Table 4.1.22 *Neck. Physical exposure – randomised controlled trials.*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Conlon et al 2008 [24] USA	RCT Engineering staff or professionals supporting engineering with estimated computer use for at least 20 hrs/week 1 year n=206, whereof 114 completed the entire year while 92 contributed a partial year 28% women	Neck/shoulder diagnosis discomfort >5, scale 0–10, no discomfort – unbearable discomfort or pain medication, thought to be related to computer work, and a disorder diagnosed by physical examination, but only if discomfort score was ≤5 prior intervention	Type of mouse Arm support	HR (95% CI) crude *Type of mouse* Conventional mouse: 1.0 Alternative mouse (neutral forearm position): 0.82 (0.32–2.10) *Arm support* No forearm support board: 1.0 Forearm support board: 1.74 (0.67–4.49)	HR (95% CI) adjusted for age, gender, effort/reward imbalance, birth control pill use, hrs of aerobic activity, mean pre-intervention score and oophorectomy *Type of mouse* Conventional mouse: 1.0 Alternative mouse (neutral forearm position): 0.62 (0.23–1.67) *Arm support* No forearm support board: 1.0 Forearm support board: 1.69 (0.62–4.64)	Moderate

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Table 4.1.22 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Gerr et al 2005 [25] USA	RCT Newly hired persons in insurance and financial companies, food product producers and universities that anticipated using a single computer workstation for ≥15 hrs/week and at least as many hrs as in previous job and were asymptomatic at baseline 6 months n=339 whereof 204 contributed completely and 70 contributed less than 12 weeks 77% women	Neck/shoulder discomfort (discomfort ≥6, VAS scale 0–10, or pain medication)	*No intervention* *Alternate intervention* – Head tilt angle ≤3° (extension) – Head rotation <15° in either direction (L/R) – J key ≥2 cm below elbow hight – Keyboard inner elbow angle ≥120° – J key ≥12.5 cm from edge of desk or work surface – Keyboard wrist ulnar deviation 0° to –20° (>20° radial deviation) – Armrest present – Keyboard wrist rest present – Mouse wrist ulnar deviation –5° to 5° – Mouse wrist extension 20° to 30° – Mouse next to keyboard – High quality chair present *Conventional intervention* – Eye height level with top of monitor screen – Head rotation <15° in either direction (L/R) – J key ≥3 cm above elbow height – Keyboard shoulder flexion –10° to 20° – Keyboard shoulder abduction –10° to 20° – Keyboard inner elbow angle 80° to 100° – Keyboard wrist ulnar deviation –10° to 10° – Keyboard wrist extension –10° to 10° – Keyboard wrist rest present – Mouse wrist ulnar deviation –10° to 10° – Mouse wrist extension –10° to 10° – Armrest present – High quality chair present	No difference in time to symptoms between groups (log rank test probability=0.84)	HR (95% CI) controlled for gender, age and hrs keying previous week *No intervention* 1.0 *Alternate intervention* 1.07 (0.64–1.80) *Conventional intervention* 1.00 (0.60–1.68)	Moderate

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Table 4.1.22 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Rempel et al 2006 [26] USA	RCT Registered nurses or healthcare specialists at two customer service centre sites of a large healthcare company who performed computer based customer service work >20 hrs/w and did not have an active workers compensation claim involving the neck, shoulders or upper extremities 52 weeks n=182, whereof 57 dropped out before completing the full 12 months 95% women	Neck/shoulder diagnosis (discomfort >5 the preceding 7 days, scale 0–10, no pain – unbearable pain or pain medication not associated with an acute traumatic event and a disorder diagnosed by physical examination, but only if discomfort score was ≤5 prior intervention	Type of computer input device Arm support	HR (95% CI) unadjusted *Type of computer input device* Mouse: 1.0 Trackball: 0.61 (0.31–1.17) *Arm support* No armboard: 1.0 Armboard: 0.53 (0.28–1.03)	HR (95% CI) adjusted for age, gender, pre-intervention pain score, composite psychological strain score, iso-strain (forced into the model) and all other covariates from baseline that changed the HR of the intervention variable by 0.05 or more *Type of computer input device* Mouse: 1.0 Trackball: 0.62 (0.30–1.28) *Arm support* No armboard: 1.0 Armboard: 0.49 (0.24–0.97)	Moderate

CI = Confidence interval; HR = Hazard ratio; RCT = Randomised controlled trial

Table 4.1.23 *Neck. Physical exposure – cohort studies.*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Andersen et al 2007 [9] Denmark	Cohort General working population, industrial and service sector 2 years n=1 513 % women not reported	Severe neck/ shoulder pain (some to very much pain the past 12 months)	Repetitive hand work Lifting, cumulative Lifting, cumulative, at or above shoulder level Pushing, cumulative Squatting >5 min/hr Standing >30 min/hr Sitting >30 min/hr	HR (95% CI) adjusted for gender, age, occupational group, intervention group *Repetitive hand work* 0–9 min/hr: 1.0 10–44 min/hr: 1.0 (0.7–1.5) 45–60 min/hr: 1.5 (1.0–2.1) *Lifting, cumulative* Never: 1.0 1–99 kg/hr: 1.4 (0.9–1.9) ≥100 kg/hr: 1.9 (1.3–2.7) *Lifting, cumulative, at or above shoulder level* Never: 1.0 1–49 kg/hr: 1.2 (0.7–2.2) ≥50 kg/hr: 2.1 (1.3–3.5) *Pushing, cumulative* Never: 1.0 1–354 kg/hr: 1.3 (0.9–1.9) ≥355 kg/hr: 1.5 (1.0–2.2) *Squatting >5 min/hr* No: 1.0 Yes: 1.6 (1.1–2.2) *Standing >30 min/hr* No: 1.0 Yes: 1.8 (1.2–2.2) *Sitting > 30 min/hr* No: 1.0 Yes: 0.7 (0.5–1.1)	HR (95% CI) adjusted for gender, age, occupational group, intervention group, included physical factors, job satisfaction, education level, other chronic disease *Repetitive hand work* 0–9 min/hr: – 10–44 min/hr: – 45–60 min/hr: – *Lifting, cumulative* Never: – 1–99 kg/hr: – ≥100 kg/hr: – *Lifting, cumulative, at or above shoulder level* Never: 1.0 1–49 kg/hr: 1.1 (0.6–2.0) ≥50 kg/hr: 1.9 (1.1–3.3) *Pushing, cumulative* Never: – 1–354 kg/hr: – ≥355 kg/hr: – *Squatting >5 min/hr* No: 1.0 Yes: 1.4 (1.0–2.0) *Standing >30 min/hr* No: – Yes: – *Sitting >30 min/hr* No: – Yes: –	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Andersen et al 2008 [10] Denmark	Cohort Professional computer users, mainly technical assistants 2000–2001 n=2 146 74% women Part of same cohort as Brandt et al 2004 [13]	Acute neck pain (pain level 0–6, last 7 days after exposure recording time) Prolonged neck pain (pain ≥4, score range 0–7, for 3 consecutive weeks followed after pain ≤2.5 for 4 consecutive weeks) Chronic neck pain (at least 30 days past 12 months and quite a lot of trouble but free from pain above 3, score range 0–7, at baseline	Mouse work Keyboard work		OR (95% CI) mutually adjusted for fixed covariates from baseline <u>*Acute neck pain*</u> *Mouse work* Usage time, hrs/w per interquartile range (0; 2.1; 5.2; 9.0; 46): 1.04 (1.00–1.09) Speed, mouse clicks per 25 clicks/min: 0.99 (0.97–1.02) Average activity periods per 10 min: (0.99–1.02) Average micro-pauses per min: 0.97 (0.94–1.00) *Keyboard work* Usage time, hrs/w before outcome per interquartile range (0; 0.4; 0.9; 1.7; 22): 1.1 (0.98–1.03) Speed per 100 key-strokes/min: 0.99 (0.96–1.02) Average activity periods per 2 min: 1.00 (0.98–1.01) Average micro-pauses per min: 1.01 (0.97–1.04) Results continues on the next page	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Andersen et al continued 2008 [10] Denmark					*Prolonged neck pain* *Mouse work* Usage time, hrs/w before outcome per interquartile range (0–46): 1.01 (0.97–1.06) Speed per 25 clicks/min: 0.84 (0.63–1.12) Average activity periods per 10 min: 1.02 (0.92–1.13) Average micro-pauses per min: 0.96 (0.75–1.24) *Keyboard work* Usage time, hrs/w before outcome per interquartile range (0; 0.4; 0.9; 1.7; 22): 1.08 (0.80–1.47) Speed per 100 key-strokes/min: 0.85 (0.63–1.16) Average activity periods per 2 min: 1.06 (0.96–1.16) Average micro-pauses per min: 0.95 (0.84–1.07) OR mutual adjusted for gender, age, and included variables Results continues on the next page	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Andersen et al continued 2008 [10] Denmark					*Chronic neck pain* *Mouse work* Usage time, hrs/yr per inter-quartile range (0–1 590 hrs/yr): 0.77 (0.55–1.07) *Keyboard work* Usage time, hrs/yr per inter-quartile range (0–550 hrs/yr): 1.05 (0.74–1.51) *Seniority* ≤3 yrs: 1.0 4–7 yrs: 1.06 (0.36–3.07) 8–10 yrs: 1.88 (0.65–5.44) >10 yrs: 2.53 (0.84–7.56)	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Andersen et al 2003 [11] Denmark	Cohort Danish general working population, industrial and service sector 1994/1995–1999 4-years n=1 964 at risk for being a symptom case and 1 869 at risk for being a clinical case (at 1 year follow-up) % women not reported	Neck/shoulder pain (pain and impairment of daily activities past 3 months, symptom cases, score <12, score range 0–36, at baseline and an increase of 12 score values during follow-up) Neck/shoulder pain with pressure tenderness (pain and impairment of daily activities past 3 months, as above, and pressure tenderness, clinical cases)	Repetitive shoulder movements Force requirements Neck flexion, prop of task cycle time with neck flexed >20° Lack of recovery time, prop of task cycle time without micro-pauses <u>*Combined exposure*</u> Repetition and force Repetition and % of working time with neck flexed ≥20° Repetition and recovery	OR (95% CI) crude 95% CI calculated from raw data presented <u>*Neck/shoulder pain*</u> *Repetitive shoulder movements* Reference: 1.0 1–15 movements/min: 1.2 (0.9–1.4) 16–40 movements/min: 1.7 (1.3–2.1) *Force requirements* Reference: 1.0 <10% MVC: 1.3 (1.1–1.6) ≥10% MVC: 1.4 (1.1–1.7) *Neck flexion, prop of task cycle time with neck flexed >20°* Reference: 1.0 <66% of time: 1.2 (1.0–1.5) ≥66% of time: 1.6 (1.3–2.0) *Lack of recovery time, prop of task cycle time without micro-pauses* Reference: 1.0 <80% of time: 1.3 (0.9–1.7) ≥80% of time: 1.4 (1.2–1.7) Results continues on the next page	OR (95% CI) adjusted for age, gender, BMI, pain pressure threshold, intrinsic effort, physical leisure time physical activity, psychosocial factors, level of distress <u>*Neck/shoulder pain*</u> *Repetitive shoulder movements* Reference: 1.0 1–15 movements/min: 1.1 (0.9–1.3) 16–40 movements/min: 1.5 (1.2–1.9) *Force requirements* Reference: 1.0 <10% MVC: 1.2 (0.9–1.5) ≥10% MVC: 1.3 (1.0–1.7) *Neck flexion, prop of task cycle time with neck flexed >20°* Reference: 1.0 <66% of time: 1.1 (0.9–1.4) ≥66% of time: 1.4 (1.1–1.8) Approximately same estimate for neck and shoulder, respectively *Lack of recovery time, prop of task cycle time without micro-pauses* Reference: 1.0 <80% of time: 1.2 (0.9–1.6) ≥80% of time: 1.3 (1.0–1.5) Results continues on the next page	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Andersen et al continued 2003 [11] Denmark				*Neck/shoulder pain with pressure tenderness* *Repetitive shoulder movements* Reference: 1.0 1–15 movements/min: 1.6 (0.8–3.1) 16–40 movements/min: 3.9 (2.1–7.2) *Force requirements* Reference: 1.0 <10% MVC: 2.7 (1.5–4.8) ≥10% MVC: 2.1 (1.0–4.1) *Neck flexion,prop of task cycle time with neck flexed >20°* Reference: 1.0 <66% of time: 1.8 (0.9–3.3) ≥66% of time: 3.6 (1.9–6.6) *Lack of recovery time, prop of task cycle time without micro-pauses* Reference: 1.0 <80% of time: 1.2 (0.4–3.2) ≥80% of time: 2.8 (1.5–5.0) Results continues on the next page	*Neck/shoulder pain with pressure tenderness* *Repetitive shoulder movements* Reference: 1.0 1–15 movements/min: 1.3 (0.7–2.6) 16–40 movements/min: 3.0 (1.5–5.8) *Force requirements* Reference: 1.0 <10% MVC: 1.9 (1.0–3.6) ≥10% MVC: 2.0 (1.0–4.2) *Neck flexion, prop of task cycle time with neck flexed >20°* Reference: 1.0 <66% of time: 1.4 (0.7–2.9) ≥66% of time: 2.6 (1.3–5.1) *Lack of recovery time, prop of task cycle time without micro-pauses* Reference: 1.0 <80% of time: 1.0 (0.4–2.9) ≥80% of time: 2.1 (1.1–3.9) Results continues on the next page	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Andersen et al continued 2003 [11] Denmark				*Combined exposure* *Repetition and force* Reference: 1.0 Low rep and low force: 1.8 (0.9–3.5) High rep and low force: 4.8 (2.5–9.3) Low rep and high force: 1.2 (0.4–3.4) High rep and high force: 2.9 (1.4–6.1) *Repetition and % of working time with neck flexed >20°* Reference: 1.0 Low rep and low % of time: 1.4 (0.7–2.8) High rep and low % of time: 3.4 (1.5–7.8) Low rep and high % of time: 2.6 (1.1–6.0) High rep and high % of time: 4.1 (2.1–7.7) *Repetition and recovery* Reference: 1.0 Low rep and high recovery: 1.0 (0.3–3.2) High rep and high recovery: 1.9 (0.2–14.8) Low rep and low recovery: 1.9 (1.0–3.6) High rep and low recovery: 4.0 (2.1–7.4)	*Combined exposure* *Repetition and force* Reference: 1.0 Low rep and low force: 1.3 (0.6–2.7) High rep and low force: 3.3 (1.6–6.9) Low rep and high force: 1.3 (0.4–3.7) High rep and high force: 2.6 (1.2–5.9) *Repetition and % of working time with neck flexed >20°* Reference: 1.0 Low rep and low % of time: 1.2 (0.6–2.5) High rep and low % of time: 2.5 (1.0–6.0) Low rep and high % of time: 1.6 (0.6–4.1) High rep and high % of time: 3.2 (1.6–6.4) *Repetition and recovery* Reference: 1.0 Low rep and high recovery: 1.0 (0.3–3.1) High rep and high recovery: 1.5 (0.2–11.9) Low rep and low recovery: 1.4 (0.7–2.9) High rep and low recovery: 3.1 (1.6–6.0)	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Ariëns et al 2001 [30] The Netherlands	Cohort Workers from industrial and service branches, such as metal, computer software, chemical, pharmaceutical, food, wood construction industry, insurance companies, child-care centres, hospitals, distribution companies, and bricklayers 1994–1997 3 years n=977 25% women Based on same cohort as Hamberg-van Reenen et al 2006 [16]	Neck pain (regular or prolonged neck pain the previous 12 months on at least one of the three follow-up measurements)	Neck flexion ≥20° Neck flexion ≥45° Neck rotation ≥45° Sitting <u>*Subcohort no change in work*</u> (n=686) Neck flexion ≥20° Neck flexion ≥45° Neck rotation ≥45° Sitting <u>*Stratified for neck endurance time*</u> Neck flexion ≥20° Neck flexion ≥45°	RR (95% CI) crude *Neck flexion >20°* <60% of time: 1.00 60–70% of time: 1.62 (0.85–3.09) >70% of time: 2.01 (0.98–4.11) *Neck flexion >45°* <5% of time: 1.00 5–10% of time: 1.19 (0.78–1.82) >10% of time: 1.50 (0.87–2.58) *Neck rotation >45°* <25% of time: 1.00 25–30% of time: 1.33 (0.78–2.28) >30% of time: 0.86 (0.38–1.95) *Sitting* <1% of time: 1.00 1–50% of time: 1.41 (0.88–2.27) 50–75% of time: 1.68 (0.76–3.74) 75–95% of time: 1.46 (0.86–2.45) >95% of time: 2.01 (1.04–3.88) Results continues on the next page	RR (95% CI) adjusted for gender, age, and included physical variables *Neck flexion >20°* <60% of time: 1.00 60–70% of time: 1.21 (0.58–2.53) >70% of time: 1.63 (0.70–3.82) *Neck flexion >45°* <5% of time: 1.00 5–10% of time: 1.27 (0.81–1.97) >10% of time: 1.16 (0.62–2.17) *Neck rotation >45°* <25% of time: 1.00 25–30% of time: 1.40 (0.81–2.43) >30% of time: 0.98 (0.42–2.26) *Sitting* <1% of time: 1.00 1–50% of time: 1.25 (0.75–2.09) 50–75% of time: 1.43 (0.59–3.50) 75–95% of time: 1.29 (0.71–2.37) >95% of time: 2.34 (1.05–5.21) Results continues on the next page	High

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Ariëns et al continued 2001 [30] The Netherlands				*Subcohort no change in work* *Neck flexion >20°* <60% of time: – 60–70% of time: – >70% of time: – *Neck flexion >45°* <5% of time: – 5–10% of time: – >10% of time: – *Neck rotation >45°* <25% of time: – 25–30% of time: – >30% of time: – *Sitting* <1% of time: – 1–50% of time: – 50–75% of time: – 75–95% of time: – >95% of time: –	*Subcohort no change in work* *Neck flexion >20°* <60% of time: 1.00 60–70% of time: 1.76 (0.78–3.94) >70% of time: 1.66 (0.57–4.81) *Neck flexion >45°* <5% of time: 1.00 5–10% of time: 1.16 (0.66–2.04) >10% of time: 1.30 (0.61–2.76) *Neck rotation >45°* <25% of time: 1.00 25–30% of time: 1.25 (0.61–2.55) >30% of time: 1.13 (0.41–3.17) *Sitting* <1% of time: 1.00 1–50% of time: 1.79 (0.86–3.74) 50–75% of time: 1.85 (0.56–6.11) 75–95% of time: 1.58 (0.68–3.63) >95% of time: 3.28 (1.22–8.81)	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Ariëns et al continued 2001 [30] The Netherlands				<u>*Stratified for neck endurance time*</u> *Neck flexion >20°* <60% of time: 1.00 >60% of time: 2.50 (1.11–5.56) and low endurance time *Neck flexion >20°* <60% of time: 1.00 >60% of time: 1.32 (0.52–3.35) and medium endurance time *Neck flexion >20°* <60% of time: 1.00 >60% of time: 1.11 (0.34–3.65) and high endurance time *Neck flexion >45°* <5% of time: 1.00 >5% of time: 1.89 (1.02–3.52) and low endurance time *Neck flexion >45°* <5% of time: 1.00 >5% of time: 1.08 (0.57–2.05) and medium endurance time *Neck flexion >45°* <5% of time: 1.00 >5% of time: 0.84 (0.38–1.86) and high endurance time		

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Bergqvist et al 1992 [31] Sweden	Cohort Office workers in travel agencies, newspaper production, postal office, and insurance companies 1981–1987 n=341 76% women	Pain or discomfort in neck or shoulder	VDT use VDT use >30 hrs/w	*VDT use* Never: 1 1981 and 1987: 0.94 (0.53–1.64) 1987 but not 1981: 0.99 (0.51–1.94) 1987, regardless of 1981: 0.95 (0.55–1.64) *VDT use >30 h/w* Never: 1 1981 and 1987: 0.64 (0.38–1.06) 1987 but not 1981: 0.44 (0.19–1.02) 1987, regardless of 1981: 0.59 (0.36–0.96) Cumulative incidence (% per weekly hour of VDT work): –0.46 (–1.05–0.12)	Not reported	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Brandt et al 2004 [13] Denmark	Cohort Professional computer users, mainly technical assistants 2000–2001 n=4 548 % women not reported Based on same cohort as Andersen et al 2008 [10]	Neck pain (at least current, last 7 days, moderate pain, score ≥4, score range 0–7, and quite a lot, or more pain last 12 months)	Work with mouse Work with keyboard Arm support mouse Arm support keyboard Abnormal keyboard position Screen Chair not adjusted Desk not adjusted Not satisfied with work place design Work with mouse hrs/w Work with keyboard	RR (95% CI) adjusted for work with mouse and keyboard and all physical factors *Work with mouse* 0–9 hrs/w: 1.0 10–19 hrs/w: 1.2 (0.6–2.2) 20–29 hrs/w: 1.1 (0.5–2.4) ≥30 hrs/w: 1.9 (0.6–6.1) *Work with keyboard* 0–4 hrs/w: 1.0 5–9 hrs/w: 0.9 (0.4–2.0) 10–14 hrs/w: 1.0 (0.4–2.3) ≥15 hrs/w: 2.1 (0.9–4.6) *Arm support mouse* No: 1.0 <50% of time: 1.0 (0.3–2.9) ≥50% of time: 1.1 (0.5–2.5) *Arm support keyboard* No: 1.0 <50% of time: 0.6 (0.3–1.4) ≥50% of time: 1.0 (0.6–1.8) *Abnormal keyboard position* 1.0 (0.4–2.2) Results continues on the next page	RR (95% CI) final model includes physical, psychosocial and personal characteristics *Work with mouse* 0–9 hrs/w: 1.0 10–19 hrs/w: 1.1 (0.6–1.9) 20–29 hrs/w: 0.9 (0.4–1.9) ≥30 hrs/w: 2.4 (0.8–6.8) *Work with keyboard* 0–4 hrs/w: 1.0 5–9 hrs/w: 1.1 (0.5–2.2) 10–14 hrs/w: 1.0 (0.4–2.2) ≥15 hrs/w: 1.8 (0.8–3.9) *Arm support mouse* No: – <50% of time: – ≥50% of time: – *Arm support keyboard* No: – <50% of time: – ≥50% of time: – *Abnormal keyboard position* – Results continues on the next page	High

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Brandt et al continued 2004 [13] Denmark				*Screen* Too high: 0.8 (0.1–5.7) Too low: 0.9 (0.5–1.4) To the right or left: 1.0 (0.4–2.5) *Chair not adjusted* 1.0 (0.2–4.3) *Desk not adjusted* 0.9 (0.5–1.8) *Not satisfied with work place design* 1.4 (0.7–2.9) RR adjusted for work with mouse and keyboard and personal characteristics *Work with mouse hrs/w* 0–9 hrs/w: 1.0 10–19 hrs/w: 1.5 (0.8–2.7) 20–29 hrs/w: 1.3 (0.6–2.8) ≥30 hrs/w: 3.2 (1.1–9.5) *Work with keyboard* 0–4 hrs/w: 1.0 5–9 hrs/w: 1.1 (0.5–2.4) 10–14 hrs/w: 0.9 (0.4–2.2) ≥15 hrs/w: 2.2 (0.97–5.1)	*Screen* Too high: – Too low: – To the right or left: – *Chair not adjusted* – *Desk not adjusted* – *Not satisfied with work place design* – *Work with mouse hrs/w* 0–9 hrs/w: 1.0 10–19 hrs/w: 1.1 (0.6–1.9) 20–29 hrs/w: 0.9 (0.4–1.9) ≥30 hrs/w: 2.4 (0.8–6.8) *Work with keyboard* 0–4 hrs/w: 1.0 5–9 hrs/w: 1.1 (0.5–2.2) 10–14 hrs/w: 1.0 (0.4–2.2) ≥15 hrs/w: 1.8 (0.8–3.9)	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Eriksen et al 1999 [14] Norway	Cohort Working population in one municipality 1990–1994 n=576 38% women	Neck pain previous 12 months Neck pain previous 7 days	Heavy lifting Work with hands above shoulder level Work in the same position over a long time Repetitive stereotypical movements Sitting Standing High work pace	RR (95% CI) crude calculated from raw data presented <u>*Neck pain previous 12 months*</u> *Heavy lifting* No: 1.0 Yes: 1.20 (0.90–1.59)[1] *Work with hands above shoulder level* No: 1.0 Yes: 0.72 (0.44–1.18) *Work in the same position over a long time* No: 1.0 Yes: 1.36 (1.01–1.82) *Repetitive stereotypical movements* No: 1.0 Yes: 1.16 (0.84–1.59) *Sitting* No: 1.0 Yes: 0.95 (0.73–1.25) *Standing* No: 1.0 Yes: 1.04 (0.77–1.40) *High work pace* No: 1.0 Yes: 1.18 (0.90–1.56)	RR (95% CI) adjusted for all covariates at baseline <u>*Neck pain previous 12 months*</u> *Heavy lifting* No: – Yes: – *Work with hands above shoulder level* No: – Yes: – *Work in the same position over a long time* No: – Yes: – *Repetitive stereotypical movements* No: – Yes: – *Sitting* No: – Yes: – *Standing* No: – Yes: – *High work pace* No: – Yes: –	Moderate [1] Uncertain value because absolute and relative numbers are not congruent

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Eriksen et al continued 1999 [14] Norway				<u>*Neck pain previous 7 days*</u> *Heavy lifting* No: 1.00 Yes: 0.96 (0.56–1.64) *Work with hands above shoulder level* No: 1.0 Yes: 0.52 (0.19–1.38) *Work in the same position over a long time* No: 1.0 Yes: 1.20 (0.69–2.08) *Repetitive stereotypical movements* No: 1.0 Yes: 1.08 (0.61–1.93) *Sitting* No: 1.0 Yes: 0.86 (0.53–1.39) *Standing* No: 1.0 Yes: 1.18 (0.70–1.98) *High work pace* No: 1.0 Yes: 0.90 (0.54–1.51)	<u>*Neck pain previous 7 days*</u> *Heavy lifting* No: – Yes: – *Work with hands above shoulder level* No: – Yes: – *Work in the same position over a long time* No: – Yes: – *Repetitive stereotypical movements* No: – Yes: – *Sitting* No: – Yes: – *Standing* No: – Yes: – *High work pace* No: – Yes: –	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Feveile et al 2002 [15] Denmark	Cohort Random sample of working population 1990–1995 n=1 895 33% women	Neck/shoulder pain (last 12 months)	<u>*Men*</u> Physically hard (breathe faster) Twist and bend the body the same way several times/hr Work with hands lifted to shoulder height or higher Repetitive work tasks several times/hr ≥3/4 of their working hrs Sedentary work ≥3/4 of their working hrs Heavy lifting (lift >20 kg daily) Continues on the next page	<u>*Men*</u> *Physically hard (breathe faster)* p=0.13 *Twist and bend the body the same way several times/hr* p=0.03 *Work with hands lifted to shoulder height or higher* p=0.11 *Repetitive work tasks several times/hr ≥3/4 of their working hrs* p=0.47 *Sedentary work ≥3/4 of their working hrs* p=0.74 *Heavy lifting (lift >20 kg daily)* p=0.10 Results continues on the next page	OR (95% CI) adjusted for all covariates <u>*Men*</u> *Physically hard (breathe faster)* Seldom/never: – 1/4–1/2 working time: – ≥3/4 of working time: – *Twist and bend the body the same way several times/hr* Seldom/never: 1.0 1/4–1/2 working time: 1.56 (1.10–2.22) ≥3/4 of working time: 1.51 (1.01–2.26) *Work with hands lifted to shoulder height or higher* Seldom/never: – 1/4–1/2 working time: – ≥3/4 of working time: – *Repetitive work tasks several times/hr ≥3/4 of their working hrs* – *Sedentary work ≥3/4 of their working hrs* – *Heavy lifting (lift >20 kg daily)* – Results continues on the next page	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Feveile et al continued 2002 [15] Denmark			*Interaction* Heavy lifting and sedentary work – Seldom/never and seldom/never – Seldom/never and 1/4–1/2 of working hrs – Seldom/never and ≥3/4 of working hrs – 1/4–1/2 of working hrs and seldom/never – 1/4–1/2 of working hrs and 1/4–1/2 of working hrs – 1/4–1/2 of working hrs and ≥3/4 of working hrs – ≥3/4 of working hrs and seldom/never – ≥3/4 of working hrs and 1/4–1/2 of working hrs – ≥3/4 of working hrs and ≥3/4 of working hrs Continues on the next page		*Interaction* *Heavy lifting and sedentary work* Seldom/never and seldom/never: 1.0 Seldom/never and 1/4–1/2 of working hrs: 1.42 (0.99–2.03) Seldom/never and ≥3/4 of working hrs: 1.50 (1.05–2.15) 1/4–1/2 of working hrs and seldom/never: 1.42 (0.89–2.67) 1/4–1/2 of working hrs and 1/4–1/2 of working hrs: 1.61 (0.80–3.24) 1/4–1/2 of working hrs and ≥3/4 of working hrs: 0.18 (0.02–1.41) ≥3/4 of working hrs and seldom/never: 2.35 (1.10–5.00) ≥3/4 of working hrs and 1/4–1/2 of working hrs: 1.38 (0.33–5.76) ≥3/4 of working hrs and ≥3/4 of working hrs: 2.36 (0.14–39.45) Results continues on the next page	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Feveile et al continued 2002 [15] Denmark			<u>*Women*</u> Physically hard (breathe faster) Twist and bend the body the same way several times/hr Work with hands lifted to shoulder height or higher Repetitive work tasks several times/hr ≥3/4 of their working hrs Sedentary work ≥3/4 of their working hrs Heavy lifting (lift >20 kg daily)	<u>*Women*</u> *Physically hard (breathe faster)* p=0.48 *Twist and bend the body the same way several times/hr* p=0.15 *Work with hands lifted to shoulder height or higher* p=0.09 *Repetitive work tasks several times/hr ≥3/4 of their working hrs* p=0.66 *Sedentary work ≥3/4 of their working hrs* p=0.66 *Heavy lifting (lift >20 kg daily)* p=0.26	<u>*Women*</u> *Physically hard (breathe faster)* Seldom/never: – 1/4–1/2 working time: – ≥3/4 of working time: – *Twist and bend the body the same way several times/hr* Seldom/never: – 1/4–1/2 working time: – ≥3/4 of working time: – *Work with hands lifted to shoulder height or higher* Seldom/never: – 1/4–1/2 working time: – ≥3/4 of working time: – *Repetitive work tasks several times/hr ≥3/4 of their working hrs* – *Sedentary work ≥3/4 of their working hrs* – *Heavy lifting (lift >20 kg daily)* – Results continues on the next page	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Feveile et al continued 2002 [15] Denmark					*Interaction* *Heavy lifting and sedentary work* Seldom/never and seldom/never: – Seldom/never and 1/4–1/2 of working hrs: – Seldom/never and ≥3/4 of working hrs: – 1/4–1/2 of working hrs and seldom/never: – 1/4–1/2 of working hrs and 1/4–1/2 of working hrs: – 1/4–1/2 of working hrs and ≥3/4 of working hrs: – ≥3/4 of working hrs and seldom/never: – ≥3/4 of working hrs and 1/4–1/2 of working hrs: – ≥3/4 of working hrs and ≥3/4 of working hrs: –	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Hamberg-van Reenen et al 2006 [16] The Netherlands	Cohort Blue- and white collar workers Same study population as Ariëns et al 2001 [30] 1994–1997 n=962 Approximately 30% women	Neck pain (regular or prolonged pain past 12 months)	Isokinetic lifting strength (N) and lifting ≥10 kg at work Static endurance and neck flexion ≥20 degrees at work Reference = high cap, low exp High-balance group = high cap, high exp Low-balance group = low cap, low exp Imbalance = low cap, high exp	RR (95% CI) adjusted for follow-up time *Isokinetic lifting strength (N) and lifting ≥10 kg at work* Reference: 1.00 High-balance group: 0.76 (0.54–1.08) Low-balance group: 1.99 (1.51–2.62) Imbalance: 1.31 (0.96–1.78) *Static endurance and neck flexion ≥20° at work* Reference: 1.00 High-balance group: 1.38 (1.00–1.89) Low-balance group: 1.32 (0.94–1.85) Imbalance: 2.07 (1.53–2.79)	RR (95% CI) adjusted for follow-up time, gender, age, length, education and previous neck pain *Isokinetic lifting strength (N) and lifting ≥10 kg at work* Reference: 1.00 High-balance group: 1.00 (0.72–1.40) Low-balance group: 1.35 (1.03–1.79) Imbalance: 1.20 (0.88–1.62) RR (95% CI) adjusted for follow-up time, gender, age, co-morbidity of low-back or shoulder pain, previous neck pain, isokinetic lifting strength of the neck-shoulder muscles and number of years of sports participation *Static endurance and neck flexion ≥20° at work* Reference: 1.00 High-balance group: 1.11 (0.78–1.57) Low-balance group: 0.96 (0.65–1.42) Imbalance: 1.36 (0.96–1.91)	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
van den Heuvel et al 2006 [21] The Netherlands	Cohort Office workers selected from the same study population as Ariëns et al 2001 [30] and Hamberg-van Reenen 2006 [16] 1995–1997 3 years n=371 % women not reported	Neck/shoulder symptoms (regular or prolonged pain past 12 months)	*Video observations* Neck flexion ≥20° Neck flexion ≥45° Neck rotation ≥45° Arm elevation 30–60° *Self-reported* Prolonged neck flexion Prolonged neck extension Prolonged neck rotation Computer work	OR (95% CI) crude *Video observations* *Neck flexion ≥20°* 0–33% of time: 1.00 33–38% of time: 1.01 (0.60–1.71) 38–73% of time: 1.20 (0.70–2.05) *Neck flexion ≥45°* 0–3% of time: 1.00 3–4% of time: 1.05 (0.62–1.79) 4–24% of time: 1.21 (0.70–2.08) *Neck rotation ≥45°* 2–13% of time: 1.00 14% of time: 1.37 (0.87–2.16) 14–45% of time: 2.60 (1.54–4.40) *Arm elevation 30–60°* 9–32%: 1.00 32–35%: 0.56 (0.29–1.07) 36–65%: 0.70 (0.46–1.06) Results continues on the next page	OR (95% CI) adjusted for the value of the outcome measure at the time of exposure, age, gender, and psycho-social work characteristics *Video observations* *Neck flexion ≥20°* 0–33% of time: 1.00 33–38% of time: 0.92 (0.58–1.46) 38–73% of time: 1.06 (0.65–1.72) *Neck flexion ≥45°* 0–3% of time: 1.00 3–4% of time: 0.95 (0.59–1.52) 4–24% of time: 1.10 (0.67–1.80) *Neck rotation ≥45°* 2–13% of time: 1.00 14% of time: 1.06 (0.70–1.60) 14–45% of time: 1.57 (0.99–2.50) *Arm elevation 30–60°* 9–32%: 1.00 32–35%: 0.76 (0.42–1.38) 36–65%: 0.81 (0.55–1.19) Results continues on the next page	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
van den Heuvel et al continued 2006 [21] The Netherlands				*Self-reported* *Prolonged neck flexion* No: 1.00 Yes: 1.49 (1.09–2.02) *Prolonged neck extension* No: 1.00 Yes: 1.43 (0.78–2.61) *Prolonged neck rotation* No: 1.00 Yes: 1.69 (1.29–2.21) *Computer work* Seldom: 1.00 Rather often: 1.14 (0.84–1.54) Very often: 1.03 (0.70–1.52)	*Self-reported* *Prolonged neck flexion* No: 1.00 Yes: 1.35 (0.92–1.99) *Prolonged neck extension* No: 1.00 Yes: 2.42 (1.22–4.80) *Prolonged neck rotation* No: 1.00 Yes: 1.43 (1.02–2.01) *Computer work* Seldom: 1.00 Rather often: 1.23 (0.81–1.85) Very often: 0.94 (0.60–1.48)	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Jensen et al 2003 [17] Denmark	Cohort A variety of computer users 1999–2000 (17 to 23 months) n=1 182 55% women	Neckpain symptoms (>7 days within the last year)	Duration of employment in same job Experience with computer use Repetitiveness Training in software use Computer skills Technical problems with computer Quality of technical support Screen height Disturbed by glare *Among subjects working 32–41 hrs/w and did not change job during follow-up* Worktime at computer Worktime using mouse	OR (95% CI) calculated from raw data presented *Women* *Duration of employment in same job* p=0.22 >3 years: 1.0 1–3 years: 1.7 (1.1–2.5) <1 years: 1.2 (0.7–1.9) *Experience with computer use* p=0.26 0–3 years: 1.4 (0.8–2.4) 4–7 years: 1.2 (0.7–2.0) 8–12 years: 0.9 (0.6–1.4) >12 years: 1.0 *Repetitiveness* p=0.08 Varied work: 1.0 Repetitive movements: 1.1 (0.7–1.7) Repetitive tasks and movements: 1.5 (1.0–2.3) *Training in software use* p=0.98 Sufficient: 1.0 Insufficient: 1.0 (0.6–1.6) *Computer skills* p=0.89 Extremely good: 1.0 Good: 1.0 (0.7–1.4) Bad or somewhat good: 1.1 (0.6–1.9) *Technical problems with computer* p=0.096 Less than once a month: 1.0 At least once a month: 1.1 (0.7–1.8) Daily or at least once a week: 1.5 (0.9–2.3) Results continues on the next page	OR adjusted for all covariates, remaining if p<0.10 *Women* *Duration of employment in same job* Not included in final model *Experience with computer use* Not included in final model *Repetitiveness* Not included in final model *Training in software use* Not included in final model *Computer skills* Not included in final model *Technical problems with computer* Not included in final model Results continues on the next page	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Jensen et al continued 2003 [17] Denmark				*Quality of technical support* p=0.38 Very satisfactory: 1.0 Satisfactory: 1.2 (0.7–2.3) Dissatisfactory: 1.4 (0.7–2.6) *Screen height* p=0.071 Top or below eye level: 1.0 Top above eye level: 1.5 (1.0–2.2) *Disturbed by glare* p=0.056 No: 1.0 Every once in a while: 1.1 (0.7–1.7) Daily or several times a week: 1.6 (1.0–2.5)	*Quality of technical support* Not included in final model *Screen height* Top or below eye level: 1.0 Top above eye level: 1.5 (1.0–2.2) *Disturbed by glare* Not included in final model	
				<u>*Men*</u> *Duration of employment in same job* p=0.034 >3 years: 1.0 1–3 years: 1.2 (0.7–2.1) <1 years: 1.9 (1.0–3.4) *Experience with computer use* p=0.90 0–3 years: 1.2 (0.5–2.6) 4–7 years: 0.8 (0.4–1.9) 8–12 years: 1.8 (1.0–3.1) >12 years: 1.0 *Repetitiveness* p=0.86 Varied work: 1.0 Repetitive movements: 1.2 (0.6–2.4) Repetitive tasks and movements: 0.9 (0.4–2.5)	<u>*Men*</u> *Duration of employment in same job* >3 years: 1.0 1–3 years: 1.4 (0.8–2.5) <1 years: 2.1 (1.1–3.9) *Experience with computer use* Not included in final model *Repetitiveness* Not included in final model	
				Results continues on the next page	Results continues on the next page	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Jensen et al continued 2003 [17] Denmark				*Training in software use* p=0.066 Sufficient: 1.0 Insufficient: 0.50 (0.2–1.0)	*Training in software use* Not included in final model	
				Computer skills p=0.088 Extremely good: 1.0 Good: 1.4 (0.8–2.4) Bad or somewhat good: 0.2 (0.2–1.0)	*Computer skills* Extremely good: 1.0 Good: 1.2 (0.7–2.1) Bad or somewhat good: 0.4 (0.1–0.9)	
				Technical problems with computer p=0.12 Less than once a month: 1.0 At least once a month: 1.4 (0.8–2.5) Daily or at least once a week: 1.6 (0.9–2.8)	*Technical problems with computer* Not included in final model	
				Quality of technical support p=0.62 Very satisfactory: 1.0 Satisfactory: 1.4 (0.7–2.8) Dissatisfactory: 1.3 (0.6–3.0)	*Quality of technical support* Not included in final model	
				Screen height p=0.76 Top or below eye level: 1.0 Top above eye level: 1.1 (0.6–1.8)	*Screen height* Not included in final model	
				Disturbed by glare p=0.88 No: 1.0 Every once in a while: 1.2 (0.7–2.0) Daily or several times a week: 0.9 (0.4–1.7)	*Disturbed by glare* Not included in final model	
					Results continues on the next page	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Jensen et al continued 2003 [17] Denmark					*Among subjects working 32–41 hrs/w and did not change job during follow-up* *Worktime at computer* 0–25%: 1.0 ≤50%: 1.5 (0.7–3.1) ≤75%: 1.3 (0.6–2.7) Almost all time: 1.6 (0.8–3.3) *Worktime using mouse* Seldom: 1.3 (0.4–4.3) ≤25%: 1.0 50–100%: 1.7 (0.5–5.7)	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Marcus et al 2002 [18] USA	Cohort Newly employed computer users 1995–1998 1998–2001 Up to 3 years follow-up n=436 for neck/ shoulder discomfort n=472 for neck/ shoulder disorders 71% women at baseline	Neck/shoulder discomfort previous week (symptom intensity ≥6, VAS scale 0–10, or pain medication) Specific neck/ shoulder disorder (neck/shoulder discomfort previous week, symptom intensity ≥6, VAS scale 0–10, or pain medication, and got diagnosis at clinical examination)	Keyboard to elbow height difference Keyboard inner elbow angle Keyboard shoulder abduction angle Keyboard shoulder flexion angle Distance from table edge to "J" key Mouse inner elbow angle Mouse shoulder abduction angle Mouse shoulder flexion angle Monitor head tilt angle Monitor head rotation angle Presence of chair arm rest Presence of telephone shoulder rest Hours keying per week (HR per hour) Keyboard inner angle by hrs keying/week interaction	HR (95% CI) crude <u>*Neck/shoulder discomfort previous week*</u> *Keyboard to elbow height difference* ≤0 cm: 1.0 >0 cm: 1.47 (1.01–2.14) *Keyboard inner elbow angle* ≤121°: 1.0 >121°: 0.50 (0.30–0.82) *Keyboard shoulder abduction angle* ≤10°: 1.0 11–14°: 1.13 (0.70–1.82) 15–17°: 0.94 (0.52–1.69) >17°: 0.85 (0.50–1.47) *Keyboard shoulder flexion angle* ≤22°: 1.0 23–28°: 1.36 (0.82–2.25) 29–35°: 1.13 (0.68–1.89) >35°: 0.66 (0.37–1.18) *Distance from table edge to "J" key* ≤17 cm: 1.0 >17 cm: 0.71 (0.45–1.13) Results continues on the next page	HR 95% CI) adjusted for psychosocial variables and all variables in the model <u>*Neck/shoulder discomfort previous week*</u> *Keyboard to elbow height difference* ≤0 cm: 1.0 >0 cm: 1.42 (0.96–2.10) *Keyboard inner elbow angle* ≤121°: 1.0 >121°: 0.16 (0.04–0.62) *Keyboard shoulder abduction angle* – *Keyboard shoulder flexion angle* – *Distance from table edge to "J" key* – Results continues on the next page	High

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Marcus et al continued 2002 [18] USA				*Mouse inner elbow angle* ≤137°: 1.0 138–148°: 1.41 (0.93–2.01) >148°: 0.84 (0.50–1.41) *Mouse shoulder abduction angle* ≤21°: 1.0 22–27°: 0.81 (0.49–1.35) 28–33°: 0.84 (0.49–1.45) >33°: 1.16 (0.70–1.91) *Mouse shoulder flexion angle* ≤25°: 1.0 26–34°: 1.23 (0.72–2.12) 35–44°: 1.66 (0.97–2.86) >44°: 1.26 (0.72–2.28) *Monitor head tilt angle* ≤3°: 1.0 >3° (more extended): 1.53 (0.91–2.57) *Monitor head rotation angle* ≤10°: 1.0 >10°: 1.09 (0.70–1.52) *Presence of chair arm rest* No: 1.0 Yes: 0.73 (0.49–1.09) *Presence of telephone shoulder rest* No: 1.0 Yes: 1.85 (1.03–3.30) *Hours keying per week (HR per hour)* – *Keyboard inner angle by hrs keying/week interaction* – Results continues on the next page	*Mouse inner elbow angle* ≤137°: 1.0 138–148°: 1.67 (1.09–2.55) >148°: 0.94 (0.56–1.59) *Mouse shoulder abduction angle* – *Mouse shoulder flexion angle* – *Monitor head tilt angle* ≤3°: 1.0 >3° (more extended): 1.58 (0.94–2.65) *Monitor head rotation angle* – *Presence of chair arm rest* – *Presence of telephone shoulder rest* No: 1.0 Yes: 2.05 (1.14–3.71) *Hours keying per week (HR per hour)* 1.01 (0.99–1.03) *Keyboard inner angle by hrs keying/week interaction* 1.05 (1.00–1.10) Results continues on the next page	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Marcus et al continued 2002 [18] USA				<u>*Specific neck/shoulder disorder*</u> *Keyboard to elbow height difference* ≤0 cm: 1.0 0–2.3 cm: 1.56 (0.90–2.70) >2.3 cm: 0.91 (0.48–1.69) *Keyboard inner elbow angle* ≤121°: 1.0 >121°: 0.64 (0.35–1.18) *Keyboard shoulder abduction angle* ≤10°: 1.0 11–14°: 1.23 (0.68–2.25) 15–17°: 0.66 (0.29–1.53) >17°: 1.01 (0.52–1.96) *Keyboard shoulder flexion angle* ≤21°: 1.0 22–28°: 1.27 (0.65–2.45) 29–35°: 1.47 (0.78–2.77) >35°: 0.66 (0.31–1.43) *Distance from table edge to "J" key* ≤12.5 cm: 1.0 >12.5 cm: 0.79 (0.49–1.27) Results continues on the next page	<u>*Specific neck/shoulder disorder*</u> *Keyboard to elbow height difference* – *Keyboard inner elbow angle* ≤121°: 1.0 >121°: 0.11 (0.02–0.66) *Keyboard shoulder abduction angle* – *Keyboard shoulder flexion angle* – *Distance from table edge to "J" key* – Results continues on the next page	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Marcus et al continued 2002 [18] USA				*Mouse inner elbow angle* ≤137°: 1.0 138–148°: 1.43 (0.84–2.44) >148°: 0.78 (0.41–1.51)	*Mouse inner elbow angle* –	
				Mouse shoulder abduction angle ≤21°: 1.0 22–27°: 1.06 (0.56–1.98) 28–33°: 0.87 (0.42–1.78) >33°: 1.32 (0.69–2.51)	*Mouse shoulder abduction angle* –	
				Mouse shoulder flexion angle ≤25°: 1.0 26–34°: 0.98 (0.51–1.88) 35–44°: 1.08 (0.55–2.13) >44°: 0.98 (0.50–1.92)	*Mouse shoulder flexion angle* –	
				Monitor head tilt angle ≤3°: 1.0 >3° (more extended): 1.76 (0.87–3.55)	*Monitor head tilt angle* –	
				Monitor head rotation angle 0–10°: 1.0 >10°: 1.11 (0.64–1.96)	*Monitor head rotation angle* –	
				Presence of chair arm rest No: 1.0 Yes: 0.60 (0.36–0.97)	*Presence of chair arm rest* –	
				Presence of telephone shoulder rest No: 1.0 Yes: 2.78 (1.46–5.32)	*Presence of telephone shoulder rest* No: 1.0 Yes: 2.71 (1.40–5.23)	
					Hours keying per week (HR per hour) 1.01 (0.99–1.04)	
					Keyboard inner angle by hrs keying/week interaction 1.07 (1.01–1.14)	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Smedley et al 2003 [19] United Kingdom	Cohort Female nurses Follow-up at three-monthly intervals over 2 years. Average follow-up time 13 months n=587 100% women	Neck/shoulder pain (lasting for longer than 1 day during the previous 3 months)	Frequency per shift of: Assist patient to move from lying to sitting or from sitting to lying Reposition a patient slumped in a chair Assist a patient to mobilise using a walking stick, Zimmer frame, or crutches Move a patient around in a wheelchair, bed, hoist, trolley, commode, etc Assist a patient to sit up from a lying position Assist a patient to move up/down the bed Reposition (turn or roll) a patient Transfer a patient in/out of a bath Wash/dress a patient on a chair/commode Wash/dress a patient on an ambulift/hoist Wash/dress a patient on a bed Number of above activities performed unaided	RR (95% CI) crude calculated from raw data presented *Frequency per shift of: Assist patient to move from lying to sitting or from sitting to lying* 0: 1.0 1–4: 1.28 (0.96–1.71) ≥5: 1.31 (0.99–1.83) *Reposition a patient slumped in a chair* 0: 1.0 ≥1: 1.19 (0.93–1.54) *Assist a patient to mobilise using a walking stick, Zimmer frame, or crutches* 0: 1.0 1–4: 1.27 (0.97–1.66) ≥5: 1.39 (1.03–1.87) *Move a patient around in a wheelchair, bed, hoist, trolley, commode, etc* 0: 1.0 1–4: 1.12 (0.83–1.51) ≥5: 1.46 (1.07–1.98) *Assist a patient to sit up from a lying position* 0: 1.0 1–4: 1.16 (0.87–1.54) ≥5: 1.27 (0.92–1.75) *Assist a patient to move up/down the bed* 0: 1.0 1–4: 0.81 (0.60–1.09) ≥5: 1.17 (0.86–1.59) Results continues on the next page	HR (95% CI) adjusted for age, BMI and frequently feeling tired, low, tense or under stress *Frequency per shift of: Assist patient to move from lying to sitting or from sitting to lying* 0: 1.0 1–4: 1.3 (0.9–1.8) ≥5: 1.4 (0.9–2.1) *Reposition a patient slumped in a chair* 0: 1.0 ≥1: 1.3 (0.9–1.8) *Assist a patient to mobilise using a walking stick, Zimmer frame, or crutches* 0: 1.0 1–4: 1.4 (1.0–1.9) ≥5: 1.6 (1.1–2.3) *Move a patient around in a wheelchair, bed, hoist, trolley, commode, etc* 0: 1.0 1–4: 1.2 (0.8–1.7) ≥5: 1.6 (1.1–2.4) *Assist a patient to sit up from a lying position* 0: 1.0 1–4: 1.2 (0.9–1.8) ≥5: 1.3 (0.9–1.9) *Assist a patient to move up/down the bed* 0: 1.0 1–4: 0.8 (0.5–1.1) ≥5: 1.1 (0.8–1.7) Results continues on the next page	High

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Smedley et al continued 2003 [19] United Kingdom				*Reposition (turn or roll) a patient* 0: 1.0 1–4: 0.94 (0.70–1.26) ≥5: 1.41 (0.98–2.02) *Transfer a patient in/out of a bath* 0: 1.0 ≥1: 1.29 (0.98–1.69) *Wash/dress a patient on a chair/commode* 0: 1.0 1–4: 1.03 (0.80–1.34) ≥5: 1.37 (0.99–1.90) *Wash/dress a patient on an ambulift/hoist* 0: 1.0 ≥1: 0.96 (0.60–1.52) *Wash/dress a patient on a bed* 0: 1.0 1–4: 1.04 (0.80–1.35) ≥5: 1.38 0.99–1.91) *Number of above activities performed unaided* 0: 1.0 1–2: 0.86 (0.48–1.51) 3–4: 0.73 (0.42–1.27) 5–6: 0.91 (0.55–1.50) 7: 1.04 (0.65–1.67) 8: 1.11 (0.69–1.80)	*Reposition (turn or roll) a patient* 0: 1.0 1–4: 1.0 (0.7–1.4) ≥5: 1.5 (0.9–2.4) *Transfer a patient in/out of a bath* 0: 1.0 ≥1: 1.4 (1.0–2.0) *Wash/dress a patient on a chair/commode* 0: 1.0 1–4: 1.1 (0.8–1.5) ≥5: 1.7 (1.1–2.8) *Wash/dress a patient on an ambulift/hoist* 0: 1.0 ≥1: 1.1 (0.6 to 1.9) *Wash/dress a patient on a bed* 0: 1.0 1–4: 1.1 (0.8–1.5) ≥5: 1.6 (1.0–2.5) *Number of above activities performed unaided* 0: 1.0 1–2: 1.1 (0.6–2.2) 3–4: 0.8 (0.4–1.6) 5–6: 1.1 (0.6–2.0) 7: 1.3 (0.7–2.3) 8: 1.5 (0.8–2.8) p-trend=0.09	

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Wahlstrom et al 2004 [20] Sweden	Cohort Computer users from different types of work-places Median period of follow-up 10.9 months, range 0–17 months n=671 49% women	Pain or aches in the neck and/or scapular area ≥3 days during the preceding month	Combinations of exposure to precision work and repetitive work Low exposure= precision and repetitive work ≤ median duration Medium exposure= precision or repetitive work > median duration High exposure= precision and repetitive work > median duration	IRR (95% CI) adjusted for gender *Combinations of exposure to precision work and repetitive work* Low exposure: 1.0 Medium exposure: 1.4 (1.01–1.99) High exposure: 1.5 (0.97–2.22)	IRR (95% CI) adjusted for muscular tension, job strain and age *Combinations of exposure to precision work and repetitive work* Low exposure: 1.0 Medium exposure: 1.4 (0.99–2.01) High exposure: 1.3 (0.85–2.03)	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Wigaeus Tornqvist et al 2009 [22] Sweden	Cohort Computer users from different types of work-places n=1 073 10 months, average 329 days, range 28 to 540 days 58% women	Pain or aches in the neck and/or scapular area ≥3 days during the preceding month	Duration of computer work (h/day) Duration of data/text entry (h/day) Duration and frequency of continuous computer work without breaks >10 min Duration of mouse use (h/day) Mouse placement Comfort of computer work environment Variation of work tasks	IRR (95% CI) crude *Duration of computer work (h/day)* <2: 1.00 2 to <4: 1.61 (1.19–2.16) ≥4: 1.73 (1.30–2.30) *Duration of data/text entry (h/day)* <0.5: 1.00 0.5 to <3: 1.19 (0.94–1.49) ≥3: 1.36 (1.02–1.83) *Duration and freq. of cont. computer work without breaks >10 min* <2 h: 1.00 2–3 h daily or >3 h< few times/week: 1.28 (1.04–1.57) >3 h at least a few times/day: 1.43 (1.08–1.89) *Duration of mouse use (h/day)* <0.5: 1.00 0.5 to <3: 1.24 (0.99–1.57) ≥3: 1.28 (0.93–1.76) *Mouse placement* Optimal: 1.00 Non-optimal: 1.09 (0.88; 1.35) *Comfort of computer work environment* High: 1.00 Medium: 1.08 (0.85–1.36) Low: 1.48 (1.13–1.93) *Variation of work tasks* ≥5 work tasks (≥30 min): 1.00 3–4 work tasks (≥30 min): 1.22 (0.95–1.57) ≤2 work tasks (≥30 min): 1.55 (1.19–2.03)	IRR adjusted for all other included variables *Duration of computer work (h/day)* <2: 1.00 2 to <4: 1.20 (0.82–1.74) ≥4: 1.19 (0.79–1.81) *Duration of data/text entry (h/day)* <0.5: 1.00 0.5 to <3: 0.88 (0.67–1.15) ≥3: 0.97 (0.66–1.43) *Duration and freq. of cont. computer work without breaks >10 min* <2 h: 1.00 2–3 h daily or >3 h< few times/week: 1.14 (0.89–1.46) >3 h at least a few times/day: 1.34 (0.95–1.88) *Duration of mouse use (h/day)* <0.5: 1.00 0.5 to <3: 1.08 (0.80–1.45) ≥3: 0.88 (0.58–1.33) *Mouse placement* Optimal: 1.00 Non-optimal: 0.94 (0.74–1.20) *Comfort of computer work environment* High: 1.00 Medium: 1.03 (0.79–1.34) Low: 1.41 (1.04–1.92) *Variation of work tasks* ≥5 work tasks (≥30 min): 1.00 3–4 work tasks (≥30 min): 1.10 (0.82–1.47) ≤2 work tasks (≥30 min): 1.28 (0.91–1.81)	Moderate

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Table 4.1.23 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Viikari-Juntura et al 2001 [23] Finland	Cohort Forest industry workers 1992–1995 3 follow-ups n=4 283 25% women at baseline	Radiating neck pain (no, 0–7, moderate, 8–30, severe, >30 days)	Physical strenuousness of work Squatting or kneeling at work (h/day) Twisting movements of the trunk during a work day Working with a hand above shoulder level (h/day) Working with a hand above shoulder level (h/day) Working with the trunk in forward flexion (h/day)	OR (95% CI) crude calculated from raw data[2] *Physical strenuousness of work* Not at all: 1.0 Rather light: 1.5 (1.3–1.9) Somewhat strenuous: 1.9 (1.5–2.3) Rather strenuous: 2.5 (2.0–3.2) Very strenuous: 2.9 (2.3–3.8) *Squatting or kneeling at work (h/day)* Not at all: 1.0 <0.5: 1.0 (0.8–1.2) 0.5–1: 1.2 (1.0–1.4) >1: 1.5 (1.2–1.8) *Twisting movements of the trunk during a work day* Not at all: 1.0 Little: 1.8 (1.3–2.7) Moderate: 3.2 (2.2–4.7) Much: 5.0 (3.4–7.4) *Working with a hand above shoulder level (h/day)* <0.5: 1.0 0.5–1: 1.2 (1.0–1.4) >1: 2.0 (1.7–2.3) *Working with a hand above shoulder level (h/day)* <0.5: 1.0 0.5–1: 1.2 (1.0–1.4) >1: 2.0 (1.7–2.3) *Working with the trunk in forward flexion (h/day)* <1: 1.0 1–2: 1.2 (1.0–1.4) >2: 1.7 (1.5–2.0)	OR (95% CI) adjusted for all included variables *Physical strenuousness of work* – *Squatting or kneeling at work (h/day)* – <u>*Marginal model*</u> *Twisting movements of the trunk during a work day* Not at all: 1.0 Little: 1.8 (1.0–3.3) Moderate: 2.9 (1.6–5.2) Much: 3.5 (1.9–6.7) *Working with a hand above shoulder level (h/day)* <0.5: 1.0 0.5–1: 3.4 (1.5–7.5) >1: 2.2 (0.7–6.4) <u>*Transition model*</u> *Working with a hand above shoulder level (h/day)* <0.5: 1.0 0.5–1: 1.2 (1.0–1.5) >1: 1.6 (1.3–2.0) *Working with the trunk in forward flexion (h/day)* <1: 1.0 1–2: 1.2 (1.0–1.3) >2: 1.2 (1.0–1.3)	Moderate [2] The outcomes moderate and severe pain have been compiled to one outcome

BMI = Body mass index; CI = Confidence interval; HR = Hazard ratio; IRR = Incidence rate ratio; MVC = Maximum voluntary contraction; N = Newton; OR = Odds ratio; RR = Relative risk; VAS = Visual analogue scale; VDT = Video display terminal

Table 4.1.24 *Neck. Psychosocial exposure – cohort studies.*

Author Year Reference Country	Setting Study period n included Gender	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Andersen et al 2003 [11] Denmark	Cohort Danish general working population, industrial and service sector 4 years n=2 368 (including prevalent cases at 1 year follow-up) % women not reported	Neck/shoulder pain (pain and impairment of daily activities past 3 months, symptom cases) Neck/shoulder pain with pressure tenderness (pain and impairment of daily activities past 3 months, and pressure tenderness, clinical cases)	Job demands Job control Social support *Level of distress* Low Medium High		OR (95% CI) adjusted for age, gender, BMI, intrinsic effort, physical leisure time activity and level of distress) *Neck/shoulder pain* *Job demands* High: 1.0 Low: 1.5 (1.3–1.8) *Job control* High: 1.0 Low: 1.2 (1.0–1.5) *Social support* High: 1.0 Low: 1.0 (0.9–1.3) *Neck/shoulder pain with pressure tenderness* *Job demands* High: 1.0 Low: 1.7 (1.1–2.9) *Job control* High: 1.0 Low: 1.3 (0.8–2.1) *Social support* High: 1.0 Low: 1.3 (0.8–2.1) *Level of distress* Low: 1.0 Medium: 1.7 (1.0–2.9) High: 2.8 (1.4–5.4)	Moderate

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Table 4.1.24 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Ariëns et al 2001 [12] The Netherlands	Cohort Dutch working population, industrial and service sector n=977 1994–1997 25% women	Neck pain (regular or prolonged at least 1 day last 12 months)	Quantitative demands Skill discretion Decision authority Co-worker support Supervisor support Conflicting job demands Job security	HR (95% CI) from univariate Cox regression models *Quantitative demands* Low: 1.0 Medium: 1.34 (0.92–1.94) High: 2.46 (1.51–4.03) *Skill discretion* High: 1.0 Medium: 1.05 (0.74–1.49) Low: 1.23 (0.62–2.45) *Decision authority* High: 1.0 Medium: 1.17 (0.83–1.65) Low: 1.64 (0.79–3.43) *Co-worker support* High: 1.0 Medium: 1.41 (0.74–2.68) Low: 1.96 (0.91–4.22) *Supervisor support* High: 1.0 Medium: 0.99 (0.67–1.47) Low: 1.16 (0.61–2.11) *Conflicting job demands* Totally disagree: 1.0 Agree: 1.01 (0.69–1.47) Totally agree: 1.08 (0.56–2.08) *Job security* Totally agree: 1.0 Totally disagree: 1.19 (0.81–1.76)	HR (95% CI) Cox regression models adjusted for age, gender and psychosocial variables *Quantitative demands* Low: 1.0 Medium: 1.29 (0.88–1.87) High: 2.14 (1.28–3.58) *Skill discretion* High: 1.00 Medium: 1.09 (0.72–1.64) Low: 1.27 (0.59–2.74) *Decision authority* High: 1.00 Medium: 1.21 (0.84–1.74) Low: 1.60 (0.74–3.45) *Co-worker support* High: 1.00 Medium: 1.59 (0.82–3.08) Low: 2.43 (1.11–5.29) *Supervisor support* High: 1.00 Medium: 0.86 (0.57–1.32) Low: 0.95 (0.47–1.93) *Conflicting job demands* Totally disagree: 1.0 Agree: 1.11 (0.75–1.63) Totally agree: 1.32 (0.68–2.56) *Job security* Totally agree: 1.0 Totally disagree: 1.27 (0.86–1.89)	Moderate

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Table 4.1.24 continued

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Brandt et al 2004 [13] Denmark	Cohort Danish professional computer workers, technical assistants and machine technicians 2000–2001 n=6 943 (subjects with symptoms included) at follow-up % women not reported	Neck pain (current last 7 days at least moderate and quite a lot, or more, pain last 12 months)	High demands Low control Low social support Time pressure	HR (95% CI) final model includes time with mouse and keyboard and psychosocial characteristics High demands: 1.7 (1.0–2.8) Low control: 1.3 (0.8–2.2) Low social support: 1.4 (0.9–2.4) Time pressure: 0.8 (0.4–1.4)	HR (95% CI) final model includes physical, psychosocial and personal characteristics High demands: 1.7 (1.0–2.7) Low control: – Low social support: 1.5 (0.9–2.4) Time pressure: –	Moderate

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Table 4.1.24 continued

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Eriksen et al 1999 [14] Norway	Cohort Norwegian working population 1990–1994 n=618 38% women	Neck pain previous 12 months Neck pain previous 7 days	Work hours per week Influence on own work situation Stressful work or work environment	RR (95% CI) calculated from available raw data *Neck pain previous 12 months* *Work hours per week* <20: 1.0 20–39: 0.87 (0.57–1.3) ≥40: 0.70 (0.41–1.2) *Influence on own work situation* A great deal: 1.0 To some extent: 1.3 (1.0–1.7) Little/very little: 1.7 (1.2–2.5) *Stressful work or work environment* Little: 1.0 Mediocre: 1.0 (0.75–1.3) Much: 1.3 (0.92–1.9) Very much: 1.5 (0.84–2.6) *Neck pain previous 7 days* *Work hours per week* <20: 1.0 20–39: 1.4 (0.44–4.1) ≥40: 1.0 (0.32–3.2) *Influence on own work situation* A great deal: 1.0 To some extent: 1.7 (1.0–3.0) Little/very little: 2.2 (1.1–4.7) *Stressful work or work environment* Little: 1.0 Mediocre: 1.0 (0.58–1.8) Much: 1.0 (0.57–1.8) Very much: 1.2 (0.37–3.6)	RR (95% CI) adjusted for all covariates at baseline *Neck pain previous 12 months* *Work hours per week* <20: – 20–39: – ≥40: – *Influence on own work situation* A great deal: 1.00 To some extent: 1.27 (0.80–2.04) Little/very little: 2.21 (1.18–4.14) *Stressful work or work environment* Little: – Mediocre: – Much: – Very much: – *Neck pain previous 7 days* *Work hours per week* <20: – 20–39: – ≥40: – *Influence on own work situation* A great deal: 1.00 To some extent: 1.66 (0.84–3.29) Little/very little: 2.85 (1.21–6.73) *Stressful work or work environment* Little: – Mediocre: – Much: – Very much: –	Moderate

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Table 4.1.24 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Feveile et al 2002 [15] Denmark	Cohort Random sample of Danish working population 1990–1995 n=1 855 33% women	Neck/shoulder pain (last 12 months)	Social support High psychological job demands Low skill discretion Low decision authority	*Low social support* Men: p=0.03 Women: p=0.42 *High psychological job demands* Men: p=0.19 Women: p=0.53 *Low skill discretion* Men: p=0.21 Women: p=0.94 *Low decision authority* Men: p=0.34 Women: p=0.69	*Social support (men)* OR (95% CI) High: 1.45 (1.00–2.09) Rather high: 1.00 Rather low: 1.17 (0.83–1.66) Low: 1.76 (1.24–2.50) *High psychological job demands* Not included in final model *Low skill discretion* Not included in final model *Low decision authority* Not included in final model	Moderate

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Table 4.1.24 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Hannan et al 2005 [27] USA	Cohort Newly hired American computer users 6 months during March 2000–May 2003 n=314	Neck/shoulder discomfort ≥6 (VAS 0–10) Diary (daily)	Job strain quadrants Interactions keying (hrs/day) and job strain quadrant Job strain ratio categories Interactions previous keying (years) and job strain ratio	*Job strain quadrants* Low strain: 1.00 High strain: 1.88 (1.11–3.19) Active: 0.93 (0.53–1.61) Passive: 1.0 (0.57–1.77)	*Job strain quadrants* Low strain: 1.00 High strain: 1.65 (0.91–2.99) Active: 0.79 (0.43–1.46) Passive: 0.75 (0.39–1.47) *Interactions keying (hrs/day) and job strain quadrant* Low strain ≤5.25: 1.00 Active ≤5.25: 1.40 (0.61–3.20) Passive ≤5.25: 1.67 (0.73–3.83) High strain ≤5.25: 2.38 (1.01–5.61) Low strain >5.25: 2.38 (1.01–5.61) Active >5.25: 0.89 (0.35–2.24) Passive >5.25: 0.97 (0.39–2.42) High strain >5.25: 2.74 (1.22–6.20) *Job strain ratio categories* 1st category: 1.00 2nd category: 0.76 (0.41–1.40) 3rd category: 1.15 (0.63–2.09) 4th category: 1.55 (0.83–2.89) *Interactions previous keying (years) and job strain ratio* 1st category ≤4: 1.00 2nd category ≤4: 0.54 (0.16–1.82) 3rd category ≤4: 2.01 (0.76–5.30) 4th category ≤4: 3.16 (1.25–8.00) 1st category >4: 2.33 (0.92–5.87) 2nd category >4: 1.70 (0.70–4.09) 3rd category >4: 1.66 (0.67–4.13) 4th category >4: 1.95 (0.73–5.22)	Moderate

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Table 4.1.24 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
van den Heuvel et al 2006 [21] The Netherlands	Cohort Follow-up 3 years 1995–1997 n=398 Prevalence of women not reported	Neck/shoulder symptoms	Working week Long working days	OR (95% CI) crude *Working week* <8 h: 1.00 40 h: 0.68 (0.39–1.18) >40 h: 0.97 (0.48–1.95) *Long working days* <8.5 h/day: 1.00 ≥8.5 h/day: 1.81 (1.01–3.27)	OR (95% CI) adjusted for the value of the outcome measure at time of exposure, age, gender and psycho-social factors *Working week* <8 h: 1.00 40 h: 0.89 (0.54–1.45) >40 h: 1.04 (0.55–1.97) *Long working days* <8.5 h/day: 1.00 ≥8.5 h/day: 1.57 (0.91–2.70)	Moderate

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Table 4.1.24 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Jensen et al 2003 [17] Denmark	A variety of computer users 1999–2001 (17–23 months) n=1 192 (non-symptomatic subjects at baseline) 55% women	Neck symptoms (not including shoulder)	Influence at work Developmental possibilities Social support	RR (95% CI) crude risks calculated from available raw data <u>*Women*</u> *Influence at work* High: 1.0 Medium high: 1.4 (0.9–2.0) Medium low: 1.8 (1.2–2.7) Low: 1.9 (1.3–2.6) *Developmental possibilities* High: 1.0 Medium high: 1.2 (0.8–1.7) Medium low: 1.1 (0.8–1.6) Low: 1.3 (0.9–1.9) *Social support* High: 1.0 Medium high: 1.0 (0.7–1.5) Medium low: 1.1 (0.8–1.6) Low: 1.4 (1.0–2.0) <u>*Men*</u> *Influence at work* High: 1.0 Medium high: 1.3 (0.6–2.6) Medium low: 1.2 (0.6–2.5) Low: 1.3 (0.5–3.2) *Developmental possibilities* High: 1.0 Medium high: 1.3 (0.8–2.0) Medium low: 1.3 (0.8–2.1) Low: 1.1 (0.7–1.4) *Social support* High: 1.0 Medium high: 1.1 (0.7–1.7) Medium low: 0.6 (0.3–1.1) Low: 0.7 (0.4–1.4)	OR (95% CI) from logistic regression models adjusted for a variety of baseline factors <u>*Women*</u> *Influence at work* High: 1.0 Medium high: 1.4 (0.8–2.5) Medium low: 2.1 (1.2–3.6) Low: 2.2 (1.3–3.7)	Moderate

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Table 4.1.24 continued

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Larsman et al 2009 [28] Sweden	Cohort Service workers, child minders, preschool teachers and nursing assistants Follow-up during 18 months in 1990s n=741 100% women	Neck pain the previous 12 months	Decision latitude (low/high)[1] Psychological load (high/low) Social support (low/high) High load/low, latitude/ high support High load/low, latitude/ low support High load/high, latitude/ high support High load/high, latitude/ low support Low load/low, latitude/ high support Low load/low, latitude/ low support Low load/high, latitude/ high support Low load/high, latitude/ low support	OR (95% CI) Decision latitude: 1.56 (1.13–2.16) Psychological load: 1.57 (1.13–2.17) Social support: 1.02 (0.74–1.40) High load/low, latitude/ high support: 1.69 (0.86–3.31) High load/low, latitude/ low support: 2.06 (1.26–3.37) High load/high, latitude/ high support: 1.59 (0.89–2.86) High load/high, latitude/ low support: 1.35 (0.69–2.64) Low load/low, latitude/ high support: 2.36 (1.20–4.63) Low load/low, latitude/ low support: 1.09 (0.59–2.0) Low load/high, latitude/ high support: 1.00 Low load/high, latitude/ low support: 0.76 (0.37–1.56)	No adjusted risk estimates reported	Moderate
Larsman et al 2009 [29] Sweden	Cohort Childcare workers 18 months during 1990s n=388 100% women	Neck or shoulder pain the previous 12 months	Psychological workload	*Psychological workload* 1.9–2.1 p<0.01		Moderate
Lipscomb et al 2008 [35] USA	Cohort Poultry workers 2002–2004 100% women n=109	Upper extremity disorders	Job insecurity	RR (95% CI) crude *Job insecurity* Low: 1.0 High: 2.0 (0.81–5.17)	RR (95% CI) adjusted for baseline variables including diabetes and children at home *Job insecurity* Low: 1.0 High: 1.9 (0.80–4.31)	Moderate

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Table 4.1.24 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Smedley et al 2003 [19] United Kingdom	Cohort Nurses Follow-up at three-monthly intervals over 2 years Average follow-up time 13 months n=587 100% women	Neck/shoulder pain	Demand Interest Control Support Satisfaction	RR (95% CI) crude calculated from presented raw data *Demand* Low: 1.0 Intermediate: 1.0 (0.8–1.4) High: 1.0 (0.8–1.4) *Interest* High: 1.0 Intermediate: 1.0 (0.8–1.3) Low: 1.2 (0.9–1.5) *Control* Low: 1.0 Intermediate: 0.9 (0.6–1.1) High: 1.0 (0.8–1.3) *Support* High: 1.0 Intermediate: 0.9 (0.7–1.1) Low: 1.0 (0.8–1.3) *Satisfaction* Low: 0.9 (0.7–1.3) Intermediate: 1.2 (0.9–1.5) High: 1.0	HR (95% CI) adjusted for age, BMI and frequently feeling tired, low, tense or under stress *Demand* Low: 1.0 Intermediate: 1.0 (0.7–1.4) High: 0.9 (0.7–1.4) *Interest* High: 1.0 Intermediate: 1.1 (0.8–1.5) Low: 1.2 (0.9–1.8) *Control* Low: 1.0 Intermediate: 0.9 (0.6–1.3) High: 1.1 (0.8–1.6) *Support* High: 1.0 Intermediate: 0.9 (0.6–1.2) Low: 0.9 (0.6–1.3) *Satisfaction* Low: 1.0 Intermediate: 1.3 (0.9–1.8) High: 1.2 (0.8–1.8)	Moderate

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Table 4.1.24 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Wahlström et al 2004 [20] Sweden	Cohort Computer users from different types of work-places Mean period of follow-up 10.9 months, range 0–17 months n=671 49% women	Reported pain or aches in the neck and/or scapular area ≥3 days during the preceding month	*Job strain* High (high demands and low decision latitude) Medium (high demands and high decision latitude) Low (low demands and low decision latitude)	IRR (95% CI) adjusted for gender *Job strain* High: 1.6 (1.03–2.61) Medium: 1.5 (1.00–2.18) Low: 1.0	IRR (95% CI) adjusted for muscular tension, physical exposure and age *Job strain* High: 1.5 (0.95–2.52) Medium: 1.5 (1.02–2.32) Low: 1.0 HR (95% CI) adjusted for age and gender *Job strain and muscular tension* High tension, high strain: 4.0 (1.60–10.0) *Job strain and physical exposure* High strain, high physical: 2.7 (1.20–5.90)	Moderate
Wigaeus Tornqvist et al 2009 [22] Sweden	Cohort 1 247 subjects responded to at least one follow-up questionnaire Ten months, average 329 days, range 28–540 days 58% women	Neck and/or scapular symptoms	Demands in relation to competence Job strain Social support	IRR (95% CI) crude *Demands in relation to competence* In accordance: 1.00 Lower than competence: 1.07 (0.85–1.35) Higher than competence: 1.46 (1.12–1.92) *Job strain* Low: 1.00 Medium: 1.8 (1.28–2.47) High: 2.4 (1.41–4.02) *Social support* High: 1.00 Medium: 0.99 (0.80–1.22) Low: 1.40 (0.98–1.99)	IRR adjusted for all other variables included *Demands in relation to competence* In accordance: 1.00 Lower than competence: 1.01 (0.76–1.34) Higher than competence: 1.34 (0.98–1.85) *Job strain* Low: 1.00 Medium: 1.65 (1.12–2.43) High: 2.15 (1.16–3.99) *Social support* High: 1.00 Medium: 0.97 (0.76–1.24) Low: 1.2 (0.82–1.89)	Moderate

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Table 4.1.24 *continued*

Author Year Reference Country	Design Setting Study period n participating at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model	Study quality
Viikari-Juntura et al 2001 [23] Finland	Cohort Finnish forest workers 1992–1995 n=5 180 25% women at baseline	Radiating neck pain	<u>*Marginal model*</u> Mental stress Balance of work demands Overload at work <u>*Transition model*</u> Mental stress	Not reported	OR (95% CI) adjusted for all included variables <u>*Marginal model*</u> *Mental stress* Not at all: 1.0 Little: 1.5 (0.8–3.0) To some extent: 2.2 (1.2–4.3) Much: 6.4 (3.1–13.0) *Balance of work demands* Good: 1.0 Moderate: 1.2 (1.0–1.3) Poor: 1.2 (1.0–1.3) *Overload at work* Not at all: 1.0 Little: 1.2 (1.1–1.3) Definite: 1.3 (1.1–1.5) <u>*Transition model*</u> *Mental stress* Not at all: 1.0 Little: 1.3 (1.1–1.5) To some extent: 1.5 (1.3–1.8) Much: 1.7 (1.4–2.0)	Moderate

[1] According to the results section, and in concordance with the hypothesis, while the table says "high/low" for decision latitude and social support.

BMI = Body mass index; CI = Confidence interval; HR = Hazard ratio; IRR = Incidence rate ratio; OR = Odds ratio; RR = Relative risk; VAS = Visual analogue scale

Table 4.2.17 *Shoulders. Physical exposure – randomised controlled trials.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Conlon et al 2008 [5] USA	RCT California, USA, aerospace engineering firm 2002–2003 (1 year) n=206 28% women	Neck/shoulder disorder (diagnosed at physical examination following self-report of discomfort of >5 on a 0–10 point scale)	Alternative mouse Forearm support board Four intervention groups: 1) Conventional mouse 2) Alternative mouse with neutral forearm posture 3) Conventional mouse plus forearm support board 4) Alternative mouse plus forearm support board Analyses were made of alternative mouse and forearm support as two independent variables	HR (95% CI) Alternative mouse: 0.82 (0.32–2.10) Forearm support board: 1.74 (0.67–4.49)	HR (95% CI) Alternative mouse: 0.62 (0.23–1.67) Forearm support board: 1.69 (0.62–4.64)
Gerr et al[1] 2005 [6] USA	RCT Atlanta, Georgia, USA, newly hired persons working with computer workstation 6 months follow-up n=358 77% women Baseline participation rate difficult to assess	Neck/shoulder discomfort (any discomfort such as pain, aching, burning, numbness or tingling in neck, shoulders, rated as ≥6 on a 0–10 VAS scale, or medications taken for any such outcomes)	<u>*Neck/shoulder*</u> No intervention Alternate intervention group Conventional intervention group Alternate intervention based on protective factors for both neck/shoulder and hand/arm symptoms identified in a previous cohort study by the same research group Conventional intervention based on recommendations from various sources, eg OSHA, NIOSH, and private industry	Not reported	HR (95% CI) No intervention: 1.0 Alternate intervention group: 1.07 (0.64–1.80) Conventional intervention group: 1.00 (0.60–1.68)

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Table 4.2.17 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Rempel[1] 2006 [7] USA	RCT California, USA, call centre operators at a large healthcare company. 1 year follow-up n=182 94%, 98%, 100%, 89% women in each of the four intervention groups Baseline participation rate difficult to assess	Neck/shoulder disorder (diagnosed at physical examination following self-report of discomfort of >5 on a 0–10 point scale)	Neck/shoulder Trackball mouse Forearm support board Four intervention groups: 1) Ergonomics training 2) Trackball mouse and ergonomics training 3) Forearm support board and ergonomics training 4) Trackball mouse, forearm support board and ergonomics training Analyses were made of trackball mouse and forearm support board as two independent variables	HR (95% CI) <u>*Neck/shoulder*</u> Trackball mouse: 0.61 (0.31–1.17) Forearm support board: 0.53 (0.28–1.03)	HR (95% CI) <u>*Neck/shoulder*</u> Trackball mouse: 0.62 (0.30–1.28) Forearm support board: 0.49 (0.24–0.97)

[1] Study quality is moderate.

CI = Confidence interval; HR = Hazard ratio; NIOSH = National Institute for Occupational Safety and Health; OSHA = Occupational Safety and Heath Administration; RCT = Randomised controlled trial; VAS = Visual analogue scale

Table 4.2.18 *Shoulders. Physical exposure – cohort studies.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Andersen et al[2] 2008 [9] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=2 146 74% women	Acute shoulder pain (increased pain level) Prolonged shoulder pain (at least moderate pain during three consecutive weeks) Chronic shoulder pain (pain or discomfort lasting >30 days, causing quite a lot of trouble during the past 12 months)	All analyses are based on continuous exposure data Mouse variables Keyboard variables Mouse usage time Keyboard usage time	<u>*Acute shoulder pain*</u> *Mouse variables* 2%/h/week *Keyboard variables* No association	OR (95% CI) <u>*Acute shoulder pain*</u> *Mouse variables* Usage time (interquartile range): 1.10 (1.05–1.16) Speed of clicking (per 25 clicks/min): 1.02 (0.99–1.05) Length of activity periods (per 10 min): 0.99 (0.97–1.01) Micro-pauses (per min): 1.02 (0.99–1.06) *Keyboard variables* Usage time: 1.01 (0.98–1.04) Speed of clicking: 0.95 (0.92–0.98) Length of activity periods: 0.99 (0.98–1.01) Micro-pauses: 0.95 (0.91–0.98) <u>*Prolonged shoulder pain*</u> *Mouse variables* Usage time: 1.02 (0.96–1.08) Speed of clicking: 1.11 (0.79–1.56) Length of activity periods: 0.98 (0.86–1.12) Micro-pauses: 0.85 (0.62–1.16) *Keyboard variables* Usage time: 0.87 (0.60–1.26) Speed of clicking: 0.72 (0.49–1.06) Length of activity periods: 0.95 (0.77–1.16) Micro-pauses: 1.08 (0.94–1.23) <u>*Chronic shoulder pain*</u> Mouse usage time: 1.11 (0.86–1.44) Keyboard usage time: 0.91 (0.68–1.21)

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Table 4.2.18 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Brandt et al[3] 2004 [8] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=4 764 About 50% women	Shoulder pain (of at least moderate degree during the past 7 days, that had bothered the subject at least quite a lot during the year under study)	Mouse use h/w Forearm/wrist support (mouse) Keyboard use h/w Forearm/wrist support (keyboard) Screen Not suitably adjusted chair Not suitably adjusted desk Dissatisfied with work place design	RR (95% CI) adjusted for time with mouse and keyboard *Mouse use h/w* 0–9: 1 10–19: 1.1 (0.6–2.0) 20–29: 2.0 (1.0–4.0) ≥30: 4.0 (1.5–11.1) *Forearm/wrist support (mouse)* No arm support: 1 <50% of time: 1.4 (0.6–3.7) ≥50% of time: 1.0 (0.5–2.3) Abnormal mouse position: 0.6 (0.2–1.7) *Keyboard use h/w* 0–4: 1 5–9: 1.3 (0.7–2.7) 10–14: 1.8 (0.8–3.9) ≥15: 2.6 (1.2–5.9) *Forearm/wrist support (keyboard)* No arm support: 1 <50% of time: 0.9 (0.5–1.7) ≥50% to 100% of time: 1.1 (0.7–1.9) Abnormal keyboard position: 0.7 (0.3–1.5) *Screen* Too high: – Too low: 1.0 (0.6–1.6) To the right or left: 1.2 (0.5–2.8) *Not suitably adjusted chair* 1.0 (0.2–4.0) *Not suitably adjusted desk* 0.9 (0.5–1.6) *Dissatisfied with work place design* 1.0 (0.5–2.1)	RR (95% CI) *Mouse use h/w* 0–9: 1 10–19: 1.2 (0.7–2.1) 20–29: 1.9 (1.0–3.5) ≥30: 3.3 (1.2–8.9) *Forearm/wrist support (mouse)* Not included in final model *Keyboard use h/w* 0–4: 1 5–9: 1.3 (0.7–2.6) 10–14: 1.6 (0.8–3.3) ≥15: 2.2 (1.0–4.9) *Forearm/wrist support (keyboard)* Not included in final model *Screen* Not included in final model *Not suitably adjusted chair* Not included in final model *Not suitably adjusted desk* Not included in final model *Dissatisfied with work place design* Not included in final model

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Table 4.2.18 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Hamberg-van Reenen et al[2] 2006 [12] The Netherlands	Cohort Bluecollar workers, workers in caring professions and office workers 1994–1997 n=1 227 About 30% women at baseline	Shoulder pain (regular or prolonged pain last 12 months)	Isokinetic lifting strength and lifting ≥10 kg Isokinetic lifting strength and upper-arm elevation ≥30° Isokinetic lifting strength and upper-arm elevation ≥90° Static endurance and upper-arm elevation ≥30° Static endurance and upper-arm elevation ≥90° Static endurance and repeated movements (Reference group = high capacity, low exposure High-balance group = high capacity, high exposure Low-balance group = low capacity, low exposure Imbalance group = low capacity, high exposure)	RR (95% CI *Isokinetic lifting strength and lifting ≥10 kg* Reference group: 1.00 High-balance group: 0.86 (0.63–1.17) Low-balance group: 1.73 (1.31–2.27) Imbalance group: 1.38 (1.04–1.84) *Isokinetic lifting strength and upper-arm elevation ≥30°* Reference group: 1.00 High-balance group: 0.93 (0.68–1.27) Low-balance group: 1.53 (1.16–2.02) Imbalance group: 1.75 (1.34–2.30) *Isokinetic lifting strength and upper-arm elevation ≥90°* Reference group: 1.00 High-balance group: 0.84 (0.62–1.15) Low-balance group: 1.65 (1.26–2.17) Imbalance group: 1.48 (1.12–1.94) *Static endurance and upper-arm elevation ≥30°* Reference group: 1.00 High-balance group: 1.06 (0.79–1.40) Low-balance group: 1.38 (1.05–1.80) Imbalance group: 1.29 (0.99–1.69) *Static endurance and upper-arm elevation ≥90°* Reference group: 1.00 High-balance group: 0.86 (0.51–0.91) Low-balance group: 1.14 (0.88–1.48) Imbalance group: 1.08 (0.84–1.39) *Static endurance and repeated movements* Reference group: 1.00 High-balance group: 1.02 (0.75–1.38) Low-balance group: 1.27 (1.01–1.60) Imbalance group: 1.38 (1.03–1.84)	RR (95% CI) *Isokinetic lifting strength and lifting ≥10 kg* Reference group: 1.00 High-balance group: 0.71 (0.48–1.06) Low-balance group: 1.09 (0.71–1.65) Imbalance group: 0.76 (0.51–1.13) *Isokinetic lifting strength and upper-arm elevation ≥30°* Reference group: 1.00 High-balance group: 0.80 (0.60–1.07) Low-balance group: 0.90 (0.67–1.22) Imbalance group: 1.08 (0.82–1.43) *Isokinetic lifting strength and upper-arm elevation ≥90°* Reference group: 1.00 High-balance group: 0.71 (0.49–1.02) Low-balance group: 1.02 (0.71–1.46) Imbalance group: 0.94 (0.66–1.34) *Static endurance and upper-arm elevation ≥30°* Reference group: 1.00 High-balance group: 1.00 (0.78–1.29) Low-balance group: 1.08 (0.85–1.37) Imbalance group: 1.06 (0.84–1.34) *Static endurance and upper-arm elevation ≥90°* Reference group: 1.00 High-balance group: 0.75 (0.52–1.08) Low-balance group: 0.91 (0.66–1.23) Imbalance group: 0.93 (0.68–1.25) *Static endurance and repeated movements* Reference group: 1.00 High-balance group: 0.93 (0.65–1.32) Low-balance group: 0.98 (0.73–1.33) Imbalance group: 0.94 (0.67–1.31)

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Table 4.2.18 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Harkness et al[2] 2003 [13] United Kingdom	Cohort New employees 12 diverse occupational groups 1 year follow-up n=638 35% women Participation rate – Baseline 91% – Follow-up I 79% – Follow-up II 88%	Shoulder pain lasting at least 24 hours during the previous month	<u>*Manual handling*</u> Lifting Carrying on one shoulder Lifting at or above shoulder level Pushing/pulling <u>*Posture*</u> Drive as part of job Stretching below knee level Hands above shoulder Repetitive arm/wrist movements	OR (95% CI) <u>*Manual handling*</u> *Lifting* Never: 1 ≤22 lb: 1.8 (1.2–2.8) >22 lb: 1.8 (1.2–2.8) *Carrying on one shoulder* Never: 1 ≤25 lb: 1.5 (0.9–2.5) >25 lb: 1.7 (1.0–2.8) *Lifting at or above shoulder level* Never: 1 ≤20 lb: 1.8 (1.1–2.8) >20 lb: 1.7 (1.1–2.8) *Pushing/pulling* Never: 1 >70 lb: 1.1 (0.7–1.8) ≥70 lb: 2.0 (1.3–2.9) <u>*Posture*</u> *Drive as part of job* No: 1 Yes: 1.4 (0.9–2.1) *Stretching below knee level* Never: 1 <15 min: 1.2 (0.8–1.7) ≥15 min: 1.6 (0.96–2.6) *Hands above shoulder* Never: 1 <15 min: 1.1 (0.7–1.6) ≥15 min: 1.9 (1.2–2.8) *Repetitive arm/wrist movements* Never: 1 <2 hours: 1.1 (0.7–1.6) ≥2 hours: 1.1 (0.7–1.7)	OR (95% CI) <u>*Manual handling*</u> *Lifting* Never: 1 ≤22 lb: 1.6 (0.99–2.7) >22 lb: 1.7 (0.9–3.0) *Carrying on one shoulder* Not included in final model *Lifting at or above shoulder level* Not included in final model *Pushing/pulling* Never: 1 >70 lb: 1.1 (0.7–1.9) ≥70 lb: 1.9 (1.1–3.3) <u>*Posture*</u> *Drive as part of job* Not included in final model *Stretching below knee level* Not included in final model *Hands above shoulder* Never: 1 <15 min: 1.0 (0.6–1.6) ≥15 min: 1.6 (0.98–2.5) *Repetitive arm/wrist movements* Not included in final model

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Table 4.2.18 continued

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Juul-Kristensen et al[2] 2004 [14] Denmark	Cohort Office workers with different kinds of computer work Beginning of 1999–end of 2000 Frequency of shoulder pain n=1 123 56% women Intensity of shoulder pain n=1 365 58% women Participation rate – Baseline 69% – Follow-up 77%	Frequency of shoulder pain (>7 days during last 12 months) Intensity of shoulder pain (mean shoulder pain ≥4 (scale 0–9) during last 3 months)	Computer work	OR (95% CI) adjusted for gender and age *Frequency of shoulder pain* *Computer work* >50%: 1.31 (0.76–2.28) >75%: 1.22 (0.72–2.08) Almost all the time: 1.06 (0.63–1.77) No adjusted chair: 1.46 (0.75–2.83) No adjusted desk: 0.69 (0.37–1.29) No arm rest space: 0.98 (0.62–1.55) Screen below eye height: 1.02 (0.68–1.51) Never standing: 1.09 (0.72–1.65) Glares or reflection: 1.21 (0.76–1.92) Small influence on pauses: 1.50 (0.94–2.39) Necessity to work fast: 1.08 (0.72–1.61) *Intensity of shoulder pain* *Computer work* >50%: 1.23 (0.76–1.99) >75%: 1.01 (0.63–1.62) Almost all the time: 1.31 (0.84–2.04) No adjusted chair: 1.29 (0.74–2.26) No adjusted desk: 1.09 (0.66–1.80) No armrest space: 1.06 (0.71–1.57) Screen below eye height: 1.13 (0.79–1.60) Never standing: 1.07 (0.76–1.52) Glares or reflection: 1.51 (1.04–2.20) Small influence on pauses: 1.54 (1.03–2.31) Necessity to work fast: 0.99 (0.70–1.40)	OR (95% CI) *Frequency of shoulder pain* *Computer work* >50%: 1.23 (0.63–2.40) >75%: 1.00 (0.51–1.94) Almost all the time: 0.69 (0.34–1.39) No adjusted chair: 1.53 (0.77–3.03) No adjusted desk: 0.66 (0.35–1.26) No arm rest space: 0.91 (0.56–1.47) Screen below eye height: 1.03 (0.68–1.55) Never standing: 1.12 (0.72–1.72) Glares or reflection: 1.08 (0.66–1.78[1]) Small influence on pauses: 1.87 (1.05–3.33) Necessity to work fast: 1.01 (0.70–1.73) *Intensity of shoulder pain* *Computer work* >50%: 1.07 (0.60–1.90) >75%: 0.95 (0.53–1.70) Almost all the time: 0.78 (0.43–1.43) No adjusted chair: 1.14 (0.64–2.05) No adjusted desk: 1.11 (0.66–1.86) No armrest space: 0.95 (0.63–1.43) Screen below eye height: 1.16 (0.80–1.68) Never standing: 1.11 (0.77–1.60) Glares or reflection: 1.55 (1.05–2.30) Small influence on pauses: 1.58 (0.96–2.60) Necessity to work fast: 0.98 (0.67–1.43)

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Table 4.2.18 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Miranda et al[2] 2001 [16] Finland	Cohort Employees at large forestry company 1994–995 n=2 094 47% women among white collar workers 18% women among blue collar workers Participation rate – Baseline 47% of original cohort from 1992 – Follow-up 90%	Shoulder pain (at least 8 days during the preceding 12 months)	Physical strenuousness of work Working with hands above shoulder, hours/day Working with the trunk flexed forward, hours/day Twisting movements of the trunk Working with rotated neck, hours/day Working in sitting position, hours/day Repetitive work Daily lifting of loads	OR (95% CI) adjusted for age and gender *Physical strenuousness of work* Not at all or rather light: 1.0 Somewhat strenuous: 1.7 (1.2–2.3) Rather or very strenuous: 2.4 (1.7–3.4) *Working with hands above shoulder, hours/day* <0.5: 1.0 0.5–1: 1.4 (1.0–2.0) >1: 1.8 (1.3–2.6) *Working with the trunk flexed forward, hours/day* <0.5: 1.0 0.5–1: 2.1 (1.5–3.0) 1–2: 1.5 (1.0–2.4) >2: 2.3 (1.6–3.2) *Twisting movements of the trunk* Not at all: 1.0 Little or moderately: 2.9 (1.3–6.7) Much: 5.1 (2.1–12.3) *Working with rotated neck, hours/day* <0.5: 1.0 0.5–1: 1.3 (1.0–1.9) >1: 1.6 (1.2–2.2) *Working in sitting position, hours/day* <2: 1.0 2–4: 0.7 (0.5–1.0) >4: 0.7 (0.5–0.9) *Repetitive work* No association *Daily lifting of loads* No association	OR (95% CI) *Physical strenuousness of work* Not at all or rather light: 1.0 Somewhat strenuous: 1.6 (1.1–2.3) Rather or very strenuous: 2.0 (1.3–3.1) *Working with hands above shoulder, hours/day* <0.5: 1.0 0.5–1: 1.1 (0.8–1.6) >1: 1.3 (0.8–1.9) *Working with the trunk flexed forward, hours/day* <0.5: 1.0 0.5–1: 1.7 (1.2–2.5) 1–2: 1.2 (0.7–2.0) >2: 1.6 (0.9–2.6) *Twisting movements of the trunk* Not included in final model *Working with rotated neck, hours/day* Not included in final model *Working in sitting position, hours/day* Not included in final model *Repetitive work* Not included in final model *Daily lifting of loads* Not included in final model

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Table 4.2.18 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Wigaeus Tornqvist et al[2] 2009 [18] Sweden	Cohort Computer users with varying occupations at 46 different worksites Average follow-up time: 329 days (range 28–540) 10 monthly questionnaires n=1 247 60% women Participation rate – Baseline 84% – Follow-up 97%	Shoulder joint or upper arm pain or aches at least 3 days during the preceding month	Duration of computer work (hours/day) Duration of data/text entry (hours/day) Duration and frequently of continuous computer work without breaks (breaks >10 min) Duration of mouse use (hours/day) Mouse placement Comfort of the computer work environment (score –44 to +44) Variation of work tasks	RR (95% CI) *Duration of computer work (hours/day)* <2: 1.0 2–<4: 1.32 (0.95–1.82) ≥4: 1.35 (0.99–1.84) *Duration of data/text entry (hours/day)* <0.5: 1.0 0.5 to <3: 1.02 (0.78–1.33) ≥3: 1.33 (0.96–1.85) *Duration and freq. of cont. computer work without breaks (breaks >10 min)* <2 h: 1.0 2–3 h/day or >3 h < few times/week: 1.08 (0.85–1.37) >3 h at least a few times/week: 1.55 (1.15–2.08) *Duration of mouse use (hours/day)* <0.5: 1.0 0.5 to <3: 1.41 (1.07–1.85) ≥3: 1.31 (0.90–1.90) *Mouse placement* Optimal: 1.0 Non optimal: 1.11 (0.87–1.42) *Comfort of the computer work environment (score –44 to +44)* High (≥25): 1.0 Medium (3–24): 1.23 (0.93–1.63) Low (≤2): 1.64 (1.20–2.24) *Variation of work tasks* ≥5 work tasks (≥30 min): 1.0 3–4 work tasks (≥30 min): 1.06 (0.79–1.40) ≤2 work tasks (≥30 min): 1.37 (1.02–1.83)	RR (95% CI) *Duration of computer work (hours/day)* <2: 1.0 2–<4: 0.74 (0.49–1.13) ≥4: 0.66 (0.41–1.07) *Duration of data/text entry (hours/day)* <0.5: 1.0 0.5 to <3: 0.87 (0.63–1.19) ≥3: 1.17 (0.75–1.83) *Duration and freq. of cont. computer work without breaks (breaks >10 min)* <2 h: 1.0 2–3 h/day or >3 h < few times/week: 0.91 (0.68–1.21) >3 h at least a few times/week: 1.30 (0.89–1.90) *Duration of mouse use (hours/day)* <0.5: 1.0 0.5 to <3: 1.62 (1.12–2.34) ≥3: 1.30 (0.77–2.19) *Mouse placement* Optimal: 1.0 Non optimal: 0.89 (0.67–1.19) *Comfort of the computer work environment (score –44 to +44)* High (≥25): 1.0 Medium (3–24): 1.35 (0.98–1.87) Low (≤2): 1.90 (1.32–2.73) *Variation of work tasks* ≥5 work tasks (≥30 min): 1.0 3–4 work tasks (≥30 min): 1.09 (0.77–1.54) ≤2 work tasks (≥30 min): 1.40 (0.93–2.10)

[1] Upper confidence interval given as 0.78 in the paper, which must be incorrect. Given a p-value of 0.76, it seems likely that the correct number is 1.78.
[2] Study quality is moderate.
[3] Study quality is high.

CI = Confidence interval; IRR = Incidence rate ratio; OR = Odds ratio; RR = Relative risk

Table 4.2.19 *Shoulders. Psychosocial exposure – cohort studies.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Brandt et al[2] 2004 [8] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=4 764 About 50% women Participation rate – Baseline 73% – Follow-up 82%	Shoulder pain (of at least moderate degree during the past 7 days, that had bothered the subject at least quite a lot during the year under study)	High job demands Low decision latitude Low social support High time pressure	RR (95% CI) adjusted for time with mouse and keyboard High job demands: 1.4 (0.9–2.2) Low control: 1.9 (1.2–2.9) Low social support: 1.3 (0.8–2.1) High time pressure: 1.0 (0.6–1.6)	RR (95% CI) High job demands: Not included in final model Low control: 1.9 (1.2–2.9) Low social support: Not included in final model High time pressure: Not included in final model
Gardner et al[3] 2008 [11] USA	Cohort Industries, new employees 2004–2006 n=560 35% women Participation rate – Baseline not given – Follow-up 87%	Hand and or upper extremity symptoms	Social support Job decision latitude Job insecurity	Not reported	OR (95% CI) *Social support* Low: 1 Medium: 0.75 (0.47–1.20) High: 0.78 (0.46–1.34) *Job decision latitude* Low: 1 Medium: 0.85 (0.54–1.35) High: 1.03 (0.62–1.72) *Job insecurity* Low: 1 Medium: 1.48 (0.94–2.33) High: 1.20 (0.70–2.03)

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Table 4.2.19 *continued*

Author **Year** **Reference** **Country**	**Design** **Setting** **Study period** **n at first follow-up** **% women**	**Outcome** **Diagnosis**	**Psychosocial exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Harkness et al[3] 2003 [13] United Kingdom	Cohort New employees 12 diverse occupational groups 1 year follow-up n=638 35% women Paricipation rate – Baseline 91% – Follow-up I 79% – Follow-up II 88%	Shoulder pain (lasting at least 24 hours during the previous month)	*Job demand* Stressful work Monotonous work Hectic work Job satisfaction Social support from colleagues Control over own work Learn new things	OR (95% CI) *Job demand* *Stressful work* Never/occasionally: 1 At least half the time: 0.9 (0.6–1.3) *Monotonous work* Never/occasionally: 1 At least half the time: 1.9 (1.2–2.9) *Hectic work* Never/occasionally: 1 At least half the time: 0.9 (0.6–1.3) *Job satisfaction* Not dissatisfied: 1 (Very)/dissatisfied: 0.7 (0.2–2.0) *Social support from colleagues* Not dissatisfied: 1 (Very)/dissatisfied: 1.0 (0.4–3.0) *Control over own work* At least sometimes: 1 (Very)/seldom: 1.1 (0.6–2.0) *Learn new things* At least sometimes: 1 (Very)/seldom: 1.2 (0.6–2.5)	OR (95% CI) *Job demand* *Stressful work* Not included in final model *Monotonous work* Never/occasionally: 1 At least half the time: 1.7 (1.1–2.8) *Hectic work* Not included in final model *Job satisfaction* Not included in final model *Social support from colleagues* Not included in final model *Control over own work* Not included in final model *Learn new things* Not included in final model

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Table 4.2.19 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Juul-Kristensen et al[3] 2004 [14] Denmark	Cohort Office workers with different kinds of computer work Beginning of 1999–end of 2000 Frequency of shoulder pain n=1 123 56% women Intensity of shoulder pain n=1 365 58% women Participation rate – Baseline 69% – Follow-up 77%	Frequency of shoulder pain (>7 days during last 12 months) Intensity of shoulder pain (mean shoulder pain ≥4 (scale 0–9) during previous 3 months)	Cognitive demands Sensory demands Influence at work Developmental possibilities Social support	OR (95% CI) *Frequency of shoulder pain* Cognitive demands: 1.00 (0.99–1.01) Sensory demands: 1.01 (1.00–1.02) Influence at work: 0.99 (0.98–0.99) Developmental possibilities: 1.00 (0.99–1.02) Social support: 1.00 (0.99–1.01) *Intensity of shoulder pain* Cognitive demands: 1.01 (1.00–1.02) Sensory demands: 1.00 (0.99–1.01) Influence at work: 0.99 (0.98–1.00) Developmental possibilities: 0.99 (0.98–1.00) Social support: 1.00 (0.99–1.01)	OR (95% CI) *Frequency of shoulder pain* Cognitive demands: 1.00 (0.98–1.02) Sensory demands: 1.01 (1.00–1.02) Influence at work: 1.00 (0.98–1.01) Developmental possibilities: 1.00 (0.99–1.02) Social support: 1.00 (0.99–1.01) *Intensity of shoulder pain* Cognitive demands: 1.01 (0.99–1.02) Sensory demands: 1.00 (0.99–1.01) Influence at work: 0.99 (0.98–1.01) Developmental possibilities: 0.99 (0.98–1.01) Social support: 1.00 (0.99–1.01)

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Table 4.2.19 continued

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Larsman et al[3] 2009 [15] Sweden	Cohort Service organisation workers 1990s 18 month follow-up n=670 100% women	Shoulder pain (previous 12 months)	Decision latitude (low/high)[1] Psychological load (high/low) Social support (low/high) High load/low latitude/ high support High load/low latitude/ low support High load/high latitude/ high support High load/high latitude/ low support Low load/low latitude/ high support Low load/low latitude/ low support Low load/high latitude/ high support Low load/high latitude/ low support	OR (95% CI) Decision latitude: 1.95 (1.39–2.74) Psychological load: 1.23 (0.88–1.73) Social support: 1.43 (1.02–2.00) High load/low latitude/high support: 2.17 (1.10–4.27) High load/low latitude/low support: 2.00 (1.17–3.39) High load/high latitude/high support: 0.78 (0.39–1.57) High load/high latitude/low support: 1.93 (1.01–3.69) Low load/low latitude/high support: 2.19 (1.05–4.54) Low load/low latitude/low support: 2.13 (1.17–3.86) Low load/high latitude/high support: 1.00 Low load/high latitude/low support: 0.90 (0.44–1.86)	No adjusted risk estimates reported
Silverstein et al[3] 2006 [17] USA	Cohort Manufacturing and healthcare facilities 2001–2004 n=436 51% women Includes prevalent cases (approximately 30%) Participation rate – Baseline 64% – Follow-up 62%	Rotator cuff tendinitis	High job demands High decision latitude High job satisfaction High social support High job security	RR (95% CI) High job demands: 1.3 (0.7–2.8) High decision latitude: 1.1 (0.6–2.3) High job satisfaction: 0.7 (0.3–1.3) High social support: 0.7 (0.4–1.4) High job security: 0.6 (0.3–1.1) All risk estimates completely unadjusted (calculated from crude tables)	No adjusted risk estimates reported

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Table 4.2.19 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Wigaeus Tornqvist et al[3] 2009 [18] Sweden	Cohort Computer users with varying occupations at 46 different worksites Average follow-up time: 329 days (range 28–540) 10 monthly questionnaires n=1 247 60 % women Participation rate – Baseline 84% – Follow-up 97%	Shoulder joint or upper arm pain or aches at least 3 days during the preceding month	Demands in relation to competence Job strain (demands, score 5–20, decision latitude, score 6–24) Social support (score 6–24)	RR (95% CI) *Demands in relation to competence* In accordance with competence: 1.0 Lower than competence: 1.27 (0.99–1.63) Higher than competence: 1.32 (0.96–1.80) *Job strain* Low (demands <13 + decision latitude >19): 1.0 Medium: 1.46 (1.02–2.09) High (demands ≥16 + decision latitude ≤15): 1.71 (0.95–3.07) *Social support* High (>20): 1.0 Medium (16–20): 1.06 (0.83–1.35) Low (≤15): 1.21 (0.80–1.82)	RR (95% CI) *Demands in relation to competence* In accordance with competence: 1.0 Lower than competence: 1.25 (0.91–1.71) Higher than competence: 1.33 (0.92–1.92) *Job strain* Low (demands <13 + decision latitude >19): 1.0 Medium: 1.00 (0.67–1.50) High (demands ≥16 + decision latitude ≤15): 1.06 (0.51–2.18) *Social support* High (>20): 1.0 Medium (16–20): 1.13 (0.84–1.51) Low (≤15): 1.19 (0.72–1.98)

[1] (According to the results section, and in concordance with the hypothesis, while the table says "high/low" for decision latitude and social support)
[2] Study quality is high.
[3] Study quality is moderate.

CI = Confidence interval; OR = Odds ratio; RR = Relative risk

Table 4.3.19 *Elbows and forearms. Physical exposure – randomised control trials.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Conlon et al[1] 2008 [2] USA	RCT California, aerospace engineering firm 2002–2003 (1 year) n=206 28% women	Incident musculoskeletal disorder diagnosed at physical examination following self-report of discomfort of >5 on a 0–10 point scale. Three categories: – neck/shoulder – right elbow/forearm/wrist/hand – left elbow/forearm/wrist/hand	Right upper extremity Left upper extremity Four intervention groups: 1) Conventional mouse 2) Alternative mouse with neutral forearm posture 3) Conventional mouse plus forearm support board 4) Alternative mouse plus forearm support board Analyses were made of alternative mouse and forearm support as two independent variables	HR (95% CI) *Right upper extremity* Alternative mouse: 0.70 (0.31–1.59) Forearm support board: 0.86 (0.39–1.90) *Left upper extremity* Alternative mouse: 0.99 (0.27–3.70) Forearm support board: 0.85 (0.23–3.16)	HR (95% CI) *Right upper extremity* Alternative mouse: 0.57 (0.24–1.34) Forearm support board: 0.74 (0.31–1.74) *Left upper extremity* Alternative mouse: 2.06 (0.42–10.1) Forearm support board: 0.68 (0.15–3.08)
Gerr et al[1] 2005 [3] USA	RCT Atlanta, Georgia, USA, newly hired persons working with computer workstation 6 months follow-up n=358 77% women	Any discomfort such as pain, aching, burning, numbness or tingling in neck, shoulders, elbows/forearms, hands/wrists or fingers, rated as ≥6 on a 0–10 VAS scale, or medications taken for any such outcomes Grouped into hand/arm and neck/shoulder	No intervention Alternate intervention group Conventional intervention group Alternate intervention based on protective factors for both neck/shoulder and hand/arm symptoms identified in a previous cohort study by the same research group Conventional intervention based on recommendations from various sources, eg OSHA, NIOSH, and private industry	Not reported	HR (95% CI) No intervention: 1.0 Alternate intervention group: 0.92 (0.49–1.71) Conventional intervention group: 1.05 (0.58–1.90)

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Table 4.3.19 *continued*

Author **Year** **Reference** **Country**	**Design** **Setting** **Study period** **n at first follow-up** **% women**	**Outcome** **Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Rempel et al[1] 2006 [4] USA	RCT California, call centre operators at a large healthcare company 1 year follow-up n=182 94%, 98%, 100%, 89% women in each of the four intervention groups	Incident musculoskeletal disorder diagnosed at physical examination following self-report of discomfort of more than 5 on a 0–10 point scale Three categories: – neck/shoulder – right elbow/forearm/wrist/hand – left elbow/forearm/wrist/hand	Right upper extremity Left upper extremity Four intervention groups: 1) Ergonomics training 2) Trackball mouse and ergonomics training 3) Forearm support board and ergonomics training 4) Trackball mouse, forearm support board and ergonomics training Analyses were made of trackball mouse and forearm support board as two independent variables	HR (95% CI) *Right upper extremity* Trackball mouse: 1.30 (0.62–2.71) Forearm support board: 0.81 (0.39–1.69) *Left upper extremity* Trackball mouse: 0.56 (0.21–1.52) Forearm support board: 0.66 (0.25–1.73)	HR (95% CI) *Right upper extremity* Trackball mouse: 1.26 (0.56–2.86) Forearm support board: 0.64 (0.28–1.45) *Left upper extremity* Trackball mouse: 0.19 (0.04–0.90) Forearm support board: 0.29 (0.08–1.05)

1. Study quality is moderate.

CI = Confidence interval; HR = Hazard ratio; NIOSH = National Institute for Occupational Safety; OSHA = Occupational Safety and Heath Administration; RCT = Randomised controlled trial

Table 4.3.20 *Elbows and forearms. Physical exposure – cohort studies.*

Author Year Reference Country	**Design Setting Study period n at first follow-up % women**	**Outcome Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Andersen et al[2] 2007 [5] Denmark	Cohort General working population, industrial and service sector 24-month follow-up n=1 513 64% women	Pain in the elbow, forearm and hand region bothering the subject at least "some" during the past 12 months	Repetitive work, min/hour Lifting, cumulative kg/hour Lifting at or above shoulder level, kg/hour Pushing, cumulative kg/hour Squatting >5 min/hour Standing >30 min/hour Sitting >30 min/hour	HR (95% CI) adjusted for gender, age and occupation *Repetitive work, min/hour* 0–9: 1.0 10–44: 1.2 (0.7–2.1) 45–60: 1.9 (1.2–3.1) *Lifting, cumulative kg/hour* Never: 1.0 1–99: 1.3 (0.8–2.1) ≥100: 1.6 (0.9–2.7) *Lifting at or above shoulder level, kg/hour* Never: 1.0 1–49: 0.9 (0.4–2.2) ≥50: 2.2 (1.1–4.3) *Pushing, cumulative kg/hour* Never: 1.0 1–354: 1.6 (0.9–2.7) ≥355: 1.8 (1.1–3.1) *Squatting >5 min/hour* No: 1.0 Yes: 1.2 (0.7–2.0) *Standing >30 min/hour* No: 1.0 Yes: 2.0 (1.1–3.7) *Sitting >30 min/hour* No: 1.0 Yes: 1.0 (0.6–1.7)	HR (95% CI) *Repetitive work, min/hour* 0–9: 1.0 10–44: 1.1 (0.6–2.0) 45–60: 1.7 (1.0–2.9) *Lifting, cumulative kg/hour* Not included in final model *Lifting at or above shoulder level, kg/hour* Not included in final model *Pushing, cumulative kg/hour* Not included in final model *Squatting >5 min/hour* Not included in final model *Standing >30 min/hour* Not included in final model *Sitting >30 min/hour* Not included in final model

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Table 4.3.20 *continued*

Author **Year** **Reference** **Country**	**Design** **Setting** **Study period** **n at first follow-up** **% women**	**Outcome** **Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
van den Heuvel et al[2] 2006 [8] The Netherlands	Cohort Office workers (computing professionals, administrative associate professionals and office clerks) 1994–1997 n=371 % women not reported	Elbow, wrist or hand symptoms (previous 12 months)	Wrist flexion Wrist pronation Arm elevation 30–60° (percentage of time) Computer work	OR (95% CI) *Wrist flexion* No: 1.00 Yes: 1.53 (1.01–2.33) *Wrist pronation* No: 1.00 Yes: 1.14 (0.64–2.04) *Arm elevation 30–60° (percentage of time)* Low (9–32%): 1.00 Medium (32–35%): 0.33 (0.15–0.73) High (36–65%): 0.57 (0.34–0.96) *Computer work* Seldom/never to now and then: 1.00 Rather often: 1.22 (0.68–2.18) Very often: 1.42 (0.77–2.60)	OR (95% CI) *Wrist flexion* No: 1.00 Yes: 1.45 (0.92–2.30) *Wrist pronation* No: 1.00 Yes: 1.27 (0.69–2.34) *Arm elevation 30–60° (percentage of time)* Low (9–32%): 1.00 Medium (32–35%): 0.52 (0.25–1.11) High (36–65%): 0.82 (0.51–1.31) *Computer work* Seldom/never to now and then: 1.00 Rather often: 1.29 (0.63–2.66) Very often: 1.42 (0.70–2.86)

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Juul-Kristensen et al[2] 2004 [9] Denmark	Cohort Office workers with different kinds of computer work Beginning of 1999 to end of 2000 *Frequency of elbow pain* n=1 334 56% women *Intensity of elbow pain* n=1 469 58% women	Frequency of elbow pain (>7 days during previous 12 months) Intensity of elbow pain (mean shoulder pain ≥4 (scale 0–9) during previous 3 months)	Computer work	OR (95% CI) adjusted for gender and age *Frequency of elbow pain* *Computer work* >50%: 1.01 (0.53–1.94) >75%: 0.97 (0.52–1.81) Almost all the time: 1.08 (0.60–1.93) No adjusted chair: 0.82 (0.38–1.77) No adjusted desk: 1.10 (0.57–2.14) No arm rest space: 1.04 (0.62–1.74) Screen below eye height: 1.79 (1.10–2.93) Never standing: 0.81 (0.51–1.28) Glares or reflection: 1.24 (0.74–2.07) Small influence on pauses: 1.17 (0.70–1.96) Necessity to work fast: 1.30 (0.82–2.04) *Intensity of elbow pain* *Computer work* >50%: 1.47 (0.86–2.49) >75%: 1.02 (0.59–1.76) Almost all the time: 1.50 (0.92–2.47) No adjusted chair: 1.20 (0.62–2.32) No adjusted desk: 0.90 (0.50–1.63) No arm rest space: 0.94 (0.60–1.46) Screen below eye height: 1.22 (0.82–1.81) Never standing: 0.84 (0.57–1.23) Glares or reflection: 1.30 (0.84–2.01) Small influence on pauses: 1.31 (0.83–2.05) Necessity to work fast: 0.68 (0.47–1.00)	OR (95% CI) *Frequency of elbow pain* *Computer work* >50%: 1.11 (0.51–2.40) >75%: 0.95 (0.43–2.10) Almost all the time: 1.08 (0.48–2.39) No adjusted chair: 0.68 (0.30–1.56) No adjusted desk: 1.03 (0.51–2.09) No arm rest space: 0.97 (0.57–1.68) Screen below eye height: 1.85 (1.11–3.08) Never standing: 0.86 (0.53–1.40) Glares or reflection: 1.20 (0.70–2.07) Small influence on pauses: 1.20 (0.64–2.27) Necessity to work fast: 1.15 (0.69–1.92) *Intensity of elbow pain* *Computer work* >50%: 1.12 (0.58–2.18) >75%: 0.90 (0.47–1.74) Almost all the time: 1.08 (0.48–2.39) No adjusted chair: 1.22 (0.61–2.43) No adjusted desk: 0.90 (0.49–1.65) No arm rest space: 0.89 (0.56–1.41) Screen below eye height: 1.20 (0.80–1.80) Never standing: 0.88 (0.59–1.31) Glares or reflection: 1.22 (0.78–1.93) Small influence on pauses: 1.06 (0.62–1.82) Necessity to work fast: 0.59 (0.39–0.90)

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Table 4.3.20 *continued*

Author Year Reference Country	**Design Setting Study period n at first follow-up % women**	**Outcome Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Kryger et al[2] 2003 [10] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=5 116 64% women	Forearm pain (of at least moderate degree during the past 7 days, that had bothered the subject at least quite a lot during the year under study)	Mouse use (hours/week) Arm support Keyboard use (hours/week) Not satisfied with work place design Work chair not adjusted Work desk not adjusted	OR (95% CI) model including time with mouse and keyboard *Mouse use (hours/week)* 0–9: 1 10–19: 1.8 (0.9–3.9) 20–29: 1.8 (0.7–4.6) ≥30: 6.8 (2.1–23) *Arm support (mouse)* No arm support (mouse): 1 Arm support (mouse) <50% time: 0.4 (0.1–1.3) Arm support (mouse) ≥50% time: 0.7 (0.3–2.0) Abnormal mouse position: 1.5 (0.6–3.6) *Keyboard use (hours/week)* 0–4: 1 5–9: 1.3 (0.5–3.2) 10–14: 1.4 (0.5–3.7) ≥15: 2.4 (0.9–6.7) *Arm support (keyboard)* No arm support (keyboard): 1 Arm support (keyboard) <50% time: 1.1 (0.5–2.5) Arm support (keyboard) ≥50% time: 1.2 (0.6–2.3) Abnormal keyboard position: 1.2 (0.6–2.6) *Not satisfied with work place design* 1.1 (0.4–2.7) *Work chair not adjusted* 0.8 (0.1–6.0) *Work desk not adjusted* 0.6 (0.3–1.4)	OR (95% CI) *Mouse use (hours/week)* 0–9: 1 10–19: 2.2 (1.0–4.7) 20–29: 2.6 (1.0–6.6) ≥30: 8.4 (2.5–29) *Arm support (mouse)* Not included in final model *Keyboard use (hours/week)* 0–4: 1 5–9: 1.2 (0.5–2.9) 10–14: 1.3 (0.5–3.4) ≥15: 2.6 (0.9–7.3) *Arm support (keyboard)* Not included in final model *Not satisfied with work place design* Not included in final model *Work chair not adjusted* Not included in final model *Work desk not adjusted* Not included in final model

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Lassen et al[2] 2004 [11] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=4 031 (12-month pain) n=5 287 (severe pain) 49% women	Elbow pain (previous 12-months) Severe elbow pain (lasting at least 30 days, causing at least 'quite a lot of trouble')	Mouse use per 10 hours/week, continuous Mouse use hours/week Forearm/wrist support (mouse) Abnormal mouse position Keyboard use per 10 hours/week, continuous Keyboard use hours/week Forearm/wrist support (keyboard)	OR (95% CI)[1] <u>*Elbow pain*</u> *Mouse use (hours/week)* 0 to <2.5: 1 2.5 to <5: 1.37 (0.80–2.33) 5 to <10: 2.22 (1.47–3.38) 10 to <15: 2.03 (1.37–3.03) 15 to <20: 2.75 (1.85–4.10) 20 to <25: 2.92 (1.94–4.41) 25 to <30: 3.82 (2.35–6.22) ≥30: 3.18 (1.88–5.38)	OR (95% CI) <u>*Elbow pain*</u> *Mouse use per 10 hours/week, continuous* 1.55 (1.35–1.78) *Mouse use (hours/week)* 0 to <2.5: 1 2.5 to <5: 1.47 (0.84–2.54) 5 to <10: 2.35 (1.51–3.70) 10 to <15: 2.20 (1.42–3.45) 15 to <20: 3.12 (2.01–4.92) 20 to <25: 3.21 (2.03–5.17) 25 to <30: 4.83 (2.79–8.40) ≥30: 4.74 (2.51–8.95) *Forearm/wrist support (mouse)* <50% of time: 1.32 (0.86–2.02) ≥50% of time: 1.04 (0.75–1.44) *Abnormal mouse position* 1.04 (0.68–1.53) *Keyboard use per 10 hours/week, continuous* 1.19 (0.97–1.46)
				Results continues on the next page	Results continues on the next page

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Lassen et al continued 2004 [11] Denmark				*Keyboard use hours/week* 0 to <2.5: 1 2.5 to <5: 1.32 (0.83–2.10) 5 to <10: 1.57 (1.02–2.42) 10 to <15: 1.29 (0.82–2.02) 15 to <20: 1.29 (0.78–2.14) ≥20: 1.20 (0.65–2.22)	*Keyboard use hours/week* 0 to <2.5: 1 2.5 to <5: 1.04 (0.65–1.69) 5 to <10: 1.47 (0.98–2.26) 10 to <15: 1.33 (0.85–2.11) 15 to <20: 1.29 (0.78–2.17) ≥20: 1.98 (0.96–3.95) *Forearm/wrist support (keyboard)* <50% of time: 1.07 (0.79–1.44) ≥50% to 100% of time: 1.27 (0.99–1.62) *Abnormal keyboard position* 1.01 (0.74–1.37) *Not suitably adjusted chair* 0.93 (0.48–1.69) *Not suitably adjusted desk* 1.24 (0.95–1.60) *Unsatisfied with work place design* 1.63 (1.18–2.23)
				Results continues on the next page	Results continues on the next page

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Lassen et al continued 2004 [11] Denmark				<u>*Severe elbow pain*</u> *Mouse use (hours/week)* 0 to <2.5: 1 2.5 to <5: 1.16 (0.39–3.49) 5 to <10: 1.66 (0.71–3.92) 10 to <15: 2.49 (1.17–5.31) 15 to <20: 1.53 (0.66–3.52) 20 to <25: 2.41 (1.08–5.36) 25 to <30: 2.96 (1.19–7.38) ≥30: 4.23 (1.73–10.37)	<u>*Severe elbow pain*</u> *Mouse use per 10 hours/week, continuous* 1.52 (1.17–1.98) *Mouse use (hours/week)* 0 to <2.5: 1 2.5 to <5: 1.16 (0.34–3.54) 5 to <10: 1.42 (0.58–3.64) 10 to <15: 2.14 (0.93–5.32) 15 to <20: 1.45 (0.59–3.78) 20 to <25: 2.88 (1.18–7.54) 25 to <30: 4.16 (1.45–12.13) ≥30: 6.91 (2.21–22.53) *Forearm/wrist support (mouse)* <50% of time: 2.23 (0.99–5.18) ≥50% of time: 1.46 (0.76–3.07) *Abnormal mouse position* 1.35 (0.67–2.49)
				Results continues on the next page	Results continues on the next page

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Lassen et al continued 2004 [11] Denmark					*Keyboard use per 10 hours/week, continuous* 1.42 (0.96–2.08)
				Keyboard use (hours/week) 0 to <2.5: 1 2.5 to <5: 1.29 (0.54–3.09) 5 to <10: 1.11 (0.49–2.53) 10 to <15: 1.54 (0.67–3.51) 15 to <20: 1.39 (0.55–3.53) ≥20: 1.76 (0.61–5.10)	*Keyboard use (hours/week)* 0 to <2.5: 1 2.5 to <5: 1.09 (0.44–3.00) 5 to <10: 1.58 (0.71–4.03) 10 to <15: 2.49 (1.08–6.53) 15 to <20: 2.86 (1.08–8.12) ≥20: 3.79 (0.91–14.11)
					Forearm/wrist support (keyboard) <50% of time: 0.76 (0.42–1.33) ≥50% to 100% of time: 1.01 (0.64–1.59)
					Abnormal keyboard position 1.45 (0.85–2.36)
					Not suitably adjusted chair 1.35 (0.40–3.47)
					Not suitably adjusted desk 0.69 (0.39–1.16)
					Unsatisfied with work place design 1.92 (1.06–3.37)

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Table 4.3.20 *continued*

Author **Year** **Reference** **Country**	**Design** **Setting** **Study period** **n at first follow-up** **% women**	**Outcome** **Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Macfarlane et al[3] 2000 [12] United Kingdom	Cohort General population 2 year follow-up n=1 260 59% women	Forearm pain during the previous month, lasting at least one day	Lift or carry weights Push or pull weights Type for 30 minutes without break Repetitive arm movements Repetitive wrist movements	RR (95% CI) adjusted for age and gender *Lift or carry weights* Never: 1 Occasionally: 1.0 (0.5–2.0) Half or most of the time: 1.7 (0.8–3.6) *Push or pull weights* Never: 1 Occasionally: 1.0 (0.5–2.1) Half or most of the time: 2.0 (0.96–4.3) *Type for 30 minutes without break* Never: 1 Occasionally: 1.0 (0.5–2.1) Half or most of the time: 1.0 (0.4–2.4) *Repetitive arm movements* Never: 1 Occasionally: 1.8 (0.6–5.1) Half or most of the time: 4.1 (1.7–10) *Repetitive wrist movements* Never: 1 Occasionally: 1.4 (0.4–4.2) Half or most of the time: 3.4 (1.3–8.7)	RR (95% CI) *Lift or carry weights* Not included in final model *Push or pull weights* Not included in final model *Type for 30 minutes without break* Not included in final model *Repetitive arm movements* Never: 1 Occasionally: 1.2 (0.4–3.7) Half or most of the time: 2.9 (1.2–7.3) *Repetitive wrist movements* Not included in final model

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Table 4.3.20 *continued*

Author **Year** **Reference** **Country**	**Design** **Setting** **Study period** **n at first follow-up** **% women**	**Outcome** **Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Marcus et al[3] 2002 [13] USA	Cohort Newly hired computer workers 3-year follow-up study n=496 (Symptoms) n=520 (Disorders) 71% women	Symptoms in elbows/forearms, hands/wrists or fingers during the previous week (reported in weekly questionnaires throughout the follow-up) Disorders in the elbows, forearms and/or hands (medial or lateral epicondylitis, wrist or finger tendonitis, carpal tunnel syndrome or ulnar neuritis)	Keyboard wrist extension angle Keyboard wrist ulnar deviation angle Distance table surface to "J" key Distance table edge to "J" key Presence of wrist rest Mouse wrist ulnar deviation angle Mouse wrist extension angle Average key activation force Presence of sharp leading edge on table surface Hours keying per week (HR per hour)	HR (95% CI) *Symptoms in elbows/forearms, hands/wrists or fingers during the previous week* *Keyboard wrist extension angle* ≤30°: 1.0 >30°: 1.28 (0.81–2.01) *Keyboard wrist ulnar deviation angle* <–5°: 1.05 (0.50–2.24) –5° to 5°: 1.0 6° to 10°: 1.02 (0.61–1.68) >10°: 1.12 (0.63–2.00) *Distance table surface to "J" key* ≤3.5 cm: 1.0 >3.5 cm: 1.54 (0.96–2.49) *Distance table edge to "J" key* ≤12 cm: 1.0 >12 cm: 0.61 (0.40–0.92) *Presence of wrist rest* No: 1.0 Yes: 1.32 (0.86–2.02) Results continues on the next page	HR (95% CI) *Symptoms in elbows/forearms, hands/wrists or fingers during the previous week* *Keyboard wrist extension angle* Not included in final model *Keyboard wrist ulnar deviation angle* *Distance table surface to "J" key* Not included in final model *Distance table edge to "J" key* >12 cm: 0.50 (0.32–0.80) *Presence of wrist rest* Yes: 1.66 (1.03–2.67) Results continues on the next page

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Marcus et al continued 2002 [13] USA				*Mouse wrist ulnar deviation angle* ≤–5°: 1.12 (0.69–1.83) –5° to 5°: 1.0 >5°: 0.92 (0.54–1.57)	*Mouse wrist ulnar deviation angle* Not included in final model
				Mouse wrist extension angle ≤17°: 1.0 17° to 23°: 0.62 (0.34–1.12) 24° to 30°: 0.87 (0.52–1.44) >30°: 0.97 (0.55–1.72)	*Mouse wrist extension angle* Not included in final model
				Average key activation force ≤48 g: 1.0 >48 g: 1.32 (0.80–2.18)	*Average key activation force* Not included in final model
				Presence of sharp leading edge on table surface No: 1.0 Yes: 1.11 (0.73–1.69)	*Presence of sharp leading edge on table surface* Not included in final model
					Hours keying per week (HR per hour) 1.04 (1.02–1.06)
				Disorders in the elbows, forearms and/or hands *Keyboard wrist extension angle* –10° to 10°: 1.28 (0.49–3.34) 11° to 25°: 1.0 26° to 30°: 0.65 (0.27–1.57) >30°: 1.58 (0.87–2.88)	*Disorders in the elbows, forearms and/or hands* *Keyboard wrist extension angle* Not included in final model
				Keyboard wrist ulnar deviation angle <–5°: 1.08 (0.42–2.77) –5° to 5°: 1.0 6° to 10°: 0.80 (0.43–1.59) >10°: 0.85 (0.39–1.86)	*Keyboard wrist ulnar deviation angle* Not included in final model
				Results continues on the next page	Results continues on the next page

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Marcus et al continued 2002 [13] USA				*Distance table surface to "J" key* ≤3.5 cm: 1.0 >3.5 cm: 1.61 (0.87–3.00)	*Distance table surface to "J" key* Not included in final model
				Distance table edge to "J" key ≤12 cm: 1.0 >12 cm: 0.47 (0.27–0.83)	*Distance table edge to "J" key* >12 cm: 0.38 (0.20–0.71)
				Presence of wrist rest No: 1.0 Yes: 1.37 (0.78–2.38)	*Presence of wrist rest* Yes: 1.96 (1.03–3.65)
				Mouse wrist ulnar deviation angle ≤–5°: 1.99 (1.09–3.63) –5° to 5°: 1.0 >5°: 1.22 (0.62–2.43)	*Mouse wrist ulnar deviation angle* ≤–5°: 1.82 (1.03–3.22) –5° to 5°: – >5°: 1.0
				Mouse wrist extension angle ≤17°: 1.0 17° to 23°: 0.64 (0.30–1.35) 24° to 30°: 0.78 (0.40–1.53) >30°: 0.77 (0.39–1.66)	*Mouse wrist extension angle* Not included in final model
				Average key activation force ≤48 g: 1.0 >48 g: 1.81 (0.89–3.70)	*Average key activation force* Not included in final model
				Presence of sharp leading edge on table surface No: 1.0 Yes: 0.96 (0.55–1.66)	*Presence of sharp leading edge on table surface* Not included in final model
					Hours keying per week (HR per h) 1.04 (1.02–1.06)

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Nahit et al[2] 2003 [14] United Kingdom	Cohort First full-time employment in 12 occupational groups in industries with musculoskeletal disorders Study period not given Recruitment at year –1, baseline measurement at 0 and follow-up at +1 year n=666 34% women	Forearm pain	Lifting with 1 hand Lifting with 2 hands Carrying on 1 shoulder Lifting above shoulder level Pushing Pulling Sitting Standing Driving Kneeling Squatting Bending Stretching below knee level Working with hands above shoulder Repetitive wrist movements Repetitive arm movements	OR (95% CI) adjusted for age, gender and occupational group *Lifting with 1 hand* Never: 1.0 <16 lbs: 1.0 (0.5–1.8) ≥16 lbs: 0.8 (0.4–1.8) *Lifting with 2 hands* Never: 1.0 <25 lbs: 1.7 (0.8–3.3) ≥25 lbs: 1.9 (0.9–4.0) *Carrying on 1 shoulder* Never: 1.0 <30 lbs: 0.8 (0.3–2.0) ≥30 lbs: 2.1 (0.9–4.9) *Lifting above shoulder level* Never: 1.0 <20 lbs: 0.9 (0.4–2.2) ≥20 lbs: 1.5 (0.7–3.5) *Pushing* Never: 1.0 <69 lbs: 0.6 (0.3–1.6) ≥69 lbs: 1.2 (0.6–2.5) *Pulling* Never: 1.0 <58 lbs: 0.5 (0.1–1.6) ≥58 lbs: 1.3 (0.5–3.0) Results continues on the next page	OR (95% CI) *Lifting with 1 hand* Not included in final model *Lifting with 2 hands* Not included in final model *Carrying on 1 shoulder* Not included in final model *Lifting above shoulder level* Not included in final model *Pushing* Not included in final model *Pulling* Not included in final model Results continues on the next page

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Nahit et al continued 2003 [14] United Kingdom				*Sitting* <4 hours: 1.0 ≥4 hours: 1.0 (0.5–1.9)	*Sitting* Not included in final model
				Standing <4 hours: 1.0 ≥4 hours: 1.4 (0.7–2.8)	*Standing* Not included in final model
				Driving <4 hours: 1.0 ≥4 hours: 0.8 (0.3–2.4)	*Driving* Not included in final model
				Kneeling <15 minutes: 1.0 ≥15 minutes: 1.8 (0.9–3.4)	*Kneeling* Not included in final model
				Squatting <15 minutes: 1.0 ≥15 minutes: 2.0 (1.0–3.9)	*Squatting* Not included in final model
				Bending <15 minutes: 1.0 ≥15 minutes: 2.2 (1.2–3.8)	*Bending* Not included in final model
				Stretching below knee level <15 minutes: 1.0 ≥15 minutes: 1.6 (0.7–3.3)	*Stretching below knee level* Not included in final model
				Working with hands above shoulder <15 minutes: 1.0 ≥15 minutes: 2.4 (1.3–4.5)	*Working with hands above shoulder* <15 minutes: 1.0 ≥15 minutes: 2.2 (1.1–4.3)
				Repetitive wrist movements <2 hours: 1.0 ≥2 hours: 2.9 (1.6–5.2)	*Repetitive wrist movements* <2 hours: 1.0 ≥2 hours: 2.9 (1.5–5.3)
				Repetitive arm movements <2 hours: 1.0 ≥2 hours: 2.9 (1.6–5.2)	*Repetitive arm movements* Not included in final model

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Table 4.3.20 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Wigaeus Tornqvist et al[2] 2009 [16] Sweden	Cohort Computer users with varying occupations at 46 different worksites Average follow-up time: 329 days (range 28–540) 10 monthly questionnaires n=1 170 59% women	Hand/arm (elbows, forearms, wrists, hands, fingers) pain or aches at least 3 days during the preceding month	Duration of computer work (hours/day) Duration of data/text entry (hours/day) Duration and frequency of continous computer work without breaks (breaks >10 minutes) Duration of mouse use (hours/day) Mouse placement Comfort of computer work environment (score –44 to +44) Variation of work tasks	RR (95% CI) *Duration of computer work (hours/day)* <2: 1.0 2 to <4: 1.30 (0.95–1.78) ≥4: 1.56 (1.16–2.09) *Duration of data/text entry (hours/day)* <0.5: 1.0 0.5 to <3: 0.95 (0.74–1.22) ≥3: 1.12 (0.81–1.56) *Duration and freq. of continued computer work without breaks (breaks >10 min)* <2 hours: 1.0 2–3 hours/day or >3 hours < few times/week: 1.16 (0.93–1.45) ≥3 hours at least a few times/week: 1.51 (1.13–2.01) *Duration of mouse use (hours/day)* <0.5: 1.0 0.5 to <3: 1.41 (1.09–1.84) ≥3: 1.74 (1.24–2.43) *Mouse placement* Optimal: 1.0 Non optimal: 1.31 (1.03–1.67) *Comfort of computer work environment (score –44 to +44)* High (≥25): 1.0 Medium (3–24): 1.09 (0.84–1.41) Low (≤2): 1.61 (1.21–2.15) *Variation of work tasks* ≥5 work tasks (≥30 min): 1.0 3–4 work tasks (≥30 min): 1.25 (0.95–1.65) ≤2 work tasks (≥30 min): 1.51 (1.13–2.01)	RR (95% CI) *Duration of computer work (hours/day)* <2: 1.0 2 to <4: 0.82 (0.54–1.22) ≥4: 0.87 (0.55–1.38) *Duration of data/text entry (hours/day)* <0.5: 1.0 0.5 to <3: 0.87 (0.64–1.18) ≥3: 1.03 (0.68–1.58) *Duration and freq. of continued computer work without breaks (breaks >10 min)* <2 hours: 1.0 2–3 hours/day or >3 hours < few times/week: 0.94 (0.72–1.23) ≥3 hours at least a few times/week: 1.06 (0.73–1.55) *Duration of mouse use (hours/day)* <0.5: 1.0 0.5 to <3: 1.44 (1.01–2.05) ≥3: 1.70 (1.07–2.70) *Mouse placement* Optimal: 1.0 Non optimal: 1.26 (0.95–1.67) *Comfort of computer work environment (score –44 to +44)* High (≥25): 1.0 Medium (3–24): 1.13 (0.83–1.53) Low (≤2): 1.71 (1.22–2.39) *Variation of work tasks* ≥5 work tasks (≥30 min): 1.0 3–4 work tasks (≥30 min): 1.16 (0.84–1.60) ≤2 work tasks (≥30 min): 1.36 (0.93–2.01)

[1] OR calculated by reviewers for given data on cases in exposed and unexposed groups.
[2] Study quality is moderate.
[3] Study quality is high.

CI = Confidence interval; HR = Hazard ratio; OR = Odds ratio; RR = Relative risk

Table 4.3.21 *Elbows and forearms. Physical exposure – case-control studies.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Haahr et al[1] 2003 [17] Denmark	Case-control Denmark May 1998–May 2000 209 cases (52% women) 274 controls (57% women)	Lateral epicondylitis (diagnosed by general practitioners)	*Working posture* Arms lifted in front of body Hands bent or twisted *Repetitive movements* Same movements of fingers or hands Same movements of arms *Precision* Work demands precision movements *Force* Use of tools weighing >1 kg *Force index* Use of tools weighing 100 g to 1 kg and/or use of tools >1 kg *Strain* (women and men) *Physical strain* (women and men)	OR (95% CI) adjusted for age and BMI ***Women*** *Working posture* *Arms lifted in front of body* Never or almost never: 1.0 1/4 to 1/2 of the time: 2.1 (1.1–4.0) 3/4 to almost all the time: 4.4 (2.3–8.3) *Hands bent or twisted* Never or almost never: 1.0 1/4 to 1/2 of the time: 2.9 (1.6–5.2) 3/4 to almost all the time: 10.0 (4.1–22.4) *Repetitive movements* *Same movements of fingers or hands* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.5 (0.8–2.7) 3/4 to almost all the time: 2.8 (1.4–5.4) *Same movements of arms* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.8 (0.9–3.4) 3/4 to almost all the time: 4.8 (2.4–9.8) *Precision* *Work demands precision movements* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.7 (0.9–4.2) 3/4 to almost all the time: 1.1 (0.4–2.8) *Force* *Use of tools weighing >1 kg* No force full work: 1.0 Force full work: 2.8 (1.6–5.0) *Force index* *Use of tools weighing 100 g to 1 kg and/or use of tools >1 kg* No force full work: 1.0 Force full work level 1: 2.9 (1.6–5.5) Force full work level 2: 4.0 (1.9–8.4) Results continues on the next page	OR (95% CI) adjusted for age, BMI and psychosocial factors ***Women*** *Working posture* *Arms lifted in front of body* Never or almost never: 1.0 1/4 to 1/2 of the time: 2.0 (1.0–3.9) 3/4 to almost all the time: 4.0 (2.0–8.3) *Hands bent or twisted* Never or almost never: 1.0 1/4 to 1/2 of the time: 2.8 (1.4–5.4) 3/4 to almost all the time: 7.4 (2.9–18.7) *Repetitive movements* *Same movements of fingers or hands* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.3 (0.7–2.5) 3/4 to almost all the time: 1.9 (0.9–4.0) *Same movements of arms* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.5 (0.6–3.9) 3/4 to almost all the time: 3.7 (1.7–8.3) *Precision* *Work demands precision movements* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.5 (0.6–3.9) 3/4 to almost all the time: 0.9 (0.3–2.5) *Force* *Use of tools weighing >1 kg* No force full work: 1.0 Force full work: 3.0 (1.6–5.5) *Force index* *Use of tools weighing 100 g to 1 kg and/or use of tools >1 kg* No force full work: 1.0 Force full work level 1: 2.6 (1.3–5.3) Force full work level 2: 4.6 (2.1–10.3) Results continues on the next page

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Table 4.3.21 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Haahr et al continued 2003 [17] Denmark				***Men*** *Working posture* *Arms lifted in front of body* Never or almost never: 1.0 1/4 to 1/2 of the time: 2.6 (1.3–5.1) 3/4 to almost all the time: 2.1 (1.1–4.3) *Hands bent or twisted* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.9 (1.0–3.6) 3/4 to almost all the time: 3.2 (1.5–6.9) *Repetitive movements* *Same movements of fingers or hands* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.5 (0.8–2.9) 3/4 to almost all the time: 2.2 (1.0–4.8) *Same movements of arms* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.9 (1.0–3.7) 3/4 to almost all the time: 2.5 (1.2–5.2) *Precision* *Work demands precision movements* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.0 (0.5–2.2) 3/4 to almost all the time: 5.4 (1.7–17.1) *Force* *Use of tools weighing >1 kg* No force full work: 1.0 Force full work: 2.2 (1.3–3.9) *Force index* *Use of tools weighing 100 g to 1 kg and/or use of tools >1 kg* No force full work: 1.0 Force full work level 1: 2.0 (1.0–3.8) Force full work level 2: 3.8 (1.8–8.9) Results continues on the next page	***Men*** *Working posture* *Arms lifted in front of body* Never or almost never: 1.0 1/4 to 1/2 of the time: 2.7 (1.3–5.5) 3/4 to almost all the time: 1.9 (0.9–4.3) *Hands bent or twisted* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.6 (0.8–3.3) 3/4 to almost all the time: 3.2 (1.3–7.9) *Repetitive movements* *Same movements of fingers or hands* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.7 (0.9–3.3) 3/4 to almost all the time: 2.2 (0.9–5.3) *Same movements of arms* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.8 (0.9–3.6) 3/4 to almost all the time: 1.9 (0.8–4.6) *Precision* *Work demands precision movements* Never or almost never: 1.0 1/4 to 1/2 of the time: 1.0 (0.5–2.2) 3/4 to almost all the time: 5.2 (1.5–17.9) *Force* *Use of tools weighing >1 kg* No force full work: 1.0 Force full work: 2.1 (1.1–3.8) *Force index* *Use of tools weighing 100 g to 1 kg and/or use of tools >1 kg* No force full work: 1.0 Force full work level 1: 2.0 (1.0–4.1) Force full work level 2: 3.5 (1.6–7.7) Results continues on the next page

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Table 4.3.21 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Haahr et al continued 2003 [17] Denmark				***Women and men*** (adjusted for age, gender and BMI) *Strain* *Repetition and force* Low repetition/low force: 1.0 Low repetition/high force: 1.7 (0.9–3.5) High repetition/low force: 1.4 (0.9–2.3) High repetition /high force: 3.9 (2.2–6.9) Extreme posture: – *Repetition and posture* Low repetition/neutral posture: 1.0 Low repetition/extreme posture: 2.3 (1.1–4.8) High repetition/neutral posture: 1.1 (0.6–2.0) High repetition/extreme posture: 3.0 (1.9–4.9) High force: – *Force and posture* Low force/neutral posture: 1.0 Low force/extreme posture: 2.2 (1.4–3.6) High force/neutral posture: 1.8 (0.9–3.7) Low force/extreme posture: 4.3 (2.6–7.0) High repetition: – *Physical strain* None: – Low: – Medium: – High: –	***Women and men*** (adjusted for age, gender, BMI and psychosocial factors) *Strain* *Repetition and force* Low repetition/low force: 1.0 Low repetition/high force: 1.5 (0.7–3.2) High repetition/low force: 1.1 (0.6–1.9) High repetition /high force: 2.5 (1.3–4.9) Extreme posture: 1.6 (1.0–2.7) *Repetition and posture* Low repetition/neutral posture: 1.0 Low repetition/extreme posture: 1.6 (0.7–3.7) High repetition/neutral posture: 1.3 (0.7–3.2) High repetition/extreme posture: 2.1 (1.2–2.6) High force: 2.0 (1.3–3.2) *Force and posture* Low force/neutral posture: 1.0 Low force/extreme posture: 1.6 (0.9–2.8) High force/neutral posture: 1.9 (0.9–4.0) Low force/extreme posture: 3.3 (1.9–5.8) High repetition: 1.3 (0.8–2.0) *Physical strain* None: 1.0 Low: 1.4 (0.8–2.7) Medium: 2.0 (1.1–3.7) High: 4.4 (2.3–8.7)

1. Study quality is moderate.

BMI = Body mass index; CI = Confidence interval; OR = Odds ratio

Table 4.3.22 *Elbows and forearms. Psychosocial exposure – cohort studies.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Andersen et al[1] 2007 [5] Denmark	Cohort General working population, industrial and service sector 24-month follow-up n=1 513 64% women	Pain in the elbow, forearm and hand region bothering the subject at least "some" during the past 12 months	Job demands Job control Social support from supervisors Social support from colleagues Management quality Job satisfaction	HR (95% CI) adjusted for gender, age and occupation *Job demands* Low: 1.0 High: 0.8 (0.5–1.2) *Job control* High: 1.0 Low: 1.5 (0.9–2.2) *Social support from supervisors* High: 1.0 Low: 1.2 (0.8–1.9) *Social support from colleagues* High: 1.0 Low: 1.5 (0.9–2.4) *Management quality* High: 1.0 Low: 1.3 (0.9–2.0) *Job satisfaction* High: 1.0 Low: 1.3 (0.5–2.9)	None of the psychosocial factors were included in the final model

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Table 4.3.22 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Gardner et al[1] 2008 [6] USA	Cohort Industries, new employees 2004–2006 n=560 35% women	Hand and or upper extremity symptoms	Social support Job decision latitude Job insecurity	Not reported	OR (95% CI) *Social support* Low: 1 Medium: 0.75 (0.47–1.20) High: 0.78 (0.46–1.34) *Job decision latitude* Low: 1 Medium: 0.85 (0.54–1.35) High: 1.03 (0.62–1.72) *Job insecurity* Low: 1 Medium: 1.48 (0.94–2.33) High: 1.20 (0.70–2.03)
Hannan et al[1] 2005 [7] USA	Cohort Newly hired employees using computers, from several large companies in Atlanta, Georgia 2000–2003 Weekly assessments up to 6 months for each participant n=333 71% women	Discomfort in elbows, forearms, hands, wrists or fingers (≥6 on a scale from 0–10 or use of pain medication, on any day during the preceding week)	Job strain quadrants Job strain ration	HR (95% CI) age-adjusted *Job strain quadrants* Low strain: 1.00 High strain: 1.48 (0.71–3.08) Active: 1.72 (0.89–3.34) Passive: 1.36 (0.66–2.79) *Job strain ration* 1st category: 1.00 2nd category: 1.12 (1.56–2.26) 3rd category: 1.36 (0.70–2.64) 4th category: 1.24 (0.62–2.46)	HR (95% CI) *Job strain quadrants* Low strain: 1.00 High strain: 1.28 (0.58–2.85) Active: 1.36 (0.65–2.85) Passive: 1.12 (0.49–2.54) *Job strain ration* 1st category: 1.00 2nd category: 1.03 (0.48–2.19) 3rd category: 1.13 (0.55–2.32) 4th category: 1.04 (0.48–2.26)

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Table 4.3.22 *continued*

Author Year Reference Country	**Design Setting Study period n at first follow-up % women**	**Outcome Diagnosis**	**Psychosocial exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Juul-Kristensen et al[1] 2004 [9] Denmark	Cohort Office workers with different kinds of computer work Beginning of 1999 to end of 2000 Frequency of elbow pain n=1 334 56% women Intensity of elbow pain n=1 469 58% women	Frequency of elbow pain (>7 days during previous 12 months) Intensity of elbow pain (mean shoulder pain ≥4 (scale 0–9) during previous 3 months)	Cognitive demands Sensory demands Influence at work Developmental possibilities Social support	OR (95% CI) adjusted for gender and age *Frequency of elbow pain* Cognitive demands: 1.02 (1.00–1.03) Sensory demands: 1.00 (0.99–1.01) Influence at work: 0.99 (0.98–1.00) Developmental possibilities: 0.99 (0.98–1.01) Social support: 1.00 (0.99–1.01) *Intensity of elbow pain* Cognitive demands: 1.01 (1.00–1.02) Sensory demands: 1.00 (0.99–1.01) Influence at work: 0.99 (0.98–1.01) Developmental possibilities: 0.99 (0.98–1.00) Social support: 1.00 (0.99–1.01)	OR (95% CI) *Frequency of elbow pain* Cognitive demands: 1.01 (1.00–1.03) Sensory demands: 1.00 (0.99–1.02) Influence at work: 1.00 (0.98–1.02) Developmental possibilities: 0.99 (0.98–1.01) Social support: 1.00 (0.98–1.01) *Intensity of elbow pain* Cognitive demands: 1.01 (0.99–1.02) Sensory demands: 1.01 (0.99–1.02) Influence at work: 0.99 (0.98–1.00) Developmental possibilities: 1.00 (0.99–1.02) Social support: 1.00 (0.99–1.01)
Kryger et al[1] 2003 [10] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=5 116 64% women	Forearm pain of at least moderate degree during the past 7 days, that had bothered the subject at least quite a lot during the year under study	High demands Low control Low social support Time pressure	OR (95% CI) model including time with mouse and keyboard High demands: 1.8 (1.0–3.3) Low control: 1.0 (0.5–1.7) Low social support: 1.1 (0.6–2.0) Time pressure: 1.8 (1.0–3.3)	OR(95% CI) High demands: 1.9 (1.0–3.4) Low control: Not included in final model Low social support: Not included in final model Time pressure: 1.7 (0.9–3.1)

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Table 4.3.22 continued

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Lassen et al[1] 2004 [11] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=4 031 (12-month pain) n=5 287 (severe pain) 49% women	Elbow pain previous 12-months Severe elbow pain (lasting at least 30 days, causing at least 'quite a lot of trouble')	High strain index High job demands Low decision latitude Low social support High time pressure	Not reported	OR (95% CI) *Elbow pain* High strain index: 1.21 (0.78–1.87) High job demands: 1.33 (1.02–1.74) Low decision latitude: 1.03 (0.78–1.87) Low social support: 1.09 (0.78–1.38) High time pressure: 1.11 (0.86–1.42) *Severe elbow pain* High strain index: 0.83 (0.34–1.95) High job demands: 1.07 (0.65–1.73) Low decision latitude: 0.86 (0.50–1.45) Low social support: 0.91 (0.60–1.39) High time pressure: 1.14 (0.71–1.80)

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Table 4.3.22 *continued*

Author **Year** **Reference** **Country**	**Design** **Setting** **Study period** **n at first follow-up** **% women**	**Outcome** **Diagnosis**	**Psychosocial exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Macfarlane et al[2] 2000 [12] United Kingdom	Cohort General population 2 year follow-up n=1 260 59% women	Forearm pain during the previous month, lasting at least one day	Feel job too hectic or fast Feel job boring or monotonous Job causes stress or worry Satisfied with support from supervisors and colleagues Feel can learn new things Feel can make decisions Feel satisfied with job	RR (95% CI) adjusted for age and gender *Feel job too hectic or fast* Never: 1.0 Occasionally: 1.9 (0.7–5.0) Half or most of the time: 2.0 (0.7–5.6) *Feel job boring or monotonous* Never: 1.0 Occasionally: 2.4 (1.2–5.0) Half or most of the time: 2.5 (0.95–6.6) *Job causes stress or worry* Never: 1.0 Occasionally: 3.1 (0.7–3.1) Half or most of the time: 3.3 (0.7–14.2) *Satisfied with support from supervisors and colleagues* Most of the time: 1.0 Half the time: 2.1 (0.9–5.1) Occasionally or never: 4.7 (2.2–10) *Feel can learn new things* Most of the time: 1.0 Half the time: 0.3 (0.1–1.2) Occasionally or never: 1.6 (0.8–3.3) *Feel can make decisions* Most of the time: 1.0 Half the time: 1.0 (0.4–2.4) Occasionally or never: 2.0 (0.9–4.2) *Feel satisfied with job* Most of the time: 1.0 Half the time: 1.4 (0.7–2.8) Occasionally or never: 1.0 (0.4–3.0)	RR (95% CI) *Feel job too hectic or fast* Not included in final model *Feel job boring or monotonous* Not included in final model *Job causes stress or worry* Not included in final model *Satisfied with support from supervisors and colleagues* Most of the time: – Half the time: 1.6 (0.7–3.9) Occasionally or never: 2.6 (1.1–5.8) *Feel can learn new things* Not included in final model *Feel can make decisions* Not included in final model *Feel satisfied with job* Not included in final model

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Table 4.3.22 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Nahit et al[1] 2003 [14] United Kingdom	Cohort First full-time employment in 12 occupational groups in industries with musculoskeletal disorders Study period not given Recruitment at year –1, baseline measurement at 0 and follow-up at +1 year n=666 34% women	Forearm pain	*Job demand* Stressful work Monotonous work Hectic work *Job satisfaction* Satisfaction with job *Social support* Satisfaction with support *Control over work* Able to decide how to carry out work Learning new things at work	OR (95% CI) adjusted for age, gender and occupational group *Job demand* *Stressful work* Never/occasionally: 1.0 At least half the time: 1.1 (0.5–2.2) *Monotonous work* Never/occasionally: 1.0 At least half the time: 3.0 (1.6–5.7) *Hectic work* Never/occasionally: 1.0 At least half the time: 1.2 (0.6–2.3) *Job satisfaction* *Satisfaction with job* Not dissatisfied: 1.0 (Very)/dissatisfied: 1.7 (0.6–4.7) *Social support* *Satisfaction with support* Not dissatisfied: 1.0 (Very)/dissatisfied: 1.4 (0.4–5.0) *Control over work* *Able to decide how to carry out work* At least sometimes: 1.0 (Very)/seldom: 2.6 (1.1–6.1) *Learning new things at work* At least sometimes: 1.0 (Very)/seldom: 1.3 (0.5–3.5)	OR (95% CI) *Job demand* *Stressful work* Not included in final model *Monotonous work* Never/occasionally: 1.0 At least half the time: 3.0 (1.5–5.8) *Hectic work* Not included in final model *Job satisfaction* *Satisfaction with job* Not included in final model *Social support* *Satisfaction with support* Not included in final model *Control over work* *Able to decide how to carry out work* Not included in final model *Learning new things at work* Not included in final model

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Table 4.3.22 *continued*

Author Year Reference Country	**Design Setting Study period n at first follow-up % women**	**Outcome Diagnosis**	**Psychosocial exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Wigaeus Tornqvist et al[1] 2009 [16] Sweden	Cohort Computer users with varying occupations at 46 different work-sites Average follow-up time: 329 days (range 28–540) 10 monthly questionnaires n=1 170 59% women	Hand/arm (elbows, fore-arms, wrists, hands, fingers) pain or aches at least 3 days during the preceding month	Demands in relation to competence Job strain (demands, score 5–20, decision latitude, score 6–24) Social support (score 6–24) High (>20) Medium (16–20) Low (<15)	RR (95% CI) *Demands in relation to competence* In accordance with competence: 1.0 Lower than competence: 1.11 (0.87–1.42) Higher than competence: 1.19 (0.87–1.62) *Job strain (demands, score 5–20, decision latitude, score 6–24)* Low (demands <13 + decision latitude >19): 1.0 Medium: 1.48 (1.05–2.07) High (demands ≥16 + decision latitude ≤15): 2.02 (1.17–3.47) *Social support (score 6–24)* High (>20): 1.0 Medium (16–20): 1.00 (0.79–1.25) Low (<15): 1.44 (1.00–2.08)	RR (95% CI) *Demands in relation to competence* In accordance with competence: 1.0 Lower than competence: 1.10 (0.81–1.49) Higher than competence: 1.19 (0.82–1.71) *Job strain (demands, score 5–20, decision latitude, score 6–24)* Low (demands <13 + decision latitude >19): 1.0 Medium: 1.22 (0.84–1.78) High (demands ≥16 + decision latitude ≤15): 1.11 (0.55–2.25) *Social support (score 6–24)* High (>20): 1.0 Medium (16–20): 0.94 (0.72–1.23) Low (<15): 1.39 (0.90–2.15)

[1] Study quality is moderate.
[2] Study quality is high.

CI = Confidence interval; HR = Hazard ratio; OR = Odds ratio; RR = Relative risk

Table 4.3.23 *Elbows and forearms. Psychosocial exposure – case-control studies.*

Author Year Reference Country	**Design Setting Study period n at first follow-up % women**	**Outcome Diagnosis**	**Psychosocial exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Haahr et al[1] 2003 [17] Denmark	Case-control May 1998–May 2000 209 cases (52% women) 274 controls (57% women)	Lateral epicondylitis diagnosed by general practitioners	Demands Control Social support	OR (95% CI) adjusted for age and BMI <u>*Women*</u> *Demands* Low: 1.0 High: 1.0 (0.6–1.7) *Control* High: 1.0 Low: 2.0 (1.1–3.7) *Social support* High: 1.0 Low: 3.0 (1.5–5.9) <u>*Men*</u> *Demands* Low: 1.0 High: 0.7 (0.4–1.2) *Control* High: 1.0 Low: 1.7 (0.9–3.0) *Social support* High: 1.0 Low: 1.0 (0.5–1.8)	OR (95% CI) <u>*Women and men*</u> *Demands* Low: 1.0 High: 0.8 (0.6–1.3) *Control* High: 1.0 Low: 1.5 (0.9–2.3) *Social support* High: 1.0 Low: 1.5 (0.9–2.4)

[1] Study quality is moderate.

BMI = Body mass index; CI = Confidence interval; OR = Odds ratio

Table 4.4.14 *Wrists/hands. Physical exposure – randomised controlled trials.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Conlon et al[1] 2008 [3] USA	RCT California, aerospace engineering firm 2002–2003 (1 year) n=206 28% women	Incident musculoskeletal disorder diagnosed at physical examination following self-report of discomfort of >5 on a 0–10 point scale – right elbow/forearm/wrist/hand – left elbow/forearm/wrist/hand	Right upper extremity Left upper extremity Alternative mouse Forearm support board Four intervention groups: 1) Conventional mouse 2) Alternative mouse with neutral forearm posture 3) Conventional mouse plus forearm support board 4) Alternative mouse plus forearm support board Analyses were made of alternative mouse and forearm support as two independent variables	HR (95% CI) *Right upper extremity* Alternative mouse: 0.70 (0.31–1.59) Forearm support board: 0.86 (0.39–1.90) *Left upper extremity* Alternative mouse: 0.99 (0.27–3.70) Forearm support board: 0.85 (0.23–3.16)	HR (95% CI) *Right upper extremity* Alternative mouse: 0.57 (0.24–1.34) Forearm support board: 0.74 (0.31–1.74) *Left upper extremity* Alternative mouse: 2.06 (0.42–10.1) Forearm support board: 0.68 (0.15–3.08)
Conlon et al[1] 2009 [4] USA	RCT California, aerospace engineering firm 2002–2003 (1 year) n=154 27% women	Change in median and ulnar nerve motor latency between first and final nerve conduction measurement >0.10 ms	Right wrist, ulnar nerve Right wrist, median nerve Left wrist, ulnar nerve Left wrist, median nerve Alternative mouse Forearm support board	HR (95% CI) *Right wrist, ulnar nerve* Alternative mouse: 0.52 (0.26–1.02) Forearm support board: 1.47 (0.75–2.89) *Right wrist, median nerve* Alternative mouse: 0.75 (0.37–1.53) Forearm support board: 0.83 (0.40–1.69) *Left wrist, ulnar nerve* Alternative mouse: 0.84 (0.42–1.66) Forearm support board: 0.61 (0.30–1.20) *Left wrist, median nerve* Alternative mouse: 1.02 (0.51–2.03) Forearm support board: 1.41 (0.70–2.83)	HR (95% CI) *Right wrist, ulnar nerve* Alternative mouse: 0.47 (0.22–0.98) Forearm support board: 1.42 (0.70–2.90) *Right wrist, median nerve* Alternative mouse: 0.72 (0.33–1.57) Forearm support board: 0.74 (0.34–1.63) *Left wrist, ulnar nerve* Alternative mouse: 0.84 (0.41–1.74) Forearm support board: 0.64 (0.31–1.35) *Left wrist, median nerve* Alternative mouse: 0.76 (0.34–1.68) Forearm support board: 1.39 (0.65–2.98)

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Table 4.4.14 continued

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Gerr et al[1] 2005 [5] USA	RCT Atlanta, Georgia, newly hired persons working with computer workstation 6 months follow-up n=358 77% women	Any discomfort such as pain, aching, burning, numbness or tingling in elbows/forearms, hands/wrists or fingers, rated as ≥6 on a 0–10 VAS scale, or medications taken for any such outcomes. Grouped into hand/arm	No intervention Alternate intervention group Conventional intervention group Alternate intervention based on protective factors for both neck/shoulder and hand/arm symptoms identified in a previous cohort study by the same research group Conventional intervention based on recommendations from various sources, ie OSHA, NIOSH, and private industry	Not reported	HR (95% CI) No intervention: 1.0 Alternate intervention group: 0.92 (0.49–1.71) Conventional intervention group: 1.05 (0.58–1.90)
Rempel et al[1] 2006 [1] USA	RCT California, USA, callcentre operators at a large healthcare company 1 year follow-up n=182 94%, 98%, 100%, 89% women in each of the four intervention groups	Incident musculoskeletal disorder diagnosed at physical examination following self-report of discomfort of more than 5 on a 0–10 point scale – right elbow/forearm/wrist/hand – left elbow/forearm/wrist/hand	Right upper extremity Left upper extremity Four intervention groups: 1) Ergonomics training 2) Trackball mouse and ergonomics training 3) Forearm support board and ergonomics training 4) Trackball mouse, forearm support board and ergonomics training Analyses were made of trackball mouse and forearm support board as two independent variables	HR (95% CI) *Right upper extremity* Trackball mouse: 1.30 (0.62–2.71) Forearm support board: 0.81 (0.39–1.69) *Left upper extremity* Trackball mouse: 0.56 (0.21–1.52) Forearm support board: 0.66 (0.25–1.73)	HR (95% CI) *Right upper extremity* Trackball mouse: 1.26 (0.56–2.86) Forearm support board: 0.64 (0.28–1.45) *Left upper extremity* Trackball mouse: 0.19 (0.04–0.90) Forearm support board: 0.29 (0.08–1.05)

1. Study quality is moderate.

CI = Confidence interval; HR = Hazard ratio; NIOSH = National Institute for Occupational Safety and Health OSHA = Occupational Safety and Heath Administration; RCT = Randomised controlled trial; VAS = Visuel analogue scale

Table 4.4.15 *Wrists/hands. Physical exposure – cohort studies.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Andersen et al[2] 2007 [8] Denmark	Cohort General working population, industrial and service sector 24-month follow-up n=1 513 64% women	Pain in the elbow, fore-arm and hand region bothering the subject at least "some" during the past 12 months	Repetitive work (min/h) Lifting, cumulative (kg/h) Lifting at or above shoulder level (kg/h) Pushing, cumulative (kg/h) Squatting >5 min/h Standing >30 min/h Sitting >30 min/h	HR (95% CI) adjusted for gender, age and occupation *Repetitive work (min/h)* 0–9: 1.0 10–44: 1.2 (0.7–2.1) 45–60: 1.9 (1.2–3.1) *Lifting, cumulative (kg/h)* Never: 1.0 1–99: 1.3 (0.8–2.1) ≥100: 1.6 (0.9–2.7) *Lifting at or above shoulder level (kg/h)* Never: 1.0 1–49: 0.9 (0.4–2.2) ≥50: 2.2 (1.1–4.3) *Pushing, cumulative (kg/h)* Never: 1.0 1–354: 1.6 (0.9–2.7) ≥355: 1.8 (1.1–3.1) *Squatting >5 min/h* No: 1.0 Yes: 1.2 (0.7–2.0) *Standing >30 min/h* No: 1.0 Yes: 2.0 (1.1–3.7) *Sitting >30 min/h* No: 1.0 Yes: 1.0 (0.6–1.7)	HR (95% CI) *Repetitive work (min/h)* 0–9: 1.0 10–44: 1.1 (0.6–2.0) 45–60: 1.7 (1.0–2.9) *Lifting, cumulative (kg/h)* Not included in final model *Lifting at or above shoulder level (kg/h)* Not included in final model *Pushing, cumulative (kg/h)* Not included in final model *Squatting >5 min/h* Not included in final model *Standing >30 min/h* Not included in final model *Sitting >30 min/h* Not included in final model

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Andersen et al[2] 2003 [6] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=2 727 64% women	Carpal tunnel syndrome	Mouse use (h/w) Forearm/wrist support (mouse) Keyboard use (h/w) Forearm/wrist support (keyboard) Abnormal keyboard position Not suitably adjusted chair Not suitably adjusted desk Unsatisfied with work place design	OR (95% CI)[1] *Mouse use (h/w)* 0 to <2.5: 1.0 2.5 to <5: 0.8 (0.3–2.1) 5 to <10: 1.7 (0.9–3.3) 10 to <15: 1.8 (1.0–3.3) 15 to <20: 1.8 (1.0–3.4) 20 to <25: 2.0 (1.1–3.7) 25 to <30: 2.7 (1.3–5.5) ≥30: 2.2 (1.0–4.9) *Forearm/wrist support (mouse)* Never: 1.0 >0% to 50% of time: 1.6 (0.8–3.3) >50% to 100% of time: 1.8 (1.1–3.1) Abnormal mouse position: – *Keyboard use (h/w)* 0 to <2.5: 1.0 2.5 to <5: 0.9 (0.5–1.7) 5 to <10: 0.8 (0.5–1.5) 10 to <15: 1.1 (0.6–2.0) 15 to <20: 0.7 (0.3–1.4) ≥20: 0.9 (0.3–2.2) *Forearm/wrist support (keyboard)* Never: 1.0 >0% to 50% of time: 1.2 (0.8–1.8) >50% to 100% of time: 0.8 (0.5–1.1) Abnormal keyboard position: – Not suitably adjusted chair: – Not suitably adjusted desk: – Unsatisfied with work place design: –	OR (95% CI) *Mouse use (h/w)* 0 to <2.5: 1.0 2.5 to <5: 0.7 (0.3–1.9) 5 to <10: 1.9 (0.9–4.0) 10 to <15: 1.6 (0.8–3.3) 15 to <20: 2.0 (0.9–4.2) 20 to <25: 2.6 (1.2–5.5) 25 to <30: 3.2 (1.3–7.9) ≥30: 2.7 (1.0–7.6) *Forearm/wrist support (mouse)* Never: 1.0 >0% to 50% of time: 1.5 (0.7–3.3) >50% to 100% of time: 1.9 (0.99–3.5) Abnormal mouse position: 0.4 (0.1–0.9) *Keyboard use (h/w)* 0 to <2.5: 1.0 2.5 to <5: 0.9 (0.4–1.8) 5 to <10: 0.8 (0.4–1.5) 10 to <15: 1.2 (0.6–2.5) 15 to <20: 0.8 (0.4–1.5) ≥20: 1.4 (0.5–4.3) *Forearm/wrist support (keyboard)* Never: 1.0 >0% to 50% of time: 1.2 (0.8–1.8) >50% to 100% of time: 0.7 (0.5–1.1) Abnormal keyboard position: 1.1 (0.7–1.7) Not suitably adjusted chair: 1.3 (0.5–3.3) Not suitably adjusted desk: 1.0 (0.7–1.6) Unsatisfied with work place design: 0.9 (0.5–1.6)

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Table 4.4.15 *continued*

Author Year Reference Country	**Design Setting Study period n at first follow-up % women**	**Outcome Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Feveile et al[2] 2002 [9] Denmark	Cohort General population 1990–1995 n=3 179 42% women	Wrist/ hand pain/ discomfort	Repetitive work tasks Physically hard work Working with hands raised Twisting or bending of the trunk	 <u>*Men*</u> Repetitive work tasks: p=0.08 Physically hard work: p=0.01 Working with hands raised: p=0.03 Twisting or bending of the trunk: p=0.00 <u>*Women*</u> Repetitive work tasks: p=0.36 Physically hard work: p=0.02 Working with hands raised: p=0.10 Twisting or bending of the trunk: p=0.00	OR (95% CI) <u>*Men*</u> Repetitive work tasks: Not included in final model Physically hard work: Not included in final model Working with hands raised: Not included in final model *Twisting or bending of the trunk* Seldom/never: 1.00 1/4–1/2 of working hours: 1.80 (1.25–2.60) ≥3/4 of the working hours: 1.74 (1.18–2.57) <u>*Women*</u> Repetitive work tasks: Not included in final model Physically hard work: Not included in final model Working with hands raised: Not included in final model *Twisting or bending of the trunk* Seldom/never: 1.00 1/4–1/2 of working hours: 1.39 (0.95–2.02) ≥3/4 of the working hours: 1.94 (1.34–2.80)

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
van den Heuvel et al[2] 2006 [12] The Netherlands	Cohort Office workers (computing professionals, administrative associate professionals and office clerks) 1994–1997 n=371 % women not reported	Elbow, wrist or hand symptoms (previous 12 months)	Wrist flexion Wrist pronation Arm elevation 30–60° (percentage of time) Computer work	OR (95% CI) *Wrist flexion* No: 1.00 Yes: 1.53 (1.01–2.33) *Wrist pronation* No: 1.00 Yes: 1.14 (0.64–2.04) *Arm elevation 30–60° (percentage of time)* Low (9–32%): 1.00 Medium (32–35%): 0.33 (0.15–0.73) High (36–65%): 0.57 (0.34–0.96) *Computer work* Seldom/never to now and then: 1.00 Rather often: 1.22 (0.68–2.18) Very often: 1.42 (0.77–2.60)	OR (95% CI) *Wrist flexion* No: 1.00 Yes: 1.45 (0.92–2.30) *Wrist pronation* No: 1.00 Yes: 1.27 (0.69–2.34) *Arm elevation 30–60° (percentage of time)* Low (9–32%): 1.00 Medium (32–35%): 0.52 (0.25–1.11) High (36–65%): 0.82 (0.51–1.31) *Computer work* Seldom/never to now and then: 1.00 Rather often: 1.29 (0.63–2.66) Very often: 1.42 (0.70–2.86)

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Jensen et al[2] 2003 [13] Denmark	Cohort Computer users 1999–2000 n=1 661 67% women	Hand/wrist symptoms for >7 days within the previous year	Worktime at computer Worktime using mouse Experience with computer use, years Repetitiveness Space for arm support Disturbed by glare	OR (95% CI) *Worktime at computer* Not reported, numbers not available *Worktime using mouse* Not reported, numbers not available *Experience with computer use, years* (adjusted for gender) 0–3: 1.0 4–7: 1.26 (0.83–1.90) 8–12: 1.20 (0.80–1.81) >12: 1.04 (0.68–1.59) *Repetitiveness* Varied work: 1.0 Repetitive movements: 1.14 (0.83–1.56) Repetitive tasks and movements: 1.55 (1.11–2.15) *Space for arm support* Yes: 1.0 No: 1.18 (0.89–1.57) *Disturbed by glare* No: 1.0 Once in a while: 1.50 (1.12–2.01) Daily: 1.58 (1.12–2.22)	OR (95% CI) *Worktime at computer* 0–25%: 1.5 (0.7–3.4) 50%: 1.0 (ref) 75%: 2.0 (1.1–3.9) 100%: 2.3 (1.2–4.3) *Worktime using mouse* Seldom: 4.0 (1.1–14.4) 25%: 1.0 (ref) 50–100%: 4.0 (1.0–15.5) *Experience with computer use, years* Not included in final model *Repetitiveness* Not included in final model *Space for arm support* Not included in final model *Disturbed by glare* Not included in final model

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Lassen et al[2] 2004 [7] Denmark	Cohort Computer users; technical assistants and machine technicians January 2000–January 2001 n=2 973 (12-month pain) n=5 148 (severe pain) 44%/48% women	Wrist/hand pain previous 12 months Severe wrist/hand pain Wrist tendonopathy De Quervain's syndrome	Mouse use ≥10 h/w Mouse use h/w Forearm/wrist support (mouse) Abnormal mouse position Keyboard use ≥10 h/w Keyboard use h/w Forearm/wrist support (keyboard) Abnormal keyboard position Not suitably adjusted chair Not suitably adjusted desk Unsatisfied with work place design	OR (95% CI)[1] <u>*Wrist/hand pain*</u> *Mouse use h/w* 0 to <2.5: 1 2.5 to <5: 1.65 (1.06–2.58) 5 to <10: 2.23 (1.54–3.23) 10 to <15: 2.22 (1.56–3.17) 15 to <20: 2.77 (1.93–3.99) 20 to <25: 2.27 (1.51–3.41) 25 to <30: 3.21 (1.96–5.26) ≥30: 2.88 (1.69–4.89) *Keyboard use h/w* 0 to <2.5: 1 2.5 to <5: 0.93 (0.61–1.41) 5 to <10: 0.92 (0.62–1.35) 10 to <15: 1.01 (0.67–1.50) 15 to <20: 1.06 (0.68–1.68) ≥20: 1.09 (0.61–1.93)	OR (95% CI) <u>*Wrist/hand pain*</u> *Mouse use ≥10 h/w* 1.32 (1.16–1.51) *Mouse use h/w* 0 to <2.5: 1 2.5 to <5: 1.57 (0.99–2.51) 5 to <10: 2.16 (1.46–3.22) 10 to <15: 2.05 (1.37–3.07) 15 to <20: 2.46 (1.65–3.72) 20 to <25: 2.07 (1.32–3.26) 25 to <30: 3.16 (1.82–5.46) ≥30: 3.05 (1.63–5.67) *Forearm/wrist support (mouse)* <50% of time: 1.22 (0.78–1.88) ≥50% of time: 1.55 (1.14–2.13) Abnormal mouse position: 1.01 (0.69–1.47) *Keyboard use ≥10 h/w* 1.29 (1.06–1.57) *Keyboard use h/w* 0 to <2.5: 1 2.5 to <5: 0.63 (0.41–0.98) 5 to <10: 0.73 (0.50–1.07) 10 to <15: 0.80 (0.53–1.20) 15 to <20: 0.87 (0.55–1.38) ≥20: 1.04 (0.51–2.04) *Forearm/wrist support (keyboard)* <50% of time: 1.14 (0.85–1.51) ≥50% to 100% of time: 0.96 (0.75–1.23) Abnormal keyboard position: 0.97 (0.71–1.31) Not suitably adjusted chair: 1.05 (0.52–1.98) Not suitably adjusted desk: 1.30 (1.00–1.68) Unsatisfied with work place design: 0.99 (0.69–1.40)
				Results continues on the next page	Results continues on the next page

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Lassen et al continued 2004 [7] Denmark				<u>*Severe wrist/hand pain*</u> *Mouse use h/w* 0 to <2.5: 1 2.5 to <5: 0.78 (0.27–2.20) 5 to <10: 1.69 (0.82–3.44) 10 to <15: 1.64 (0.84–3.20) 15 to <20: 1.99 (1.02–3.89) 20 to <25: 4.20 (2.24–7.88) 25 to <30: 4.75 (2.35–9.58) ≥30: 2.48 (1.04–5.91) *Keyboard use h/w* 0 to <2.5: 1 2.5 to <5: 1.24 (0.63–2.43) 5 to <10: 1.04 (0.55–1.97) 10 to <15: 1.06 (0.55–2.04) 15 to <20: 1.29 (0.62–2.65) ≥20: 0.71 (0.25–2.05)	<u>*Severe wrist/hand pain*</u> Mouse use ≥10 h/w 1.67 (1.35–2.08) *Mouse use h/w* 0 to <2.5: 1 2.5 to <5: 0.73 (0.23–2.01) 5 to <10: 1.55 (0.74–3.34) 10 to <15: 1.40 (0.68–3.01) 15 to <20: 1.68 (0.82–3.58) 20 to <25: 4.21 (2.12–8.85) 25 to <30: 4.81 (2.18–10.99) ≥30: 2.30 (0.83–6.26) *Forearm/wrist support (mouse)* <50% of time: 1.57 (0.78–3.16) ≥50% of time: 1.31 (0.77–2.34) Abnormal mouse position: 1.22 (0.67–2.06) *Keyboard use ≥10 h/w* 1.34 (0.96–1.86) *Keyboard use h/w* 0 to <2.5: 1 2.5 to <5: 1.14 (0.58–2.38) 5 to <10: 0.99 (0.54–1.95) 10 to <15: 1.46 (0.76–2.98) 15 to <20: 1.89 (0.90–4.10) ≥20: 1.60 (0.43–4.94) *Forearm/wrist support (keyboard)* <50% of time: 0.74 (0.46–1.16) ≥50% to 100% of time: 0.87 (0.60–1.26) Abnormal keyboard position: 0.84 (0.50–1.32) Not suitably adjusted chair: 1.93 (0.82–3.98) Not suitably adjusted desk: 0.69 (0.43–1.07) Unsatisfied with work place design: 1.67 (1.02–2.67) <u>*Wrist tendonopathy*</u> – <u>*De Quervain's syndrome*</u> –

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Table 4.4.15 *continued*

Author **Year** **Reference** **Country**	**Design** **Setting** **Study period** **n at first follow-up** **% women**	**Outcome** **Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Malchaire et al[2] 1997 [14] Belgium	Cohort Repetitive industrial work, office work with varying proportions of computer work 2 years follow-up n=146 48% women	Ache, pain or discomfort in the wrists	Force (per 10% EMGmax) Force (% time with EMG above 15% max) Repetitiveness in force Repetitiveness in angles or in force Wrist flexion mean velocity Wrist velocity (% time above 50°/s) Wrist postures	Not reported	OR (95% CI) Force (per 10% EMGmax): 1.38 (1.02–1.86) Force (% time with EMG above 15% max): 1.15 (0.99–1.35) Repetitiveness in force: 1.92 (0.96–3.86) Repetitiveness in angles or in force: 1.47 (0.95–2.28) Wrist flexion mean velocity: 1.29 (0.97–1.73) Wrist velocity (% time above 50°/s): 1.46 (1.01–2.11) Wrist postures: Not included in final model

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Table 4.4.15 *continued*

Author **Year** **Reference** **Country**	**Design** **Setting** **Study period** **n at first follow-up** **% women**	**Outcome** **Diagnosis**	**Physical exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Marcus et al[3] 2002 [15] USA	Cohort Newly hired computer workers 3-year follow-up study n=496 (symptoms) n=520 (disorders) 71% women	Symptoms in elbows/forearms, hands/wrists or fingers during the previous week (reported in weekly questionnaires throughout the follow-up) Disorders in the elbows, forearms and or hands (medial or lateral epicondylitis, wrist or finger tendonitis, carpal tunnel syndrome or ulnar neuritis)	Keyboard wrist extension angle Keyboard wrist ulnar deviation angle Distance table surface to "J" key Distance table edge to "J" key Presence of a wrist rest Mouse wrist ulnar deviation angle Mouse wrist extension angle Average key activation force Presence of sharp leading edge on table surface Hours keying per week (HR per hour)	HR (95% CI) <u>*Symptoms in elbows/forearms, hands/wrists or fingers during the previous week*</u> *Keyboard wrist extension angle* ≤30°: 1.0 >30°: 1.28 (0.81–2.01) *Keyboard wrist ulnar deviation angle* <–5°: 1.05 (0.50–2.24) –5° to 5°: 1.0 6° to 10°: 1.02 (0.61–1.68) >10°: 1.12 (0.63–2.00) *Distance table surface to "J" key* ≤3.5 cm: 1.0 >3.5 cm: 1.54 (0.96–2.49) *Distance table edge to "J" key* ≤12 cm: 1.0 >12 cm: 0.61 (0.40–0.92) *Presence of a wrist rest* No: 1.0 Yes: 1.32 (0.86–2.02) *Mouse wrist ulnar deviation angle* ≤–5°: 1.12 (0.69–1.83) –5° to 5°: 1.0 >5°: 0.92 (0.54–1.57) *Mouse wrist extension angle* ≤17°: 1.0 17° to 23°: 0.62 (0.34–1.12) 24° to 30°: 0.87 (0.52–1.44) >30°: 0.97 (0.55–1.72) *Average key activation force* ≤48 *g*: 1.0 >48 *g*: 1.32 (0.80–2.18) Results continues on the next page	HR (95% CI) <u>*Symptoms in elbows/forearms, hands/wrists or fingers during the previous week*</u> *Keyboard wrist extension angle* Not included in final model *Keyboard wrist ulnar deviation angle* Not included in final model *Distance table surface to "J" key* Not included in final model *Distance table edge to "J" key* ≤12 cm: – >12 cm: 0.50 (0.32–0.80) *Presence of a wrist rest* No: – Yes: 1.66 (1.03–2.67) *Mouse wrist ulnar deviation angle* Not included in final model *Mouse wrist extension angle* Not included in final model *Average key activation force* Not included in final model Results continues on the next page

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Marcus et al continued 2002 [15] USA				*Presence of sharp leading edge on table surface* No: 1.0 Yes: 1.11 (0.73–1.69)	*Presence of sharp leading edge on table surface* Not included in final model *Hours keying per week (HR per hour)* 1.04 (1.02–1.06)
				Disorders in the elbows, forearms and or hands *Keyboard wrist extension angle* –10° to 10°: 1.28 (0.49–3.34) 11° to 25°: 1.0 26° to 30°: 0.65 (0.27–1.57) >30°: 1.58 (0.87–2.88)	*Disorders in the elbows, forearms and or hands* *Keyboard wrist extension angle* Not included in final model
				Keyboard wrist ulnar deviation angle <–5°: 1.08 (0.42–2.77) –5° to 5°: 1.0 6° to 10°: 0.80 (0.43–1.59) >10°: 0.85 (0.39–1.86)	*Keyboard wrist ulnar deviation angle* Not included in final model
				Distance table surface to "J" key ≤3.5 cm: 1.0 >3.5 cm: 1.61 (0.87–3.00)	*Distance table surface to "J" key* Not included in final model
				Distance table edge to "J" key ≤12 cm: 1.0 >12 cm: 0.47 (0.27–0.83)	*Distance table edge to "J" key* ≤12 cm: – >12 cm: 0.38 (0.20–0.71)
				Presence of a wrist rest No: 1.0 Yes: 1.37 (0.78–2.38)	*Presence of a wrist rest* No: – Yes: 1.96 (1.03–3.65)
				Mouse wrist ulnar deviation angle ≤–5°: 1.99 (1.09–3.63) –5° to 5°: 1.0 >5°: 1.22 (0.62–2.43)	*Mouse wrist ulnar deviation angle* ≤–5°: 1.82 (1.03–3.22) –5° to 5°: – >5: –
				Results continues on the next page	Results continues on the next page

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Marcus et al continued 2002 [15] USA				*Mouse wrist extension angle* ≤17°: 1.0 17° to 23°: 0.64 (0.30–1.35) 24° to 30°: 0.78 (0.40–1.53) >30°: 0.77 (0.39–1.66)	*Mouse wrist extension angle* Not included in final model
				Average key activation force ≤48 *g*: 1.0 >48 *g*: 1.81 (0.89–3.70)	*Average key activation force* Not included in final model
				Presence of a sharp leading edge on table surface No: 1.0 Yes: 0.96 (0.55–1.66)	*Presence of a sharp leading edge on table surface* Not included in final model
					Hours keying per week (HR per hour) 1.04 (1.02–1.06)

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Thomsen et al[2] 2007 [16] Denmark	Cohort 19 companies with a wide range of ergonomic and psychosocial loads and unexposed group with non-repetitive work 1994–1995 with follow-up three times, at 6–12 month intervals n=3 123 (including prevalent cases at baseline) 58% women at baseline	Hand/wrist pain Possible tendonitis: Too few cases for meaningful analyses	Number of repetitions/min Force (scale 1–5) Position (% of time) Nb the reference category is the same in all analyses: non repetitive work, also in analyses of force and position	RR (95% CI) *Number of repetitions/min* *Continuous variable, including only the repetitive group (1–3, tertiles)* – *Categorical* Non repetitive work: 1.0 Low (≤10.8): 1.3 (1.0–1.7) High (>10.8): 2.0 (1.5–2.6) *Force (scale 1–5)* *Continuous variable, including only the repetitive group (1–3, tertiles)* – *Categorical* Non repetitive work: 1.0 Low (≤1): 1.5 (1.1–2.0) High (>1): 1.8 (1.4–2.3) *Position (% of time)* *Continuous variable, including only the repetitive group (1–3, tertiles)* – *Categorical* Non repetitive work: 1.0 Low (≤19.8): 1.4 (1.1–1.9) High (>19.8): 1.8 (1.4–2.4) Crude relative risks were calculated based on information in Table 4 in the paper, where "n" can be interpreted as approximate person-years according to Dr JF Thomsen	OR (95% CI) *Number of repetitions/min* *Continuous variable, including only the repetitive group (1–3, tertiles)* 1.6 (1.2–2.3) *Categorical* Non repetitive work: 1.0 Low (≤10.8): 1.2 (0.8–1.7) High (>10.8): 1.7 (1.1–2.7) *Force (scale 1–5)* *Continuous variable, including only the repetitive group (1–3, tertiles)* 1.4 (1.1–1.8) *Categorical* Non repetitive work: 1.0 Low (≤1): 1.2 (0.8–1.7) High (>1): 1.3 (0.9–1.9) *Position (% of time)* *Continuous variable, including only the repetitive group (1–3, tertiles)* 1.2 (1.0–1.4) *Categorical* Non repetitive work: 1.0 Low (≤19.8): 1.2 (0.8–1.7) High (>19.8): 1.2 (0.8–1.8)

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Table 4.4.15 continued

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Violante et al[3] 2007 [17] USA	Cohort Workers performing tasks with wide range of biomechanical loads 2000–2001 1 year follow-up n=1 760 61% women	Carpal tunnel syndrome	Biomechanical load based on hand-activity level and peak force (1–3)	OR (95% CI) *Biomechanical load based on hand-activity level and peak force (1–3)* Acceptable (below action limit, AL): 1.0 Borderline (between AL and threshold limit, THL): 1.2 (0.8–2.0) Unacceptable (over THL): 2.8 (1.9–4.0)	OR (95% CI) *Biomechanical load based on hand-activity level and peak force (1–3)* Acceptable (below action limit, AL): 1.0 Borderline (between AL and threshold limit, THL): 1.5 (0.9–2.5) Unacceptable (over THL): 3.0 (2.0–4.5)
Werner et al[2] 2005 [18] USA	Cohort USA Automobile assembly workers Study period not given 1 year follow-up n=189 25% women	Carpal tunnel syndrome	Hand activity level (1–3; acceptable, borderline, unacceptable) Hand repetition (range 1.9–7.0) Peak hand force (range 1.0–3.0) Wrist posture (flexion/extension deviation, average, range 0.5–3.1) Wrist posture (radial/ulnar deviation, average, range 0–3.1) Elbow posture (1–10 scale, average range 1.2–4.0)	ORs not reported Hand activity level: p=0.31 Hand repetition: p=0.40 Peak hand force: p=0.91 Wrist posture (flexion/extension deviation): p=0.20 Wrist posture (radial/ulnar deviation): p=0.02 Elbow posture: p=0.01 Reports only p-values for differences in levels between cases and non-cases	OR (95% CI) Hand activity level: Not included in final model Hand repetition: Not included in final model Peak hand force: Not included in final model Wrist posture (flexion/extension deviation): Not included in final model Wrist posture (radial/ulnar deviation): Not included in final model Elbow posture: 8.08 (1.48–44.22) per one point increase (continuous variables)

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Table 4.4.15 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Wigaeus Tornqvist et al[2] 2009 [19] Sweden	Cohort Computer users with varying occupations at 46 different worksites Average follow-up time: 329 days (range 28–540) 10 monthly questionnaires n=1 170 59% women	Hand/arm (elbows, fore-arms, wrists, hands, fingers) pain or aches at least 3 days during the preceding month	Duration of computer work (h/day) Duration of data/text entry (h/day) Duration and frequency of continuous computer work without breaks (breaks >10 min) Duration of mouse use (h/day) Mouse placement Comfort of the computer work environment (score –44 to +44) Variation of work tasks	RR (95% CI) *Duration of computer work (h/day)* <2: 1.0 2 to <4: 1.30 (0.95–1.78) ≥4: 1.56 (1.16–2.09) *Duration of data/text entry (h/day)* <0.5: 1.0 0.5 to <3: 0.95 (0.74–1.22) ≥3: 1.12 (0.81–1.56) *Duration and freq. of cont. computer work without breaks (breaks >10 min)* <2 h: 1.0 2–3 h/day or >3 h< few times/week: 1.16 (0.93–1.45) >3 h at least a few times/week: 1.51 (1.13–2.01) *Duration of mouse use (h/day)* <0.5: 1.0 0.5 to <3: 1.41 (1.09–1.84) ≥3: 1.74 (1.24–2.43) *Mouse placement* Optimal: 1.0 Non optimal: 1.31 (1.03–1.67) *Comfort of the computer work environment (score –44 to +44)* High (≥25): 1.0 Medium (3–24): 1.09 (0.84–1.41) Low (≤2): 1.61 (1.21–2.15) *Variation of work tasks* ≥5 work tasks (≥30 min): 1.0 3–4 work tasks (≥30 min): 1.25 (0.95–1.65) ≤2 work tasks (≥30 min): 1.51 (1.13–2.01)	RR (95% CI) *Duration of computer work (h/day)* <2: 1.0 2 to <4: 0.82 (0.54–1.22) ≥4: 0.87 (0.55–1.38) *Duration of data/text entry (h/day)* <0.5: 1.0 0.5 to <3: 0.87 (0.64–1.18) ≥3: 1.03 (0.68–1.58) *Duration and freq. of cont. computer work without breaks (breaks >10 min)* <2 h: 1.0 2–3 h/day or >3 h< few times/week: 0.94 (0.72–1.23) >3 h at least a few times/week: 1.06 (0.73–1.55) *Duration of mouse use (h/day)* <0.5: 1.0 0.5 to <3: 1.44 (1.01–2.05) ≥3: 1.70 (1.07–2.70) *Mouse placement* Optimal: 1.0 Non optimal: 1.26 (0.95–1.67) *Comfort of the computer work environment (score –44 to +44)* High (≥25): 1.0 Medium (3–24): 1.13 (0.83–1.53) Low (≤2): 1.71 (1.22–2.39) *Variation of work tasks* ≥5 work tasks (≥30 min): 1.0 3–4 work tasks (≥30 min): 1.16 (0.84–1.60) ≤2 work tasks (≥30 min): 1.36 (0.93–2.01)

[1] OR calculated by reviewers for given data on cases in exposed and unexposed groups.
[2] Study quality is moderate.
[3] Study quality is high.

CI = Confidence interval; EMG = Electromyography; HR = Hazard ratio; Nb = Nota bene (note well); OR = Odds ratio; RR = Relative risk

Table 4.4.16 *Wrists/hands. Physical exposure – case-control studies.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Physical exposure	Risk estimate, least adjusted model	Risk estimate, final model
Nordström et al[1] 1997 [20] USA	Case-control Wisconsin Cases identified through Marshfield Clinic computerised diagnosis file covering a catchment area of 55 000 residents Controls; People in the Marshfield area, frequency matched on age. Not stated how they were identified or selected May 1994– October 1995 206 cases 211 controls % women not given	Newly diagnosed cases of carpal tunnel syndrome	Mean workday use of power tools or machinery, hours Mean workday bend or twist hands, hours	OR (95% CI) adjusted for age *Mean workday use of power tools or machinery, hours* 0: 1.0 0.08–0.75: 0.60 (0.27–1.36) 1–2: 1.43 (0.66–3.13) 2.5–5.5: 1.20 (0.59–2.45) 6–11: 2.52 (1.13–5.62) *Mean workday bend or twist hands, hours* 0: 1.0 0.25–1.75: 1.34 (0.64–2.80) 2–3: 1.23 (0.60–2.53) 3.5–6: 2.33 (1.24–4.36) 7–16: 2.47 (1.38–4.43)	OR (95% CI) *Mean workday use of power tools or machinery, hours* 0: 1.0 0.08–0.75: 0.53 (0.17–1.64) 1–2: 1.43 (0.52–3.90) 2.5–5.5: 1.58 (0.63–4.00) 6–11: 3.30 (1.11–9.80) *Mean workday bend or twist hands, hours* 0: 1.0 0.25–1.75: 2.42 (0.88–6.62) 2–3: 1.27 (0.50–3.26) 3.5–6: 2.65 (1.83–5.92) 7–16: 2.11 (0.98–4.52)

1. Study quality is moderate.

CI = Confidence interval; OR = Odds ratio

Table 4.4.17 *Wrists/hands. Psychosocial exposure – cohort studies.*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Andersen et al[1] 2007 [8] Denmark	Cohort General working population, industrial and service sector 24-month follow-up n=1 513 64% women	Pain in the elbow, forearm and hand region bothering the subject at least "some" during the past 12 months	Job demands Job control Social support from supervisors Social support from colleagues Management quality Job satisfaction	HR (95% CI) adjusted for gender, age and occupation *Job demands* Low: 1.0 High: 0.8 (0.5–1.2) *Job control* High: 1.0 Low: 1.5 (0.9–2.2) *Social support from supervisors* High: 1.0 Low: 1.2 (0.8–1.9) *Social support from colleagues* High: 1.0 Low: 1.5 (0.9–2.4) *Management quality* High: 1.0 Low: 1.3 (0.9–2.0) *Job satisfaction* High: 1.0 Low: 1.3 (0.5–2.9)	None of the psychosocial factors were included in the final model
Andersen et al[1] 2003 [6] Denmark	Cohort Computer users; Technical assistants and machine technicians 2000–2001 n=5 073 64% women	Carpal tunnel syndrome	High demands Low control Low social support Time pressure	Not reported	OR (95% CI) High demands: 1.3 (0.9–1.8) Low control: 0.9 (0.7–1.4) Low social support: 1.2 (0.9–1.8) Time pressure: 1.0 (0.7–1.6)

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Table 4.4.17 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Feveile et al[1] 2002 [9] Denmark	Cohort General population 1990–1995 n=3 179 42% women	Wrist/hand pain or discomfort	High psychological job demands Low skill discretion Low decision authority Low social support	*Men* High psychological job demands: p=0.36 Low skill discretion: p=0.12 Low decision authority: p=0.15 Low social support: p=0.41 *Women* High psychological job demands: p=0.09 Low skill discretion: p=0.64 Low decision authority: p=0.31 Low social support: p=0.87	None of the psychosocial factors were included in the final model
Gardner et al[1] 2008 [10] USA	Cohort Industries, new employees 2004–2006 n=560 35% women	Hand and/or upper extremity symptoms	Social support Job decision latitude Job insecurity	Not reported	OR (95% CI) *Social support* Low: 1 Medium: 0.75 (0.47–1.20) High: 0.78 (0.46–1.34) *Job decision latitude* Low: 1 Medium: 0.85 (0.54–1.35) High: 1.03 (0.62–1.72) *Job insecurity* Low: 1 Medium: 1.48 (0.94–2.33) High: 1.20 (0.70–2.03)

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Table 4.4.17 continued

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Hannan et al[1] 2005 [11] USA	Cohort Newly hired employees using computers, from several large companies in Atlanta, Georgia 2000–2003 Weekly assessments <6 months for each participant n=333 71% women	Discomfort in elbows, forearms, hands, wrists or fingers (≥6 on a scale from 0 to 10, or use of pain medication, on any day during the preceding week)	Job strain quadrants Job strain ration	HR (95% CI) age-adjusted *Job strain quadrants* Low strain: 1.00 High strain: 1.48 (0.71–3.08) Active: 1.72 (0.89–3.34) Passive: 1.36 (0.66–2.79) *Job strain ration* 1st category: 1.00 2nd category: 1.12 (1.56–2.26) 3rd category: 1.36 (0.70–2.64) 4th category: 1.24 (0.62–2.46)	HR (95% CI) *Job strain quadrants* Low strain: 1.00 High strain: 1.28 (0.58–2.85) Active: 1.36 (0.65–2.85) Passive: 1.12 (0.49–2.54) *Job strain ration* 1st category: 1.00 2nd category: 1.03 (0.48–2.19) 3rd category: 1.13 (0.55–2.32) 4th category: 1.04 (0.48–2.26)

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Table 4.4.17 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Jensen et al[1] 2003 [13] Denmark	Cohort Computer users 1999–2000 n=1 661 67% women	Hand/wrist symptoms for >7 days within previous year	Sensorial demands Influence at work Quantitative demands Cognitive demands Developmental possibilities Social support	OR calculated from tables <u>*Women*</u> *Sensorial demands* Low: 1.0 Medium low: 0.6 (0.3–1.1) Medium high: 0.8 (0.5–1.3) High: 1.3 (0.9–2.0) *Influence at work* High: 1.0 Medium high: 1.6 (1.0–2.6) Medium low: 2.3 (1.4–3.6) Low: 2.6 (1.7–4.1) *Quantitative demands* Low: 1.0 Medium low: 1.1 (0.7–1.8) Medium high: 1.4 (0.9–2.1) High: 1.4 (0.9–2.1) *Cognitive demands* Low: 1.0 Medium low: 1.4 (0.9–2.2) Medium high: 1.1 (0.7–1.6) High: 1.0 (0.7–1.5) *Developmental possibilities* High: 1.0 Medium high: 1.5 (1.0–2.3) Medium low: 1.1 (0.7–1.9) Low: 1.5 (1.0–2.4) *Social support* High: 1.0 Medium high: 1.1 (0.7–1.6) Medium low: 1.1 (0.7–1.6) Low: 1.5 (1.0–2.3) Results continues on the next page	OR (95% CI) <u>*Women*</u> *Sensorial demands* Low: 1.0 Medium low: 0.6 (0.3–1.1) Medium high: 0.8 (0.5–1.3) High: 1.3 (0.8–2.0) *Influence at work* High: 1.0 Medium high: 1.5 (0.9–2.5) Medium low: 2.3 (1.5–3.8) Low: 2.4 (1.5–3.8) *Quantitative demands* Not included in final model *Cognitive demands* Not included in final model *Developmental possibilities* Not included in final model *Social support* Not included in final model Results continues on the next page

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Table 4.4.17 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Jensen et al continued 2003 [13] Denmark				*Men* *Sensorial demands* Low: 1.0 Medium low: 1.4 (0.7–2.6) Medium high: 1.0 (0.5–1.8) High: 0.9 (0.5–1.9) *Influence at work* High: 1.0 Medium high: 2.2 (1.2–4.0) Medium low: 2.4 (1.3–4.7) Low: 1.6 (0.6–3.8) *Quantitative demands* Low: 1.0 Medium low: 0.8 (0.4–1.8) Medium high: 0.7 (0.3–1.5) High: 0.8 (0.4–1.4) *Cognitive demands* Low: 1.0 Medium low: 0.6 (0.2–1.3) Medium high: 0.7 (0.4–1.4) High: 0.8 (0.4–1.5) *Developmental possibilities* High: 1.0 Medium high: 1.0 (0.6–1.8) Medium low: 1.3 (0.6–2.7) Low: 1.2 (0.6–2.6) *Social support* High: 1.0 Medium high: 0.8 (0.4–1.4) Medium low: 0.8 (0.4–1.5) Low: 0.6 (0.3–1.3)	*Men* *Sensorial demands* Not included in final model *Influence at work* High: 1.0 Medium high: 2.2 (1.2–4.0) Medium low: 2.5 (1.3–4.8) Low: 1.6 (0.6–4.0) *Quantitative demands* Not included in final model *Cognitive demands* Not included in final model *Developmental possibilities* Not included in final model *Social support* Not included in final model

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Table 4.4.17 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Lassen et al[1] 2004 [7] Denmark	Cohort Computer users; Technical assistants and machine technicians January 2000–January 2001 n=2 973 (12-month pain) n=5 148 (severe pain) 44%/48% women	Wrist/hand pain previous 12 months Severe wrist/hand pain Wrist tendonopathy De Quervain's syndrome	High strain index High job demands Low decision latitude Low social support High time pressure	Not reported	OR (95% CI) *Wrist/hand pain previous 12 months* High strain index: 0.87 (0.55–1.38) High job demands: 0.98 (0.75–1.27) Low decision latitude: 1.26 (0.95–1.65) Low social support: 1.02 (0.91–1.27) High time pressure: 1.18 (0.91–1.52) *Severe wrist/hand pain* High strain-index: 0.82 (0.42–1.60) High job demands: 1.18 (0.77–1.80) Low decision latitude: 1.30 (0.85–1.96) Low social support: 0.91 (0.64–1.27) High time pressure: 1.08 (0.73–1.58) *Wrist tendonopathy* – *De Quervain's syndrome* –
Werner et al[1] 2005 [18] USA	Cohort Automobile assembly workers Study period not given 1 year follow-up n=189 25% women	Carpal tunnel syndrome	Co-worker support Skill discretion Decision authority Job creativity Supervisor support Job insecurity Job dissatisfaction	ORs not reported Co-worker support: p=0.004 Skill discretion: p=0.3 Decision authority: p=0.34 Job creativity: p=0.32 Supervisor support: p=0.47 Job insecurity: p=0.50 Job dissatisfaction: p=0.07	OR (95% CI) Co-worker support: 0.69 (0.48–0.99) Skill discretion: Not included in final model Decision authority: Not included in final model Job creativity: Not included in final model Supervisor support: Not included in final model Job insecurity: Not included in final model Job dissatisfaction: Not included in final model

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Table 4.4.17 *continued*

Author Year Reference Country	Design Setting Study period n at first follow-up % women	Outcome Diagnosis	Psychosocial exposure	Risk estimate, least adjusted model	Risk estimate, final model
Wigaeus Tornqvist et al[1] 2009 [19] Sweden	Cohort Computer users with varying occupations at 46 different worksites Average follow-up time: 329 days (range 28–540) 10 monthly questionnaires n=1 170 59% women	Hand/arm (elbows, forearms, wrists, hands, fingers) pain or aches at least 3 days during the preceding month	Demands in relation to competence Job strain (demands, score 5–20, decision latitude, score 6–24) Social support (score 6–24)	RR (95% CI) *Demands in relation to competence* In accordance with competence: 1.0 Lower than competence: 1.11 (0.87–1.42) Higher than competence: 1.19 (0.87–1.62) *Job strain* Low (demands <13 + decision latitude >19): 1.0 Medium: 1.48 (1.05–2.07) High (demands ≥16 + decision latitude ≤15): 2.02 (1.17–3.47) *Social support* High (>20): 1.0 Medium (16–20): 1.00 (0.79–1.25) Low (≤15): 1.44 (1.00–2.08)	RR (95% CI) *Demands in relation to competence* In accordance with competence: 1.0 Lower than competence: 1.10 (0.81–1.49) Higher than competence: 1.19 (0.82–1.71) *Job strain* Low (demands <13 + decision latitude >19): 1.0 Medium: 1.22 (0.84–1.78) High (demands ≥16 + decision latitude ≤15): 1.11 (0.55–2.25) *Social support* High (>20): 1.0 Medium (16–20): 0.94 (0.72–1.23) Low (≤15): 1.39 (0.90–2.15)

[1] Study quality is moderate.

CI = Confidence interval; HR = Hazard ratio; OR = Odds ratio; RR = Relative risk

Table 4.4.18 *Wrists/hands. Psychosocial exposure – case-control studies.*

Author Year Reference Country	**Design Setting Study period n at first follow-up % women**	**Outcome Diagnosis**	**Psychosocial exposure**	**Risk estimate, least adjusted model**	**Risk estimate, final model**
Nordström et al[1] 1997 [20] USA	Case-control Wisconsin Cases identified through Marshfield Clinic computerised diagnosis file covering a catchment area of 55 000 residents Controls; People in the Marshfield area, frequency matched on age. Not stated how they were identified or selected May 1994–October 1995 206 cases 211 controls % women not given	Newly diagnosed cases of carpal tunnel syndrome	Job control (low=little control)	OR (95% CI) adjusted for age *Job control* 1–2.7: 1.0 2.8–3.4: 0.80 (0.44–1.47) 3.6–3.8: 0.36 (0.18–0.71) 4–4.4: 0.46 (0.24–0.86) 4.6–4.8: 0.42 (0.21–0.83)	OR (95% CI) *Job control* 1–2.7: 1.0 2.8–3.4: 1.05 (0.48–2.27) 3.6–3.8: 0.34 (0.14–0.82) 4–4.4: 0.64 (0.29–1.42) 4.6–4.8: 0.35 (0.14–0.91)

1. Study quality is moderate.

CI = Confidence interval; OR = Odds ratio

Table 4.5.1 *Etiological studies of factors associated with cervical distortion[1].*

Author Year Reference Country	Number of subjects included in the analysis (n)	Exposures	Subject related factors	OR or RR (95% CI)	Quality
Berglund et al 2003 [20] Sweden	6 581 adults reporting motor claim with or without injury to one motor insurance company	*Seating position,* *(ref = Rear seat passenger)* Driver Front seat passenger *Collision impact* *(ref = side collision)* Rear-end collision Frontal collision Other (incl rollover)	Age (ref=55+) 18–34 35–44 45–54 Female	OR *Age* 18–34: 1.19 (1.11–1.28) 35–44: 1.14 (1.06–1.23) 45–54: 1.10 (1.02–1.18) Female: 1.20 (1.16–1.25) *Seating position* Driver: 1.78 (1.60–1.97) Front seat passenger: 1.40 (1.25–1.57) *Collision impact* Rear-end collision: 1.82 (1.68–1.96) Frontal collision: 1.25 (1.15–1.36) Other (incl rollover): 1.17 (1.07–1.27)	Moderate
Cassidy et al 2000 [25] Canada	7 462 adults reporting neck pain to one motor insurance company		Age (ref 50+) 18–24 (no fault) 18–24 (tort)	Unadjusted IRR *Age* 18–24 (no fault[2]): 3.5 18–24 (tort[3]): 4.6	High
Farmer et al 1999 [22] USA	5 083 car drivers exposed to rear end collision and reporting motor claims with or without injury	Cars equipped with correct adjusted head restraints		Females: OR= 0.64, p<0.05 Males: OR=0.90 ns	Moderate
Farmer et al 2003 [21] USA	2 641 car drivers exposed to rear end collision and reporting motor claims with or without injury	New design of head restraints and seats		Active head restraints were associated with a reduction of injury claims for neck pain in drivers, OR=0.57, <0.05 (female drivers; OR=0.45, p<0.05, and male drivers OR=0.69, ns)	Moderate

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Table 4.5.1 *continued*

Author Year Reference Country	Number of subjects included in the analysis (n)	Exposures	Subject related factors	OR or RR (95% CI)	Quality
Farmer et al 2008 [27] USA	2 857 car drivers exposed to rear end collision and reporting motor claims with or without injury	*Vehicle damage (ref = minor)* Moderate/severe *Vehicle price (ref <$30 000)* $30 000 or more *Classification of seat/head restraint* Good vs poor Acceptable vs poor Marginal vs poor	Female	*Vehicle damage (ref = minor)* Moderate/severe: 1.44 (1.24–1.66) *Vehicle price (ref <$30 000)* $30 000 or more: 1.85 (1.63–2.08) *Classification of seat/head restraint* Good vs poor: 0.85 (0.70–1.01) Acceptable vs poor: 1.00 (0.82–1.20) Marginal vs poor: 0.92 (0.75–1.11)	Moderate
Kullgren et al 2008 [35] Sweden	236 drivers or front seat passengers	Acceleration (g) and change of velocity (km/h)	Female	*Acceleration (g) and change of velocity (km/h)* 1.45 A linear relationship between an increase in acceleration and change of velocity and an increase in injury risk	Moderate
Obelieniene et al 1999 [26] Lithuania	210 car occupants		Female Prior neck pain	Unadjusted OR Female: 1.7 (ns) Prior neck pain: 1.9 ($p<0.03$)	Moderate
Suissa et al 1995 [24] Canada	3 014 462 adults reporting neck pain to one motor insurance company		Female	Unadjusted IRR Female: 1.5	High

[1] The estimates are derived from the publication or have been calculated from the raw data in the publication.
[2] No-fault system, where insurance compensation is payable, independent of fault for collision.
[3] Tort system, where insurance compensation is payable based on fault for collision and includes pain and suffering.

CI = Confidence interval; IRR = Incidence raio rate; ns = Non-significant; OR = Odds ratio; RR = Relative risk

Table 4.5.2 *Studies excluded after the review process.*

First author Year Reference	Reason(s) for exclusion
Giannoudis 2007 [28]	Not the same method used to define outcome for exposed and non-exposed
Krafft 2000 [23]	Altogether several weaknesses
Jakobsson 2008 [34]	Altogether several weaknesses
Malik 2004 [29]	Exposure not defined
Minoyama 2004 [30]	Study base not defined
Moskal 2008 [31]	Outcome not defined
Represas 2008 [32]	High risk for detection bias, ie, the cases are related to the exposure of interest
Wiles 2005 [33]	Altogether several weaknesses

Table 4.6.1 *Included systematic reviews.*

Reference	General-ization	Questions & results				Quality aspects	
Author Year Reference	**Covered period, Populations & contexts**	**Outcome Measurement of outcome**	**Exposures supported by empirical evidence**	**Exposures examined but not supported**	**Quantitative estimates (if any)**	**Reviewers judgement of quality of evidence**	**Number and types of included studies**
Abbas et al 1998 [3]	1980–1995 Workers in various branches, often repe-titive jobs 11 studies from the USA, 6 from Europe	CTS	Job titles (14 included studies) Ergonomic movements (3 included studies)		Job titles (pooled risk estimates, random model) OR 2.46 (1.84–3.30), p=0.81 Movements OR 2.53 (1.65–3.89) $R^{2\,adj}$ 0.43 that risk estimates can be explained by country of publication, study population, force and repetition	No quality assessment of included studies	3 surveys and 14 cross-sectional studies
Ariëns et al 2000 [6]	1974–2006 Blue collar and white collar employees 25 studies	Neck pain Tension-neck syndrome Self reported in 21 studies	Physical risk factors Sitting (duration) Twisting of trunk Bending of trunk		No quantitative estimates presented. Concludes that some evidence exists between twisting or bending and neck pain, and also for duration of sitting	Quality assessment lists according to criteria for different types of studies Cross sectional studies of low study quality for neck postures, arm force, work place design. Some cross sectional studies of better quality for duration of work postures and twisting or bending of trunk	22 cross-sectional studies, 2 cohort and 1 case referent
Ariëns 2001 et al [7]	1966–1997 Blue collar and white collar employees 20 studies	Neck pain Neck symptoms Self reported	Psychosocial risk factors ie conflicts, stress, job control, social support, job satisfaction, and others	Job strain, low supervisor support, conflicts at work, low job security, limited rest break opportunities	No quantitative estimates presented Some evidence between neck pain and high job demands, low job control, skill discretion, low job satisfaction	Assessment of study quality using a quality assessment list	19 cross-sectional studies and 1 cohort study

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Table 4.6.1 *continued*

Reference	General-ization	Questions & results				Quality aspects	
Author Year Reference	**Covered period, Populations & contexts**	**Outcome Measurement of outcome**	**Exposures supported by empirical evidence**	**Exposures examined but not supported**	**Quantitative estimates (if any)**	**Reviewers judgement of quality of evidence**	**Number and types of included studies**
Bongers et al 2002 [13]	1980–1999	Shoulder, elbow and hand/wrist Self reported		Risk estimates High job demands 1.5–2.4 (attributable fraction 33–58%) Low decision lattitude 1.6–2.8 (attributable fraction 37–64%)	High job stress High job demands are associated with upper extremity disorders	Assessment of study quality using a quality assessment list. Studies rated high (1), good (10), moderate (12) and poor (6)	24 cross-sectional studies, 1 cohort and 1 case-control study
Côté et al 2008 [8]	1980–2006 Focus on workers 20 studies on risk factors out of 109 studies in total	Neck pain	Increased risk of neck pain from: *Psychosocial exposure* High job strain/ low job control Low co-worker support Job insecurity *Physical exposure* Sedentary position Repetitive work Neck posture Poor computer workstation design	Taking breaks during computer work Doing shift-work Computer technical support	Not presented free of charge	Quality assessment of included studies. Difficult to assess due to lack of tables ie free of charge	On risk factors for neck pain 19 cohort studies and 1 RCT
Crawford et al 2008 [18]	Search period not explained Blue collar and white collar employees in the tele-communi-cations sector 43 studies included	MSD	Manhole cover removal Ladder handling Overhead line work Cable handling Road breaking Work organisation	Not specified	Only study specific risk estimates reported	Study quality assess-ment limited to study design, numbers of study population, data collection and confidence limits (ie Waddell 2000)	Of 43 studies included 25 were cross-sectional

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Table 4.6.1 *continued*

Reference	General-ization	Questions & results				Quality aspects	
Author Year Reference	**Covered period, Populations & contexts**	**Outcome Measurement of outcome**	**Exposures supported by empirical evidence**	**Exposures examined but not supported**	**Quantitative estimates (if any)**	**Reviewers judgement of quality of evidence**	**Number and types of included studies**
Hansson et al 2001 [9]	1966–Spring 2001	Neck and upper extremity	*Strong evidence* Highly repetitive work with arms elevated >60° and shoulder tendinitis Job satisfaction and neck problem Highly repetitive work with hands and CTS *Moderate evidence* Combination of repetitive work and heavy work and lateral epicondylitis Power grip exposure and CTS *Limited evidence* Bent or twisted trunk and neck problems Work place design and neck problems Social support and neck problem	Not specified	Only study specific risk estimates reported	Study quality assessment using previous systematic reviews including SBU Neck pain, back pain (2000)	<u>*Neck problems*</u> Physical exposure 23 cross-sectional and 9 cohort/case-control studies Psychosocial exposure 24 cohort/case-control studies <u>*Shoulder problems*</u> 48 cross-sectional and 16 cohort/case-control studies <u>*Elbow*</u> 10 cross-sectional and 3 cohort/case-control studies
Hooftman et al 2004 [1]	1960–2002 Focus on gender differences	Neck/shoulder complaints	*Strong evidence* Arm posture female greater than men	Social support No evidence of gender difference for neck-shoulder complaints	Only study specific risk estimates reported	Methodological quality assessed Tested for Kappa	9 studies of which 4 rated as high quality. 4 case-control and 5 cross-sectional

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Table 4.6.1 continued

Reference	Generalization	Questions & results				Quality aspects	
Author Year Reference	**Covered period, Populations & contexts**	**Outcome Measurement of outcome**	**Exposures supported by empirical evidence**	**Exposures examined but not supported**	**Quantitative estimates (if any)**	**Reviewers judgement of quality of evidence**	**Number and types of included studies**
Ijmker et al 2007 [2]	1950–2005 Denmark, Finland, Sweden and USA Office workers in various branches, professional technicians	Self-reported pain, discomfort or musculoskeletal symptoms for ≥7 days (+ intensity level) in neck, shoulder, elbow, forearm, and/or wrist, or possible CTS	Duration of: – Total computer use – Mouse use – Keyboard use	Not specified	Only study specific risk estimates reported	6 of 9 papers rated high quality. Moderate evidence (based on methodological quality and consistency) for an association between duration of mouse use and hand/arm symptoms	9 studies from 5 cohorts Only cross-sectional
Lakke et al 2009 [19]	January 2000–January 2008 Synthesis of other published systematic reviews	Neck and upper extremity	Moderate evidence: Duration of mouse time use Keyboard time use (neck)	Not specified	No specific risk estimates reported	Only one systematic review included risk factors for neck and upper extremity (ie Ijmker 2007)	9 systematic reviews included of which 8 on back and 1 of neck and upper extremity
Liss et al 1996 [17]	1990–October 1994 Blue collar and white collar employees 10 studies	Dupuytren´s Contracture (5 studies)	Only one study without major flaws (although a cross-sectional study) thus no evidence stated	Not stated	Only study specific risk estimates reported	Quality assessment and interobserver agreement calculated using Kappa	5 studies of which 4 cross-sectional and 1 population based survey

The table continues on the next page

Table 4.6.1 continued

Reference	General-ization	Questions & results				Quality aspects	
Author Year Reference	**Covered period, Populations & contexts**	**Outcome Measurement of outcome**	**Exposures supported by empirical evidence**	**Exposures examined but not supported**	**Quantitative estimates (if any)**	**Reviewers judgement of quality of evidence**	**Number and types of included studies**
Palmer et al 2007 [10]	1990–2004 Blue collar and white collar employees 18 studies	Tenosynovitis Epicondylitis	*Tenosynovitis* Job title 6 studies baseline not stated. Physical activities one cross-sectional study. Limited evidence from job title *Epicondylitis* Job title 6 studies baseline not stated for 5, and one without unexposed group. Physical activity 2 studies of which one without unexposed group. Limited evidence from job title	Not stated	Only study specific risk estimates reported	Quality assessment not stated	18 studies of which 13 had reference groups. No evidence from studies based on physical activities
Palmer et al 2007 [22]	Other systematic reviews published 2001 completed by search until May 2006	Neck pain with palpation tenderness	*Physical exposure* Moderate evidence for: – Repetition of the shoulder – Repetition of the shoulder with neck flexion – Repetition with static loading of neck-shoulder muscles and neck flexion	*Physical exposure* Precision Rest breaks Lifting or manual handling High physical workload *Psychosocial exposure* Job creativity Job satisfaction	Only study specific risk estimates reported	Principles for quality assessment reported	21 studies of which 15 cross-sectional, 4 prospective and 2 case-referent

The table continues on the next page

Table 4.6.1 continued

Reference	General-ization	Questions & results				Quality aspects	
Author Year Reference	**Covered period, Populations & contexts**	**Outcome Measurement of outcome**	**Exposures supported by empirical evidence**	**Exposures examined but not supported**	**Quantitative estimates (if any)**	**Reviewers judgement of quality of evidence**	**Number and types of included studies**
Sherehiy et al 2004 [20]	1966–2003 Nursing professionals	MSD including neck/shoulder region	*Physical risk exposure* Physical load Work task Work posture All studies were cross-sectional *Psychosocial risk exposure* Job demand Job control Job stress Social relations at work Organization of work All studies but two were cross-sectional	Job satisfaction	*Physical risk exposure* Physical load: OR 1.4–1.8 Work task: OR 3.30 Work posture: OR 1.7–2.3 (all studies cross-sectional) *Psychosocial risk exposure* Job demand: OR 1.14–1.66 Job control: OR 1.73 Job stress: OR 1.1–1.5 Social relations at work: OR 1.35–2.03 Organisation of work: OR 1.0–1.08 (all studies but two were cross-sectional)	Of 16 included studies on neck/shoulder there were 5 cohort studies Conclusions regarding evidence mainly based on studies with cross-sectional design	*Psychosocial risk* 8 studies on shoulder/neck of which 2 were cohorts *Physical risk* 8 studies included no cohort study
Stock 1991 [5]	1966–1990 3 out of 54 studies met criteria of inclusion Industrial workers and clerks	Neck and upper limbs	Repetitive forceful work exposures and hand and wrist tendon and tendon sheath disorders, and CTS	Not specified	Hand-wrist tendinitis: OR 9.1 (CI 4.9–16.2) CTS: OR 15.5 (CI 1.7–141.5)	Included studies from the 1970-ies and 1980-ties	3 cross-sectional studies only
Thomsen et al 2008 [4]	1966–August 2008 Employees using computers	CTS	None	Computer work (mouse or key-board) and carpal tunnel syndrome	None	No scoring system used, descriptive data only	All 8 included studies had important limitations

The table continues on the next page

Table 4.6.1 continued

Reference	General-ization	Questions & results				Quality aspects	
Author Year Reference	**Covered period, Populations & Contexts**	**Outcome Measurement of outcome**	**Exposures supported by empirical evidence**	**Exposures examined but not supported**	**Quantitative estimates (if any)**	**Reviewers judgement of quality of evidence**	**Number and types of included studies**
van der Windt 2000 [14]	1966–September 1998 General population and working population	Shoulder pain	Repetitive movements	*Psychosocial risk factors* High psychological demands Poor control at work Poor social support Job dissatisfaction	OR 1.4–46	Checklist for assessment of methodological quality No strong associations, lacking consistency across studies	Of 29 included studies 26 were cross-sectional and 3 case-control studies
van Rijn et al 2009 [15]	1966–September 2007 General population and working population	Disorders at the elbow	<u>*Lateral epicondylitis*</u> *Physical exposure* Handling tools >1 kg Handling loads >20 kg at least 10 times/day *Psychosocial exposure* Low job control Low social support	Not specified	Handling tools >1 kg: OR 2.1–3.0 Handling loads >20 kg at least 10 times/day: OR 2.6 Low job control: OR 2.2 Low social support: OR 1.8	Study quality assess-ment based on Dutch Cochrane Centre criteria van Rijn et al state: Findings from cross-sectional studies need to be confirmed in longitudinal studies	Of 13 included studies 9 were cross-sectional, 2 case-control studies and 2 cohort studies
van Rijn et al 2009 [16]	1966–September 2007 Blue collar and white collar employees	CTS	Hand force of >4 kg Repetitiveness at work Combinations	Psychosocial risk factors	Only study specific risk estimates reported *Settings of high risk of CTS* Meat industry: OR 76.5 Fish-processing: OR 21.3 Forestry work: OR 11.4	Study quality assessment based on Dutch Cochrane Centre criteria	Of 44 included studies 30 were cross-sectional, 9 case-control studies and 5 cohort studies

The table continues on the next page

Table 4.6.1 *continued*

Reference	General-ization	Questions & results				Quality aspects	
Author Year Reference	**Covered period, Populations & contexts**	**Outcome Measurement of outcome**	**Exposures supported by empirical evidence**	**Exposures examined but not supported**	**Quantitative estimates (if any)**	**Reviewers judgement of quality of evidence**	**Number and types of included studies**
van Rijn et al 2010 [21]	1966–November 2009 General population and working population	Tendinitis of biceps Rotator cuff tears SIS Supra-scapular nerve com-pression	Highly repetitive work Forceful exertion at work Awkward postures High psychosocial demand	Job title and Rotator cuff tears or suprascapular nerve compres-sion	Only study specific risk estimates reported *Settings of high risk* Slaughter house/SIS: OR 5.27 Fish-processing/tendinitis of the biceps tendon: OR 2.28 SIS: OR 3.38	Study quality assessment based on Dutch Cochrane Centre criteria	Of 17 included studies 14 were cross-sectional, 1 case-control studies and 2 cohort studies
Veiersted et al 2006 [12]	1966–April 2005 Computer work	Neck and upper extremity	Neck pain with physical findings and computer use and computer mouse time (limited evidence) Wrist tendonitis and computer use/ mouse time/key-board time (limited evidence)	Computer use/ mouse time/key-board time and shoulder tendonitis Epicondylitis Nerve entrapments	Only study specific risk estimates reported	Study quality assessment based on Cochrane Collaboration back review group	Of 7 studies included 2 were cross-sectio-nal, 4 were cohort studies (of which 3 from NUDATA) and 1 was case-control
Waters et al 2008 [11]	1966–May 2005 HEV operation	Neck disorders	Not stated	No evidence regarding neck pain (only 1 study had neck as outcome)	Only study specific risk estimates reported	Study quality assessment using the Epidemiological Appraisal Instrument	Of 18 studies included 12 were cross-sectional, 5 were cohorts and 1 of a hybrid design

CI = Confidence interval; CTS = Carpal tunnel syndrome; HEV = Heavy equipment vehicle; MSD = Musculoskeletal disorders; SIS = Subacromial impingment syndrome; OR = Odds ratio; RCT = Randomised controlled trial

Table 4.6.2 *Neck/shoulder – included studies in systematic reviews.*

Reasons for exclusion are given in the column marked SBU 2011: 1 = according to criteria of exclusion of abstracts; 2 = cross-sectional study; 3 = limited study quality; 4 = according to criteria of exclusion of studies in full text; 5 = included in the SBU report.

Original study First author, year	Arbete och hälsa 2001	Ariëns 2000	Ariëns 2001	Côté 2008	Hooftman 2004	Lakke 2009	NIOSH 1997	Veiersted 2006	SBU 2011
Ahlberg 1995			X						**2**
Amano 1998	X						X		**2**
Andersen 1993a	X	X					X		**2**
Andersen 1993b	X						X		**1**
Andersen 2003						X			**5**
Andersen 2007									**5**
Andersen 2008									**5**
Ariens 2001				X					**5**
Barnekow 1998					X				**1**
Bergenudd 1988	X						X		**1**
Bergqvist 1995	X	X	X				X	X	**2**
Bernard 1994	X	X	X				X		**2**
Bigos 1989	X						X		**1**
Bildt 1998					X				**1**
Bildt 1999					X				**1**
Bildt 2000	X								**1**
Bovenzi 1991	X						X		**2**
Brandt 2004				X		X		X	**5**
Bru 1996		X	X						**2**
Cassou 2002				X	X				**3**
Dartigues 1998	X	X	X						**2**
Dimberg 1989	X	X					X		**2**
Ekberg 1994	X						X		**4**
Eriksen 1999				X					**5**
Estlander 1988	X								**4**
Ferraz 1995								X	**2**
Feveile 2002									**5**
Fredriksson 1999					X				**3**
Fredriksson 2000					X				**3**
Gerr 2002				X				X	**4**
Gerr 2005				X					**5**
Hales 1994	X	X	X				X		**2**
Hagberg 2005				X					**Students in music**

The table continues on the next page

Table 4.6.2 continued

Original study First author, year	Arbete och hälsa 2001	Ariëns 2000	Ariëns 2001	Côté 2008	Hooftman 2004	Lakke 2009	NIOSH 1997	Veiersted 2006	SBU 2011
Hamberg-van Reenen 2006				X					**5**
Hannan 2005				X					**5**
Heuvel 2005				X					**3**
Heuvel 2006									**5**
Ignatius 1993	X	X	X						**2**
Jensen 1996				X					**3**
Jensen 2002					X				**2**
Jensen 2003				X					**5**
Johansson 1994	X	X	X				X		**2**
Johansson 1995	X	X	X						**2**
Jonsson 1988	X						X		**2**
Kamwendo 1991	X	X	X				X		**2**
Karlqvist 2002					X				**2**
Kilbom 1986	X	X	X						**2**
Kuorinka 1979	X						X		**Before 1980**
Korhonen 2003				X					**3**
Kryger 2003						X			**5**
Köster 1999					X				**1**
Lagerström 1995			X						**2**
Larsman 2009									**5**
Lassen 2004						X			**5**
Lau 1996		X							**2**
Leclerc 1999	X			X					**3**
Linton 1990	X	X	X				X		**2**
Lipscomb 2008									**5**
Luime 2005				X					**3**
Luopajarvi 1979							X		**Before 1980**
Marcus 2002				X		X			**5**
Milerad 1990	X						X		**2**
Mortimer 1998					X				**1**
Mundt 1993		X							**1**
Musson 1989	X	X	X				X		**2**
Mäkelä 1991	X	X	X		X				**2**
Ohlsson 1995	X						X		**2**
Palmer 2000					X				**2**
Palmer 2001					X				**2**
Pietri-Taleb 1994	X			X					**3**

The table continues on the next page

Table 4.6.2 *continued*

Original study First author, year	Arbete och hälsa 2001	Ariëns 2000	Ariëns 2001	Côté 2008	Hooftman 2004	Lakke 2009	NIOSH 1997	Veiersted 2006	SBU 2011
Pope 1997					X				**2**
Rempel 2006									**5**
Rugulies 2005				X					**4**
Rundcrantz 1991	X	X							**4**
Schibye 1995	X	X					X		**2**
Silverstein 1985	X						X		**1**
Skov 1996	X	X	X				X		**2**
Smedley 2003				X					**5**
Tharr 1995	X	X	X						**2**
Thorbjörnsson 2000					X				**1**
Tola 1988	X						X		**2**
Toomingas 1997			X						**2**
Torgén 1997					X				**1**
Torgén 1999					X				**1**
Tornqvist 2001					X			X	**3**
Tornqvist 2009									**5**
Veiersted 1993	X						X		**4**
Veiersted 1994	X						X		**3**
Viikari-Juntura 1994	X	X	X	X			X		**3**
Viikari-Juntura 2001				X					**5**
Vingård 1999					X				**1**
Vingård 2000					X				**1**
Wahlström 2004				X					**5**
Wells 1983	X	X					X		**2**
Wiktorin 1999					X				**1**
Yu 1996	X	X					X		**2**
Zettenberg 1997			X						**2**
Östergren 2005				X					**3**

Table 4.6.3 *Shoulder – included studies in systematic reviews.*

Reasons for exclusion are given in the column marked SBU 2011: 1 = according to criteria of exclusion of abstracts; 2 = cross-sectional study; 3 = limited study quality; 4 = according to criteria of exclusion of studies in full text; 5 = included in the SBU report.

Original study First author, year	Arbete och hälsa 2001	Bongers 2002	Crawford 2008	Ijmker 2007	Lakke 2009	NIOSH 1997	van Rijn 2010	Sherehiy 2004	Veiersted 2006	van der Windt 2000	SBU 2011
Ahlberg 1995		X						X			**2**
Andersen 1993a	X					X	X				**2**
Andersen 1993b	X					X					**1**
Andersen 2003				X	X						**5**
Andersen 2008											**5**
Baker 2000			X								**2**
Baker 2003			X								**2**
Bergenudd 1988	X					X				X	**1**
Bergenudd 1994	X									X	**2**
Bernard 1994	X	X				X				X	**2**
Bergqvist 1992				X							**5**
Bergqvist 1995a		X	X			X			X		**2**
Bergqvist 1995b						X					**2**
Bjelle 1979	X	X				X				X	**Before 1980**
Bjelle 1981	X					X					**4**
Brandt 2004				X	X				X		**5**
Bru 1993								X			**2**
Bru 1996		X						X			**2**
Brulin 1998						X		X			**2**
Burdorf 1991	X									X	**2**
Burdorf 1997	X	X								X	**2**
Chang 2003			X								**1**
Chiang 1993	X					X					**2**
Chung 1997			X								**2**
Conlon 2004											**5**
Cook 2000			X								**2**
Cook 2004			X								**1**
Devereux 1999			X								**2**
Devereux 2002			X								**2**
Dimberg 1989	X	X								X	**2**
Ekberg 1995	X					X					**2**
Engels 1998								X			**2**
English 1995	X					X				X	**1**
Engström 1995											**2**

The table continues on the next page

Table 4.6.3 continued

Original study First author, year	Arbete och hälsa 2001	Bongers 2002	Crawford 2008	Ijmker 2007	Lakke 2009	NIOSH 1997	van Rijn 2010	Sherehiy 2004	Veiersted 2006	van der Windt 2000	SBU 2011
Faucett 2002			X								**1**
Ferraz 1995									X		**2**
Ferreira 1997		X	X								**1**
Ferreira 2002			X								**2**
Finsen 1997	X										**2**
Flodmark 1992	X					X					**2**
Frost 2002							X				**2**
Gallacher 1993			X								**1**
Gallacher 2001			X								**1**
Gardner 2008											**5**
Gerr 2002									X		**4**
Gerr 2005											**5**
Graves 1996			X								**2**
Hamberg-Reenen 2006											**5**
Hamrick 1993			X								**1**
Hagberg 1981	X					X					**1**
Hales 1994	X	X	X			X				X	**2**
Halford 2003			X								**2**
Harkness 2003											**5**
Herberts 1981	X					X					**2**
Herberts 1984	X					X					**2**
Hoekstra 1992			X								**2**
Hoekstra 1995		X									**2**
Hoekstra 1996		X	X								**2**
Hollman 2001								X			**2**
Hughes 1997	X					X				X	**2**
Hägg 1997	X										**2**
Ignatius 1993	X					X					**2**
Imbeau 2001			X								**1**
Imbeau 1998			X								**1**
Jacobsson 1992	X									X	**2**
Jensen 2002			X								**2**
Jensen 2003				X							**5**
Johansson 1993	X	X								X	**2**
Johansson 1994	X	X				X				X	**2**
Johansson 1995										X	**2**
Johnsson 1988	X					X					**2**

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Table 4.6.3 continued

Original study First author, year	Arbete och hälsa 2001	Bongers 2002	Crawford 2008	Ijmker 2007	Lakke 2009	NIOSH 1997	van Rijn 2010	Sherehiy 2004	Veiersted 2006	van der Windt 2000	SBU 2011
Josephson 1997								X			**4**
Juul-Kristensen 2004				X							**5**
Kaergaard 2000	X										**3**
Kamwendo 1991	X	X				X				X	**2**
Katevuo 1985	X										**2**
Kihlbom 1986	X					X				X	**2**
Korhonen 2003				X							**3**
Kryger 2003				X	X						**5**
Kvarnström 1983	X					X					**2**
Lagerström 1995	X	X						X		X	**2**
Laflamme 1997								X			**1**
Larsman 2009											**5**
Lassen 2004				X	X						**5**
Leclerc 1998		X									**2**
Lemasters 1998	X	X								X	**2**
Linton 1989	X					X				X	**2**
Liss 1995	X					X				X	**2**
Lundborg 1999	X										**2**
Luopajärvi 1979	X					X					**2**
Magnavita 1999		X									**2**
Marcus 1996		X	X								**2**
Marcus 2002				X							**5**
May 1997			X								**2**
McCormack 1990	X					X					**2**
Milerad 1990	X					X					**2**
Miranda 2001											**5**
Mirbod 1997	X									X	**2**
Miranda 2005					X		X				**2**
Mital 1995			X					X			**1**
Myers 2002								X			**1**
Nag 2004			X								**2**
Norman 2004			X								**2**
Ohlsson 1989	X					X				X	**2**
Ohlsson 1995	X					X					**2**
Ono 1995								X			**2**
Palmer 1998			X								**2**
Park 1997			X								**2**
Pickett 1991		X									**2**

The table continues on the next page

Table 4.6.3 continued

Original study First author, year	Arbete och hälsa 2001	Bongers 2002	Crawford 2008	Ijmker 2007	Lakke 2009	NIOSH 1997	van Rijn 2010	Sherehiy 2004	Veiersted 2006	van der Windt 2000	SBU 2011
Picton 2003			X								**2**
Pocekay 1995		X									**2**
Pope 1997	X									X	**2**
Punnett 1998	X										**2**
Punnett 2000	X										**4**
Rempel 2006											**5**
Rosignol 1987	X					X					**2**
Roquelaure 1997		X									**2**
Rundcrantz 1990	X									X	**2**
Rundcrantz 1991	X										**4**
Sakakibara 1995	X					X					**2**
Scibye 1995	X					X					**1**
Silverstein 1987		X				X					**2**
Silverstein 1996	X									X	**2**
Silverstein 2006											**5**
Silverstein 2008							X				**2**
Skov 1996	X									X	**2**
Sobti 1997	X									X	**2**
Sporrong 1999	X										**1**
Stenlund 1992	X					X					**2**
Stenlund 1993	X					X				X	**2**
Sutinen 2006							X				**1**
Svendsen 2004							X				**2**
Toomingas 1997		X									**2**
Toomingas 2003			X								**4**
Tornqvist 2001									X		**3**
Tornqvist 2009											**5**
Törner 1991	X										**2**
Van der Beek 1993	X									X	**2**
Veiersted 1993a	X					X					**4**
Veiersted 1993b	X					X					**1**
Vilkki 1996			X								**2**
Walker 1985			X								**2**
Wells 1983	X										**2**
Westgaard 1992		X									**2**
Yu 1996	X					X				X	**2**
Zetterberg 1997		X									**2**
Öberg 1995	X										**1**

Table 4.6.4 *Elbow – included studies in systematic reviews.*

Reasons for exclusion are given in the column marked SBU 2011: 1 = according to criteria of exclusion of abstracts; 2 = cross-sectional study; 3 = limited study quality; 4 = according to criteria of exclusion of studies in full text; 5 = included in the SBU report.

Original study First author, year	Arbete och hälsa 2001	Bongers 2002	Crawford 2008	NIOSH 1997	van Rijn 2009	Veiersted 2006	SBU 2011
Ahlberg 1995		X					**2**
Andersen 1993	X			X			**2**
Andersen 2007							**5**
Baker 2000			X				**2**
Bergqvist 1995		X				X	**2**
Bernhard 1994		X					**2**
Bjelle 1979		X					**Before 1980**
Bru 1996		X					**2**
Burdorf 1997		X					**2**
Byström 1995	X			X			**2**
Chiang 1993	X			X	X		**2**
Descatha 2003					X		**3**
Descatha 2004					X		**5**
Dimberg 1989		X		X			**2**
Ferraz 1995						X	**2**
Ferreira 1997		X				X	**1**
Gardner 2008							**5**
Gerr 2002							**4**
Haahr 2003					X		**5**
Hales 1994		X	X	X			**2**
Hannan 2005							**5**
Hansson 2000					X		**2**
Hoekstra 1992			X				**2**
Hoekstra 1994				X			**2**
Hoekstra 1995		X					**2**
Hoekstra 1996		X					**2**
Johansson 1993		X					**2**
Johansson 1994		X					**2**
Kamwendo 1991		X					**2**
Kurppa 1991	X			X			**4**
Kryger 2003							**5**
Lagerström 1995		X					**2**
Lassen 2004						X	**5**
Leclerc 1998		X					**2**

The table continues on the next page

Table 4.6.4 continued

Original study First author, year	Arbete och hälsa 2001	Bongers 2002	Crawford 2008	NIOSH 1997	van Rijn 2009	Veiersted 2006	SBU 2011
Leclerc 2001					X		**3**
Lemasters 1998		X					**2**
Luopajärvi 1979	X			X			**2**
Magnavita 1999		X					**2**
Marcus 1996		X					**2**
McCormack 1990	X			X			**2**
McFarlane 2000							**5**
Moore 1994	X			X			**1**
Nahit 2003							**5**
Ohlsson 1989	X			X			**2**
Ohlsson 1995	X						**2**
Ono 1998	X				X		**2**
Pickett 1991		X					**2**
Pocekay 1995		X					**2**
Punnett 1985	X			X			**2**
Ritz 1995	X			X	X		**2**
Roquelaure 1997		X					**4**
Roquelaure 2008					X		**3**
Roto 1984	X			X			**2**
Shiri 2006					X		**2**
Silverstein 1987		X					**2**
Toomingas 1997		X					**2**
Tornqvist 2001						X	**3**
Tornqvist 2009							**5**
Viikari-Juntura 1991	X			X			**1**
Westgaard 1992		X					**2**
Zetterberg 1997		X					**2**

Table 4.6.5 *Carpal tunnel syndrome – included studies in systematic reviews.*

Reasons for exclusion are given in the column marked SBU 2011: 1 = according to criteria of exclusion of abstracts; 2 = cross-sectional study; 3 = limited study quality; 4 = according to criteria of exclusion of studies in full text; 5 = included in the SBU report.

Original study First author, year	Abbas 1998	Arbete och hälsa 2001	NIOSH 1997	Thomsen 2008	van Rijn 2009	SBU 2011
Abbas 2001					X	**2**
Ali 2006				X	X	**2**
Andersen 2003				X	X	**5**
Andersen 2007						**5**
Atroshi 2007				X		**2**
Babski 2002					X	**2**
Barnhardt 1991		X	X		X	**2**
Barnhardt 1994	X					**2**
Blanc 1996					X	**1**
Bonfiglioli 2007					X	**2**
Bovenzi 1991	X	X	X		X	**2**
Bovenzi 1994		X	X			**2**
Bovenzi 2005					X	**2**
Chiang 1990			X		X	**2**
Chiang 1993	X	X	X		X	**2**
Conlon 2008						**5**
Conlon 2009						**5**
Cosgrove 2002					X	**1**
de Krom 1990	X	X	X	X	X	**1**
Diaz 2001					X	**1**
Feveile 2002						**5**
Frost 1998		X			X	**2**
Gardner 2008						**5**
Gell 2005					X	**3**
Gerr 2002				X		**4**
Gerr 2005						**5**
Gorsche 1999					X	**2**
Hannan 2005						**5**
Harber 1992	X					**2**
Heuvel 2006						**5**
Hou 2007					X	**2**
Jensen 2003						**5**
Juul-Kristensen 2004						**5**
Jianmongkol 2005					X	**2**
Kim 2004					X	**2**
Kryger 2003						**5**
Kutluhan 2001					X	**2**

The table continues on the next page

Table 4.6.5 *continued*

Original study First author, year	Abbas 1998	Arbete och hälsa 2001	NIOSH 1997	Thomsen 2008	van Rijn 2009	SBU 2011
Lam 1998					X	**1**
Lassen 2004						**5**
Latko 1999		X			X	**2**
Leclerc 1998					X	**2**
Liss 1995	X		X		X	**2**
Marcus 2002						**5**
Margolis 1987	X				X	**2**
McChaire 1997						**5**
McCormack 1990			X		X	**2**
McFarlane 2000						**5**
Moore 1994			X		X	**1**
Morgenstern 1991	X		X		X	**2**
Nahit 2003						**5**
Nathan 1988			X	X		**1**
Nathan 1995	X					**2**
Nathan 2002				X	X	**1**
Nathan 2005					X	**1**
Nilsson 1994	X	X				**2**
Nordander 1999					X	**2**
Nordström 1997		X			X	**5**
Osario 1994	X		X			**2**
Park 1992					X	**1**
Pocekay 1995	X				X	**2**
Punnett 1985	X		X			**2**
Rempel 2006						**5**
Roquelaure 1997					X	**4**
Roquelore 2001					X	**2**
Silverstein 1987	X	X	X		X	**2**
Silverstein 1996					X	**2**
Stevens 2001				X	X	**2**
Thomsen 2002				X		**3**
Thomsen 2007						**5**
Tornqvist 2009						**5**
Volante 2007						**5**
Wang 2005					X	**2**
Weislander 1989	X	X	X		X	**3**
Werner 2005					X	**5**
Yagev 2001					X	**4**

Table 4.6.6 *Hand/wrist – included studies in systematic reviews.*

Reasons for exclusion are given in the column marked SBU 2011: 1 = according to criteria of exclusion of abstracts; 2 = cross-sectional study; 3 = limited study quality; 4 = according to criteria of exclusion of studies in full text; 5 = included in the SBU report.

Original study First author, year	Bongers 2002	Crawford 2008	Ijmker 2006	Liss 1996	NIOSH 1997	Palmer 2007	Stock 1991	Veiersted 2006	SBU 2011
Amano 1988					X	X			**2**
Andersen 1993						X			**2**
Andersen 2003			X						**5**
Andersen 2007									**5**
Baker 2000		X							**2**
Bennett 1982				X					**2**
Bergqvist 1992			X						**5**
Bergqvist 1995	X	X						X	**2**
Bernard 1994	X								**2**
Bovenzi 1991						X			**2**
Byström 1995					X	X			**4**
Chiang 1993						X			**2**
Conlon 2008									**5**
Conlon 2009									**5**
Cook 2000		X							**2**
Devereux 2002		X							**2**
Dimberg 1987						X			**4**
Early 1962				X					**2**
Engström 1999	X								**2**
Ferraz 1995								X	**2**
Ferreira 2002		X							**2**
Feveile 2002									**5**
Gardner 2008									**5**
Gerr 2002								X	**4**
Gerr 2005									**5**
Hales 1994	X	X							**2**
Hansson 2005									**5**
Herzog 1951				X					**Before 1980**
Heuvel 2006									**5**
Hoekstra 1995	X								**2**
Hoekstra 1996	X								**2**
Hueston 1960				X					**Before 1980**
Jensen 2002		X							**2**
Jensen 2003									**5**
Kryger 2003			X					X	**5**

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Table 4.6.6 continued

Original study First author, year	Bongers 2002	Crawford 2008	Ijmker 2006	Liss 1996	NIOSH 1997	Palmer 2007	Stock 1991	Veiersted 2006	SBU 2011
Kuorinka 1979					X	X			**Before 1980**
Kurppa 1991					X	X			**4**
Lassen 2004			X						**5**
Leclerc 2001						X			**3**
Luopajärvi 1979					X	X	X		**2**
Magnavita 1999	X								**2**
Malchaire 1997									**5**
Marcus 1996	X	X							**2**
Marcus 2002			X						**5**
McCormack 1990					X	X			**2**
Mikkelsen 1990				X					**Before 1980**
Nordström 1997									**5**
Ono 1998						X			**2**
Pickett 1991	X								**2**
Rempel 2006									**5**
Ritz 1995						X			**2**
Roto 1984					X	X			**2**
Silverstein 1985							X		**1**
Silverstein 1986							X		**1**
Silverstein 1987							X		**2**
Thomsen 2007									**5**
Toomingas 1997	X								**2**
Tornqvist 2001								X	**3**
Tornqvist 2009									**5**
Viikari-Juntura 1991						X			**1**
Volante 2007									**5**
Werner 2002						X			**1**
Werner 2005									**5**

Table 4.6.7 *Systematic reviews on neck pain.*

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Ariëns et al 2000 [6] Physical	22/25 (88%)	13/25 (52%)	Keyboard placement Time spent on telephone Number of breaks Times getting up from chair Perceived ergonomic load Sitting posture Sitting >5 h/day Cervical spine rotation-flexion-extension Permanent posture Strenous muscular activity Mismatch of desk and chair heights Bending the neck at work Daily typing hours Heavy material handling Extreme work posture Light bent work posture Monotonous work movements Twisted work postures Deep forward flexed trunk Hands above shoulder level Work with office machines Time per work cycle in neck flexion Time per work cycle upper arm 0–30° abducted	Some evidence for a positive relationship between neck pain and the duration of sitting and twisting or bending of the trunk

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Table 4.6.7 continued

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Ariëns et al 2001 [7] Psychosocial	19/20 (95%)	13/20 (65%)	Influence on working conditions Anxiety about reorganisation Conflict related to work Control over time High demand on work Fear of being replaced by computer Feeling of isolation Friendly spirit with fellow workers Good contact with superiors Group conflict Help and support at work High decision latitude High information processing demand High job strain High psychological workload High psychosocial demands High social support High workload variability Hour spent under deadline/week Increasing work preassure Intensity of authority over decisions Interaction with co-workers Stimulating work Job control Job requires a variety of demands Job requires a variety of tasks Job satisfaction Job security Lack of productivity standard Lack of stimulation Limited rest breaks Low influence on work Low social support Low stimulus from work Low support from superiors Low work commitment Low work control Low work satisfaction Low skill utilization Mental stress at work Monotonous work Overtime work Perceived competition Poor work content Routine work lacking decision making opportunities Work overload	Some evidence for a positive relationship between neck pain and high quantitative job demands, low social support (co-worker), low job control, high and low skill discretion and low job satisfaction

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Table 4.6.7 *continued*

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Côté et al 2008 [8] Physical Psychosocial	0/20 (0%)	11/20 (55%)	*Physical* Bending at work Chair armrests Disturbed by glare frequently Extreme work posture Hands above shoulder level Head posture while working with computer Heavy material handling Keyboard placement Lifting frequently >25 kg Mouse position Physical environment poor Physical work load Precision of work Repetitive movements Screen position Sitting >5 h/day Telephone shoulder rests Upper extremity posture while working with computer Weight carrying Working time with computer Working with cervical spine in flexion Workstation modification *Psychosocial* Help and support at your work High job strain Job control Job satisfaction Job security Stress at work	*Physical risk factors at work* The preponderance of evidence indicates that working in a sedentary position repetitive or precision work. We found evidence that working with the cervical spine in flexion for prolonged periods of time: – Inadequate keyboard position – Inadequate mouse position – Head posture while working at the computer – Interventions aimed at modifying work stations and workers' posture do not reduce the risk for neck pain among computer users *Psychosocial/organisation exposures* *Self reported, job strain* The preponderance of evidence indicates that workers exposed to high job strain/demands or low job control were more likely to develop neck pain than those exposed to lower *Self reported, social support* The preponderance of evidence indicates that workers who report low co-worker support are more likely to develop neck pain *Self-reported, job security* We found evidence that job security is associated with the risk of neck pain

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Table 4.6.7 continued

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Hansson et al 2001 [9] Physical	22/32 (69%)	16/32 (50%)	Bending while working Chair discomfort Computer screen work >6 h/day Demanding working position Dental patient´s position Dentist´s working position Driving distance per year Extreme work posture Hands above shoulder level Heavy material handling High working pace Highly repetitive work Hours of type-writing per day Hours working at keyboard Montonous work movements Neck flexion during work Perceived ergonomic load Physical stress at work Physical work load Repetitive movements Sitting >5 h/day Sitting posture Strenous muscular activity Time per work cycle in neck flexion Time per work cycle upper arm 0–30° abducted Time spent on telephone Turning neck/bending forward/bending aside while handling impact tool Twisted work postures Weight carrying Work title Working in standing position Working with elevated shoulders Working with office machines Work place lay-out	Limited evidence for an increased occurrence of neck problems for those exposed to work with a bent or twisted trunk and for an association between work place design and neck problems

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Table 4.6.7 *continued*

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Hansson et al 2001 [9] Psychosocial	13/24 (54%)	13/24 (54%)	High demands on attention High psychosocial demand/work load Job satisfaction Mental stress at work Unclear role at work Work overload	Strong association was found for an association between low job satisfaction and increased occurrence of …. neck pain. Limited evidence was found for the association between social support and the occurrence of neck problem
Hooftman et al 2004 [1] Gender Physical	5/9 (55%)	6/9 (67%)	*Physical* Highly repetitive work Upper extremity posture while working with computer *Psychosocial* High social support High work demands Job control	For lifting, strong evidence was found that men have a higher risk of neck-shoulder complaints than women. For arm posture, strong evidence was found that women have a higher risk of neck-shoulder complaints than men
Lakke et al 2009 [19] Physical	(part of) 5/5	4/5	*Physical* Total computer use time Mouse use time Keyboard use time	*Quality of evidence/risk factor* *Low* Computer use time and neck pain *Moderate* Mouse use time and neck pain *Moderate* Keyboard use time and neck pain
Veiersted et al 2006 [12] Computer work	2/7 (28%)	5/7 (71%)	*Physical* Chair armrests Disturbed by glare frequently Elbow angle >121° Head posture while working with computer Hours of VDT work >20 h/week Keyboard placement Longer daily video display use workhours Mouse position Sitting >5 h/day Telephone shoulder rests Working time with computer Working with VDU and job strain *Psychosocial* Limited rest break opportunities	Limited evidence of an association for neck pain with physical findings and computer use per se, and computer mouse time Limited evidence of an association for wrist tendonitis and computer use, and computer mouse time, and computer keyboard time

VDT = Video display terminal; VDU = Visual display unit

Table 4.6.8 *Systematic reviews on shoulder pain.*

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Bongers et al 2002 [13] Psychosocial	19/19 (100%)	11/19 (58%)	High quantitative job demands High qualitative job demands Low stimulus from work Low job control Few rest break opportunities Low job satisfaction High job stress Support non-work	Evidence presented as shoulder and/or elbow and/or wrist hand region: Evidence that high job demands and high job stress are associated with upper limb problems. General psychological distress is likely to be related to upper limb problems
Crawford et al 2008 [18] Physical	7/34 (20%)	2/34 (6%)	Work title (service technicians, call centre workers) Ladder handling Working overhead	Concerns musculoskeletal disorders. Musculoskeletal disorders and related risk factors occurred during a range of service technicians' work tasks (ie manhole removal, ladder handling, cable handling, road breaking). Risk factors at call centres included non-optimal work place layout and work organisation issues
Hansson et al 2001 [9] Physical	16/64 (25%)	36/64 (56%)	Work title (auto assembly-line; fruit packing; fruit picking, cannery work; meat packing, sewing machine work, welders, truck drivers, postmen, dental employees, typewriters, computer work) Repetition Static workload Shoulder abduction >30° Forward flexion 30° Repetitive work Physical stress (workload) Monotonous work Number of clients served Hands held less than 35° above shoulders	Strong evidence for a positive association between highly repetitive, static work with arms abducted/elevated more than 60 degrees and shoulder tendinitis. Even stronger association if these positions were combined with handheld tools above shoulder level. Limited evidence that the magnitude of tendinitis because of lack of data on exposure and diagnosis. Moderate (research-based) evidence that shoulder load may increase the risks for development of arthrosis in the acromioclavicular joint. Limited evidence for a positive association between neurogenic TOS and work related shoulder load
Ijmker et al 2007 [2] Computer work	7/7	5/7	Duration of computer use Ergonomic factors Mouse use hours Keyboard use hours	The neck-shoulder region seemed less susceptible to exposure to computer use than the hand-arm region. The low number of high-quality studies prevents drawing a firm conclusion

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Table 4.6.8 *continued*

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Lakke et al 2009 [19] Psychosocial	See Ijmker 2007 [2] 4/4	See Ijmker 2007 [2] 4/4	See Kuijpers 2004 based on cohort studies by Andersen 2003, Brandt 2004, Kryger 2003 and Lassen 2004	Overload at work: summarised results were positive but no evidence for risk factors
van Rijn et al 2010 [21] Physical	6/7	4/7	*Physical risk factors* Force (lifetime force requirements, force requirements, heavy lifting >20 kg 10 times a day) Repetitiveness (frequent shoulder movements) Posture (exposure time, micro-pauses, upper arm elevation >90°, working with hands above shoulders) Combined exposures (frequency and force, frequency and micro-pauses) *Psychosocial risk factors* Job demands Job control Social support Decision latitude Job satisfaction Job security	*Physical risk factors* The occurance of SIS was associated with highly repetitive work, forceful exertion in work, and akward postures *Psychosocial risk factors* The occurance of SIS was associated with high psychosocial job demand

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Table 4.6.8 *continued*

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Sherehiy et al 2004 [20] Physical	11/15 (73%)	6/15 (40%)	*Physical risk factors* Physical load Work posture Work task and activities Ergonomics of the ward Physical conditions of work environment *Psychosocial risk factors* Job demand Job control Job stress Job satisfaction Work content Personality traits Psychosomatic symptoms Social relations at work Institutional policy Organisation of work	*Physical risk factors* The strongest evidence for an association of physical factors with musculoskeletal disorders was found for physical load and manual lifting and handling of patients. Working and lifting in awkward and forward-bent postures produced especially high risk for musculoskeletal problems *Psychosocial risk factors* Consistent evidence (of an association) was found only for organisation factors (work schedule, nursing category, work shift, number of staff at the ward, social relations)
Veiersted et al 2006 [12] Computer work	1/5	3/5	Possible causal relationship between different aspects of computer work, including keyboard and mouse use, and neck and upper extremity musculo-skeletal disorders with physical findings	Insufficient evidence of possible association between computer work and shoulder tendonitis or shoulder myalgia (includes computer work per se, mouse time, keyboard time)
van der Windt et al 2000 [14] Physical	26/29 (90%)	16/29 (55%)	Occupational risk factors related to physical load and psychosocial factors	The available evidence was not consistent across studies and the associations were generally not strong

SIS = Subacromial impingement syndrome; TOS = Thorasic outlet syndrome

Table 4.6.9 *Systematic reviews on elbow pain.*

Author Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Bongers et al 2002 [13] Psychosocial	23/26 (88%)	11/26 (42%)	Job demand Stimulus from work Job control Social support Rest break opportunities Job stress	High job stress is consistently associated with upper extremity problems. High job demand is in most studies associated with upper extremity problems
Crawford et al 2008 [18] Physical	3/3	0/3	Service technicians Ladder handling Working overhead Call centre workers	A lack of consistency in the measurement tools and diagnostic criteria
Hansson et al 2001 [9] Physical	3/14 (21%)	4/14 (29%)	Years as dressmaker/textile worker/cook/butcher Work title Repetitive work Work load Repetitive motions Assembly line	The association between occupational factors and epicondylitis is weak. Weak evidence for solely repetitive work or solely heavy work as risk factors. Moderate evidence for an association between combined exposures (repetitive work and heavy work) and the development of lateral epicondylitis
van Rijn et al 2009 [15] Physical	4/10	2/10	Handling of loads Hand grip force Repetitiveness Repetitive work Posture/elbow strain Posture/turn and screw Elbow support Combined exposure Job control Social support	Indications that lateral epicondylitis is associated with the following physical risk factors: handling loads >20 kg at least 10 times per day, handling tools >1 kg, repetitive hand/arm movements >2 h/day, arms lifted in front of the body, hands bent or twist and precision movements during part of the working day. Psychosocial risk factors associated with the occurrence of lateral epicondylitis are low job control and low social support
Veiersted et al 2006 [12] Computer work	1/5	4/5	Typing time Mouse operating time Computer work time Forearm support Position of wrist	Insufficient evidence of an association between computer work per se, mouse time, keyboard time and epicondylitis

Table 4.6.10 *Systematic reviews on carpal tunnel syndrome.*

Autho Year Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Abbas et al 1998 [3] Physical	12/17 (70%)	2/17 (12%)	Job titles Ranges of movements Repetition Force	Contry of publication, study type, force and repetitive motion were significant predictors of risk. $R^{2\,adj}$ 0.43
Hansson et al 2001 [9] Physical	9/12 (75%)	3/12 (25%)	Repetition Force Position of wrist in hours Force – repetition	Strong evidence for the relation between highly repetitive work with the hands and carpal tunnel syndrome Moderate evidence for the relation between solely a power grip without other exposures as well as exposure only for non-neutral postures of the wrist and carpal tunnel syndrome
Thomsen et al 2008 [4] Physical	3/8 (37%)	3/8 (37%)	Daily hours with keyboard Years of computer work Job functions Hours of typing/week	Insufficient evidence to conclude that computer work (mouse and keyboard) causes carpal tunnel syndrome
van Rijn et al 2009 [16] Physical	15/24 (63%)	4/24 (17%)	Load on wrist Pinch grasp Manual work light/moderate/high Precision grip vs power grip Heavy lifting Handling cold items Work cycle time Frequency of mouse use Work h/week Hand-bending Right-handed mouse use	Consistent indications that carpal tunnel syndrome is associated with: – An average hand force requirement of >4 kg – Repetitiveness at work, – A daily 8-hour energy-equivalent frequency-weighted acceleration of 3.9 m/s^2
van Rijn et al 2009 [16] Psychosocial	1/4	2/4	High vs low social support Job control Time pressure Possibilities to take brakes Work strongly controlled by superiors Work demand Task control	Reported associations were not statistically significant

Table 4.6.11 *Systematic reviews on hand/wrist pain.*

Author Year of Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Bongers et al 2002 [13] Psychosocial	9/10	3/10	High qualitative job demands High quantitative job demands Low job control Low social support Few rest break opportunities Low job satisfaction High job stress	High job stress consistently associated with upper extremity problems. High job demands is also in most studies associated with these disorders. Firm conclusions on the role of these factors in the etiology of upper extremity problems are not possible due to the cross-sectional nature of most studies
Crawford et al 2008 [18] Physical Psychosocial	8/9	2/9	Working time at a VDT Duration in the job Workstation arrangements Telephone use (h/day) Computer time (h/day) Workload variety Physical exposure Psychosocial exposure Information processing demands Job stress	A lack of consistency in the measurement tools and diagnostic criteria. Much of the research was cross-sectional in design often involving small numbers of participants
Ijmker et al 2006 [2] Computer work	0/5	4/5	Duration of computer use Keyboard use time Mouse use Hours per week at VDT	Moderate evidence for a positive association between the duration of mouse use and hand-arm symptoms
Liss et al 1996 [17] Physical	5/5	1/5	Manual vs clerical work Bagging plant vs non-bagging Heavy vs non-manual work Brewery vs office Miners vs clerical	Given the cross-sectional designs one cannot tell if the positive associations between manual work and Duuytren's. Contracture are causal
Palmer et al 2007 [10] Physical	0/16	3/16	Occupational title (shoe assemblers, sewng machinists, forestry workers, assembly workers, meat cutters, textile workers)	Little consistent evidence of work activities associated with tenosyvitis and epicondylitis

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Table 4.6.11 *continued*

Author Year of Reference Exposure	Cross-sectional studies of all included	Studies from Scandinavia of all included studies	Risk factors included	Statement of evidence
Stock et al 1991 [5] Physical	0/2	2/2	Repetition Force Static loading Joint position	Strong evidence of a causal relationship between repetitive, forceful work and the development of musculoskeletal disorders of the tendon and tendon sheats in the hands and wrists and nerve entrapment of the median nerve at the carpal tunnel
Veiersted et al 2006 [12] Computer work	1/5	4/5	Working time with VDT Ergonomic factors (such as static work posture, leg space at table) Workload Break time Psychosocial exposures (such as job strain, social support, working night)	Limited evidence of an association between computer work per se, mouse time, keyboard time and wrist tendonitis

VDT = Video display terminal