

WORKPLACE INTERVENTION STUDIES

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WHY INTERVENTION RESEARCH?

Intervention research and programs are particularly relevant and important in the field of CVD prevention for two reasons: First, we know more risk factors for CVD than for any other major disease.^{18,24,25,27,29} Second, CVD is the major cause of death in many countries and will continue to be so in the foreseeable future.³⁰

In most textbooks on empirical methods, research designs are ordered in a hierarchy with case reports at the bottom and randomized trials at the top (Table 1). It generally is assumed that the most conclusive evidence regarding causality is gathered from randomized trials, while case studies can be used only for generating hypotheses. This hierarchy can be useful, but the randomized trial is not the only road to causal evidence. Rather, we should regard the randomized trial as a basic paradigm or model to keep in mind when we discuss and evaluate empirical research. Conclusions on causal evidence should be based on the total body of empirical evidence with relevance for a causal hypothesis, be it experimental or observational.^{4,40}

The intervention study is a strong design. The three main reasons for doing intervention research are: (1) strong causal evidence, (2) demonstration of feasibility, and (3) the power of the practical example. In those cases where an intervention study is possible, the evidence usually is considered as strong support—or falsification—of a causal hypothesis. However, bear in mind that causal evidence is of little practical importance if the intervention is not feasible. While etiologic studies try to answer the question: "Does the pill have (the desired) effect?", feasibility studies try to answer the equally important question: "Does the patient take (the intended) pill?"⁴² It does not help that the patient takes the pill, if it has no effect, and it is equally superfluous that the pill has a beneficial effect, if the patient does not take it. Therefore, both etiologic research and feasibility studies are of paramount importance. Feasibility studies are particularly important in the occupational setting, because of the large number of barriers against implementation of research findings in this environment.

The power of the practical example is its demonstration that a given intervention is possible and has the intended effect. Usually the power of the practical example is strongest when the example comes not only from the same country but also from the same type of industry. English union representatives and management from the car industry are easier to convince if a given intervention has proved to be effective in another English car factory than if the example is taken from a kindergarten in San Francisco!

TABLE 1. The Hierarchy of Research Designs

Intervention studies:	Randomized trials Quasi experiments Natural experiments
Observational studies:	Longitudinal studies Case-control studies Prospective studies Cross-sectional studies Case-only studies Case reports

TYPES OF INTERVENTION STUDIES

There are five main types of intervention studies: laboratory experiments, clinical trials, field trials, community trials, and natural experiments. Sometimes, the term "quasi experiment" is used to describe intervention studies without a comparison group. Work environment intervention studies usually are classified as field trials (the participants are healthy individuals), community trials (the unit of intervention is not the individual but the worksite), or natural experiments (in those cases when the interventions are not planned by the researcher or are part of a systematic evaluation program).

Dramatic changes often occur in the working environment without any evaluation of short- or long-term effects on the health of the employees. Such changes may involve new chemical or physical substances, new shiftwork systems, new ways of organizing work, or new methods in biological engineering. As a rule, changes at the workplaces are introduced to reduce production costs and/or to increase productivity, not to improve the health of the employees. In many countries, however, increasing attention is being paid to the possible long-term consequences for employee health and psychological well-being, and the dual goal of increased productivity and improved workers' health is being pursued.

The role of the employees in workplace interventions varies dramatically. At one end of this spectrum, changes or interventions are introduced by management without any participation of the employees or their representatives. In some cases the workers are not even aware of the changes or of the possible health consequences. At the other end are the participatory intervention projects (also called Participatory Action Research), in which the workers and/or their representatives take active part in all phases.¹⁴ To some degree, the nature of the collaboration between researchers, workers, and management reflects national norms and traditions. In Scandinavia, for example, where more than 90% of all employees are unionized, the workers almost always are involved in worksite intervention projects. A strong participatory element is especially important when the organizational intervention study focuses on work organization, communication, or interpersonal relations.²²

INTERVENTION RESEARCH IN CARDIOVASCULAR WORKPLACE EPIDEMIOLOGY

Some of the following examples are natural experiments, which may not normally be considered as interventions, but they are included to illustrate the great potential of this type of research.

shipyard without (threats of) closure. The incidence of hospital admissions due to CVD among the workers from the closed shipyard was compared with the control group during three distinct periods. Before the closure (1979-80) the RR was 0.80, during closure (1981-83) it was 1.04, and after closure the RR was 1.60. This means that the RR doubled during the study period. For IHD alone the RR was 2.6 during the period after closure. Hospital admissions due to other diseases did not increase among the unemployed. In fact, the opposite trend was observed for accidents and diseases of the digestive system.¹⁶

This is a natural experiment. The researchers could re-establish the hospital admissions of the two historical cohorts through the National Register of Patients by using the personal registration numbers of the shipyard workers. This method can only be used in Nordic and a few other countries. Of course, randomization is impossible in cases like this, but Iversen quickly established a comparison group, and both groups were followed after closure using questionnaires and hospitalization data.

These six psychosocial interventions illustrate the significance of the central dimensions of stressors at work. The significance of high demands is illustrated in the studies on bus drivers, in the bank study, and in the Danish IPAW intervention study. Control is an important dimension in all the studies, with the bank study as a possible exception. Predictability plays a significant role in the Norwegian study of rumors, in the Iversen study on unemployment, and in the IPAW study. Furthermore, social support and meaning of work are central dimensions in the IPAW study. Finally, effort-reward imbalance seems to be a stressor in the bus driver studies and in the two studies on (threats of) unemployment. Future intervention studies in the psychosocial field should be theory based to increase scientific validity and generality.

All of the aforementioned intervention studies are extremely different with regard to exposure, endpoints, duration, design, study base, and setting. Nevertheless, these examples demonstrate the broad range of possibilities for research and practice in the field of CV health at the worksite. Any difficulties due to the fact that the worksite is the "arena of research" should be seen as challenges for the researcher. For example, the researcher should be ready when opportunities for studying natural interventions present themselves. In the case of Iversen's study of unemployment, the rumors about a possible factory closure were mentioned in the news, and Iversen contacted the shipyard a few days later, ready to start his project. Situations like that cannot be planned, but research institutions can be ready to act by preparing themselves for the unexpected and by maintaining good relationships with relevant workplaces as well as management and union representatives.

These studies do have one important factor in common: none is based on a representative sample of individuals from a geographical area or country. In CV epidemiology, the sampling of individuals has been a strong tradition since the Framingham studies started in the 1940s. This tradition has resulted in a strong orientation towards individual risk factors in CV epidemiology and prevention. In studying the role of work environmental factors, the use of representative samples has a number of negative consequences: (1) the jobs of the respondents are poorly described, (2) many of the respondents have medium exposure or low exposure, which gives low statistical power, (3) most occupational titles are much too broad, which results in heterogeneous groups, and (4) superficial knowledge about the jobs makes it difficult to suggest improvements of the work environment.²⁶ In the study of occupational risk factors (observational as well as interventional), it is of paramount importance to use a focused study design and to identify exposed/nonexposed

groups rather than "representative" individuals. A closer look at the examples presented here illustrates the point: None of the risk factors, such as carbon disulphide, rumors about factory closure, working in a private bank, or driving a bus in the city, could have been identified in a large representative study.

It could be argued that many of the examples mentioned (such as the studies of Belgian bank employees and Copenhagen bus drivers) are not intervention studies, but ordinary observational studies. This is, of course, correct from a formal point of view, but the intervention paradigm is not only the recipe of a study design; it is a way of looking at and analyzing a study. Society sometimes performs experiments which the researcher would not be allowed to perform. It was by looking at the different sources of water supply in London in the middle of the 19th century that John Snow discovered the association between contaminated water and cholera.⁴³ The situation was close to an experiment, because some households received clean water from one company while others did not. Snow analyzed this pattern correctly, and his results could be used immediately for prevention.

LEVELS OF INTERVENTION

Within the field of occupational intervention, it is customary to distinguish between three levels of intervention: the individual level, the individual/group interface level, and the organizational level (Table 2). The issue of intervention level has caused discussion and controversy in occupational medicine and disease prevention for many years. When physical and chemical exposures are the focus, the issue is "personal protection" versus "improvements of the work environment." Employers argue that it is unnecessary to spend millions of dollars to reduce the noise level at a workplace when the same effect can be achieved by using cheap and uncomplicated earplugs. Employees argue that earplugs (and other types of personal protective equipment) are not safe and may cause accidents, and that it is the responsibility of the employer to provide a safe workplace.

When psychosocial factors and stress are the focus, the issue is equally controversial. NIOSH uses the following careful wording: "Nearly everyone agrees that job stress results from the interaction of the worker and the conditions of work. Views differ, however, on the importance of worker characteristics versus working conditions as the primary cause of job stress. These differing viewpoints are important

TABLE 2. Examples of Interventions at Three Different Levels in the Workplace

The individual level:

- Using personal protective equipment (such as mask or earplugs)
- Practicing meditation or relaxation techniques
- Eating a healthy meal during lunch
- Attending a company fitness program after working hours

The individual/group interface level:

- Respecting the nonsmokers when smoking at the workplace
- Creating peer groups to help victims of harassment or bullying
- Using support groups of workers in health promotion programs to keep colleagues from resuming smoking
- Teaching the workers to solve conflicts at work through assertion training

The organizational level:

- Enforcing company policy on passive smoking
 - Changing the organizational structure of the workplace to increase workers' control and skill discretion
 - Reducing workplace noise levels
 - Changing the shiftwork system from a counter-clockwise to a clockwise schedule
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because they suggest different ways to prevent stress at work . . . Although the importance of individual differences cannot be ignored, scientific evidence suggests that certain working conditions are stressful to most people. Such evidence argues for a greater emphasis on working conditions as the key source of job stress, and for job redesign as a primary prevention strategy."³²

Recent reviews have found that most studies on workplace stress interventions have analyzed the effects of interventions at the *individual* level (Table 3). This situation is deplored by many researchers because they feel that intervention research should focus more on the fundamental causes of stress at work.^{8,19,44} Almost all reviews on the topics of stress management, organizational interventions, and stress intervention conclude that there should be much more intervention research at the organizational level. However, few authors analyze the explanations for the present situation. There seems to be an implicit understanding that the researchers should "know better," and the situation could be changed through a common decision to do other types of research. Rather than "blaming the researcher," consider some of the main obstacles related to organizational interventions:

- Organizational interventions are time-consuming and expensive because they involve many employees.
- Organizational interventions are difficult to describe, control, and evaluate.
- Management dislikes the idea of an intervention study because they view the organization of the workplace as their responsibility. They give up some power by participating in a research project.
- Management may think that possible mistakes or unpopular actions taken by company leaders during the intervention will be made public to the employees or to the media.
- The workers (and/or unions) may be opposed to some organizational interventions because they believe they interfere with the collective bargaining system at the workplace.
- Management also may be afraid of losing a monopoly on information.
- Organizational interventions may raise the expectations of the workers and may increase job dissatisfaction if those expectations are not met.
- If the intervention is a failure, it may cause internal as well as external troubles.

Many of these points should be quite obvious to researchers of social phenomena. Doing intervention research requires mutual confidence and respect of all the parties involved. Workplace participants may get the impression that researchers lose interest in the problems as soon as they have collected the data they need for their project. Before starting an organizational intervention project is a good idea to have a formal agreement in which the obligations and rights of all participants are

TABLE 3. Distribution of Stress Management Studies According to Level of Intervention and Level of Outcome

Level of Interventions	Level of Outcome Measures		
	<i>Individual</i>	<i>Individual/Organization Interface</i>	<i>Organization</i>
Individual	20	11	3
Individual/organization interface	2	1	
Organization	2	1	2

Note: one study could include several types of interventions.

From van der Hek H, Plomp HN: Occupational stress management programmes: A practical overview of published effect studies. *Occup Med* 47:133-141, 1997; with permission.

clarified. (For a further discussion of the questions related to the "individualistic bias" of psychosocial interventions, see references 15, 22, 38, and 44.)

In connection with the prevention of CVD, it would be extremely interesting to see more organizational intervention studies related to shift work, job strain, social support at work, effort-reward imbalance, job stress in general, noise, chemicals, and passive smoking. Furthermore, organizational level changes should be included in workplace health promotion and rehabilitation studies.

Primary, Secondary, and Tertiary Prevention

The question of primary versus secondary or tertiary prevention often is confused with the level of intervention, so that organizational interventions are considered "primary" while the interventions at the individual level are considered "secondary" or "tertiary." This is not necessarily a correct distinction. Most textbooks define primary prevention as interventions with the purpose of preventing the occurrence of disease among healthy individuals; secondary prevention as early diagnosis and treatment; and tertiary prevention as treatment to limit consequences of disease. Individual and organizational level interventions can benefit healthy as well as "ill" persons. Much of the confusion probably originates from a basic confusion related to the concept of disease. Most studies do not distinguish sharply between symptoms, signs, risk factors, illness, and disease. If symptoms such as stress or fatigue and risk factors such as high cholesterol or hypertension are considered "diseases," then it follows that almost all employees have a disease, and, hence, that most prevention is secondary.

Since this book is about CV diseases, I find it most fruitful to limit the definition to these diseases and not consider stress, hypertension, or other risk factors as diseases. Reduction of stress, treatment of hypertension, and smoking cessation are primary prevention activities.

In CV epidemiology it is common to distinguish between mass intervention strategy and high-risk intervention strategy. The high-risk strategy aims at reaching individuals with high risk (e.g., those with high cholesterol level or tobacco smokers), while the mass intervention strategy aims at reducing the risk of everyone a little bit, thereby reducing the whole burden of disease in the population. There is a third strategy in occupational and environmental medicine: the environmental strategy.

The workplace can play an important role in the prevention of CVD and other diseases by combining different prevention strategies. The workplace should be a healthy environment, promote a healthy lifestyle according to the cultural and social norms of the society, and play an active role in the rehabilitation of employees with (previous) CVD. These three strategies are not mutually exclusive; they can supplement and strengthen each other to achieve these goals (Fig. 2). For example, the workplace should have a clear policy on passive smoking so that nobody is exposed (the environmental approach); help smokers in their efforts to quit smoking through an active health promotion plan (the health promotion approach); and contribute to the rehabilitation of workers with CVD (or lung diseases) by providing a job without air pollution (the rehabilitation approach). Stress management and health promotion programs focusing on the individual or on individual risk factors often have been accused of blaming the victim, and with good reason. Under an integrated prevention program, the workers feel that the workplace contributes to their health and well being, and the employer will notice that the employees contribute to their own health, as well.³

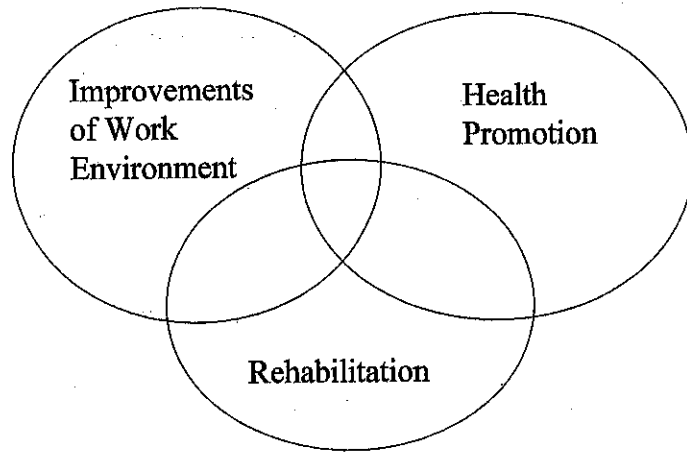


FIGURE 2. A model of integrated prevention of CVDs at the workplace.

CONCLUSIONS

The key word for intervention studies and programs at the workplace is integration: integration between interventions at different levels; between primary, secondary, and tertiary prevention; between mass, high-risk, and environmental approaches; and between different disciplines. Although occupational intervention research can be criticized for methodological and theoretical weaknesses,⁹ it is still a fact that the quality has improved appreciably during recent years.^{15,22} Intervention research and practical intervention programs give us insight regarding etiology as well as feasibility that cannot be gained in any other way: Which types of interventions result in desired changes with regard to health and well-being, and which types of interventions are possible to implement at the workplaces? Intervention research requires collaboration between researchers and individuals at the worksite, and researchers should realize that the learning process in this teamwork goes both ways. Intervention research tends to be more complicated than observational research, but the benefit with regard to scientific and practical insight is considerable. Therefore, the alert researcher should always look for windows of opportunity to perform intervention research together with workers (and their representatives) and employers.

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