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Building an evidence base for occupational health interventions

by Jos Verbeek, PhD,^{1,2} Kaj Husman, MD,¹ Frank van Dijk, MD,² Merja Jauhiainen, MSc,³ Iris Pasternack, MD,⁴ Harri Vainio, PhD⁵

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This article summarizes arguments for building an evidence base for occupational health. Evidence is needed on the most effective ways of eliminating health hazards in the workplace and at work, enhancing healthy behavior or the empowerment of workers, and preventing and treating occupational diseases and occupational disability. An evidence base for occupational health must include systematic reviews. The Cochrane Collaboration has brought together some of the evidence; however, a search for systematic reviews on the top priorities in occupational health research showed that systematic reviews are lacking in many areas. Current reviewing methods can be adapted to the special features of occupational health. It is concluded that more effort should be invested in the preparation, maintenance, and dissemination of systematic reviews in order to create a necessary evidence base for occupational health interventions. Occupational health could benefit considerably from greater awareness of the evidence for and against various types of intervention.

Key terms evidence-based medicine, intervention studies, occupational health services, occupational medicine, systematic reviews.

Occupational health has always remained somewhat outside mainstream health care. Although it is founded on medical science, occupational health is strongly based on consensus among social partners and on legislation. Over the past 100 years, knowledge about the adverse health effects of work, work conditions, and the work environment has increased tremendously. Emerging knowledge about health hazards at work has sometimes prompted action in the form of preventive measures, such as the lowering of exposure levels and the introduction of medical surveillance. These ideas have been incorporated into legal protective measures, such as European Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers. This action has, beyond doubt, contributed to the steady decrease in ill health and fatalities among workers in industrialized countries (1).

Research in occupational health has concentrated on the causes of ill health at work and has led to

a substantial body of work on occupational exposure. A Medline search with the medical subject heading “occupational exposure” yielded more than 26 000 references, of which 2984 were classified as reviews and 89 as meta-analyses. In addition, national institutes such as the National Institute for Occupational Safety and Health in the United States and international organizations such as the International Agency for Research on Cancer have published monographs on the effects of occupational exposure on factors adverse to health. These publications constitute a valuable body of evidence on the effects of a wide range of occupational exposures.

The findings with regard to work-related diseases and adverse health effects have been strongly associated with immediate preventive action (2). In evaluating these preventive measures, we usually rely on surveillance, for example, medical or hazard surveillance (3). However, this is a very crude form of evaluation when

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compared with methods such as evaluation studies or experimental studies. Especially, surveillance does not provide a comparison of preventive methods that would enable a conclusion to be drawn about the most effective types of preventive intervention. To that end, more-detailed evaluation studies or experimental studies are needed. It is widely acknowledged that more and better research is needed on interventions in occupational health (4, 5). A good example is noise, for which a complicated set of preventive measures has been advocated, from eliminating the source to measuring hearing thresholds or introducing hearing protection. It is not clear which of, and in which context, these measures contributes best to the prevention of noise-induced hearing loss. In fact, in view of the high prevalence of noise-induced hearing loss in many countries, the effectiveness of the package can be questioned (6). Preventing adverse health effects due to hazards at work is therefore complicated. More and better knowledge about effectiveness would make better-informed decisions possible.

Almost 10 years ago, researchers in the United States proposed to “develop a new research-based body of literature to which both academics and practitioners can continue to add new evidence concerning various aspects of occupational health and safety [p 764]” (4). Much research has indeed been carried out, but its results are not readily available to scientists and practitioners. During the same period, evidence-based medicine became a popular approach among clinicians and clinical epidemiologists as a means to facilitate the transfer of the results of scientific research to medical practice and thus improve the quality of health care. The advocates of evidence-based medicine propose that research evidence should be a much stronger guiding principle in daily practice (7). Practitioners and policy-makers in occupational health who want to use scientific evidence are faced with huge amounts of information hidden in various databases and data banks. There is therefore a need for syntheses of evidence, such as systematic reviews, to provide a better basis for rational decision making. This need was recognized by Archie Cochrane some decades ago, and his idea has materialized in the Cochrane Collaboration, a network organization with the objective of preparing, maintaining, and disseminating systematic reviews on the effectiveness of intervention in health care (see www.cochrane.org).

It has been argued that evidence-based medicine should and can be a guiding principle for interventions in prevention and occupational health (8–10). Although systematic reviews have been conducted on the effectiveness of interventions in occupational injury (11), no organized attempt has been made to develop systematic reviews in the field of occupational health. Moreover, it is unclear which strategy would be best for meeting

the information needs of practitioners and policymakers in occupational health. In this article, we propose arguments for developing a strategy for summarizing evidence on the efficacy and effectiveness of occupational health interventions. First, we examine the kind of evidence needed in occupational health. Then, we assess the work already done by the Cochrane Collaboration. Next, we consider possible ways of organizing the evidence. We end by suggesting areas in which systematic reviews are needed and how they could be organized.

Occupational health intervention

The evidence base must be helpful to persons who intervene to improve occupational health. We must therefore define the scope of occupational health in this respect. The term “occupational health” was defined in 1950 by two authoritative bodies, the International Labour Office and the World Health Organization (WHO), as “the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people and people to their jobs [p 21]” (12). Later, the definition was further elaborated. Basically it comes down to two major objectives for occupational health: the prevention of occupational diseases or work-related health complaints and the prevention or mitigation of occupational disability resulting from disease. In our view, these two objectives can be attained through the following three intervention strategies, applied alone or in combination (figure 1): (i) elimination or control of hazards at work or in organizations related to health and disability, (ii) change in health- and disability-related behavior and skills among workers, and (iii) prevention or better treatment of disease and related disabilities.

In recent reviews on the effectiveness of occupational hygiene strategies, studies were further categorized according to the means used to reduce exposure, referred to as the “hierarchy of controls” (4, 13). WHO developed a model to explain the relationship between disability and other health aspects; this model resulted in the International Classification of Functioning, Disability and Health (14). It includes factors that can be modified by interventions. Disease, environmental factors, and personal factors are the main components that can be targeted, coinciding with the aforementioned objectives of occupational health intervention.

Another way of categorizing occupational health interventions is according to the work methods used by occupational health services, such as pre-employment examinations, health surveillance, worksite visits, consultant services, and health promotion (15). This categorization may, however, overlook many important forms of intervention that do not fall into the traditional

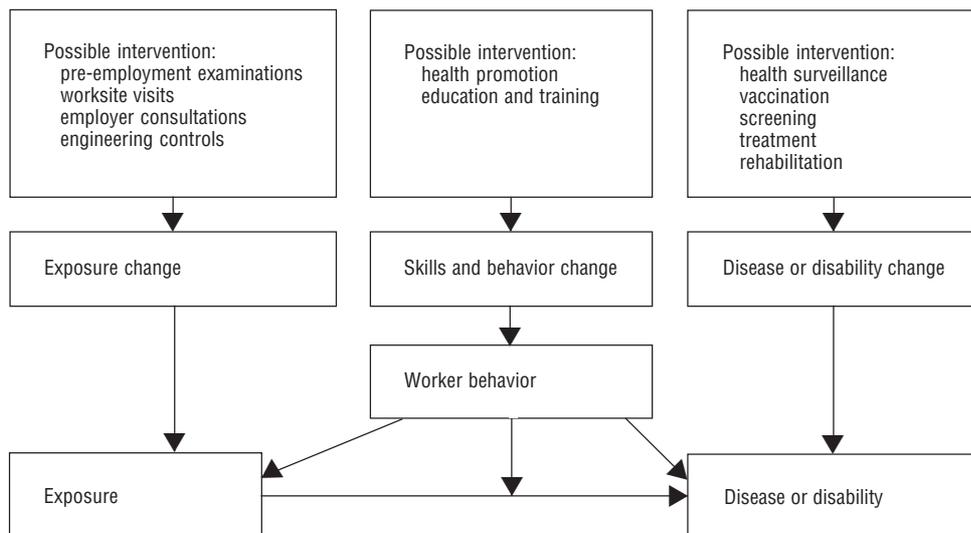


Figure 1. Possible interventions in occupational disease and occupational disability.

category of work methods or are carried out by other professionals or personnel managers.

We therefore advocate the use of the objectives listed in figure 1 or a combination of the two approaches, which could result in the identification of the need for systematic reviews, for example, on the effectiveness of health surveillance in the prevention of occupational asthma.

A third way of categorizing occupational health interventions is on the basis of whether they are carried out at work, such as worksite health promotion programs. Any health care intervention that is conducted at work would thus qualify as occupational health intervention. The idea behind this alternative is that the use of the workplace as a vehicle increases the uptake of or compliance with the intervention. Occupational health

programs for smoking cessation and cardiovascular disease prevention have been realized in this manner (16).

In summary, we suggest that all occupational health interventions be grouped into one of three categories, being directed at exposure at work, at workers' health behavior, or at disease or disability. In addition, interventions could be categorized on the basis of whether it makes use of the workplace as a vehicle for health promotion.

What is already in the Cochrane Library?

In order to prepare, maintain, and promote the accessibility of systematic reviews on the effects of health care interventions, the Cochrane Collaboration maintains several databases, including the Cochrane Database of Systematic Reviews. The Cochrane Library also contains searchable databases on the following topics: abstracts of non-Cochrane reviews of effectiveness, controlled trials, methodological studies, health technology assessments, and economic evaluations. These databases show what has already been done on the effectiveness of occupational health interventions within the scope of the Cochrane Collaboration.

As we do not yet have a well-developed search strategy for occupational health interventions, we used the phrases that we have found to be the most pertinent, such as "occupational health", "occupational diseases", "occupational disability", "occupational exposure" and "occupational health services" (table 1). The search yielded 26 systematic reviews and 24 protocols for systematic reviews. Further analysis of topics and contents showed that 20 of the reviews and 21 of the protocols were highly relevant to occupational health. The most frequent topics were smoking cessation, back and other musculoskeletal pain, leptospirosis, lung cancer, and hepatitis B. Protocols have been developed for reviews

Table 1. Results of a search of the Cochrane Library for occupational health interventions in November 2003. All search words were combined with the Boolean operator NEXT. Disease was truncated as *diseas** and exposure as *expos**. (DARE = Database of Abstracts of Reviews of Effects, OR = Boolean operator OR)

Search term	Cochrane systematic reviews	Abstracts of reviews (DARE)	Controlled trials	Method studies	Health technology assessment	Economic reviews
Occupational health	30	26	364	6	2	102
Occupational diseases	8	20	342	–	1	52
Occupational disability	–	1	4	–	–	–
Occupational exposure	16	6	275	1	2	21
Occupational health services	3	9	121	1	–	44
All the above combined with OR	50	44	886	7	5	155

on hepatitis B, stress, tinnitus, hand eczema, and epicondylitis. Most of the reviews concerned treatment, but many also addressed preventive aspects.

In conclusion, the search revealed that different types of occupational health interventions have already been reviewed by the Cochrane Collaboration but that there is still ample room for additional topics.

Features of evidence on occupational health intervention

The approach to synthesizing evidence on occupational health interventions is still not well developed. The procedure differs importantly from that used for clinical medicine, as pointed out by Vineis in his article on primary prevention intervention (8). Many of his observations also hold for occupational health. First, the evaluation of interventions with respect to hazardous work conditions comprises two steps. In the first, we would assess evidence for a cause-effect relationship (eg, the effect of different intensities of noise on noise-induced hearing loss). In the second step, we would evaluate the efficacy and effectiveness of preventive activities (eg, ways in which workers' exposure to noise can be modified). If we are unsure that the relationship is causal, we can use health-related outcomes to evaluate the intervention. In our example, this step would involve evaluating hearing conservation programs only on the basis of the incidence of hearing loss.

The second difference from typical systematic reviews on health care interventions is that randomized clinical trials are often not available, so that the systematic reviews are based on weaker evidence, such as cohort studies or case-control studies. Finally, a discrepancy is to be expected between theoretical efficacy and the effectiveness in practical situations because the effectiveness of occupational health services depends strongly on their context. In clinical medicine, the context is usually a patient in a hospital bed or in a physician's office. In occupational health services, we also deal with a specific department in an enterprise, with the objective of decreasing the level of exposure to health hazards or facilitating the return to work of employees after sick leave. The occupational health context includes highly variable organizational factors, such as supervisors, technical knowledge, and attitudes towards occupational health services. Thus, even when interventions are efficacious in a well-controlled environment or an experiment, they are usually less effective in practice.

The Taskforce on Community Preventive Services, an initiative of the Department of Health and Human Services in the United States, tried to overcome obstacles for synthesizing evidence in public health (17), and their conclusions apply equally well to occupational health. The Taskforce first constructed a logic framework, mapping out a chain of hypothesized causal

relationships among determinants, intermediate outcomes, and health outcomes. If the links between intermediate outcomes and health outcomes were well established, evidence of the effectiveness of interventions on the intermediate outcomes was also taken into account. The minimum requirement for an evaluation study to be included as evidence was that the study design include a before-after comparison. The quality of the study method was assessed according to criteria developed by the Taskforce. We found other examples in the literature in which several institutes joined forces to produce systematic reviews, such as that published in a supplement to the *American Journal of Preventive Medicine* (11). Although this effort resulted in high-quality systematic reviews, we do not know if this initiative has been followed-up (18).

These considerations lead to the process of synthesis of evidence depicted in figure 2.

How much work will be needed?

All decisions about intervention in occupational health cannot be based on evidence from the literature. In clinical medicine, it has been calculated, for example, that 127 randomized controlled trials, 63 500 patients, and 286 years would be required to provide evidence about the effectiveness of possible combinations of agents to treat Alzheimer's disease (19). In addition, it is clear that the evidence base is not static, but is, instead, provisional, defeasible, and emergent (20, 21). Nevertheless, it is interesting to identify areas in which systematic reviews are needed. We did so by searching for research agendas that list the top priorities in research, according to

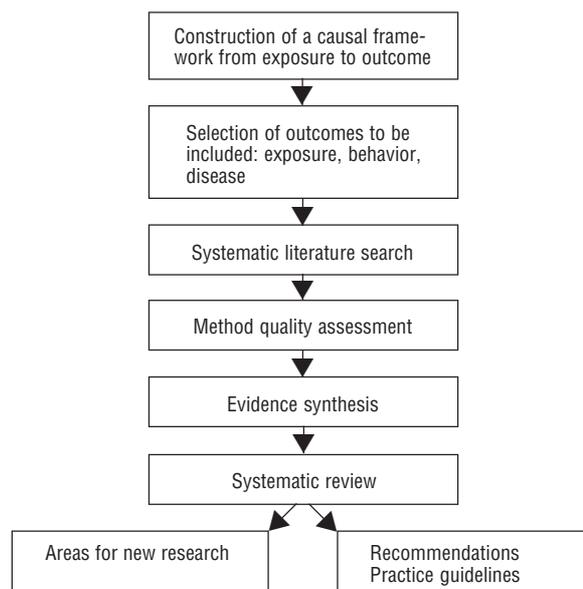


Figure 2. Evidence collection and synthesis for occupational health intervention.

practitioners and researchers in occupational health. A well-known research agenda is that set by the National Institute for Occupational Safety and Health in the United States (5). Occupational health professionals and researchers' surveys on research priorities gave a similar picture (22, 23). We used the topics listed in the research agendas to search Medline for systematic reviews on the effectiveness of interventions in preventing or treating occupational diseases or reviews on the effectiveness of specific work methods in occupational health. There are eight topics on disease and injury and five on the work environment and workforces. We found reviews on interventions for topics like "infectious diseases", "low-back disorders" and "dermatitis". But systematic reviews about the effectiveness of occupational health interventions in research areas of top priority, such as "asthma", "hearing loss", "fertility", and "indoor-air quality", are still lacking.

Concluding remarks

A stronger base of evidence is needed for occupational health interventions, and it can be established. We need more and better occupational health intervention studies. We strongly advocate the development of more systematic reviews of interventions in the area of occupational health. To this end, the authors are involved in the initiative of an "occupational health field" in the Cochrane Collaboration. The aim of the field is to gather evidence on the effectiveness of occupational health interventions and to stimulate systematic reviews on such interventions. Participation in the Cochrane Collaboration can stimulate researchers and practitioners to develop systematic reviews, but this will not be enough. It will take the dedication of researchers and practitioners around the world to contribute on a voluntary basis to the evidence base on occupational health. We recommend that the organizations that employ them make the necessary funds available. The Finnish Institute of Occupational Health and the Coronel Institute of the University of Amsterdam will vigorously support all initiatives to conduct systematic reviews on occupational health intervention.

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