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Workplace interventions to prevent musculoskeletal and visual symptoms and disorders among computer users: A systematic review

Summary

About this summary:

This summary is based on the report *Workplace interventions to prevent musculoskeletal and visual symptoms and disorders among computer users: A systematic review*

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Foreword

In recent years, the Institute for Work & Health has been actively engaged in building relationships with Prevention System agencies and organizations in Ontario.

In these encounters, we often hear that potential research users want more evidence about the effectiveness of interventions aimed at protecting workers' health. We are also told that even when research evidence exists, it is often hard to access, difficult to understand and is not always presented in language and formats suitable to non-scientific audiences.

In response to these needs, the Institute for Work & Health has established a dedicated group to conduct systematic reviews of relevant research studies in the area of workplace injury and illness prevention. In instances where there are too few studies to conduct a full Systematic Review we may provide our audiences with a narrative review.

- Our systematic review team monitors developments in the international research literature on workplace health protection and selects timely, relevant topics for evidence review.
- Our scientists then synthesize both established and emerging evidence on each topic through the application of rigorous methods.
- We then present summaries of the research evidence and recommendations following from this evidence in formats which are accessible to non-scientific audiences.

The Institute consults regularly with workplace parties to identify areas of workplace health protection that might lend themselves to a systematic review of the evidence.

We appreciate the support of the Ontario Workplace Safety & Insurance Board (WSIB) in funding this four-year Prevention Systematic Reviews initiative. As the major funder, the WSIB demonstrates its own commitment to protecting workers' health by supporting consensus-based policy development which incorporates the best available research evidence.

Many members of the Institute's staff participated in conducting this Systematic Review. A number of external reviewers in academic and workplace leadership positions provided valuable comments on earlier versions of the report. On behalf of the Institute, I would like to express gratitude for these contributions.

Dr. Cameron Mustard
President, Institute for Work & Health
February, 2006

1.0 Introduction

The most common occupational health complaints among computer users are visual symptoms and musculoskeletal (MSK) disorders (Hagberg and Rempel 1997). Such problems include eye discomfort and sustained pain in the neck and upper extremities.

Recently, the Institute of Medicine, an American non-profit organization which provides evidence-based information on matters of biomedical science, medicine, and health, called for more intervention research in the area of workplace MSK and visual health. The goal of such research would be to provide scientifically credible evidence to practitioners about how to reduce health risks associated with computer work (NRC 2001).

The Institute for Work & Health, in collaboration with researchers from the United States, undertook a systematic review to identify studies that evaluated the effects of workplace interventions on visual or upper-body MSK symptoms/disorders among computer users. Studies that met the design and quality criteria were evaluated in detail and the data were synthesized. Based on the synthesis, the review team identified the need for further, high quality intervention studies in this area of workplace health.

2.0 What is a Systematic Review?

In a systematic review, researchers develop a clearly formulated question, use systematic and explicit methods to identify, select and critically appraise relevant research, and then analyze data from studies selected in the review process. The review normally includes the following steps:

- determine the question
- develop a search strategy and search the literature
- select studies that meet inclusion/exclusion criteria
- assess the methodological quality of selected studies and eliminate those in which quality is not sufficient
- systematically extract and summarize key elements of the included studies
- describe the results from individual studies – synthesize the results and report them.

3.0 How did the review begin?

The primary question addressed by this systematic review was: "Do office interventions among computer users have an effect on MSK and visual health status?" To address this question, the review team considered studies with analyses that focused on specific intervention types, for example, ergonomic training and type of keyboard used, and their effect on MSK or visual health outcomes

A review team comprised of nine researchers from the U.S. and Canada participated in the process. Some reviewers were identified based on their expertise in conducting epidemiologic or intervention studies related to MSK or visual disorders among computer users. Some were recruited for their experience in conducting systematic reviews. Members of the review team had backgrounds in epidemiology, ergonomics, occupational medicine, safety engineering and optometry.

The review team considered articles published or in press in the English language, peer-reviewed, scientific literature from 1980 onward. (This year marks the time when computers started becoming more widely used in office settings.) Book chapters and conference proceedings were excluded.

4.0 How did the review proceed?

4.1 Literature search

Four English language databases were searched for relevant articles published or in press from peer-reviewed scientific literature, from 1980 onward. Three terms from the primary question, "office," "intervention" and "health" were defined and used to develop the literature search criteria. In total, 7313 articles were identified in this comprehensive search.

4.2 Study relevance

Study relevance was determined by reviewing the titles and abstracts and, where necessary, the full text of the articles. From the 7313 articles identified, 31 met the study relevance criteria. Articles were screened for relevance in two steps. First a single reviewer considered whether: an intervention occurred, the study took place in an office setting, and the intervention was related to computer use. The second step addressed detailed study design and outcomes criteria and was carried out by two independent reviewers who agreed on relevance.

4.3 Quality appraisal and data extraction

The 31 studies that met the relevance criteria were assessed for methodological quality using 19 quality criteria. The criteria were weighted (on a scale of 1 to 3) according to the importance of each item as decided by the entire review team. Using this weighted quality scale, nine studies were classified as high quality and 22 as medium quality. No studies were classified as low quality.

4.4 Evidence Synthesis

The studies reviewed came from different countries, involved different kinds of interventions, focused on different systems (visual and MSK), used different health outcome measurements and involved substantially different levels of statistical analyses.

Such a high level of variation required the use of a synthesis approach adapted from Slavin and others (Slavin 1995, Franche 2004, Coté 2001) known as "best evidence synthesis." The best evidence synthesis approach considers the quality of the studies, the quantity of studies and the consistency of the findings among the studies. "Quality" refers to the methodological strength of the studies. The team developed a list of 19 methodological items to assess study quality. "Quantity" refers to the number of studies that provide evidence on the same health outcome. "Consistency" refers to the similarity of results observed across the studies on the same health outcome.

The levels of evidence were defined in the following way:

- Strong - a strong level of evidence required three or more high quality studies that converge on the same findings.
- Moderate - a moderate level of evidence was defined as two or more studies, the majority of which were medium quality or better, converging on the same findings.
- Mixed - a mixed level of evidence described two or more medium or better quality studies having inconsistent findings.
- Partial - partial evidence was assigned when two or more studies, the majority of which are of a low quality, converge on the same findings.
- Insufficient – the level of evidence was considered insufficient if the above criteria were not met.

Three (of the 31) studies did not include statistical comparisons between groups; therefore 28 studies were included in the data synthesis.

5.0 Findings and recommendations

The synthesis across all studies suggests a mixed level of evidence for the effect of ergonomic interventions on MSK outcomes or visual symptoms. This means the review found medium to high quality studies with inconsistent findings. The finding of mixed evidence may be due to the variation of intervention types grouped together across the studies reviewed. The research team did not find evidence that any office ergonomic intervention had a negative effect on MSK or visual health. The findings did not change when only high quality studies were considered.

There was no strong evidence that any specific office ergonomic intervention had positive effects on either MSK or visual health. However, there was considerable variability among interventions that are described with similar terms such as "workstation adjustment" and "office equipment". For strong evidence to be determined, additional high quality studies would need to agree on consistent findings.

There were three interventions for which moderate evidence was determined.

- There was **moderate evidence** that **workstation adjustments as implemented in the studies reviewed** had **NO** impact on **MSK or visual outcomes.**
- There was **moderate evidence** that **rest breaks together with exercise during the breaks** have **NO** impact on **MSK outcomes.**
- There was **moderate evidence** that **alternative pointing devices** (i.e. mouse, trackball) have a **POSITIVE** effect on **MSK outcomes**.

These findings should not discourage researchers from studying different workstation adjustments or rest break patterns combined with exercises. However, care should be taken in making any generalizations about the role of either workstation adjustments alone or rest breaks plus exercises in improving MSK or visual health. To advance the field and shift the level of evidence from moderate to strong, further research of high methodological quality should be performed.

The review team concluded there was mixed evidence (moderate and high quality studies with inconsistent findings) for a range of interventions:

- There was **mixed evidence** that **ergonomic training, arm supports, alternative keyboards** and **rest breaks** have an impact on **MSK outcomes**.
- There was **mixed evidence** that **screen filters** have an impact on **visual outcomes**.

The team considered the interventions with a mixed level of evidence to be particularly important to researchers, funders, labour and employers participating in research. For several specific interventions, the addition of higher quality studies could have shifted the level of evidence from mixed to moderate or strong.

Finally, many specific or unique combinations of office ergonomic interventions were evaluated with a single study. Such unique single intervention studies provided an insufficient level of evidence for the review team to make general assertions about intervention effectiveness, regardless of the quality of the studies:

- There was **insufficient evidence** to determine an effect on **MSK outcomes** for any of the following interventions: **exercise training; stress management training; ergonomic training together with workstation adjustment; a new chair; lighting change plus workstation adjustment plus VDT glasses; a new office; lens type** and **VDT glasses.**
- There was **insufficient evidence** to determine an effect on **visual outcomes** for any of the following interventions: **ergonomic training; rest breaks; lighting change plus workstation adjustment plus VDT glasses; lens type; VDT glasses; herbal eye drops; and OptiZen™ eyedrops.**

6.0 Areas for further research

The overwhelming message from this review is that more high quality intervention research is needed. Well-designed studies, such as randomized controlled trials with adequate sample sizes and study durations are required before major conclusions regarding interventions can be drawn.

It is vital that steps be taken to generate the amount and quality of evidence required so that informed decisions about these interventions can be made. With the continued growth of the knowledge workforce and reliance on computers, stakeholders need to be diligent about developing and supporting high quality research. The information from this review should be used to guide future research in office ergonomic interventions and alert stakeholders to the current state of the evidence.

In addition to recommending more high quality research, the review team believes that further reviews on this topic should include non-English articles and grey literature and that the authors of the articles reviewed be contacted for their data, to allow for a more in-depth analysis.

7.0 Conclusion

The current systematic review represents the most comprehensive review to date of the literature about office ergonomic interventions in relation to MSK and visual health outcomes. The conclusions about the levels of evidence for the variety of office interventions in this review come from a highly systematic and transparent approach of searching and synthesizing the literature.

The review team suggests stronger levels of evidence are needed to make policy or best practices recommendations. Such recommendations demand consistent findings from a number of high quality studies. The review did not find this level of evidence among the studies reviewed.

With moderate levels of evidence the review team felt they could make recommendations about "practices to consider". However, in two categories when the results demonstrated moderate levels of evidence, it was to support interventions having NO effect on MSK or visual outcomes. The third finding of moderate level of evidence suggested that alternative pointing devices have a positive effect on MSK outcomes. However, this finding was based on single studies of two different devices, an alternative mouse study and a trackball study, making it difficult to issue practice recommendations. Therefore the team cannot make specific recommendations about practices to consider for the interventions of workstation adjustments, rest breaks with exercise and alternative pointing devices.

An important message to all stakeholders is that the current state of the peer reviewed literature provides limited high quality evidence to support the benefits of office ergonomic interventions on MSK or visual health. This does not mean that these interventions should not be implemented but rather that more research is required.

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