more recent publications different risks of overtime work are pointed out,²⁶ but the specific association between overtime work and

neck and shoulder disorders has not been investigated. Overtime work can be considered as a measure of duration of exposure.

This factor was found to be associated with neck and shoulder disorders among women in the age adjusted analysis, both as reflected by the cumulative incidence and prevalence, and retained its explanatory power in the final analyses on the prevalence of shoulder disorders. This finding is supported by reports from cross sectional studies, in which associations have been found between the amount of time worked and symptoms.^{27 28} Additionally, overtime work may be an indicator of an ambitious personality, similar to a so called type A personality (excessive competitiveness, impatience, hostility, time urgency),²⁹ which has been found to be related to shoulder and neck symptoms.³⁰ The number of women reporting overtime work in the present study was small (n=16). Night work or shift work also showed high relative risk estimates in the age adjusted analyses for neck and shoulder disorders among men. This type of work has not previously been identified as a risk indicator for musculoskeletal disorders. However conclusions must be drawn with caution due to the few subjects exposed.

FACTORS RELATED TO LEISURE TIME AND INTERACTION BETWEEN FACTORS RELATED TO WORK AND LEISURE TIME

Dissatisfaction with leisure time, and in some analyses low family support, were associated with disorders in the neck, shoulders, and hands and wrists. These factors interacted with different physical and psychosocial factors related to work and working time. The findings may point to the experience of total overload and dissatisfaction with life as a whole, as critical for development of disorders of the upper extremities. Having a job and also being responsible for children has often been considered as a particularly female situation.³¹ In the present study more than three times as many women as men reported this. However, among both sexes this situation was associated with upper limb disorders. The interaction analysis showed even higher relative risk estimates when additional domestic work was combined with high mental or physical load or overtime work. This may point to role conflicts due to competing demands from work and family life.

BLUE COLLAR WORK

Socioeconomic group has been found to be an important risk indicator in investigations of musculoskeletal disorders. Blue collar workers had a higher prevalence of neck-shoulder disorders than white collar workers in a Finnish study.^{14 32} In this study blue collar work was associated with shoulder disorders in men, but in women only for those with additional domestic work.

DIFFERENCES IN DISORDERS OF NECK, SHOULDER, AND HAND AND WRIST

The physical work load seems to play a more important part in hand and wrist disorders than in neck and shoulder disorders.

DIFFERENCES BETWEEN THE SEXES

In this study mostly factors related to perception—for example, monotony and high mental load at work—were associated with an increased risk in women, whereas for men more concrete risk factors related to work were found. High mental load at work, describing both a feeling of hectic work pace and mental exhaustion at the end of the working day, was the most common risk factor among women for neck and shoulder disorders. Interactions between risk factors related to work and leisure time were more common among women than among men. Similar findings were obtained in another part of the REBUS study—on low back disorders.³³

Information on risk factors for neck and shoulder disorders, in other publications as well as in our study, has often been obtained from studies performed only among men,³⁴ or based on knowledge about risks in men's working lives. As women had more symptoms and disorders in the neck, shoulders, and hands and wrists than men, both in this study and in others,² future efforts should be made to identify those potential risk factors at work to which women are exposed. Also by analysing interactions between different risk factors new knowledge may be obtained about disorders in the upper limbs among both sexes.

EARLIER SYMPTOMS AS A RISK FACTOR

Neck symptoms in 1969 were risk factors for neck disorders 24 years later. Earlier symptoms have been found to be risk factors for subsequent disorders of the low back in other studies.^{33–35} In two studies, previous frequent contacts with healthcare providers because of neck and shoulder disorders (severe cases) were associated with long term sick leave and consequences for daily life.^{36–37} Serious cases of neck disorders in 1969—that is, subjects with symptoms, signs, and consequences for daily living—were excluded from the present study. Thus, among women even mild previous neck disorders increase the risk to an extent comparable with that associated with several of the work related factors.

METHODOLOGICAL CONSIDERATIONS

Among women 42% and among men 19% did not have a job in 1969 and were therefore considered to be unexposed during the study. In 1993 only 11% of the women and 9% of the men were not gainfully employed. Many people may have developed disorders during the study period depending on exposures later in life. This may lead to an underestimation of the relative risks in this study.

The potential risk factors investigated in this study were chosen on the basis of information obtained in the 1969 study.¹⁵ The questions asked, especially those on physically strenuous work or monotony, cover only some aspects of the physical workload. High physical load at work includes both heavy lifting and feeling of physically exhaustion after work. Separate analyses of the potential risk factors included shows that the combination of these factors mirrors the risk well.

The analysis involves many multivariate and interaction analysis but biological plausibility and patterns in the risk factors identified contradict the idea that the findings could be due to change, as suggested from the multiple comparisons concept.

A serious problem in this type of study is the risk of recall errors. In an investigation of recall of occupational injuries, a bias was found towards a lower reporting rate when the recall period increased.³⁸ But as this had little influence on the associations found, it was suggested that self reported survey data, with longer recall periods, may be useful in studying the associations between various risk factors and occupational injuries.

In a study conducted in Sweden,³⁹ it was found that patients underreported their symptoms compared with the doctors' medical records and similar results were obtained in the United States.⁴⁰ Our results may thus be fraught with a bias of underreporting of symptoms leading to medical treatment. With questions about special events (visits to caregivers) instead of questions about symptoms, an attempt was made to keep the bias as low as possible. Data on visits to caregivers may, however, introduce a bias connected with illness behaviour. If the underreporting and illness behaviour is independent of exposure, the relative risk estimates will be biased towards one. In this study information about potential risk factors was recorded well before any disorders occurred or were asked for, which is likely to have reduced the risk of differential misclassification of both outcome and exposure.

From one study it was concluded that people are more likely to remember illness and hospital visits if these have occurred recently.⁴¹ Also often the "telescopic effect" is reported,⁴² which means that people have a tendency to consider events to have happened closer in time than is really the case. Our results may have a bias in that direction or, alternatively, point to interactions, described in other studies, between age, physically strenuous jobs, and increase in musculoskeletal symptoms.⁴³ No bias for age or social class was found in the outcome reports.

Another problem is the many drop outs from the study. Several measures were taken in this study both to reduce the size of the drop out group and to analyse possible differences between this group and the study group. From the analyses of the telephone interview, no indications were found that the drop outs were in a poorer state of health than the subjects in the study group, at least not for neck, shoulder, and hand and wrist disorders.

Conclusions

Factors related or not related to work, different among men and women, were associated with presence of disorders in the upper limbs during a subsequent period of up to 24 years. Many of these risk factors were already known, but unexpectedly other factors related to working hours played a part. In future studies these factors should be investigated as well as interactions between factors related and not related to

work. Efforts should also be made to identify the risk factors connected with experience of mental workload. Neck disorders, even of a non-severe kind, earlier in life predict recurrent neck disorders among women.

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