sharing best evidence

Highlights of a systematic review

Do workplace programs protect upper extremity musculoskeletal health?

Occupational health and safety (OHS) professionals often rely on workplace programs to prevent and manage painful disorders and injuries of the upper extremity, an area of the body that includes the neck, shoulders, upper arms, elbows, forearms, wrists and hands. Given the broad use of these programs, OHS professionals want to know if they are worthwhile. Do these programs actually protect upper extremity health?

Workers in all industries are vulnerable to injury and illness of the upper extremity. They may experience pain, numbness or inflammation in the muscles, tendons, ligaments, joints, nerves or other soft tissue, which may be warning signs of current or impending upper extremity musculoskeletal disorders (MSDs). These upper extremity MSDs, as well as traumatic injuries, can result in lost productivity and lost-time claims. (In Ontario, upper extremity MSDs and injuries accounted for about 30 per cent of lost-time claims in 2006.)

Upper extremity MSDs and injuries can arise from many factors. Workplace risks for MSDs include: physical factors such as awkward postures, repetitive movements and heavy loads; psychosocial factors such as job dissatisfaction; and personal factors such as employment tenure. Workplace risks for traumatic injuries include the absence of machine guards, for example.

Key messages

We **recommend** against the use of workstation adjustments alone, as there is strong evidence that they have no effect on upper extremity musculoskeletal disorders (MSDs). (However, when combined with ergonomics training, there is limited evidence that workstation adjustments show a benefit.)

A **practice to consider** is to use arm supports, as there is moderate evidence that they may reduce upper extremity MSDs.

The research evidence does not support adopting biofeedback training and job stress management to reduce upper extremity MSDs.

The many causes of MSDs and injuries also bring multiple solutions. However, little research has been done to show which health and safety interventions are effective. OHS professionals seek reliable research evidence on how to prevent upper extremity MSDs.

A systematic review led by the Institute for Work & Health sought to provide evidence on effective programs by answering the following question: ***Do occupational health and safety interventions prevent upper extremity musculoskeletal symptoms, signs, disorders, injuries, claims and lost time?***

How was the review conducted?

The review team consisted of 14 researchers from the United States, Canada and Europe. The team identified an initial set of 15,000 articles. After reviewing studies for their relevance to the review question and assessing their quality, 36 medium or high quality studies were included in the review. Researchers focused on interventions conducted at worksites.

Stakeholders were a valuable part of the review process. Members of Ontario's health and safety system attended two meetings to provide feedback on specific aspects of the review including the research question, search terms and findings.

What were the main findings?

The review team identified 19 categories of health and safety interventions:

- exercise (4 studies)
- ergonomic training plus exercise (3 studies)
- biofeedback training (3 studies)
- cognitive behavioural training (1 study)
- job stress management training (2 studies)
- workstation adjustment (4 studies)
- ergonomic training (4 studies)
- ergonomic training plus workstation adjustment (1 study)
- alternative keyboards (2 studies)
- alternative pointing devices (2 studies)
- arm supports (3 studies)
- new chair (1 study)
- rest breaks (4 studies)
- rest breaks plus exercise (1 study)
- participatory ergonomics (1 study)
- broad-based musculoskeletal injury prevention program (1 study)
- miscellaneous work redesign (4 studies)
- multi-component patient handling (1 study)
- prevention strategies plus physical therapy (1 study)

Across these 19 intervention categories, the results showed a mixed level of evidence overall for the effect of occupational health and safety interventions on upper extremity health outcomes. This means that the findings of medium and high quality studies were inconsistent. In this review,

Table 1: Levels of Evidence

Level of evidence	Minimum quality	Minimum quantity	Consistency
Strong (results in a **recommendation**)	High (>85%)	3 high quality studies	3 high quality studies agree. If there are more than 3 studies, 3/4 of the medium and high quality studies agree.
Moderate (results in a **practice consideration**)	Medium (50-85%)	2 high quality studies OR 2 medium and 1 high quality studies	2 high quality studies agree OR 2 medium and 1 high quality studies agree. If there are more than 3 studies, more than 2/3 of the medium and high quality studies agree.
Limited	Medium (50-85%)	1 high quality study OR 2 medium quality studies OR 1 medium and 1 high quality study	If 2 studies, they agree. If there are more than 2 studies, more than 1/2 of the medium and high quality studies agree.
Mixed	Medium and high	2 medium and/or high quality studies	Findings from medium and high quality studies are contradictory.
Insufficient	No high quality studies, only one medium quality study, and/or any number of low quality studies.		

inconsistencies arose because some interventions showed a positive effect and some interventions showed no effect on upper extremity health. None of the interventions showed a negative or harmful effect on upper extremity health.

As for each type of intervention, the review team found the following results.

Workstation adjustments: There is **strong evidence** that workstation adjustments alone have **no effect** on upper extremity outcomes. This category looked at physical adjustments to computer workstations in office environments to reduce stress on the body due to poor posture.

Arm supports: There is **moderate evidence** that adding arm supports to computer workstations has a **positive effect** on upper extremity outcomes. The review team concluded that arm supports are an important design strategy for reducing muscle loading in the upper extremity in a range of work environments.

Biofeedback training: There is **moderate evidence** that biofeedback training, in which monitoring instruments are used to provide information about increased muscle tension, has **no effect** on upper extremity outcomes.

Job stress management training: There is **moderate evidence** that job stress management training has **no effect** on upper extremity outcomes.

Ergonomics training plus workstation adjustment: There is **limited evidence** of a **positive effect** on upper extremity outcomes when workstation adjustments are combined with ergonomics training. The review team called this significant because there is strong evidence showing that workstation adjustments alone have no effect and mixed evidence showing that ergonomics training alone has either a positive or no effect. The review team concluded that, until more studies are done, workstation adjustments combined with ergonomics training appear to be more effective than implementing either on their own.

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.

We appreciate the support of the Ontario Workplace Safety and Insurance Board (WSIB) in funding this four-year Prevention Systematic Reviews initiative.

There is **limited evidence** of a **positive effect** on upper extremity outcomes for each of these three interventions:

Alternative keyboards
New chair
Rest breaks

There is **limited evidence** that each of these two interventions has **no effect** on outcomes:

Cognitive behavioural training
Miscellaneous work redesign strategies

There is **mixed evidence** for the effectiveness of these interventions on upper extremity outcomes. That is, study findings for each of these intervention

categories were inconsistent (showing both a **positive effect** and **no effect**):

Exercise
Ergonomics training plus exercise
Ergonomics training
Alternative pointing devices

For some types of interventions, there was a lack of higher quality studies. More evidence is needed to show whether the following interventions have an effect on upper extremity health outcomes:

Rest breaks plus exercise
Participatory ergonomics
Broad-based MSD injury prevention program
Multi-component patient handling
Prevention strategies plus physical therapy

Conclusions

The purpose of this systematic review was to determine if occupational health and safety interventions have an impact on upper extremity musculoskeletal health. Based on the results of the review, the researchers concluded:

1. Workstation adjustments alone are not effective in reducing upper extremity MSDs.
2. Using arm supports to reduce muscle loading can be particularly effective in reducing upper extremity MSDs.
3. Biofeedback and job stress management are not ideal as training programs for reducing upper extremity MSDs.
4. More high quality research into occupational health and safety interventions to prevent and manage upper extremity MSDs and injuries is needed. Such research should compare the group receiving the intervention with a control group that receives no intervention, contain larger study samples, and follow workers for at least four to 12 months to observe changes.
5. Future research should look at the effectiveness of combined interventions (such as training combined with new equipment and/or workstation adjustments), the experiences of non-office workers, and the prevention and handling of traumatic upper extremity injuries. With respect to the latter, the review team was surprised not to find a single higher quality study that addressed the prevention of acute traumatic upper extremity injuries.

The reviewers' diverse areas of expertise benefited this review greatly. The research literature search was broad. The research team had confidence in the conclusions of the studies included in the evidence synthesis. A number of external research partners and stakeholders helped to determine the direction of the final review. The results show that more high quality research across industries/sectors is of importance. Health and safety professionals require a larger store of research evidence to help them identify the best ways to prevent upper extremity MSDs and injuries.

These findings are based on the report *Systematic review of the role of occupational health and safety interventions in the prevention of upper extremity musculoskeletal symptoms, signs, disorders, injuries, claims and lost time* by Benjamin C. Amick III, Carol Kennedy, Jack Dennerlein, Shelley Brewer, Starly Catli, Renee Williams, Consol Serra, Fred Gerr, Emma Irvin, Quenby Mahood, Al Franzblau, Dwayne Van Eerd, Bradley Evanoff and David Rempel.

The full report is available at:
www.iwh.on.ca/systematic-reviews.

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