Measurement of Cost-Effectiveness of Interventions in Occupational Health

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Introduction

Cost-effectiveness has become an important aspect in evaluating health care interventions in occupational health. It has been demonstrated that healthy workers are more productive in performing paid work. On the other hand, performing work may affect our health due to strenuous working conditions and cause temporary sickness absence and permanent disability. [European Foudation, 2001] In evaluation of health care programmes the analyst is predominantly interested in two aspects: the gains in health and the costs of the intervention activities. When a health care programme improves health and productivity of working people, both employer and employee may reap benefits from productivity gains as a result of better health.

The discussion of cost-effectiveness will increasingly also become relevant for typical occupational hygiene control measures. Companies will ask for evidence that the proposed control measures are worth their money. This requires measurement and valuation of the costs and health benefits of interventions. A cost-effectiveness analysis requires that the gains in health status (e.g. less low-back pain, less hearing loss, less occupational cancer) due to the interventions are compared to the costs to achieve these health benefits. A cost-effective intervention will result in substantial health gains for moderate costs.

Health, costs, and benefits

The measurement and valuation of health may be very straightforward. Examples are the reduction in number of mesothelioma cases after the ban on asbestos use and the reduction in low-back pain after introducing lifting aids. However, a crucial question pertains to the valuation of these health gains. When confronted with the problem of spending money on lifting aids or on asbestos-free products, some comparisons must be made between the health benefits of both interventions. Since it is not possible to directly compare the consequences of 1 death due to mesothelioma death or 10 subjects with low-back pain, generic measures of health status have been developed. These generic measures cover physical, psychological, and social well-being and are sometimes referred to as quality of life assessments. It is assumed that a generic health questionnaire allows for comparison of health status irrespectively of diagnosis.[Essink-Bot et al., 1993].

With regard to the economic evaluation of all consequences of an intervention, in general, a distinction is being made between direct and indirect costs. Direct costs are recognisable 'out of pocket' costs which include the costs of the introduction and implementation of control measures and the costs of health care due to associated illnesses. Indirect costs are primarily costs due to production loss because of morbidity and mortality. These costs include absence from work (short / long term), reduced productivity at work due to health complaints, disability or premature death, and production loss of those with unpaid work. Although these costs may be difficult to estimate, the indirect costs as a consequence of productivity losses are usually far greater than direct costs. In a recent Swedish study among computers users it was estimated that the mean loss of productivity among those reporting health complaints affecting their work amounted to almost 17 hours per month. The loss due to reduced productivity without

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sickness absence exceeded the loss due to sickness absence [Hagberg et al., 2002].
In a cost-effectiveness analysis the valuations of health and costs are combined into a single measure. In this respect, a measure often used is the amount of money required for one additional year of life. An evaluation in the United States on cost-effectiveness of control measures at the workplace showed a large variation. The introduction of the arsene emission limit for copper smelters required an investment of 74,000 USD per life year gained. The ban on asbestos friction materials was estimated at 24,000 USD per life year and the reduction of the benzene limit from 10 ppm to 1 ppm in the rubber industry at 76,000 USD per life year. These figures are in sharp contrast with the estimated costs of 6,700,000 USD per life year for the reduction of the formaldehyde limit from 3 ppm to 1 ppm in the woodworking industry [Tengs et al., 1995].

An example for the construction industry

In the construction industry the introduction of a mechanic device to assist the roadmaker while laying a brick-paved road (paving machine) has been advocated strongly by occupational health professionals for many years. This machine is able to take up 46 bricks at a time and reduces the number of bricks required per m² road to be put down manually by almost 90%. This will certainly aid the brick layer during the task of brick laying, but the effects on his total physical load during a whole workday have been debated. Some brick layers have complained that while working with the paving machine the time spent doing other strenuous tasks have increased substantially.
In a before and after design the effects of starting to use this ergonomic intervention was evaluated with respect to its impact on physical load, workers' health, and costs and benefits. The posture and movements of workers were continuously measured over the workday and linked to simultaneously collected observations of the tasks performed. Questionnaires on working conditions, use of materials and machines, and health were collected. An economic analysis at company level was performed.
The introduction of mechanized paving had positive and negative effects on the physical load. The average physical load of a team of workers (2-3 subjects) was significantly reduced due to less work time in a kneeling/squatting position and less lifting of loads (primarily bricks), although the work time with awkward back postures increased slightly. When stratifying the physical load by job title, it became clear that for the hod man (whose main task is carrying bricks) the physical load reduced drastically, but that for the brick layer the work time with an awkward back posture increased. The overall large reduction in physical load in the task of brick laying was partly offset by spending more time in other strenuous tasks and an increased productivity.
With respect to health, the results showed no differences in the occurrence of musculoskeletal complaints. However, there seemed to be a trend that workers with low-back pain were on sick leave less often, possibly indicating that the reduction in physical load allowed workers with low-back pain to continue their work more easily during machinal paving compared with manual paving. The estimated reduction in sick leave hardly affected the estimated production costs.
The productivity of machinal paving was about 63-80% larger than the manual way of paving roads. The estimated costs for manual work amounted to €12.7-13.9 per m² road. The paving machine reduced these costs by only 4-9%. The additional investments in machinery were more than compensated by the increased productivity. Important constrains for this conclusion were that the paving machine must by used at least 100 days per year (which seems not feasible for many companies due to technical and organisational problems) and that the type of work must allow the use of the paving machine. These constrains largely explain why most construction companies have not introduced this intervention, although the occupational health service for the construction industry and the labour inspectorate have strongly supported the use of this intervention.
In addition, when asking workers about the introduction of the paving machine, they often noted the loss of their craftmanship as a major obstacle for using the machine. They have chosen this occupation because of the skills required to pave a road and they argue against changed work practices when these skills are negatively affected.

Conclusion

Cost-effectiveness considerations will increasingly play a role in decisions about interventions at the workplace.
Information on cost-effectiveness of different control measures may guide the occupational hygienist towards a better advice on priorities in occupational health programmes. The example of the construction industry illustrates that the cost-effectiveness of ergonomic interventions should be demonstrated before advocating their implementation.

References

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