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

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TNO Work and Employment (formerly NIA TNO) is a service organization in the areas of innovation of work, organization and technology, and employment research.
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Contents

Samenvatting

Arbeidsgebonden klachten van nek en bovenste extremiteiten (RSI): risicoberoepen en risicofactoren in de Belgische 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. 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 de resultaten beschreven van een onderzoek naar de prevalentie van en risicofactoren voor klachten van de nek en bovenste extremiteiten, dat uitgevoerd is in het kader van het SAFE-programma van de Europese Commissie. De resultaten zijn verkregen met behulp van een vragenlijst-onderzoek dat in 1998 in België is uitgevoerd onder 1100 werknemers uit ongeveer 100 bedrijven.
De prevalentie van werkgerelateerde klachten van nek, schouder, elleboog, hand of pols die de afgelopen 12 maanden waren opgetreden was 39.4%. Nek- en schouderklachten werden het vaakst gerapporteerd, respectievelijk door 27.6% en 21.7% van de werknemers. Ruim 15% van de werknemers rapporteerde pols of handklachten en 8% van de werknemers rapporteerde elleboogklachten te hebben gehad de afgelopen 12 maanden. Deze prevalentiecijfers zijn waarschijnlijk enigzins 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 en kleermakers (65.8%), metselaars, timmermannen en andere bouwvakkers (54.0%), en secretaresses (44.9%). Industrietakken waarin de meeste klachten gerapporteerd werden waren de bouw (47.8%) en de transportindustrie (44.4%).
Vrouwen bleken meer klachten van nek en bovenste extremiteiten te rapporteren dan mannen, ook na correctie voor leeftijd, aantal werkuren en alle mogelijke fysieke en psychosociale risicofactoren. Ook werden na correctie voor deze factoren verhoogd risico's gevonden voor vaak achtereen met gebogen polsen werken (odds ratio (OR)=2.0) en weinig sociale steun van leidinggevende en collega's (OR=1.9). Matig verhoogde risico's (statistisch significant verhoogde ORs rond 1,5) werden gevonden voor vaak dezelfde beweging maken met het hoofd, vaak buigen of draaien met de nek, hoge werkdruk en weinig regelmogelijkheden. Een licht verhoogd risico (OR=1,2) werd gezien voor vaak langdurig in dezelfde houding werken. Kortcyclisch werk (minder dan 1,5 minuut durende taken gedurende meer dan de helft van de werktijd), vaak vele malen per minuut dezelfde bewegingen maken met arm, hand of vingers, vaak ver reiken met handen of armen, en vaak armen geheven houden waren niet gerelateerd aan het optreden van de totale groep van nekklachten en klachten van de bovenste extremiteiten. De aantallen in de steekproef waren te klein om de groep met klachten uit te splitsen naar specifieke klachten in bepaalde lichaamsregio's.

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 cervobrachial 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 heterogenous group of disorders.

1.1.2 Risk factors

There is ample and consistent evidence that a variety of localised 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 aetiology 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. 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 Bernard (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, sewers, 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; Blatter and Bongers, 1999). Both Otten et al (1998) and Blatter and Bongers (1999) investigated the prevalence of work related upper limb symptoms within the last year with respectively population-based data from the Central Bureau for Statistics (CBS), and a company based sample from the monitor on Stress and Physical load (MSLB) Study in The Netherlands. Otten et al found a prevalence of work related symptoms of neck, shoulder, arm and hand of 19%; Blatter and Bongers found a prevalence of 30%. Compared with the company-based study in The Netherlands, the response rate was higher and probably less selective in the CBS study, which may be a likely explanation for the discrepancy observed. Industries with relatively high prevalence figures were agriculture (32% in CBS-study and not included in MSLB-study, respectively), environmental, cultural and other services (26% and 29%, respectively), transport and communication (24% and 32%), construction (23% and 38%), hotel, restaurant and other catering industry (22% and 40%), and production industry (20% and 33%, respectively). The prevalence of symptoms decreased by age and differed slightly between men and women (18% vs 20% found by Otten et al; 29% vs 33% found by Blatter and Bongers). The physical risk factors of RSI related symptoms that were identified in both studies by means of multivariate analyses were 'working in prolonged flexed posture with upper part of the body', and with smaller risk estimates, 'use of force', and 'use of vibrating tools'. Additional risk factors that were found in the population based study of Otten et al were 'repetitive movements' and 'working in inconvenient posture with upper part of the body'. Additional risk factors identified by Blatter and Bongers in the company-based study, that were moderately associated with symptoms, were 'bending of the neck', 'bending of the wrists', and 'working with a rotated neck'.

The purpose of the present project is to draw a relevant framework regarding prevalence figures of and risk factors for work related upper limb symptoms in Europe for the purpose of policy reasons. Therefore, it is necessary to substantiate the above findings with results from studies in other European countries, such as Belgium. The present study is conducted within the framework of the SAFE programme of the European Committee. The aim of the project described in this report 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 succesful policies at small and medium-sized entreprises (SMEs) in Belgium.

1.2 Research questions

The research questions of 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?
- how do these risk factors and high risk occupations and industrial branches compare to other European countries?

2. Population and Methods

2.1 Population

The study population of this cross-sectional study consisted of 1120 Belgian employees who were questioned in November and December 1998 by means of the Questionnaire on Work, Health and Repetitive Movements, and the 116 employers or personnel managers of these employees, who were interrogated by telephone interview. The population was composed by means of a two-step sampling procedure.

Firstly, 399 companies, representative of company size and industrial sector in Belgium were sampled from the so-called 'RSZ-repertory of companies' of 1995. However, as a consequence of this, only the private sector was included in the sample and public/government authorities and the educational sector were lacking. To be included in the sample, the companies had to employ at least five persons. When a company decided to participate, the personnel manager was interviewed by telephone. Because the willingness to distribute questionnaires among employees appeared to be low (44%) and large companies and companies in Brussels were largely underrepresented, an additional sample was drawn of 50 companies with at least 500 employees. In total, 439 companies were contacted.

Secondly, questionnaires were sent to the personnel manager, to be randomly distributed among all or part of the employees in the company. In companies with 60 employees, all employees were given a questionnaire, in companies which employed more than 60 but less than 100 persons, between 60 and 80 employees received a questionnaire. In companies which employed between 100 and 500 employees, 100-120 were given a questionnaire, and in companies with 500 employees or more, 150 questionnaires were handed out.

2.2 Methods

The interview of the personnel manager was short. Questions were asked about the exact size of the company, the proportion of employees that worked with visual display units and that performed repetitive work, whether these employees had work related complaints of neck and upper limb, and whether preventive measures were taken to diminish the time spent working with a VDU, repetitive work and the complaints associated with these types of work.

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, secundary 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 five questions on good atmosphere and support 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 identify occupational and industrial risk groups with a high overall physical and psychosocial load, the occupational groups with the five highest frequencies and industrial groups with the two highest frequencies on each individual risk factor were ap-

pointed first. Subsequently, occupational groups were indicated as 'high physical risk groups' if at least eight out of 11 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. Industrial groups were indicated as 'high physical risk groups' if at least eight out of 11 physical risk factors belonged to the two highest frequencies, and as 'high psychosocial risk groups' if at least four out of five psychosocial risk factors belonged to the two 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). ORs are statistically significantly different from unity when the confidence interval does not include one. 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.

3. Results

3.1 Response

Eventually, 236 personnel managers were contacted and interviewed. Although 22% (n=53) of the personnel managers refused to distribute questionnaires in their companies, questionnaires were received from 116 companies, which means that in 67 companies employers forgot or refused to circulate them after all, or that none of the workers responded. From the 6080 questionnaires that were sent to the companies, 1120 (18%) useful questionnaires were returned and included in the employee study population.

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

3.2.1 Potential risk factors

In general, short repetitive tasks of less then five minutes during at least 50% of the work-time were reported by 10% of the subjects. Risk factors that were reported often were repeated movements with arm, hand or fingers (58%), bending of the neck (53%) and working in prolonged flexed posture (64%) (Table 1, appendix).

Table 3-1 Occupations and industries with highest prevalences of physical risk factors

High risk occupations or industries	High overall physical risk*	Type of physical risk
occupations		
bricklayers, carpenters	•	bending of neck, reaching with arms / hands, arms raised, use of vibrating tools
tailors	•	short repetitive tasks < 1.5 min, repeated movements with arm, hand or fingers, repeated movements with head, bending of wrists, rotated neck, bended wrists, prolonged flexed posture
machine metal workers	•	-
industries		
other craft industries		short repetitive tasks < 1.5 min
construction		repeated movements with arm, hand or fingers, repeated movements with head, bending of neck, bending of wrists, rotated neck, bended wrists, reaching with arms / hands, arms raised, use of vibrating tools
financial services		prolonged flexed posture

* at least eight out of 11 physical risk factors must belong to the five highest prevalences of occupational categories and to the two highest prevalences of industrial categories

In Table 1 (appendix) the occupation-specific occurrence of potential physical and psychosocial risk factors for neck and upper limb symptoms is presented. Physical risk factors were most prevalent in tailors (Table 3-1). Another occupational group in which physical factors were very prevalent were bricklayers, carpenters and other building occupations. Overall physical risk was high in bricklayers, carpenters and other building occupations, tailors, and machine metal workers.

Large differences in the prevalence of physical risk factors were found regarding bending of the wrists (94% in tailors and 26% in commercial occupations), working with bended wrist (89% in tailors and 7% in commercial occupations), reaching with arms or hands (69% in bricklayers and 9% in bookkeepers), working with arms raised 63% in bricklayers and 2% in bookkeepers) and use of vibrating tools (67% in bricklayers and zero % in secretaries and bookkeepers).

Psychosocial risk factors were prevalent in tailors too (Table 3-2). Low social support was reported most often in machine metal workers. Overall high psychosocial load was high in other craft occupations.

Table 3-2 Occupations and industries with highest prevalences of psychosocial risk factors

High risk occupations and industries	High overall psychosocial risk*	Type of psychosocial risk
occupations		
tailors	•	high quantitative job demands, low decision authority, low skill discretion, low job satisfaction
machine metal workers		low social support
other craft occupations	•	-
industries		
energy, chemist, metal industry		high quantitative job demands, low job satisfaction
other craft industries		low decision authority, low skill discretion
transportation		low social support

* at least four out of five psychosocial risk factors must belong to the five highest prevalences of occupational categories, and to the two highest prevalences of industrial categories

In Table 2 (appendix), industry specific occurrences of physical and psychosocial risk factors are shown. Industries were categorised into six industrial categories. It is obvious that in the construction industry, physical risk factors are most prevalent (Table 3-1). In other craft industries, risk factors were also reported often. Differences between industries are mostly not very large, except for use of vibrating tools (42% in construction and 5% in hotel, restaurant and other catering industry).

High quantitative job demands were reported most often by workers in energy, chemist and metal industry; in other craft industries, low decision authority, low skill discretion and low job satisfaction were most prevalent. Low social support

was most often reported in transportation industry. No industries could be identified that met our criteria of a high overall psychosocial risk, but other craft industries almost met the criteria (Table 3-2).

3.2.2 Prevalence of work related neck and upper limb symptoms

The overall prevalence of work related neck or upper limb symptoms that occurred during the last year was 39.4%. From these 446 persons, 71% reported pain in the neck during the past 12 months, 56% reported shoulder problems, 20% reported pain in the elbow, and 39% reported pain in the wrist or hand (fig 1). Figure 2 shows the relative contribution of complaints of each separate part of the body to the total of work related neck and upper limb symptoms. Fourteen percent reported neck symptoms only, 7% reported shoulder symptoms only, almost 3% reported elbow symptoms only, and 6% reported hand or wrist symptoms only. The combination of neck and shoulder symptoms occurred in 19% and the combination of elbow and wrist or hand was reported by 1.3%. The other persons, comprising 49.6% of the subjects with symptoms, reported to have had symptoms of two other regions, of three regions of the neck or upper limb or symptoms of all four regions. When pain in the neck was excluded from the criteria for RSI related symptoms, the overall prevalence was 31.0%.

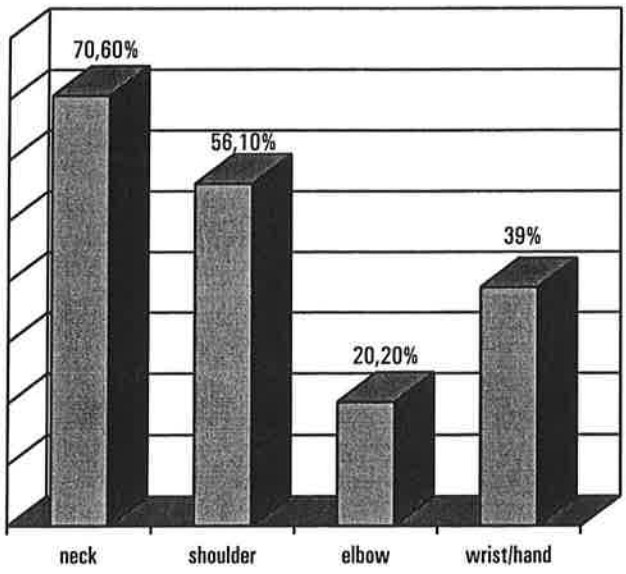

Figure 1 *Percentage of the persons with symptoms that reported pain in the neck, shoulder, elbow, wrist or hand*

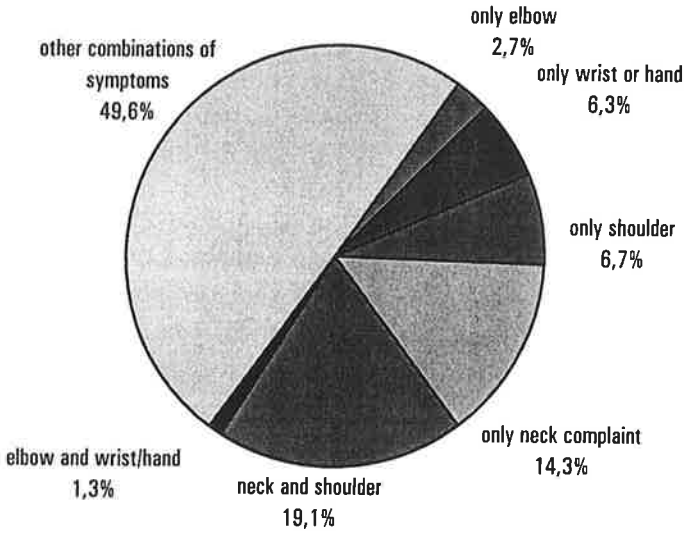

Figure 2 *Relative contribution of each individual symptom of neck, shoulder, elbow and wrist or hand to the total group of persons with symptoms*

Table 3 (appendix) shows the prevalence of work related neck or upper limb symptoms, upper limb symptoms, and the prevalence of separate work related neck, shoulder, elbow, and wrist or hand symptoms by occupation. Work related neck or upper limb symptoms were most prevalent in tailors (66%), bricklayers, carpenters and other building occupations (54%), secretaries and typists, machine metal workers (42%), and other craft occupations (40%) (figure 3). Considering neck and upper limb symptoms separately, it appeared that all symptoms were most prevalent in tailors: neck symptoms were reported by 58% of the tailors, shoulder symptoms by 50%, elbow symptoms by 24%, and wrist or hand symptoms by 45%. Moreover, the prevalence in tailors differed largely from other high prevalent occupations.

In table 4 (appendix) the prevalence of symptoms by industry is presented. Work related neck or upper limb symptoms were reported most often in the construction industry (48%), transport industry (44%) and financial services (43%). Prevalences in separate industries did not differ greatly from each other; in the hotel and other catering industry prevalence was the lowest, which was still 36%. Work related neck symptoms were most prevalent in transport industry (42%), shoulder symptoms (26%) and elbow symptoms (13%) in 'other craft industries', and wrist or hand symptoms in the construction industry.

We investigated whether the prevalence of work related neck or upper limb symptoms differed by size of the company that people worked in. Figure 4 shows the results of prevalence according to company size in the total population, and stratified into three groups: administrative occupations, production industry, (consisting of energy, chemist, metal and other craft industries), and the construction industry. In the total population of workers, the prevalence of symptoms was 36% in small

companies, 43% in medium-sized companies, and 39% in large companies. In administrative workers and in the construction industry the prevalence increased by size of the company: in administrative workers it was 30%, 37% and 41%, respectively; in the construction industry 38%, 48%, and 53%, respectively. However, in the production industry, the prevalence of symptoms decreased by size of the company (50% in small companies, 49% in medium-sized, and 34% in large companies).

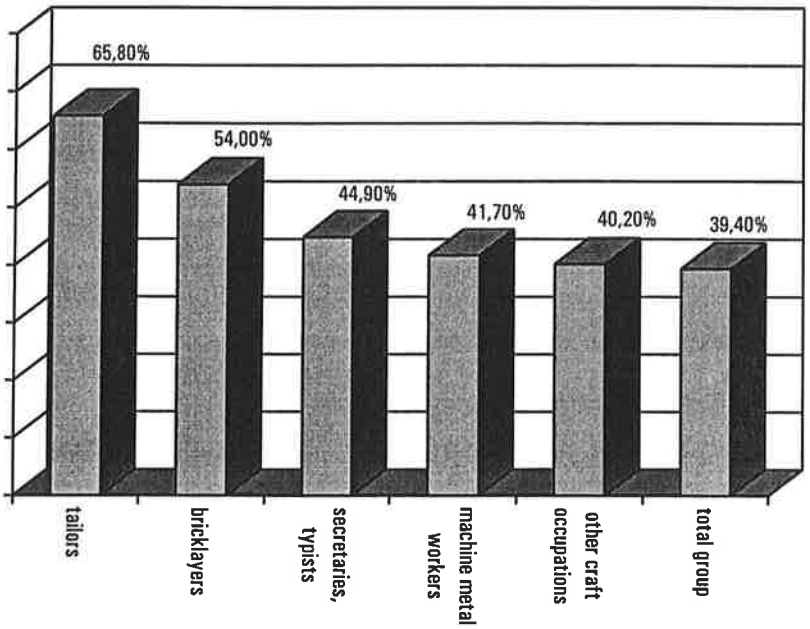

Figure 3 Occupations with high prevalence of work related neck and upper limb symptoms

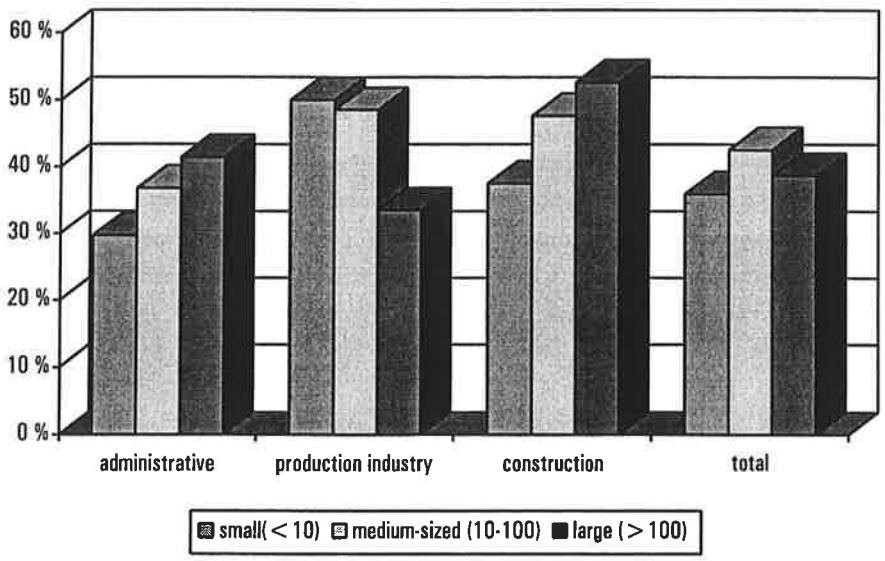

Figure 4 Prevalence of work related neck or upper limb symptoms by size of the company in Belgium

3.2.3 Self-reported preventive measures

Subjects were asked whether preventive measures regarding different aspects were taken during the past 12 months (Table 5 and Table 6, appendix). Fourteen percent reported that machinery or instruments were introduced to reduce physical load. Occupational groups reporting high frequencies of this preventive measure were machine metal workers (42%), bricklayers, and engineer fitters (both 31%) (table 5, appendix). Job rotation was reported by 7% of the total population. Occupations in which job rotation was reported more than average were service occupations (15%) and other craft occupations (14%). Adding tasks was the most reported preventive measure (24%); courses on the prevention of musculoskeletal symptoms and on the prevention of workstress were not often done, by 3% and 2.5% of the total population, respectively. In general, machine metal workers and subjects with other craft occupations reported the highest frequencies of preventive measures performed in the past 12 months. Occupations in which most measures or more additional measures regarding physical load and regarding workstress were desired were machine metal workers, workers with other craft occupations, and tailors.

In Table 6 (appendix), frequencies of reported preventive measures were categorised into industries. The introduction of machinery or instruments was frequently reported by construction workers and workers in other craft occupations. Adding tasks was relatively frequently reported by workers in hotel, restaurant and other catering industry (29%). Overall, workers in energy, chemist, and metal industry reported most often that preventive measures were performed during the past 12 months. Workers in other craft industries and in construction most often answered positively on the question whether more measures were desired regarding physical load (64% and 53%). Workers in energy, chemist, and metal industry and workers in other craft industries most often reported that they wanted more preventive measures regarding workstress to be taken (67% and 65%).

3.3 Risk factors for work related neck and upper limb symptoms

To identify physical and psychosocial risk factors for neck and upper limb symptoms, crude and adjusted odds ratios were calculated. The results of these analyses are presented in table 7 (appendix). In general it can be remarked that all univariately calculated risk estimates were increased and statistically different from unity for subjects with the risk factor compared to subjects without the risk factor, but that they decreased drastically after adjustment for all other risk factors.

With regard to physical load, repeated movements with the head and bending of the neck were moderately increased, with ORs of 1.52 (95%CI:0.98-2.35) and of 1.63 (95%CI:1.05-2.54) respectively. Performing short repetitive tasks of less than 1.5 minute and performing repeated movements with arm, hand or fingers were not associated with work related symptoms of neck or upper limb. Working in a pro-

longed flexed posture was only slightly and not statistically significantly associated with symptoms (OR=1.24; 95%CI:0.87-1.77). An increased risk was found for working with bended wrists (OR=1.96, 95%CI:1.21-3.20).

Almost all psychosocial factors that were measured were associated with work related neck or upper limb symptoms, also after adjustment for physical risk factors. Low social support was most strongly associated with neck or upper limb symptoms (OR=1.87, 95%CI:1.24-2.92). High quantitative job demands (OR=1.39, 95%CI: 0.99-1.97) and low decision authority (OR=1.48, 95%CI:0.91-2.38) were moderately associated with symptoms. Low job satisfaction, which may also be considered an intermediate factor, was also associated with symptoms (OR=1.82, 95%CI:1.13-2.93). Finally, women have a higher risk of neck and upper limb symptoms than men (OR=1.53, 95%CI:1.06-2.21).

Risk factors for separate neck, shoulder, elbow and wrist or hand symptoms are presented in table 8 (appendix). Women appear to have more neck symptoms, shoulder symptoms and hand or wrist symptoms than men, and somewhat less elbow symptoms. The strongest physical risk factor for neck symptoms was bending of the neck (OR=1.98, 95%CI:1.22-3.24), shoulder symptoms were moderately associated with working with a rotated neck (OR=1.74, 95%CI:1.04-2.91), which was the strongest risk factor for shoulder symptoms. Working with raised arms was the strongest risk factor for elbow symptoms (OR=2.14, 95%CI:0.98-4.65); bending of the wrists was strongly associated with hand or wrist symptoms (OR=4.09, 95%CI:1.97-8.50). The psychosocial factors 'high quantitative job demands' and 'low social support' were associated with all separate symptoms of neck, shoulder, elbow or wrist.

4. Discussion and conclusions

4.1 Results

In this study on prevalence and risk factors for work related neck or upper limb symptoms in the Belgian working population, we found an overall prevalence of work and upper limb symptoms occurring in the past 12 months of 39%. High risk occupations for neck and shoulder symptoms were tailors and secretaries; elbow and wrist or hand symptoms were also most prevalent in tailors, and in bricklayers, carpenters and other building occupations. High risk industries were the construction industry with respect to work related neck or upper limb symptoms in general. Neck symptoms were most prevalent in transport industry, shoulder and elbow symptoms in other craft industries, and wrist or hand symptoms in the construction industry. Prevalence rates of work related neck or upper limb symptoms varied by company size, but no unambiguous effect was observed. In the total population, the prevalence was highest in employees who worked in medium-sized entreprises (between 10 and 100 employees) and lowest in people working in small entreprises, with less than 10 employees. In administrative workers and in construction workers, the prevalence increased with company size; in the production industry (energy, chemist, metal industry and other craft industries) the prevalence decreased with size of the company.

Crude, univariate analyses yielded fairly strong risk factors, but after adjustment for all other factors we did not find strong risk factors for neck or upper limb symptoms in general anymore. Since many physical and psychosocial factors are correlated, adjustment for all other factors might have resulted in overadjustment. The strongest associations were found for working with bended wrist, low social support and low job satisfaction, although the last factor may also be considered an intermediate factor. Other factors, such as repeated movements with the head, bending of the neck, high quantitative job demands, and low decision authority were only moderately associated with symptoms after adjustment for other potential physical and psychosocial risk factors. Working in prolonged flexed posture was slightly associated with symptoms; short repetitive tasks and repeated movements did not appear to be associated with neck or upper limb symptoms in general.

Investigation of the separate work related symptoms of neck, shoulder, elbow, and hand or wrist revealed somewhat stronger risk factors. Bending of the neck was associated with neck symptoms, working with rotated neck was a risk factor for shoulder symptoms, working with the arms raised was a risk factor for elbow symptoms, and bending of the wrists was a strong risk factor for hand or wrist symptoms.

Occupations and industries in which physical and psychosocial risk factors were often reported were tailors, bricklayers and machine metal workers, construction

workers and other craft industries. Machine metal workers, workers with other craft occupations, and workers in energy, chemist and metal industry reported the highest frequencies of preventive measures that were taken. Occupational and industrial groups in which many workers desired additional preventive measures were machine metal workers, other craft occupations and industries, and tailors.

4.2 Methodological limitations

Some methodological limitations of this study deserve attention before the results are interpreted. Firstly, the response was very low: only 18% of the total number of questionnaires that was distributed was returned. This response did not seem to be very selective according to the industrial distribution of the population (see further on), but it is likely that this response was selective with regard to health status of the population: employees with health problems are probably more eager to respond than healthy workers. Therefore, the overall prevalence of 39% is likely to be overestimated due to the selective response. An indication of this may be found in the high proportion (70%) in workers reporting symptoms that reported two or more symptoms of neck, shoulder, elbow or hand or wrist.

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 prolonged 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.

Unfortunately, the study population is not totally representative of the Belgian working population. Due to differential response, the production industry and construction industry are slightly underrepresented whereas the hotel, restaurant and catering industry is overrepresented in comparison to the Belgian working popula-

tion. The production industry occupied 55% of the Belgian population (i.e. the total population except government institutions, the educational sector and the quartaire sector), whereas it made up 45% of the study population; construction made up 15% of the Belgian working population and 12,6% of the study population. The hotel industry occupied 9% of the Belgian population and 22% of the study 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 Belgium, a prevalence of 40% was found, which does not differ substantially from 39.4%.

Furthermore, as a consequence of the sampling procedure, that made use of the so-called "RSZ repertory of companies," government institutions and the educational, health, welfare and cultural sectors were not included in the sample at all. Since the prevalence of neck and upper limb symptoms is not estimated in these industrial sectors in Belgium, we cannot adjust the total prevalence rate according to this bias due to selective sampling. However, from estimates in The Netherlands, we know that industry specific prevalence figures were lower than average in education, government institutions, health care and environmental, social and cultural services. If this finding is representative of the Belgian situation, we may conclude that the prevalence of 39.4% is an overestimate of the real prevalence in the Belgian working population.

Another result of the sampling procedure in this study is that a larger part of the employees working in small companies was sampled than of the employees working in large companies. Although one would expect an overrepresentation of employees working in small enterprises in the study population, employees in small companies were underrepresented (11% in the study population, compared to 20% in the total Belgian working population (RSZ, 1998)) and employees working in large companies were overrepresented (56% compared to 48%). Since the prevalence of neck and upper limb symptoms was slightly lower in small-sized companies (36% vs 42% in medium-sized companies and 39% in large companies) the overall prevalence estimate adjusted for this effect is slightly lower, i.e. 39.3%. In conclusion, due to selection and sampling procedures, the prevalence rates are probably overestimated. Unfortunately, this overestimation cannot be quantified.

In this study, 1120 questionnaires of employees could be used for the analyses. Due to small numbers in specific occupational categories, such as engineer fitters (n=16), machine metal workers (n=24) and loaders and unloaders (n=11), occupation-specific estimates of frequencies and prevalences lack precision. However, for reasons of comparability with the Dutch study mentioned in the next paragraph, we kept the categorisation of occupations the same as in the Dutch study.

4.3 Comparison with results of the 'Monitor on Stress and Physical Load' in The Netherlands

In 1995 and 1996 in The Netherlands, a large company-based study was conducted among 1700 companies and 10.000 employees (Houtman et al, 1998). The questions about symptoms of neck and upper limb and risk factors asked to the employees were identical to the questions in the Belgian study described in this report. The results of work related neck and upper limb symptoms in The Netherlands are described by Blatter and Bongers (1999). Although the questions on symptoms and risk factors in the Belgian and Dutch study were identical, the populations were not quite the same. Although the proportions of female employees in the two studies were identical, i.e. one third of the population, the Belgian study population consisted of relatively more shift workers and less part-timers than the Dutch study population; moreover, government authorities and the educational sector were, in contrast with the Dutch study population, not included in the Belgian population. Finally, industries were categorised in a different manner in the Belgian and the Dutch study.

When the results of the Belgian study were compared with those of the Dutch study, remarkable similarities were observed. Firstly, the group of subjects that reported symptoms consisted of a comparable part of subjects with only neck symptoms, shoulder symptoms, elbow symptoms, hand or wrist symptoms, or subjects with two or more symptoms of neck or upper limb. Differences in the prevalence of symptoms that were seen in small, medium-sized and large entreprises in administrative workers, production industry and construction industry were comparable. Both in Belgium and in The Netherlands, the prevalence of neck or upper limb symptoms increased with increasing size of the company in administrative workers and in the construction industry; the prevalence decreased with increasing size of the company in the production industry.

The same occupational groups had the highest prevalences of symptoms of neck or upper limb symptoms in general: tailors had the highest prevalences in Belgium and The Netherlands, bricklayers had the second highest prevalence rate in Belgium and The Netherlands, secretaries were third in Belgium and fourth in The Netherlands, other craft occupations had the fifth highest prevalence of symptoms, both in Belgium and in The Netherlands.

Regarding frequencies of self reported risk factors, some risk factors were as often reported in Belgium as in the Netherlands, such as short repetitive tasks of less than 1.5 minute (both 10%), bending of the neck (53% vs 52%), working with bended wrists (35% vs 33%), working with the arms raised (17% vs 18%), high job demands (both 24%), low skill discretion (both 9%), low social support (18% vs 16%) and low job satisfaction (12% vs 10%). In some occupations in Belgium and the Netherlands, frequencies of physical risk factors, except 'prolonged flexed posture',

were very comparable, such as in 'other administrative workers', in 'medical, scientific and management workers', and in the construction industry.

Agreement was also observed for certain physical risk factors for neck or upper limb symptoms in general. Firstly, crude estimates of risk factors in Belgium and the Netherlands were quite comparable. Considering the adjusted estimates, short repetitive tasks of less than 1.5 minute and repeated movements of arm, hand or fingers did not appear to be risk factors for symptoms in general. Furthermore, adjusted increased risk estimates of bending of the neck, high quantitative job demands, low social support, and low job satisfaction were more or less the same. The last resemblance worth mentioning are the gender-specific prevalence rates of the separate symptoms of neck, shoulder, elbow and hand or wrist. Both in Belgium as in The Netherlands, women suffered more from neck, shoulder and hand or wrist symptoms than men; elbow symptoms were somewhat less prevalent in women in Belgium and in The Netherlands.

A number of differences between the Belgian and Dutch results may be noticed too. Firstly, the prevalence of self-reported work related neck or upper limb symptoms in general was higher in Belgium (39% vs 30%) and also the separate symptoms of neck, shoulder, elbow and hand or wrist were reported more often in Belgium than in The Netherlands. Moreover, the occupation and industry specific prevalence of separate symptoms differed slightly: tailors had the highest prevalence of all symptoms of neck, shoulder, elbow and hand or wrist in Belgium, whereas in The Netherlands, neck symptoms were most prevalent in secretaries and typists, and elbow symptoms were most prevalent in bricklayers. Yet, in Belgium, secretaries had the second highest prevalence rate of neck symptoms, just as bricklayers had the second highest prevalence of elbow symptoms.

Secondly, with respect to the frequencies of self reported risk factors, some physical risk factors, such as 'working in a flexed prolonged posture', 'repeated movements with arm, hand or fingers', 'repeated movements with the head', and 'working with a rotated neck', were reported more often by the Belgian than by the Dutch workers. Frequencies of physical risk factors were almost all reported more often by Belgian tailors than by Dutch tailors. This does also apply to bricklayers and machine metal workers. On the other hand, some occupation specific frequencies of risk factors were remarkably lower in Belgium than in The Netherlands, such as reported by workers in the hotel, restaurant, and catering industry.

Regarding preventive measures, machinery or instruments, job rotation and 'adding tasks' were reported to be introduced more often by Belgian than by Dutch workers; in contrast with this finding, courses and health consulting hours were reported less by Belgian than by Dutch workers. Belgian workers reported more often that they desired additional preventive measures than Dutch workers.

Risk factors for work related neck or upper limb symptoms in general that were identified in the Belgian but not in the Dutch study were 'repeated movements with

the head', working with bended wrists, and low decision authority. Risk factors that were identified in the Dutch but not in the Belgian study were 'working with a rotated neck', use of vibrating tools, and low skill discretion.
In addition, short repetitive tasks of less than 1.5 minute and repeated movements with arm hand or fingers appeared to be moderately associated with elbow symptoms and hand or wrist symptoms in The Netherlands, but not with shoulder symptoms. In Belgium, on the contrary, short repetitive tasks and repeated movements with arm hand or fingers were indeed moderately associated with shoulder symptoms, and not with hand or wrist symptoms.

A summary of the differences and similarities between the Belgian and Dutch studies is given in Tabel 4-1.

Tabel 4-1 Summary of differences and similarities in results between Belgian and Dutch study (Blatter and Bongers, 1999)

differences
• higher prevalence of symptoms in Belgium compared to Netherlands
• higher frequencies of the physical risk factors working in flexed posture, repeated movements with arm, hand or fingers, repeated movements with the head, working with rotated neck in Belgium compared to Netherlands
• some risk factors identified in Belgium and not in The Netherlands, some risk factors identified in The Netherlands and not in Belgium
similarities
• similar frequencies of the physical risk factors short repetitive tasks less than 1.5 minute, bending of neck, working with bended wrists, working with arms raised and all psychosocial risk factors
• similar prevalence differences by size of the companies in administrative workers, production industry and construction industry
• similar high risk occupations: tailors, bricklayers, secretaries, other craft occupations
• risk factors with similar high estimates: short repetitive tasks less than 1.5 minute, repeated movements of arm, hand or fingers, bending of the neck, high quantitative job demands, low social support, and low job satisfaction'

4.4 Comparison with other literature

Prevalence estimates of work related neck or upper limb symptoms in a population-based study from the Central Bureau of Statistics in The Netherlands (Otten et al, 1998) were lower than in the present Belgian study and the company-based study in The Netherlands (Blatter and Bongers, 1999): 19% of the subjects reported to have had symptoms during the past 12 months. Compared with the company-based studies in Belgium and The Netherlands, the response rate was higher and probably less selective in the CBS study, which may be a likely explanation for the discrepancy observed.

With regard to the identification of risk factors, the questions on the presence of risk factors in our questionnaire were slighter 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 quantitative job demands, low decision authority, low social support, 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 increased risk for 'often performing repetitive movements or using force with arms or hands'. The association with 'prolonged posture' was stronger in the CBS study. Our data showed no association with the use of vibrating tools whereas Otten et al (1998) found a moderate association. 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 and low social support 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.

4.5 Conclusion

Thus, in conclusion, some of the findings in this Belgian study were confirmed by other, partly comparable studies in The Netherlands. Women have a higher risk of work related neck and upper limb symptoms than men, even when other risk factors are taken into account. Tailors, bricklayers and other construction workers report high frequencies of physical and psychosocial risk factors for neck or upper limb symptoms. Tailors, bricklayers and secretaries and typists also report the highest occupation-specific prevalence figures. From the occupational risk factors for neck or upper limb symptoms in general, bending of the neck is a consistent risk factor and 'working in a prolonged flexed' is a more or less consistent risk factor across studies. High quantitative job demands and low social support are psychosocial risk factors that are consistently associated with symptoms, even when other physical risk factors are taken into account.

5. Recommendations

Although the results of this Belgian study have increased insight into prevalence and risk factors of neck or upper limb symptoms, 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 working populations in Europe. 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 long-lasting serious health complaints?)

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

- construction industry, especially regarding wrist or hand problems
- other craft industry, especially regarding shoulder and elbow problems
- transportation, especially regarding neck symptoms

Occupations with high prevalences of work related neck and upper limb symptoms that deserve priority are:

- tailors, with regard to neck and all upper limb symptoms
- bricklayers, carpenters and other building occupations, especially with regard to elbow symptoms and wrist or hand symptoms
- secretaries and typists, especially regarding neck and shoulder symptoms

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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 Belgium

	bricklayers, carpenters a o building occ (n=87)	tailors (n=38)	engineer fitters (n=16)	machine-metal workers (n=24)	other craft occupations (n=179)	loaders, unloaders, packers (n=11)	secretaries, typists (n=78)	bookkeepers, cashiers (n=57)	other admin-istr (n=239)	commercial occupations (n=79)	service occupations (n=29)	medical, scientific, management and other (n=206)	total (n=1120)
	%	%	%	%	%	%	%	%	%	%	%	%	%
women	0.0	97.4	0.0	4.2	7.3	9.1	94.9	49.1	52.7	40.5	62.1	16.5	34.9
shift work	29.3	48.6	25.0	43.5	49.2	54.5	17.9	14.3	16.8	20.3	27.6	27.9	28.3
fulltime work	98.8	100.0	100.0	95.8	97.8	100.0	80.8	91.1	82.0	82.3	62.1	98.6	90.7
short repetitive tasks < 1,5 min	14.9	26.3	18.8	0.0	12.3	9.1	3.8	5.3	7.9	3.8	17.2	9.2	9.7
repeated movements with arm, hand, fingers	81.2	86.8	62.5	73.9	53.4	81.8	75.0	53.7	61.3	36.7	62.1	41.6	57.9
repeated movements with head	61.9	82.9	50.0	45.5	40.7	45.5	55.4	41.5	36.6	26.7	25.0	21.5	39.2
bending of neck	85.5	84.2	80.0	73.9	64.2	54.5	60.0	42.9	45.3	45.5	57.7	32.2	53.2
bending of wrists	93.0	94.4	87.5	81.0	65.3	81.8	36.2	30.2	36.2	26.4	57.1	39.3	50.6
reaching with arms / hands	69.4	65.7	18.8	54.4	34.9	54.4	16.2	9.4	11.4	12.3	53.8	17.4	26.5
arms raised	63.4	21.2	31.3	38.1	25.3	18.2	4.1	1.9	4.4	7.0	39.1	9.2	16.7
prolonged flexed posture	70.7	94.4	25.0	70.8	52.6	54.5	75.3	71.4	71.9	60.5	72.0	51.5	63.7
rotated neck	66.3	86.5	31.3	54.5	41.6	27.3	42.9	32.1	37.6	21.8	36.0	27.5	39.4
bended wrists	76.2	88.9	50.0	59.1	38.9	36.4	32.9	17.0	27.4	6.8	38.5	25.7	35.2
use of vibrating tools	67.4	24.3	50.0	43.5	29.8	9.1	0.0	0.0	0.4	3.8	3.4	4.8	14.8
high job demands	23.0	39.5	6.3	16.7	25.7	9.1	19.2	19.3	21.3	27.8	20.7	30.4	24.4
low desicion authority	33.3	68.4	6.3	12.5	24.6	18.2	9.0	3.5	1.7	11.4	27.6	8.2	14.6
low skill discretion	4.6	28.9	0.0	0.0	11.2	18.2	10.3	8.8	5.0	10.1	27.6	6.3	8.7
low social support	16.1	26.3	6.3	29.2	19.6	9.1	23.1	17.5	13.4	24.1	10.3	18.8	18.1
low job satisfaction	1.9	37.1	6.3	20.8	12.5	9.1	9.0	7.3	7.6	18.2	13.8	10.3	11.7

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

	energy, chemist, metal industry (n=298)	other craft industries (n=200)	construction (n=138)	hotel, restaurant a. o. catering industry (n=244)	transportation (n=108)	financial services (n=109)	total (n=1097)
	%	%	%	%	%	%	%
women	32.7	38.0	19.0	43.4	29.6	41.3	34.9
shift work	29.2	42.1	32.4	14.4	17.9	32.4	27.8
fulltime work	90.3	95.5	92.0	84.0	96.3	88.9	90.5
short repetitive tasks							
<1,5 min	8.4	16.5	5.8	5.3	14.8	4.6	9.1
repeated movements with arm, hand, fingers	55.5	63.8	64.9	50.6	58.9	63.6	58.2
repeated movements with head	33.1	46.8	49.6	34.5	40.4	45.2	39.9
bending of neck	49.1	66.8	67.4	47.2	46.3	58.7	54.9
bending of wrists	46.5	68.8	69.1	41.7	40.0	52.5	52.4
reaching with arms / hands	19.2	42.1	45.2	18.7	16.0	25.5	27.0
arms raised	10.8	24.2	39.6	13.2	2.0	19.8	17.5
prolonged flexed posture	66.2	56.3	68.4	55.5	72.4	73.8	63.7
rotated neck	37.9	50.0	55.6	30.9	34.9	39.8	40.7
bended wrists	31.9	51.6	53.4	23.5	27.5	33.0	36.0
use of vibrating tools	11.4	18.1	42.0	5.4	7.4	26.9	16.3
high job demands	26.5	22.5	24.6	25.8	25.9	20.2	24.7
low desicion authority	6.0	22.5	21.0	8.2	21.3	20.2	14.3
low skill discretion	6.4	16.0	2.9	11.5	1.9	5.5	8.3
low social support	19.5	17.0	10.9	19.3	20.4	17.4	17.8
low job satisfaction	12.6	13.2	8.1	11.3	9.3	12.1	11.5

Table 3 Prevalence of self reported work related neck and upper limb symptoms in past 12 months in several occupational groups in Belgium

	bricklayers, carpenters a o building occ (n=87)	tailors (n=38)	engineer fitters (n=16)	machine-metal workers (n=24)	other craft occupations (n=179)	loaders, unloaders, packers (n=11)	secretaries, typists (n=78)	bookkeepers, cashiers (n=57)	other administr (n=239)	commercial occupations (n=79)	service occupations (n=29)	medical, scientific, management and other (n=206)	total (n=1120)
	%	%	%	%	%	%	%	%	%	%	%	%	%
work related neck symptoms	20.7	57.9	12.5	20.8	22.3	18.2	33.3	26.3	33.1	20.3	27.6	26.6	27.6
work related shoulder symptoms	24.1	50.0	6.3	20.8	20.7	9.1	26.9	19.3	25.1	12.7	20.7	16.9	21.7
work related elbow symptoms	18.4	23.7	0.0	12.5	8.4	9.1	6.4	5.3	3.3	3.8	3.4	9.2	8.0
work related wrist or hand symptoms	31.0	44.7	0.0	37.5	15.6	9.1	15.4	14.0	9.6	8.9	10.3	12.1	15.3
work related neck or upper limb symptoms	54.0	65.8	12.5	41.7	40.2	36.4	44.9	31.6	38.9	27.8	37.9	34.8	39.4
work related upper limb symptoms	49.4	60.5	6.3	41.7	32.4	27.3	32.1	24.6	29.7	19.0	31.0	25.1	31.0
emotional exhaustion	3.4	7.9	0.0	12.5	6.1	0.0	5.1	5.3	3.8	7.6	6.9	5.8	5.4

Table 4 Prevalence of self reported work related neck and upper limb symptoms in past 12 months in several industries in Belgium

	energy, chemist, metal industry (n=298)	other craft industries (n=200)	construction (n=138)	hotel, restaurant a. o. catering industry (n=244)	transportation (n=108)	financial services (n=109)	total (n=1097)
	%	%	%	%	%	%	%
work related neck symptoms	26.5	25.5	29.0	26.2	41.7	26.6	28.1
work related shoulder symptoms	19.8	26.0	21.0	19.7	25.0	23.9	22.0
work related elbow symptoms	6.0	12.5	11.6	5.3	3.7	9.2	7.8
work related wrist or hand symptoms	12.1	21.0	21.7	15.6	7.4	16.5	15.7
work related neck or upper limb symptoms	35.9	40.0	47.8	35.7	44.4	43.1	39.7
work related upper limb symptoms	26.5	36.0	37.7	29.9	25.9	34.9	31.2
emotional exhaustion	4.7	7.0	4.3	6.1	2.8	6.4	5.4

Table 5 Preventive measures taken during the past 12 months in several occupational groups in Belgium

	bricklayers, carpenters a o building occ (n=87)	tailors (n=38)	engineer fitters (n=16)	machine-metal workers (n=24)	other craft occupations (n=179)	loaders, unloaders, packers (n=11)	secretaries, typists (n=78)	bookkeepers, cashiers (n=57)	other ad-minstr (n=239)	commercial occupations (n=79)	service occu-pations (n=29)	medical, scientific, management and other (n=206)	total (n=1120)
	%	%	%	%	%	%	%	%	%	%	%	%	%
machinery / instruments	30.8	8.3	31.3	41.7	26.0	27.3	5.2	7.3	10.3	3.9	10.7	7.5	14.2
job rotation	5.2	2.9	6.3	8.7	14.0	0.0	2.6	5.5	6.5	3.9	15.4	6.1	7.1
adding tasks	21.3	14.3	31.3	17.4	32.6	27.3	23.7	16.4	24.0	24.0	21.4	20.7	23.8
course on prevention of musculoskeletal symp	3.9	0.0	0.0	4.3	5.2	10.0	2.7	3.6	3.0	0.0	10.7	1.5	3.1
course on prevention of workstress	0.0	0.0	0.0	4.2	3.0	0.0	1.3	1.8	1.7	5.3	0.0	4.5	2.5
health consulting hour	1.3	0.0	6.3	8.3	8.8	10.0	3.9	1.9	1.3	2.6	6.9	7.6	4.6
more measures desired regarding physical load	67.9	84.8	62.5	75.0	58.4	40.0	33.3	24.1	37.8	46.7	25.9	39.3	46.3
more measures desired regarding workstress	53.8	85.7	40.0	79.2	64.9	50.0	64.5	44.6	61.0	64.9	50.0	65.0	62.1

Table 6 Preventive measures taken during the past 12 months in several industries in Belgium

	energy, chemist, metal industry (n=298)	other craft industries (n=200)	construction (n=138)	hotel, restaurant a. o. catering industry (n=244)	transportation (n=108)	financial services (n=109)	total (n=1097)
	%	%	%	%	%	%	%
machinery instruments	13.7	21.6	22.9	13.2	5.8	11.5	15.2
job rotation	9.2	9.6	2.3	8.6	4.9	7.8	7.7
adding tasks	25.7	23.2	21.8	29.1	18.3	22.8	24.5
course on prevention of musculoskeletal symp	5.8	0.5	2.3	3.9	1.0	2.9	3.2
course on prevention of workstress	4.5	1.0	0.8	4.3	1.0	0.0	2.6
health consulting hour	6.6	7.3	1.5	3.0	3.9	2.9	4.7
more measures desired regarding physical load	47.5	63.5	53.0	34.2	34.6	41.8	46.3
more measures desired regarding workstress	67.2	65.4	53.4	57.6	62.5	62.5	62.1

Table 7 Physical and psychosocial risk factors for work related neck or upper limb symptoms in Belgium

	symptoms (n=446)	no symptoms (n=674)	OR	95% CI	ORadj[1]	95% CI
sex women	184	204	1.62	1.26-2.08	1.53	1.06-2.21
shift work	131	186	1.09	0.84-1.42	1.06	0.75-1.50
fulltime work	396	617	0.73	0.49-1.10	0.85	0.50-1.45
short repetitive tasks < 1.5 min	52	53	1.55	1.03-2.31	1.00	0.58-1.71
repeated movement with arm, hand, fingers	319	323	2.75	2.12-3.56	1.00	0.66-1.52
repeated movements with head	245	185	3.38	2.61-4.37	1.52	0.98-2.35
bending of neck	305	294	3.10	2.39-4.01	1.63	1.05-2.54
bending of wrists	286	279	2.75	2.13-3.55	1.06	0.66-1.69
reaching with arms / hands	160	131	2.39	1.81-3.14	1.00	0.63-1.58
arms raised	102	85	2.13	1.55-2.94	1.00	0.66-1.84
prolonged flexed posture	327	359	2.55	1.95-3.34	1.24	0.87-1.77
rotated neck	248	200	3.22	2.50-4.15	1.07	0.68-1.69
bended wrists	232	157	3.78	2.90-4.91	1.96	1.21-3.20
use of vibrating tools	88	93	1.55	1.12-2.13	0.85	0.53-1.37
high quantitative job demands	139	135	1.81	1.37-2.38	1.39	0.99-1.97
low desicion authority	97	63	2.70	1.91-3.80	1.48	0.91-2.38
low skill discretion	50	46	1.72	1.13-2.62	0.98	0.57-1.70
low social support	123	78	2.91	2.12-3.98	1.87	1.24-2.82
low job satisfaction	69	58	1.96	1.35-2.85	1.82	1.13-2.93

[1] adjusted for all other risk factors and age

Table 8 Physical and psychosocial adjusted risk factors for separate work related neck, shoulder, elbow, and wrist symptoms in Belgium

	neck		shoulder		elbow		hand or wrist	
	n_{cases}=315 $n_{controls}$=805		n_{cases}=250 $n_{controls}$=870		n_{cases}=90 $n_{controls}$=1030		n_{cases}=174 $n_{controls}$=946	
	ORadj[1]	95%CI	ORadj[1]	95%CI	ORadj[1]	95%CI	ORadj[1]	95%CI
sex women	1.96	1.33-2.90	2.13	1.40-3.24	0.84	0.41-1.73	1.56	0.94-2.60
shift work	0.85	0.58-1.25	1.18	0.80-1.75	1.09	0.60-1.99	0.99	0.63-1.56
fulltime work	0.89	0.51-1.56	1.02	0.57-1.83	0.56	0.22-1.46	1.45	0.64-3.27
short repetitive tasks < 1.5 min	0.75	0.42-1.35	1.45	0.83-2.55	1.36	0.59-3.10	1.14	0.61-2.14
repeated movement of arm, hand, fingers	0.73	0.45-1.18	1.44	0.87-2.38	0.98	0.41-2.32	1.06	0.56-2.00
repeated movements of head	1.66	1.02-2.69	0.99	0.60-1.63	0.90	0.39-2.07	1.21	0.65-2.22
bending of neck	1.98	1.22-3.24	1.34	0.79-2.27	1.08	0.44-2.68	0.78	0.40-1.52
bending of wrists	0.91	0.54-1.53	0.98	0.56-1.71	1.54	0.59-4.07	4.09	1.97-8.50
reaching with arms / hands	0.88	0.54-1.44	0.82	0.49-1.36	1.97	0.92-4.23	1.98	1.14-3.44
arms raised	0.98	0.57-1.69	1.55	0.89-2.68	2.14	0.98-4.65	1.02	0.57-1.85
prolonged flexed posture	1.56	1.05-2.33	1.37	0.89-2.12	0.84	0.42-1.67	1.09	0.65-1.84
rotated neck	1.31	0.80-2.13	1.74	1.04-2.91	1.02	0.43-2.43	0.69	0.36-1.34
bended wrists	1.63	0.95-2.78	1.13	0.65-1.98	1.83	0.74-4.57	1.85	0.97-3.53
use of vibrating tools	0.55	0.33-0.94	1.01	0.59-1.71	0.36	0.16-0.80	0.89	0.50-1.57
high quantitative job demands	1.46	1.02-2.11	1.49	1.01-2.19	1.75	0.97-3.16	1.48	0.95-2.33
low desicion authority	1.17	0.71-1.94	1.09	0.65-1.82	1.65	0.82-3.34	1.56	0.92-2.64
low skill discretion	0.72	0.40-1.29	1.07	0.60-1.92	0.85	0.33-2.16	1.60	0.83-3.08
low social support	1.71	1.13-2.59	1.71	1.11-2.63	1.65	0.88-3.08	1.87	1.14-3.06
low job satisfaction	2.19	1.35-3.54	1.92	1.17-3.16	1.69	0.83-3.44	1.16	0.64-2.08

[1] adjusted for all other risk factors and age