

What is economic evaluation and what questions can it help to answer?

13

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Overview

So far we have learned that perfectly competitive markets provide the most efficient allocation of resources. We have also learned that markets in health care suffer from a number of 'failures' and for this reason (as well as equity concerns) governments intervene. Having no 'market' does not remove the central problem of allocating scarce resources. We will learn in this chapter and the subsequent three chapters that economic evaluation is one approach that can assist with resource allocation where markets do not exist.

We begin our exploration of economic evaluation by introducing some key concepts. You will encounter these concepts throughout the following three chapters so it is important that you understand them. This chapter will also give an overview of the types of economic evaluation and the sorts of policy questions they can address. Chapters 14 and 15 look at the *methods* for measuring and valuing costs and consequences while Chapter 16 discusses ways of *presenting and interpreting* information on costs and consequences to inform health care decision-making.

Learning objectives

After working through this chapter, you will be able to:

- define economic evaluation
- describe the different techniques of economic evaluation
- explain how economic evaluation helps to assess efficiency
- explain the main stages in economic evaluation
- describe how economic evaluation can contribute to answering policy questions

Key terms

Cost-benefit analysis. An economic evaluation technique in which outcomes are expressed in monetary terms.

Cost-effectiveness analysis. An economic evaluation technique in which outcomes are expressed in health units such as life years saved.

Cost-utility analysis. An economic evaluation technique where outcomes are expressed in health units that capture not just the quantity but quality of life.

Economic evaluation. Compares the costs and consequences of alternative health care interventions to assess their value for money.

Sensitivity analysis. The process of assessing the robustness of the findings of an economic evaluation by varying the assumptions used in the analysis.

A day in the life of a health minister

As free markets rarely exist in health care, decisions have to be made about which health services should be funded in the face of resource scarcity. These are difficult decisions to make especially when medical technologies are improving and expanding, real incomes are increasing and many countries have an ageing population.

A minister of health once remarked that 'the only thing a minister of health is ever destined to discuss with the medical profession is money'. There never seems to be enough money to do everything worth doing and ministries of health frequently encounter situations where each request for additional funding may be legitimate in that it will improve health but the budget often cannot cover all of the requests. For example, suppose a minister of health receives requests from two different programmes, one from the Tuberculosis Programme (TBP) and the other from the Expanded Programme on Immunization (EPI). The TBP wants additional funding for 'Directly observed therapy – short course' or DOTS. The EPI wants to add hepatitis B vaccine (HBV) to its routine programme. Without an increase in the overall budget, the new programmes could not be covered unless some other programmes are cut.

The question, then, is how can the minister decide which of the requests should be supported? Giving support for one, or possibly both, means that something else should be cut back – which programme should it be? Which interventions are 'worthwhile'? This is where economic evaluation comes into the picture.

Impact of health problems

A key priority of many societies around the world is the alleviation of health problems: disease, injury or a risk factor for one of these. The impact of such health problems can be manifested in different ways – physical disability, morbidity and mortality, emotional distress, social difficulties and isolation, and financial and economic losses. Each manifestation can be seen at the level of the individual, the family and household, the local community, and the rest of society. The impact of health problems can be measured as:

- the number of cases;
- the number of deaths;
- the amount of disability, pain or suffering;

- the number of people with a risk factor;
- the amount of money spent on a health problem;
- the amount of lost income due to a health problem.

For example, the death during childbirth of a mother who already has two children and who is the only schoolteacher in the village can be measured in various ways, such as:

- a 'case' of maternal mortality;
- the number of years of life she has lost by dying prematurely;
- the amount of her wages that her family will no longer receive;
- the effect of the loss of her wages, particularly on her school-age children who can't be educated because the money for school fees is no longer available;
- the loss to her husband who misses her company and her skills as a housekeeper and part-time farmer;
- the loss of her guidance and training for her young children;
- the loss of the investment her own parents made in training and educating her to be a teacher;
- the loss to the school system which now has to hire or train new teachers to replace her.

So, in economic evaluation the impact of health problems can be assessed using a variety of health measures such as the number of cases of illness, the number of deaths due to illness, the number of potential years of life lost due to illness or in monetary terms as the *cost of health problems* – the monetary value of resources spent or lost because of the health problem.

Resources needed for an intervention

You know in advance that you will never have enough money to do everything you would like – so knowing all the possible interventions available for a health problem is not enough. It means you also need to know what the interventions cost. Determining the cost of an intervention can sometimes be complicated. A first step is to know what specific resources are used to implement the intervention. Resources are the ingredients of health care interventions. They are also referred to as *inputs* or *resource inputs*. A useful approach is to divide the resources into seven categories:

- personnel;
- buildings and space;
- equipment;
- supplies and pharmaceuticals;
- transportation;
- training;
- social mobilization and publicity including information, education and communication.

Activity 13.1

Look at the photograph of a growth monitoring session in a low-income country. What resources are being used in the health intervention depicted?



Figure 13.1 A health intervention in a developing country

Source: Global Samaritans

Feedback

In the photo your attention was probably first drawn to the equipment, in particular the weighing scale. Then you will have noticed the staff – the nurse who is writing down the weights of the babies. She has been trained to carry out this activity. You may have forgotten the vehicle and driver – they are not in the picture. Other activities would include the maintenance of vehicles and equipment, the training of staff, the supervision by higher levels of staff at a health centre or wherever they are based. Another resource to keep in mind is the time of the mothers – they could be doing other activities instead of waiting for their babies to be weighed. And how did the mothers know that there would be a growth monitoring session in this place at this time? Resources have gone into informing and motivating the mothers to bring their babies.

Having identified the resources, you need to measure how much of each resource is used. This is what economists call production – how much of each resource or input is required to produce the growth monitoring service. Finally, you need to establish the value of each resource that you have used, so that you can calculate the cost of the intervention. The most straightforward way to value resources is to use money as the measure. Some costs will not be easy to determine – think of the time of the women who brought their children for the growth monitoring session. How would you estimate its value in monetary terms? For the moment it is enough that you begin to be aware that costing is not always a simple matter of collecting price information – it may require skill and judgement on the part of the economist. We will explore costs more closely in the next chapter.

Outcomes or consequences

The goal of an intervention is to reduce the impact of a health problem. For economic evaluations, you need to measure how much the impact is reduced. To figure out if the intervention has done enough good to justify its cost, you need to know how the health problem changes after the intervention. Specifically, you need to know what occurs *as a result of* the intervention, in other words, the outcome or consequences of the intervention.

You can assess this change by measuring the difference in the health problem in one of two ways. You can either measure the impact of the health problem before and after the intervention, or with and without the intervention. For this reason economic evaluations are often done alongside clinical trials or some other form of intervention evaluation where these impacts are being specifically assessed.

Since impact is assessed using either health measures (number of deaths, number of cases, etc.) or their monetary equivalent, and since outcome is merely the difference in impact, units used to measure outcome are identical to the units used to measure impact.

Take the example of the use of impregnated bed nets to prevent malaria. If you wanted to determine their impact, you could calculate the number of deaths in children aged 6 months to 5 years in a village where the nets were impregnated and compare this to the number of malaria deaths in villages of similar size and characteristics where the bed nets were not impregnated. Suppose that the results showed that:

- villages which did not receive the intervention had 73 deaths from malaria;
- villages where bed nets were impregnated (with the intervention) had 16 deaths from malaria.

As a result of the intervention, you could conclude that there were 57 fewer deaths from malaria. The *outcome* of the new malaria intervention then is a reduction of 57 deaths.

While health care's goal is to achieve as greater reduction in health problems as possible, your health care budget often won't allow you to implement all desirable interventions. This is exactly the same dilemma faced by the minister of health at the beginning of this chapter. He or she still faces the challenge of comparing the request for funding by the TBP for DOTS with the request for funding from the EPI to introduce HBV. Some decision must be made as regards the relative value of the interventions. This is how economics as a discipline can assist.

What is economic evaluation?

According to Drummond *et al.* (2005) two features characterize economic evaluation: it is a *comparative* analysis (i.e. it compares two or more different options), and it compares these options in terms of their *costs and their consequences*. Figure 13.2 illustrates this. Two alternatives are presented, A and B. When assessing programmes A and B, we compare the difference in costs with the difference in consequences. This is called an *incremental analysis*. Let us now begin thinking about comparing costs and consequences of different interventions in a practical way.

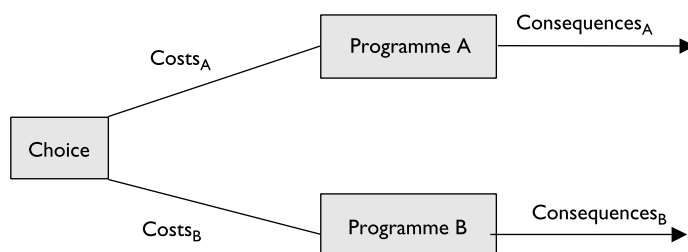


Figure 13.2 Costs and consequences

Source: Drummond *et al.* (2005)

Activity 13.2

Imagine that programme A is a community-wide programme distributing free insecticide-treated bed nets (ITNs) to control malaria. What alternative programmes might you want to compare this against?

Feedback

Here are some suggestions but you can probably think of others. We have concentrated on malaria but you might be interested in comparing your intervention with other infectious disease programmes or alternatively non-health programmes in the agricultural or education sectors.

- Do nothing (i.e. not implementing ITNs).
- Using ITNs only in target groups (i.e. pregnant women and children under 5).
- Social marketing of ITNs – social marketing projects encourage private sector distribution networks to make health products available to low-income people at subsidized prices. Products are sold, rather than given away free of charge.
- Distributing ITNs only in malaria endemic areas.
- Other forms of malaria control such as indoor residual spraying (IRS) or intermittent presumptive treatment (IPT) in pregnant women or infants.
- Treating malaria using different antimalarials.

Types of economic evaluation

Table 13.1 summarizes the different types of economic evaluation studies.

Cost–benefit analysis

Cost–benefit analysis (CBA) is a method of economic evaluation where the monetary value of the resources consumed by a health intervention (costs) is compared with the monetary value of the outcomes (benefits) achieved by the intervention. While the lay meaning of 'benefit' is 'something good', in CBA it means the 'monetary value of the outcomes' achieved by an intervention. CBA is appropriate when a decision-maker wants to know: is a single intervention policy or a number of intervention policies

Table 13.1 Types of economic evaluation

Type of analysis	Measurement/valuation of costs in both alternatives	Identification of consequences	Measurement/valuation of consequences
Cost–benefit analysis	Monetary units	Single or multiple effects, not necessarily common to both alternatives	Monetary units
Cost-effectiveness analysis	Monetary units	Single effect of interest, common to both alternatives, but achieved to different degrees	Natural units (e.g. life years gained, points of blood pressure reduction, etc.)
Cost–utility analysis	Monetary units	Single or multiple effects, not necessarily common to both alternatives	Healthy years (typically measured as quality adjusted life years)
Cost analysis	Monetary units	None	None

Source: Drummond et al. (2005)

worth implementing? (i.e. are benefits greater than the costs?) Two common cost–benefit indicators are:

- net present value (NPV): this result is expressed as a single number with monetary units;
- benefit–cost ratio (BCR): this result is expressed as a ratio of benefits to costs.

NPV is calculated by subtracting the cost of an intervention from its benefits. When the benefit is bigger than the cost, the net benefit will be greater than zero. This says that the value of the outcomes is worth more than the value of resources used up by the intervention, so the intervention is worthwhile.

Another way of comparing cost and benefit is the BCR. This is simply the benefits divided by the costs. The higher the BCR, the more worthwhile the intervention – and some interventions can actually be cost-saving, in other words, implementing them can save money for health services or for a society as a whole.

From a societal perspective, as long as net benefits are greater than zero, or benefits exceed costs (the BCR is greater than 1), the intervention should be implemented. For now, it is important to recognize that CBA’s greatest appeal lies in the fact that it can be used to compare interventions with a range of different outcomes. These interventions can even relate to different sectors of the economy. In practice, however, the monetary valuation of benefits in CBA is difficult. Placing a value on human life and health can be extremely hard. Decision-makers can also find a single amount representing costs and benefits of a programme ‘disconcertingly impenetrable’ (Fox-Rushby and Cairns 2005).

Cost-effectiveness analysis

Cost-effectiveness analysis (CEA) is the most commonly used form of economic evaluation in the health sector. Under this method, the value of the resources spent on an intervention is compared with the quantity of health gained as a result. Unlike CBA,

which compares monetary costs with monetary outcomes, CEA compares the cost of an intervention with the intervention's *health* outcomes.

Cost-effectiveness is typically expressed as a ratio of costs divided by health outcomes. The *cost-effectiveness ratio* (CER) of one intervention can then be compared with that of another. CERs typically come in the form of average cost-effectiveness ratios (ACERs) or incremental cost-effectiveness ratios (ICERs). ACERs relate to single interventions whereas ICERs compare relative costs and effects. ICERs are the ratio of the difference in cost between two alternatives to the difference in effectiveness between the same two alternatives. These two types of CER are shown in Figure 13.3.

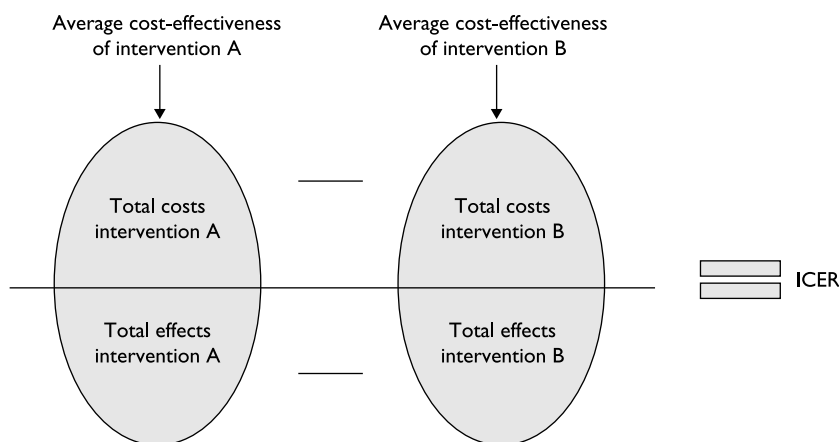


Figure 13.3 Comparative economic evaluation

Source: Fox-Rushby and Cairns (2005)

Where interventions are independent (i.e. the costs and effects of one intervention are not influenced by the introduction of another intervention(s)) then cost-effectiveness ratios can be calculated for each intervention and ranked giving those with a lower ACER higher priority. However, interventions are often not mutually exclusive, for example comparing two types of diagnostic testing for malaria. In this case we need to know what are the additional benefits to be gained from the new intervention and at what additional cost. This is where ICERs come into play. We will come back to CERs in Chapter 16.

CEA has been applied to many different types of health intervention. Its results – such as cost per life year gained – are often easily interpreted by planners and policy-makers. However, one of the key limitations of CEA is that it is restricted to comparisons of interventions that have a common single unit of effect.

Cost-utility analysis

Cost-utility analysis (CUA) is a broader form of analysis than CEA but a variant of that general approach (Drummond *et al.* 2005) and for that reason is often discussed under the heading of 'cost-effectiveness analysis'. Using CUA, one can assess the quality of, for example, life years gained, not just the crude number of years lived in a particular health

state. This is especially useful for those interventions that may extend life but at the expense of side-effects (e.g. treatment for certain types of cancer). The most common measures of consequences in CUA are the quality adjusted life year (QALY) and the disability adjusted life year (DALY).

CUA was developed to address the problem of conventional CEA, which did not allow decision-makers to compare the value of interventions for different health problems. While this is a definite strength of the approach, some have questioned the ability of CUA to capture all the valued characteristics associated with an intervention. For example, QALYs do not capture differences in the process characteristics of interventions (such as respect, autonomy, provision of information, etc.), despite substantial evidence that patients *do* attach value to these (Mooney 1994; Howard *et al.* 2008).

Cost analysis or cost minimization analysis

Cost-minimization analysis (CMA) is a narrow subset of CEA. It is used to measure and compare input costs across alternatives where there is good evidence that outcomes are identical. Thus, the types of intervention that can be evaluated with this method are rather limited.

Activity 13.3

Now that you have gained an understanding of the main types of economic evaluation it is important to also learn how these techniques can be used to address policy questions. For each of the policy questions listed below, identify which type of economic evaluation would be most appropriate to use and explain why. The idea for this exercise came from a similar activity used by Fox-Rushby and Cairns (2005).

- 1 The Ministry of Finance wants to know whether it is worth investing further resources into malaria control or building new primary schools?
- 2 The Ministry of Health wants to compare the costs of receiving intravenous antibiotics in a hospital with receiving the same antibiotics (at the same doses) at home via a home health care service.
- 3 The Ministry of Health wants to compare the costs and outcomes of two interventions for the treatment of early stage breast cancer: mastectomy without breast reconstruction compared to breast conserving surgery and radiotherapy (breast conservation).
- 4 A malaria control programme wants to use economic evaluation to compare two different diagnostic strategies for malaria treatment: microscopy and rapid diagnostic tests.

Feedback:

- 1 CBA, as here we are dealing with the size of the budget and comparing interventions across different sectors of the economy.
- 2 CMA, as outcomes *should* be the same.
- 3 CUA, as there are likely to be differences in mortality and morbidity.
- 4 CEA, as there is likely to be a common unit of effect – e.g. cost per case detected.

Efficiency and economic evaluation

It is important to recognize that economic evaluation is *not* about choosing the cheapest option. According to Maynard (1987), 'The pursuit of efficient practices is not merely about reducing costs. If it were, the most "efficient" procedure would be to do nothing as that pushes costs to zero'.

The main forms of economic evaluation (i.e. CEA, CUA and CBA) can be used to pursue two types of efficiency: economic and allocative. We learned in Chapter 7 that economic efficiency enables assessment of the relative value for money of interventions with directly comparable outcomes. Put differently, economic efficiency is concerned with 'what is the least costly way to *achieve* a particular goal?'. Allocative efficiency describes a situation where resources are allocated and goods distributed in a way that maximizes social welfare. Allocative efficiency judges whether the goal itself is worthwhile pursuing. This requires us to take a 'societal perspective' and consider costs and benefits within and outside the health sector.

CEA and CUA are based on the production function approach (see Chapter 5) which focuses on the least cost way of producing a good whether it be a car or a hip replacement. These techniques compute the ratio of input to output (or vice versa) with inputs valued in monetary terms and is therefore a measure of economic efficiency. CEA considers only one measure of effectiveness and as a result often omits important social costs and benefits.

CBA can be used to measure both economic and allocative efficiency questions. It can be measured either within the health care sector or across other sectors of the economy because in principle it assesses all relevant costs and benefits that result from an intervention. While in theory this provides the most comprehensive form of economic evaluation, its use in the health sector has been limited largely due to the practical problems of measuring and valuing these benefits. In addition to economic and allocative efficiency, CBA is based on Pareto welfare optimization. In other words, the aim of CBA is to provide a framework for assessing the ability of an intervention or policy to offer a potential Pareto improvement (see Chapter 7 for an explanation of Pareto efficiency).

Stages of economic evaluation

There are four broad steps in undertaking an economic evaluation:

- defining the decision problem (also known as 'framing the evaluation');
- identifying, quantifying and valuing the resources needed;
- identifying, quantifying and valuing the health consequences;
- presenting and interpreting the evidence for decision-making.

You will learn about the second step in the next chapter, the third step in Chapter 15 and the fourth step in Chapter 16. For now we will concentrate on defining the decision problem.

Defining the decision problem

When defining the decision problem you will need to include clear statements on the purpose of the evaluation, intended audience, time frame, perspective and interventions for comparison.

Purpose

It is important to be very clear about *why* you are carrying out the economic evaluation. The statement of purpose should include the following information:

- the intervention(s);
- the health problem addressed by the intervention;
- the reason for conducting the evaluation and its importance;
- the units of analysis.

In terms of the last point, you want your analysis to have an impact on policy. Therefore it is important that results should be easy to communicate in terms that are both useful and understandable to the target audience. People want to know what they are getting for their money and this is most easily communicated when costs and outcomes are simplified to units that people can understand.

Audience

The main audience should be those attempting to use the information.

Activity 13.4

Can you identify what groups might use the results of an economic evaluation in their decision-making?

Feedback

Audiences can include:

- government (e.g. Ministry of Health);
- international health organizations (e.g. World Health Organization);
- multilateral development banks (e.g. World Bank);
- bilateral aid agencies (e.g. Swedish International Development Cooperation Agency – SIDA);
- non-governmental organizations (NGOs) (e.g. Oxfam);
- drug companies;
- global health partnerships (e.g. Global Fund);
- advocacy or special interest groups (e.g. tobacco control advocacy groups).

The audience will have an important bearing on the perspective of the analysis and in turn the different options being compared. An economic evaluation designed to inform a large international donor, such as the World Bank, about the cost-effectiveness of scaling up malaria control in the Africa region will be different to an evaluation for an NGO that wants to compare mechanisms for delivering antenatal care to women living in a remote area of Nepal. The main differences will lie in the way results are presented and the types of costs and effects taken into account. We will come back to this last point under 'perspectives'.

Time frame

Interventions often have different time patterns for their costs and outcomes; costs and outcomes are usually spread out over time (often a number of years) and, frequently, costs and outcomes change over time. It is quite common that the costs of the intervention are incurred at the beginning, while the benefits occur far in the future – an example would be an immunization programme for hepatitis B. A cost analysis must therefore consider the time course of interventions and outcomes separately and adjust for changes over time. *Discounting* is a procedure economists use to relate costs and outcomes occurring at different times to a common basis. We will learn more about this technique in the next chapter.

To understand how and why the costs of an intervention vary, think about dividing an intervention into start-up costs (those needed to set up the intervention) and maintenance costs (those needed to keep it going). If you do the cost analysis when beginning the intervention, it would be a mistake to assume that start-up costs (such as building a new clinic) are representative of the costs you will incur in later years. Conversely, if you begin the cost analysis after the intervention has begun, you cannot assume that everything put in place at the beginning of the project no longer has to be paid for and therefore has a value of zero.

Perspectives: whose costs and whose outcomes?

It is important to realize that health interventions frequently have costs and outcomes that affect different parts of a society. The perspective or viewpoint is like the lens through which costs and consequences are examined. It can be broad or narrow. Commonly used perspectives include:

- *Societal* – the broadest viewpoint possible which takes into account all the costs and all the outcomes of a health intervention, regardless of who incurs them or who gains from them. A societal perspective requires a vast range of micro and macro data and would be highly unlikely to address a specific audience;
- *Health system* – obviously a narrower point of view, this includes the costs borne and the outcomes received by the health sector.

Correctly thinking through the perspective can save large amounts of time and effort in performing the analysis because, depending on the perspective taken, some hard-to-measure costs and outcomes may not have to be considered.

The simplest example is the expenditure for a prescription drug. If the patient must pay 100 per cent of the cost of the drug, then the cost might not be important to the health service. On the other hand, if the health system must bear all of the costs of the drug, then this will directly reduce the funds available for other interventions and the health system might be very concerned with the drug costs – as the example below will show.

Should expensive drugs be provided free?

Consider a disease for which there is a drug treatment but the drugs are very expensive – e.g. they cost £10,000 to £12,000 per year for each patient. Citizens'

groups representing those affected by the disease are requesting that the Ministry of Health provide this medication free of charge to everyone with the disease. Now consider two contrasting perspectives: that of the Ministry and that of a group of citizens.

From the perspective of the Ministry, providing this drug will indeed help patients with the disease but the opportunity cost of these drugs is significant in terms of what could be provided for other patients. The budget is limited – what is the best use of available resources?

In contrast, the citizens' group will focus on the positive impact the drug is likely to have on people with the disease: they will be able to lead more normal lives of higher quality, perform their household duties and remain productive members of society, and their need to use the health services over any given period of time will be reduced. In contrast, if they do not get the drug they may not be able to work and consequently will be unable to support themselves or their families financially. From this perspective, supplying the drug will lessen the burden on the family and society.

You can see from the above example that the perspective you choose will dictate how you look at costs and outcomes.

Specifying the interventions/options for comparison

All the relevant interventions directly related to the health problem being evaluated should be included in the analysis. Interventions need to be described in enough detail that will allow all relevant costs and outcomes to be identified. For costs, this means asking who does what, to whom, where and how often (Drummond et al. 2005). For outcomes or consequences, it is important to examine which ones are measurable and in turn how they can be valued (Fox-Rushby and Cairns 2005). As you have learnt, the choice of outcome will dictate the type of economic evaluation undertaken (i.e. CEA, CUA or CBA).

Sensitivity analysis

For each stage of an economic evaluation it is important to document any assumptions made. You will have gathered by now that conducting an economic evaluation is far from an exact science. Lots of difficult questions are raised that do not always have clear-cut answers. Many of the procedures to estimate costs and benefits require estimates of data and preferences that are not known with certainty. For example, medical professionals are uncertain about the value of many preventive measures and their views can change as new evidence becomes available. There also tends to be considerable speculation over future drug costs. *Sensitivity analysis* is the process of deliberately varying these uncertain factors to examine their effect on the findings of a study. These type of assumptions will need to be tested under the final stage of an economic evaluation (i.e. 'presentation and interpretation of the evidence' (discussed in Chapter 16).

Summary

You have learned in this chapter that economic evaluation generates information on efficiency in non-market situations by comparing the costs and consequences of alternatives. There are three main forms of economic evaluation (CBA, CUA and CEA) and it is the way outcomes are expressed which distinguishes them. Under CBA outcomes are expressed in monetary terms, under CEA they are expressed in single health effects such as life years saved and for CUA multiple effects can be captured under measures such as QALYs. Establishing the purpose, audience, perspective, time frame and interventions for comparison are all important first steps in economic evaluation regardless of the type of tool being used.

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Further reading

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