

Health and economic impact of occupational health services

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The benefits of occupational health services are obvious and objectively demonstrable. But investments in their expansion are limited since all money spent on worker health and safety is deflected from alternative uses. Economic evaluation (cost–benefit analysis, cost–effectiveness analysis, and cost–utility analysis) of such services is thus important as a guide to rational choices, the dependency on the validity of assumptions made being the main limitation, along with the nonconsideration of social and ethical objectives if decisions are based on costs and benefits alone. Its unidimensional perspective has the strength of providing the clarity needed, however, especially in developing countries resisting moral suasion. Although monetary resources are what decision makers understand and respond to, it has been deeply held societal values that have persuaded more enlightened governments and firms of industrialized countries to invest a priori in comprehensive occupational health services. Ultimately, the formulation of policies on occupational safety and health must be both economically and ethically sound.

Key terms cost benefit; health economics; occupational safety.

Work-related injuries and illnesses kill an estimated 1.2 million people around the world every year. This figure roughly equals the global annual number of deaths from malaria or is four times the number of lives lost in the Asian Tsunami. In terms of morbidity, 250 million work-related accidents and 160 million work-related illnesses occur annually (1), and these numbers translate into an annual economic loss of approximately 4% of the world's gross national product (2).

Despite these stark numbers, only an estimated 5–10% of the workers in developing countries and 20–50% of the workers in industrialized countries have access to adequate occupational health services. Even in a developed country like the United States, approximately 70% of the hundred million workforce is not covered by occupational health services, and fewer than 15% work in plants with a full-time or part-time physician (3, 4).

Apart from being an antidote to unsafe work conditions, which breed ill health and predispose to injury and death, occupational health services have been endorsed by both the World Health Organization (WHO) and the International Labour Office (ILO) as a prescription for a healthier, happier, and more productive workforce. Therefore, the justification for the propagation and

adoption of occupational health services worldwide is as self-evident as for the distribution of mosquito nets, vaccination against epidemic diseases, or, for that matter, the installation of early warning systems in the Tsunami-prone oceans of the world. Or is it?

Dollars and sense of occupational health services

Unfortunately, simply making the case for some intervention or other on the basis of its undoubted benefits is not enough. We live in a world of competing demands for limited resources. Prudence dictates that, although a healthier workforce will almost certainly mean decreased absenteeism and increased productivity and although a safer work environment will surely result in fewer injuries and decreased workers' compensation claims, one must still weigh the benefits against the costs and seek the most cost-effective way of achieving the same end.

Not surprisingly, cost-conscious governments and funding agencies around the world are increasingly turning to economic evaluation as a tool to guide rational choices and improve efficiency. In economic

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evaluation, both costs and outcomes are analyzed, and alternative strategies are compared. The key questions to ask are “Is it worth doing?” and “Is it the best way of achieving the desired results?” The following three types of economic evaluation are relevant to occupational health services: (i) cost–benefit analyses, (ii) cost–effectiveness analyses, and (iii) cost–utility analyses.

Cost–benefit analyses

Cost–benefit analyses are currently the best known and most frequently used tool in occupational health settings. In its simplest form, the costs and benefits of a particular policy or program are measured in terms of their equivalent monetary value. When benefits outweigh the costs, it is worth doing. In other words, cost–benefit analyses seek to measure the economic efficiency of a proposed policy or project.

In the estimation of the benefits, a monetary value is apportioned to the avoided consequences (eg, costs of health care, rehabilitation, or workers’ compensation). The analysis must also take into consideration the fact that costs and benefits may be generated over a period of time, the costs and benefits often occurring in different time periods. Because costs or benefits 10 years later are not directly comparable with their value today, financial discounting (ie, expressing all future costs and benefits in their present value equivalent) is applied in the analyses. Thus

$$\text{value} = \sum (B_t - C_t) / (1 + n)^t,$$

where B = sum of all consequences, C = sum of all costs, t = discount over time, and n = discount rate.

The effects on productivity and reduced sickness absence can also be quantified and reflected as savings. More sophisticated forms of cost–benefit analyses would factor other intangible benefits into the equation (eg, providing employees with on-site primary health care may give them a sense of loyalty to the company because the company is demonstrating that it cares for its employees).

When all else is equal, it would be logical to choose the option that will obtain the greatest benefit at least cost (productive efficiency). However, because not all else is always equal, there should be an attempt to track the distribution of costs and benefits among the various segments of society (eg, how the benefits are distributed by age, gender, income, race, geographic location, and time) to ascertain whether imbalances between benefits and costs are present for those segments of the population which are most vulnerable (allocative efficiency).

Cost–effectiveness analyses

The cost–effectiveness analysis is a technique for comparing the cost and effectiveness of two or more alternatives. In its most common form, a new strategy is compared with current practice in the calculation of the cost–effectiveness (CE) ratio:

$$\text{CE ratio} = (\text{cost}_{\text{new strategy}} - \text{cost}_{\text{current practice}}) / (\text{effect}_{\text{new strategy}} - \text{effect}_{\text{current practice}}).$$

Note that cost–effectiveness analyses measure health benefits not in monetary units, but in natural units such as life years saved or gained or improvements in functional status (eg, units of blood pressure or cholesterol reduced) and that the cost–effectiveness ratio is actually the ratio of marginal cost to marginal effectiveness. One might think of the resulting number as the “price” of the additional outcome purchased by switching from current practice to the new strategy (eg, USD 10 000 per life year). If the price is low enough, the new strategy is considered “cost-effective”.

In general, one strategy is considered more cost-effective than another if it is (i) less costly and at least as effective and (ii) more effective and more costly, but the additional benefit is considered worth the extra cost.

However, because costs and benefits are measured in noncomparable units, their ratio can only provide a measure of the relative efficiency of the alternative interventions. Cost–effectiveness analyses do not, for instance, enable us to evaluate the relative efficiency of interventions that provide more benefit at greater cost or less benefit at lower cost. Another limitation is their inability to compare interventions with differing natural effects (eg, an intervention aimed at increasing life years gained cannot be directly compared with another aimed at improving physical functioning). Cost–effectiveness analyses therefore cannot directly address allocative efficiency.

Cost–utility analyses

Cost–utility analyses are a variant of cost–effectiveness analyses, in which the outcomes of the intervention are translated into a measure that includes both morbidity and mortality dimensions [eg, using a utility-based measure such as quality-adjusted life years (QALY)]. The impacts of competing interventions are expressed in terms of costs per QALY. An intervention is deemed efficient, relative to an alternative, if it results in higher or equal benefits at lower cost. The use of a single measure of both qualitative (morbidity) and quantitative (mortality) health benefit enables diverse health care interventions to be compared. Hence, cost–utility analyses can address both productive efficiency and allocative efficiency.

Advantages and disadvantages of cost–benefit analyses

Advantages

- Promotes fiscal accountability: tells
 - what level of service
 - what number of clients will benefit and
 - at what cost
- Helps set priorities
 - estimate what program costs and benefits are *before* implementation (may reveal unexpected costs)
 - budget and allocate funds
- Help persuade legislators, policy makers and funders
 - Even a relatively incomplete cost–benefit analysis can be persuasive!

Disadvantages

- Requires technical skill and knowledge
 - Solid grounding in economic theory and techniques (consultant often needed)
- May be overly simplistic
 - Promotes unrealistically high expectations, with political backlash
- No standard way to assign monetary value
- Market costs do not reflect “real” social costs
- Most cost–benefit analyses do not look at long-term outcomes

Limitations of the economic approach

A major limitation of all economic evaluations is that their validity depends on the validity of the assumptions made. For instance, while cost–benefit analyses attempt to quantify benefits or costs in terms of their monetary value, such quantification is not always possible or easy. How does one measure, for instance, the pain and suffering of victims, their friends, and loved ones in economic terms? The difficulty or impossibility of compensating for the loss of life or limb reflects the inadequacy of trying to attach a value or worth to health in monetary units. For this reason, sensitivity analysis is often required to show how the results will change with different analytical choices and with variations in the uncertain levels of key costs and benefits.

Moreover, the improvement in occupational health and safety is more than a technical issue of costs. Decisions based on cost–benefit analyses, for example, may fail to consider all of society’s objectives, including important social and ethical objectives. As Nobel laureate and eminent developmental economist Amartya Sen has observed, a policy may make perfect economic sense, yet still be “perfectly disgusting” by any ethical standard (5).

Strengths of the economic approach

On the other hand, the strength of the economic approach lies precisely in its unidimensional perspective because it offers the clarity needed for advocacy. For instance, the statement that “in 1992, the direct cost paid out in compensation for work-related diseases and injuries in the European Union reached 27 000 million Euros”, does have the effect of making elected officials sit up and take notice. Similarly, “in 1992, the total

direct and indirect costs associated with work-related injuries and diseases in the USA were estimated to be USD 171 000 million, surpassing those of AIDS and on a par with those of cancer and heart disease” (1).

Perhaps even more importantly, monetary value is what ministers of finance and key government officials understand and will respond to. Economic evaluation provides them with the justification needed for resource allocation decisions. Many a new initiative for occupational safety and health, conceived in purely qualitative terms, would have had a better chance of gaining approval if the negative health or economic impacts had been quantified and shown to cost more than their prevention—since refusal of endorsement would then appear irrational.

The process is admittedly technical, and there will inevitably be data and information gaps. However, it is often better to make the best estimates one can and present them along with a description of the uncertainties and caveats, than not to attempt an economic analysis at all.

In some European countries (eg, the United Kingdom and Denmark), an assessment of economic impact has become one of the standard items of information required for the decision-making process when new occupational health programs and interventions are proposed. This is a positive development that renders the decision-making process more robust. Health and safety measures are no longer introduced in an ad hoc manner, reliant solely upon intuitive considerations. The trade-offs that have to be made when one course of action is chosen over another are made more transparent. And when each subcomponent of the proposed policy or program is subjected to systematic scrutiny, important unforeseen or distributional consequences can be identified.

There is also an increasing trend in the European Union and the United States to require a cost–benefit

analysis before legislation on occupational safety and health is introduced. This requirement parallels the broader insistence of cost-conscious legislators and payers for evidence-based clinical practice, in response to runaway health care costs. After all, the introduction of occupational safety and health legislative instruments, like the provision of health care, is not without costs and may even be counter-productive in some cases (6). It has been estimated, for instance, that the direct costs of federal environmental, health, and safety regulations in the United States are on the order of USD 200 billion annually (or about the size of all federal domestic, non-defense discretionary spending), while the benefits of the regulations remain uncertain (7). How much of these costs represent waste, inappropriateness, and inefficiency? It is clearly consistent with society's implicit desire to make the fullest use of its resources to find out.

Economic evaluation of existing measures concerning occupational safety and health is also gaining momentum at the company level in many industrialized countries. However, the assessment of *national* occupational health and safety systems at the macro-level has so far received limited attention.

Ideally, there should be a standard format for conducting and presenting the results of economic evaluation. For example, there should be a core set of economic assumptions used in calculating benefits and costs. The European Union is leading the way in developing a common methodology that would both improve the robustness of the quantification process and facilitate comparisons across countries. The Safety & Health & Performance & Enterprises (SHAPE) program has produced relevant information on methodologies and is testing them for occupational safety and health cost-benefit analyses. The European Agency for Safety and Health at Work has also devised models for calculating the costs at company and national levels (8).

Economic evaluation and developing countries

Unfortunately, despite the compelling case for occupational health services on moral and health grounds, the concept has not gained acceptance in many developing countries, where workers are still struggling for basic protection and adequate workmen's compensation, while employers are bent on denying or reducing their liability for work-related diseases and injuries. The cynical view would be that some governments and profit-driven multinationals may see the costly regulatory environment of occupational safety and health in Western industrialized nations as a distinct competitive economic disadvantage to be avoided at all costs. After all, "cheap labor" is what makes third world countries attractive to foreign manufacturing plants.

However, the real reason may be that the potential economic benefits of worker health, of reduced sickness absenteeism and work disability, and of increased productivity have not been clearly articulated or demonstrated. The role of economic evaluation in these situations would be to buttress the moral and ethical arguments for occupational health services and to illuminate the trade-offs and compromises that must inevitably be made in order that "net welfare loss" be minimized as a whole. Otherwise, the arguments that safer and healthier work conditions are actually in the interests of workers, employers, and governments alike, when all factors are considered, will remain an open question at best.

Concluding remarks

While the benefits of occupational health services are intuitively obvious and indeed demonstrable, there are limits to investing in its provision and expansion, given that every dollar spent on worker health and safety means less money all round for alternative uses.

Advocates of the use of occupational health services will do well to be conversant with the measurement and evaluation of the health and economic impact of occupational safety and health interventions because data, and money, are what decision-makers understand and respond to. Properly used, economic evaluation facilitates better informed, evidence-based decision making. But the economic arguments should supplement, not replace, moral suasion. It should be remembered that, historically, most occupational health and safety initiatives in industrialized countries did not come about because of economic arguments. In fact, it is doubtful that economic evaluation, resting on the neoclassical, utility-maximizing welfare model, would have had the same power as the ethical and moral arguments reflecting deeply-held societal values in persuading the more enlightened governments and firms to invest a priori in comprehensive occupational health services.

Ultimately, the formulation of policies concerning occupational safety and health must be both economically *and* ethically sound.

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Definition of occupational health services

The term “occupational health services” refers to services entrusted with essentially preventive functions and the responsibility for advising employer, workers, and their representatives in undertakings on:

- Requirements for establishing and maintaining a safe and healthy work environment that will facilitate optimal physical and mental health in relation to work.
- The adaptation of work to the capabilities of workers in light of their state of physical and mental health.

Functions of occupational health services

The functions of occupational health services generally include the following (9):

- The identification and assessment of the risks from health hazards in the workplace.
- The surveillance of factors in the work environment and work practices that may affect workers’ health, including sanitary installations, canteens and housing when these facilities are provided by the employer.
- Advice on the planning and organization of work, including the design of workplaces, the choice, maintenance and condition of machinery and other equipment, and substances used in work.
- Participation in the development of programs for improving work practices and in the testing and evaluation of health aspects of new equipment.
- Advice on occupational health, safety, hygiene, and ergonomics and on individual and collective protective equipment.
- Surveillance of workers’ health in relation to work.
- Promoting the adaptation of work to the worker.
- Contributing to vocational rehabilitation measures.
- Collaboration in providing information, training, and education in the fields of occupational health, hygiene, and ergonomics.
- Organizing first-aid and emergency treatment.
- Participation in analysis of occupational accidents and occupational diseases.