



INSTITUTE  
FOR WORK & HEALTH  
INSTITUT DE RECHERCHE  
SUR LE TRAVAIL ET  
LA SANTÉ

## **Preventing Injury, Illness and Disability at Work: What Works and How Do We Know?**

**A Discussion Paper for Ontario's Occupational  
Health and Safety Community**

About this report:

Authors: John Frank<sup>1,2,3</sup>, Kim Cullen<sup>1</sup>, and the  
IWH Ad Hoc Working Group\*

<sup>1</sup> Institute for Work & Health

<sup>2</sup> University of Toronto

<sup>3</sup> Canadian Institutes of Health Research –  
Institute of Population and Public Health

\*Curtis Breslin, Donald Cole, Pierre Côté, Renée-Louise Franche, Cameron Mustard,  
Rhoda Reardon, Harry Shannon, Sandra Sinclair

If you would like to receive a copy of this or any other of our reports, please contact us at:  
Institute for Work & Health  
481 University Avenue, Suite 800  
Toronto, Ontario M5G 2E9

Or you can visit our web site at [www.iwh.on.ca](http://www.iwh.on.ca).

© Institute for Work & Health, October 2003  
For reprint permission contact the Institute for Work & Health

## Table of Contents

---

<b>Introduction</b> .....	1
Four Key Themes for Discussion .....	1
The Time Is Right .....	2
<b>THEME 1</b> .....	4
Key Messages (THEME 1):.....	6
<b>THEME 2</b> .....	7
Breaking Down the Silos .....	7
Key Messages (THEME 2):.....	9
<b>THEME 3</b> .....	10
When it comes to prevention, what do we mean by “evidence”?.....	11
Case Studies.....	14
Key Messages (THEME 3):.....	15
<b>THEME 4</b> .....	16
Key Messages (THEME 4):.....	17
<b>Next Steps</b> .....	17
<b>Appendix A: Specific Case Example 1 – Lumbar Supports</b> .....	18
<b>Appendix B: Specific Case Example 2 – Active Intervention Program</b> .....	19
<b>Appendix C: Specific Case Example 3 – Different Back Injury Management Programs</b> .....	20
<b>Reference List</b> .....	21

## Introduction

Historically, occupational health and safety (OH&S) programs have been directed at workplace safety management and also at reducing workers' exposures to chemical and/or physical hazards. But after several decades of concentrated effort by researchers, policy-makers and employers, the decline in rates of workplace injuries is decelerating and long absences from work persist after injury (1-3).

There is now a consensus from leading OH&S researchers that workplace injuries are related to a complex set of risk factors, including physical-ergonomic, psychosocial and work-organizational factors. There is also agreement that, in many cases, these injuries can be prevented by adopting certain policies, procedures and practices.

This paper is intended to initiate a dialogue about prevention among all those who are interested in making Ontario workplaces safer and healthier by building a framework for further discussion and activity.

### Four Key Themes for Discussion

We have identified four key themes that may help to guide our discussion: *(Note: These are not listed in order of importance, but in a way that allows for a logical progression of ideas.)*

- **THEME 1** There are multiple causes for current workplace injury, illness and disability. Therefore it makes sense that preventing these problems will require multiple solutions, operating in synergy.
- **THEME 2** An optimal effort to reduce workplace injury, illness and disability must build on the strengths of traditional primary and secondary prevention approaches, merging these to create a more effective strategy.
- **THEME 3** Before we can agree on which prevention strategies work and which do not, we need a shared understanding of how effectiveness in OH&S interventions should be evaluated. [Effectiveness can be defined as “the extent to which a specific intervention, procedure, regimen, or service, when deployed in the field, does what it is intended to do for a defined population.”(4) ]
- **THEME 4** We must work towards building relationships between those who *do* research and those who *use* this knowledge, so we produce relevant research that is readily taken up and applied to improve occupational health and safety.

## The Time Is Right

Why do we feel this is the right time to initiate a dialogue on prevention of workplace injury?

- There is currently a renewed impetus for increased prevention activities in Ontario. The Ontario Workplace Safety & Insurance Board (WSIB) has stated its continuing commitment to “eliminate all workplace injuries and illnesses in Ontario.” Changes introduced to the Workplace Safety and Insurance Act (5) mean that the WSIB shifted its strict role of providing no-fault workplace insurance for employers and their workers to include injury and illness prevention (see *Figure 1*). Other jurisdictions also have strong prevention mandates, for example, the Workers’ Compensation Board (WCB) of British Columbia regulates occupational health and safety standard compliance through routine inspections of workplaces as part of its prevention agenda (6).

Figure 1

**Ontario WSIB Injury Prevention Policy Statement**

In order to promote health and safety in workplaces and to prevent and reduce the occurrence of workplace injuries and occupational diseases, the Board's functions include:

- to promote public awareness of occupational health and safety
- to educate employers, workers and other persons about occupational health and safety
- to foster a commitment to occupational health and safety among employers, workers and others
- to develop standards for the certification of persons who are required to be certified for the purposes of the *Occupational Health and Safety Act* and to approve training programs for certification
- to certify persons who meet the standards
- to develop standards for the accreditation of employers who adopt health and safety policies and operate successful health and safety programs
- to accredit employers who meet the standards
- to designate safe workplace associations, to designate medical clinics and training centres specializing in occupational health and safety matters and to oversee their operation and make grants or provide funds to them
- to provide funding for occupational health and safety research
- to develop standards for training about first aid and to provide funding to those offering such training
- to advise the Minister on matters relating to occupational health and safety that are referred to the Board or brought to its attention.

- OH&S practitioners have moved beyond simply presenting workplaces with advice based on anecdotal evidence or lists of mandated “rules” established by regulators. More and more, they are seeking and then sharing interventions and strategies that have proven effective using sound, evaluative research. This apparent desire to evaluate their own products and services and to better understand their impact further demonstrates that stakeholders are ready for a dialogue about prevention effectiveness.

- Health and safety researchers are demonstrating a new awareness that simply “studying and publishing” falls short. Researchers—and those who fund their work—now recognize how important it is, right from the start, to explicitly identify methods for transferring research results to relevant audiences. This increased focus on those who actually use research knowledge has also helped to inform the research agenda, stimulating researchers to ask questions that are more relevant from the user’s perspective.
- Finally, within the workplace itself, there are notable examples of employers and labour representatives who are eager to incorporate research knowledge into their decision-making.

# THEME 1

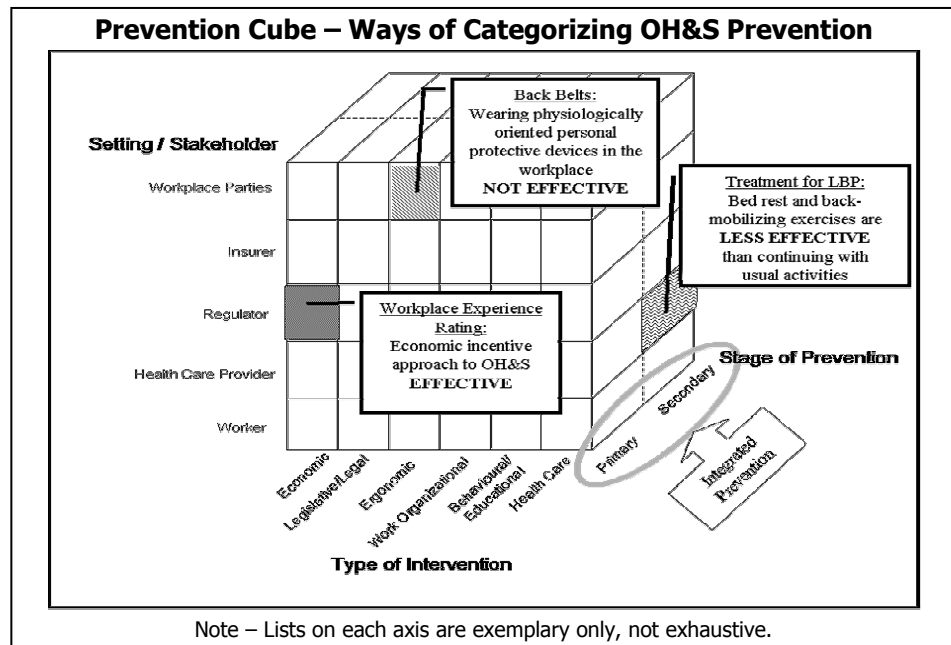
*There are multiple causes for current workplace injury, illness and disability. Therefore it makes sense that preventing these problems will require multiple solutions, operating in synergy.*

A recent study by scientists from the Institute for Work & Health and the University of Waterloo offers a clear example of how multiple causes contribute to workplace health problems. The researchers looked at possible “leading indicators” (risk factors) for new complaints of work-related low-back pain among workers at a Canadian General Motors plant in Ontario.(7) They found that *both* psychosocial factors (such as perceptions that the workplace was not socially supportive) and measured ergonomic exposures on the job played a significant role in workers’ risk for a new episode of low-back pain. The study demonstrates that tackling only ergonomic physical factors or psychosocial workplace factors would almost certainly be insufficient for prevention efforts to succeed.

To effectively design, implement and evaluate OH&S preventive interventions, a fusion of stakeholder involvement and active intervention is fundamental. It is also essential to reliably evaluate the chosen interventions’ impact on a *range* of outcomes. This is the main reason such evaluations generally require the involvement of a mix of disciplines, including behavioural science (individual and organizational), epidemiology and biostatistics and economics.

One way to conceptualize workplace prevention initiatives is to identify settings, stakeholders, types of intervention and stage of intervention (see “Prevention Cube” model, *Figure 2*). Any OH&S prevention policy or program can be slotted into at least one “cell” of the cube.

Figure 2



**SETTING** This includes the place where an intervention will be applied (workplace, health care or other setting).

**STAKEHOLDERS** This includes knowing who will be the responsible partners for implementation of prevention interventions (workplace parties, insurers, regulators, workers or others).

**TYPE OF INTERVENTION** This includes various kinds of prevention interventions that might be applied (e.g., ergonomic, educational, legislative). Such interventions are usually related to some desired outcome (changes in attitudes or knowledge, behaviours, self-reported symptom rates, compensation claim rates, costs, etc.).

**STAGE OF INTERVENTION** This involves considering when it would be most appropriate to stage a particular intervention—primary prevention involves intervening before the onset of symptoms, while secondary prevention takes place after onset (usually to prevent subsequent episodes). It is becoming increasingly clear that simultaneously addressing both “before-” and “after-” injury initiatives may be more effective than continuing to segregate prevention resources into two silos. (This idea will be more fully explored in Theme 3.).

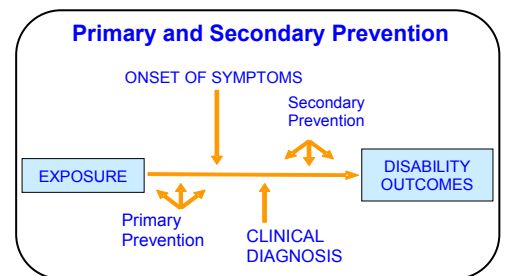
Most OH&S practitioners would describe two fundamental approaches to prevention, according to the stage of health addressed: before or after the onset of injury, illness or disability (see *Figure 3*).

**Primary Prevention:** This type of intervention aims to reduce risk of injury or illness *before* the event occurs (while the person is still healthy). This is generally accomplished by modifying factors known to increase risk by directly controlling a specific hazard or set of hazards—for example, strengthening the person’s resistance (against injury or illness) by increasing his/her skills and/or modifying the work environment.

**Secondary Prevention:** This type of intervention occurs *after* injury or illness has already occurred and aims to reduce long-term disability as well as its associated personal, social and economic costs. Such interventions would include improving the quality of care that workers receive or introducing appropriate disability management strategies. The latter includes the provision, at the workplace, of suitably modified work to accommodate the worker until the disability improves, or vocational retraining if the disability is permanent and incompatible with the worker’s original job. (Such interventions have a much lower success rate and are more costly when they are implemented more than six months post-injury).

Secondary prevention is not restricted to work-related musculoskeletal disorders and injuries. Some toxic-substance exposures in workplaces

Figure 3





are currently best controlled by a combination of exposure-reduction-at-source (primary prevention), combined with “biological monitoring” of the levels of body-burden absorbed (e.g. lead exposure) and/or the degree of “sensitization” of the worker to the substance (e.g. noise-induced hearing loss). (We will return to this idea in Theme 2, when we consider the emerging case for *integrated* occupational prevention programs in workplaces.)

In general, while primary prevention is clearly preferable to secondary prevention on ethical grounds, it is not always feasible. This is especially true in areas where there is limited knowledge about causation of injury, illness or disability. For example, when it comes to occupational low-back pain (the largest single cause of workers’ compensation claims in many jurisdictions) we still have few *proven* primary preventive interventions--although some ergonomic and work-organizational interventions are “promising” (8). Yet we know a great deal about how to reduce disability and promote full recovery in workers who have already been injured, especially in terms of optimal health-care practices, and disability management policies at the workplace (9).

#### **Key Messages (THEME 1):**

- Because there is usually no single cause for workplace injury, illness and disability and no single solution, stakeholders should look more broadly towards other disciplines when designing interventions and expect to take a partnership based “multi-pronged” approach.
- Understanding and documenting the impact of interventions is also a complex task that requires a multidisciplinary and diversely skilled group.

## THEME 2

*An optimal effort to reduce workplace injury, illness and disability must build on the strengths of traditional primary and secondary prevention approaches, merging these to create a more effective strategy.*

Many OH&S experts are embracing the concept that a more holistic approach to primary and secondary prevention strategies makes sense. How can this change in perspective be explained?

- The commonest occupational injuries—soft-tissue sprains and strains, including low-back pain of “mechanical origin” and repetitive strain injuries of the upper limb – tend to recur over many years after their first onset. Such injuries are already so common in some workforces that most workers cannot benefit from truly *primary* prevention, because they have already had symptoms. The goal now must be to control those symptoms, reduce disability and optimize function.
- It has been shown in a number of settings that integrated, multi-pronged programs work best. These include ergonomic improvements in job design; toxic exposure control programs; modern disability management via workplace committees and multidisciplinary care teams; and finally, an OH&S “cultural change” in the workplace as a whole. When used together, these approaches contribute powerfully to *both* primary and secondary intervention in a synergistic way (10-12). These integrated OH&S intervention programs can thus be said to contribute to *overall disability prevention or “control,”* acting at multiple stages before the disability becomes chronic or severe.

Indeed, a recent consultant’s report to Ontario’s WSIB stated that: “Prevention organizations are increasing their focus on secondary as well as primary prevention. As such there is a move towards greater integration between Prevention and Return to Work along the continuum.”(13).

### Breaking Down the Silos

Recently, Yassi, Ostry, and Spiegel (14) argued the logic behind integrating workplace resources across primary and secondary prevention approaches--a task that they described as “breaking down the solitudes”. This proposal stemmed from the following observations:

- An effective ergonomic *primary* prevention initiative in a hospital setting resulted not just in fewer injuries (primary

prevention) but also in unexpectedly shorter durations of lost time after injury (secondary prevention) (15)

- A comprehensive, hospital-based, return-to-work program for nursing personnel, which decreased time lost from work after injury on targeted wards (secondary prevention), also resulted in an unexpected 33 per cent reduction in injury incidence (primary prevention) (11;12).

In both of the previous studies, Yassi and colleagues noted that senior management commitment and meaningful worker participation were crucial for the success of the programs. Synergistic injury prevention and disability management initiatives appear to make more efficient use of available resources (both personnel and financial), and should lead to more sustained improvements in workplace injury, illness and disability outcomes.

- A recent qualitative study from Quebec (16), examining return-to-work success after musculoskeletal injury in the electric and electronic sector, identified several key factors that facilitated return to work. One key to success was the integration of health and safety prevention activities and return-to-work programs. Injury investigations examining the physical and organizational factors that led to the workplace injury were useful in making recommendations for job modifications to help the injured worker return to his/her regular job. The investigations also yielded corrective strategies that would prevent similar injuries from happening to other workers. Another effective approach identified in the study was to utilize the same safety-oriented individuals who were responsible for prevention of MSK injuries in the development of appropriate modified return-to-work programs for injured workers.
- A “people-oriented” culture in the workplace is crucial to the success of integrated prevention and return-to-work programs. For example, Stock et al. (16) found that when management demonstrated a strong commitment to effective health and safety initiatives through their actions, workers believed their employers were genuinely concerned with their health and well-being, rather than simply being preoccupied with cost-control. This commitment from management fosters an environment in which there is open communication and trust between workers and their supervisors when designing return-to-work plans. Workers are more likely to attempt early return-to-work in such cases.
- Recognizing the multifactorial risk factors for musculoskeletal disorders, Cole, et al (17) have developed and are testing a new framework for evaluating an integrated prevention intervention program within the office operations of a large

Ontario newspaper. This framework provides stakeholders with strategies, objectives, and measurement tools to evaluate the effectiveness of comprehensive intervention programs on outcomes, including both injury incidence and long-term disability. While the researchers are optimistic that this framework will be useful in evaluating integrated primary and secondary prevention interventions, it is still too early to draw conclusions about effectiveness. Their work remains “promising, but not yet proven effective,” and as such, will be discussed under Theme 3.

Despite the growing evidence that primary and secondary prevention strategies work best when they work together, some stakeholders are still structured—or mandated—to work only on primary prevention (traditional safety programs in the workplace) or secondary prevention (disability management programs). This is not an ideal situation, but it provides us with an obvious target for change.

### **Key Messages (THEME 2):**

- Combining primary and secondary interventions can yield greater impact than the sum of impacts from separately implemented interventions.
- Policies regarding the mandate of OH&S organizations should be examined to ensure that they facilitate a holistic, synergistic approach.
- Workplaces should examine their internal systems to ensure they have not structured programs in a way that encourages isolated “silos” and under-utilization of skills and experience.
- Researchers and stakeholders should experiment with novel approaches to deliver primary and secondary prevention programs in a more integrated fashion in Ontario.

## THEME 3

*Before we can agree on which prevention strategies work and which do not, we need a shared understanding of how effectiveness in OH&S interventions should be evaluated. [Effectiveness can be defined as “the extent to which a specific intervention, procedure, regimen, or service, when deployed in the field, does what it is intended to do for a defined population”(4)]*

In order for a preventive strategy to be successful, we need reliable ways to measure and determine effectiveness. Only then can we be sure that reductions in occupational “adverse outcomes” are the direct result of particular policies or programs. The major thrust of this theme will be to emphasize the importance of carefully evaluating the effectiveness of interventions and conducting these evaluations together in an interdisciplinary fashion.

OH&S decision-making involves much more than simply evaluating the *effectiveness* of promising interventions. Those who decide whether or not to implement a particular intervention must also consider important criteria such as cost, feasibility, equity, ethics, etc. Runyan (18) has provided a practical guide for decision-makers that can help them determine whether implementation of an intervention is warranted.

The best way to ensure that evidence-based interventions are used is to develop a partnership between those who produce research/evaluation knowledge and those who use it. In many cases, however, researchers and decision-makers are unable to understand each other’s needs or even to communicate effectively. Jonathon Lomas, an academic who has devoted much of his career to improving research dissemination and knowledge uptake, says this situation is like “two people trying to assemble a jigsaw puzzle, each with half the pieces... but each working in a separate room”.(19)

There are two critical junctures in the relationship between research producers/evaluators and decision-makers. The first occurs before the decision to implement a program or policy; the second critical period occurs after implementation, when the time comes to measure impact.

Before deciding whether to implement a new intervention (program, policy or practice), decision-makers may seek some kind of helpful tool or decision-aid. One tool is an expert critical review of available evidence that has been translated into an accessible format. Eventually, it becomes possible to produce regularly updated and “user-friendly” databases that efficiently summarize the best-quality evidence available on each major intervention option, for use by a wide variety of audiences. This strategy is already working for clinicians who seek best evidence on health-care interventions (e.g., The Cochrane Library) (20).

After implementation, a certain amount of time must pass before observers can determine whether or not it has been effective. During this period, it's important to maintain close collaboration among the research users (those responsible for OH&S programs, policies and practices) and the researchers/evaluators who are trained to assess impact. This approach is more likely to produce a rigorous, comprehensive evaluation design. The evaluation strategy should always be agreed upon *a priori*, to provide answers to the users' key questions about the intervention.

This kind of multi-step, “before-and-after” process is critical to ensure that appropriate prevention goals are achieved. One exciting example of this strategy comes from Yassi and colleagues (21) in British Columbia. Using a collaborative problem-solving approach, researchers, workers and managers identified problems and implemented evidence-based initiatives to improve the health and working conditions of health-care workers.

First, the B.C. collaborators conducted a needs assessment, then carried out a review of the scientific literature. The process also included stakeholder focus groups and cost-benefit analyses. The researchers then used their data to develop “best practice” guidelines. The project was so successful that all stakeholder parties have agreed to continue this collaboration and process as they address ongoing OH&S challenges in the health-care sector.

### **When it comes to prevention, what do we mean by “evidence”?**

A major challenge to those involved in designing prevention strategies is obtaining the best possible evidence both before and after an intervention takes place. Researchers must be extremely careful in designing such interventions, and also in how they collect, synthesize and interpret data. Here are some points to consider in future discussions:

#### ***Evaluating effectiveness takes time.***

A considerable amount of time must often pass before it is possible to determine with certainty whether an intervention has had any impact and whether that impact has been positive. Mere “personal observation” of effectiveness is not enough.

For example, in the worst case scenario of asbestos exposure reduction, it takes between 20 and 50 years to see any reduction in the rates of asbestos-related cancers, and slightly less time before we see fewer new cases of asbestosis.

When it comes to implementing better “return-to-work” policies, the “lag times” are shorter, but it can still take between three and five years before a reduction in long-term disability and its costs become apparent. (However, early leading indicators of impact may be noticed sooner—for example, there may be reductions in the

proportion of worker compensation [WC] claimants still on temporary disability payments at one year after injury.)

***Commonly accepted wisdom is not necessarily evidence.***

When it comes to prevention interventions, often no rigorous evaluations are carried out to determine effectiveness. This can result in the widespread adoption of ineffective interventions. For example, Saari (22) described a safety-poster campaign at a shipyard that was well-received by the workers. But careful comparisons with a control group found that the poster campaign had no actual effect on safety outcomes among shipyard workers. According to Saari, “If a careful evaluation of accidents had not been made, the campaign would have been promoted as an effective programme.”

***Evidence evaluators must possess a diverse skill-set.***

Many disciplines are involved in evaluating effectiveness of OH&S interventions (e.g. management sciences, organizational behaviour, traditional social and behavioural sciences, epidemiology, biostatistics, ergonomics, biomechanics, physiology). However, many researchers are not experienced in multidisciplinary teamwork. Thus, some evaluations of new programs or policies are not well done because the evaluating team is too narrowly-based. Achieving multidisciplinary evaluations requires building closer long-term relationships among workplaces, regulators, insurers, other stakeholders and researchers. (We will return to this idea under Theme 4).

***Real-world interventions cannot be properly evaluated in a laboratory***

Many extraneous factors can influence OH&S outcomes requiring complex evaluation approaches and study designs. This is further complicated by the fact that many such influencing factors do not remain constant over the duration of a new program/policy implementation. One example is provincial (or national) worker compensation claim rates, which are affected over time by an array of factors such as: business cycles and labour market phenomena; legislative and regulatory changes; evolving long-term sectoral shifts in workforce composition; and the nature of the economy, such as declining primary resource extraction and increasing service sectors. (2;3;23)

***Findings should be replicable***

An important principle in science is replication. In many circumstances, we only have one high-quality study looking at a particular intervention, and we must rely on it as the best information available. But single studies may have flaws (or quirks) that are not obvious. Ideally, it is better to have corroborative evidence from at least one other independent study (conducted by others in a different setting). Many will remember the example from physics of the false promise of cold fusion. After the study by Pons and Fleishman (1989) was reported, many others tried to replicate their results, but could not

do so. It was thus generally agreed that the initial experiment was flawed.

***Individual stakeholder agendas must not be allowed to influence evaluation results.***

There is a natural tendency in prevention evaluations—as in other aspects of OH&S—for various “vested interests” to desire particular evaluation outcomes. This underscores the need for high quality, scientifically determined effectiveness evidence which can withstand scientific peer review and legal scrutiny. For details, we refer you to the 2000 USA Occupational Health and Safety Administration (OHSA) Ergonomic Regulations hearings (24).

***Researchers and evaluators must do more than simply share results.***

They must also share an understanding of what does—and does not—constitute dependable, strong, and reliable results. Unfortunately, the strength of much prevention research available today is limited—reviews show that a large proportion of published studies (even those that have undergone peer-review) are based on weak designs. They are thus open to criticism and, as such, are not helpful to decision-makers and other prevention stakeholders. (To better understand the challenges of designing and conducting credible evaluative studies, see *Figure 4*.)

Figure 4

**Can we trust the evidence?**

One important tool for determining the evidence about a particular intervention is the “systematic review” – a scientific weighing of existing literature. During this process, reviewers must judge whether findings “for” or “against” the intervention are strong enough to be reliable. In fact, many “promising” interventions are currently supported by weak (methodologically inadequate) studies. Such interventions cannot themselves be discarded because quality research is lacking. They remain “promising but not proven,” pending more and better research, and can thus be described as *future research priorities*.

It may be easier to produce convincing evidence of effectiveness for the “biomedical” and educational preventive interventions – this is because such interventions can be more readily randomized (i.e. applied to different groups of individuals or workplaces) in a controlled experiment.

It is much more difficult to evaluate policy interventions, which can only be implemented at the level of entire populations/jurisdictions, since they tend to require more complex study designs. Despite the greater challenges of evaluating policy and program interventions, sound results are possible if there is adequate scientific input to study design, preferably well in advance of initiation. Time series and quasi-experiments are examples of more complex study designs, which can be used under these circumstances.(25)

Here are some useful concepts to consider in a discussion of evidence-based practice:

- Is there evidence? (Has the intervention been studied using sound scientific enquiry?)
- Does the evidence *support* the intervention by offering proof that it works? Or does the evidence *not support* the intervention by showing it makes no difference to outcomes? Or is there evidence *against* the intervention, because research shows it actually causes harm?
- How strong is the evidence for or against an intervention? This is determined by examining both how the study was designed and how many good quality studies have generated the same evidence (preferably from different settings).
- Research designs must be carefully considered when weighing evidence about the effectiveness of prevention interventions.



It is vital that OH&S policy-makers, program managers and practitioners understand what constitutes high-quality evidence. Some new, user-friendly guides on how to conduct exemplary OH&S evaluations are now available, especially for workplace interventions (25). For workplace parties and OH&S professionals seeking information and practical assistance, research advisors and consultants skilled in evaluation design will continue to be needed.

### ***Look at existing evidence for ethical and economic impacts***

In addition to the above considerations, before a prevention intervention is implemented, the stakeholders need to look at existing evidence for both the ethical and economic impacts.

**Ethical concerns** There is always the possibility that an apparently benign prevention program may have unanticipated negative effects. For example, some researchers looking at experience-ratings<sup>1</sup> of workers' compensation premiums have been concerned that business firms might attempt to "hide" cases of occupational injury and illness (26). One method to conceal such data would be to provide health care directly to the injured worker and thus bypass formal reporting to the workers compensation system. Decision-makers and stakeholders must be aware that an intervention can have this kind of unintended effect.

**Economic considerations** Each prevention option (including the "do nothing"/business-as-usual" option) has pros and cons and an effect on costs. To achieve the *best use of available resources* for OH&S prevention, existing evidence about these alternative programs, policies and practices should be used to inform decision-makers, so as to help insure the best possible decisions are made.

### **Case Studies**

Before we move on to the next theme in our prevention discussion, we think it's important to share some actual case studies that illustrate the challenges facing decision-makers and researchers in their quest for evidence-based interventions. Appendices A through C (attached) cite specific studies that have greatly influenced the field of OH&S prevention. In each case, we summarize and critique a recent, relevant high-quality review<sup>2</sup> of the literature or a convincing original intervention study. Our intent is to demonstrate, by concrete example, how preventive interventions should be evaluated, and also why we believe each study is scientifically credible. The case studies also show how evidence quality is influenced by study design, the number

---

<sup>1</sup> The process through which employer's workers' compensation insurance premiums are tied to their accident records (i.e., higher accidents rates produce higher premiums the employer must pay). This process creates a financial incentive for employers to improve their workplace's health and safety through injury prevention.

<sup>2</sup> We often use the word *systematic* review to describe literature reviews that follow a prescribed approach to ensuring that all the best-quality studies are appropriately identified and summarized (30).

of corroborating studies and the generalizability of the results to other populations.

We can also point you to several excellent resources that offer guidance in critically appraising intervention research. (25;27-29)

**Key Messages (THEME 3):**

- Researchers and decision-makers/users must move towards a shared understanding of effectiveness. when it comes to designing and evaluating OH&S interventions. Such a dialogue should be initiated across a broad set of research disciplines and should include all who might use such evaluative research—program administrators, policy makers, practitioners, and the OH&S institutions/organizations they represent.
- The new delivery structure required for integrated primary and secondary prevention interventions would produce unique challenges in evaluation. These should be dealt with using more sophisticated methods in better-planned evaluations.

## THEME 4

*We must work towards building relationships between those who do research and those who use this knowledge, so we produce relevant research that is readily taken up and applied to improve occupational health and safety.*

- Research organizations and granting agencies are already recognizing how essential it is that knowledge gained through scientific study does not stop at publication. They understand the value of knowledge transfer (KT) (also known as knowledge transfer and exchange), a discipline that ensures that knowledge is transferred, in the form of compelling ideas or useful tools, to the appropriate “audiences.”
- At the same time, many decision-making organizations have recognized the need inform their prevention activities by obtaining scientifically standardized evidence reviews of existing research (known as “systematic synthesis.”).

The Canadian Health Services Research Foundation describes this as the “push/pull style of knowledge brokering.” It further suggests that this is a stepping stone for better, longer-term knowledge-brokering, which is built on sustained relationship building between the producers and users of research knowledge.

When we talk about health outcomes and the role of knowledge transfer, it is worth remembering that many diverse methods can be effective in “getting the message out” to the intended audience (see *Figure 5.*)

Figure 5

### **Popular Education/Knowledge Transfer Intervention**

In Australia, a multimedia back education ad campaign targeted at the general public attempted to change attitudes and expectations around back pain. The results demonstrated in the two-year program were:

- more scientifically-based beliefs about back pain in the general population
- improved knowledge and attitudes of health-care practitioners, which appeared to influence their management of back pain
- reduction in compensation and disability costs related to back pain

*Buchbinder, Jolley, & Wyatt, 2001 (31)*

While these important seeds are finally being planted, we must take steps to tend and encourage the crop. For example, we must develop planned, multi-year programs of KT/KE activities which link OH&S evaluative researchers and research users. This will yield research that is relevant and informed by user experience, that produces knowledge that proceeds directly to uptake and application, and that results in improved “real world” decision-making. Such an approach recognizes that research and decision-making are part of a paired process, and that the greatest benefit comes from creating and exploiting multiple points of contact within long-term relationships.

#### **Key Messages (THEME 4):**

- Stakeholders (both researchers and research-users) should create “neutral-turf meeting-grounds” for the regular exchange of knowledge and ideas. This type of independent, scientifically credible forum would allow OH&S stakeholders—who may hold quite different views and values—to interact directly and meaningfully with researchers. Such discussions could address questions about “what works” in occupational health prevention, and also consider what kinds of evaluative research are required to prevent injury, illness and disability in Ontario workplaces.
- An assessment of stakeholders’ continuing education needs and wishes should be undertaken—especially concerning the use of evaluative research results in their decision-making.

#### **Next Steps:**

In this paper we have reviewed the types of prevention interventions in OH&S; argued for more integration of primary and secondary prevention; suggested the need for shared understanding of what constitutes convincing evidence of effectiveness and advocated for closer ties between OH&S researchers and research-users/decision-makers. All of these strategies are themselves like links in a chain—the chain leading from sound OH&S research to effective policies, programs and practices. Any weak link and the whole chain may be compromised—but together we believe that these strategies can and will make a significant difference to workers’ health.

The Institute has drafted this discussion document to initiate a dialogue among Ontario’s prevention partners to work towards more effective prevention interventions. We see the discussion as another step on the road to building a common understanding and set of objectives among the prevention partners.

## Appendix A: Specific Case Example 1 – Lumbar Supports

### Are lumbar supports effective for prevention (primary and secondary) and treatment of non-specific low-back pain (LBP)?

Citation: Jellema et al., 2001 (32)

**Design:** Systematic review of randomized and nonrandomized controlled trials on prevention and treatment of non-specific LBP using lumbar supports.

**Sample:** 7 prevention trials and 6 treatment trials

**Analysis:** Qualitative analysis of the scientific evidence from the 13 trials.

**Results:** Prevention:

1. Moderate evidence that lumbar supports are **not** effective for primary prevention of LBP
2. **No** evidence on effectiveness for secondary prevention of LBP

Treatment:

1. Limited evidence that lumbar supports are more effective than no intervention for pain relief for patients who already have LBP
2. Conflicting evidence as to whether lumbar supports are more or less effective than other interventions for treatment of LBP

**Interpretation:**

1. Lumbar supports are **not** recommended for primary prevention or treatment of non-specific LBP
2. There is a continued need for high-quality RCTs on the effectiveness of lumbar supports for prevention and treatment of LBP

**Basis for selection of this study as high-quality:**

This systematic review met the assessment criteria for evaluating the quality of systematic reviews. (30)

**Possible mechanism by which the intervention “worked” or did not work:**

Compliance may have been a problem for many of the studies reviewed – i.e., individuals assigned to wear lumbar supports may not have complied with recommended usage throughout the study period.

Also, there is a body of expert opinion among biomechanical researchers suggesting that back belts simply do not have the right “physics” to prevent back strain, but they may have substantial “psychological effects” – e.g., by constantly reminding workers to lift more carefully, thus explaining their minor positive effects in some studies.

**Overall Implications for Action**

Based on current evidence, lumbar supports are not recommended for primary prevention or treatment of non-specific LBP.

## Appendix B: Specific Case Example 2 – Active Intervention Program

### Is an early, active intervention program for workers with soft-tissue injuries more effective than usual care in reducing disability related outcomes?

Citation: Sinclair et al., 1997 (33)

**Design:** Observational prospective cohort study (i.e., observing a defined group over time)

**Sample:** 885 injured workers in Ontario with “new” back injury cases from May-Nov. '93.

**Analysis:** The main research questions:

1. Were there differences between program attendees and non-attendees on disability outcomes?
2. Was this difference a spurious result of baseline differences between groups, or due to the program’s effects?

**Results:**

1. Patients in both the intervention group and usual care demonstrated improvements in functional status, pain ratings and quality of life from baseline to 1 year follow-up.
2. However, there was no statistical difference between the groups on effectiveness for these non-economic outcomes, nor for the total time on benefits (an economic outcome).

**Interpretation:** There was *no* advantage to participating in the early, active intervention program over usual care for treatment of work-related soft-tissue injuries to the back.

#### **Basis for selection of this study as high-quality:**

This study met the appraisal criteria for evaluating the quality of individual cohort studies as described by Côté et al. (34)

#### **Possible mechanisms by which the intervention “worked” or did not work:**

The intervention program was not more effective than usual care. This may be due to:

1. Workers entering the program too soon—many would have done well with no program.
2. Physicians making unscreened referrals to this program without identifying valid prognostic factors, rather than referring only high-risk cases. Clinician and patient awareness and personal preference may have guided the referral decision.
3. The program was unrelated to work demands, and did not liaise at all with the workplace.
4. Participants may have stayed in the program too long due to:
  - a perception by clinicians and WCB case managers that this program was effective and thus other interventions were not necessary,
  - an employer perception that workers need to be “fully recovered” before RTW,
  - a financial incentive for community clinics to delay discharge.

#### **Overall Implications for Action**

This early, active intervention program was *not* more effective than usual care in reducing periods of disability for workers with “new” back related injuries.

## Appendix C: Specific Case Example 3 – Different Back Injury Management Programs

### Is there a difference in the effectiveness of four different back injury management programs in reducing disability outcomes?

Citation: Loisel et al., 1997 (35)

**Design:** Population-based randomized control trial in Sherbrooke, Quebec.

**Sample:** Injured workers with back pain (absent from work or on light duties for at least 4 weeks up to 12 weeks) were randomized into 1 of 4 treatment conditions (usual care, occupational intervention, clinical intervention, full intervention--a combination of the last two).

**Analysis:** Duration of absence from *regular* work and functional status and pain were compared between groups.

**Results:**

1. The full intervention group had a lower duration of absence from regular work compared to the usual care group.
2. The full intervention group returned to regular work 2.41 times faster than those in the usual care group (statistically significant\*).
3. The rate of return to work for the groups receiving the *occupational* intervention was 1.91 times faster than for those that did not (statistically significant\*).
4. There was no significant difference in duration of absence from regular work between the groups that received the *clinical* intervention vs. those that did not.
5. At 1-year follow-up, the full intervention demonstrated a significant improvement in functional status over the "usual care" group. A similar trend was found for the pain measure (not statistically significant\*).

**Interpretation:** The full intervention program (comprised both clinical and occupational intervention components) was effective in reducing the outcomes of disability in this study.

**Basis for selection of this study as high-quality:**

This study met the methodological quality criteria for evaluating a RCT as described by Jellema et al. (32)

**Possible mechanisms by which the intervention "worked" or did not work:**

There is mounting evidence that effective back-injury management programs must have a tie into the workplace (11;12;36). This study provides further support for this view.

**Overall Implications for Action**

Interventions designed to reduce disability outcomes for subacute to chronic back pain management should incorporate both clinical and occupational intervention strategies.

## Reference List

- (1) Workplace Safety and Insurance Board. Statistical supplement to the 2000 Annual Report. Toronto: Workplace Safety and Insurance Board, 2000.
- (2) Ostry A. From chainsaws to keyboards: Injury and Industrial disease in British Columbia. In: Sullivan T, editor. *Injury and the New World of Work*. Vancouver: UBC Press, 2000: 27-45.
- (3) Mustard C, Cole D, Shannon H, Pole J, Sullivan T, Allingham R et al. Declining trends in work-related morbidity and disability 1993-1998: A comparison of survey estimates and compensation insurance claims. *Am J Public Health* 2003; 93:1283-1286.
- (4) Last JM. *A dictionary of epidemiology*. Toronto: Oxford University Press, 1988.
- (5) Workplace Safety and Insurance Act Part II 4(1). 1997. Retrieved: October 22, 2002. Accessed at: [http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/97w16\\_e.htm#P566\\_15675](http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/97w16_e.htm#P566_15675).
- (6) Workers' Compensation Board of BC. Part 3: Rights and Responsibilities. Occupational Health and Safety Programs. [worksafebc.com](http://worksafebc.com) 2002. Retrieved on: June 6, 2003. Accessed at: <http://regulation.healthandsafetycentre.org/s/Part3.asp#SectionNumber:3.5>.
- (7) Kerr MS, Frank JW, Shannon HS, Norman RW, Wells RP, Neumann WP et al. Biomechanical and psychosocial risk factors for low back pain at work. *Am J Public Health* 2001; 91(7):1069-1075.
- (8) Linton SJ, van Tulder MW. Preventive interventions for back and neck pain. In: Nachemson A, Jonsson E, editors. *Neck and back pain: the scientific evidence of causes, diagnosis, and treatment*. Philadelphia: Lippincott Williams & Wilkins, 2000: 127-148.
- (9) Frank J, Sinclair S, Hogg-Johnson S, Shannon HS, Bombardier C, Beaton D et al. Preventing disability from work-related low-back pain. *Can Med Assoc J* 1998; 158(12):1625-1631.
- (10) Habeck RV, Hunt HA, VanTol B. Workplace factors associated with preventing and managing work disability. *Rehab Counselling Bull* 1998; 42(2):98-143.
- (11) Yassi A, Khokhar J, Tate R. The epidemiology of back injuries in nurses at a large Canadian tertiary care hospital: Implications for prevention. *Occup Med* 1995; 45:215-221.
- (12) Yassi A, Tate R, Cooper JE, Snow C, Vallentyne S, Khokhar JB. Early intervention for back-injured nurses at a large Canadian tertiary care hospital: an evaluation of the effectiveness and cost benefits of a two-year pilot project. *Occup Med* 1995; 45(4):209-214.
- (13) Unknown. Draft For Discussion: Workplace Health & Safety in Ontario. Macro Environmental Scan. January 17, 2003, 3-44.
- (14) Yassi A, Ostry A, Spiegel J. Injury prevention and return to work: Breaking down the solitudes. In: Sullivan T, Frank J, editors. *Preventing and managing injury and disability at work*. London: Taylor & Francis, 2003: 75-86.
- (15) Ronald LA, Yassi A, Spiegel J, Tate RB, Tait D, Mozel MR. Effectiveness of installing overhead ceiling lifts. *AAOHN Journal* 2002; 50(3):120-127.
- (16) Stock S, Deguire S, Baril R, Durand M-J. Obstacles and factors facilitating return to work of workers with musculoskeletal disorders: Summary of the report on the Quebec qualitative study in the electric and electronic sector of Workready Phase 1. Montreal: Direction de la sante publique, 1999.



- (17) Cole DC, Wells RP, Worksite Upper Extremity Group. Interventions for musculoskeletal disorders in computer-intense office work: a framework for evaluation. *Work & Stress* 2002; 16(2):95-106.
- (18) Runyan CW. Using the Haddon matrix: introducing the third dimension. *Injury Prevention* 1998; 4(4):302-307.
- (19) Lomas J. Improving research dissemination and uptake in the health sector: Beyond the sound of one hand clapping. Hamilton: CHEPA, 1997.
- (20) The Cochrane Library. The Cochrane Collaboration. Retrieved on June 6, 2003. Accessed at: <http://www.update-software.com/cochrane/>.
- (21) Yassi A, Ostry AS, Spiegel J, Walsh G, de Boer HM. A collaborative evidence-based approach to making healthcare a healthier place to work. *Hosp Q* 2002; 5(3):70-78.
- (22) Saari J. Safety interventions: International perspectives. In: Feyer AM, Williamson A, editors. *Occupational Injury - Risk, Prevention and Intervention*. London: Taylor and Francis, 1998: 179-195.
- (23) Gunderson M, Hyatt D. Workforce and workplace change: Implications for injuries and compensation. In: Sullivan T, editor. *Injury and the new world of work*. Vancouver: UBC Press, 2000: 46-68.
- (24) Frank J, Lomax G. Public health action to control hazards: How good should the evidence be? Reflections on the OSHA Ergonomics standard hearings. *New Solutions* 2002; 12(1):17-25.
- (25) Robson LS, Shannon HS, Goldenhar LM, Hale AR. Guide to evaluating the effectiveness of strategies for preventing work injuries. How to show whether a safety intervention really works. Department of Health and Human Services; Centers for Disease Control and Prevention; National Institute for Occupational Safety and Health; Institute for Work & Health, 2001.
- (26) Ison TG. The significance of experience rating. *Osgoode Hall Law Journal* 1986; 24(4):723-742.
- (27) Goldenhar LM, Schulte PA. Methodological issues for intervention research in occupational health and safety. *Am J Ind Med* 1996; 29:289-294.
- (28) Goldenhar LM, Schulte PA. Intervention research in occupational health and safety. *J Occup Med* 1994; 36(7):763-775.
- (29) Shannon HS, Robson LS, Guastello SJ. Methodological criteria for evaluating occupational safety intervention research. *Safety Science* 1999; 31:161-179.
- (30) Klassen TP, Jadad AR, Moher D. Guides for reading and interpreting systematic reviews I: getting started. *Arch Pediatr Adolesc Med* 1998; 152:700-704.
- (31) Buchbinder R, Jolley D, Wyatt M. 2001 Volvo Award Winner in Clinical Studies: Effects of a media campaign on back pain beliefs and its potential influence on management of low back pain in general practice. *Spine* 2001; 26(23):2535-2542.
- (32) Jellema MP, Tulder MW, Poppel MN, Nachemson AL, Bouter LM. Lumbar supports for prevention and treatment of low back pain: A systematic review with the framework of the cochrane back review group. *Spine* 2001; 26(4):377-386.
- (33) Sinclair SJ, Hogg-Johnson SA, Mondloch MV, Shields SA. The effectiveness of an early active intervention program for workers with soft tissue injuries: The Early Claimant Cohort study. *Spine* 1997; 22(24):2919-2931.

- (34) Cote P, Cassidy JD, Carroll L, Frank JW, Bombardier C. A systematic review of the prognosis of acute whiplash and a new conceptual framework to synthesize the literature. *Spine* 2001; 26(19):E445-E458.
- (35) Loisel P, Abenhaim L, Durand P, Esdaile JM, Suissa S, Gosselin L et al. A population-based, randomized clinical trial on back pain management. *Spine* 1997; 22(24):2911-2918.
- (36) Lindstrom I, Ohlund C, Eek C, Wallin L, Peterson LE, Fordyce WE et al. The effect of graded activity on patients with subacute low back pain: A randomized prospective clinical study with an operant-conditioning behavioral approach. *Phys Ther* 1992; 72(4):279-293.