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Work related neck and upper limb symptoms (RSI): High risk occupations and risk factors in the Dutch working population

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Contents

Samenvatting	i
1. Introduction	1
1.1 Literature	1
1.1.1 Definition	1
1.1.2 Risk factors.....	1
1.1.3 Prevalence	3
1.1.4 The Monitor on Stress and Physical Load	3
1.2 Research questions	4
2. Population and Methods	5
2.1 Population.....	5
2.2 Methods	5
2.3 Statistical analysis	7
3. Results	9
3.1 Response.....	9
3.2 Occupation and industry-specific frequencies of potential risk factors, symptoms and preventive measures	9
3.2.1 Potential work related risk factors.....	9
3.2.2 Potential company related risk factors	11
3.2.3 Prevalence of work related neck and upper limb symptoms	12
3.2.4 Preventive measures reported by employees.....	16
3.3 Work related risk factors for neck and upper limb symptoms	17
3.4 Company related risk factors for neck and upper limb symptoms	19
4. Discussion and conclusions	20
4.1 Results	20
4.2 Methodological limitations.....	21
4.3 Comparison with the literature	22
4.4 Conclusion.....	24
5. Recommendations.....	26
6. References	28
Appendix	31

Samenvatting

Arbeidsgebonden klachten van nek en bovenste extremiteiten (RSI): risico-beroepen en risicofactoren in de Nederlandse werkende populatie

Er is de laatste tijd veel aandacht in de literatuur geweest voor werkgerelateerde klachten van nek en bovenste extremiteiten, ook wel Repetitive Strain Injuries genoemd. Gegevens over het voorkomen van ernstige en minder ernstige klachten van de nek en bovenste extremiteiten zijn schaars, vooral gegevens over de situatie in Nederland. Literatuurreviews van voornamelijk buitenlands onderzoek wijzen uit dat gegronde aanwijzingen bestaan voor associaties tussen klachten van nek, schouder, arm en hand aan de ene kant en fysieke en psychosociale risicofactoren aan de andere kant.

In dit rapport worden resultaten beschreven van prevalentieschattingen van en risicofactoren voor klachten van de nek en bovenste extremiteiten. Deze resultaten zijn verkregen met behulp van de werknemersgegevens van de Monitor Stress en Lichamelijk Belasting, een vragenlijst-onderzoek dat in 1995/1996 is uitgevoerd onder ongeveer 1700 werkgevers en 10.000 werknemers uit ongeveer 1000 bedrijven.

De prevalentie van werkgerelateerde klachten van nek, schouder, elleboog, hand of pols die de afgelopen 12 maanden waren opgetreden was 30.5%. Nek- en schouderklachten werden het vaakst gerapporteerd, respectievelijk door 19.8% en 18.7% van de werknemers. Ruim 10% van de werknemers rapporteerde pols of handklachten en 6% van de werknemers rapporteerde elleboogklachten te hebben gehad de afgelopen 12 maanden. Deze prevalentiecijfers zijn waarschijnlijk enigszins overschat door een lage en waarschijnlijk selectieve respons. Beroepsgroepen waar klachten van de nek en de bovenste extremiteiten het meest voorkwamen waren naai(st)ers (47.2%), metselaars, timmermannen en andere bouwvakkers (43.0%), en laders, lossers en inpakkers (42.3%); industrietakken waarin de meeste klachten gerapporteerd werden waren de horeca (40.4%), de bouw (37.7%) en de productie-industrie (33.2%).

Vrouwen bleken meer klachten van nek en bovenste extremiteiten te rapporteren dan mannen. Na correctie voor leeftijd, geslacht, aantal werkuren en alle mogelijke fysieke en psychosociale risicofactoren werden voor klachten van nek en bovenste extremiteiten matig verhoogde risico's (statistisch significant verhoogde odds ratios rond 1,5) gevonden voor vaak langdurig in dezelfde houding werken, vaak lang achtereen met voorovergebogen of gedraaide nek werken, vaak buigen of draaien met de nek, vaak buigen of draaien met de polsen, vaak trillend gereedschap in de handen hebben, hoge werkdruk en weinig sociale steun van leidinggevende en collega's. Licht verhoogde risico's (odds ratios rond 1,2) werden gezien voor vaak vele malen per minuut dezelfde bewegingen maken met arm, hand of vingers, vaak ver reiken met handen of armen, vaak armen geheven houden, vaak grote kracht uitoefenen op gereedschappen of apparaten en het hebben van weinig vaardigheidsmogelijkheden. Kortcyclisch werk (minder dan 1,5 minuut durende taken gedurende meer dan de helft van de werktijd) is niet gerelateerd aan de totale groep van nekkklachten en klachten van de bovenste extremiteiten, maar bleek wel licht geasso-

cieerd te zijn met specifieke klachten aan elleboog en hand of pols. Bedrijfsgerelateerde variabelen, zoals het aangesloten zijn bij een arbodienst, het uitgevoerd hebben van een RI&E of het hebben uitgevoerd van maatregelen, waren niet geassocieerd met het voorkomen van klachten.

1. Introduction

1.1 Literature

1.1.1 Definition

Over the years, different work related symptoms such as recurring or persistent pain, numbness, aching, burning or stiffness of the shoulder, elbow, wrist, hand and sometimes the neck, have been grouped under the heading of one umbrella term. Moreover, many different terms are used for this group of disorders: repetitive strain injuries (RSI), cumulative trauma disorders (CTD), occupational cervicobrachial disorders (OCD), work related musculoskeletal disorders (WMSD), and work related upper limb disorders (WRULD). In spite of its clear disadvantages, in the Netherlands the term RSI is almost exclusively used for this heterogeneous group of disorders.

1.1.2 Risk factors

There is ample and consistent evidence that a variety of localized musculoskeletal symptoms are associated with work related risk factors such as repetition, physical load, certain prolonged postures and local vibration. The symptoms and their severity increase with the intensity and duration of the work exposure (Hagberg et al, 1995; SCMDIC, 1996). In published literature reviews, it has been stated that an increased risk of RSI is mainly associated with the frequency of the movements, the velocity and acceleration of the movements, external forces, prolonged static load of the muscles and extreme working postures of the joints (Bernard, 1997; Stock, 1991; Kilbom, 1994; National Research Council, 1998). In the literature there is agreement that primarily the combination of different risk factors, such as forceful exertion, repetition of movements and extreme posture of the joints, lead to strongly increased risks for RSI related symptoms, mainly during industrial repetitive work.

Recently the attention to psychosocial factors as risk factors in the etiology and prognosis of musculoskeletal diseases has risen. Although the etiologic mechanisms are poorly understood, there is increasing evidence that variables such as monotonous work, time pressure, poor work content and high work demands play a role in the development of work-related musculoskeletal disorders (Bongers et al 1993, Bernard 1997). Little control over one's job also seems to be an important risk factor. The data on support by colleagues or superiors are rather contradictory. Yet there is evidence that high demands in combination with little support give an elevated risk on musculoskeletal problems (Bongers et al, 1993; Bongers and Houtman, 1995; Moon and Sauter, 1996; Bernard, 1997).

Punnett and Bergqvist recently reviewed the epidemiological literature on work with visual display units (VDU) and neck or upper extremity musculoskeletal problems among office workers (1997). They concluded that convincing evidence exists for a relationship between visual display unit work and neck and shoulder problems. The risk increases with the hours per day and the total number of years in which computer work is being performed. Also for disorders of the hand and wrist evidence was found that the use of VDU or the keyboard was a direct causative agent; the risk increases by duration of exposure. Also, high work demands, postural stress, and low decision authority seem to be associated with neck or upper extremity musculoskeletal problems. The authors add to this finding that it is still not clear whether these problems are a direct consequence of these factors or whether these factors contribute to sustained muscle loading, less alternating postures, less breaks and more repetitive finger motions.

Mouse use in relation to working with computers is considered one of the risk factors for RSI. However, little is known about the association between RSI and the design or the use of keyboard or mouse. From the limited number of studies, which are often of moderate quality, it appears to be very unclear whether 'ergonomically designed' keyboards contribute to a more favourable work posture and to less fatigue or pain. Massaar (1998) did not observe an association between the frequency of complaints and use of a mouse in more than 2000 visual display workers. However, the duration of mouse was not taken in consideration in that study. Experiments in The Netherlands could not demonstrate that use of an ergonomic keyboard contributes to improvement of postures and a decrease in discomfort and fatigue (De Ridder et al, 1995).

Although in the popular press work related upper limb symptoms have primarily been associated with computer work, increased risks of work related upper limb symptoms have been found in many industrial occupations as well. Reviews of studies on RSI in industry have been published by Bernhard (1997) and Sluiter et al (1998). The highest rates of hand and wrist problems (e.g. Carpal Tunnel Syndrome or hand/wrist tendinitis) occur in job tasks with high work demands for intensive manual exertion, e.g. in meatcutters, packers, poultry processors, textile workers, and automobile assembly workers. Elbow disorders occur most often in mechanics, butchers, construction workers and boilermakers (Bernard, 1997). From employer information from the Monitor on Stress and Physical Workload in The Netherlands it is known that repetitive work is frequently occurring in the food industry (75% of the employers pointed out that repetitive work was performed in their company), textile and clothing industry (70%), graphical industry and publishing business (50%), restaurant, hotel and other catering industry, retail trade, and transportation (Bongers et al, 1998). The following occupations are generally regarded as risk groups for (specific) RSI related symptoms: cashiers, sewing women, assembly workers, packaging workers, hairdressers, slaughterers, meat production workers, sorting workers, metal workers, plasterers, bricklayers, jointers, tilers, musicians, data-entry workers, journalists, CAD-drawer and computer programmers (De Ridder, 1997).

1.1.3 Prevalence

The prevalence of the above mentioned work related upper limb symptoms varies with each separate disorder and depends strongly on the criteria that have been used to diagnose the symptoms or disorders. Moreover, the individual percentages in the literature differ by occupation (Hagberg et al, 1995). Only limited data are available with respect to the Dutch situation. Otten et al (1998) recently investigated the prevalence of work related upper limb symptoms within the last year with population-based data from the Central Bureau for Statistics in The Netherlands. They found a prevalence of work related symptoms of neck, shoulder, arm and hand of 19%. Industries with relatively high prevalence figures were agriculture (32%), environmental, cultural and other services (26%), transport and communication (24%), construction (23%), hotel, restaurant and other catering industry (22%), and production industry (20%). The prevalence of symptoms decreased by age and differed slightly between men (18%) and women (20%). The risk factors of RSI related symptoms that were identified in a multivariate analysis were 'working in prolonged flexed posture with upper part of the body', repetitive movements, and with smaller risk estimates, 'working in inconvenient posture with upper part of the body', use of force, use of vibrating tools, and fulltime work.

To draw a relevant framework regarding prevalence figures of work related upper limb symptoms for the purpose of policy reasons, it is necessary to substantiate the above findings with, firstly, occupation and industry specific prevalence figures from other studies in The Netherlands and, secondly, with more detailed data regarding the most important risk factors.

1.1.4 The Monitor on Stress and Physical Load

Due to changes in legislation on occupational health and safety in 1990, aiming to promote preventive action in the workplace, a national Monitor on Stress and Physical Load was developed in The Netherlands. The purpose of this Monitor was to monitor risks for and consequences of stress and physical load at work, preventive actions taken in companies to reduce these risks and organisational and environmental variables that facilitate preventive actions (Houtman et al, 1998a; Houtman et al, 1998b). With the help of the large set of data obtained by this Monitor, it is feasible to identify risk groups and risk factors for work related neck and upper limb symptoms in The Netherlands. The present study is conducted within the framework of the SAFE programme of the European Committee. The aim of this project is to get a better insight in the prevalence of work related neck and upper limb disorders (RSI), in the key causes and risk factors, as well as in successful policies at small and medium-sized enterprises (SMEs).

1.2 Research questions

The research questions that are being answered in this study are:

- which are high risk occupations and high risk industries with regard to potential risk factors for work related neck and upper limb symptoms?
- what is the total prevalence of work related neck and upper limb symptoms and what are occupation specific and industry specific prevalences?
- do small and medium sized enterprises have higher prevalences of work related neck and upper limb symptoms than large enterprises ?
- what is the variation between occupations and industries with regard to preventive measures for counteracting work related neck and upper limb symptoms?
- which risk factors for work related neck and upper limb symptoms can be identified?

The potential risk factors that are being investigated can be divided into work related, or individual factors, such as physical and psychosocial workload, and company related factors or characteristics of the company, such as prevention policy with regard to work related disorders and size of the company.

2. Population and Methods

2.1 Population

The study population consisted of 984 employers and 10813 employees who were interviewed in the period from 1995 to 1996 by means of the Monitor on Stress and Physical Load. The population was composed by means of a two-step sampling procedure. First, a sample was drawn from companies in The Netherlands with at least 5 employees. The sampling procedure was representative of the national distribution of industrial sector, size of the company and region. When a company decided to participate, the employer and an employees' representative were personally interviewed with a structured interview.

Secondly, a sample of the employees was given a questionnaire, if the employer gave permission for this. In companies with less than 60 employees, all employees were given a questionnaire, in companies with more than 60 employees and less than 120, every second employee was sampled. Above 120 employees, every third employee was sampled, with a maximum of 60. When explicitly requested for by the employer, questionnaires were distributed among all employees of the company.

2.2 Methods

The employer and employees' representatives interview included questions on the presence of risk factors for stress and musculoskeletal problems, whether these factors were considered a problem, whether symptoms regarding stress and musculoskeletal problems were raised and whether these were considered work related. Questions on preventive action were directed at the time of implementation (either in the past 12 months, before this 12 month period, or not at all), the type of measure (general measures, measures related to stress or physical load, measures related to workers or to work), and type of prevention (primary, secondary, or tertiary). Also, some questions were directed to the goal the employer wanted to obtain with the preventive measures, the evaluation of the measures, and the benefits obtained. With respect to structural prevention, questions were asked about available professional expertise in the organisation, including the presence or absence of an occupational physician, a special coordinator for health and safety issues, an ergonomist, an occupational hygienist, and a psychologist specialised in work and health issues. General preventive measures that were asked for included whether or not a risk assessment was conducted, whether or not a specific investigation of workplace risk and health was performed or whether or not a contract research agency was commissioned to conduct these activities. Research at the workplace may or may not have been specifically directed at work stress or physical load. Measures to reduce physical load that were specifically asked about were preventive instructions to the workers, introduction of instruments or appliances to reduce heavy work, adjustment of task, job rotation, adjustment of the work place, and introduction of a fitness pro-

gramme. Finally, questions about potentially facilitating or inhibiting factors for effective intervention were asked. Items were size and socioeconomic or financial position of the company, and organisational characteristics (production structure, hierarchical levels). Also, the attitude towards occupational health and safety in the branch of industry was assumed to influence the prevention policy of individual companies. Therefore, questions on these topics were included as well.

In the employee questionnaire parts of different questionnaires were combined. To measure work stress, the Job Content Questionnaire (Karasek, 1985) was used to obtain scales for the main dimensions for work stress risks - that is, quantitative job demands (work pace), skill discretion, and decision authority (autonomy). Also the questions on social support were included. To complement information on relations at work, a scale on relations with colleagues and supervisor from the Dutch questionnaire on work and health (VAG; Gründemann et al, 1993) was used. Finally, questions measuring decision authority with respect to working conditions, first tested in the Nova-Weba study (Houtman et al, 1994) were included. To measure consequences of stress, a questionnaire on emotional exhaustion (part of the Dutch MBI; Schaufeli et al, 1993) and a 13 item questionnaire on psychosomatic complaints (VOEG) were included (Dirken, 1969; Joosten and Drop, 1987; Van Sonsbeek, 1990). Risks for physical load and musculoskeletal complaints were measured by a short version of the questionnaire on musculoskeletal load and health complaints, validated for Dutch employees (VBA) (Hildebrandt and Douwes, 1991). The VBA is partly based on the standardised nordic questionnaires for musculoskeletal symptoms (Kuorinka et al, 1987). With respect to preventive actions, the employee had to indicate whether specific measures on stress or on physical load were taken, either directed at the work situation or at the workers. Also specific questions were asked on measures with respect to primary, secondary or tertiary prevention, introduced in their department in the past 12 months. Finally, several questions considered relevant as mediating or confounding variables were included, that is questions on gender, age, education, job title, tenure, and shift work.

Work related neck or upper limb symptoms were measured by the following question: "Did you feel any pain or trouble during the past 12 months from neck, shoulders, elbow, wrist or hand? If yes, does it relate to your work, according to your opinion?". Symptoms that were not considered work related by the employee were not included. The wording of the questions on risk factors for work related neck and upper limb symptoms was as follows: "In your job, do you often have to bend or turn with your neck / reach far with your hands or arms / keep the same posture for a long time?". These risk factors were dichotomous variables. Psychosocial scales were dichotomised by means of the following definitions: 'low decision authority' was defined when zero or one question out of six with regard to decision authority were answered positively; 'high quantitative work demands' was defined when four or five questions out of five questions on aspects of high work demands were answered positively; 'low skill discretion' was defined when zero or one out of five questions on skill discretion were answered positively; 'low social support' was defined when zero or one question out of 5 questions on good atmosphere and sup-

port of management were answered positively. All remaining persons belonged to the reference category.

2.3 Statistical analysis

To compare occupations and industries with respect to the presence of potential risk factors for work related neck and upper limb disorders, the prevalence of these symptoms, and preventive measures taken, percentages were calculated. To be able to calculate occupation and industry specific percentages of company-related risk factors, company related factors were first attributed to all employees working in that company.

To identify occupational and industrial risk groups with a high overall physical and psychosocial load, the occupational and industrial groups with the five highest frequencies on each individual risk factor were appointed first. Subsequently, occupational and industrial groups were indicated as high physical risk groups if at least nine out of twelve physical risk factors belonged to the five highest frequencies, and as high psychosocial risk groups if at least four out of five psychosocial risk factors belonged to the five highest frequencies. Groups in which many preventive actions were taken were identified in the same way, i.e. if at least five out of six preventive measures belonged to the five highest frequencies.

To identify physical and psychosocial risk factors for work related neck and upper limb symptoms, univariate and multivariate logistic regression analyses were conducted to calculate crude and adjusted odds ratios (OR) with 95% confidence intervals (CI). In the multivariate analyses, the ORs were adjusted for all other physical and psychosocial risk factors, age, sex, shift work, part-time work and job satisfaction. Risk factors were identified for the total group of neck or upper limb disorders together, as well as for the separate symptoms. In addition to analyses on the total population, risk factors were identified for subgroups such as metal workers and engineer fitters, secretaries en typists, and bricklayers en carpenters separately.

To identify company related risk factors for work related neck and upper limb factors, multilevel analyses were performed with the statistical package MLN. With multilevel analyses it is possible to include variables at different levels in one logistic regression model simultaneously. Since the results did not differ largely from an analysis in which company related factors were 'de-aggregated', i.e. attributed to the individual worker level for all workers in one company, the final results that were presented were achieved by conventional logistic regression methods in SPSS.

3. Results

3.1 Response

Eventually, 1716 companies were included in the study, which means that 1716 employers participated in the interview. Although only 12% of them refused to distribute questionnaires in their companies, questionnaires were received from 984 companies (57%), which means that in 521 companies (30%) employers forgot or refused to circulate them after all or that none of the workers responded. From the 30.844 questionnaires that were left in the companies, 10.813 (35%) useful questionnaires were returned and were included in the employee study population.

3.2 Occupation and industry-specific frequencies of potential risk factors, symptoms and preventive measures

3.2.1 Potential work related risk factors

In Table 1 (appendix) the occurrence of potential physical and psychosocial risk factors for neck and upper limb symptoms in several occupational groups is presented. The frequencies of risk factors are given for the total population as well. Occupations in which the highest frequencies of physical risk factors were observed are presented in Table 3-1. Overall physical risk was high in bricklayers, tailors, and loaders, unloaders and packers. Separate physical risk factors were very prevalent in bricklayers, tailors, machine metal workers, loaders, unloaders and packers, and secretaries and typists. Large differences were found between occupations with regard to frequencies of reaching with arms or hands (range between 7.2% in bookkeepers and 54.9% in bricklayers), arms raised (range between 3.2% in bookkeepers and 48.6% in bricklayers), use of vibrating tools (range between 0.0% in bookkeepers and 42.9% in engineer fitters) and use of force (range between 0.0% in bookkeepers and 53.6% in engineer fitters).

A high total psychosocial load was observed in loaders, unloaders and packers. Separate psychosocial risk factors were prevalent in engineer fitters and loaders, unloaders, and packers (Table 3-2). Large differences were found between occupations with regard to frequencies of low decision authority (range between 2.9% in bookkeepers and 20.9% in loaders, unloaders and packers), and low skill discretion (range between 5.0% in medical, scientific and management occupations and 31.1% in loaders, unloaders and packers).

In Table 2 (appendix), industry-specific frequencies of risk factors are presented. Industries with a high overall physical risk were construction and production industry. Eight out of twelve risk factors were most prevalent in construction workers. Also in hotel, restaurant and other catering services, high frequencies of separate

physical risk factors were observed (Table 3-1). Large differences were observed between industries with regard to short repetitive tasks less than 1.5 minute, working with bended wrists and use of vibrating tools. In education and financial services, low frequencies of risk factors were observed.

Table 3-A Occupations and industries with highest prevalence of physical risk factors

HIGH RISK OCCU-PATIONS OR INDUS-TRIES	HIGH OVERALL PHYSICAL RISK*	TYPE OF PHYSICAL RISK
occupations		
BRICKLAYERS	•	BENDING OF NECK, BENDING OF WRISTS, REACHING WITH ARMS / HANDS, ARMS RAISED
TAILORS	•	ROTATED NECK, BENDED WRISTS, PROLONGED POSTURE
ENGINEER FITTERS		USE OF FORCE, USE OF VIBRATING TOOLS
MACHINE METAL WORKERS		SHORT REPETITIVE TASKS < 1.5 MIN
LOADERS, UNLOADERS	•	REPEATED MOVEMENT WITH HEAD
SECRETARIES, TYPISTS		REPEATED MOVEMENT WITH ARM, HAND OR FINGERS
industries		
CONSTRUCTION	•	USE OF FORCE, ROTATED NECK, BENDED WRISTS, REPEATED MOVEMENT WITH HEAD, REPEATED MOVEMENT WITH ARM, HAND OR FINGERS, ARMS RAISED, PROLONGED POSTURE, USE OF VIBRATING TOOLS
HOTEL, RESTAURANT AND OTHER CATERING INDUSTRY		SHORT REPETITIVE TASKS < 1.5 MIN, BENDING OF NECK, BENDING OF WRISTS, REACHING WITH ARMS / HANDS
PRODUCTION-INDUSTRY	•	

* AT LEAST NINE OUT OF 12 PHYSICAL RISK FACTORS MUST BELONG TO FIVE HIGHEST PREVALENCE FIGURES

No industries could be identified that met our criteria of a high overall psychosocial risk. In industry, low social support and low job satisfaction were most prevalent. In hotel, restaurant and other catering industry, low decision authority and low skill discretion were reported most often (Table 3-2).

In general, short repetitive tasks were reported by 10% of the subjects. Risk factors that were reported relatively often were bending of neck (51.5%), bending of the wrists (53.6%), and repeated movements with arm hand or fingers (52.8%).

Table 3-B Occupations and industries with highest prevalences of psychosocial risk factors

HIGH RISK OCCUPATIONS OR INDUSTRIES	HIGH OVER-ALL PSYCHOSOCIAL RISK*	TYPE OF PSYCHOSOCIAL RISK
occupations		
ENGINEER FITTERS LOADERS, UNLOADERS, PACKERS	•	LOW JOB SATISFACTION HIGH QUANTITATIVE JOB DEMANDS, LOW DECISION AUTHORITY, LOW SKILL DISCRETION, LOW SOCIAL SUPPORT
industries		
PRODUCTION-INDUSTRY		LOW SOCIAL SUPPORT , LOW JOB SATISFACTION
HOTEL, RESTAURANT AND OTHER CATERING INDUSTRY		LOW DECISION AUTHORITY, LOW SKILL DISCRETION
FINANCIAL SERVICES		HIGH QUANTITATIVE JOB DEMANDS

* AT LEAST FOUR OUT OF FIVE PSYCHOSOCIAL RISK FACTORS MUST BELONG TO FIVE HIGHEST PREVALENCE FIGURES

3.2.2 Potential company related risk factors

In Table 3 and 4 (appendix) the occurrences of company related factors that may (indirectly) be associated with neck and upper limb symptoms are presented for the total population and separately for subjects in different occupational and industrial groups. All company related factors reported by the employer, such as taking preventive measures, socio-economic position of the company and policies regarding work and health, were disaggregated to the level of the individual employee.

Tailors appeared to be working in small companies in which few preventive measures were taken: 53% of their employers reported that no preventive measures regarding physical load were taken, compared to 24% in the total population; 67% reported no general preventive measures, compared to 33% of all subjects, and 61% reported that no risk assessment had taken place in the last year, compared to 34% in the total population. It has to be marked, however, that the group of tailors consisted of only 72 subjects.

Machine-metal workers worked in companies in which it was most often reported that no policy regarding sick leave existed (17% compared to 12% in the total

group) and in which sick leave was high (42% of employers of machine-metalworkers reported a sick leave higher than 5%, compared to 35% in the total population) (Table 3 appendix).

With respect to the classification of industrial groups, it can be seen that few preventive measures were taken during the last year according to the employers of financial service companies: 49% of the workers' employers reported that no preventive measures were taken regarding physical load, compared to 24% of the total population, and 51% reported no general measures, compared to 34% of the total group. Employers in government agencies often reported a poor or moderate socio-economic position (27% compared to 15% in general) and a very high sick leave (80% reported a sick leave of more than 5%, compared to 36% in general). Also, 80% of the people working at government agencies worked in a company of more than 100 employees, compared to 29% in general. In wholesale trade and repair industry, employers often reported that no policy regarding sick leave existed (34% compared to 13%). Employees in wholesale trade and repair industry often worked in small companies.

3.2.3 Prevalence of work related neck and upper limb symptoms

The overall prevalence, consisting of pain in neck, shoulder, elbow or wrist or hand during the last year that is considered work related was 30.5%. From these persons, 67.6% reported pain in the neck, 64.6% reported pain in the shoulder, 22% reported pain in the elbow, and 38.2% reported pain in the wrist or hand (Fig. 1).

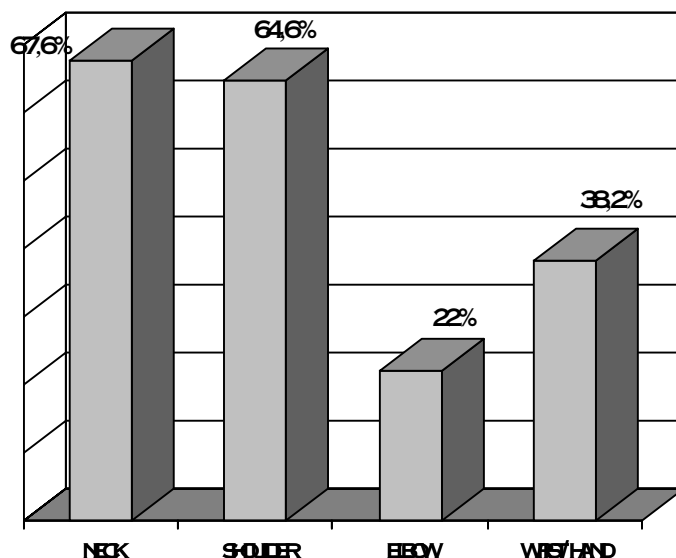


Figure A Percentage of the persons with symptoms that reported pain in the neck, shoulder, elbow, wrist or hand

Figure 2 shows the relative contribution of each individual complaint of neck, shoulder, elbow, and wrist or hand to the total of work related neck and upper limb symptoms. About 64% reported to have at least two symptoms, 14.1% reported only neck symptoms, 10% reported only shoulder complaints, 8.7% had only wrist or hand symptoms and 3.6% reported only complaints of the elbow. When pain in the neck was excluded from the definition, the overall prevalence was 25.7%.

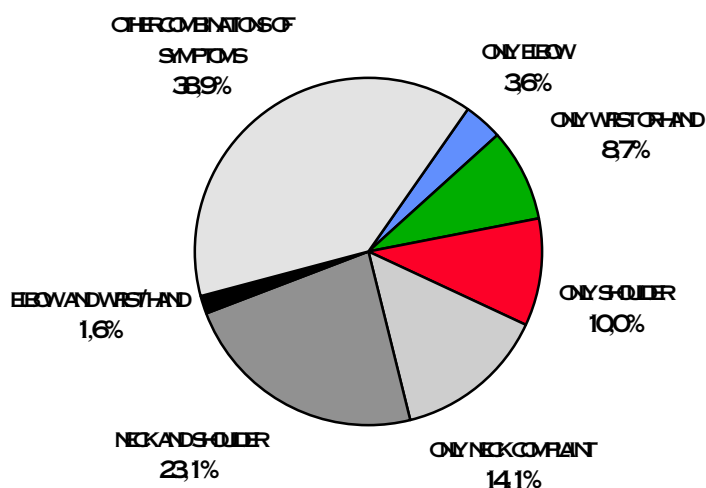


Figure B Relative contribution of each individual symptom of neck, shoulder, elbow and wrist or hand to the total group of persons with symptoms

Table 5 (appendix) shows the prevalence of work related neck or upper limb symptoms, upper limb symptoms, and the individual work related neck, shoulder, elbow, and wrist or hand symptoms by occupation. Neck or upper limb symptoms were most prevalent in tailors (47.2%), bricklayers and carpenters (43.0%), loaders, unloaders and packers (42.3%), secretaries (38.2%) and other craft occupations (35.5%) (Fig. 3).

Considering each individual type of complaint, work related neck symptoms were most prevalent in secretaries (31.8%), shoulder symptoms in tailors (30.6%), elbow symptoms in bricklayers and carpenters (12.7%), and wrist and hand symptoms in tailors (19.4%) (Table 3-3).

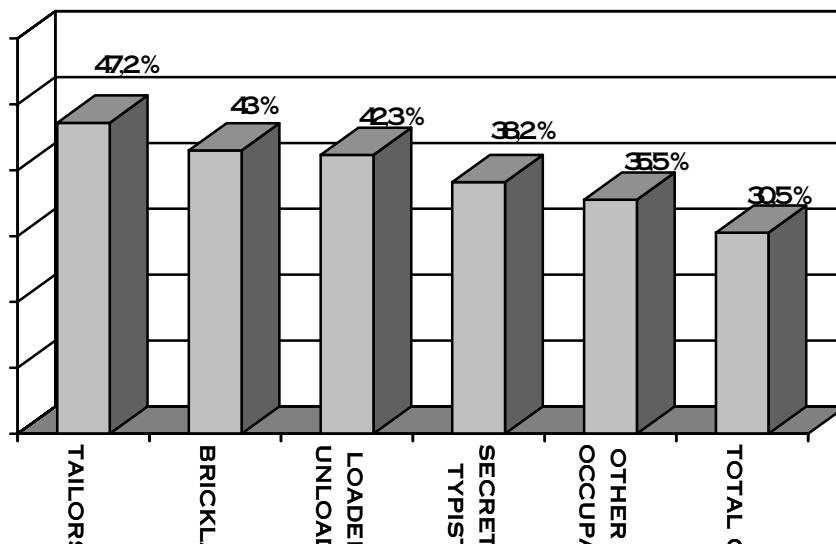


Figure C Occupations with high prevalence of work related neck and upper limb symptoms

Table 3-C High risk occupations and high risk industries with respect to prevalence of separate work related neck, shoulder, elbow, and wrist or hand symptoms

High risk occupations or industries	Type of symptom
occupations	
BRICKLAYERS, CARPENTERS AND OTHER BUILDING	ELBOW
TAILORS	SHOULDER WRIST OR HAND
SECRETARIES, TYPISTS	NECK
industries	
CONSTRUCTION	ELBOW WRIST OR HAND
HOTEL, RESTAURANT AND OTHER CATERING INDUSTRY	NECK SHOULDER

Table 6 (appendix) shows the prevalence of symptoms by industry. High prevalences were found in hotel, restaurant and other catering industry (40.4%), construction industry (37.7%), production industry (33.2%), and transportation (31.7%) (Fig. 4).

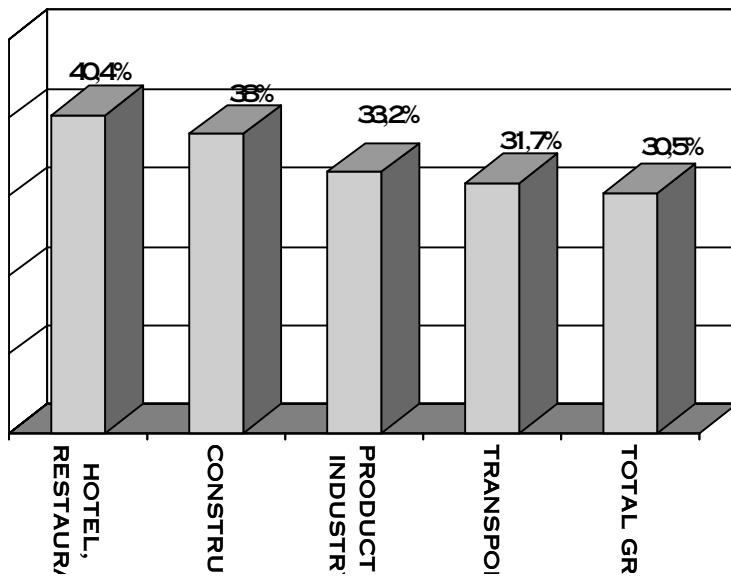


Figure D Industries with high prevalence of work related neck and upper limb symptoms

Work related neck and shoulder symptoms occurred most often in hotel, restaurant and other catering industry (22.8% and 26.5%). Work related elbow symptoms and wrist and hand symptoms were most prevalent in the construction industry (11.3% and 16.4%, respectively) (Table 3-3).

We also considered prevalence differences according to size of the company. In small-sized companies, defined as companies with 10 employees or less, the prevalence of work related neck and upper limb symptoms was 25.7%, whereas in medium-sized companies with a size between 11 and 100 employees, and in large companies with more than 100 employees, the prevalence of work related neck and upper limb symptoms was 31.2% and 31.0% respectively. When stratified according to workers in administrative jobs, the prevalence was 15.8% in small-sized enterprises, 29.1% in medium-sized enterprises and 33.4% in large enterprises. In production industry, the prevalence was 38.5% in small-sized enterprises, 33.9% in medium-sized enterprises and 29.4% in large enterprises. Within the construction industry, the prevalence was 33.0% in small-sized enterprises, 37.3% in medium-sized enterprises and 45.3% in large enterprises (Fig. 5).

3.2.4 Preventive measures reported by employees

In Table 7 (appendix), frequencies of preventive measures that were taken during the past 12 months and additional measures that are still desired are presented by occupation. Machinery or instruments to diminish heavy workload were procured most often among tailors

(19.1% compared to 11.7% in the total group). Courses for the prevention of musculoskeletal disorders were given most often in service occupations (12.2% compared to 6.0% in the total group). If all preventive measures were regarded together, it can be seen that many preventive measures are taken in the group of loaders, unloaders and packers, engineer fitters, and other administrative personnel. Despite this, additional preventive measures were desired most often in engineer fitters, machine-metal workers, other craft occupations, and loaders, unloaders and packers.

Frequencies of preventive measures taken and preventive measures that are still desired in different industries are presented in Table 8 (appendix). Preventive ac-

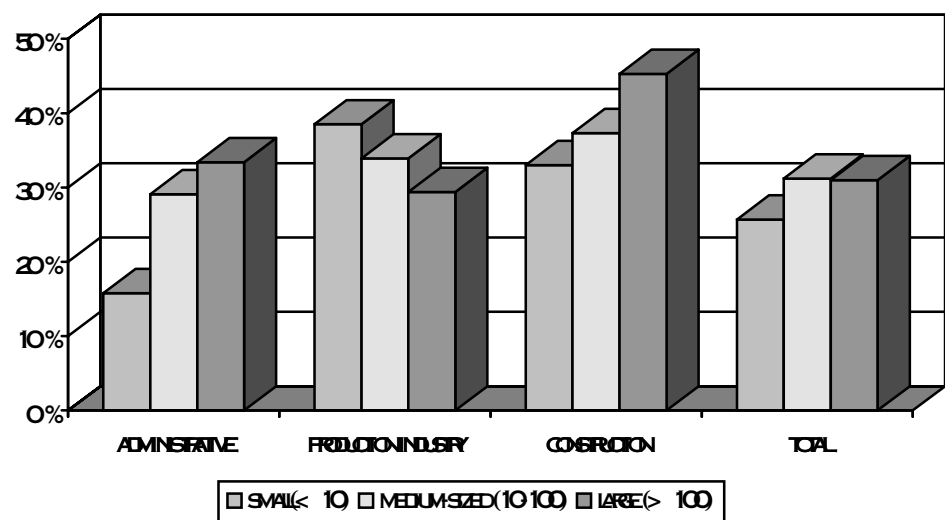


Figure E Prevalence of work related neck or upper limb symptoms by size of the company

tions during the last 12 months were most often taken in health care and welfare. In production industry and public authorities, high frequencies of preventive measures taken were observed also. Machinery was procured most frequently in health care and welfare; courses to prevent musculoskeletal disorders were given most often in hotel, restaurant and other catering industry. Preventive measures regarding physical load were desired most often by construction workers; preventive measures regarding workstress were desired most often by educational personnel. Additional measures in general were most often wished for in production industry, construction, and health care and welfare (Table 3-4).

Table 3-D Occupational and industrial groups in which many preventive measures are taken or additional preventive measures are desired

Occupations	Industries
many preventive measures taken	
LOADERS, UNLOADERS, PACKERS (ENGINEER FITTERS) (OTHER ADMINISTRATIVE)	HEALTH CARE AND WELFARE (INDUSTRY) (PUBLIC AUTHORITIES)
many preventive measures desired	
LOADERS, UNLOADERS, PACKERS ENGINEER FITTERS MACHINE-METAL WORKERS OTHER CRAFT OCCUPATIONS	INDUSTRY CONSTRUCTION HEALTH CARE AND WELFARE

3.3 Work related risk factors for neck and upper limb symptoms

In Table 9 (appendix), the results with regard to the association between the physical and psychosocial risk factors and the work related neck and upper limb symptoms are presented. The strength of the association is estimated by means of the crude and adjusted ORs; the 95% confidence interval indicates the precision of the estimate. In general it can be remarked that all crude risk estimates were increased and that they decreased drastically after adjustment for all other risk factors. Furthermore, almost all crude and adjusted risk factors were statistically significantly different from unity and some were of borderline significance. Women appeared to have a higher risk of work related neck and upper limb symptoms than men (OR=1.45, 95%CI:1.22-1.51). After adjustment for all other variables, moderately increased ORs were observed for bending of the neck (OR=1.49, 95%CI:1.30-1.70), bending of the wrists (OR=1.41, 95%CI:1.22-1.63), and working with rotated neck (OR=1.60, 95%CI:1.40-1.84). Also, moderately increased ORs were found for working in prolonged posture (OR=1.60, 95%CI:1.42-1.80), and use of vibrating tools (OR=1.35, 95%CI:1.13-1.60). No associations were found between perform-

ing short repetitive tasks of less than 1.5 minute (OR=1.04, 95%CI:0.88-1.23) or performing repetitive movements with arm, hand or fingers (OR=1.16, 95%CI: 1.01-1.34) and neck and upper limb symptoms. With regard to psychosocial risk factors, high quantitative job demands were moderately associated with symptoms (OR=1.56, 95%CI:1.38-1.75), just as working with low social support (OR=1.56, 95%CI:1.35-1.80), and a low job satisfaction in general (OR=1.85, 95%CI:1.56-2.17). When we excluded neck symptoms from the analyses and investigated risk factors for upper limb symptoms, the strength of the associations did not change much.

Risk factors for neck, shoulder, elbow, and wrist or hand symptoms separately are presented in Table 10 (appendix). Bending of the neck (OR=2.06, 95%CI:1.74-2.44) and working with a bended neck (OR=2.08, 95%CI:1.79-2.43) were strongly associated with work related neck symptoms. These factors were also moderately associated with shoulder symptoms (OR=1.59, 95%CI:1.34-1.88 and OR=1.50, 95%CI:1.29-1.76, respectively). Slight associations were found between performing short repetitive tasks of less than 1.5 minute, repeated movements of arm, hand or finger and elbow and wrist symptoms. Use of vibrating tools had the strongest association with elbow complaints (OR=1.72, 95%CI:1.33-2.23). Bending of the wrist and working with bended wrists were strong risk factors for wrist symptoms (OR=2.70, 95%CI:2.11-3.47 and OR=2.02, 95%CI:1.64-2.49, respectively).

The performance of tasks such as short repetitive tasks, working with bended wrists, or working in the same posture for long period, may indicate largely differing levels of physical load and different types of physical load in different occupations. Therefore, risk factors for neck and upper limb symptoms were investigated in three occupational groups separately, i.e. bricklayers en carpenters (first column of Table 1), metal workers and engineer fitters (third and fourth column of Table 1), and secretaries en typists (seventh column of Table 1). The results are presented in Table 11 (appendix). Firstly, bricklayers, carpenters and other building occupations are considered. Fulltime work was significantly associated with work related neck and upper limb symptoms in bricklayers (OR=8.46, 95%CI:1.55-46.02). A moderately increased risk of statistical significance was observed for bending of the neck (OR=2.27, 95%CI:1.12-4.59). Increased ORs were also found for reaching with arms or hands (OR=2.08, 95%CI:1.14-3.77) and working with high quantitative job demands (OR=3.93, 95%CI:2.04-7.57). Regarding metal workers and engineer fitters, working in prolonged posture yielded an increased OR of 2.59 (95%CI:1.44-4.65). With regard to psychosocial load, a low job satisfaction in general was significantly associated with work related neck and upper limb symptoms (OR=2.85, 95%CI:1.39-5.88) in metal workers and engineer fitters. In the group of secretaries and typists, bending of the neck was strongly associated with work related neck and upper limb symptoms (OR=3.12, 95%CI:1.72-5.65). An increased OR was also seen for working in prolonged posture (OR=1.81, 95%CI:1.05-3.12). Three psychosocial variables were associated with work related neck and upper limb symptoms in secretaries and typists: low skill discretion (OR=2.08, 95%CI:1.13-3.82), low social

support (OR=2.03, 95%CI:1.02-4.04) and low job satisfaction in general (OR=2.04, 95%CI:0.97-4.35).

3.4 Company related risk factors for neck and upper limb symptoms

First, all company related factors reported by the employer, such as taking preventive measures, socio-economic position of the company and policies regarding work and health, were disaggregated to the level of the individual employee. We investigated the influence of this disaggregation on the strength and the precision of the effect estimate by means of multilevel logistic regression. From the results that are shown in Table 13 (appendix), it can be seen that both differences between crude as between adjusted ORs can be neglected. The 95% confidence intervals were slightly narrower when analyses were performed with conventional logistic regression models.

Results of multivariate logistic regression analyses of eight factors probably related to the risk of neck and upper limb disorders are shown in Table 12 (appendix). No moderately or strongly increased ORs were observed for these company related factors. Employees working in companies with a bad or moderate socio-economic position had only a slightly higher risk of having neck or upper limb symptoms of 10%, but the (conventionally calculated) confidence interval just included 1.00. A high sick-leave percentage was also slightly associated with symptoms, but this factor can hardly be considered a risk factor. Indicators of poor practices regarding preventive measures were not associated with a higher occurrence of work related neck or upper limb symptoms.

4. Discussion and conclusions

4.1 Results

In this study we found an overall prevalence of 30% of neck or upper limb symptoms in the Dutch working population in the past year. High risk occupations with respect to work related neck or upper limb symptoms are bricklayers (elbow problems), tailors (shoulder and wrist or hand problems), and secretaries and typists (neck problems). High risk industries are construction (elbow and wrist or hand problems) and hotel, restaurant, and other catering industry (neck and shoulder problems). When all symptoms are considered at the same time, high prevalences are also found in loaders, unloaders and packers, other craft occupations, and production industry and transportation. Prevalence rates differed by size of the company, but no unequivocal effect was observed. In the total group of employees in the study population, the prevalence increased by size of the company, although the difference between medium-sized and large enterprises was small. In administrative and construction workers, the prevalence also increased by company size, but in the group of industrial workers the prevalence decreased by increasing size of the company.

We did not find any strong risk factors for the group of work related neck or upper limb symptoms. Moderate associations were found for prolonged flexed posture and working with rotated neck, high quantitative job demands, low social support, and low job satisfaction. The last factor may also be considered an intermediate factor between risk factors and symptoms. Sex was also a risk factor for the occurrence of symptoms. To evaluate whether this was due to prevalence increases in specific occupations, we stratified the occupation-specific prevalence calculations according to men and women. In all occupations that could be compared between men and women, women reported more neck or upper limb symptoms than men.

Slightly stronger associations were observed for the separate work related neck, shoulder, elbow and wrist symptoms: neck problems were associated with bending of the neck and working with a rotated neck, elbow problems were associated with use of vibrating tools, and wrist complaints were associated with bending of the wrists and working with bended wrists. Although short repetitive tasks were not associated with neck or upper limb symptoms in general or with neck or shoulder problems, a slight association was found for elbow and hand or wrist symptoms.

In contrast with the present situation in The Netherlands, during the period of data-collection of this study, only part of the companies had commissioned an occupational safety and health service. During that time, risk assessments were not obligatory either. Therefore, we were able to evaluate the effect of these situations. Whether in a company a risk assessment was performed or preventive measures were taken, did not have any influence on the occurrence of work related neck or

upper limb symptoms. In addition, the size or the socio-economic position of the company were not associated with the risk of symptoms either.

Occupations and industries in which physical and psychosocial risk factors were often reported were bricklayers, tailors, loaders, unloaders and packers, and industry. Loaders, unloaders and packers, and production industry workers reported that many preventive measures were taken at work during the past 12 months, but they still desired that more preventive measures would be taken.

4.2 Methodological limitations

There are several methodological aspects of this study that deserve attention. Firstly, the response rate was low: 35% when compared with the total number of questionnaires that was distributed, and 48% when companies of which no questionnaires were returned were excluded from the denominator. It is likely that this response was selective as well: employees with health problems were probably more eager to respond than employees who did not have any problems. Therefore, the overall prevalence figure of 30.5% is probably overestimated due to selective response. Furthermore, it is remarkable that almost two thirds of those reporting symptoms reported two or more symptoms of neck or upper limb.

Secondly, in this cross-sectional study both independent and dependent variables are self-reports measured with a questionnaire. Little information was available on duration, frequency, severity of the complaints, and disability due to the complaints. Therefore, not all complaints included in this study are clinically relevant or will lead to serious disorders in time. Furthermore, several publications have shown that the validity of self-reported physical exposure is questionable. The ability of self-administered questionnaires to discriminate between exposed and non-exposed is acceptable, but the ability to quantify the duration and the frequency of exposure in more detail is generally poor. In the questionnaire that was used for the present study, duration and frequency of exposure were not asked for and so the validity of the self-reported risk factors may be acceptable. However, in addition, in cross-sectional studies the perception of symptoms may bias the self-assessment of work load which may result in health based differential misclassification of exposure and thus in spurious associations (Viikari-Juntura et al, 1996; Wiktorin et al, 1993).

In this study work related neck and upper limb symptoms were defined as 'having had any pain or discomfort from neck, arm, elbow, wrist or hand, in past 12 months'. Therefore, we were not able to separate incidentally occurring symptoms from chronic and frequently occurring symptoms and disorders. As a result, we refer to work related neck and upper limb symptoms rather than to work related neck and upper limb disorders in this report.

The study population is not representative of the Dutch working population. As a result of the sampling procedure in this study, a larger part of the employees working in small companies than of the employees working in large companies was sam-

pled, resulting in an overrepresentation of employees working in small enterprises. Since the prevalence of neck or upper limb symptoms was slightly lower in small-sized companies (26% versus 31%), the overall prevalence is probably an underestimate due to this effect.

In the study population of the 'Monitor on Stress and Physical Workload' industrial and construction workers are overrepresented, whereas wholesale trade, transportation and service workers are underrepresented in comparison to the Dutch work population. We investigated the influence of this form of selection bias on the overall prevalence of work related neck and upper limb symptoms. After adjustment for the distribution of industries in the general population in The Netherlands (CBS, 1996), a prevalence of 29.7% was found. Thus, only a slightly lower overall prevalence is observed after adjustment for selection bias according to distribution of industry.

In conclusion, the estimated prevalence of work related neck and upper limb symptoms may be slightly overestimated or underestimated due to the fact that the study sample was not fully representative of the Dutch working population. However, these effects are small. The likely range of the prevalence estimate varies between 29% and 31%. The effect of the low and probably selective response may be large and cannot be estimated.

A two-step sample was drawn to obtain the study population of employees and to collect the data. As a consequence of this, two problems may arise when analysing the data. Firstly, in two stage sampling, observations within a macro unit, such as employees within a company, may be correlated. Secondly, the data that are collected are of different levels. When company related factors that are obtained from the employer are disaggregated, i.e. attributed to all employees in a company, the sample size is exaggerated, because the data are treated as if they were independent observations, whereas in fact there is no independence (Snijders and Bosker, 1999, in press). Multilevel logistic regression analyses were performed to be able to adjust for the dependence of the observations in the sample and to simultaneously analyse independent and dependent variables on different levels in a methodologically correct way. However, since the results did not differ from analyses in which company factors were disaggregated, we presented the results from the analyses with conventional logistic regression models.

4.3 Comparison with the literature

Our results, especially the results regarding prevalence rates of neck and upper limb disorders, can be compared with a limited number of conducted studies. In a study in an administrative population (Hoogendoorn and Bongers, in preparation), almost one third of the employees with an administrative function doing computer work appeared to have one or more regularly occurring or or prolonged complaints of neck, shoulder, arm or wrist during the past 12 months. These figures are compara-

ble with the prevalence figures of 38.2% for administrative personnel and 23% for bookkeepers and cashiers that were found in the present study. It has to be marked, however, that in the Hoogendoorn study the prevalence concerns 'regular or long-lasting complaints', while in the present study it concerns 'ever having had a complaint' during the last 12 months. In a recently published Dutch study among more than 2000 visual display unit workers who worked with a visual display unit at least two hours per day, more than half of the respondents reported to have complaints of neck, shoulder, arms, wrist or fingers: 47% sometimes had complaints, 9% often had complaints (Massaar, 1998) In comparison, 27% of the employees who did not work with VDUs reported complaints of the neck or upper extremity.

In a study in an industrial population in The Netherlands (Hoogendoorn and Bongers, in preparation), 28.6% of industrial and other not administrative personnel reported to have at least one of shoulder, elbow, and wrist symptoms, which can be compared with 28.5% upper limb complaints (so without neck symptoms) that were reported in the production industry in the present study. Again, in the Hoogendoorn study it concerns regular or long-lasting complaints, while in the present study it concerns ever having had a complaint during the last 12 months.

In the study of Otten et al (1998) which was performed with Dutch population-based data, and in which the category with RSI related symptoms was identically defined as in our study, an overall prevalence of RSI related symptoms of 19% was found. Obviously this figure is much lower than the prevalence of 30.5% that we found in the present study. One of the most obvious reasons for this discrepancy is the low and probably selective response that we were concerned with in the Monitor on Stress and Physical Load, probably overestimating the prevalence of work related neck and upper limb symptoms.

Although the estimated response in this study of work related neck and upper limb symptoms is high, others (in non-representative studies) have reported similar high prevalences. However, in the only other large scale representative survey, the reported prevalences are much lower, although the industry specific prevalences were quite similar. Therefore, we conclude that the prevalence of work related neck and upper limb symptoms in high risk occupations is around 25-30% and in the total working population between 20% and 30%. As indicated earlier this prevalence concerns self-reported work related symptoms, and not diagnosed disorders.

When we compare the rank orders of industry-specific prevalences from both studies, it can be seen that the five industries with the highest prevalences in our study (hotel, restaurant and catering industry, construction, industry, transportation and environmental and cultural services) were identical to the rank order top five of Otten et al, with the exception of agriculture, which was not represented in our sample and thus could not be included in the study.

Absolute prevalence estimates differed. For instance, the prevalence in the hotel, restaurant and catering industry was 40.4% in the present study and 22% in the

study of Otten et al, the prevalence in the construction industry was 38% in our study and 23% in the study of Otten et al, and the prevalence of work related neck and upper limb symptoms in the production industry was 33% in the present study whereas it was 20% in the study of Otten et al.

We can conclude that the following industries are high risk branches for self-reported work related neck and upper limb disorders: hotel, restaurant and other catering industry, construction industry, production industry, and transportation.

With regard to the identification of risk factors, the questions on the presence of risk factors in our questionnaire were slightly more detailed than the CBS questions of Otten et al (1998). The factors that can be compared are repetitive movements, prolonged flexed posture, use of vibrating tools, high work rate, low control, negative atmosphere, and gender. Although 'short repetitive tasks of less than 1.5 minute' and 'repetitive movements with arm, hand or finger' were not associated with work related neck or upper limb symptoms in the present study, Otten et al observed an OR of 1.84 (95%CI: 1.51-2.24) for 'often performing repetitive movements or using force with arms or hands'. Use of force was only slightly associated with neck or upper limb symptoms in our study: (OR=1.23, 95%CI: 1.04-1.44). The association with 'prolonged posture' was comparable: in the CBS study ORs of 2.36 (95%CI: 1.93-2.88) and 1.36 (95%CI: 1.04-1.79) were found for 'often working with prolonged posture of upper part of the body' and 'sometimes working with prolonged posture of upper part of the body', whereas we found an OR of 1.60 (95%CI: 1.42-1.80) for 'prolonged flexed posture of the body'. Our results showed a similar association with the use of vibrating tools compared to Otten et al (1998): OR=1.35 (95%CI: 1.13-1.60) in the present study versus ORs of 1.28 (95%CI: 1.01-1.65) for frequent use and 1.32 (95%CI: 0.97-1.80) for infrequent use of vibrating tools. In the total population high quantitative job demands, low decision authority and low social support were not associated with RSI related symptoms in the study of Otten et al (1998). In the present study, high quantitative job demands (OR=1.56, 95%CI: 1.38-1.75) and low social support (OR=1.56, 95%CI: 1.35-1.80) yet were moderately associated with work related neck and upper limb symptoms. The higher risk for women compared to men that was found by Otten et al was of the same magnitude as that observed in our study after adjustment for confounders (OR=1.55 versus OR=1.45).

Company related factors of neck and upper limb disorders were not studied or reported before. In this study, we did not find any evidence of their importance with respect to the occurrence of symptoms either.

4.4 Conclusion

Thus, in conclusion, women have a higher risk of work related neck and upper limb symptoms than men, even when other risk factors are taken into account. From the occupational factors, prolonged flexed posture is a consistent risk factor across studies and across occupations, although of moderate magnitude. Repetitive move-

ment or short cycled work seems to be less important, although it may be associated with symptoms in specific occupations and in particular in relation to wrist symptoms. In addition, use of vibrating tools is systematically associated with self reported work related neck and upper limb symptoms. The associations between work related psychosocial risk factors are not consistent across studies. In the present study, in addition to high work demands and low support, low job satisfaction was quite strongly associated with the symptoms under study.

5. Recommendations

Additional representative survey data are necessary to obtain a more definite and more refined picture of the prevalence of work related neck and upper limb symptoms in the Dutch working population. Furthermore, it is recommended that:

- relationships between the risk factors and the separate symptoms of neck, shoulder, elbow or wrist are verified
- the observed risk factors are analysed in relation to more detailed complaints, so that more serious disorders can be analysed separately
- not only self-reported exposures and symptoms are analysed, but also observed exposures in relation to more objectively obtained health complaints
- longitudinal data are analysed, in order to get better insight into causal relationships and in the natural course of the disease (How do incidentally occurring symptoms develop into longlasting serious health complaints?)

Most of these research questions can be addressed with currently available data sources in The Netherlands such as the ZARA Monitor, the POLS population survey 1998, and the Dutch prospective study on risk factors for musculoskeletal disorders.

Regarding policy making, the following industrial branches and occupations deserve priority because they have high prevalences of symptoms:

- hotel, restaurant and other catering industry, especially regarding neck and shoulder symptoms
- construction industry, especially regarding elbow and wrist or hand problems
- production industry
- transportation
- tailors, especially with regard to shoulder, and wrist or hand problems
- bricklayers, carpenters and other building occupations, especially with regard to elbow symptoms
- loaders, unloaders and packers
- secretaries and typists, especially regarding neck symptoms
- other craft occupations

Within these branches and occupations, action should be directed primarily towards reduction of prolonged flexed posture and working with a rotated neck. Also, women deserve specific attention in all industry branches. The occupation-specific risks that deserve most attention are:

- reaching with arms or hands and high quantitative job demands for bricklayers, carpenters and other building occupations
- working in prolonged flexed posture for machine-metal workers
- bending of the neck and working with low support for secretaries and typists.

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Appendix

Table 1 Physical and psychosocial risk factors for work related neck and upper limb symptoms; occurrence in several occupational groups in The Netherlands

	BRICK- LAYERS, CARPEN- TERS A O BUILDING OCC (N=535) %	TAI- LORS (N=72) %	ENGI- NEER FIT- TERS (N=252) %	MA- CHINE- METAL WORK- ERS (N=226) %	OTHER CRAFT OCCUPA- TIONS (N=224 O) %	LOAD- ERS, UN- LOAD- ERS, PACK- ERS (N=196) %	SECRE- TARIES, TYP- ISTS (N=531) %	BOOK- KEEP- ERS, CASH- IERS (N=348) %	OTHE R AD- MIN- ISTR (N=10 89) %	COMMER- CIAL OCCUPA- TIONS (N=882) %	SERV- ICE OC- CUPA- TIONS (N=115 9) %	MEDI- CAL, SCIEN- TIFIC, MANAGE- MEN- TAND OTHER (N=274 8) %	TOTAL (N=108 13) %
WOMEN	0.9	63.9	1.2	2.7	9.0	15.8	98.7	48.6	60.7	38.7	62.5	40.6	37.2
SHIFT WORK	2.5	2.8	9.2	18.3	15.8	28.9	1.7	1.2	2.1	3.4	15.6	12.8	10.6
FULLTIME WORK	96.4	67.1	96.8	96.8	95.2	92.1	55.1	77.8	72.1	82.1	49.2	72.3	77.5
SHORT REPETI- TIVE TASKS <1,5 MIN	12.9	15.3	5.5	19.9	13.1	18.9	13.2	13.5	8.5	9.3	8.3	7.0	10.2
REPEATED MOVEMENTS WITH ARM, HAND, FINGERS	73.9	74.3	54.4	54.8	56.5	73.2	86.5	65.3	62.5	40.5	51.5	35.8	52.8
REPEATED MOVEMENTS WITH HEAD BENDING OF NECK	53.3	47.8	26.4	35.3	34.0	56.5	49.7	39.6	38.1	23.5	33.0	21.0	32.2
BENDING OF WRISTS	73.7	72.1	53.5	49.8	59.7	71.7	63.1	50.1	49.8	37.5	56.4	39.9	51.5
ROTATED NECK BENDED WRISTS REACHING WITH	87.5	77.9	77.3	67.1	69.9	73.9	55.6	42.3	39.8	33.6	58.5	39.4	53.6
ROTATED NECK BENDED WRISTS REACHING WITH	48.8	61.4	32.7	29.0	33.7	41.3	44.5	39.5	39.1	19.9	29.3	23.0	31.5
	61.9	65.2	51.8	41.0	43.0	54.1	43.1	29.6	26.8	16.8	35.1	21.3	33.4

ARMS / HANDS	54.9	44.1	35.0	29.8	31.3	44.0	11.3	7.2	9.6	13.8	31.8	14.5	22.7
ARMS RAISED	48.6	24.2	32.4	20.9	28.3	30.6	11.0	3.2	5.0	9.1	22.6	10.3	17.8
PROLONGED FLEXED POS- TURE	55.9	79.1	35.5	43.8	49.4	55.4	69.9	62.6	58.1	37.1	33.9	33.7	45.1
USE OF VIBRAT- ING TOOLS	42.4	17.1	42.9	23.6	25.1	8.9	0.2	0.0	0.4	0.8	5.3	4.3	11.3
USE OF FORCE	41.4	22.6	53.6	34.4	30.9	14.2	0.2	-	0.2	1.0	7.7	7.7	14.0
HIGH JOB DE- MANDS	21.5	19.4	15.7	15.9	22.6	32.1	23.9	20.1	26.2	28.6	20.2	27.4	24.3
LOW DESICION AUTHORITY	9.7	19.4	7.5	6.6	12.1	20.9	4.3	2.9	3.8	6.5	13.8	10.9	9.7
LOW SKILL DIS- CRETION	8.4	20.8	6.3	13.3	10.4	31.1	13.7	6.0	8.9	7.5	15.6	5.0	9.5
LOW SOCIAL SUPPORT	15.3	16.7	17.6	18.6	20.5	29.1	12.6	13.5	14.2	11.7	13.5	14.0	15.7
LOW JOB SAT- ISFACTION	9.8	2.9	15.7	14.2	13.9	11.9	10.6	8.4	10.6	7.4	7.2	8.5	10.0

Table 2 Physical and psychosocial risk factors for work related neck and upper limb symptoms; occurrence in several industries in The Netherlands

	PRO- DUCTION INDUS- TRY (N=3470) %	CON- STRUC- TION (N=903) %	WHOLE- SALE TRADE AND REPARA- TION (N=1276) %	HOTEL, RES- TAURAN T A. O. CATER- ING IN- DUSTRY (N=136) %	TRANS- PORTA- TION (N=476) %	FINAN- CIAL SERV- ICES (N=199) %	REAL ESTATE AND BUSI- NESS- LIKE SERV- ICES (N=1003) %	PUBLIC AUTHORI- TIES (N=943) %	EDUCA- TION (N=35 4) %	HEALTH CARE AND WEL- FARE (N=1286) %	ENVIRON- MENTAL, CUL- TURAL AND OTHER SERV- ICES (N=466) %	TOTAL (N=1081 3) %
WOMEN	21.3	7.5	40.6	66.2	26.9	50.3	43.4	34.8	56.8	79.5	52.6	36.9
SHIFT WORK	13.3	0.7	5.2	23.4	24.0	5.6	2.8	6.6	0.9	23.3	9.1	10.7
FULLTIME WORK	91.0	94.0	80.4	46.3	83.5	86.9	73.6	82.7	60.6	37.9	60.7	77.7
SHORT REPETI- TIVE TASKS <1,5 MIN	13.5	8.3	11.4	23.5	14.3	7.5	9.1	6.7	1.7	4.3	11.2	10.2
REPEATED MOVEMENTS WITH ARM, HAND, FINGERS	58.4	66.4	55.6	64.9	56.0	50.8	55.8	51.3	17.1	34.9	56.4	53.3
REPEATED MOVEMENTS WITH HEAD	34.9	43.3	33.8	41.1	40.6	30.6	31.7	31.8	12.6	22.7	32.5	32.8
BENDING OF NECK	52.9	68.3	50.8	69.5	58.5	50.8	49.2	45.2	36.0	50.4	49.5	52.3
BENDING OF WRISTS	61.3	78.2	53.7	79.7	52.7	35.6	47.4	38.7	23.0	47.1	53.8	54.5
ROTATED NECK	35.3	43.8	28.8	28.8	28.1	29.5	29.9	34.1	13.7	26.6	28.7	32.0
BENDED WRISTS	40.7	54.6	31.2	49.3	29.8	21.1	30.4	26.0	6.3	23.0	34.0	34.1
REACHING WITH ARMS / HANDS	24.9	45.7	25.3	48.8	22.4	6.6	14.6	13.2	8.4	21.7	22.2	23.4
ARMS RAISED	20.9	43.1	17.1	30.8	17.4	7.2	10.0	9.8	6.7	12.8	22.3	18.5

PROLONGED FLEXED POSTURE	50.0	55.0	44.8	38.6	54.4	46.2	44.4	53.5	14.5	27.2	48.3	45.5
USE OF VIBRATING TOOLS	17.5	40.5	7.4	3.1	6.1	0.0	3.5	6.6	0.3	1.6	8.8	11.9
USE OF FORCE	19.6	42.6	10.8	6.8	14.6	-	6.1	7.8	1.9	7.8	8.0	14.7
HIGH JOB DEMANDS	23.9	26.5	24.0	22.1	22.5	28.1	24.8	26.9	27.1	21.5	24.7	24.3
LOW DECISION AUTHORITY	10.4	7.8	10.1	20.6	15.3	6.0	5.9	5.4	18.1	12.6	10.5	10.1
LOW SKILL DISCRETION	12.9	5.6	13.9	26.5	11.1	5.0	9.5	4.1	4.0	6.1	8.4	9.9
LOW SOCIAL SUPPORT	20.6	17.2	16.1	13.2	14.5	13.1	12.5	15.9	11.6	10.7	13.9	16.2
LOW JOB SATISFACTION	12.5	11.1	10.2	8.1	9.1	7.6	6.5	10.0	8.9	7.6	9.2	10.2

Table 3 Potential company related risk factors for work related neck and upper limb symptoms; occurrence in several occupational groups in The Netherlands

	BRICK- LAYERS, CARPEN- TERS A O BUILD- ING OCC (N=535) %	TAI- LORS (N=72) %	ENGI- NEER FITTERS (N=252) %	MA- CHINE- METAL WORK- ERS (N=226) %	OTHER CRAFT OCCUPA- TIONS (N=224 0) %	LOAD- ERS, UN- LOAD- ERS, PACK- ERS (N=196) %	SECRE- TARIES, TYPISTS (N=531) %	BOOK- KEEP- ERS, CASH- IERS (N=348) %	OTHER ADMIN- ISTR (N=108 9) %	COMMER- CIAL OCCUPA- TIONS (N=882) %	SERV- ICE OC- CUPA- TIONS (N=115 9) %	MEDI- CAL, SCIEN- TIFIC, MANAGE- MEN- TAND OTHER (N=274 8) %	TOTAL (N=10 813) %
NO OCCUPA- TIONAL SAFETY AND HEALTH SERVICE	17.5	9.9	24.9	31.9	21.2	14.0	14.8	16.8	21.3	15.0	6.8	12.6	16.2
NO PREVENTIVE MEASURES FOR PHYSICAL LOAD	23.7	53.5	20.9	14.6	19.9	13.5	28.0	29.2	23.5	31.8	24.8	23.9	23.9
NO GENERAL PREVENTIVE MEASURES	32.0	67.6	39.9	32.3	36.5	29.0	33.5	34.7	26.0	45.7	31.0	29.3	33.2
NO RISK AS- SESSMENT	41.0	60.6	32.0	35.4	32.4	20.2	34.8	33.5	27.5	36.8	36.7	34.0	33.8
POOR OR MOD- ERATE FINAN- CIAL POSITION	9.9	11.3	15.6	15.9	15.1	18.4	11.6	15.2	18.2	10.2	17.4	17.3	15.4
NO POLICY RE- GARDING SICK LEAVE*	10.5	5.9**	14.9	17.5	14.9	13.0	15.3	12.2	6.5	17.2	7.0	12.8	12.3
HIGH SICK LEAVE (> 5%)	32.0	8.5	38.3	41.6	29.5	36.3	28.8	27.7	40.5	19.4	41.1	40.8	34.6
SMALL COMPA- NIES (< 10)	12.0	25.4	12.8	11.1	10.7	6.3	11.5	11.4	8.0	18.5	10.0	9.6	10.9
LARGE COMPA- NIES (> 100)	13.9	8.5	26.0	13.5	22.2	28.6	30.4	24.6	44.1	19.0	34.6	37.7	29.8

* THIS QUESTION WAS ONLY ASKED IN HALF OF THE COMPANIES

** ONLY 17 TAILORS IN TOTAL IN THIS PART OF THE STUDY POPULATION

Table 4 Potential company related risk factors for work related neck and upper limb symptoms; occurrence in several industries

	PRODUC- TION INDUS- TRY (N=347 0) %	CON- STRUC- TION (N=903) %	WHOLE SALE TRADE AND REPA- RATION (N=127 6) %	HOTEL, RES- TAURAN T A. O. CATER- ING INDUS- TRY (N=136) %	TRANS- PORTA- TION (N=476) %	FINAN- CIAL SERV- ICES (N=199) %	REAL ES- TATE AND BUSINESS- LIKE SERVICES (N=1003) %	PUBLIC AUTHOR ITIES (N=943) %	EDU- CATION (N=354) %	HEALTH CARE AND WEL- FARE (N=128 6) %	ENVIRON- MENTAL, CULTURAL AND OTHER SERVICES (N=466) %	TOTAL (N=1081 3) %
NO OCCUPA- TIONAL SAFETY AND HEALTH SERVICE	20.3	31.3	16.6	1.5	14.2	29.1	7.7	26.0	3.7	3.7	14.9	16.9
NO PREVENTIVE MEASURES FOR PHYSICAL LOAD	17.2	19.6	35.4	27.4	42.5	49.2	35.1	11.7	43.3	18.7	32.3	24.4
NO GENERAL PREVENTIVE MEASURES	33.5	45.5	49.2	39.3	42.5	51.3	39.7	4.4	44.2	21.6	42.5	34.5
NO RISK AS- SESSMENT	33.5	40.8	38.6	34.8	39.7	29.6	41.7	18.9	45.0	30.6	43.3	34.9
POOR OR MOD- ERATE FINAN- CIAL POSITION	15.2	15.3	14.4	3.1	13.7	18.6	9.2	27.3	23.6	18.0	9.5	15.5
NO POLICY RE- GARDING SICK LEAVE*	13.6	20.6	34.2	-	30.5	-	0.0**	0.0	20.1	6.5	-	12.8
HIGH SICK LEAVE (> 5%)	33.7	39.8	13.1	27.4	22.4	0.0	13.9	80.1	62.3	54.2	20.5	35.7
SMALL COMPA- NIES (< 10)	9.1	10.4	21.1	20.0	10.8	18.6	13.9	0.6	9.3	6.3	19.8	10.9
LARGE COMPA- NIES (> 100)	24.4	10.5	16.7	0.0	9.5	18.1	17.0	79.7	9.1	64.8	12.5	29.4

* THIS FACTOR WAS ONLY ASKED IN HALF OF THE COMPANIES

** ONLY 22 PERSONS IN TOTAL IN REAL ESTATE BUSINESS IN THIS PART OF THE STUDY POPULATION

Table 5 Prevalence of self reported work related neck and upper limb symptoms in past 12 months in several occupational groups in The Netherlands

	BRICK-LAYERS, CARPENTERS, OTHER BUILDING (N=535)	TAILORS (N=72)	ENGINEER FITTERS (N=252)	MACHINISTS METAL WORKERS (N=226)	OTHER CRAFT OCCUPATIONS (N=224)	LOADERS, UNLOADERS, PACKERS (N=196)	SECRETARIES, TYPISTS (N=531)	BOOKKEEPERS, CASHIERS (N=348)	OTHER ADMINISTRATIVE (N=1089)	COMMERCIAL OCCUPATIONS (N=882)	SERVICE OCCUPATIONS (N=1159)	MEDICAL, SCIENTIFIC, MANAGEMENT OTHER (N=2748)	TOTAL (N=10813)
	%	%	%	%	%	%	%	%	%	%	%	%	%
WORK RELATED NECK SYMPTOMS	23.0	27.8	17.6	11.9	20.1	23.5	31.8	20.4	22.8	15.2	18.4	17.8	19.8
WORK RELATED SHOULDER SYMPTOMS	25.8	30.6	16.5	18.6	20.3	26.5	27.5	13.5	19.8	12.0	20.0	15.4	18.7
WORK RELATED ELBOW SYMPTOMS	12.7	5.6	9.8	5.8	9.7	11.7	5.8	2.6	3.1	2.4	6.3	3.6	6.0
WORK RELATED WRIST OR HAND SYMPTOMS	18.1	19.4	13.7	16.4	15.2	17.3	14.3	7.2	6.8	6.6	9.3	7.4	10.7
WORK RELATED NECK OR UPPER LIMB SYMPTOMS	43.0	47.2	33.3	32.7	35.5	42.3	38.2	23.0	26.7	21.2	30.5	25.2	30.5
WORK RELATED UPPER LIMB SYMPTOMS	37.9	38.9	29.4	30.5	30.6	37.2	32.6	18.1	21.6	16.0	26.6	20.3	25.4
EMOTIONAL EXHAUSTION	3.7	4.2	3.5	3.1	4.8	7.7	2.4	2.9	3.6	2.7	3.9	4.0	4.0

Table 6 Prevalence of self reported work related neck and upper limb symptoms in past 12 months in several industries in The Netherlands

	PRODUC- TION INDUS- TRY (N=347 0) %	CON- STRUC- TION (N=903) %	WHOLE SALE TRADE AND REPA- RATION (N=127 6) %	HOTEL, RESTAU- RANT A. O. CA- TERING INDUS- TRY (N=136) %	TRANS- PORTA- TION (N=476) %	FINAN- CIAL SERV- ICES (N=199) %	REAL ESTATE AND BUSI- NESS- LIKE SERV- ICES (N=100 3) %	PUBLIC AUTHO- RITIES (N=943) %	EDUCA- TION (N=35 4) %	HEALTH CARE AND WELFARE (N=1286) %	ENVIRON- MENTAL, CULTURAL AND OTHER SERVICES (N=466) %	TOTAL (N=1081 3) %
WORK RELATED NECK SYMPTOMS	20.1	20.2	16.9	22.8	20.4	22.6	19.1	21.1	18.1	20.5	20.6	19.8
WORK RELATED SHOULDER SYMPTOMS	19.5	23.5	16.5	26.5	20.0	20.6	18.0	18.0	16.9	18.1	21.5	18.9
WORK RELATED ELBOW SYMP- TOMS	7.1	11.3	5.2	8.8	7.6	5.5	4.7	4.6	3.7	4.2	4.9	6.2
WORK RELATED WRIST OR HAND SYMPTOMS	14.0	16.4	10.0	13.2	10.1	6.5	8.1	6.9	2.3	8.4	9.2	10.9
WORK RELATED NECK OR UPPER LIMB SYMPTOMS	33.2	37.7	27.9	40.4	31.7	27.6	26.3	27.0	22.6	28.6	28.8	30.5
WORK RELATED UPPER LIMB SYMPTOMS	28.5	33.7	23.0	34.6	26.7	22.6	20.4	21.0	19.2	23.6	26.4	25.7
EMOTIONAL EX- HAUSTION	4.5	4.0	3.6	4.4	4.6	3.5	2.3	3.9	8.8	3.0	3.9	4.0

Table 7 Preventive measures taken during the past 12 months in several occupational groups, reported by employees in The Netherlands

	BRICK-LAYERS, CARPENTERS AND BUILDING OCC (N=535)	TAILORS (N=72)	ENGINEER FITTERS (N=252)	MACHINISTS METAL WORKERS (N=226)	OTHER CRAFT OCCUPATIONS (N=224)	LOADERS, UNLOADERS, PACKERS (N=196)	SECRETARIES, TYPISTS (N=531)	BOOKKEEPERS, CASHIERS (N=348)	OTHER ADMINISTRATORS (N=108)	COMMERCIAL OCCUPATIONS (N=882)	SERVICE OCCUPATIONS (N=115)	MEDICAL, SCIENTIFIC, MANAGEMENT AND OTHER (N=274)	TOTAL (N=10813)
	%	%	%	%	%	%	%	%	%	%	%	%	%
MACHINERY / INSTRUMENTS	17.7	19.1	16.3	14.6	16.3	17.1	5.8	5.3	5.8	7.3	11.3	11.6	11.7
JOB ROTATION	4.3	7.6	9.4	4.7	7.7	17.0	6.1	7.7	8.7	5.8	8.6	6.8	7.4
ADDING TASKS	12.4	21.2	21.5	15.7	16.9	27.9	25.2	25.9	24.3	21.3	18.2	18.6	19.5
COURSE ON PREVENTION OF MUSCULOSKELETAL SYMP	9.7	0.0	3.1	3.2	3.4	7.4	4.0	2.6	3.6	3.1	12.2	7.9	6.0
COURSE ON PREVENTION OF WORKSTRESS	2.0	0.0	0.4	0.5	1.8	4.8	2.1	2.1	3.0	1.0	8.4	5.6	3.6
HEALTH CONSULTING HOUR	7.1	3.0	12.0	9.1	10.8	5.9	9.7	14.7	16.4	6.0	7.0	12.0	10.6
MORE MEASURES DESIRED REGARDING PHYSICAL LOAD	58.2	50.0	56.0	58.1	52.2	61.7	30.1	25.4	30.3	27.3	39.6	33.1	39.9
MORE MEASURES DESIRED REGARDING WORKSTRESS	52.0	54.7	61.9	54.9	60.3	60.8	47.8	47.1	54.3	46.8	51.7	57.5	55.2

Table 8 Preventive measures taken during the past 12 months in several industries, reported by employees in The Netherlands

	PRODUC- TION INDUS- TRY (N=347 0) %	CON- STRUC- TION (N=903) %	WHOLE SALE TRADE AND REPA- RATION (N=127 6) %	HOTEL, RES- T A. O. CATER- ING INDUS- TRY (N=136) %	TRANS- PORTA- TION (N=476) %	FINAN- CIAL SERV- ICES (N=199) %	REAL ESTATE AND BUSI- NESS- LIKE SERV- ICES (N=1003) %	PUBLIC AUTHORI- TIES (N=943) %	EDUCA- TION (N=354) %	HEALTH CARE AND WELFARE (N=1286) %	ENVIRON- MENTAL, CULTURAL AND OTHER SERVICES (N=466) %	TOTAL (N=1081 3) %
MACHINERY	14.2	14.4	12.7	9.2	9.1	2.1	7.6	6.9	1.5	17.5	8.4	12.0
INSTRUMENTS												
JOB ROTATION	9.3	3.8	8.8	8.0	7.4	5.2	5.4	6.4	4.8	7.1	8.6	7.5
ADDING TASKS	21.1	14.4	22.6	19.2	15.7	14.9	17.2	22.2	13.0	21.3	19.2	19.7
COURSE ON PREVENTION OF MUSCULO- SKELETAL SYMP	4.1	5.8	2.8	17.4	3.5	3.6	5.1	6.5	2.3	16.7	5.2	6.1
COURSE ON PREVENTION OF WORK- STRESS	1.8	2.0	1.3	2.3	3.3	1.5	2.9	6.2	5.2	10.6	2.7	3.6
HEALTH CON- SULTING HOUR	13.6	5.6	3.2	0.0	4.4	4.6	8.5	27.8	5.2	9.4	5.9	10.6
MORE MEAS- URES DESIRED REGARDING PHYSICAL LOAD	49.7	50.5	34.9	37.2	40.9	26.6	26.1	33.3	20.6	39.8	34.4	40.4
MORE MEAS- URES DESIRED REGARDING WORKSTRESS	59.1	55.3	48.8	31.3	54.2	47.9	41.8	64.9	66.0	58.9	49.5	55.5

Table 9 Physical and psychosocial risk factors for work related neck or upper limb symptoms in The Netherlands

	SYMPTOMS N=3275)	NO SYMPTOMS (N=7475)	OR	95% CI	ORADJ ¹	95% CI
SEX WOMEN	1287	2651	1.18	1.09-1.28	1.45	1.22-1.51
SHIFT WORK	364	758	1.10	0.97-1.26	1.09	0.92-1.29
FULLTIME WORK	2562	5739	1.08	0.98-1.20	1.12	0.97-1.30
SHORT REPETITIVE TASKS < 1.5 MIN	439	665	1.59	1.40-1.81	1.04	0.88-1.23
REPEATED MOVEMENT WITH ARM, HAND, FINGERS	2265	3376	2.76	2.53-3.02	1.16	1.01-1.34
REPEATED MOVEMENTS WITH HEAD	1557	1831	2.84	2.59-3.11	0.95	0.82-1.09
BENDING OF NECK	2290	3101	3.40	3.10-3.72	1.49	1.29-1.72
BENDING OF WRISTS	2318	3317	3.18	2.90-3.48	1.41	1.21-1.64
REACHING WITH ARMS / HANDS	1166	1284	2.70	2.46-2.97	1.23	1.07-1.42
ARMS RAISED	962	949	2.90	2.61-3.21	1.20	1.03-1.39
PROLONGED FLEXED POSTURE	2050	2695	3.00	2.75-3.27	1.60	1.42-1.80
ROTATED NECK	1668	1643	3.73	3.41-4.08	1.60	1.40-1.84
BENDED WRISTS	1696	1815	3.44	3.15-3.76	1.13	0.98-1.31
USE OF FORCE	670	756	2.38	2.12-2.67	1.23	1.04-1.44
USE OF VIBRATING TOOLS	613	637	2.46	2.19-2.78	1.35	1.13-1.60
HIGH QUANTITATIVE JOB DE- MANDS	1146	1479	2.19	2.00-2.40	1.56	1.38-1.75
LOW DECISION AUTHORITY	451	643	1.70	1.50-1.93	1.05	0.88-1.26
LOW SKILL DISCRETION	431	632	1.65	1.44-1.87	1.28	1.07-1.54
LOW SOCIAL SUPPORT	843	907	2.52	2.27-2.79	1.56	1.35-1.80
LOW JOB SATISFACTION	608	482	3.31	2.92-3.77	1.85	1.56-2.17

¹ ADJUSTED FOR ALL OTHER
RISK FACTORS AND AGE

Table 10 Physical and psychosocial adjusted risk factors for separate work related neck, shoulder, elbow, and wrist symptoms in The Netherlands

	NECK N _{CASES} =2130 N _{CONTROLS} =8683		SHOULDER N _{CASES} =2036 N _{CONTROLS} =8777		ELBOW N _{CASES} =667 N _{CONTROLS} =10146		HAND OR WRIST N _{CASES} =1172 N _{CONTROLS} =9641	
	ORADJ ¹	95% CI	ORADJ ¹	95% CI	ORADJ ¹	95% CI	ORADJ ¹	95% CI
SEX WOMEN	1.79	1.54-2.08	1.92	1.64-2.22	0.76	0.57-1.01	1.30	1.06-1.59
SHIFT WORK	1.10	0.91-1.34	1.04	0.86-1.27	1.31	0.97-1.75	0.99	0.78-1.25
FULLTIME WORK	1.06	0.90-1.25	1.09	0.92-1.28	1.14	0.83-1.57	1.13	0.91-1.41
SHORT REPETITIVE TASKS < 1.5 MIN	0.97	0.81-1.17	1.02	0.85-1.22	1.28	0.98-1.68	1.26	1.02-1.55
REPEATED MOVEMENT OF ARM, HAND, FINGERS	1.09	0.93-1.29	1.07	0.91-1.26	1.48	1.12-1.97	1.24	1.00-1.53
REPEATED MOVEMENTS OF HEAD	1.06	0.91-1.24	1.05	0.89-1.23	0.97	0.76-1.25	0.81	0.67-0.99
BENDING OF NECK	2.06	1.74-2.44	1.59	1.34-1.88	1.57	1.18-2.08	0.90	0.73-1.11
BENDING OF WRISTS	1.00	0.84-1.20	1.22	1.02-1.46	1.39	1.01-1.92	2.70	2.11-3.47
REACHING WITH ARMS / HANDS	1.04	0.89-1.22	1.18	1.01-1.38	0.96	0.75-1.23	1.22	1.02-1.47
ARMS RAISED	1.15	0.97-1.36	1.46	1.24-1.73	1.48	1.15-1.90	1.19	0.99-1.44
PROLONGED FLEXED POSTURE	1.65	1.44-1.90	1.53	1.33-1.76	1.29	1.02-1.62	1.54	1.28-1.83
ROTATED NECK	2.08	1.79-2.43	1.50	1.29-1.76	0.92	0.71-1.19	0.96	0.79-1.17
BENDED WRISTS	0.89	0.75-1.06	1.06	0.90-1.26	1.49	1.12-1.97	2.02	1.64-2.49
USE OF VIBRATING TOOLS	0.97	0.79-1.18	1.27	1.05-1.53	1.72	1.33-2.23	1.38	1.12-1.70
USE OF FORCE	0.93	0.77-1.12	1.12	0.94-1.35	1.20	0.92-1.55	1.29	1.05-1.58
HIGH QUANTITATIVE JOB DEMANDS	1.68	1.47-1.91	1.50	1.32-1.71	1.26	1.02-1.55	1.37	1.16-1.61
LOW DECISION AUTHOR- ITY	1.02	0.84-1.24	1.00	0.82-1.21	0.90	0.67-1.22	1.16	0.93-1.46
LOW SKILL DISCRETION	1.14	0.93-1.39	1.23	1.01-1.49	1.66	1.23-2.23	1.45	1.16-1.82
LOW SOCIAL SUPPORT	1.56	1.33-1.82	1.46	1.25-1.71	1.45	1.14-1.83	1.31	1.09-1.59
LOW JOB SATISFACTION	1.72	1.43-2.04	1.64	1.37-1.96	1.41	1.08-1.81	1.56	1.27-1.92

¹ ADJUSTED FOR ALL
OTHER RISK FACTORS

AND AGE

Table 11 Physical and psychosocial risk factors for work related neck or upper limb symptoms in bricklayers and carpenters, machine-metalworkers, and secretaries and typists in The Netherlands

	BRICKLAYERS, CARPENTERS (N=535)		MACHINE-METALWORKERS (N=481)		SECRETARIES, TYPISTS (N=531)	
	ORADJ ¹	95%CI	ORADJ ¹	95%CI	ORADJ ¹	95%CI
SHIFT WORK	0.16	0.01-1.67	0.59	0.26-1.35	0.50	0.09-2.82
FULLTIME WORK	8.46	1.55-46.02	1.85	0.31-11.19	1.08	0.70-1.68
SHORT REPETITIVE TASKS < 1.5 MIN	0.78	0.37-1.64	0.82	0.37-1.85	0.80	0.43-1.47
REPEATED MOVEMENT OF ARM, HAND, FINGERS	1.14	0.59-2.23	1.27	0.68-2.38	1.01	0.47-2.14
REPEATED MOVEMENT OF HEAD	0.54	0.28-1.03	1.09	0.57-2.09	1.10	0.67-1.79
BENDING OF NECK	2.27	1.12-4.59	1.26	0.66-2.40	3.12	1.72-5.65
BENDING OF WRISTS	1.43	0.59-3.48	1.30	0.62-2.75	1.10	0.60-2.02
REACHING WITH ARMS / HANDS	2.08	1.14-3.77	1.25	0.67-2.31	0.53	0.27-1.03
ARMS RAISED	0.95	0.53-1.70	1.26	0.64-2.48	1.04	0.53-2.07
PROLONGED FLEXED POSTURE	0.77	0.44-1.36	2.59	1.44-4.65	1.81	1.05-3.12
ROTATED NECK	1.42	0.74-2.69	0.75	0.38-1.46	1.03	0.61-1.73
BENDED WRISTS	1.15	0.59-2.24	0.95	0.49-1.84	1.20	0.67-2.13
USE OF VIBRATING TOOLS	1.41	0.86-2.33	1.46	0.81-2.63	-	
USE OF FORCE	1.31	0.79-2.17	1.43	0.80-2.54	-	
HIGH QUANTITATIVE JOB DE- MANDS	3.93	2.04-7.57	1.09	0.55-2.14	1.21	0.73-2.02
LOW DECISION AUTHORITY	1.69	0.63-4.54	1.12	0.36-3.49	0.59	0.19-1.81
LOW SKILL DISCRETION	2.56	0.94-6.92	0.89	0.34-2.36	2.08	1.13-3.82
LOW SOCIAL SUPPORT	0.94	0.44-2.03	1.24	0.64-2.40	2.03	1.02-4.04
LOW JOB SATISFACTION	1.01	0.41-2.43	2.85	1.39-5.88	2.04	0.97-4.35

¹ ADJUSTED FOR ALL OTHER RISK FACTORS, SEX, AND AGE

Table 12 Potential company related risk factors for work related neck or upper limb symptoms in The Netherlands

	SYMPTOMS (N=3275)	NO SYMPTOMS (N=7475)	OR	95% CI	ORADJ ¹	95% CI
NO OCCUPATIONAL SAFETY AND HEALTH SERVICE	557	1214	1.08	0.95-1.22	1.05	0.93-1.19
NO RISK ASSESSMENT	1114	2540	1.00	0.91-1.11	1.03	0.93-1.15
NO PREVENTIVE MEASURES TAKEN REGARDING PHYSICAL LOAD	754	1802	0.95	0.85-1.06	0.97	0.87-1.08
NO GENERAL PREVENTIVE MEASURES TAKEN	1097	2516	1.00	0.91-1.09	1.03	0.92-1.15
SMALL COMPANIES (1-10)	292	845	0.79	0.67-0.92	0.77	0.66-0.90
LARGE COMPANIES (> 100)	955	2113	0.95	0.86-1.05	0.97	0.87-1.07
POOR OR MODERATE SOCIO-ECONOMIC POSITION	517	1033	1.15	1.02-1.29	1.12	1.00-1.26
HIGH SICK-LEAVE PERCENTAGE (MORE THAN 5%)	1217	2521	1.16	1.06-1.28	1.15	1.04-1.26
NO POLICY REGARDING SICK-LEAVE ²	244	555	0.92	0.79-1.09	-	

¹ ADJUSTED FOR ALL OTHER RISK FACTORS

² ASKED IN ONLY HALF OF THE COMPANIES

Table 13 Odds ratios for the effect of company related factors on RSI prevalence estimated with conventional logistic regression (company related factors de-aggregated to individual level) and estimated with multilevel logistic regression analyses in The Netherlands

	CONVENTIONAL (ONE LEVEL) LOGISTIC REGRESSION			MULTILEVEL LOGISTIC REGRESSION		
	CRUDE OR	95% CI	ADJUSTED ¹ OR	CRUDE OR	95% CI	ADJUSTED ¹ OR
NO SERVICE FOR OCCUPATIONAL SAFETY AND HEALTH	1.08	0.95-1.22	1.09	1.05	0.89-1.23	1.12
NO PREVENTIVE MEASURES	0.95	0.85-1.06	0.98	0.91	0.79-1.04	0.97

TAKEN REGARDING PHYSICAL
LOAD

NO RISK INVENTORY AND AS- ASSESSMENT	1.00	0.91-1.11	1.02	0.97	0.86-1.11	1.04
HIGH SICK-LEAVE PERCENTAGE (MORE THAN 5%)	1.16	1.06-1.28	1.18	1.20	1.05-1.37	1.19
SMALL COMPANIES (1-10)	0.79	0.67-0.92	0.78	0.77	0.64-0.92	0.77
LARGE COMPANIES (> 100)	0.95	0.86-1.05	0.88	0.99	0.86-1.16	0.91

¹ ADJUSTED FOR ALL OTHER
RISK FACTORS