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**IMPROVING OCCUPATIONAL HEALTH & SAFETY POLICY
THROUGH INTERVENTION RESEARCH**
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Introduction

Intervention research in occupational health and safety (OHS) addresses the development, implementation, and evaluation of OHS interventions.⁽¹⁾ The emphasis in intervention research is *applied* rather than *basic* or *etiologic*. Etiologic OSH research is about identifying risk factors for occupational injury and disease, such as in epidemiology studies about the relationship between job stress and heart disease. 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.^(2, 3) 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.⁽⁴⁾ 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⁽¹⁾ 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 at end of paper).⁽¹⁾ Further, it includes a set of five tasks that are important in any intervention research study: (1) gathering background information and conducting needs assessment on the problem and the range of possible intervention strategies, (2) developing partnerships with relevant stakeholder groups, (3) choosing appropriate research methods and study designs, (4)

conducting the research, and (5) reporting on and disseminating findings. Finally, intervention research can be conducted at levels ranging from simple worksite programs to national or international policy.

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, and Australian National Occupational Health & Safety Commission (NOHSC) model regulations). Despite the fact that OHS regulatory interventions are often challenged by various stakeholder groups—on one side for being too stringent and on the other for being too lax—there has been relatively little peer-reviewed research published on the evaluation of such interventions.^(1, 5, 6) 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 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.⁽⁵⁾ 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 working conditions, 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, the peak of mesothelioma incidence is projected to occur after 2010,⁽⁷⁾ 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.⁽⁸⁾ 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. Most of the general messages contained herein, however, relate equally to safety and health concerns.

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 effects of such actions will be on hazards and associated injury and disease patterns. 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 hazards 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 always about 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 examples, that (1) roughly one fourth of responding employers provided no worker training, with small employers being the least likely to provide training, and (2) the percent of non-compliant employers was 53%, 46%, and 41% with one or more training, MSDS, or labelling requirements, respectively.⁽⁹⁾ 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.^(10, 11) 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.^(11, 12) 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 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.⁽⁸⁾ 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. For example, if an effectiveness evaluation study documents a decline in a hazardous exposure following a policy intervention on that specific exposure, it *suggests* but does not formally *prove* that the policy *caused* the decline. Combining qualitative and quantitative approaches, however, can greatly improve the interpretability of such observational studies.^(13, 14) 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)⁽¹⁵⁾; (2) decreases in blood lead (as a bio-marker of both exposure and health outcomes) after implementation of the US lead in construction standard⁽¹⁶⁾; and (3) decreases in silicosis (health outcome) after implementation of the US respirable quartz standard.⁽¹⁷⁾ Health outcome evaluations are particularly challenging for diseases with long latencies from first exposure to manifestation of

disease (e.g., asbestosis), multi-factorial aetiology (e.g., asthma), or both (e.g., lung cancer).⁽¹⁷⁾

A recent example from a coordinated policy intervention to address occupational skin disease in Germany illustrates several important themes.⁽¹⁸⁾ In Germany as well as other industrialized countries, there is a high incidence of occupational skin disease (OSD) among hairdressers and barbers.⁽¹⁹⁾ A population-based register, or health surveillance system, on 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.⁽¹⁸⁾ The evidence of effectiveness of these combined efforts in reducing OSD is convincing. Concomitant process evaluation would help to sort out the relative contributions of the three complementary policy interventions (i.e., how did the implementation of each of the three policies compare in terms of quality, quantity, intensity, etc.?).

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. For the sake of justifying policy intervention, sufficient levels of proof of policy effectiveness should be guided by 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.⁽¹³⁾

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 of 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⁽²⁰⁾ (see www.coshh-essentials.org.uk). Upstream intervention effectiveness evaluation measures for such interventions are only beginning to be developed.⁽²¹⁾

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.⁽²²⁾ 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.^(23, 24)

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.^(13, 25) 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. Many impact and outcome measures have also 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.⁽²⁶⁾ 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.⁽²⁷⁻²⁹⁾ 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.

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

Menckel E and Westerholm P. 1999. *Evaluation in Occupational Health Practice*. Oxford: Butterworth-Heinemann.

Robson, L., H. Shannon, et al. (2001). *Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries: How to Show Whether a Safety Intervention Really Works*. Cincinnati, OH (USA), US Centres for Disease Control, NIOSH Publication #2001-119. Available on web at <http://www.iwh.on.ca/Pages/Publications/safetybook.htm> .

Literature Cited

1. Goldenhar, L.M., LaMontagne, A.D., Katz, T., et al.: The intervention research process in occupational safety & health: an overview from the NORA Intervention Effectiveness Research Team. *J Occup Environ Med* 43(7):616-622 (2001).
2. NIOSH: National Occupational Research Agenda: U.S. Public Health Service, Centers for Disease Control: National Institute for Occupational Safety and Health, 1996.
3. Rosenstock, L., Olenec, C., and Wagner, G.R.: The national occupational research agenda: a model of broad stakeholder input into priority setting. *American Journal of Public Health* 88(3):353-356 (1998).
4. Rosenstock, L.: The future of intervention research at NIOSH. *American Journal of Industrial Medicine* 29:295-297 (1996).
5. LaMontagne, A.D.: Evaluation of OSHA health standards. In: *Occupational Health: Recognizing and Preventing Work-Related Disease*, pp. 134-135. Levy, B.S. and Wegman, D.H., Eds. Lippincott Williams & Wilkins, Philadelphia (2000).
6. Winder, C.: The long road to hazardous substances regulation. *J Occup Health Safety--Aust NZ* 15(2):99-102 (1999).
7. Leigh, J., Davidson, P., Hendrie, L., et al.: Malignant mesothelioma in Australia, 1945-2000. *American Journal of Industrial Medicine* 41:188-201 (2002).
8. LaMontagne, A.D. and Kelsey, K.T.: OSHA's renewed mandate for Regulatory Flexibility review: in support of the 1984 ethylene oxide standard. *American J Ind Med* 34:95-104 (1998).
9. G.A.O.: OSHA Action Needed to Improve Compliance with Hazard Communication Standard. Washington, DC: U.S. General Accounting Office, 1991.
10. LaMontagne, A.D., Mangione, T.W., Christiani, D.C., et al.: Medical surveillance for ethylene oxide exposure: practices and clinical findings in Massachusetts hospitals. *Journal of Occupational and Environmental Medicine* 38(2):144-154 (1996).
11. LaMontagne, A.D. and Kelsey, K.T.: Evaluating OSHA's ethylene oxide standard: employer exposure monitoring activities in Massachusetts hospitals from 1985-1993. *Am J Public Health* 87(7):1119-1125 (1997).
12. LaMontagne, A.D., Rudd, R.E., Mangione, T.W., et al.: Determinants of the provision of ethylene oxide medical surveillance in Massachusetts hospitals. *Journal of Occupational and Environmental Medicine* 38(2):155-168 (1996).

13. Zwerling, C., Daltroy, L., Fine, L., et al.: Design and conduct of occupational injury intervention studies: a review of evaluation strategies. *Am J Industrial Med* 32:164-179 (1997).
14. LaMontagne, A.D. and Needleman, C.: Overcoming practical challenges in intervention research in occupational health and safety. *Am J Ind Med* 29(4):367-72 (1996).
15. Robins, T.G., Hugentobler, M.K., Kaminski, M., et al.: Implementation of the federal hazard communication standard: does training work? *Journal of Occupational Medicine* 32:1133-1140 (1990).
16. Levin, S., Goldberg, M., and Doucette, J.: The effect of the OSHA Lead Exposure in Construction Standard on blood levels among iron workers employed in bridge rehabilitation. *American Journal of Industrial Medicine* 31:303-309 (1997).
17. Stayner, L., E., K., Rice, F., et al.: Approaches for assessing the efficacy of occupational health and safety standards. *American Journal of Industrial Medicine* 29:353-357 (1996).
18. Dickel, H., Kuss, O., Schmidt, A., et al.: Impact of preventive strategies on trend of occupational skin disease in hairdressers: population-based register study. *BMJ* 324:1422-1423 (2002).
19. Dickel, H., Kuss, O., Blesius, C., et al.: Occupational skin diseases in Northern Bavaria between 1990 and 1999: a population-based study. *Br J Dermatology* 145:453-462 (2001).
20. Russell, R.M., Maidment, S.C., Brooke, I., et al.: An introduction to a UK scheme to help small firms control health risks from chemicals. *Ann Occup Hyg* 42(6):367-376 (1998).
21. LaMontagne, A.D., Youngstrom, R., Lewiton, M., et al.: A walk-through exposure prevention rating method for intervention needs assessment and effectiveness evaluation. *Applied Occ Env Hygiene* (in press).
22. Roelofs, C., Moure-Eraso, R., and Ellenbecker, M.: Pollution prevention and the work environment: The Massachusetts experience. *Applied Occ Env Hygiene* 15(11):843-850 (2000).
23. Frick, K., Jensen, P., L, Quinlan, M., et al.: *Systematic Occupational Health and Safety Management; Perspectives on an International Development*. Amsterdam: Pergamon Press, (2000).
24. Quinlan, M.: Promoting occupational health and safety management systems: a pathway to success - maybe. *J Occup Health Safety - Aust NZ* 15(6):535-541 (1999).

25. Schulte, P.A., Goldenhar, L.M., and Connally, L.B.: Intervention research: science, skills, and strategies. *American Journal of Industrial Medicine* 29(4):285-288 (1996).
26. Boden, L.I., Biddle, E.A., and Spieler, E.A.: Social and economic impacts of workplace illness and injury: current and future directions for research. *American Journal of Industrial Medicine* 40:398-402 (2001).
27. Gomez, M.R.: Exposure surveillance tools needed in agency GPRA plans. *AIHA Journal* 59:371-374 (1998).
28. LaMontagne, A.D. and Kelsey, K.T.: Evaluating OSHA's ethylene oxide standard: exposure determinants in Massachusetts hospitals. *Am J Public Health* 91(3):412-417 (2001).
29. LaMontagne, A.D., Herrick, R.F., Van Dyke, M.V., et al.: Exposure databases and exposure surveillance: promise and practice. *AIHA Journal* 63:205-212 (2002).