Musculoskeletal Disorders

Examining best practices for prevention

By Benjamin C. Amick III, Shelley Brewer, Jessica M. Tullar, Dwayne Van Eerd, Donald C. Cole and Emile Tompa

ERGONOMIC BEST PRACTICES refers to the most effective techniques, methods or processes for preventing risks and injuries and controlling costs related to injuries. While best practices are often based on standards related to the best available scientific evidence, the evidence can change over time. Successful ergonomic practices evolve, requiring practitioners to keep up-to-date on the available evidence.

The challenge is how to separate scientifically credible evidence from the methods of marketing. What is an SH&E manager to do when multiple product representatives attest to the science supporting their products? How can a safety professional sift through the mass of scientific publications? The occupational safety and health research community has sought to better clarify how it can bring evidence to the SH&E professional. Lavis, Posada, Haines, et al. (2004) have proposed a generic model of how science informs evidence-based decision making.

Consider the example of back belts. Once a solution touted as a "best practice" for preventing back injuries, especially in materials handling jobs, back belt purchases took off in the 1980s and 1990s (Atkinson, 2001). Why? Research coming out of ergonomic laboratories and field studies was indicating the potential biomechanical benefits and user comfort associated with back belt use (Mitchell, Lawler, Bowen, et al., 1994). Back belts were considered a practical and cost-effective back injury prevention strategy (Allen & Wilder, 1996). As a result, wearing back belts became commonplace.

However, as the results from workplace studies emerged, the effectiveness of back belts in reducing back injuries was not clear (VanPoppel, Koes, van der Ploeg, et al., 1998). Based on the literature, NIOSH (1996) officially chose to not support back belt use. Following the publication of the NIOSH alert, several other studies appeared that refuted (Wassell, Gardner, Landsittel, et al., 2000) or supported back belt use (Krause & McArthur, 1996; Krause, Schaffer, Rice, et al., 2002). A 2003 systematic review of research concluded that the evidence did not support back belt use in preventing back injuries (Ammendolia, Kerr & Bombardier, 2005).

Innovations may be sparked by new ideas and some basic science, but actionable messages, especially those related to best practices, should evolve from a more systematic synthesis of research. It should look at the body of evidence, not just a few studies (Figure 1).

Linking Science to Defining Best Practices

Those interested in applying research to practice must sift through the hundreds of studies that provide the evidence base for decision making and synthesize that pool of information. In healthcare, systematic reviews have become the language of scientific consensus, bringing together a large number of diverse research studies to answer the question, What drug, medical device or medical treatment

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works? One example is the Cochrane Back Review Group (see sidebar on p. 26).

A systematic review provides a concise and transparent synthesis of research evidence, making it a valuable decision-making tool for practitioners and researchers. Systematic reviews provide an objective literature synopsis on a specific topic and have the following advantages:

1) Unlike a narrative review, a systematic review assesses individual study quality and only synthesizes the evidence from studies of sufficient quality. By eliminating the information from the lower-quality studies, this step allows for great confidence in the overall findings and messages.

2) Because a systematic review is based on the convergence of multiple research studies, the likelihood of being misled by research is lower—bias in the conclusions about intervention effectiveness is reduced.

3) Using a systematic review as a decision-making tool constitutes a more efficient use of time because the research literature has already been identified, selected, appraised and synthesized in a systematic and transparent way by experts in the research field—efficiency is increased.

4) Scientific debate about systematic reviews is more constructive because discussions focus on quality appraisal and evidence synthesis rather than on why one study was identified and selected over others (Lavis, et al., 2004).

A challenge to SH&E professionals is to keep up with the sheer number of published scientific studies. Too often, these studies are published in scientific journals that are not easily accessible by the practicing professional. Systematic reviews provide one opportunity to link practitioners to the science in an approach that allows the SH&E professionals to make their own judgments about the current state of the evidence.

Institute for Work & Health Prevention Review Program

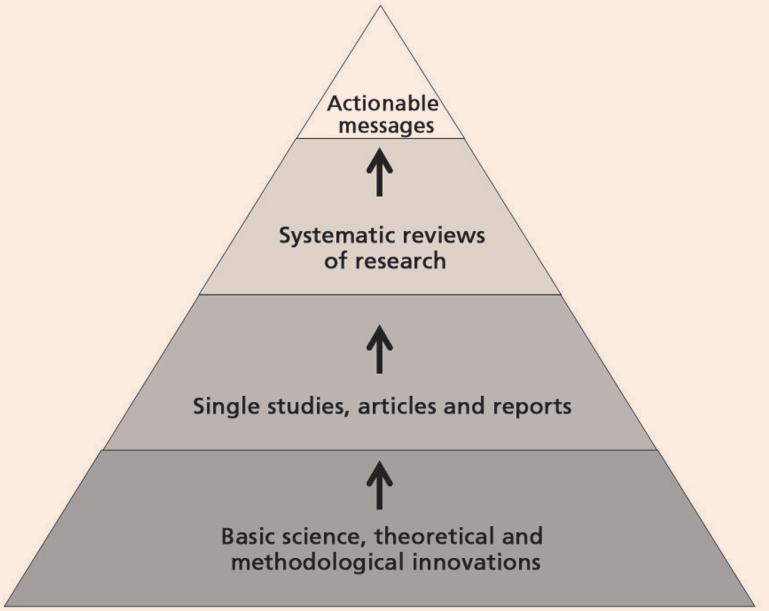
In 2004, the Institute for Work & Health (IWH) launched a prevention systematic review initiative. The initiative was undertaken in response to a concern raised by employers, labor and the Workplace Safety and Insurance Board of Ontario that limited evidence was accessible about effective interventions for protecting workers' health.

To date, the following reviews focused on the prevention of musculoskeletal injuries have been completed by IWH:

- Interventions in Healthcare Settings to Protect Musculoskeletal Health: A Systematic Review;
- Workplace Interventions to Prevent Musculoskeletal and Visual Symptoms and Disorders Among Computer Users: A Systematic Review;
- A Systematic Review of Occupational Health and Safety Interventions with Economic Evaluations;
- The Effectiveness of Participatory Ergonomic Interventions;
- A Systematic Review of Injury/Illness Prevention and Loss Control (IPC) Programs;
- Participatory Ergonomic Interventions: Implementation and Process.

Figure 1

Hierarchical Structure of Evidence



These reviews have examined more than 100,000 scientific papers and extracted data from more than 200 research studies that were considered to provide scientifically credible evidence for decision making. All reviews are free to download at www.iwh.on.ca. It is interesting to note that the stakeholder community had the opportunity to define and select from more than 50 possible systematic reviews and supported those listed.

The Systematic Review Process

The IWH systematic review process is typically completed in seven steps (inner circle of Figure 2, p. 27). The process differentiates itself from other systematic review processes by involving employers, safety professionals, labor, policy representatives and other key consumers of the information (hereafter referred to as stakeholders) at each stage of the process. Figure 2 identifies five stakeholder engagement opportunities in the review process. For each review, there is an effort to integrate practitioners and policy makers as team members. Their participation helps improve the review's relevance and the likelihood that stakeholders will use the findings (Keown, Van Eerd & Irvin, 2008).

Evidence-Based Best Ergonomics Practices

Overall, findings from various systematic reviews suggest ergonomic best practices are not about specific ergonomic tools/procedures but are more about integrated approaches to hazard control. When engaging in ergonomic changes to improve safety and prevent injury, no strong evidence suggests that any

Abstract: *To address the burden of musculoskeletal injuries, SH&E professionals must be informed about the scientific evidence that leads to ergonomic best practices. However, the large number of published ergonomic studies makes it difficult to keep up with the evidence and link it to best practices. Systematic reviews, such as those conducted by the Institute for Work & Health Prevention, are one way to link science to practice.*

one specific intervention is effective (Brewer, Van Eerd, Amick, et al., 2006; Brewer, King, Amick, et al., 2007). However, there is evidence for multicomponent programs and combinations of interventions.

First, the following are key characteristics of successful ergonomic programs:

- An effective ergonomic program must be supported by an organizational policy.
- An effective ergonomic program must be implemented with broad-based ergonomics training and not simply training on how to use the tool correctly or use the appropriate technique.
- An effective ergonomic program must make available to the worker the appropriate technology with which to perform the work safely (Amick, Tullar, Brewer, et al., 2006).

One clear example emerged from the healthcare systematic review where insufficient evidence existed to support the use of ceiling lifts with lift training as an effective injury prevention intervention (Amick, et al., 2006). Rather, the evidence supports establishing some form of zero-lift policy that clearly indicates management commitment to enforcing this initiative at the unit level. Supervisors must be guided by this policy directive on what and how to support safe patient-handling behaviors.

Training must be broad-based and not only consider how to use the lift, but also how to motivate employees to engage in proper lifting. Consider the healthcare setting in which workers are present to help the patient. When faced with the trade-off between helping a patient in a timely manner or waiting for assistance to handle a patient, workers may choose to help the patient at significant risk to themselves. The training must provide the appropriate motivation and supports for modeling a behavior that is counterintuitive to the worker and the healthcare culture. The training could cover supervisory practices for policy enforcement. Finally, the ceiling lifts and other patient handling devices must be in place.

Second, no evidence indicates that magic bullets exist as a best practice. There are no ergonomic equivalents of penicillin. In fact, credible scientific evidence indicates that the following specific practices will not reduce injuries if implemented as single component hazard controls:

- rest breaks;
- ergonomic training;
- workstation adjustments.

For ergonomics training alone, strong evidence indicates that there will be no injury reduction benefits. This makes sense to the SH&E professional, as one would never train employees in safety practices without providing them with the necessary equipment to properly implement the knowledge and skills acquired during the training. However, when these specific single practices are combined there is evidence that they are effective (see fourth point).

Third, ergonomic modifications are important in the management of workers who have developed an injury or illness. In this case, a specific set of best work accommodations does not exist. Rather, a series of reviews have demonstrated the importance of a wide range of disability management programs in reducing injury and illness (Brewer, et al., 2007; Tompa, Dolinschi, de Oliveira, et al., 2007).

Fourth, specifically for computer-based work, evidence indicates that alternative pointing devices were useful in reducing the risk of musculoskeletal injuries. Training computer users about ergonomics and then making appropriate workstation adjustments was also effective in reducing injuries (Brewer, et al., 2006). Providing the training and demonstrating the specific adjustments can serve to establish the appropriate skills and behaviors, particularly when a highly adjustable workstation is available.

Fifth, participatory ergonomic programs are effective in reducing MSD injuries or time loss (Rivilis, Van Eerd, Cullen, et al., 2008; Van Eerd, Cole, Irvin, et al., 2008). Wilson and Haines (1985) defined participative ergonomics 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." A participatory approach with active employee engagement in evaluation, problem solving and decision making along with a program champion can help to ensure program success.

Six key elements of success for participative ergonomics programs include:

- management and employee support;
- sufficient resources committed to the program;
- appropriate ergonomics training provided to all those involved;
- a team with the right people involved

Cochrane Collaborative Back Review Group

The Cochrane Collaborative Back Review Group (CBRG) is one of 50 international review groups of the Cochrane Collaboration. CBRG coordinates the publication of literature reviews of primary prevention and secondary prevention and treatment of neck and back pain and other spinal disorders, excluding inflammatory diseases and fractures. One recent review examined the effectiveness of manual materials handling training in the prevention of low back injuries.

CBRG's website contains a current list of registered titles, published protocols and published reviews (www.cochrane.iwh.on.ca). Each review is linked to the Cochrane Library (www.cochranelibrary.com), where visitors can freely access the abstract (scientific summary) and the synopsis (lay summary), where available. Full text of the review is available only by subscription or other purchasing agreements, however.

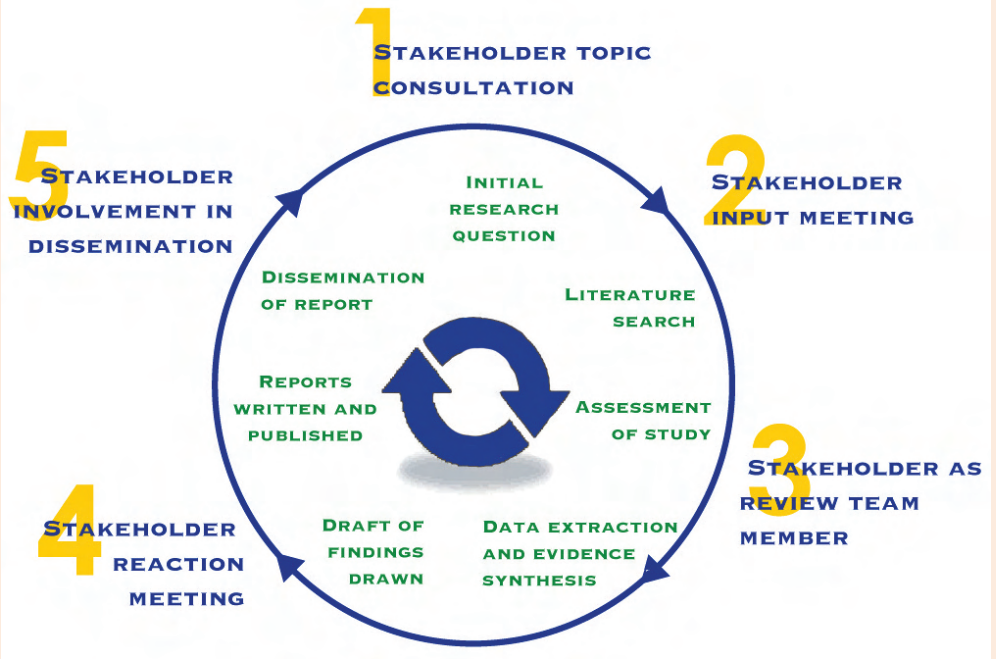
who understand their responsibilities and make decisions in a consultative way;

•good communication between team members, between the team and management, and between the team and individuals in the workplace;

•training in how the organization works so the team functions well to identify and make necessary changes (Van Eerd, et al., 2008).

Figure 2

IWH Systematic Review Process



Evidence Important to Practice

The body of scientific evidence supports the financial case for ergonomic programs. First, strong evidence indicates that ergonomic programs are cost effective. The evidence is particularly strong for ergonomic programs implemented in manufacturing (Tompa, et al., 2007).

There is also support for the cost-effectiveness of ergonomic programs in the administrative and support sector, the healthcare sector and the transportation sector. Finally, strong evidence exists for the cost-effectiveness of multifaceted disability management programs with ergonomics as a core facet (Tompa, de Oliveira, Dolinschi, et al., 2008). Thus, the body of scientific evidence supports the financial case for ergonomics programs.

Additionally, workplaces and researchers can partner to plan and implement effective ergonomic interventions. Best practices evolve from the best science, and it is necessary to have scientific evaluations occur in workplaces. Successful interventions require all parties to collaborate to ensure that the research brings value to the organization and to the growing body of evidence on the success or failure of ergonomic programs, injury reduction and control.

Discussion

Systematic reviews are an important element in the synthesis of the scientific evidence on how occupational safety and health programs work. Despite widespread use of a range of ergonomic guidelines and standards for preventing injuries, the scientific evidence on the effectiveness of ergonomic programs, policies and practices for reducing injuries is less robust than one might expect. A range of ergonomic practices was identified (e.g., ergonomic training alone) that may not result in significant injury and illness reduction.

However, no ergonomic intervention had adverse health effects, suggesting that businesses and SH&E professionals should continue to implement and test new or innovative programs. The hope is that the lessons learned from this group of systematic reviews can help in designing future evaluation efforts that can contribute to the growing evidence base defining ergonomics best practices.

The focus on injury outcomes in defining ergonomic program effectiveness, not on reductions in the exposure or changes in behavior, was a choice. A large amount of literature exists on how ergonomic programs or practices can change exposures (e.g., muscle loading) and behaviors (e.g., lifting postures), but researchers often assume that this translates into injury reductions without directly measuring these reductions.

Many ergonomic programs can increase performance and contribute to productivity independent of reducing ergonomic hazards. Thus, there can be other important metrics for evaluating ergonomic program performance. The goal of this review was to examine injury reduction, since this outcome represents an important program implementation goal.

One challenge in evidence synthesis and the development of best practices is how to determine when the evidence is sufficiently robust to make a recommendation for best practices. The approach chosen synthesizes evidence based on a triangulation of three criteria: research quality; the number of studies and the convergence of findings. When the studies did not use a control or comparison group to evaluate an ergonomic program, the research was less likely to be assessed as high quality. Across reviews this was a common research quality distinction (with the exception of the participatory ergonomic process review).

In healthcare, for example, when faced with the trade-off between helping a patient in a timely manner or waiting for assistance, workers may choose to help the patient, which may put the worker at significant risk. Ergonomics training must provide the appropriate motivation and supports for modeling a behavior that is counterintuitive to the worker and the work culture.

Furthermore, it was assumed that more than one study was necessary to define a best practice. But, if multiple studies are required, how many are enough? Three were chosen.

In discussions with safety professionals in Canada attending the 2006 International Accident Prevention Association meetings in Toronto and U.S. safety professionals attending ASSE's Safety 2007 conference in Las Vegas, NV, they tell us that not only must it be multiple assessments of ergonomic effectiveness, but success in settings that are relevant to their business. Currently, there are insufficient studies from each sector or setting to be able to define a best practice for specific interventions within a particular context. Until the ergonomic program effectiveness literature matures further, requiring more than three studies to be in agreement is an unrealistic expectation.

One goal of the IWH prevention review program has been to increase the accessibility of this literature to practicing professionals. This article represents the first in a series that will present the injury prevention literature to the SH&E professional community. Future articles will draw from the noted reviews and three systematic reviews that IWH is currently completing:

- A Systematic Review of the Effectiveness of Training and Education Programs for the Protection of Workers (in partnership with NIOSH);
- Effectiveness and Implementation of Health and Safety Programs in Small Enterprises: A Systematic Review of Quantitative Intervention and Qualitative Literature;
- 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.

Systematic reviews provide SH&E professionals with an opportunity to use the best available scientific evidence to inform best practices. IWH's systematic reviews have demonstrated that ergonomic programs can be cost effective. The body of evidence, while limited, indicates specific ergonomic policies and practices to continue and some that perhaps need to be reexamined.

Since no ergonomic programs created adverse health effects, opportunities for innovation remain great. As practicing professionals continue to be faced with making decisions about best ergonomics practices it seems critical to evaluate these innovative programs to grow the body of evidence important for defining best practices. ■

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