



Occupational exposures and complaints of neck, shoulder, arm, or hand

A systematic review

Summary and conclusions

Introduction

This systematic review is a sequel to the report “Occupational exposures and neck and upper extremity disorder” published by SBU in 2012. The term complaint is used as a general description of all symptoms in a region and comprises pain, discomfort, and specific diseases.

Background and Aim

The objective of this systematic review is to assess the scientific evidence describing the influence of occupational exposures on the development of complaints in the neck, shoulders, arms, or hands. A wide range of occupational exposures were investigated, for example, physical workload, and psychosocial and organisational factors.

Conclusions

This systematic literature review has uncovered a substantial body of evidence that supports an increased risk of complaints of neck, shoulder, arm, or hand are associated with a variety of occupational exposures. Conclusions are not formulated for the results evaluated as having a very low certainty of evidence. No results were evaluated as having a high certainty of evidence. The review evaluates longitudinal studies on the association between exposures in the workplace and complaints but cannot give a definite answer to whether occupational exposure is the only contributing factor to these complaints.

People with the following occupational exposures more often develop complaints of *neck or neck/shoulders* than people who are not subjected to the specified exposure to the same degree:

- ▶ working with the neck bent forwards or backwards (moderate certainty)
- ▶ working with arms elevated (low certainty)
- ▶ working with repetitive arm movements (low certainty)
- ▶ experiencing high quantitative demands (low certainty)
- ▶ experiencing an imbalance between efforts and rewards (low certainty)

People with the following occupational exposures more often develop complaints of *shoulders or impingement* than people who are not subjected to the specified exposure to the same degree:

- ▶ doing heavy lifting and forceful work with neck and/or shoulders (moderate certainty)
- ▶ working with arms elevated (moderate certainty)
- ▶ working with repetitive arm movements (moderate certainty for shoulder complaints and low certainty for impingement)

People with the following occupational exposures more often develop complaints of *arms and/or forearms* than people who are not subjected to the specified exposure to the same degree:

- ▶ doing heavy lifting and forceful work with neck and/or shoulders (moderate certainty)
- ▶ doing forceful work with wrist and/or hand (low certainty)
- ▶ working with repetitive arm movements (low certainty)

The conclusions continues on the next page

People exposed to forceful work with neck and/or shoulders more often develop *ulnar nerve entrapment* than people who are not subjected to the specified exposure to the same degree.

People with the following occupational exposures more often develop complaints of *wrists and/or hands* than people who are not subjected to the specified exposure to the same degree:

- ▶ doing forceful work with wrists and/or hands (moderate certainty)
- ▶ doing forceful work combined with repetitive movements with hands (moderate certainty)
- ▶ working with wrists in a bent or twisted position (low certainty)
- ▶ working with repetitive wrist and/or hand movements (low certainty)

- ▶ experiencing high job strain, that is a situation where one experiences high job demands combined with low control or decision latitude at work (low certainty)

People with the following occupational exposures more often develop *carpal tunnel syndrome* than people who are not subjected to the specified exposure to the same degree:

- ▶ doing forceful work with wrist and/or hand (moderate certainty)
- ▶ doing forceful work combined with repetitive movements with hands (moderate certainty)

Results regarding differences between men and women were inconclusive, so this report cannot conclude if women and men with similar occupational exposures develop complaints of neck, shoulders, arms, or hands to a different extent.

Review questions

1. Is there an association between exposures in the workplace and complaints of neck, shoulders, arms, or hands?
2. To what extent do these associations differ between women and men?

Inclusion criteria

The inclusion criteria were structured according to PEOS (Population, Exposure, Outcome, and Study design).

Population: Workers in various occupations.

Exposure: Exposures in the workplace. Exposures only assessed by job title, and vibration exposures were excluded.

Outcome: Complaints of neck, shoulders, arms, or hands. Indirect assessments of complaints, such as sick leave, were excluded.

Study design: Prospective and retrospective cohort studies and case-control studies.

Language: English, Swedish, Norwegian, or Danish.

Search period: From 2010 to 2021. Final search august, 2021.

Databases searched: Embase via Elsevier, Ovid MEDLINE, PsycInfo via EBSCO, and Scopus via Elsevier.

Client/patient involvement: No

Method

A systematic review was undertaken following the PRISMA statement and standard methods used by SBU adapted to the context of occupational exposures. Studies that fulfilled the inclusion criteria were assessed for risk of bias by two experts independently, using pre-set protocols. After conducting independent assessments, the two experts had to agree on a mutual relevance and risk of bias classification. Only studies with low or moderate risk of bias were included in the assessment. The certainty of evidence was assessed with the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system.

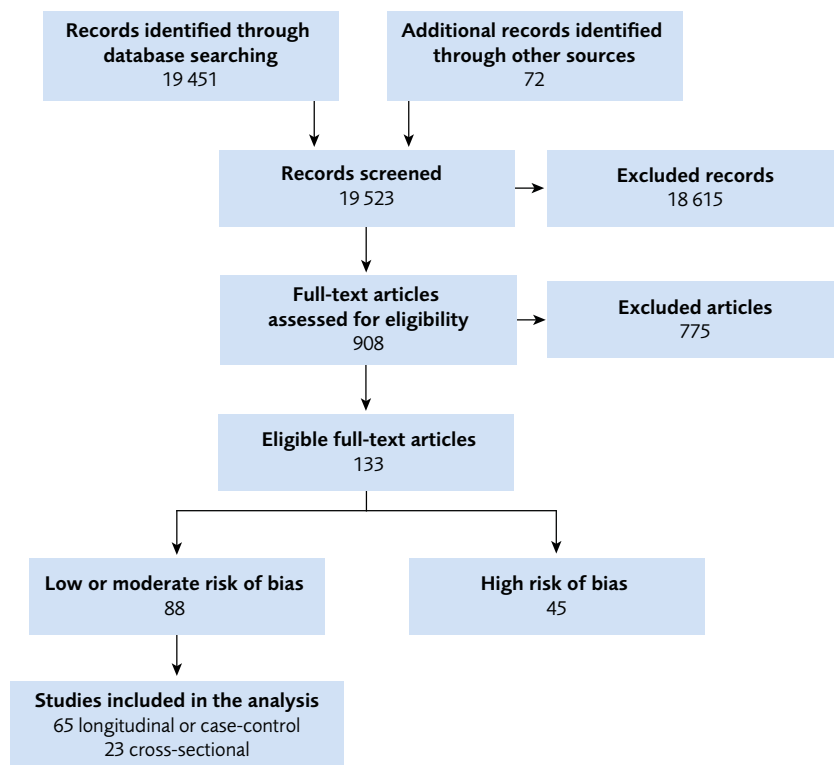


Figure 1 Flow chart.

Results

A total of 19 451 abstracts were identified by the literature search (see Figure 1), 908 were read in full-text and 133 studies were eligible. Sixtyfive longitudinal or case-control studies were considered to have a low or moderate risk of bias and were included in the analyses.

Tables below

Summary of findings for the association between occupational exposure and complaints of neck, shoulders, arms, or hands. The results are based on longitudinal and case-controls studies.

Table 1 Neck or neck/shoulders.

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Force (push, pull, lift, or exert a force)				
with neck and/or shoulders	7 studies n=4677	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
with wrist and/or hand	1 study n=1324	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Posture				
Neck posture	5 studies n=47 918	Neck or neck/shoulders	⊕⊕⊕○	A positive association exists
Trunk posture	3 studies n=40 557	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Upper arm posture	8 studies n=13 347	Neck or neck/shoulders	⊕⊕○○	A positive association exists
Sitting	2 studies n=2135	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists

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Table 1 continued

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Movements				
Repetitive arm movements	4 studies n=47 225	Neck or neck/shoulders	⊕⊕○○	A positive association exists
Repetitive wrist and/or hand movements	2 studies n=1642	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Combination of physical exposures				
Force and trunk posture	1 study n=317	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Akward lifting	1 study n=6745	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Force and neck /shoulder posture	1 study n=91	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Psychosocial work demands				
Quantitative demands	10 studies n=17 788	Neck or neck/shoulders	⊕⊕○○	A positive association exists
Qualitative demands	3 studies n=3990	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Job strain	3 studies n=759	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Effort-reward imbalance	3 studies n=3754	Neck or neck/shoulders	⊕⊕○○	A positive association exists
Effort level	2 studies n=1489	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Job insecurity	1 study n=245	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Job stress	1 study n=25 806	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Working with temporary workers	1 study n=1510	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Role conflict	2 studies n=9161	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Work pace	1 study n=1510	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Psychosocial work resources				
Job control	12 studies n=39 101	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Social support	8 studies n=5455	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Predictability	1 study n=2416	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Rewards	2 studies n=1489	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Advancement opportunities	4 studies n=5500	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists

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Table 1 continued

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Organisational factors				
Shift work	3 studies n=4512	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Overtime work	1 study n=1324	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Scope of work	2 studies n=1532	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Temporary employment	1 study n=1510	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Accord system	1 study n=245	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Destructive leadership	1 study n=951	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Fair leadership	3 studies n=10 076	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Social factors				
Bullying	1 study n=5277	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Other exposures				
Visual environment	1 study n=208	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists
Sensory demands	1 study n=208	Neck or neck/shoulders	⊕○○○	Cannot determine if an association exists

⊕○○○ = *Insufficient scientific evidence*; ⊕⊕○○ = *Limited scientific evidence*

Table 2 Shoulders.

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Force (push, pull, lift, or exert a force)				
with neck and/or shoulders	7 studies n=83 203	Shoulders	⊕⊕⊕○	A positive association exists
with neck and/or shoulders	5 studies n=44 233	Impingement	⊕⊕⊕○	A positive association exists
with wrist and/or hand	1 study n=167	Shoulders	⊕○○○	Cannot determine if an association exists
Posture				
Trunk posture	1 study n=317	Shoulders	⊕○○○	Cannot determine if an association exists
Upper arm posture	12 studies n=87 676	Shoulders	⊕⊕⊕○	A positive association exists
Upper arm posture	6 studies n=45 689	Impingement	⊕⊕⊕○	A positive association exists
Elbow and/or wrist posture	1 study n=38 897	Shoulders	⊕○○○	Cannot determine if an association exists

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Table 2 continued

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Movements				
Repetitive arm movements	7 studies n=84 075	Shoulders	⊕⊕⊕○	A positive association exists
Repetitive arm movements	5 studies n=44 739	Impingement	⊕⊕○○	A positive association exists
Precise movements with arms	1 study n=240	Shoulders	⊕○○○	Cannot determine if an association exists
Combination of physical exposures				
Force and posture	2 studies n=2103	Shoulders	⊕○○○	Cannot determine if an association exists
Force, posture, and repetitive movements	2 studies n=42 798	Shoulders	⊕○○○	Cannot determine if an association exists
Psychosocial work demands				
Quantitative demands	6 studies n=40 279	Shoulders	⊕○○○	Cannot determine if an association exists
Quantitative demands	3 studies n=38 134	Impingement	⊕○○○	Cannot determine if an association exists
Qualitative demands	2 studies n=735	Shoulders	⊕○○○	Cannot determine if an association exists
Job strain	3 studies n=4533	Shoulders	⊕○○○	Cannot determine if an association exists
Effort-reward imbalance	1 study n=106	Shoulders	⊕○○○	Cannot determine if an association exists
Effort level	1 study n=1801	Shoulders	⊕○○○	Cannot determine if an association exists
Obstacles and interruptions	1 study n=1801	Shoulders	⊕○○○	Cannot determine if an association exists
Job insecurity	1 study n=1801	Shoulders	⊕○○○	Cannot determine if an association exists
Working with temporary workers	1 study n=1655	Shoulders	⊕○○○	Cannot determine if an association exists
Work pace	1 study n=1655	Shoulders	⊕○○○	Cannot determine if an association exists
Psychosocial work resources				
Job control	8 studies n=42 713	Shoulders	⊕○○○	Cannot determine if an association exists
Job control	3 studies n=38 134	Impingement	⊕○○○	Cannot determine if an association exists
Social support	7 studies n=47 306	Shoulders	⊕○○○	Cannot determine if an association exists
Social support	3 studies n=43 283	Impingement	⊕○○○	Cannot determine if an association exists
Predictability	1 study n=1655	Shoulders	⊕○○○	Cannot determine if an association exists
Advancement opportunities	2 studies n=6880	Shoulders	⊕○○○	Cannot determine if an association exists

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Table 2 continued

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Organisational factors				
Shift work	2 studies n=3111	Shoulders	⊕○○○	Cannot determine if an association exists
Overtime work	2 studies n=3111	Shoulders	⊕○○○	Cannot determine if an association exists
Security climate	1 study n=247	Shoulders	⊕○○○	Cannot determine if an association exists
Temporary employment	2 studies n=3111	Shoulders	⊕○○○	Cannot determine if an association exists
Other exposures				
Heat	1 study n=1655	Shoulders	⊕○○○	Cannot determine if an association exists
Visually demanding work	1 study n=1655	Shoulders	⊕○○○	Cannot determine if an association exists

⊕○○○ = *Insufficient scientific evidence*; ⊕⊕○○ = *Limited scientific evidence*; ⊕⊕⊕○ = *Moderately strong scientific evidence*

Table 3 Arms.

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Force (push, pull, lift, or exert a force)				
with neck and/or shoulders	5 studies n=273 806	Arms	⊕⊕⊕○	A positive association exists
with neck and/or shoulders	3 studies n=233 744	Ulnar nerve entrapment	⊕⊕⊕○	A positive association exists
with wrist and/or hand	4 studies n=231 494	Arms	⊕⊕○○	A positive association exists
with wrist and/or hand	3 studies n=1805	Epicondylalgia	⊕○○○	Cannot determine if an association exists
Posture				
Trunk posture	1 study n=699	Arms	⊕○○○	Cannot determine if an association exists
Upper arm posture	1 study n=3833	Arms	⊕○○○	Cannot determine if an association exists
Elbow and wrist posture	5 studies n=270 388	Arms	⊕○○○	Cannot determine if an association exists
Movements				
Arm movements	1 study n=229 689	Arms	⊕○○○	Cannot determine if an association exists
Repetitive arm movements	3 studies n=272 252	Arms	⊕⊕○○	A positive association exists
Wrist and/or hand movements	4 studies n=231 414	Arms	⊕○○○	Cannot determine if an association exists
Wrist and/or hand movements	3 studies n=1725	Epicondylalgia	⊕○○○	Cannot determine if an association exists
Repetitive wrist and/or hand movements	4 studies n=231 127	Arms	⊕○○○	Cannot determine if an association exists

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Table 3 continued

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Combination of physical exposures				
Force and posture	1 study n=611	Arms	⊕○○○	Cannot determine if an association exists
Strain Index	2 studies n=1026	Arms	⊕○○○	Cannot determine if an association exists
Grip score	1 study n=229 689	Arms	⊕○○○	Cannot determine if an association exists
HAL TLV	1 study n=495	Arms	⊕○○○	Cannot determine if an association exists
Psychosocial work demands				
Quantitative demands	1 study n=531	Arms	⊕○○○	Cannot determine if an association exists
Job insecurity	1 study n=531	Arms	⊕○○○	Cannot determine if an association exists
Job stress	1 study n=531	Arms	⊕○○○	Cannot determine if an association exists
Work pace	1 study n=531	Arms	⊕○○○	Cannot determine if an association exists
Psychosocial work resources				
Job control	1 study n=531	Arms	⊕○○○	Cannot determine if an association exists
Social support	3 studies n=1725	Arms	⊕○○○	Cannot determine if an association exists
Social support	3 studies n=1725	Epicondylalgia	⊕○○○	Cannot determine if an association exists
Other exposures				
Heat	1 study n=3833	Arms	⊕○○○	Cannot determine if an association exists
Cold	1 study n=3833	Arms	⊕○○○	Cannot determine if an association exists
Temperature changes	1 study n=3833	Arms	⊕○○○	Cannot determine if an association exists

HAL TLV = Hand Activity Level – Threshold Limit Value

⊕○○○ = Insufficient scientific evidence; ⊕⊕○○ = Limited scientific evidence; ⊕⊕⊕○ = Moderately strong scientific evidence;

Table 4 Wrists and hands.

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Force (push, pull, lift, or exert a force)				
with neck and/or shoulders	5 studies n=46 994	Wrist and hand	⊕○○○	Cannot determine if an association exists
Heavy lifting	3 studies n=44 947	Wrist and hand	⊕○○○	Cannot determine if an association exists
with wrist and/or hands	8 studies n=49 565	Wrist and hand	⊕⊕⊕○	A positive association exists
with wrist and/or hands	5 studies n=9055	Carpal tunnel syndrome	⊕⊕⊕○	A positive association exists

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Table 4 continued

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Posture				
Upper arm posture	1 study n=3824	Wrist and hand	⊕○○○	Cannot determine if an association exists
Elbow and/or wrist posture	8 studies n=1 066 050	Wrist and hand	⊕⊕○○	A positive association exists
Movements				
Wrist and/or hand movements	2 studies n=1 019 616	Wrist and hand	⊕○○○	Cannot determine if an association exists
Repetitive wrist and/or hand movements	8 studies n=52 671	Wrist and hand	⊕⊕○○	A positive association exists
Repetitive wrist and/or hand movements	5 studies n=12 169	Carpal tunnel syndrome	⊕○○○	Cannot determine if an association exists
Combination of physical exposures				
HAL TLV	4 studies n=6469	Wrist and hand	⊕⊕⊕○	A positive association exists
HAL TLV	3 studies n=6229	Carpal tunnel syndrome	⊕⊕⊕○	A positive association exists
Strain index	2 studies n=2991	Wrist and hand	⊕○○○	Cannot determine if an association exists
Psychosocial work demands				
Quantitative demands	3 studies n=9775	Wrist and hand	⊕○○○	Cannot determine if an association exists
Job strain	3 studies n=2288	Wrist and hand	⊕⊕○○	A positive association exists
Job insecurity	1 study n=6407	Wrist and hand	⊕○○○	Cannot determine if an association exists
Working with temporary workers	1 study n=415	Wrist and hand	⊕○○○	Cannot determine if an association exists
Work pace	1 study n=366	Wrist and hand	⊕○○○	Cannot determine if an association exists
Psychosocial work resources				
Job control	3 studies n=4828	Wrist and hand	⊕○○○	Cannot determine if an association exists
Social support	3 studies n=7387	Wrist and hand	⊕○○○	Cannot determine if an association exists
Predictability	1 study n=1532	Wrist and hand	⊕○○○	Cannot determine if an association exists
Advancement opportunities	1 study n=1532	Wrist and hand	⊕○○○	Cannot determine if an association exists
Organisational factors				
Shift work	2 studies n=1937	Wrist and hand	⊕○○○	Cannot determine if an association exists
Overtime work	2 studies n=3584	Wrist and hand	⊕○○○	Cannot determine if an association exists

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Table 4 continued

Occupational exposure	Number of studies Number of participants, total (n)	Location of complaints	GRADE	Interpretation
Other exposures				
Heat	1 study n=3824	Wrist and hand	⊕○○○	Cannot determine if an association exists
Cold	2 studies n=4239	Wrist and hand	⊕○○○	Cannot determine if an association exists
Temperature changes	1 study n=3824	Wrist and hand	⊕○○○	Cannot determine if an association exists

HAL TLV = Hand Activity Level – Threshold Limit Value

⊕○○○ = Insufficient scientific evidence; ⊕⊕○○ = Limited scientific evidence; ⊕⊕⊕○ = Moderately strong scientific evidence

Conflicts of interest

According to SBU’s requirements, the experts and scientific reviewers participating in this project have submitted statements about conflicts of interest. These documents are available at SBU’s secretariat. SBU has determined that the conditions described in the submissions are compatible with SBU’s requirements for objectivity and impartiality.

Appendices

- Characteristics of included studies
- Search strategies
- Templates for assessment of relevance and risk of bias
- Excluded articles and articles with high risk of bias

The full report in Swedish

The full report in Swedish [Arbetsmiljöns betydelse för besvär och sjukdom i nacke, axlar, armar och händer](#).

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