



INSTITUTE  
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## **Effectiveness of Participatory Ergonomic Interventions: A Systematic Review**

**Summary**

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## Table of Contents

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	Foreword	3
<b>1.0</b>	Introduction	5
	1.1 What is Participatory Ergonomics?	5
	1.2 The objectives of this systematic review	5
<b>2.0</b>	What is a Systematic Review?	6
<b>3.0</b>	What research was included in this systematic review?	6
<b>4.0</b>	How did we proceed?	6
	4.1 Literature	6
	4.2 Study relevance	6
	4.3 Quality appraisal and data extraction	6
	4.4 Evidence synthesis	7
<b>5.0</b>	Results	7
	5.1 Effectiveness of PE interventions for improving health outcomes	7
	5.2 Methodological quality of the literature	8
<b>6.0</b>	Recommendations	9
	6.1 Recommendations about PE interventions	9
	6.2 Recommendations about further research and evaluation	9
<b>7.0</b>	Conclusions	9

## 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.

- 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 will consult 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, 2005

## **1.0 Introduction**

Work related musculoskeletal disorders (MSD) are a major source of illness and disability throughout the industrialized world. Even though many of these conditions may be preventable, they continue to have widespread negative effects on workers, employers and insurers.

There is evidence that the inappropriate design of workplaces and work processes contributes significantly to the development and chronicity of common MSDs. By improving ergonomic aspects of work and workplaces, it may be possible to prevent or reduce these disorders and increase productivity.

The scientific literature on workplace ergonomic interventions has grown substantially over the past 15 years. But to our knowledge, no systematic review of the evidence on the effectiveness of participatory ergonomic (PE) interventions has been completed – particularly in terms of health outcomes.

### **1.1 What is Participatory Ergonomics?**

Wilson<sup>1</sup> defines PE as “The involvement of people in planning and controlling a significant amount of their own work activities, with sufficient knowledge and power to influence both processes and outcomes in order to achieve desirable goals.”

Most workplace PE interventions involve forming an ergonomics “team” which guides the intervention process. This group usually includes employees, managers, ergonomists, health and safety personnel, and research experts. The team typically undergoes training to familiarize them with ergonomic principles. Combining outside expertise with the organization’s unique experience makes it possible to devise ergonomic interventions tailored to the needs of that particular workplace. This may increase the chance that the intervention will be successful

### **1.2 The objectives of this Systematic Review**

Our goal was to provide a comprehensive summary of the effectiveness of workplace-based PE interventions in improving workers’ health. We also wanted to assess the quality of the existing literature in this area and provide guidance for future research and evaluation.

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<sup>1</sup> Wilson JR, Haines HM. Participatory ergonomics, in G. Salvendy (ed.), Handbook of Human Factors and Ergonomics, 2nd Edn (New York: Wiley), 490-513; 1997.

## **2.0 What is a Systematic Review?**

In doing 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 in order:

▪ *determining the question* ▪ *developing a search strategy and searching the literature* ▪ *selecting studies that meet inclusion/exclusion criteria* ▪ *assessing the methodological quality of selected studies and eliminating those in which quality is not sufficient* ▪ *systematically extracting and summarizing key elements of the included studies* ▪ *describing the results from individual studies* ▪ *synthesizing the results and reporting them.*

## **3.0 What research was included in this systematic review?**

Electronic databases and citation lists were searched for quantitative studies about participatory ergonomics interventions in the workplace.

## **4.0 How did we proceed?**

### **4.1 Literature search**

Six databases were searched for relevant studies. A total of 442 papers met our search criteria.

### **4.2 Study relevance**

Study relevance was determined by review of titles, abstracts and where necessary, the full text of papers. The review was carried out by two independent reviewers who came to agreement on relevance. From the total of 442 papers identified in the search, a majority – 419 – were not relevant to our research question. Although these studies often reported on interesting frameworks, experiences or aspects of ergonomics, they could not help answer the question of intervention effectiveness with respect to health outcomes. In the end, 23 studies met the study relevance selection criteria.

### **4.3 Quality appraisal and data extraction**

Pairs of independent reviewers systematically appraised the methodological quality of the studies. Only studies which were rated to be of “medium” or higher quality were considered for data extraction. Ten studies that met the minimum criteria for methodological strength then proceeded to the data extraction phase and were considered for evidence synthesis.

#### 4.4 Evidence synthesis

Combining the evidence from the 10 studies was challenging, since they differed considerably in many ways. The nature of interventions differed, as did the workplaces involved, the type of participants, the risk factors that were measured and the health outcomes that were assessed. The studies also varied in terms of their units of analysis (individual, group, or workplace) and the kind of statistics used to analyze and summarize study findings.

The review team relied on a “best evidence synthesis” approach. Best evidence synthesis involves combining three aspects of the research literature: the number of studies identified; their methodological quality; and the consistency of the results across different studies.

Evidence from the 10 studies about PE interventions and their relationship to health outcomes was rated on a scale ranging from strong evidence, through moderate, partial, mixed, to insufficient evidence.

## 5.0 Results

### 5.1 Effectiveness of PE interventions for improving health outcomes

We found a wide spectrum of health outcome measures in the studies. The studies described a variety of ergonomic changes that were identified and implemented as a result of the PE intervention. Most of these changes focused on improving the physical design of equipment and workplaces. Some involved changing job tasks, job teams or how work was organized. Others involved formulating new policies or specific health and safety training.

Nine of the ten studies reported that PE interventions had positive effects on health outcomes. (One study concluded that no change in workers’ health outcomes could be attributed to the PE intervention.)

Despite research methods and reporting that differed widely across the studies, the review team assigned a level of “partial evidence” in favour of PE interventions as a way to improve health outcomes.

- The review found partial evidence that ***PE interventions had a small, positive impact on musculoskeletal symptoms.***
- The review found partial evidence that ***PE interventions had a positive impact in reducing injuries and workers’ compensation claims.*** (The size of this impact varied and should be characterized more clearly in future research.)

- The review found partial evidence that *PE interventions had a positive impact on lost days from work or sickness absence*. (Again, the size of this effect requires more precise definition.)

In looking at the studies, we noted a number of key facilitators and barriers to the participatory ergonomic process which may be of interest.

Facilitators included: active participation and acceptance of the team members by workers, senior and middle management, and union representatives (where applicable); the availability of an ergonomic expert, as either an active team member or an external advisor; access to adequate resources.

Barriers included: lack of acceptance and resources; instability within the workplace or negative economic conditions (such as recession) affecting the specific industry sector

The generally positive findings which emerged from our systematic review support the use PE interventions. Given the evidence linking workplace exposures to the burden of MSD in working populations, we should continue to practice methods proven to reduce the burden.

## **5.2 Methodological Quality of this Literature**

Overall, the methodological quality of the 23 relevant studies varied. Two studies were rated “high” or “very high,” eight were rated “medium,” and 13 were rated as being of “low ” methodological quality. Despite general weaknesses in methodological quality, the studies performed well in certain areas: describing baseline sample characteristics, documenting ergonomic changes resulting from PE intervention, measuring health outcomes at baseline and follow-up, and measuring important MSD risk factors.



## **6.0 Recommendations**

### **6.1 Recommendations about PE interventions**

- We recommend that PE interventions be implemented in workplaces as one means of reducing the burden of work-related MSDs among Canadian workers.

### **6.2 Recommendations about further research and evaluation**

- We recommend that those who use PE approaches formally document and describe the participants, the nature of ergonomic changes, and the intensity of the ergonomic intervention process (level of participation, extent of involvement)
- We recommend evaluation of PE interventions include comparison groups whenever possible, and that those who design interventions should consider randomization when many sites or organizations are involved
- We recommend that those who design, carry out and evaluate PE interventions in the workplace should pay more attention to the presence of co-interventions and potential confounders. They should also continue to measure important risk factors for musculoskeletal symptoms.
- We recommend that a systematic review of PE process evaluations be undertaken by a team including qualitative researchers.
- We recommend that PE interventions be included when researchers review evidence about the economic benefits of workplace interventions aimed at reducing the burden of MSD.

## **7.0 Conclusion**

Our systematic review found 23 relevant studies examining the effectiveness of PE interventions for health outcomes. In the ten studies that proceeded to evidence synthesis, we found a wide spectrum of health outcome measures. Nine of the ten studies reported that participatory ergonomics interventions had positive effects on health outcomes.

Despite research methods and reporting that differed widely across these studies, the review team believes there is enough evidence to recommend the use of PE interventions as a way to improve health outcomes.

We also noted a number of facilitators and barriers which may be of interest to those who design and implement PE interventions.

During the systematic review, we examined the methodological strengths and weaknesses of the existing literature on PE interventions and their relationship to health outcomes. This allowed us to develop a set of recommendations aimed at improving how such research is designed and evaluated.