

Table 2. Quality appraisal*

Author, Year	Question	Is the research question clearly stated	Were comparison groups(s) used?	Was intervention allocation described adequately?	Was recruitment rate reported?	Were pre-intervention characteristics described?	Was the loss to follow up (attrition)	Were important difference between remaining and dropouts examined?	Was intervention process adequately described?	Were intervention effects on exposure parameters documented?	Was the participation in the intervention documented? Were the UEMSD symptoms, signs, disorders, injuries, claims and/or lost time outcomes described at baseline and follow-up?	Was the length of follow-up 3 months or greater?	Was there adjustment for pre-intervention differences	Were the statistical analyses optimized for the best results?	Were all participants' outcomes analysed by the groups to which they were originally allocated?	Was there a direct between group comparison?	Total	%	Quality Rating	
	Weight	2	3	3	2	2	2	2	3	1	2	3	2	3	3	2	3			
	Max Score	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	
Rempel, 2012[65]		1	1	2	1	1	1	1	1	0	1	1	1	1	1	1	1	40	97.6	H
Haukka, 2008 [48]		1	1	2	1	1	1	0	1	1	1	1	1	1	1	1	1	39	95.1	H
Jay, 2011[50]		1	1	2	1	1	1	1	1	1	1	0	1	1	1	1	1	39	95.1	H
Parkkari, 2011[62]		1	1	2	1	1	0	1	1	1	1	1	1	1	1	1	1	39	95.1	H
Andersen, 2012[42]		1	1	2	1	1	0	1	1	0	1	1	1	1	1	1	1	38	92.7	H
van Eijsden-Besseling, 2008[69]		1	1	2	1	1	1	0	1	0	1	1	1	1	1	1	1	38	92.7	H
Vermeulen, 2011[70]		1	1	2	1	1	1	0	1	0	1	1	1	1	1	1	1	38	92.7	H

Heinrich, 2009[49]	1	1	2	1	1	1	1	0	0	1	1	1	1	1	1	1	1	37	90.2	H
King, 2013[53]	1	1	2	1	0	1	1	1	1	1	1	1	0	1	1	1	1	36	87.8	H
Meijer, 2009[58]	1	1	2	1	1	1	1	1	1	1	1	1	0	1	0	1	1	36	87.8	H
Andersen, 2008, 2010[39, 40]; Blangsted 2008 [41]	1	1	2	1	1	1	0	1	0	1	1	1	0	1	1	1	1	35	85.4	H
Mongini, 2008, 2009, 2010[59-61]	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	35	85.4	H
Levanon, 2012, 2012[55, 56]	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	34	82.9	M
Spekle, 2010[68]	1	1	2	1	1	0	0	1	1	1	1	1	0	1	1	1	1	34	82.9	M
Von Thiele Schwarz, 2008[71]	1	1	2	1	1	1	1	1	1	0	1	1	1	0	0	1	1	34	82.9	M
Pillastrini, 2009[64]	1	1	2	1	1	1	1	1	0	1	1	0	0	0	1	1	1	32	78.0	M
Shiri, 2011[67]	1	1	2	1	1	0	0	0	1	1	1	1	1	1	0	1	1	32	78.0	M
Zebis, 2011[72]	1	1	2	1	1	0	0	1	1	1	1	1	1	0	0	1	1	32	78.0	M
Driessen, 2011, 2008, 2011,	1	1	2	1	1	0	1	1	1	0	0	1	1	0	1	1	1	31	75.6	M

2012[44-47]																					
Mahmud, 2011[57]	1	1	2	0	1	1	0	1	1	0	1	1	0	0	1	1	29	70.7	M		
Pedersen, 2009[63]	1	1	2	1	1	0	0	1	0	1	1	1	0	0	0	1	28	68.3	M		
De Kraker, 2008[43]	1	1	2	0	1	0	0	1	1	1	0	0	1	0	0	1	25	61.0	M		
Robertson, 2008[66]	1	1	1	1	0	0	0	0	1	1	1	1	0	1	0	1	24	58.5	M		
Lacaze, 2010[54]	1	1	1	0	1	1	1	1	0	0	0	0	1	0	0	1	23	56.1	M		
Joshi, 2011[52]	1	1	1	0	1	1	1	0	0	0	1	0	0	0	1	1	22	53.7	M		
Jepsen, 2008[51]	1	1	1	0	0	0	0	1	0	1	1	1	0	0	0	1	21	51.2	M		
Pereira, 2013**[38]	1	1	2	1	0	0	0	0	0	0	1	0	0	0	0	1	19	46.3	L		
Bernaards, 2010**[35]	1	1	1	1	1	0	0	0	0	1	0	1	0	0	0	1	19	46.3	L		
Laestadius, 2009**[36]	1	1	1	0	1	0	0	0	1	0	1	1	0	0	0	1	19	46.3	L		
Choobineh, 2011**[37]	1	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	15	36.6	L		

*Note the quality appraisal of studies published before 2009 can be found in Kennedy et al. 2010[18]

**Excluded from analysis due to lower quality scores

H=high quality, M=medium quality, L=low quality

Table 3. Study intervention descriptions and outcome summaries organized by Intervention Category. Note when there are multiple interventions the non-relevant intervention is in light grey text.

Author, Year	Quality	Intervention description	Outcome
Intervention Category: Resistance exercise			
Jay, 2011[44]	High (39)	I: Kettlebell training: 5-10 min warm up with 10-15 min progressive weight interval training. C: No intervention.	+ (I vs C) neck/shoulder pain intensity
Andersen, 2012[45]	High (38)	I1, I2, I3: Dumbbell strength training exercises: front raises, lateral raises, reverse flies, shrugs and wrist extensions. I1: 1 hour per week, I2: 20 min three times per week, I3: 7 min nine times per week. C: No intervention.	+ (I1, I2, I3 vs C) right shoulder; ∅ (I1, I2, I3 vs C) neck; ∅ (I1, I2, I3 vs C) left shoulder
Sjogren, 2005[46]	High (37)	I: "Progressive light resistance training" exercise, on-site with physiotherapist guidance in 20 min group sessions over 15 weeks. 6 min training sessions in 3 five-week intervals—1st: 19/day, 2nd and 3rd: 1-2 per day, (7-89/week). C: No intervention. I1C: Cross-over with intervention first (15-week I then 15-week C). I2C: Cross-over with intervention second (15-week C then 15-week I).	+ (I vs C) intensity of neck symptoms ∅ (I vs C) intensity of shoulder symptoms
Andersen, 2008, 2010[47, 48]; Blangsted 2008 [49]	High (35)	I1: Specific resistance training 20 min 3 times per week. I2: All round physical exercise 1 hour weekly. C: Encouraged to form groups to improve health and working conditions.	+ (I1 vs C) neck, elbow, hand, pain intensity; + (I1 vs C) maximal muscle strength; ∅ (I1 vs C) neck pain duration; ∅ (I1 vs C) shoulder pain, intensity and duration
Pillastrini, 2009[50]	Medium (32)	I: Physical therapist led extension-oriented exercise program. Exercises reinforced lumbar extension and strengthened the spine primary stabilizers (transversus abdominis, oblique abdominal, multifidus, quadratus lumborum and erector spinae muscles).	+ (I vs C) neck pain 0-10 VAS

Zebis, 2011[51]	Medium (32)	I: High-intensity strength training with four dumbbell exercises for neck and shoulder muscles and 1 exercise for the wrist extensor muscles. C: Advised to stay physically active and received weekly supervisor consulting for 20 weeks.	+ (I vs C) neck pain intensity; neck pain case status change from baseline; shoulder pain case status change from baseline Ø shoulder pain intensity
Pedersen, 2009[52]	Medium (28)	I1: Strength resistance training with dynamic exercises with dumbbells for shoulder girdle muscles and isometric exercises for cervical spine muscles. I2: All round physical exercise encouraging participants to engage in various physical activities at the worksite and during leisure time with instruction from experts 1 to 4 times a month. C: Encouraged workers to organize and meet surrounding work place health conditions. Workers could get help but researchers did not implement changes.	+ (I1 vs C) pain duration right shoulder; pain duration low back; Ø (I1 vs C) pain duration neck
<i>Intervention Category: Forearm supports (added to workstation)</i>			
Rempel, 2006[53]	High (40)	I1: Trackball and ergonomics training. I2: Forearm support board and ergonomics training. I3: Forearm support board, trackball and ergonomics training. C: Only the ergonomics training.	+ (neck/sh, RUE pain) Ø (LUE pain) + (neck/sh disorders) Ø (R&LUE disorders) (I2&I3 vs I1&C) * the forearm effect is w or w/o trackball.
Conlon, 2008[54]	High (36)	I3: Alternative mouse with forearm support board. I2: Conventional mouse with forearm support board. I1: Alternative mouse without forearm support. C: Conventional mouse without forearm support board.	+ (I2&I3 vs I1&C) (RUE) Ø (I2&I3 vs I1&C) (neck/sh, LUE)
Lintula, 2001[55](I1 one hand, I2 both hands)	Medium (30)	I1: One Ergorest® arm support with a mouse pad for the mousing hand. I2: Ergorest® arm supports for both hands with a mouse pad for the mousing hand. C: No arm supports and instructed not to change workstations during study period.	Ø (I1 vs. I2 vs. C) (neck/sh/arm)
<i>Intervention category: Vibration feedback about static mouse use</i>			

King, 2013[56]	High (36)	I: Hoverstop mouse with a feedback signal that caused mouse to vibrate when the hand was on or above the mouse and mouse did not move for 10 seconds. A short information session about how to interpret feedback was provided. C: Alternative mouse with vibration mechanism turned off.	+/ \emptyset (I vs C) shoulder \emptyset (I vs C) UE
Meijer, 2009[57]	High (36)	I: Hoverstop mouse with a feedback signal that caused mouse to vibrate when the hand was on or above the mouse and the mouse did not move for 10 seconds. A short information session about how to interpret the feedback was provided. C: Mouse without feedback feature.	+ (I vs C) physical disability \emptyset (I vs C) UE
de Kraker, 2008[58]	Medium (25)	I: Hoverstop mouse with a feedback signal that caused mouse to vibrate when the hand was on or above the mouse and mouse did not move for 10 seconds. A short information session about how to interpret the feedback was provided. C: Control group kept working with the regular mouse: same features as experimental mouse but without the tactile, vibrating feedback signal.	\emptyset (I vs C) arm/ shoulder
<i>Intervention category: Stretching exercise programs (including Yoga) with an UE component</i>			
Mongini, 2008; 2009; 2010[59-61]	High (35)	I: Brief shoulder and neck exercises performed several times a day, a relaxation exercise, and instructions on how to reduce craniofacial and neck muscle parafunction and hyperfunction. C: No intervention.	+ (I vs C) frequency of neck pain; neck shoulder pain;
Galinsky, 2007[62]	Medium (31)	I1: Neck, shoulders, back, and upper extremities stretching for 2 minutes at every break. C: No stretching. Note: Mixed design with stretching as between-subject factor and breaks as within-subject factor. Within both groups, over the 8 weeks, workers spent 4 weeks with conventional breaks every two hours (15-minute breaks in morning and afternoon and 30-minute break for lunch) and 4 weeks with a break every hour (conventional schedule plus four five-minute breaks).	\emptyset (I1 vs C) (Musculoskeletal discomfort ratings were made for neck, shoulders, upper arms, elbows, forearms, wrists, hands)

Lacaze, 2010[63]	Medium (23)	I: Daily 10-min exercise program with 10 different sets of exercises, including stretching (hamstrings, spinal column, forearms, and shoulders), joint mobilization (hands, wrists, shoulders, column, hips, knees and ankles) and relaxation. C: Daily 10-min rest break with no physical activity or work tasks.	∅ (I vs C) neck and shoulder discomfort; neck and shoulder improvement
Joshi, 2011[64]	Medium (22)	I1: 3 x 1h/day counseling by physiotherapists and 3 x 1h/day yoga training. I2: 3 x 1h/day counseling by physiotherapists.	+ (I1 vs I2) Symptom severity score; + (I1 vs I2) Cervico-thoracic myalgia; ∅ (I1 vs I2) Functional status score; ∅ (I1 vs I2) Tingling; ∅ (I1 vs I2) on Weakness; ∅ (I1 vs I2) on Numbness; ∅ (I1 vs I2) on Nocturnal exacerbation.
Jepsen, 2008[65]	Medium (21)	I: Stretches (4) for wrist, forearm, and shoulder repeated 3X per day for 6 months. C: Questionnaire and physical examinations.	+ (I vs C) shoulder symptoms; ∅ (I vs C) elbow or wrist/hand symptoms; pain level
Nevala Puranen, 2003[66]	Medium (21)	I1: Redesign of workstations (included workstation placement in room, new worktables allowing forearm/hand support, new adjustable chair, more table space, monitors placed below eye level, paper holders provided, heights of tables and chairs adjusted for each subject, training on possibilities for adjustment, new mice and standard flat keyboards were acquired if needed). I2: Redesign of workstations (same as I1) plus training on work technique (included the use of the mouse with both hands, use of earphones for telephone communications and instruction on daily stretching exercises (for 2 minutes at regular intervals. when sitting at workstation) for upper extremity).	+ (I2 vs. I1) on neck, shoulder, and elbow symptoms ∅ (I2 vs. I1) on wrist symptoms
Intervention category: EMG Biofeedback (+/- ergo training)			

Faucett, 2002[67]	High (39)	I1: Muscle learning therapy (MLT) that used sEMG (Electromyographic) feedback and operant conditioning to decrease muscle tension. I2: Education (by an occupational health nurse) using adult learning and cognitive behavioural techniques in small group discussions to advance worker's capabilities for symptom and stress management and problem solving. C: No intervention.	∅ (I1 vs C) (UE/neck/sh)
Voerman, 2007[68]	High (36)	I: Ergonomic counseling on workstation adjustments via weekly visits by therapist (physiotherapist, health scientists) for four weeks. First visit comprised an ergonomic risk inventory and discussions with the worker about possible improvements. Workstation adjustments focused on modifying existing workstation (no new equipment). Remaining visits used to further discuss the ergonomic aspects and ergonomic adjustment consequences. In addition, workers received ambulant myofeedback training (consisted of shoulder/neck relaxation methods to reduce EMG inactivity recorded and training in a muscle reset procedure). C: Received same information as Intervention group with the exception of ambulant myofeedback.	∅ (I vs C) (sh/neck)
Levanon,2012; 2012[69, 70]	Medium (34)	I1: Ergonomics intervention with biofeedback. I2: Ergonomics Intervention without Biofeedback -- muscle activity was assessed through palpation. Oral feedback was provided. C: Received short oral presentation on how to sit, the preferred height of chair, table, keyboard and screen, and the NIOSH recommended position of the back, shoulders elbows and wrists.	+ (I1 vs I2) hand pain severity score
Peper, 2004 [71]	Medium (25)	I: Training of six weekly two hour group sessions in ergonomic principles, psychophysiological awareness and control, sEMG feedback while practicing at the workstation. C: No intervention.	+ (I vs. C) (neck/sh, arms, wr/hand)

Thomas, 1993[72]	Medium (22)	I: Biofeedback training (audible EMG biofeedback using Pocket Ergometer™ Model PE102 with electrodes placed on forearm extensor and flexor muscles) to discourage awkward hand postures and excessive force exertion with fingers. Used device for one hour per day. C: No intervention.	∅ (I vs C) (forearm/hands)
<i>Intervention category: Job stress management training (UE outcomes)</i>			
Horneij, 2001[73](I2)	High (39)	I1: individually designed physical training program based on baseline physical exam results. Exercises included: posture, balance, muscular endurance (for back, neck, abdominal, shoulder), functional exercises, stretching exercises, cardiovascular fitness exercises. Advised to perform as often as possible and at least twice a week. I2: Stress management program based on group instruction sessions focused on "perceived stress induced by lack of social support, low decision latitude/work control, and perceived high psychological work load." Groups (five to 12 subjects) met seven times over seven weeks, each time for 1.5 hours. Follow-up meetings covering both "theory and practice" occurred at three and six months. C: No intervention.	∅ (I2 vs C) (neck, sh)
Feuerstein, 2004[74]	High (36)	I: Worksite checklist evaluation by a health professional, workstation adjustments (no new equipment), stretching exercises and access to an ergonomics information website (ErgoClinic). Workers also received interactive job stress management education during two 70-minute meetings held two weeks apart followed by an email with a healthy computing tip every two weeks. C: Worksite checklist evaluation by health professional, workstation adjustments (no new equipment), stretching exercises and access to the ErgoClinic website.	∅ (I vs C) (neck/UE)
<i>Intervention category: Workstation adjustment with minimal worker engagement</i>			

Pillastrini, 2007[75]	High (41)	I: Individual workstation adjustments by trained/expert physical therapist, approx 30 minutes per individual at baseline and five to 10 minutes twice a month for five months. Brochure about VDT and MSDs was provided. C: informative brochure about VDT and MSDs.	∅ (I vs C) (sh, hand/wr, neck)
Shiri, 2011[76]	Medium (32)	I: Work accommodations, physiotherapist visiting the workplace and making recommendations regarding ergonomic improvements to improve UE disorder recovery. C: No intervention.	∅ (I vs C) pain intensity; pain interference with work; sickness absence due to UE MSD
Lin, 2007[77]	Medium (31)	I: Redesigned workstations (mainly to reduce shoulder loadings), according to workstation specification design by Occupational Safety and Health Administrations of Oregon State (OR-OSHA, 2004). C: Original workstations (matched by their similarity of age, height, weight, employment duration, working practice, and musculoskeletal (MSK) risk factors and symptoms).	∅ (I vs C) (sh) at 3 months
Robertson, 2008[78]	Medium (24)	I1: Workstation changes only: a new flexible office work space with adjustable workstations and a highly adjustable chair. I2: Workstation changes and training: a two-hour office ergonomics training with a follow-up ergo-buddy workstation assessment supported by the training facilitation. C: Control: no intervention.	+ (I1 v C) wrist/hand, finger at T1 v T3 ∅ (I1 v C) Neck, Shoulder, Elbow at T1 vs T3
<i>Intervention category: Aerobic exercise program</i>			
Andersen 2008,2010[47, 48], Blangsted 2008 [49]	High (35)	I1: Specific resistance training (SRT) 20 min 3x a week. I2: All round physical exercise (APE) 1 hour a week. C: Participants were encouraged to form groups to improve health and working conditions.	+ (I2 vs C) neck, shoulder, elbow, hand pain intensity; maximal muscle strength; ∅ (I2 vs C) neck pain duration; shoulder pain, intensity and duration
Von Thiele Schwarz, 2008[79]	Medium (34)	I1: Physical-exercise group. I2: Reduced-work hours group (RWH). C: No intervention.	∅ (I1 vs C) UE disorder

Pedersen, 2009[52]	Medium (28)	<p>I1: SRT dynamic strengthening exercises with dumbbells for the shoulder girdle muscles and isometric exercises for the cervical spine muscles.</p> <p>I2: Participants encouraged to engage in various types of physical activities at work and during leisure time with instruction from experts 1 to 4 X a month.</p> <p>C: Encouraged workers to organize and meet surrounding work place health conditions. Workers could get help but researchers did not implement change with this group.</p>	+ (I2 vs C) pain duration right shoulder; pain duration low back;(I2 vs C) pain duration neck ;
Intervention category: Alternative keyboards- key force profile			
Rempel, 1999 [80]	High (38)	<p>I: Keyboard with alternative switch design: the key force-displacement profiles have a greater travel distance until the key is "made" and greater "dampening" when the key reaches the bottom of its travel.</p> <p>C: Conventional keyboard.</p>	+ / Ø (I vs C) on reducing Phalen's test time and nerve conduction
Intervention category: Lighter/wider handle dental tools			
Rempel, 2012[81]	High (40)	<p>I: Introduction of light dental scaling instrument with larger diameter.</p> <p>C: Heavier, smaller diameter dental instrument.</p>	+ (I vs C) right shoulder pain; number of nights that participants were awakened with numbness in the right thumb or index or middle finger; Ø right wrist/hand, elbow/forearm pain
Intervention category: Postural exercise program			
van Eijsden-Besseling, 2008[82]	High (38)	<p>I1: The Mensendieck/Cesar exercises use of feedback from muscle, joint, tendon, and ligaments, therapist instructions, mirrors and videotaping. Training includes patient-specific everyday activities such as computer work. Postural exercises at home in front of a mirror and at their work place. Intervention is 10 weeks with 12 sessions lasting a total of 1.5 hours longer than I2.</p> <p>I2: PT strength and physical fitness training with 18 sessions in 10 weeks.</p>	+ (I1 vs I2) on Pain VAS (0-10) at 3 months; Ø (I1 vs I2) number of participants with complaints; Ø (I1 vs I2) Pain VAS (0-10) at 6, 12 months; Ø (I1 vs I2) DASH (0-100) at 3, 6 12 months
Intervention category: Neuromuscular exercise intervention (military)			

Parkkari, 2011[83]	High (39)	<p>I: Military recruits participated in neuromuscular training (9 exercises) to improve balance, posture, coordination and agility and received injury prevention training. During first 8 weeks recruits worked in groups for 30-45 minutes 3 X per week at moderate intensity. In weeks 9-26 they were instructed to continue exercises at least once weekly and exercise logs were reviewed weekly. They performed group exercises 2-4 X per month on top of usual training regimen (below). Injury prevention training was an informational booklet a one hour lecture/video.</p> <p>C: Usual training regimen of the Finnish army (17 hours weekly including marching cycling, skiing, swimming, orienteering, drill training and 7 hours of additional physical activity including jogging, team sports and circuit training).</p>	<p>+ (I vs C) risk for acute upper extremity injury among men with moderate to high baseline fitness; Ø (I vs C) risk for acute upper extremity injury among all men in study group</p>
<i>Intervention category: Specialized exercise program (+/- Feldenkrais)</i>			
Lundblad, 1999[84]	High (36)	<p>I1: Physiotherapy: 50 minutes twice a week (5 to 8 per group) for 16 weeks. Included training on postural awareness, stabilization exercises, relaxation techniques, lifting techniques and exercise training (included strength, coordination, endurance and flexibility training). Also received home exercise program.</p> <p>I2: Exercises according to Feldenkrais methods (includes sensory awareness of pattern of movement, aim to increase body awareness, coordination and control). Individual instruction four times and in a group (7 to 8 subjects/group) 12 times. Also received audiotapes with a total of eight exercises. Intervention lasted 50 minutes/week and subjects performed home exercises.</p> <p>C: No intervention.</p>	<p>+ (I2 vs. I1 and C) on prevalence of neck pain in the previous seven days Ø (I1 and I2 vs. C) on prevalence of shoulder pain in the previous seven days, complaint indices (neck-index, shoulders-index, neck-shoulders-index), VAS (neck and shoulder)</p>
<i>Intervention category: New adjustable chair with different seat pans (non-office)</i>			
Rempel, 2007[85] I1 (curved) and I2 (flat)	High (38)	<p>I1: New adjustable height curved seat pan chair and miscellaneous items.</p> <p>I2: New adjustable height flat seat pan chair and miscellaneous items.</p> <p>C: miscellaneous items (footrest, small table-top storage box for items, scissors, side table, task lamp and reading glasses).</p>	<p>+ (I1 vs I2 vs C) (neck/sh)</p>
<i>Intervention category: Rest breaks (office based)</i>			

Galinsky, 2007[62]	Medium (31)	<p>Mixed design with stretching exercise (Neck, shoulders, back, and upper extremities stretching for 2 minutes at every break) as a between-subject factor and rest-break schedule as a within-subject repeated measures with randomized order.</p> <p>Over the 8 weeks, all workers spent (C) 4 weeks with conventional breaks every two hours (15-minute breaks in morning and afternoon and 30- minute break for lunch) and (I2) 4 weeks with a break every hour (conventional schedule plus four five-minute breaks).</p>	+ (C vs I2) (neck, Rsh/upper arm, Rforearm/wr/hand, Lsh/upper arm, Lforearm/wrist/hand)
Galinsky, 2000[86]	Medium (29)	<p>IC: Workers alternated between an intervention and a control rest break schedule every four weeks. The control/conventional (C) schedule involved a break every two hours (15-minute breaks in am and pm and a 30-minute break for lunch). The intervention (I) schedule involved a break every hour. (conventional schedule plus four five-minute breaks). Workers were prompted to take breaks by electrical timers.</p>	+ (I vs C) (neck, Rsh/upper arm, Relbow, Rforearm/wr/hand, Lsh/upper arm, Lelbow) Ø (I vs C) (Lforearm/wrist/hand)
McLean, 2001[87] (I1 q40 min, I2 q20 min)	Medium (28)	<p>I1: Workstation assessment and adjustments. Ergobreak™ software prompted users to take 30-second breaks every 40 minutes.</p> <p>I2: Workstation assessment and adjustments. Ergobreak™ software prompted users to take 30-second breaks every 20 minutes.</p> <p>C: Workstation assessment and adjustments. Ergobreak™ software installed but provided no prompting; subjects told to take breaks whenever they wanted.</p>	+ (I2 vs C) forearm/wr Ø (I2 vs C) neck, sh Ø (I1 vs C) neck/sh/forearm/wr
van den Heuvel, 2003[88]	Medium (26)	<p>I1: Break reminder software. Software prompted user to take a five-minute break after 35 minutes of continuous computer usage and a seven-second break after five minutes of continuous computer usage. Also, workstation adjustment and training were provided.</p> <p>I2: Break reminder software plus exercise. Same as I1 plus software prompted user to do exercises during the breaks.</p> <p>C: Only workstation adjustment and training.</p>	Ø (I1 vs C) (neck/sh, arms/elbows/forearms/wr/hands/ fingers)
<i>Intervention category: Trackball pointing device (+/- forearm support)</i>			

Rempel, 2006[53] (Trackball)	High (40)	I1: Trackball and ergonomics training. I2: Forearm support board and ergonomics training. I3: Forearm support board, trackball and ergonomics training. C: Only the ergonomics training.	+ (LUE) pain & disorders Ø (neck/sh, RUE) pain & disorders (I1&I3 vs C&I2)
<i>Intervention category: Neck school program (+/- reinforcement)</i>			
Kamwendo, 1991[89]	Medium (30)	I1: Traditional neck school (four hours): four trainings by a physiotherapist on active and stretching exercises and muscle relaxation. I2: Traditional neck school plus reinforcement (two hours): physiotherapist visited the workplace to discuss ergonomic changes and provided written instructions, plus a psychologist interviewed the user to develop a personal coping strategy. C: No intervention.	Ø (I1 or I2 vs. C) on neck and shoulder pain
<i>Intervention category: Work redesign to allow for reduced shoulder loads (non-office)</i>			
Luijsterburg, 2005[90]	Medium (33)	I: Bricklayers that implemented raised bricklaying. C: Bricklayers that did not implement raised bricklaying.	Ø (I vs. C) (sh, hand/wr)
Veiersted, 2007[91]	Medium (27)	I1: Written information on ergonomic recommendations formulated in cooperation with experienced hairdressers (take breaks, relax neck and shoulders, reduce work with elevated arms, check arm position in a mirror, use helping devices). This was followed by a visit by an occupational therapy student who provided education on the background of the five recommendations and gave them a pamphlet. I2: Written information (same as I1) plus personal follow-up with a demonstration and discussion of each recommendation (10 minutes).	Ø (I1 vs. I2) (neck, sh)
van der Molen, 2004[92]	Medium (26)	I: Mechanical lifting with a crane (adjusted method), transporting materials with a crane (bricks and mortar). C: Manual (conventional method). Note: I1C: Cross-over with intervention first. I2C: Cross-over with intervention second. Order of I and C was varied across participants (each participant took part in both conditions (I and C), condition order and time of observation am/pm was randomly assigned).	Ø (I vs C) (sh)

Fredriksson, 2001[93]	Medium (21)	I: Change from lineout to line production in car body sealing. The cars were placed on "palettes," which moved ahead slowly along the line and work was performed on these moving platforms and allowed individually adjustable heights on the sides of cars, but not in front of or behind them. The height of the car was also adjustable. Four times a day the workers changed stations. C: No change in work process (another car-body department with most similar working conditions to intervention group).	Ø (I vs. C) (neck, sh, hand/wr)
<i>Intervention category: Joystick pointing device (+/- arm supports)</i>			
Conlon, 2008 [54]	High (36)	I1C2: Alternative mouse (vertical mouse) without forearm support board. C1I2: Conventional mouse with forearm support board. C1C2: Conventional mouse without forearm support board. I1I2: Alternative mouse with forearm support board.	Ø (I1 vs C1) neck/sh, R&LUE; neck/sh, R&LUE
<i>Intervention category: Individualized exercise program (+/- stress management)</i>			
Horneij 2001[73]	High (39)	I1: Individually designed physical training program based on baseline physical exam results. Exercises included: posture, balance, muscular endurance (for back, neck, abdominal, shoulder), functional exercises, stretching exercises, cardiovascular fitness exercises. Advised to perform as often as possible and at least twice a week. I2: Stress management program based on group instruction sessions focused on "perceived stress induced by lack of social support, low decision latitude/work control, and perceived high psychological work load." Groups (five to 12 subjects) met seven times over seven weeks, each time for 1.5 hours. Follow-up meetings covering both "theory and practice" occurred at three and six months. C: No intervention.	Ø (I1 and I2 vs. C) on neck and shoulder pain (Nordic Musculoskeletal Questionnaire)
<i>Intervention category: Low intensity participatory ergonomics program</i>			

Haukka, 2008[94]	High (39)	I: The workers identified problems in their work and generated and evaluated solutions for them. The changes were implemented together with the workers, middle management and technical staff. C: Three monthly visits to distribute questionnaires and document spontaneously occurred ergonomic changes.	+ (I vs C) MSK pain in neck at three months; MSK pain in forearms or hands at 3 and 9 months; Ø (I vs C) MSK pain in neck at 6, 9, 12 months; MSK pain in forearms or hands at 6 and 12 months; MSK pain in shoulder at 3,6, 9, 12 months;
Vermeulen, 2011[95]	High (38)	I: Intervention group participants received usual care and then were referred to participate in a RTW program to discuss obstacles for returning to work. C: Usual care.	Ø (I vs C) Neck Pain intensity (1-10 score)
Driessen, 2011; 2008; 2011; 2012[96-99]	Medium (31)	I: Followed steps of the Stay@Work participatory ergonomics programme which involves identifying risks, ergonomic measures and creating an implementation plan. C: Watched 3 educational films.	Ø (I vs C) neck pain at 3, 6, 9, 12 months; Ø (I vs C) the probability of preventing neck pain
Laing, 2007[100]	Medium (24)	I: Participatory ergonomic approach (consisted of a project steering committee, an ergonomic change team and an ergonomic program implementation blueprint). Aimed at improving communication and psychosocial exposures. C: No intervention.	Ø (I vs. C) on pain severity of shoulder/upper arm and forearm/hand
<i>Intervention category: Ergonomics training and workstation adjustment (+/- new chair)(office-based)</i>			
Ketola, 2002[101] (high I2 & low I1 intensity)	High (39)	I1: Ergonomic checklist, evaluation and adjusted workstations with physical therapist. New forearm and wrist rests provided if needed I2: Same ergonomic checklist and attended a one-hour group training session (two to six persons) on ergonomics and rest breaks. C: Leaflet on musculoskeletal health and VDT use.	Ø (I1 vs C) (neck, R&Lneck/sh, R&L sh, R&L forearm, R&L wr, R&L fingers) at 10 months Ø (I2 vs C) (neck, R&Lneck/sh, R&L sh, R&L forearm, R&L wr, R&L fingers) at 10 months

Gerr, 2005[102]	High (37)	I1: Training and workstation adjustments based on protective factors identified from prior studies. I2: Training and workstation adjustments based on OSHA, NIOSH and private industry standards. C: No instruction, but received the same visits from the study staff.	∅ (I1 vs I2 vs C) (arm/hand, neck/sh)
Martin, 2003 [103](and Gatty, 2004)[104]	High (36)	I: Individual training for one hour per week for four weeks in body mechanics, workstation adjustments and task modification. C: No intervention.	∅ (I v C) (elbow/forearm) ∅ (I vs C) (neck, sh, wr/hand)
Levanon, 2012; 2012[69, 70]	Medium (34)	I1 vs C, I2 vs C I1: Ergonomics intervention with biofeedback (This intervention was accompanied by traditional biofeedback which is appropriate for pain prevention as well as chronic pain.) I2: Ergonomics Intervention without Biofeedback -- muscle activity was assessed by the researcher through palpation and oral feedback was provided. C: Received short oral presentation on how to sit, the preferred heights of the chair, table, keyboard and screen, and the best position of the back, shoulders elbows and wrists, based on NIOSH recommendations.	+ (I1 vs C, I2 vs C) shoulder, neck ∅ (I1 vs C, I2 vs C) wrist, elbow
Cook, 2004[105]	Medium (33)	I: Education about workstation set-up and working posture and workstations were adjusted to support the forearm on the desk surface (no new equipment). Participants were monitored for the first few hours to ensure that they were not adopting postures of trunk flexion, shoulder elevation or increased wrist extension. C: Education about workstation set-up and working posture and, where required, adjustments to desk, chair and monitor height were made according to Australian standards.	∅ (I vs C) (neck, sh, forearm, wr)
Mahmud, 2011[106]	Medium (29)	I1: Training over 1 day. The first session consisted of lectures on office ergonomics, understanding the relationship between office ergonomics and the development of MSDs, ergonomic improvements and adjustments of workstations, and stretching exercises. The second session focused on the practical aspects of the training; trainers visited the participants' workstations and provided assistance to them on how to adjust workstations effectively. C: No ergonomic training or visit to adjust workstation	+ (I vs C) Prevalence of Neck Pain; + (I vs C) Prevalence of Right Shoulder Pain; + (I vs C) Right upper limb; + (I vs C) Left Upper Limb ∅ (I vs C) Prevalence of Left Shoulder Pain;

Robertson, 2008[78]	Medium (24)	I1: Workstation adjustment only: a new flexible office work space with adjustable workstations and a highly adjustable chair. I2: Workstation adjustment and training: a two-hour office ergonomics training with a follow-up ergo-buddy workstation assessment supported by the training facilitation. C: Control: no intervention.	+ (I2 vs C) Neck, Shoulder, wrist/hand, finger at T1 vs T3 Ø (I2 v C) Elbow, at T1 vs T3
Nevala Puranen 2003[66]	Medium (21)	I1: Redesign of workstations (included workstation placement in room, new worktables allowing forearm/hand support, new adjustable chair, more table space, monitors placed below eye level, paper holders provided, heights of tables and chairs adjusted for each subject, training on possibilities for adjustment, new mice and standard flat keyboards were acquired if needed). I2: Redesign of workstations (same as I1) plus training on work technique (included the use of the mouse with both hands, use of earphones for telephone communications and instruction on daily stretching exercises (for 2 minutes at regular intervals when sitting at workstation) for upper extremity).	+ (I2 vs. I1) on neck, shoulder, and elbow symptoms Ø (I1 vs. I2) on wrist symptoms
<i>Intervention category: Cognitive behavioural training (UE outcomes)</i>			
Faucett, 2002 (12)[67]	High (39)	I1: Muscle learning therapy (MLT) that used sEMG (Electromyographic) feedback and operant conditioning to decrease muscle tension. I2: Education (by an occupational health nurse) using adult learning and cognitive behavioural techniques in small group discussions to advance worker's capabilities for symptom and stress management and problem solving. C: No intervention.	Ø (I2 vs C) UE/neck/sh

Heinrich, 2009[107]	High (37)	<p>I1: Physical training including cardiovascular training, strengthening, relaxation exercises and posture exercises.</p> <p>I2: Cognitive behavioural training to focus the participant on the functional level they could achieve at work for 30 minutes/session over 2-3 sessions of 6-8 workers per week. Each session was 1-1.5 hours for 3 months. The remainder of each session was usual physical training (comparison group) including cardiovascular training, strengthening, relaxation exercises and posture exercises. Workplace specific exercises were developed after a video was taken of participants' workplace (all self-employed) to develop exercise tailored to workplace.</p> <p>C: Usual care.</p>	<p>+ (I1vs C) Pain, claim duration at 6 months;</p> <p>∅ (I2vs C) Pain, claim duration at 6 months;</p> <p>∅ (I1, I2 vs C) Functional status NPDI, QBPDS at 6 months;</p> <p>∅ (I1, I2 vs C)) Pain, Functional status NPDI, claim duration, QBPDS at 12 months;</p>
<i>Intervention category: Ergonomic training (office based)</i>			
Greene, 2005[108]	Medium (31)	<p>I: Active ergonomics training consisting of two, three-hour training sessions in one week.</p> <p>IC: Delayed intervention after two weeks of follow-up.</p> <p>Note: "After participants were randomly assigned to [intervention] groups, the physical proximity of participant work location in the intervention and control groups was assessed. To minimize diffusion of treatment effects, participants from the same work location were assigned to the same [intervention] group." So, although the word "randomly" was used, it appears that some kind of cluster grouping was then established with methods that are not provided.</p>	∅ (I vs. IC) (sh/upperarm/elbow/forearm/wr/hand)
Bohr, 2000[109]	Medium (26)	<p>I1: One-hour traditional ergonomics training session consisting of lecture and handouts about office ergonomics.</p> <p>I2: Two-hour participatory ergonomics training session with problem solving.</p> <p>C: No intervention.</p>	+ (I1 or I2 vs C) (neck/upper back/shoulder/upper arm/forearm/wrist/hand)

Robertson, 2008[78]	Medium (24)	I1: Workstation adjustment only: a new flexible office work space with adjustable workstations and a highly adjustable chair. I2: Workstation adjustment and training: a two-hour office ergonomics training with a follow-up ergo-buddy workstation assessment supported by the training facilitation. C: Control: no intervention.	+ (I1 vs I2) Neck, Shoulder, wrist/hand, finger at T1 v T3 Ø (I1 vs I2) Elbow, at T1 v T3
Intervention category: Alternative keyboard (split keyboard)			
Tittiranonda, 1999[110]	Medium (29)	I1: Apple Adjustable Keyboard™ (adjustable split) plus one-hour ergonomics training. I2: Comfort Keyboard System™ (adjustable split) plus one-hour ergonomics training. I3: Microsoft Natural Keyboard™ (fixed split) plus one-hour ergonomics training. C: Conventional keyboard plus one-hour ergonomics training.	+ (I3 vs C) (arm/hand) Ø (I1 or I2 vs C) (arm/hand) Ø (I1 or I3 vs C)
Intervention category: OHS training (2-3 hours) and/or ergonomic advice and/or exercise and/or medical examination			
Leclerc, 1997[111]	Medium (32)	I: Multiple interventions across multiple worksites tested. Interventions included OHS training and/or ergonomics advice and/or exercise and/or medical examination. C: Usual injury prevention policies.	+ (I vs C) (sh) Ø (I vs C) (neck; upper back)
Intervention category: Individualized interventions (office-based)			
Spekle, 2010[112]	Medium (34)	I: The RSI QuickScan, A short office ergonomic hazard identification tool, was completed and each participant received a scorecard. 16 different types of interventions were offered that were paid for by the employer. The following interventions were completed: visiting an occupational physician, obtaining an eye exam, education on RSI prevention, a single office visit with personalized workstation adjustments, a task analysis and a stress prevention training. C: Usual care.	Ø (I vs C) Arm shoulder and neck symptoms, proximal symptoms, Distal symptoms;
Patient handling program			

Yassi, 2001[113]	Medium (22)	I1: "Safe-lift" policy; lifting and transfer equipment; three hours of education on back care, patient assessment and handling techniques. I2: "No strenuous lifting" policy; new mechanical patient lifts and transfer equipment on each ward; three hours of education on back care, patient assessment and handling techniques. C: No policy change; one mechanical total body lift available on the ward and access to sliding devices from a central equipment depot on request only; no training provided.	+ (I1 vs C) (sh) ∅ (I2 vs C) (sh)
<i>Intervention category: Rest breaks and exercise</i>			
van den Heuvel, 2003[88]	Medium (26)	I1: Break reminder software. Software prompted user to take a five-minute break after 35 minutes of continuous computer usage and a seven-second break after five minutes of continuous computer usage. Also, workstation adjustment and training were provided. I2: Break reminder software plus exercise. Same as I1 plus software prompted user to do exercises during the breaks. C: Only workstation adjustment and training.	∅ (I2 vs C) (neck/sh, arms/elbows/forearms/wr/hands/fingers)
<i>Intervention category: Reduced hours</i>			
Von Thiele Schwarz, 2008[79]	Medium (34)	I1: Physical-exercise group. I2: Reduced-work hours group (RWH). C: No intervention.	∅ (I2 vs C) UE disorder

∅= no effect, += positive effect, I= Intervention, C=Control