

*Summary and Conclusions*

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# Occupational Exposures and Neck and Upper Extremity Disorders

A Systematic Review

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*Summary and Conclusions of the SBU Report:*

# Occupational Exposures and Neck and Upper Extremity Disorders

A Systematic Review

March 2012

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*Report: Occupational Exposures and Neck and Upper Extremity Disorders • Report no: 210  
Published 2012 • Type: Systematic Review • ISBN: 978-91-85413-48-5 • ISSN: 1400-1403  
English Translation of the Summary: Ron Gustafson, Medtext International AB*

Work-related problems concerning the musculoskeletal system, particularly those involving the neck, back, and shoulders are common in industrialised countries. Approximately half of all work-related injuries reported in Sweden involve disorders of the muscles and joints. These conditions per se seldom result in severe disabilities, but they can affect the individual's quality of life and generate substantial costs for society due to sick leave and lost productivity. Among the working population in Sweden, approximately 25% of women and 20% of men report having had work-related, physical problems at some point in recent years. Given this background, the Swedish Social Insurance Agency and AFA Insurance proposed that SBU use its principles for systematic review to conduct a systematic literature review of the scientific evidence regarding the association between factors in the work environment and the occurrence of problems and disorders of the musculoskeletal system. This document, the first in a series of reports, addresses the neck and upper musculoskeletal system.

## **SBU's Conclusions**

- The scientific evidence suggests that the following exposures involve risks for disorders and diseases in the:
  - neck/shoulders – work involving bending/twisting the torso, heavy work (lifting, carrying, pushing, pulling), highly demanding work, little control, narrow parameters for decision making, or a combination of highly demanding work and little control
  - shoulders – heavy work (lifting, carrying, pushing, pulling), long-term use of computer mouse
  - elbows and forearms – heavy work (lifting, carrying, pushing, pulling), repetitive work, long-term use of computer mouse
  - wrists and hands – biomechanical load (combination of repetitive hand motion and force).

- ❑ The associations reported in other systematic reviews that relate problems in the neck/shoulders to working with arms raised above shoulder height or repetitive work were not found – nor were the reported associations between carpal tunnel syndrome and repetitive or heavy work. SBU found the evidence to be insufficient to draw such conclusions. A probable explanation is that the SBU review requires studies to meet different inclusion and design criteria. The SBU report does not include cross-sectional studies, while other systematic reviews are based mainly on that type of study. Cross-sectional studies may provide information about associations, but cannot reliably answer questions of whether the problems are attributed to the work *per se*, or other factors. SBU’s conclusion that current evidence is insufficient does not rule out the possibility of a causal association, but further research that follows subjects over time is required.
- ❑ We found no studies of sufficient quality that addressed the causes of generalised pain, multilocalised pain<sup>1</sup>, or pain in the neck, shoulders, and arms.
- ❑ To identify risks and effective preventive interventions, several areas are in need of further research of high scientific quality (studies with well-defined exposures and outcomes, objective methods for measuring exposures and outcomes, longitudinal measurements, and sufficient differences in exposures).

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<sup>1</sup> Pain in at least three regions of the neck, shoulders, elbows, hands, thoracic spine, lumbar spine, hips, knees, or feet, where at least one of the regions includes the neck and upper musculoskeletal system.



# SBU's Summary

## Background and aim

This project aims to systematically and critically appraise the scientific studies used in drawing associations between factors in the work environment and the incidence of symptoms and disorders in the neck and upper musculoskeletal system. The project is limited to the risks arising from exposure in the work environment. It does not address the prognoses regarding symptoms and disorders following exposure. SBU's assessment is not aimed at determining whether or not an injury is work-related at the individual level. There is a substantial need for an updated, systematic literature review concerning the impact of work on disorders of the neck and upper musculoskeletal system. Reviewing and compiling the evidence is important in designing preventive programmes for the work environment and for ensuring legal rights when society appraises work-related injuries.

## Methods

SBU projects usually involve literature searches of issues that can be broken down into specific questions. This project, however, involves a broad literature search for outcomes related to symptoms and disorders of the neck and upper musculoskeletal system, physical and psychosocial exposures, and study design. The process of reviewing abstracts and full-text articles has been unique in that it involved two project experts in rotating work groups. Further, review checklists for cohort and case-control

studies were developed for the project (Appendix, cohort checklist). SBU's standard checklists were used for randomised studies and systematic reviews. What primarily differentiates this report from other systematic literature reviews of exposures in the work environment is that, from among the original studies, only randomised intervention trials and observational cohort and case control studies were included. Cross-sectional studies were included in the literature search, but were not appraised as separate studies due to uncertainties in appraising causal associations and due to the abundance of cohort studies and published systematic reviews (which are based to 80%–90% on cross-sectional studies). Forty high- or moderate-quality cohort studies were included. Only two case-control studies were included. Consequently, case-control studies did not play a major role in the report, nor did randomised intervention trials. Ultimately, 22 systematic literature reviews (encompassing 149 cross-sectional studies) were appraised and compared in detail in the SBU report. This includes evidence within the scientific area concerned, based on cross-sectional studies presented in the report.

## **Evidence grading**

SBU uses the international GRADE system to classify the strength of the scientific evidence. The evidence grade is based on an appraisal of the strength of the collective scientific evidence for answering a particular question in a reliable way (Facts 1). Even limited scientific evidence includes studies of high or moderate quality, but also includes factors that weaken the overall appraisal. SBU asserts that even limited scientific evidence may be sufficient to motivate interventions in clinical practice or appraise risks in the work environment. However, such decisions must have additional support, for instance from legislation or the individual's exposure to risk in the work environment, which are beyond SBU's mandate for reviewing scientific evidence.



## **Facts 1** Study quality, relevance and evidence grading.

**Study quality** refers to the scientific quality of an individual study and its capacity to answer a specific question in a reliable way.

**Evidence grade** refers to the appraised strength of the collective body of scientific evidence and its capacity to answer a specific question in a reliable way. SBU uses an international evidence grading system called GRADE. Study design is the primary factor considered in the overall appraisal of each outcome measure. Secondary factors that can increase or decrease the strength of the evidence include: study quality, relevance consistency, indirectness, transferability, effect size, data precision, risk of publication bias, and other aspects, eg the dose-response relationship.

Evidence grades – four levels

**Strong scientific evidence (⊕⊕⊕⊕)**

Based on high or medium quality studies with no factors that weaken the overall assessment.

**Moderately strong scientific evidence (⊕⊕⊕○)**

Based on high or moderate quality studies with isolated factors that weaken the overall assessment.

**Limited scientific evidence (⊕⊕○○)**

Based on high or moderate quality studies having factors that weaken the overall assessment.

**Insufficient scientific evidence (⊕○○○)**

Scientific evidence is deemed insufficient when scientific findings are absent, the quality of available studies is low, or studies of similar quality present conflicting findings.

The stronger the evidence, the lower the likelihood that new research findings would affect the documented results within the foreseeable future.

**Conclusions**

SBU's conclusions present an overall assessment of benefits, risks, and cost effectiveness.

## **Physical exposures**

### **Neck and neck/shoulders**

- Limited scientific evidence suggests that heavy work (lifting, carrying, pushing, pulling) increases the risk of symptoms in the neck/shoulders (⊕⊕○○).
- Limited scientific evidence suggests that work-related movements (twisting or bending the torso) increase the risk of symptoms in the neck/shoulders (⊕⊕○○).

### **Shoulders**

- Limited scientific evidence suggests that heavy work (lifting, carrying, pushing, pulling) increases the risk of developing pain in the shoulders (⊕⊕○○).

### **Elbows and forearms**

- Moderately strong scientific evidence indicates that repetitive work increases the risk of developing pain in the elbow and forearm (⊕⊕⊕○).
- Limited scientific evidence suggests that heavy work (lifting, carrying, pushing, pulling) increases the risk of developing pain in the elbow and forearm (⊕⊕○○).

### **Wrists and hands**

- Limited scientific evidence suggests that biomechanical loads (combination of repetitive hand motion and force) increase the risk of developing pain in the wrists and hands (⊕⊕○○).

## **Computer work**

### **Shoulders**

- Limited scientific evidence suggests that working with a computer mouse for longer periods increases the risk of developing pain in the shoulder (⊕⊕○○).

## Elbows and forearms

- Moderately strong scientific evidence indicates that long-term use of a computer mouse increases the risk of developing pain in the elbow and forearm (⊕⊕⊕○).

## Psychosocial exposures

### Neck and neck/shoulders

- Limited scientific evidence suggests that highly demanding work in combination with low control increases the risk of symptoms in the neck (⊕⊕○○).
- Limited scientific evidence suggests that highly demanding work increases the risk of symptoms in the neck (⊕⊕○○).
- Limited scientific evidence suggests that low control or low decision-making autonomy increases the risk of symptoms in the neck/shoulders (⊕⊕○○).

## Insufficient scientific evidence

Scientific evidence is insufficient regarding the following exposures:

### Physical exposures – insufficient scientific evidence

#### *Neck and neck/shoulders*

- physically heavy or stressful work
- neck position (extension, flexion, rotation)
- arms raised above shoulder height
- standing, sitting, squatting, and/or kneeling
- repetitive arm and hand motions
- repetitive work tasks or lack of variation.

#### *Shoulders*

- working with hands above shoulder height
- repetitive work.

### *Elbows and forearms*

- sitting, standing, squatting
- raised arms.

### *Wrists and hands*

- work that requires use of force
- repetitive work
- wrist position.

### *Distortion of cervical spine following motor vehicle accidents (eg to and from work)*

- seat or headrest designed to limit extension of head in rear-end collisions
- collision factors
- comorbidity.

## **Computer work – insufficient scientific evidence**

### *Neck and neck/shoulders*

- long-term computer work
- long-term use of keyboard
- long-term use of computer mouse
- computer work without break
- monotonous computer work.

### *Shoulders*

- long-term use of keyboard
- long-term work at computer, unspecified
- placement of computer mouse
- use of forearm or wrist support
- intervention involving alternative mouse, or forearm or wrist support
- opportunity to take breaks
- workplace design.

### *Elbows and forearms*

- long-term use of keyboard
- long-term work at computer, unspecified
- placement of computer mouse
- intervention involving alternative mouse, or forearm or wrist support
- placement of keyboard
- use of forearm support, keyboard
- use of individually adjustable chair or table.

### *Wrists and hands*

- long-term use of computer mouse
- long-term use of keyboard
- long-term work at computer, unspecified
- placement of computer mouse
- intervention involving alternative mouse, or forearm or wrist support
- placement of keyboard
- use of forearm or wrist support
- dissatisfaction with workplace design.

## **Psychosocial exposures – insufficient scientific evidence**

### *Neck and neck/shoulders*

- low social support
- long working hours
- high stress.

### *Shoulders*

- high demands
- low control
- high demands and low control
- low social support
- importance of opportunities for personal development
- importance of satisfaction with work.

### *Elbows and forearms*

- opportunities to take breaks
- design of computer workplace
- low social support
- high demands
- low control
- importance of opportunities for personal development
- work under time pressure
- importance of satisfaction with work.

### *Wrists and hands*

- low control
- high demands and low control
- secure employment
- dissatisfaction with work
- high demands
- low social support.

## **Research needs**

The report indicates that, in some areas, evidence for the emergence of risk of symptoms and disorders in the musculoskeletal system is uncertain despite a large number of published studies. Most of the studies, regardless of study design, have investigated multiple exposures and outcomes concurrently, which increases the risks for confounders and mass significance. The findings are often not specific enough to be useful in work involving prevention or medical insurance. A useful research approach might be to invest in large, well-executed case-control studies that attempt to capture different types of well-defined cases early in their course (ie first episode of disease). The aim would be to study risk factors for incidence; later using these cases (where one has

the resources to compile a large number) to form well-defined case cohorts to study the prognoses in detail (and also how future exposure is affected by the disease course influences).

## Discussion

An observation from reviewing studies over an extended period, in this case from 1980 to 2009, is that working environments change over time. As work involving heavy lifting decreases, it might be replaced by more monotonous work involving repetitive elements and poor psychosocial work environments. Hence, one harmful environment could be replaced by another. As fewer people are exposed to heavy lifting in the industrialised world (where most epidemiological studies take place) the interest in studying its effects decreases. Consequently few, if any, studies are published, which could be interpreted to mean that symptoms associated with heavy lifting are no longer a problem. This probably applies to several types of exposures and effects that previous studies found to be harmful. Traditional ergonomic problems, eg involving heavy lifting, working with raised arms, or highly repetitive and intensive handwork, have received less attention since people think that evidence is already available. Some studies (using better designs) are not conducted since society assumes that the evidence is sufficiently established. Given the higher standards of evidence, support for this knowledge is no longer regarded as adequate. The outcomes which are studied have also changed during the period covered by the literature search. Today, outcomes seldom focus on specific diagnoses, eg epicondylitis or carpal tunnel syndrome, but are less specific, eg “symptoms”. Although many studies may be published, often involving multiple exposures and outcomes, few studies focus on the same exposures and outcomes. Cross-sectional studies

can inform about associations if they present convincing quantitative data about exposures and outcomes. If the inclusion criteria for cross-sectional studies stipulate that the subject should have worked with a specific task for a given period before the onset of symptoms, this adds a time-conformity dimension. Cross-sectional studies have been particularly common in the epidemiology of occupational medicine and provide the knowledge base regarding many work-environment risks. Systematic reviews may be at risk of overlooking valuable information if they routinely exclude appraisals of individual cross-sectional studies.



# Reports published by SBU

## SBU Reports in English (2001-2012)

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Treatment of Hemophilia A and B and von Willebrand Disease (2011), no 208E
Dementia, three volumes (2008), no 172E
Obstructive Sleep Apnoea Syndrome (2007), no 184E
Interventions to Prevent Obesity (2005), no 173E
Moderately Elevated Blood Pressure (2004), Volume 2, no 170/2
Sickness Absence – Causes, Consequences, and Physicians' Sickness Certification Practice Scandinavian Journal of Public Health, Suppl 63 (2004), 167/suppl
Radiotherapy for Cancer (2003), Volume 2, no 162/2
Treating and Preventing Obesity (2003), no 160E
Treating Alcohol and Drug Abuse (2003), no 156E
Evidence Based Nursing: Caring for Persons with Schizophrenia (1999/2001), no 4E
Chemotherapy for Cancer (2001), Volume 2, no 155/2

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## SBU Summaries in English (2005–2012)

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Occupational Exposures and Neck and Upper Extremity Disorders (2012), no 510-61
Benign Prostatic Obstruction (2011), no 510-60
Treatment of Hemophilia A and B and von Willebrand Disease (2011), no 510-59
Medical and Psychological Methods for Preventing Sexual Offences Against Children (2011), no 510-58
Prosthetic Rehabilitation of Partially Dentate or Edentulous Patients (2010), no 510-56
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Psychiatric Risk Assessment Methods – Are Violent Acts Predictable? (2005), no 510-29
Treatment of Anxiety Disorders (2005), no 510-28
Interventions to Prevent Obesity (2005), no 510-27

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# SBU Evaluates Health Care Technology

Below is a brief summary of the mission assigned to SBU by the Swedish Government:

- SBU shall assess healthcare methods by systematically and critically reviewing the underlying scientific evidence.
- SBU shall assess new methods as well as those that are already part of established clinical practice.
- SBU's assessments shall include medical, ethical, social and economic aspects, as well as a description of the potential impact of disseminating the assessed health technologies in clinical practice.
- SBU shall compile, present and disseminate its assessment results such that all parties concerned have the opportunity to take part of them.
- SBU shall conduct informational and educational efforts to promote the application of its assessments to the rational use of available resources in clinical practice, including dental care.
- SBU shall contribute to the development of international co-operation in the field of health technology assessment and serve as a national knowledge centre for the assessment of health technologies.

## **Occupational Exposures and Neck and Upper Extremity Disorders**

The report on occupational exposures and neck and upper extremity disorders from the Swedish Council on Health Technology Assessment (SBU) is a systematic review of the scientific literature in the field.

This document presents the summary and conclusions of the full report approved by SBU's Board and Scientific Advisory Committee.

The full report is available at [www.sbu.se](http://www.sbu.se)