



# Improving Occupational Health and Safety Policy Through Intervention Research

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Intervention research in occupational health and safety (OHS) addresses the development, implementation, and evaluation of OHS interventions (Goldenhar et al, 2001). Intervention research, with its applied focus, complements etiologic research in OHS (such as occupational epidemiology). It has tended to be under-emphasized historically in relation to more basic science-oriented etiologic research. The goal of intervention research in OHS is to translate basic research knowledge into public health action and benefits. As such, intervention research in OHS is often cross-disciplinary, drawing from a range of disciplines such as program evaluation, education, and social psychology in addition to

OHS and other branches of public health.

The US National Institutes for Occupational Safety & Health (NIOSH) presented a National Occupational Research Agenda (NORA) to improve OHS in 1996 (NIOSH, 1996; Rosenstock et al, 1998). NORA was based on input from over 500 stakeholder groups across the country and identified 21 priority research areas, one of which was Intervention Effectiveness Research (Rosenstock, 1996). For each priority research area, NIOSH assembled a Team of experts in the area, drawing from labour, industry, academia, and government. The Intervention Effectiveness Research Team developed a

conceptual model of intervention research in OHS (Goldenhar et al, 2001) in order to:

- Provide an integrating framework for diverse activities;
- Articulate relationships among various types of intervention research;
- Facilitate assessment of the current state of the field in order to guide strategic planning (e.g., specific requests for intervention research proposals); and
- Develop common language to facilitate communication.

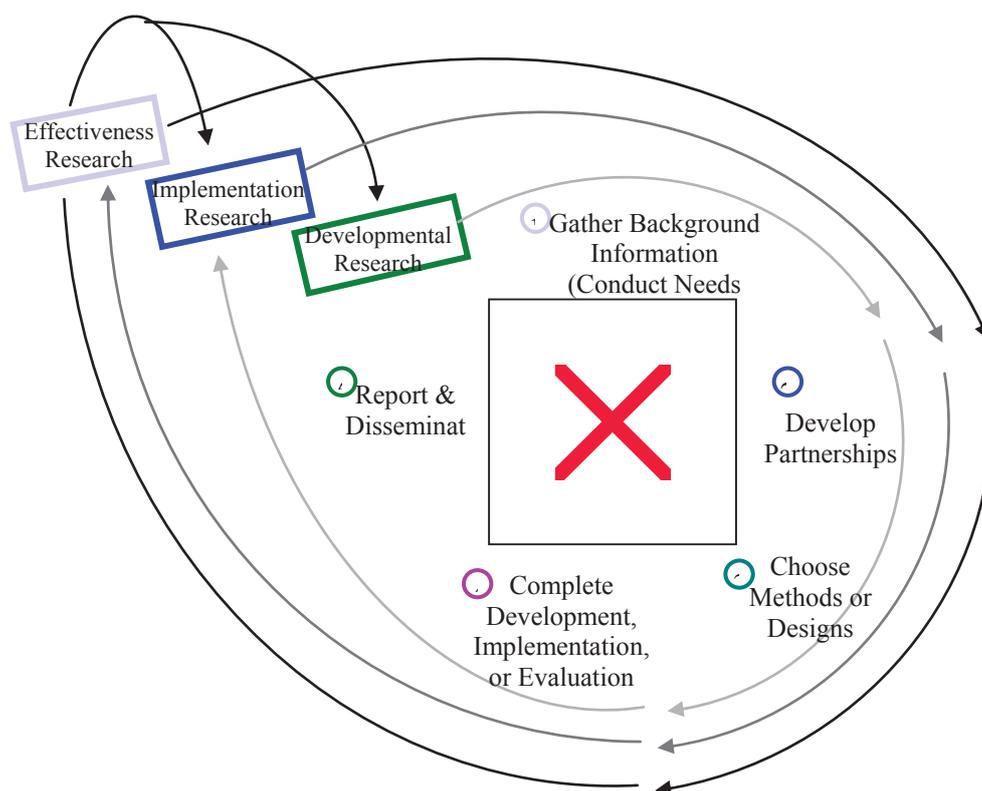
This model posits that the intervention research process is cyclical and progressive and involves three broad research phases of intervention development, implementation, and

evaluation (Figure 1) (Goldenhar et al, 2001). Further, it includes a set of five tasks that are important in any intervention research study: (i) gathering background information and conducting needs assessment on the

problem and the range of possible intervention strategies; (ii) developing partnerships with relevant stakeholder groups; (iii) choosing appropriate research methods and study designs; (iv) conducting the research; and (v)

reporting on and disseminating findings. Finally, intervention research can be conducted at levels ranging from simple worksite programs to national or international policy.

**Figure 1: Intervention Research In OHS: A Conceptual Model**



## Focus On OHS Policy Intervention Research

Policy-level interventions include mandatory national or state/province-level regulations (e.g. regulations promulgated by the various state and territory Work Cover Authorities in Australia, European Union OHS directives) as well as voluntary guidelines recommended by respected professional, trade, research, or other authoritative groups (e.g. International Labour Organisation (ILO) Conventions, International Standards Organization (ISO) Standards, US National Institute for Occupational Safety & Health (NIOSH) guidelines). Despite the fact that regulatory interventions are often challenged by various groups, there has been relatively little peer-reviewed research published on the evaluation of such interventions (Goldenhar et al, 2001; LaMontagne, 2000). What little there is tends to address regulatory or legislative more than voluntary

policies, and occupational safety more often than occupational health policy interventions. Policy-level interventions are the particularly challenging to evaluate for many reasons, including the need for large-scale study, the lack of control over the intervention, and study design limitations imposed by ethical and other concerns (LaMontagne, 2000). For occupational health-focused policies in particular (e.g. regulations on occupational carcinogens), there are additional challenges in relating interventions to disease outcomes due to long latency periods from exposure to disease, non-work contributions to many disease that are also caused by occupation, and other issues. For example, despite regulatory actions against asbestos taking off in the 1970's in many industrialized democracies, most such countries have not yet

reached the peak of asbestos related mesothelioma and lung cancer. In Australia, for example, the peak of mesothelioma incidence is projected to occur around 2010 (Leigh et al, 2002) though regulatory interventions began in earnest in the 1970's.

Despite the numerous challenges to evaluating OHS policy interventions, such research will play an increasingly important role in political and economic environments that demand greater and greater justification for new regulations of any sort, as well as greater accountability for regulations that are already in place (LaMontagne and Kelsey, 1998). The remainder of this paper will focus on how OHS policy-making, implementation, and effectiveness can be improved through intervention research, with a particular focus on policies targeting health (versus safety) outcomes.

## Evaluating OHS Policy Interventions: Implementation and Effectiveness

Policy-level interventions are usually developed based upon the best

available evidence regarding risks and how best to control them.

They thus have implied or explicit expectations about how requirements

or recommendations will be implemented, and in turn, the impacts of implementation. Fundamental evaluation questions thus concern implementation and effectiveness, as outlined below:

1. Was the policy implemented as intended (e.g., employer implementation of requirements, regulatory enforcement)?; and
2. Did implemented measures result in decreases in exposures and health effects of concern?

Implementation studies are important complements to effectiveness studies, and can also be quite valuable in their own right. Their value is often under-estimated due to the prevalent view that evaluation is synonymous with effectiveness. As examples, detailed population-based implementation studies have been conducted on the generic hazard communication (or ‘right-to-know’) and the agent-specific ethylene oxide standards in the US. The hazard communication evaluation showed, for example, that: (i) roughly one fourth of responding

employers provided no worker training, with small employers being the least likely to provide training; and (ii) the percent of non-compliant employers was 53%, 46%, and 41% with one or more training, Material Safety Data Sheet (MSDS), or labelling requirements, respectively (GAO, 1991). The ‘information for action’ yield of this study was aptly expressed in its title: “OSHA Action Needed to Improve Compliance with Hazard Communication Standard”.

The ethylene oxide evaluation showed that most hospitals had implemented the requirements for initial personal exposure monitoring, worker training, and medical surveillance (LaMontagne et al, 1996a; LaMontagne et al, 1997). However, workers at half the hospitals studied were also being exposed in accidental releases of EtO that were not being captured by personal monitoring, training was most commonly video-based, and OSHA’s Action Level trigger for medical surveillance—used in many health standards—was neither understood by employers nor related to providing surveillance

(LaMontagne et al, 1996b, 1997). These studies demonstrated the successes and shortcomings of the ethylene oxide standard, and were pivotal in the continuance of the standard when it was reviewed as test case for the expanded Regulatory Flexibility Act in 1997. This Act, combined with Small Business Regulatory Flexibility Act (SBRFA) mandated the review of OHS standards 10 years after their promulgation in order to determine whether they should be amended, continued without change, or rescinded (LaMontagne et al, 1998). In summary, process evaluation studies—when modelled on the implied or explicit logic of a particular policy—provide information needed for action to improve the policy’s implementation through enforcement, outreach, or information dissemination. Optimal implementation is a fundamental prerequisite to optimal effectiveness.

Effectiveness questions can be asked at three general levels:

1. Was implementation of the policy associated with decreased exposures to the hazard of interest?

2. Was implementation of the policy associated with decreases in health outcomes of interest?
3. Did the policy 'cause' observed changes in exposures and health outcomes?

Studies at the first two levels are observational with the usual limitations on causal inference. Combining qualitative and quantitative approaches, however, can greatly improve the interpretability of such observational studies (LaMontagne and Needleman, 1996; Zwerling et al, 1997). Examples of documented positive impacts at the first and second levels include: (1) a US Hazard Communication evaluation showing that interactive small group training methods were associated with positive changes in work practices and working conditions (proxies for decreased exposures (Robins et al, 1990); (2) decreases in blood lead (as a bio-marker of both exposure and health outcomes) after implementation of the US lead in construction standard (Levin et al, 1997); and (3) decreases in silicosis (health outcome) after implementation of the US respirable quartz standard (Stayner et al,

1996). Health outcome evaluations are particularly challenging for diseases with long latencies (e.g., asbestosis), multi-factorial aetiology (e.g., asthma), or both (e.g., lung cancer) (Stayner et al, 1996).

A recent example from a coordinated policy intervention to address occupational skin disease in Germany illustrates several important themes (Dickel et al, 2002). In Germany as well as other industrialized countries, there is a high incidence of occupational skin disease (OSD) among hairdressers and barbers (Dickel et al, 2001). A population-based register of OSD was set up in Northern Bavaria in 1990. Between 1990 and 1999, there were 856 confirmed (as occupational) initial reports of OSD in hairdressers. Reliable documentation of the OSD problem both strengthened the rationale for addressing it and enabled on-going health outcome evaluation of the impacts of any intervention. Regulatory interventions to address this problem were introduced in 1992 (Technical Rules for Hazardous Substances 530 'Hairdressing Trade') and in 1996 (Technical Rules for

Hazardous Substances 531 'Endangerment of the skin by work in the wet environment (wet work)'). In addition, the workers' compensation board executed an information campaign to support the new regulations. These efforts were complemented by a voluntary policy intervention: a 1995 agreement between hair cosmetics manufacturers and the hairdressers' guild to stop the use of glyceryl monothioglycolate in permanent wave solutions (sensitization to this agent had been previously determined to be common). Over the 1990-1999 period, the annual incidence of OSD steadily decreased from 194 to 18 cases per 10,000 workers, a statistically and clinically significant 10-fold decline (Dickel et al, 2002). The evidence of effectiveness of these combined efforts in reducing OSD is convincing. Concomitant process evaluation, which may be forthcoming, would help to sort out the relative contributions of the three complementary policy interventions (i.e., to what extent were each of the three policies implemented?).

The themes illustrated by the German OSD example include: (1) the high value of disease registries and public health surveillance systems in guiding policy-making and facilitating policy evaluation; (2) the potential for making positive change when all stakeholders are genuinely involved in the policy-making process (government, labour, and industry); (3) the need for both regulatory and voluntary policy

interventions to address OHS issues; and (4) the value of covering the full continuum of upstream (substitution of common sensitizing agent) and downstream (OSD surveillance) measures in addressing OHS issues.

Studies at the third level (did the policy ‘cause’ observed changes?) are rarely feasible due to the practical, ethical, and legal constraints of conducting randomized, controlled experiments in this context. Sufficient

levels of proof of policy effectiveness should correspond to these constraints. A sensible and economical approach to evaluating OHS interventions (of all types, including policy) has been proposed in which qualitative and quasi-experimental studies would be conducted, followed by—where both necessary and feasible—randomized, controlled trials (Zwerling et al, 1997).

### Emerging Topics and Future Directions

Emerging topics in OSH policy evaluation research include moving upstream from exposures and health outcomes to safer technologies, which would call for the assessment preventive efforts as well as exposures. The UK Health and Safety Executive’s Control of Substances Hazardous to Health “COSHH Essentials” program is an example of more upstream-focused policy. While OHS policy efforts have progressed slowly over the last two neo-liberal dominated decades in the industrialized west, broader public support for environmental policy

efforts has enabled greater progress in that sphere, some of which crosses over into OHS. For examples, environmental pollution prevention policies have appropriately moved upstream from end-of-pipe approaches to the design of production processes. The US state of Massachusetts’ Toxics Use Reduction policy has resulted in some improvements in OHS conditions, though usually only as a side-benefit of environmental policy-driven actions (Roelofs et al, 2000). Opportunities exist for strengthening OHS considerations within such environmental

policies. Finally, the last decade has seen a rapid rise in OHS management systems or programs as the generic OHS intervention of choice for employers. These programs have been driven both by regulatory and voluntary policy interventions, yet evaluation research on this emerging topic is just beginning to take off (Frick et al, 2000; Quinlan, 1999).

Opportunities for future improvements in OSH policy evaluation are many. Traditional etiologic epidemiology perspectives need to be complemented by more eclectic and action-

oriented perspectives. Examples include borrowing more from the field of program evaluation, adopting alternative paradigms such as participatory action research, and expanding the use of qualitative research methods (Zwerling et al, 1997; Schulte et al, 1996). More population-based, rather than worksite-based, studies are needed. The scientific and quality and feasibility of evaluation studies would be greatly enhanced by planning evaluations in conjunction with policy development. In addition, policy evaluation studies are

greatly facilitated where population-based occupational exposure and disease surveillance systems are in place, as was illustrated by the example from Germany above. In addition, many impact and outcome measures have been under-utilized to date. For example, more economic studies are needed that focus on health costs to affected workers as well as implementation costs to employers (Boden et al, 2001). In addition, greater utilization of exposures, hazards, and biomarkers would provide more measurable performance metrics than health outcomes, as well

as greater feasibility of demonstrating impacts of policy-level interventions (Gomez, 1998; LaMontagne and Kelsey 2001; LaMontagne et al, 2002). Expanded evaluation research in these areas will foster the development of policies that are minimally burdensome to employers and maximally effective in reducing exposures and health effects. With a continued emphasis on generating information for action, OHS policy-level evaluation research will support the continuing improvement of policy development, implementation, and effectiveness.

## OHS Intervention Research Resources

Goldenhar LM, LaMontagne AD, Katz T, Heaney C, Landsbergis P (2001): The intervention research process in occupational safety & health: an overview from the NORA Intervention Effectiveness Research Team. *J Occup Environ Med* 43: 616-622.  
LaMontagne AD (2000): Evaluation of OSHA health standards. In: Levy BS, Wegman DH (eds). *Occupational Health: Recognizing and Preventing Work-Related*

*Disease*. Fourth Edition ed. Philadelphia: Lippincott Williams & Wilkins, pp. 134-135.  
Menckel E, Westerholm P (1999): *Evaluation in Occupational Health Practice*. Oxford: Butterworth-Heinemann.  
Robson L, Shannon H, et al. (2001). *Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries: How to Show Whether a Safety Intervention Really Works*. US Centres for

Disease Control, NIOSH Publication #2001-119. <http://www.iwh.on.ca/Pages/Publications/safetybook.htm>

Williamson A (1999): *Policy and program evaluation in occupational health and safety*. In: Mayhew C, Peterson C (eds). *Occupational Health and Safety in Australia: Industry, Public Sector and Small Business*. St Leonards, NSW: Allen & Unwin.

## References

- Boden LI, Biddle EA, Spieler EA (2001): Social and economic impacts of workplace illness and injury: current and future directions for research. *Am J Ind Med* 40:398-402.
- Dickel H, Kuss O, Schmidt A, et al (2002): Impact of preventive strategies on trend of occupational skin disease in hairdressers: population-based register study. *Br Med J* 324: 1422-3.
- Dickel H, Kuss O, Blesius C, et al (2001): Occupational skin diseases in Northern Bavaria between 1990 and 1999: a population-based study. *Br J Dermatol* 145: 453-62.
- Frick K, Jensen P, Quinlan M, et al (2000): *Systematic Occupational Health and Safety Management; Perspectives on an International Development*. Amsterdam: Pergamon Press.
- GAO (1991). *OSHA Action Needed to Improve Compliance with Hazard Communication Standard*. Washington, DC: U.S. General Accounting Office.
- Goldenhar LM, LaMontagne AD, Katz T, et al (2001): The intervention research process in occupational safety & health: an overview from the NORA Intervention Effectiveness Research Team. *J Occup Environ Med* 43: 616-622.
- Gomez MR (1998). Exposure surveillance tools needed in agency GPRAs plans. *AIHA J* 59:371-4.
- LaMontagne AD (2000): Evaluation of OSHA health standards. In: Levy BS, Wegman DH (eds). *Occupational Health: Recognizing and Preventing Work-Related Disease*. Fourth Edition ed. Philadelphia: Lippincott Williams & Wilkins, pp. 134-135.
- LaMontagne AD, Kelsey KT (1998): OSHA's renewed mandate for Regulatory Flexibility review: in support of the 1984 ethylene oxide standard. *Am J Ind Med* 34: 95-104.
- LaMontagne AD, Kelsey KT (2001). Evaluating OSHA's ethylene oxide standard: exposure determinants in Massachusetts hospitals. *Am J Publ Health* 91: 412-7.
- LaMontagne AD, Mangione TW, Christiani DC, et al (1996a).: Medical surveillance for ethylene oxide exposure: practices and clinical findings in Massachusetts hospitals. *J Occup Environ Med* 38: 144-54.
- LaMontagne AD, Needleman C (1996b). Overcoming practical challenges in intervention research in occupational health and safety. *Am J Ind Med* 29: 367-72.
- LaMontagne AD, Rudd RE, Mangione TW, et al (1996): Determinants of the provision of ethylene oxide medical surveillance in Massachusetts hospitals. *J Occup Environ Med* 38: 155-68.
- LaMontagne AD, Kelsey KT (1997). Evaluating OSHA's ethylene oxide standard: employer exposure monitoring activities in

- Massachusetts hospitals from 1985-1993. *Am J Publ Health* 87: 1119-25.
- LaMontagne AD, Herrick RF, Van Dyke MV, et al (2002). Exposure databases and exposure surveillance: promise and practice. *AIHA J* 63:205-12.
- Leigh J, Davidson P, Hendrie L, et al (2002): Malignant mesothelioma in Australia, 1945-2000. *Am J Ind Med* 41: 188-201.
- Levin S, Goldberg M, Doucette J (1997): The effect of the OSHA Lead Exposure in Construction Standard on blood levels among iron workers employed in bridge rehabilitation. *Am J Ind Med* 31: 303-9.
- NIOSH (1996). National Occupational Research Agenda: U.S. Public Health Service, Centers for Disease Control: National Institute for Occupational Safety and Health.
- Quinlan M (1999). Promoting occupational health and safety management systems: a pathway to success - maybe. *J Occup Health Safety Aust NZ* 15: 535-41.
- Robins TG, Hugentobler MK, Kaminski M, et al (1990). Implementation of the federal hazard communication standard: does training work? *J Occup Med* 32: 1133-40.
- Roelofs C, Moure-Eraso R, Ellenbecker M (2000). Pollution prevention and the work environment: The Massachusetts experience. *Appl Occ Env Hygiene* 15: 843-50.
- Rosenstock L, Olenec C, Wagner GR (1998). The national occupational research agenda: a model of broad stakeholder input into priority setting. *Am J Publ Health* 88:353-6.
- Rosenstock L (1996): The future of intervention research at NIOSH. *Am J Ind Med* 29: 295-7.
- Schulte PA, Goldenhar LM, Connally LB (1996): Intervention research: science, skills, and strategies. *Am J Ind Med* 29: 285-8.
- Stayner L, Rice F, et al (1996): Approaches for assessing the efficacy of occupational health and safety standards. *Am J Ind Med* 29:353-7.
- Zwerling C, Daltroy L, Fine L, et al (1997): Design and conduct of occupational injury intervention studies: a review of evaluation strategies. *Am J Ind Med* 32:164-79.