Commentary

Systematic Reviews of Injury-Prevention Strategies for Occupational Injuries

An Overview

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Background: Information on which strategies have been shown to be effective, which are ineffective, and which strategies have been inadequately evaluated is important for both public policy and future research.

Objective: The objective of this study was to provide systematic reviews of the literature on important strategies to prevent occupational, including agricultural, injuries.

Methods: The Injury Control Research Centers (ICRCs) funded by the National Center for Injury Prevention and Control (NCIPC), Centers for Disease Control and Prevention, and Centers for Agricultural Injury funded by the Division of Safety Research, the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, identified 12 important occupational and agricultural injury-prevention strategies or areas of research. Systematic reviews of the literature were conducted to identify relevant controlled trials and studies. These were critically reviewed and summarized.

Results: A total of 12 reviews were conducted on a range of topics in the occupational injury field. Few randomized controlled trials were found; most controlled studies were either comparisons over time and/or across different populations. In several areas we were limited to summarizing the descriptive literature. Nevertheless, summaries of these studies provide meaningful conclusions about the effectiveness of various interventions to decrease morbidity and mortality from selected occupational and agricultural injuries.

Conclusions: A large body of literature on occupational, public health, or injury prevention interventions exists. The summary of this literature provides a framework to both direct policy and guide future research efforts.

Medical Subject Headings (MeSH): evidence-based medicine, intervention studies, evaluation studies, review literature (Am J Prev Med 2000;18(4S):1–3) © 2000 American Journal of Preventive Medicine

Injuries are the most important cause of death and disability for the first half of the human lifespan and are the leading cause of potential years of life lost before age 65. In all countries, occupational injuries contribute to the human and economic toll. The National Occupational Research Agenda (NORA) was established in 1996 to provide a framework to guide occupational safety and health research in the United States.[1] During the 17 months before this writing, the Injury Control Research Centers (ICRCs); the National Center for Injury Prevention and Control (NCIPC), Centers for Disease Control and Prevention (CDC), and Centers for Agricultural Injury funded by the Division of Safety Research, the National Institute for Occupational Safety and Health (NIOSH), conducted systematic reviews of the literature on strategies to prevent morbidity and mortality in the areas of occupational injuries, including agricultural injuries, health care industry injuries, and workplace violence prevention. The CDC itself has embarked on the process of producing the *Guide to Community Prevention Services*, based on systematic reviews of the relevant literature.

This supplement to the *American Journal of Preventive Medicine* is a report on this collaborative project. The purpose of these reviews is to summarize the status of intervention research on selected topics in occupational health and safety and provide recommendations for future research.

Systematic literature reviews are invaluable methods of synthesizing the existing evidence from evaluation studies. Health care providers, policymakers, and injury control professionals are faced with large amounts of information that are distributed by a large number of

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sources, and need systematic reviews to provide a basis for rational decision making. It is quite likely that when currently available evidence on the efficacy of injury-prevention interventions is thoroughly synthesized, many interventions believed to be effective will be shown to be ineffective and vice versa. In addition, systematic reviews are likely to show that some proposals for future research are redundant because intervention efficacy can already be established from existing evidence. Most importantly, such reviews will clarify which programs are appropriate to implement on a broader scale and which need further evaluation research.

It is unreasonable to expect clinicians, policymakers, program directors, employers, and agricultural health and safety centers that want reliable information about interventions to unearth all the relevant evidence from reports of original research. In the injury field, these reports are far too dispersed to make this practical. Many reports are not indexed in MEDLINE and cannot be found easily in computer searches. We found this to be particularly true of the occupational, including the agricultural, injury literature. Reviews occupy a key position in a chain that should link results of research at one end to programs and decreased injuries at the other. The goal of occupational safety and health interventions is to prevent disease and injury through combinations of techniques such as control technologies, exposure guidelines and regulations, and worker participation programs and training. There has been little research evaluating the efficacy and effectiveness of these techniques and programs. Employers, public decision makers, workplace health and safety teams, injury prevention professionals in health departments, community agencies, and other organizations need to have data on which interventions are effective and which make sense to replicate in their communities. Investigators need to know what has been done in the past to avoid duplication of these efforts, and instead to build on them. Hopefully, the information in this supplement will make the work of many people easier. Most importantly, our hope is that it will reduce morbidity and mortality from occupational and agricultural related injuries.

Choice of Topics and Outcomes

The decision to review injury topics in the occupational safety field is based on the importance of the problem. Occupational injuries resulted in 77,675 fatalities of civilian workers between 1980 and 1992.[2] This represents an annual average of 5.5 deaths per 100,000 workers. It has been estimated that, in 1995, occupational injuries cost $119 billion in lost wages and productivity, administrative expenses, health care, and other costs.[2] The specific topics chosen were those for which a systematic review of the literature would be the most useful: injury problems that were frequent and severe, and prevention strategies that had been evaluated, but for which clear conclusions about the size of the intervention effect are currently not available. Other potential topics were related to specific objectives included in the *Healthy People Goals* for the year 2000 and areas where numerous interventions were in place but specific information on effectiveness had not been summarized. The final selection of topics was left to individual reviewers and was undoubtedly based in part on their interests; many other worthwhile topics could also have been chosen. The interventions chosen that met the above criteria follow:

- Evaluating worksite-based interventions that promote safety belt use among employees
- Prevention of falls in the construction industry: evidence for program effectiveness
- Effectiveness of interventions to prevent work-related eye injuries
- Injuries related to shiftwork or fatigue
- Interventions for the primary prevention of work-related carpal tunnel syndrome
- A review of farm safety interventions
- Effectiveness of roll-over protective structures in reducing farm tractor fatalities
- Incidence and disability from farm injuries to children
- Effectiveness of interventions in reducing pesticide overexposure and poisonings in worker populations
- Evaluation of interventions to prevent needlestick injuries in health care occupations
- Crime prevention through environmental design (CPTED): summary findings of its effectiveness in reducing robberies
- Administrative and behavioral interventions for workplace violence prevention

The initial intent was to restrict the studies examined to those that used objective outcomes, including fatalities, nonfatal injuries, intermediate outcomes such as observed changes in behavior, or changes in the target outcome. For some of the topics, more subjective outcomes such as changes in self-reported knowledge, attitudes, and beliefs were the only outcome measures reported. Although these outcomes have been found to correlate poorly with observed behavior or changes in injury rates,[3–6] we felt it important to summarize the evaluations that had been carried out in these areas.

Selection of Study Type

The reviews sought to identify the best available evidence for the impact of the interventions.[7] Randomized controlled trials have become the standard study type by which the effectiveness of therapy for the treatment of medical problems is evaluated. Randomized controlled trials are also applicable to the study of

public health interventions, are feasible, and have been applied successfully in many cases.[8] Unfortunately, few randomized trials have been conducted evaluating the occupational injury interventions of interest. Some interventions have been evaluated in controlled trials, in which groups are assigned by the investigator, in a controlled, although not randomized, fashion. Other interventions, such as legislation and regulation, have been evaluated using ecologic designs, defined as studies in which populations are compared rather than individuals and in which the intervention is not subject to the influence of the investigators.[9] Comparison groups for ecologic studies can be other populations not exposed to the intervention, the same population before the intervention was implemented, or some combination of the two. In order to evaluate the effect of ecologic studies properly, it is important to determine if ascertainment of exposure, outcome, and potential confounding factors was the same for all members of the populations studied. Appropriate statistical methods can be used to control for confounding factors in order to evaluate the effect of the intervention.

Meta-analyses, defined as using statistical methods to combine the results of different studies, are suitable for summarizing randomized controlled studies in which the study populations and interventions are similar enough to warrant combining studies.[10] Meta-analysis is most useful when the individual studies are too small to yield a valid conclusion. Unfortunately, for these reviews, nearly all of the studies covered such different populations, at different points in time, that to summarize them into a single estimate of effect would be misleading. We instead chose to have the authors evaluate the methodologic quality of the study designs using standard criteria and present study results individually in tables or graphic form, showing the results of the individual studies. We asked the authors to make a conclusion about the size of the intervention effect based on a critical review of the methodologic strengths and weakness of the articles reviewed.

Conclusions

Over the last two decades, the science of injury control has come of age. This science now needs to be vigorously applied to the problem of occupational injuries. The magnitude of the problem warrants that renewed efforts be made to examine the effectiveness of intervention programs and to devote scarce resources only to the implementation of those programs found to be effective.

This work is a collaborative project of the Injury Control Research Centers and the National Center for Injury Prevention and Control, the Centers for Disease Control and Prevention (CDC), and the Division of Safety Research, the National Institute for Occupational Safety and Health (NIOSH).

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