

What workplace programs help prevent upper extremity musculoskeletal disorders?

Upper extremity musculoskeletal disorders (MSDs) include painful conditions and injuries of the muscles, tendons, joints and nerves that affect the neck, shoulders, elbows, wrists and hands. Work-related upper extremity musculoskeletal disorders (MSDs) are common and costly. In Canada, upper extremity MSDs and low-back pain are the leading causes of disabling work-related injuries.

While there is general agreement that work hazards (such as repetitive, awkward and static postures, heavy loads, vibration, low job control and poor social support) can contribute to the development of upper extremity MSDs, there is less agreement on the most appropriate ways to reduce or eliminate these hazards. Current practices in the management of upper extremity MSDs in the workplace are diverse, ranging from ergonomics training and onsite physiotherapy clinics to workstation adjustments and work redesign. Yet few studies to date have been able to say if, and which of, these programs and practices are effective.

The Institute for Work & Health (IWH) first tried to fill this research gap about 10 years ago when it conducted a review of the research to look for occupational health and safety (OHS) interventions that effectively prevent and manage upper extremity MSDs. Except for suggesting that workplaces consider using arm supports, based on moderate evidence that they can help reduce upper extremity MSDs, the IWH systematic review team could make no other recommendations to practitioners based on the research findings available at the time.

The OHS community has since expressed a need for an update of this initial systematic review to ensure its

KEY MESSAGES

We recommend implementing a workplace-based resistance training exercise program, based on strong evidence that these programs can help prevent and manage upper extremity musculoskeletal disorders (MSDs) and symptoms.

We suggest you consider the following practices, if applicable to your work context, based on moderate evidence that these practices can help prevent and manage upper extremity MSDs and symptoms: stretching exercise programs, workstation forearm supports and vibration feedback on mouse use.

We also suggest you consider alternatives to the following practices, based on moderate evidence that they have no effect on upper extremity MSDs: electro-magnetic (EMG) biofeedback, job stress management and office workstation adjustments on their own (i.e. with minimal worker involvement).

Given the limited evidence available on the effectiveness of many MSD prevention practices, occupational health and safety practitioners should use their health, safety and ergonomics knowledge and experience when considering the practices and programs best suited to their work contexts.

practices incorporate the latest findings. To that end, an IWH team set out to update the evidence by asking the following question:

What OHS workplace interventions are effective in the prevention of upper extremity MSDs?

How was the review conducted?

The review team consisted of 11 researchers from Canada, Europe and the United States with expertise in systematic review methodology or MSD interventions. The team searched six databases to identify an initial set of 9,900 studies published since the last systematic review that could potentially help answer the review question.

After reviewing these studies for their relevance and for the quality of their research methods, the team found 26 high and medium quality studies. These were combined with the 35 high and medium quality studies identified in the previous systematic review, giving the team 61 studies from which to find evidence of effective upper extremity MSD prevention programs and practices.

The team was supported by an advisory group of Ontario stakeholders (representing employers, labour groups, policy-makers, ergonomists and disability management practitioners) to ensure the review was practical and relevant. The advisory group was particularly helpful in sorting out the different categories of

prevention programs and in developing practical messages based on the findings to support evidence-based practice.

What were the main findings?

The review found **strong evidence of a positive effect** in preventing upper extremity MSDs for workplace-based resistance training. Resistance training refers to exercises that cause the muscles to contract against an external resistance (e.g. dumbbells, rubber exercise tubing, own body weight, etc.) with the expectation of increases in muscle strength, tone, mass and/or endurance. The programs described in the studies reviewed ranged from 20 minutes to one hour per week, spread across one or multiple days per week, with and without the involvement of a physiotherapist.

The review found **moderate evidence of a positive effect** for:

- stretching exercise programs (including yoga)
- vibration feedback on static mouse use
- workstation forearm supports.

Table 1: Level of evidence

Level of evidence	Minimum quality* and quantity	Consistency	Strength of message
Strong	3 high quality (H) studies	3 H studies agree; if more than 3 studies, 3/4 of the H and M studies agree	Recommendation
Moderate	2 H studies OR 2 medium quality (M) studies and 1 H study	2 H studies agree OR 2 M studies and 1 H study agree; if more than 3 studies, more than 2/3 of the M and H studies agree	Practice consideration
Limited	1 H study OR 2 M studies OR 1 M and 1 H study	2 H and/or M studies agree; if there are more than 2 studies, at least 1/2 of the M and H studies agree	Not enough evidence to make recommendation or practice consideration
Mixed	2 H and/or M studies	Findings are contradictory	Not enough evidence to make recommendation or practice consideration
Insufficient	No H studies OR only 1 M study OR M studies do not meet criteria above		Not enough evidence to make recommendation or practice consideration

* High quality studies scored >85% in the assessment of their quality; medium quality studies scored 50-85%

It also found **moderate evidence of no effect** for:

- job stress management training
- electromagnetic (EMG) biofeedback training
- workstation adjustments alone, with minimal worker engagement.

There was **limited evidence of a positive effect** for:

- aerobic exercise programs
- alternative keyboards
- trackball pointing devices (with and without arm supports)
- rest breaks
- postural exercise programs
- specialized exercise programs
- curved seat pans in chairs in non-office environments
- lighter/wider dental tools
- neuromuscular exercise in non-office environments.

There was **limited evidence of no effect** for:

- work redesign to minimize shoulder load in non-office environments
- joystick pointing devices, with or without arm supports
- neck school individualized exercise program (with and without stress management).

The review found **mixed (contradictory) evidence** for the following (i.e. a mix of studies showing both positive and no effect; no studies reported negative effects):

- ergonomics training and workstation adjustment
- low-intensity participatory ergonomics programs
- cognitive behavioural training programs
- ergonomics training.

Finally, the review found **insufficient evidence** (too few high quality studies) for the following:

- rest breaks plus exercise
- reduced hours
- alternative (split) keyboards
- individual interventions in an office environment
- patient handling programs
- two- to three-hour OHS training and/or ergonomics advice/change and /or exercise and/or medical examination.

What is a systematic review?

A systematic review is a type of research study. It aims to find an answer to a specific research question using existing scientific studies. Reviewers assess many studies, select relevant, quality studies, and analyze the results. The review normally includes the following steps:

- determine the review question
- develop a search strategy and search the research literature
- select studies that are relevant to the review question
- assess the quality of the methods in these studies and select studies of sufficient quality
- systematically extract and summarize key elements of the studies
- describe results from individual studies
- combine results and report on the evidence.

The Institute for Work & Health has established a dedicated group to conduct systematic reviews in workplace injury and illness prevention. Our team monitors developments in the international research literature in this field. We rely on feedback from non-research audiences to select timely, relevant topics for review, to help shape the research question and frame our findings.

Conclusions

The purpose of this systematic review was to determine what OHS interventions are effective in preventing upper extremity MSDs. The review team, working with members of the stakeholder advisory committee, concluded that implementing a workplace-based resistance training program can help manage and prevent upper extremity MSD symptoms and disabilities, based upon strong evidence that these programs have a positive effect.

The review team and advisory committee also suggested that practitioners consider implementing stretching exercise programs for the upper extremity, vibration feedback on static mouse use and workstation forearm supports,

if applicable to the work context, based on moderate evidence that these have a positive effect.

The team also suggested to practitioners that, using their OHS knowledge and experience, they seek alternatives to job stress management training, EMG biofeedback training and workstation adjustments alone (i.e. adjustments made with limited worker engagement), based on moderate evidence that these interventions have no effect.

The team made no other recommendations or suggested practice considerations for the other interventions studied because the evidence was limited, mixed or insufficient.

A unique aspect of this review update was the development of messages based on levels of evidence and stakeholder perspectives. Interactive engagement with stakeholders led to agreed-upon concise messages that

focus on practice, as well as context. The messages are in keeping with an evidence-based approach. That is, they provide recommendations or practice considerations to be weighed by practitioners based on their own knowledge and experience, the context in which they are working, and the needs of end users.

Upper extremity MSDs are complex, with multiple physical, psychosocial and personal causes. Therefore, the review team and advisory committee pointed out that their prevention likely requires a multi-pronged approach to their prevention and management. There is no magic bullet. Given the limited evidence available on the effectiveness of many MSD prevention practices, practitioners should use their health, safety and ergonomics knowledge and experience when considering the practices and programs best suited to their work contexts.

References and acknowledgements

These findings are based on the study: Van Eerd D, Munhall C, Irvin E, Rempel D, Brewer S, van der Beek AJ, Dennerlain JT, Tullar J, Skivinginton K, Pinion C, Amick B. Effectiveness of workplace interventions in the prevention of upper extremity musculoskeletal disorders and symptoms: an update of the evidence. *Occupational and Environmental Medicine*, 2016; 73(1):62-70; doi: 10.1136/oemed-2015-102992 [Epub 2015 Nov 12]. The full article is open access and available at: <http://oem.bmj.com/content/73/1/62>

To read the findings of the original systematic review on interventions to prevent upper extremity musculoskeletal disorders, go to: www.iwh.on.ca/sbe/do-workplace-programs-protect-upper-extremity-musculoskeletal-health

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For more tools, presentations and articles from IWH on evidence-based MSD prevention, go to: www.iwh.on.ca/msd-prevention



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