Economic evaluations of worksite health promotion programs

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SUMMARY

Background

The prevalence of modifiable health risks, such as an insufficient level of physical activity, unhealthy dietary habits, and a low level of relaxation, among the population is high. This imposes a large economic burden on society as a whole and on employers in particular. The workplace presents a useful setting for offering behavior change interventions aimed at preventing and/or reducing the prevalence of such risk factors (i.e. worksite health promotion programs). In practice, however, numerous kinds of worksite health promotion programs exist, of which only a restricted number can be provided with the available resources. Therefore, high quality evidence is needed to demonstrate their value. This evidence can be provided by performing methodologically sound economic evaluations of worksite health promotion programs, in which both the costs and consequences of alternatives are compared. Unfortunately, however, such studies are scarce. This is due to the fact that only a few of the studies that consider the effectiveness of worksite health promotion programs take the extra step of considering their resource implications. On top of that, the methodological quality of those that have been performed is generally poor, as is the uptake of their results in daily practice (*Chapter 1*). Therefore, this thesis aimed to contribute to the development of a sound evidence base on the resource implications of worksite health promotion programs as well as to improve uptake of this evidence in daily practice. This was done by summarizing the current literature on the cost-effectiveness and financial return of worksite physical activity and/or nutrition programs, generating new evidence by performing economic evaluations of various newly developed worksite health promotion programs, as well as developing and providing recommendations for good practice when conducting and disseminating economic evaluations in occupational health.

Part 1: Systematic reviews

Chapter 2 described a systematic review on the cost-effectiveness of worksite physical activity and/or nutrition programs. A literature search was performed in EMBASE, MEDLINE, SportDiscus, PsycInfo, NIOSHTIC-2, NHSEED, HTA, and Econlit

for studies published up to January 14th, 2011. Additionally, articles were searched by reviewing references, searching authors' databases, and contacting authors of included studies. Ten studies were found to be eligible for inclusion, of which four evaluated worksite nutrition programs (seven programs) and six worksite physical activity and nutrition programs (eleven programs). A risk of bias assessment indicated that the methodological quality of the included studies was generally poor. From various perspectives, all worksite nutrition as well as worksite physical activity and nutrition programs (N=6) were more costly and more effective in reducing body weight compared to usual care. When only intervention costs were considered, most worksite nutrition (N=4/5) and worksite physical activity and nutrition programs (N=5/6) were more costly and more effective in reducing cholesterol level and cardiovascular disease risks. Currently, however, there are no set levels as to how much various kinds of decision-makers are willing to pay per unit of improvement in these outcomes. One of the included studies also evaluated the cost-utility of two different delivery modes of a worksite physical activity and nutrition program (i.e. telephone-based and internet-based), and provided mixed results. That is, when comparing its results with various pre-established thresholds regarding the amount of money decision-makers are willing to pay per QALY gained, the internet-based intervention could be regarded as cost-effective ($1,698/QALY gained), whereas the phone-based intervention ($311,523/QALY gained) could not. Thus, based on the current literature, strong conclusions about the cost-effectiveness of worksite physical activity and/or nutrition programs could not be made and there seemed to be an urgent need to improve the methodological quality of such studies.

Chapter 3 described a systematic review on the financial return of worksite physical activity and/or nutrition programs. In order to identify relevant studies, a literature search was performed in eight electronic databases (EMBASE, MEDLINE, SportDiscus, PsycInfo, NIOSHTIC-2, NHSEED, HTA, and Econlit), references of relevant review articles as well as authors' own databases were searched, and authors of included studies were contacted. Eventually, 18 studies were included in the review, of which four were performed alongside a randomized controlled trial (RCT), 13 alongside a non-randomized study (NRS), and one was a modeling study. For all included studies, three metrics were (re-)calculated, including the Net Benefits,

Benefit Cost Ratio (BCR), and Return On Investment (ROI). These metrics were averaged and a subgroup analysis was performed to compare them between study designs (i.e. RCT versus NRS). Additionally, a risk of bias assessment was performed to assess the methodological quality of the studies. The results showed that average financial return estimates in terms of absenteeism benefits (NRS: ROI 325%, BCR 4.25; RCT: ROI -49%, BCR 0.51), medical benefits (NRS: ROI 95%, BCR 1.95; RCT: ROI -112%, BCR -0.12), or both (NRS: ROI 387%, BCR 4.87; RCT: ROI -92%, BCR 0.08) were positive in NRSs, but negative in RCTs. Moreover, the methodological quality of the included studies was generally poor, and even poorer in NRSs than in RCTs. These results indicate that financial return estimates of NRSs are likely to be distorted by selection bias (i.e. study results are caused by (baseline) differences between study arms, rather than by the intervention itself). Financial return estimates derived from NRSs should therefore be interpreted with great caution. RCTs with a lower risk of bias, on the other hand, indicated that worksite physical activity and/or nutrition programs may not pay for themselves in terms of reduced absenteeism costs, medical costs, or both. However, since worksite physical activity and/or nutrition programs are thought to be associated with additional types of benefits (e.g. reduced on-the-job productivity costs, also known as presenteeism benefits), conclusions about their overall profitability could not be made. Therefore, it is advisable to perform more RCT-based ROI analyses that include a consensus-based set of financial benefits.

Part 2: Applied studies

In order to generate new evidence, four economic evaluations were performed. All of them evaluated a newly developed worksite health promotion program in comparison with the existing health promotion activities of the participating companies (i.e. usual care / usual practice). In all studies, missing values were multiply imputed and uncertainty was assessed using bootstrapping techniques.

Chapter 4 presented the economic evaluation results of the Vital@Work intervention, a worksite health promotion program aimed at improving physical activity, nutrition, and relaxation, as a potentially effective tool to keep older workers vital and healthy, and thereby contributing to prolonged employability. The objective was to perform a cost-effectiveness analysis (CEA) in terms of general vitality, work-

related vitality, and need for recovery (NFR) from the societal perspective and a ROI analysis from that of the employer. Within this study, a total of 730 older hospital workers (≥ 45 years) were randomized to an intervention (n = 367) or control group (n = 363). Effect data were collected at baseline, 6-, and 12-month follow-up. Cost data were collected on a 3-monthly basis using questionnaires. The cost of the Vital@Work intervention was found to be €149 per participant. After 12 months, no statistically significant between-group differences were found for all other cost and effect measures. A joint comparison of costs and effects revealed that a substantial amount of money had to be paid by society to reach a reasonable probability of cost-effectiveness for all outcomes (e.g. ± €3,500 per 1-point improvement in general vitality (range: 0-100) for a 0.9 probability). Moreover, per Euro invested in the program, the employer was found to lose €2.21. Based on these results, it was concluded that the Vital@Work intervention was neither cost-effective from the societal perspective, nor cost-saving from that of the employer. Thus, the economic evaluation provided no evidence to support its implementation.

Chapter 5 described the economic evaluation of the Mindful VIP intervention, a mindfulness-based worksite intervention aimed at improving work engagement among knowledge workers. This economic evaluation aimed to evaluate the intervention's cost-effectiveness in comparison with usual practice from both the societal and employer's perspective. Moreover, a ROI analysis was performed to explore the intervention's impact on the company's bottom line. A total of 257 employees of two Dutch governmental research institutes were randomized to the intervention (n = 129) or control group (n = 128). Data on work engagement, general vitality, job satisfaction, and work ability were collected at baseline, six, and 12 months. Salary and absence data were collected from company records. Data on all other cost measures were collected using 3- or 6-monthly questionnaires. The cost of the Mindful VIP intervention was found to be €171 per participant from the societal perspective (estimated using bottom-up micro-costing) and €464 from that of the employer (based on market prices). After 12 months, a statistically significant but not clinically relevant adverse effect on work engagement was found (-0.19; 95%CI -0.38 to -0.01; i.e. a decrease of 0.19 on a scale from 0 to 6). There were no statistically significant differences between study groups in job satisfaction (-0.02; 95%CI -0.22

to 0.17), general vitality (-3.0; 95%CI -6.1 to 0.1), work ability (-0.34; 95%CI -0.84 to 0.17), and total costs (societal: 1,814; 95%CI -800 to 4,588, employer: 2,038; 95%CI -548 to 4,752). Moreover, the intervention's maximum probability of cost-effective was low for all outcomes (≤ 0.25) and the intervention did not result in a positive financial return to the employer. Based on these results, the Mindful VIP intervention could neither be considered cost-effective from both the societal and employer's perspective, nor cost-saving from that of the employer. Thus, this study provided no evidence to support its implementation.

Chapter 6 presented the economic evaluation results of the VIP in Construction intervention, a worksite health promotion program aimed at improving physical activity and nutrition among construction workers. The study aimed to explore the intervention's cost-effectiveness in comparison with usual practice from the societal and employer's perspective, as well as its financial return to the employer. Within this study, 314 construction workers were randomized to the intervention (n = 162) or control group (n = 152). Data on body weight, waist circumference, musculoskeletal disorders (MSD), work-related vitality, and job satisfaction were collected at baseline, six, and 12 months. Sickness absence data were collected from company records. Data on all other cost measures were collected using 3-monthly questionnaires. From the societal perspective, the cost of the VIP in Construction intervention was found to be €178 per construction worker (bottom-up micro-costed). From the employer's perspective, these costs were €287 (market prices). At 12-month follow-up, no statistically significant cost and effect differences were found between groups. Results also indicated that the intervention's probabilities of cost-effectiveness for body weight, waist circumference, and MSD gradually increased with an increasing willingness-to-pay to 0.84 (willingness-to-pay = €21,000/kg), 0.77 (willingness-to-pay = €18,000/cm), and 0.84 (willingness-to-pay = €42,000/person prevented from having a MSD), respectively. The intervention's maximum probabilities of cost-effectiveness for work-related vitality and job satisfaction were low at all ceiling ratios (≤ 0.54) and financial return estimates were positive, but their confidence intervals were rather wide and none of them was statistically significant. Based on these results it was concluded that the intervention's cost-effectiveness in improving weight-related outcomes and MSD depends on the societal and employer's willingness to

pay for these effects as well as the probability of cost-effectiveness that they consider acceptable. From the employer´s perspective, the intervention was not cost-effective in improving work-related vitality and job satisfaction. Also, due to a high level of uncertainty, it could not be concluded that the intervention was cost-beneficial to the employer.

Chapter 7 described the economic evaluation of the Be Active & Relax intervention. The objective was to evaluate the cost-effectiveness and financial return of a combined social and physical environmental intervention in office employees in comparison with usual practice, and of both intervention conditions separately. Moreover, the probabilities of the intervention conditions being cost-effective in comparison with each other were explored. This study used a 2X2 factorial design, in which 412 employees were allocated at the department level to the combined intervention (n = 92), social environmental intervention (n = 118), physical environmental intervention (n = 96), or control group (n = 106). Data on NFR, general vitality, and job satisfaction were collected at baseline, 6-, and 12-month follow-up. Salary and sickness absence data were collected from company records. Data on all other cost measures were collected using 3-monthly questionnaires. Using linear multilevel analyses, CEAs were performed from the societal (NFR and general vitality) and employer's perspective (NFR and job satisfaction), and ROI analyses from that of the employer. After 12 months, combined intervention group participants statistically significantly improved their NFR compared with the control group (-8.4; 95%CI -14.6 to -2.2). Their total employer's costs, however, were statistically significantly higher than those of the control group (3,102; 95%CI 598 to 5,969). All other between-group differences in costs and effects were not statistically significant. For NFR, the combined intervention became the preferred option at willingness-to-pay values of €170 (societal perspective) and €300 (employer's perspective) per point improvement, after which its probability of cost-effectiveness gradually increased to 0.85. For general vitality and job satisfaction, the maximum probabilities of the interventions being cost-effective in comparison with each other were low at all ceiling ratios (≤ 0.55), as were their probabilities of financial return (≤ 0.41). Depending on the societal and employer's willingness to pay and the probability of cost-effectiveness that they consider acceptable, the combined

intervention may be considered cost-effective in improving NFR. However, both separate interventions were not cost-effective in improving this outcome. Furthermore, all interventions were neither cost-effective in improving general vitality (societal perspective) and job satisfaction (employer's perspective), nor cost-saving to the employer.

Part 3: Improving evidence-based practice

As previous research indicates that the methodological quality of economic evaluations in occupational health is generally poor, *chapter 8* aimed to help occupational health researchers conduct high quality trial-based economic evaluations. This was done by discussing the theory and methodology that underlie them and by providing recommendations for good practice regarding their design, analysis, and reporting. Amongst others, it was recommended to consider the economic evaluation requirements at the earliest stage possible and to perform such evaluations alongside studies with a randomized design. Within these studies, careful considerations must be made regarding the perspective, the analytic time frame, the identification, measurement, and valuation of resource use and outcomes, as well as the methods used for calculating sample sizes, comparing costs and consequences, and handling missing data and uncertainty. The latter is of particular importance, as few economic evaluations in occupational health report on the uncertainty surrounding their incremental cost-consequence estimates, whereas failing to estimate values under uncertainty makes it impossible to determine the certainty of results and could thus lead to inappropriate decision-making.

As a first step in bridging the gap between the economic evaluation literature and daily practice in occupational health, *chapter 9* aimed to explore four issues; 1) the process by which occupational health decisions are made, 2) the importance given to the financial implications of occupational health and safety (OHS) interventions, 3) the sources of information used during the decision-making process, and 4) the occupational health decision-makers' knowledge about different economic evaluation methods. This was done by performing 18 in-depth and 25 structured interviews with occupational health decision-makers in the healthcare sector of Ontario, Canada. The analyses showed that the occupational health decision-making

process could generally be subdivided into three stages: 1) *initiation stage*, during which the need for an intervention is established, 2) *pre-implementation stage*, during which and intervention as well as its business case are developed in order to achieve senior management approval, and 3) *implementation and evaluation stage*, during which an intervention is implemented and evaluated. In line with previous research, organizations were found to invest in OHS interventions for legal, financial, and moral reasons. Moreover, information on the financial implications of such interventions was found to be of great importance to the decision-making process, particularly the employer's costs and benefits. Results also indicated that occupational health decisions are currently not being made in an evidence-based manner. That is, scientific evidence on the (financial) implications of OHS interventions was found to be rarely consulted and sound ex-post program evaluations were hardly ever performed. Furthermore, there seemed to be a need to advance the decision-makers' economic evaluation skill set. Possible strategies to overcome these issues may include the generation of scientific evidence that is in line with the needs of occupational health decision-makers (e.g. ROI analyses performed from the employer's perspective), providing busy decision-makers with critical summaries of published studies, transmitting (economic evaluation) results in easy-to-use formats, and educating occupational health decision-makers in economic evaluation methods.

Discussion

In *chapter 10*, the main findings were discussed and interpreted, and recommendations for research and practice were presented. In conclusion, the present thesis indicated that (strong) evidence of the cost-effectiveness and/or financial return of worksite health promotion programs is currently lacking. Therefore, widespread implementation of such interventions in an effort to generate cost savings is not recommended, while some of them may be considered cost-effective if decision-makers are willing to invest a certain amount of money to improve employee health. Whether the latter is the case is currently unknown. The lack of evidence of cost savings associated with existing worksite health promotion programs, however, does not negate the value of improving employee health. Therefore, future research should explore what attributes of worksite health promotion programs are most

important and how such interventions should be optimally designed. The cost-effectiveness and/or financial return of such “optimally” designed interventions should subsequently be established by performing (cluster-)RCT-based economic evaluations. Furthermore, the methodological quality of economic evaluations of worksite health promotion programs was found to be generally poor, as was the uptake of their results in daily practice. To prevent inappropriate decision-making, (occupational health) researchers as well as other relevant stakeholders should ensure that both issues are addressed.