A Manual for

Economic Evaluation in Safe Community Practice

Revised version
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Preface

As health care resources in many countries have become scarcer, there is a greater focus on the process of priority-setting between competing uses of resources. Policy and decision makers are increasingly recognising the need to consider the cost and effectiveness of alternative safety promotion strategies and to demonstrate that the costs of programs to prevent injuries do not outweigh their benefits.

The initiative for the manual was taken in the autumn of 1999, when a large number of experts and practitioners from throughout the world met at the 1st WHO Seminar on Cost Calculation and Cost-effectiveness in Injury Prevention and Safety Promotion held in Prague to discuss ways in which economic evaluation methods might be tailored for Safe Community and other local safety work.

Particular emphasis was placed on the need for a tool that could be used without the requirements of expert knowledge in economics. Several working parties made suggestions as to the contents and design of such a tool. A small working group was assigned the task of preparing a manual based on the results of the suggestions as a basis for a number of field studies.

The working group initially consisted of six people from Sweden: Bjarne Jansson, Jahangir Khan, Aime Laur, Lars Lindholm, Kent Lindqvist, and Bengt Springfeldt. They jointly represent the Karolinska Institutet, Stockholm County Council, the University of Linköping, and the University of Umeå. At a later stage, Aime Laur and Lars Lindholm left the group and were replaced by Per Nilsen (University of Linköping). A reference group was also appointed, consisting of Joan Ozanne-Smith (Australia), Bo Henriksson (Sweden), Jens Lauritzen (Denmark), Ulf Persson (Sweden), Diana Hudson (USA), Sören Kölster (Denmark), and Leif Svanström (Sweden).

The working group assembled a set of evaluation guidelines into a manual, which was tested in several field studies in Sweden, South Africa, and Bangladesh in 2000. A revised version of the manual was then presented at the 2nd WHO Seminar on Cost Calculation and Cost-Effectiveness in Injury Prevention and Safety Promotion, held in Viborg, Denmark, in October 2001. Work continued after this meeting and the present version of the manual was finished in the spring of 2004, for presentation at the WHO Safe Community conference in Prague, Czech Republic, June 2004.

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Introduction to the manual

The basic premise behind the manual is that there is a need for economic evaluations in safety promotion, but that certain simplifications are needed to make these evaluations feasible for practitioners in this field. The manual is directed at community policy and program decision makers and local safety planners and fieldworkers, who may have limited time at their disposal and lack expert knowledge in health economics, therefore needing a tool to enable them to undertake economic evaluations.

The manual aims to be user-friendly, preparing the evaluator for undertaking an economic evaluation by presenting a theoretical foundation as well as providing specific recommendations and detailed guidance on "how-to-do-it." The manual may be used both before a program is implemented and to evaluate what has been accomplished by existing initiatives.

The manual does not introduce any new or unique theoretical concepts or ideas. Rather, the theoretical framework and the method are based on the foundation of established taxonomies and economic evaluation principles of the literature, including such noted works as *Cost-Effectiveness in Health and Medicine* by Gold et al and *Methods for the Economic Evaluation of Health Care Programmes* by Drummond et al. The manual is also grounded in practice, utilising valuable empirical experience gained through field tests of the manual, reported at the Viborg Safe Community Conference in 2001 and described in *Conference Report: 1st Safe Community Conference*.

How to use the manual

The manual aims to be self-instructional, preparing the evaluator for undertaking an economic evaluation of safety promotion programs and providing guidance on "how-to-do-it." The manual is divided into two sections. The first section provides a theoretical framework for the economic evaluations of safety promotion programs. The second section describes the methodological steps of economical evaluations.

The purpose of the separation of theory (model) and practice (method) is to make the manual easy to use. An early version of the manual mixed theoretical concepts with more specific methodological advice, but this solution was found to be rather confusing when the use of the manual was examined after being applied in field tests.

The manual presents an evaluation model, which gives an overview of what aspects are captured. Models provide frameworks rather than recipes, helping

an evaluator to identify the important issues to consider in undertaking studies. The manual also describes a method: a number of steps (activities) that the evaluator needs to undertake when conducting an economic evaluation. Hence, if the evaluation model tells the evaluator "what," the evaluation method tells him or her "how."

Theoretical framework

The first five chapters provide a theoretical foundation for the economic evaluation. The initial chapter offers a brief introduction to the concept of economic analysis. The next chapter discusses how to frame an evaluation, which involves specifying the problem or question to be studied, determining the perspective, the relevant time frame, the costing basis, and the analytic method appropriate for the study.

The subsequent chapters describe the four elements of the evaluation model: (1) injury information, (2) injury costs, (3) program costs, and (4) outcome analysis. The evaluation requires information regarding the injuries and the identification and measurement of injury costs and program costs. The outcome analysis, meanwhile, is a comparison of the program's cost and health outcome.

An economic evaluation is only as good as the data it is based upon. The chapter on data collection provides guidance on how to assemble the data required for the evaluation. The final chapter of the manual's theoretical section deals with methodological issues, discussing some of the assumptions of the evaluation model presented in the manual and their ramifications for the results.

Conducting the evaluation

The second section of the manual takes the reader past the stage of general appreciation of economic evaluations, putting theory into practice by offering detailed guidance on how to conduct an actual evaluation.

The first chapter of this section gives an overview of the evaluation process. The next chapter offers a detailed step-by-step guide how to proceed when conducting an economic evaluation. The evaluation is divided into 13 methodological steps, from defining the problem or question to be studied to the presentation of the finished results.

THEORETICAL FRAMEWORK

The role of economics

It has long been recognised that one benefit of successful safety promotion programs is the resource saving that can result from reduced morbidity and mortality. Still, undue emphasis on the resource-saving aspects may give the erroneous impression that any program that fails to produce resource savings will not be justified on economic grounds. Promoting safety is not costless and any intervention whose total costs exceed resulting savings will impose a net cost to society. However, from an economic perspective, the issue is not whether safety promotion saves resources, but whether it produces health gains more cost-effectively than other alternatives.

The implied or explicit objective of economic evaluations in the health care field is to improve decisions about the allocation of health care resources. Studies have demonstrated the possibilities of reducing health care expenditures by calculating cost savings due to injury rate reductions, yet properly conducted economic evaluations are rare in the area of health and safety promotion. There are a variety of reasons for this, including misunderstanding by health promotion specialists of what health economics has to offer their discipline, the complexity of economic evaluations, and the perceived language barrier created by economic jargon and principles. However, as pressures to control health care spending have accelerated, policy and decision makers are increasingly recognising the importance of applying more rigorous economic analysis in public health.

Economics provides a framework for considering how efficiently safety promotion achieves its objectives and how intervention resources can be used most cost-effectively. Such analysis can produce essential information for devising, planning, implementing and evaluating health and safety promotion programs.

Framing the study

Before beginning an economic evaluation of a safety promotion program, the evaluator must address a number of issues. Framing the study is a crucial first step in undertaking an economic evaluation of a safety promotion program. This involves making decisions on the overall approach to the study and on specific aspects of the evaluation design. The following key points should be specified before the data collection and analytic process begins:

- Problem or question to be studied
- Perspective of the study
- Time frame of the study
- Costing basis
- Analytic method

The framing process also involves defining the audience for the evaluation. The manual is based on the assumption that the audience is policy and program decision makers.

Study question

The study question must address the policy or program issues that drive the analysis and must identify the target audience. The study should be framed to reflect the needs of the users of the results of the evaluation.

A full evaluation requires a comparison of two or more alternatives and an examination of both costs and health consequences of the alternatives. Studies that do not fulfil these two requirements are labelled partial evaluations. The different types of evaluations are described in Table 1.

Table 1: Distinguishing characteristics of health care evaluation (based on Drummond et al, 1997)

	Only health consequences examined	Only costs examined	Both costs and health consequences examined
No comparison of two or more alternatives	Partial evaluation: Outcome description	Partial evaluation: Cost description	Partial evaluation: Cost-outcome description
Comparison of two or more alternatives	Partial evaluation: Efficacy or effectiveness evaluation	Partial evaluation: Cost analysis	Full evaluation: Cost-minimisation analysis Cost-benefit analysis Cost-effectiveness analysis Cost-utility analysis

A full economic evaluation is usually formulated in terms of a choice between competing alternatives, e.g. two different programs. A (period of a) program may be compared with a "do-nothing" alternative, e.g. a pre-program period. Another option is to compare an earlier stage of a program with a later stage. The competing program, pre-program period or earlier stage of the program functions as a comparator or baseline to the program or period of interest.

A partial evaluation, e.g. a cost-outcome study, does not require the comparison of alternatives, essentially being a description of costs and/or

health consequences. This type of analysis can produce valuable information to show potential cost reductions due to safety promotion. It may also be the first step towards a full economic evaluation by providing a baseline.

Perspective of the study

It is generally agreed that evaluations of programs implemented to affect the health of populations should be done from a societal viewpoint. This is appropriate because the goal is to analyse the allocation of societal resources among competing alternatives. The costs represent what members of society give up to implement the intervention. The societal perspective accounts for all resources used, regardless of who pays for the resources or derives benefits from them. It does not include resources transferred across society members. The societal viewpoint means that opportunity costs are the appropriate method to value the costs.

Time frame

The evaluator must determine the time period in which the program will be evaluated and how far into the future costs and benefits of health outcomes that accrue from the program will be considered. The time horizon may be short for programs whose costs and benefits occur immediately, but long for programs with continuing effects. Benefits of a program may continue after an intervention is completed. Thus, the time horizon should extend far enough to capture the major health and economic outcomes of the program.

It is important that the program cost data are collected for the same time period for which the target population is served. The time period should be long enough to avoid any secular patterns, e.g. seasonal effects. The period should also be of sufficient length to capture program start-up costs in addition to annual maintenance costs of the program.

Costing basis

The injury costs can be calculated by employing either a prevalence or an incidence approach. In a prevalence-based study with a time frame of one year, all cases of a health problem are counted, but only costs of those cases incurred during the one-year period are counted. Prevalence-based costs are useful in studies of health problems of short duration.

Incidence-based costs are the total lifetime costs that are expected to result from a health problem that arose during a specific period. The incidence approach includes costs that will occur in the future, e.g. health care costs that are required for the duration of the illness and lifetime

productivity losses that result from morbidity related to the health condition. The incidence approach thus measures the savings a safety promotion program could yield.

Incidence-based costs best provide an estimate of costs reduced if a case, e.g. a traffic incident, can be avoided. Thus, it appears to be the most relevant for injury cost studies. However, while the incidence method is more useful for policymaking situations, it is data demanding because it requires good projections of the likely pattern of the disease or illness from onset to death.

Analytic method

There are several types of economic evaluation, which differ in the way that health consequences (also referred to as health effects) are identified and measured. The three economic evaluation methods most widely used are cost-effectiveness, cost-utility, and cost-benefit analysis. Their characteristics are summarised in Table 2.

Table 2: Comparison of different types of economic evaluation (based on Drummond et al, 1997)

Type of evaluation	Measurement of costs	Identification of health consequences	Measurement of health consequences
Cost-benefit analysis	Monetary	Single or multiple effects, not necessarily common to both alternatives	Monetary
Cost-effectiveness analysis	Monetary	Single effect of interest, common to both alternatives, but achieved to different degrees	Natural units
Cost-utility analysis	Monetary	Single or multiple effects, not necessarily common to both alternatives	QALYs

The different types of evaluation methods serve different purposes. The objective of cost-benefit analysis is to maximise net benefits, while the objective of cost-effectiveness analysis is to rank order the preferred alternatives for achieving a single goal. Cost-utility analysis allows more complex measures of consequences, which can be compared over different types of interventions.

The selection of the appropriate analytic method depends on many factors, including the target audience for the study, the study question, and the availability of data. The three analytic methods, cost-benefit, cost-effectiveness, and cost-utility analysis, are full evaluations since they can be used for comparisons between two or more alternatives.

There are also partial evaluations, cost and outcome analyses, which do not involve comparisons. A cost analysis, e.g. a cost description study, examines the injury costs incurred during a specific time period, while an outcome description studies the health consequences. Cost-outcome studies can be conducted to gain an understanding of the costs and/or consequences, but they also represent an important first stage of a full evaluation, providing a baseline comparator.

Cost-benefit analysis

Cost-benefit analysis attempts to value the consequences of a safety promotion program in monetary terms. The method values all effects in monetary terms to assess whether its benefits exceed its costs. A program is considered efficient if the net present value of the program benefits minus the program costs are greater than zero.

Potentially, the cost-benefit method is the broadest form of analysis, since it can be used to find out if the beneficial consequences of different types of programs justify their costs. This analysis can be applied both to limited interventions and to more comprehensive community-based strategies.

Cost-effectiveness analysis

In cost-effectiveness analysis, no attempt is made to assign a monetary value to health consequences. Instead, they are measured in "natural units" such as head injuries averted or number of successfully treated patients. The most frequently used measure is life-years gained.

The principle underlying cost-effectiveness analysis is to maximise the effectiveness, e.g. the number of life-years gained, for a given budget. This type of analysis is most useful when the goal is to identify the most cost-effective strategy from a set of alternate interventions that produce a common effect. Only one outcome at a time can be studied with the method.

Cost-effectiveness analysis has achieved a great deal of popularity in the field of health economics, one reason being that the method avoids the problem of measuring the value of health in monetary terms.

Cost-utility analysis

Cost-utility analysis differs from cost-effectiveness analysis by including measures of the quality of life. The term utility is used in a general sense to refer to the preferences individuals or a society may have for any particular set of health consequences. Cost-utility analysis is preferred when both mortality and morbidity are affected by the intervention or when quality of

life is a major concern. The method is used with increasing frequency in public health and health care settings.

Cost-utility analysis expresses the health outcome as number of life years saved with QALYs, which is a quality-of-life adjustment. The QALY is arrived at in each case by adjusting the length of time affected through the health outcome by the unity value, on a scale of 0 to 1, of the resulting level of health status. A weight of 1 corresponds to perfect health and a weight of 0 corresponds to a health state judged equivalent to death.

The decision rule is to maximise the total number of QALYs gained. Much like the case with cost-effectiveness analysis, it is not possible to determine whether a safety promotion program is economically worthwhile since the consequences are not valued, only quantified.

The advantage of the QALY as a measure of health outcome is that it can simultaneously capture gains from reduced morbidity (quality gains) and reduced mortality (quantity gains). Unlike cost-effectiveness analysis, cost-utility analysis allows prevention strategies for more than one disease or health problem to be compared since multiple health consequences are combined in a single measure.

The evaluation model

The economic evaluation model described in the manual is comprised of four components:

- Injury information
- Injury costs
- Program costs
- Outcome analysis

Injury information

Descriptive information about injuries fulfils two basic functions. First, the information is important in order to analyse how the injury costs are influenced by different factors, such as gender, age, types of injury, and severity level of injury. This information is critical in the planning of future interventions. Secondly, information about the health effects is required if the outcome analysis is performed using a cost-effectiveness or cost-utility analysis.

Injury costs

The injury costs are divided into two categories: health care costs and productivity costs. Health care costs, often referred to as direct costs, are costs for the medical treatment and events in connection with the treatment. Productivity costs, frequently labelled indirect costs, are costs associated with lost or impaired ability to work due to morbidity or mortality. Health care costs are fundamentally different from productivity costs. Whereas health care costs can be described as "resources expended," productivity costs are "resources foregone." Indirect costs, including productivity losses, commonly are substantially larger than direct costs, a reflection of the value placed on foregone productivity.

Health care costs are often divided into medical and non-medical costs. Costs incurred to secure medical treatment and medications are termed medical costs. Examples include the cost of hospitalisation, diagnostic testing, and prescription drugs. Non-medical costs are costs incurred in connection with treatment, but are not expended for medical treatment itself, e.g. transportation and other expenses.

Productivity costs are associated with lost or impaired ability to work due to the injury. These costs include costs caused by the victim's lost or impaired ability to work and/or to engage in other activities, for example performing normal housekeeping duties. Additionally, there are costs associated with people other than the injured person since relatives, friends and other acquaintances may become involved in varying degrees in taking care of the victim.

Program costs

The costs of a safety promotion program are divided into three categories: personnel costs, resource costs, and participant costs. The personnel costs are primarily salary and hourly wages for the personnel involved with the intervention. The resource costs include expenditure for facilities, rent, office supplies, equipment, lease payments, training, and other resources that are needed to provide a particular safety promotion program.

The participant costs fall into two categories: out-of-pocket expenses and productivity costs. Expenses include costs incurred for travel and child or elderly care and other expenses paid by the participant to take part in an intervention. Productivity costs are wages the participant does not receive because of time taken off from work to participate in the intervention. Productivity costs include costs assigned to travel time, waiting time, and actual service time for the participant.

Outcome analysis

The outcome analysis is simply a comparison of the costs and consequences of different programs or different time periods of a specific program under study. The manual describes three analytic methods that can be applied in the outcome analysis: cost-benefit, cost-effectiveness, and cost-utility analysis.

Data collection

The evaluation can be designed as a retrospective study or as a prospective study (or a combination thereof). A retrospective analysis attempts to identify costs and health consequences and gather data *after* a program has begun or been completed. In the worst scenario, no data have been collected for the program or they are imprecise and incomplete. In a prospective evaluation, data regarding costs and consequences are collected *while* the program is in effect. The evaluator may decide in advance what information is needed for the study, thus making it possible to collect more complete and accurate data than in a retrospective study.

Injury information

In countries with an injury register system, statistical data about the injuries can be collected from hospitals or other health care institutions, or obtained from government databases on accidents and statistics kept by insurance companies. In countries lacking an injury register system, community-based surveys may be a feasible way to obtain basic information about the injuries.

Injury costs

Health care data collection will be very different in countries with abundant statistical data and in countries lacking injury register systems and where a large proportion of the victims either treat themselves or use some kind of health care outside hospitals. If data are not available, a decision will have to be made to exclude the costs or to estimate them based on assumptions.

Regarding productivity costs, information about the daily wage for full-time permanently employed men and women in different age groups, and additional payroll expenses, can be obtained from national pay statistics.

Program costs

In a prospective study of intervention costs, the project manager of, or the person responsible for, the program should be informed that it is essential to report the costs involved. The actual computation of costs could be undertaken by administrative personnel. It is important that all cost items are recorded on a continuous basis, to ensure that nothing of importance is overlooked.

Information can be collected about travel, arrival time, and service time. One method for collecting participant costs is by participant survey. Participants can be interviewed while they are present in a facility to take part in an intervention. It may also be possible to obtain estimates from the program personnel.

Discussion

The manual is intended as a tool to facilitate economic evaluations in safety promotion. The model and method of the manual are intended to be rigorous, incorporating all major costs and health effects of relevance in order to ensure the accuracy of the evaluation. At the same time, a number of assumptions are made to simplify the evaluation process for safety promotion practitioners.

Most productivity cost calculations do not value leisure time and tend to value some groups more highly than others when only wages are considered. The method described in the manual assumes the value of time to be equal for all people, regardless of age or whether an individual is employed or not. This is clearly a simplification, which will lead to high estimates of productivity costs. However, it is based on the premise that the ultimate goal of a civilised society is to support individuals in their production of "quality of life." This quality can be produced by working in the labour market, doing domestic chores or taking part in cultural activities. If this were not the case, the care of elderly, housework and cultural activities would not have the support from society.

Safety promotion programs may yield benefits other than improved health, e.g. the improvement of environmental quality or increases in property values. The model described in the manual does not account for non-health benefits of this type, which means that the net present value of the intervention will not reflect the total economic value gained by society. There are also many health benefits which are difficult to estimate, including changes in anxiety and self-esteem.

The rationale for making a number of simplifying assumptions is to make it easier to conduct economic evaluations, yet the extent to which this goal is attained can only be assessed by field testing that involve the end-users of the manual. Small-scale implementation of the manual is planned as the next step to assess how practical the manual is and whether further modifications are called for. There is also a need for an investigation into whether it would be possible to use standard costs to further simplify the evaluation process.

In some respects, a tool such as this exhibits a "catch-22" dilemma: without the simplifications, the evaluations may be considered too complex to conduct, but accepting the simplifications may adversely affect the validity of the evaluations, i.e. the strength of the conclusions, inferences or propositions. To alleviate this inherent conflict, it is critically important for the evaluator to report the results with all the assumptions explicitly stated. The literature on economic evaluations is unified in stressing the utmost importance of evaluation transparency.

It can also be argued that the reduction of analytic complexity does not conflict with the objective of economic evaluations, i.e. to improve decisions about the allocation of health care resources. Certainly, even if the evaluations do contain a number of (clearly stated) simplifying assumptions, they may still provide critical information which contributes to more enlightened decisions. Thus, these evaluations are more likely to achieve the objective of improved resource allocation decisions than would no evaluations at all or simple uninformed guesses. Ultimately, the "opportunity cost" of not making certain simplifications may be very high indeed.

CONDUCTING THE EVALUATION

Elements of an evaluation

There are several methodological elements of an economic evaluation. The evaluation process begins with the framing of the study: defining the study question and determining the perspective of the study, the time frame, the costing basis, and the analytic method.

The next four steps involve the identification and collection of the costs and health consequences required for the study. The injury information must be classified appropriately. The relevant and important costs and health consequences need to be measured and valued accurately. After discounting past and future costs and consequences to their present value, the outcome analysis can be performed.

Finally, the evaluator needs to interpret and present the results. Every evaluation will contain some degree of uncertainty, imprecision or methodological controversy, which should be discussed. All of the assumptions upon which the values of different variables are based should be listed and it may be necessary to perform a sensitivity analysis.

The next chapter presents a full economic evaluation, comprising 13 steps from defining the problem or question to be studied to the presentation of the finished results. The step-by-step guide is followed by a chapter providing a checklist of questions for the assessment of the evaluation.

A step-by-step guide

This chapter provides a step-by-step guide how to conduct an economic evaluation, detailing the requirements of each methodological element and giving recommendations to assist the evaluator. While it is often helpful to separate the various components of a methodology so that each can be scrutinised more closely, the evaluation does not necessarily need to adhere to the exact sequence presented here. Throughout the evaluation process, it is of critical importance that all assumptions the evaluator makes are explicitly stated.

A full economic evaluation process can be divided into the following 13 steps:

- Define problem or question to be studied
- Determine perspective of the study
- Define time frame of the study
- Determine costing basis
- Determine analytic method
- Identify, classify, and collect relevant injury information
- Identify, collect and measure important and relevant health care costs (injury costs)
- Identify, collect, and measure important and relevant productivity costs (injury costs)
- Identify, collect, and measure important and relevant program costs
- Discount costs and health consequences
- Perform outcome analysis
- Analyse the results
- Present the results

It should be noted that if the study is conducted as a partial evaluation, a cost-outcome analysis, the steps (9), (10), and (11) will not be required since only costs and health consequences incurred during a certain time period are studied and there is no comparison of different alternatives. Also, step (5) is not necessary since the evaluator will already have stated in the study question that a partial evaluation will be conducted, thus eliminating the need for an analytic method to compare different alternatives.

1) Define problem or question to be studied

The evaluation process begins with the definition of the problem or question to be studied. The two options are:

- Partial evaluation: description of costs and/or health consequences incurred during a certain time period
- Full evaluation: comparison of costs and health consequences incurred during different time periods and/or with different programs

The partial evaluation can provide a baseline comparator for a full evaluation. If a full evaluation will be conducted, the question is: which are the alternatives being compared? Three typical options are:

- Comparison of (a period of) the program with a "do-nothing" alternative, e.g. a pre-program period (baseline comparator)
- Comparison of an earlier stage of the program (baseline comparator) with a later stage of the program
- Comparison of different programs

Regardless of which comparison is made, the alternatives must be clearly identified and described.

2) Determine perspective of the study

The evaluation is based on the premise that the study takes the societal perspective.

3) Define time frame of the study

We recommend using a one-year time frame, which is practical because data from health care facilities are often available for a calendar month or a fiscal year. Using data from a full year also eliminates any seasonal variations.

4) Determine costing basis

We recommend an incidence-based costing approach because it measures the savings a safety promotion program could yield. The total lifetime costs that are expected to result from a health problem that arose during the one-year study period are calculated. The calculation includes health care costs that are required for the duration of the illness and lifetime productivity losses that result from the health condition.

5) Determine analytic method

If the study question requires a full evaluation, the evaluator must choose the method or methods that is/are appropriate for the study in question. The choice has implications for which data need to be assembled. The three economic evaluation methods most widely used are cost-effectiveness, cost-utility, and cost-benefit analysis.

The three methods are complementary, rather than mutually exclusive, forms of analysis. In some instances, more than one method may be employed to answer specific policy questions. For example, if an intervention strategy is found to be the most cost-effective alternative, then the next question is whether it is cost-beneficial. In many cases, the effort required at the margin to add an additional analytic method is small.

6) Identify, classify and collect relevant injury information

The next step requires the evaluator to identify, classify and collect the important injury information. Some of the injury information must be classified in order to allow for statistical computations and analyses of how the injury costs are influenced by age, gender, and types of injury, etc. The injury information is also important for the planning of preventive work.

The evaluator must determine whether the necessary data exist. If data are not available, a decision will have to be made to exclude it or estimate it based on assumptions drawn from other sources.

Injured person

Useful information about the injured person may include gender, age, occupation, date of injury, date of consultation or admission into hospital, date of release from hospital, and number of lost workdays.

The classification of the information should be chosen as being relevant for the planning of preventive work. For example, the age groups could be classified as pre-school (0-6 years), school (7-19 years), work force (20-39 and 40-64 years), and elderly (65 and above).

In many cases, official classifications may be used. Thus, the injured person's occupation could be stated according to the divisions in the International Standard Classification of Occupations (ISCO) or according to Nordic Occupation Classification (NYK).

Injury

Information required regarding the injury itself may include a description of the injury type, external cause of the injury, injured part of the body, and the level of severity. Injury type and external cause can be diagnosed according to the International Classification of Diseases (ICD) code system.

Injury event

Relevant information about the injury event may be a description of the place of occurrence and the activity at the time of injury. The Nordic Medico Statistical Committee (NOMESCO) classification of external causes of injuries can be used for a detailed determination of both place and activity.

Table 3 summarises the injury information and classifications that may be considered. A comprehensive in-depth evaluation may require information about all the listed items, whereas a more basic evaluation could be restricted to the most vital information.

Table 3: Inventory of injury information and classification basis

Injured person	
Gender	Male/Female.
Age	Classified into relevant age categories, e.g. 0-6, 7-19, 20-39, 40-64, 65- years.
Occupation	ISCO or NYK classification.
Date of injury	Classification not needed.
Date of consultation or admission into hospital	Classification not needed.
Date of release from hospital	Classification not needed.
Lost workdays	Classification not needed.
Injury	
Injury type	ICD N code classification.
External cause of injury	ICD E code classification.
Injured part of the body	E.g. head, facial, spinal column/cord, trunk, upper extremity, lower extremity.
Severity of injury	E.g. hospitalisation and non-hospitalisation.
Injury event	
Place of occurrence	NOMESCO classification.
Activity at the time of injury	NOMESCO classification.

7) Identify, collect and measure relevant health care costs (injury costs)

Health care costs are divided into medical and non-medical costs. The structure of health care differs in various parts of the world, which makes it difficult to provide recommendations about which cost items to include within a given study. The following health care cost types should be considered when attempting to identify relevant cost items:

Medical costs

- Hospital inpatient care
- Hospital outpatient care
- Primary health care
- Home health care
- Medications
- Devices and appliances
- Rehabilitation

Non-medical costs

- Transportation
- Private costs

The evaluator needs to decide which health care costs are relevant within a given study. The decision depends on the relative order of magnitude of the costs. It is unrealistic to measure and value minor costs that are unlikely to make any difference to the overall result. Our recommendation is to exclude minor costs that are unlikely to make any difference to the overall result.

The evaluator also needs to form a judgement on how accurate cost estimates need to be. There are different levels of precision, from micro-costing, which involves the direct enumeration and costing out of every input consumed, to gross-costing, which bases cost estimates on more aggregated information on resource use, e.g. the average cost of a hospital day. What is sought in using gross costs is a satisfactory measure of the "typical" costs of health care services.

We recommend a gross-costing approach, which means that the inputs, e.g. hospital days, tests, procedures, are identified and counted. The total cost for the health care is estimated by assigning a cost to each input and then summing.

8) Identify, collect, and measure relevant productivity costs (injury costs)

Productivity costs are caused by the victim's lost or impaired ability to work or engage in other activities and by people other than the injured person who become involved in taking care of the victim. We recommend the pragmatic approach of assuming that the value of time is equal for *all* people, regardless of age or whether an individual is employed or not.

Earnings data can be used as a means of valuing lost productivity. The number of days sick, hospitalised or required by a caregiver, without distinguishing between workdays and non-workdays, is multiplied by the daily wage rate.

An average wage rate can be estimated for an entire study population. More detailed information, e.g. average earnings for different occupational categories, may be used for higher precision. Regardless of how the productivity costs are calculated, it is important to specify the assumptions when reporting the results.

9) Identify, collect, and measure relevant program costs

The personnel costs are the cost of time spent by all the people working on the safety promotion program. The total cost is calculated by multiplying the time spent on a particular program by the cost for that time. Costs for administrative and staff support involved with the safety promotion program are

calculated as a proportion of the staff time spent on the particular program that is under study.

For personnel in salaried work, the cost of time can be estimated as the average earning of different groups of personnel. The monetary value of the unpaid volunteer time and leisure time is less obvious, however. Recommendations state that an adjusted average earning is a reasonable estimate. Still, we recommend the pragmatic approach of applying the same cost of time for everyone involved in the safety promotion program, regardless of age or whether people are salaried or not (much like the case with productivity costs).

Table 4 shows which data are required to calculate annual personnel costs and how the total cost is computed. In this case, the hourly wage for the volunteers is valued at 150 Skr, which is an estimate of an unskilled labour wage rate.

Table 4: An example of a worksheet for calculating annual personnel costs

Program costs: personnel costs Personnel category	Unit	Number of units (A)	Cost per unit (B)	Proportion of time spent on the program (C)	Total cost (= A x B x C)
Administrator	Year	0.5	300,000 Skr	100%	150,000 Skr
Clerical worker	Year	1	240,000 Skr	50%	120,000 Skr
Counsellor	Hour	200	1,000 Skr	100%	200,000 Skr
Counsellor	Hour	100	750 Skr	100%	75,000 Skr
Volunteer	Hour	100	150 Skr	100%	15,000 Skr
					560,000 Skr

The resource costs, the second program cost category, include expenditure for facilities, rent, office supplies, equipment, lease payments, training, and other resources that are needed to provide a particular safety promotion program. The resources are valued according to market prices, if available, or otherwise by using some estimation of the opportunity cost.

Resource costs that are capital costs, i.e. one-time costs to purchase the major capital assets required by the program, should be annualised over the useful life of the asset, to calculate the equivalent annual cost. We recommend using the same rate as used in the calculation of the discount factor to estimate the present value of future costs, i.e. 3 per cent. The details of the calculation are described in the appendix.

Resource costs that are shared costs (also termed overhead costs), i.e. resources that serve many different departments or programs, need to be allocated using reasonable criteria.

The more important the resource costs are for the analysis, the greater the effort that should be made to estimate the cost items and distribute them accurately. The assumptions the evaluator makes should be clearly stated and motivated.

Table 5 shows a worksheet for calculating operating and capital costs of the resources used in a safety promotion program.

Table 5: An example of a worksheet for calculating annual operating and capital costs

Program costs: resource costs

Operating costs

Cost type	Unit	Number of units(A)	Cost per unit (B)	Proportion used for the program (C)	Total cost (= A x B x C)
Rent of facilities	Month	12	50,000 Skr	80%	480,000 Skr
Maintenance of facilities	Month	12	5,000 Skr	80%	48,000 Skr
Utilities	Month	12	3,000 Skr	80%	28,800 Skr
Phone	Month	12	1,450 Skr	100%	17,400 Skr
Office supplies	Month	12	1,750 Skr	100%	21,000 Skr
Computer equipment	Year	1	100,000 Skr	80%	80,000 Skr
Education materials	Sets	10,000	40 Skr	100%	400,000 Skr
Transport	Hours	375	500 Skr	100%	187,500 Skr
Travel	Kms	4,500	20 Skr	100%	90,000 Skr
					1,352,700 S

Capital costs

Cost type	Purchase price	Scrap Price	Useful life of asset	Annualised cost (A)	Propor-tion used for the pro-gramme (B)	Total cost (= A x B)
Building	500,000 Skr	300,000 Skr	20 years	333,897 Skr	80%	267,118 Skr
Equipment	100,000 Skr	10,000 Skr	10 years	92,559 Skr	100%	92,559 Skr
Vehicle	100,000 Skr	30,000 Skr	10 years	77,677 Skr	100%	77,677 Skr
						437,354 Skr

The participant costs, the third program cost category, are out-of-pocket expenses and productivity costs. Expenses include costs incurred for travel and child or elder-care and other expenses paid by the participant to take part in an intervention. Other expenses include the purchase of items not

accounted for in program costs such as the purchase of bicycle helmets. In most cases, it is possible to use market prices.

Productivity costs are wages the participant does not receive because of time taken off from work to participate in the intervention, e.,g. travel time, waiting time, and actual service time for the participant. The participant productivity costs are calculated in the same manner as the productivity costs (as part of the injury costs).

10) Discount costs and consequences

All past and future costs and consequences should be stated in terms of their present value. Hence, to determine the economic viability of a program, past and future injury and program costs/consequences must be adjusted and translated (discounted) to their present value. A dollar that an individual receives today is worth more than a dollar that will be received 10 years from now because of the propensity of humans to value the present higher than the future.

We recommend using a 3 per cent discount rate. At a 3 per cent discount rate, the present value of $5,000 in costs that will occur next year is $5,000 divided by 1.03. If those costs occurred two years from now, the present value would be $5,000/1.032; three years from now, $5,000/1.033, etc.

11) Perform outcome analysis

Once the data on costs and consequences have been assembled, the outcome analysis can be performed. The injury costs (health care costs and productivity costs) avoided are summed and compared with the program costs. If there is a net monetary benefit, i.e. the reduction in injury costs exceeds the program costs, the calculation may end here, with the result being that the program yielded net monetary savings.

If the total costs exceed the total benefits (i.e. the program costs exceed the injury costs avoided), the health effects should be analysed. The calculation of health effects depends on which of the three analytic methods is employed: cost-benefit, cost-effectiveness, and cost-utility analysis.

A cost-benefit analysis requires the measurement of the health effects in monetary terms (other than changes in productivity due to altered health states). There are a number of ways of accomplishing this, including the stated preferences method and the contingent valuation method. We recommend the evaluator to consult the literature for further information.

The health effects in a cost-effectiveness analysis must be relevant to address the study question. Three feasible options may be:

- Number of cases prevented
- Number of hospitalised cases prevented
- Number of injuries of (below/above) a certain severity level prevented

Performing a cost-utility analysis is more difficult. The health effects must be expressed as the number of life years saved and as the decreased quality of life during and after injury. To perform a cost-utility analysis, we recommend the evaluator to consult the literature for further information.

Our recommendation is for the evaluator to commence with a calculation of the monetary effects (injury costs avoided and program costs). If this analysis shows a negative result (i.e. the costs exceed the savings), a cost-effectiveness analysis may be an appropriate second step to incorporate the health effects.

12) Analyse the results

Once the results have been assembled, they can be interpreted and discussed. It may be of interest to compare the results with those of others who have investigated a similar study question or problem and to discuss the generalisability of the results to other settings.

It is of critical importance to identify sources of uncertainty of the study, which is feasible if all assumptions are explicitly stated. Sensitivity analysis is the standard way of dealing with all types of uncertainties. Sensitivity analyses are mathematical calculations that isolate the factors involved in the evaluation to indicate the degree of influence each factor has on the outcome of the entire analysis.

Sensitivity analysis can identify the cost items that most likely change the interpretation of the results, e.g. transforming the results of a cost-benefit analysis from positive to negative or vice versa. If varying the value of a single measure for which there is uncertainty changes the results, less certainty may exist about the conclusion. Conversely, sensitivity analysis can also demonstrate when an assumption does not substantially affect the conclusion. In this case, the evaluator may have more confidence in the results.

We recommend that the evaluator examine the assumptions used to calculate the injury costs and intervention costs.

13) Present the results

The implicit or explicit objective of economic evaluations is to improve decisions about the allocation of health care resources. The results must therefore be reported with all assumptions explicitly identified and presented effectively in order to assist the policy and program decision-making process.

Several of the published guidelines for economic evaluation include a suggested reporting format. There are several reasons why a common reporting format is desirable: it increases the transparency of the studies, which makes it easier to assess precisely what the evaluator has done and whether the methods and assumptions were appropriate, it facilitates comparisons between studies, and it might improve the general quality of the evaluations undertaken since the requirements of the format will lead evaluators to address important methodological considerations.

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