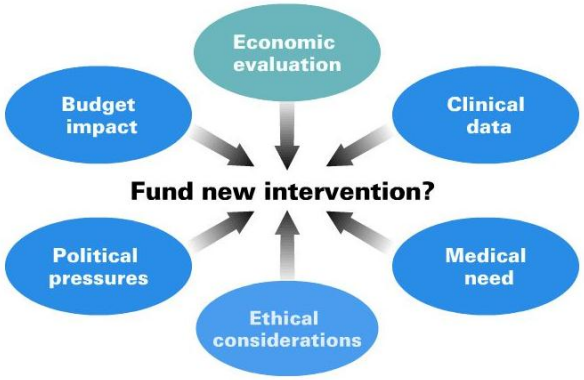
Health Economics Learning Tool
Economic evaluation

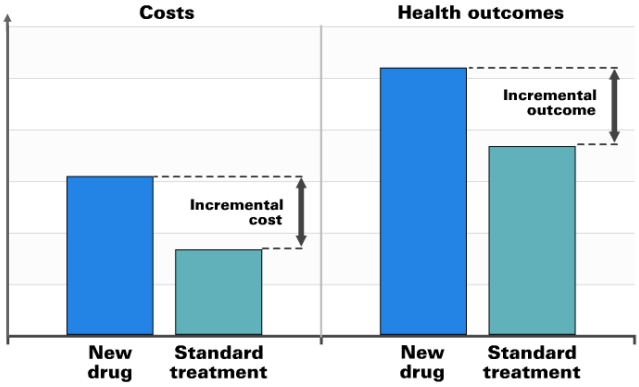
It is a fact of life that we cannot afford everything we want. This is no different in the healthcare sector – governments have budgets, insurance companies must at least break even – and so decisions must be made about how to spend limited resources.

Whether a decision-maker chooses to fund a new healthcare intervention or not can be influenced by a number of factors. One of these is economic evaluation of the intervention in terms of costs and health outcomes. Others include clinical data, medical need, budget impact, political pressures and ethical considerations.



Economic evaluation of an intervention, such as a new drug, involves comparing the costs and outcomes with a suitable comparator. The correct choice of comparator is the current standard treatment for dealing with the health problem. For example, the most-commonly prescribed drug in the treatment area. Choosing the correct comparator is important to ensure that the economic evaluation results are not misleading.

Analysis of the additional costs and outcomes of an intervention over standard treatment is a key concept in economic evaluation – it is known as 'incremental analysis'.

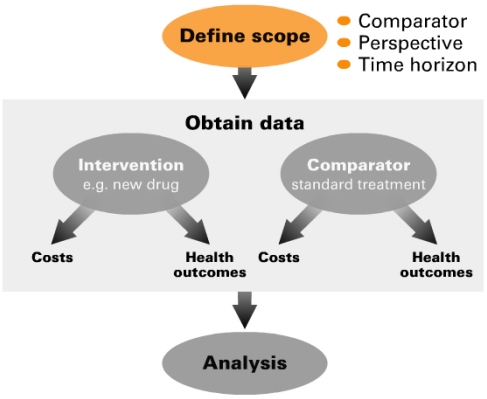


This helps to inform the question 'should the new intervention replace standard treatment?'

Should the new intervention replace standard treatment?

Health outcomes	Costs: Decrease	Costs: Increase
Improve	Yes	?
Worsen	?	No

In some cases, the answer is clear – if a new intervention improves health outcomes at reduced cost, its benefits are obvious, and if it worsens outcomes and increases costs, using it would be irrational. However, most often a trade-off occurs between costs and health outcomes – usually improved outcomes at an increased cost, although sometimes worse outcomes at a decreased cost – and a judgement must be made about whether this represents good value for money. Economic evaluation can help inform this judgement.

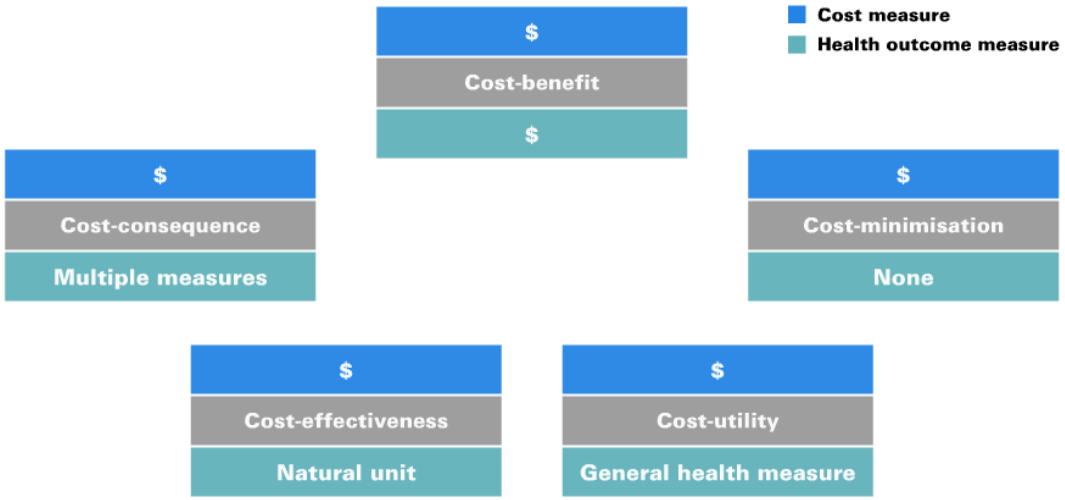


Before an economic evaluation is carried out, the scope of the study must be determined. This includes choosing the comparator (as discussed) and the perspective for the evaluation (which will be covered later). The time horizon must also be chosen – this specifies the period over which costs and outcomes are considered.

The length of the time horizon depends on when the effects or side-effects of an intervention occur. The time horizon that is typically chosen is a patient's lifetime, although shorter periods may be used depending on the aims of the study or the chosen health outcome.

Once the scope has been defined, data on the costs and outcomes of the intervention and comparator must be obtained and analysed. The results allow conclusions to be drawn about value for money. Modelling may be necessary during this process – for example, if outcomes have not been measured over a long enough period for the chosen time horizon. Sensitivity analysis is also important to assess the reliability of results. These techniques are explained in the 'Modelling' module, available from the main menu.

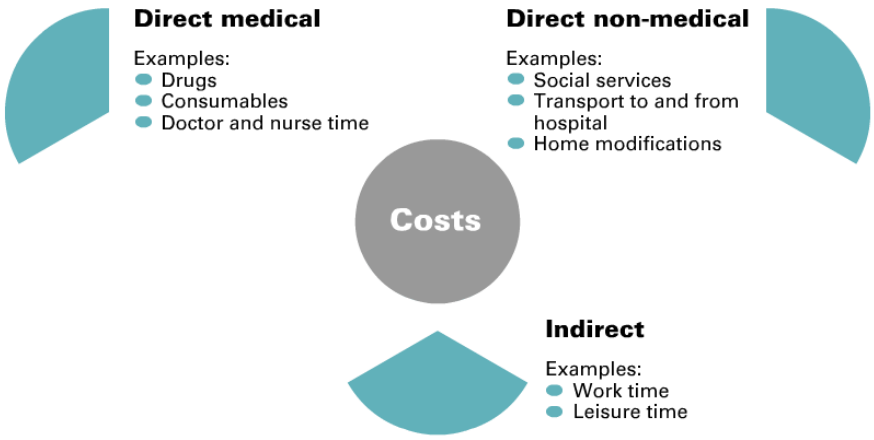
Economic evaluation can take a number of forms which all deal with costs in the same way, but deal with outcomes and express results differently.



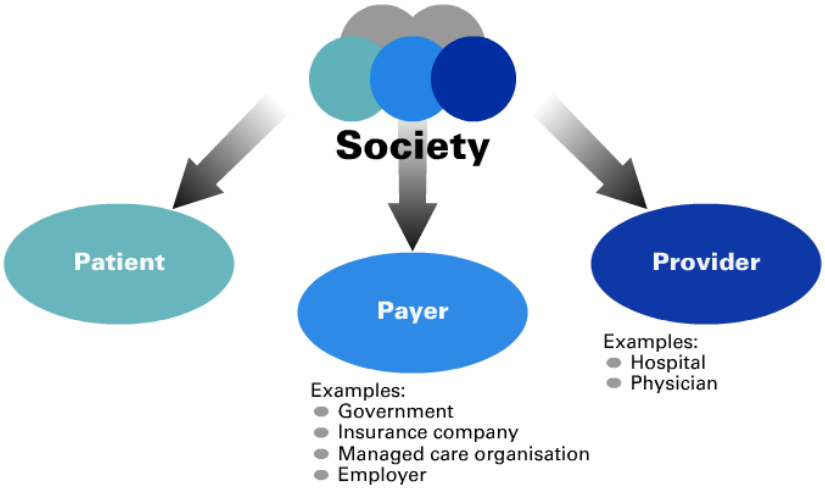
Let's first look at costs.

Economic evaluations should ideally address all costs incurred in providing a healthcare intervention, including the cost of current and future consequences – for example side effects and clinical events such as heart attacks.

Cost can be split into three categories: direct medical cost – that is, the cost of resources used within the healthcare sector; direct non-medical cost – that is, the cost of resources used in other sectors; and indirect cost, also called productivity cost – that is, the cost of time lost by patients or carers due to a condition.

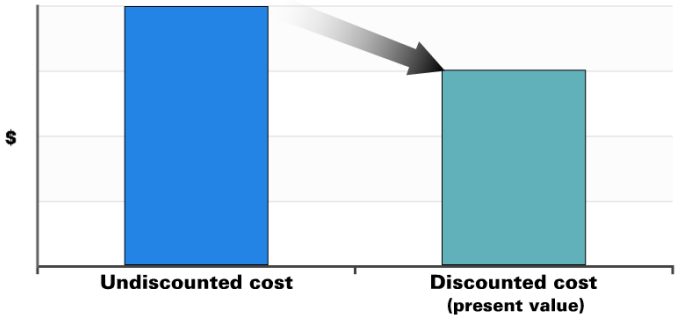


Which costs are included in an evaluation is determined by various factors, one of the most important being the perspective taken. This depends on the purpose of the evaluation and who it is aimed at.



Society is the broadest perspective and includes all costs irrespective of who incurs them. This gives the most comprehensive assessment of an intervention and is often advocated by economists. Narrower perspectives, for example the patient, provider or – most widely-used – the payer, only include costs relevant to that group. This is not necessarily a problem, but one needs to be cautious as some costs that are excluded could change the conclusion about a treatment if a broader analysis was carried out. For example, significant costs may be ignored or cost savings that are identified may actually just be costs that have shifted to another group.

Costs used in economic evaluation should be discounted to reflect 'time preference' – that is, the fact that people prefer to defer costs and receive payments sooner rather than later: everybody would rather be given ten dollars now than be promised them in 10 years' time. When costs are discounted they are expressed in present-day terms – this is called their 'present value'.



Costs occurring during the first year are not usually discounted. Costs in subsequent years are then discounted by adjusting their value based on a discount rate and the number of years in the future they occur. Let's take an example where a cost of 1,000 dollars is incurred each year for 3 years, and discount at a rate of 5 percent.

$$\text{Present value} = \frac{\text{Cost in year } n}{(1 + \text{discount rate})^{n-1}}$$

1	2	3
$1,000	$1,000	$1,000

Total undiscounted cost = $3,000

$$\$1{,}000 + \frac{\$1{,}000}{(1+0.05)^{2-1}} + \frac{\$1{,}000}{(1+0.05)^{3-1}}$$

$$\$1{,}000 + \$952 + \$907$$

Total present value = $2,859

The first year cost is left undiscounted and costs occurring in years 2 and 3 are discounted using the formula. All three values are then added together to give a total present value of 2,859 dollars compared to the undiscounted total cost of 3,000 dollars.

Outcomes can also be discounted in the same way, on the basis that people prefer to receive benefits sooner rather than later. Discounting costs is well-established, but whether outcomes should be discounted is widely debated. The discount rates used are also a topic of discussion – many current guidelines recommend that both costs and outcomes should be discounted at the same rate, although what this rate should be varies between guidelines.

UK National Institute for Health and Clinical Excellence (NICE): 3.5%

US Panel on Cost-effectiveness in Health and Medicine: 3%

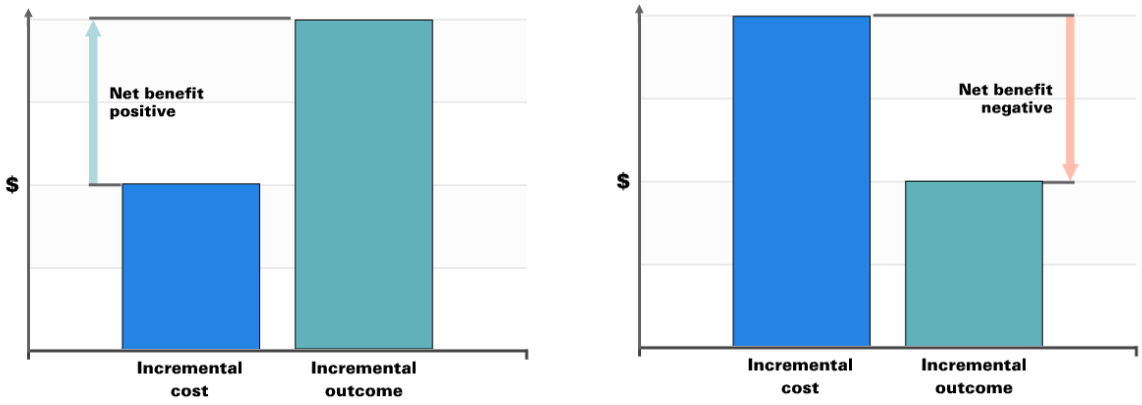
Australian Pharmaceutical Benefits Advisory Committee: 5%

Now let's turn from costs to outcomes and the analysis of data. Broadly speaking, economic evaluations either measure health outcomes in monetary terms or in non-monetary terms.

Cost-benefit analysis

In cost-benefit analysis, both costs and outcomes are valued in monetary terms – this can be achieved in a number of ways; for example, by conducting a study to measure people's 'willingness to pay' for the described outcomes.

The analysis results are usually expressed as the net benefit – that is, the incremental outcome minus the incremental cost.



A positive net benefit means that an intervention is worth adopting – in other words the benefits of the intervention exceed the costs – while a negative net benefit means that it may not be, as costs exceed benefits, although other factors may play a larger role in the decision.

Cost-benefit analysis has a strong underpinning in economic theory and so is preferred by some economists. Also, because outcomes are always in the same units, comparisons can be made between alternatives with multiple and different outcomes. Additionally, the 'willingness to pay' approach is a broad concept that can take into account the delivery process, such as administration technique and location, as well as health outcomes. It also reflects the fact that society may be more willing to pay for certain treatments, such as those for cancer. The main disadvantage of the cost-benefit approach is that it is methodologically difficult to measure individuals' true willingness to pay.

Alternative approaches use clinical measures of outcome.

Cost-consequence analysis

Cost-consequence analysis essentially involves descriptive listing of all the costs and outcomes of one or more interventions.

	Intervention A	Intervention B
Costs		
Drug cost	$60	$40
Nurse time	$8	$15
Transport to/from appointment	$15	$15
Outcomes		
Reduction in swelling	65%	70%
Health-related quality of life	71	75

This means the decision-maker must synthesise or integrate the information themselves, but it may be useful if it is unclear which health outcome they consider important.

Cost-minimisation analysis

Cost-minimisation analysis may be used when the interventions being compared have equivalent health outcomes – for example, if two drugs have similar effects on duration and quality of life, and cause similar side-effects. In this case, the results of the analysis are simply the total costs of each intervention and it is only necessary to choose the least costly option.

	Intervention A	Intervention B
Outcomes		
	Equivalent	
Costs		
Drug cost	$100	$200
Nurse time	$20	$15
Total	**$120**	**$215**

Because it involves only cost comparison, cost-minimisation analysis is intuitive and easy to understand. However, since equivalent outcomes occur fairly infrequently, applications of this type of analysis are limited.

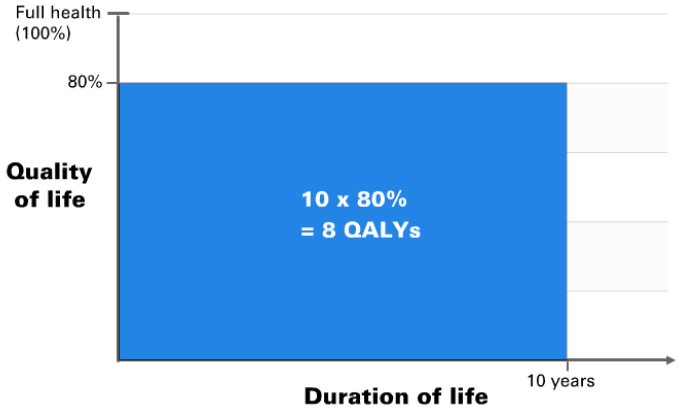
Cost-effectiveness and cost-utility analysis

Cost-effectiveness and cost-utility analyses are the most commonly-used types of economic evaluation in healthcare. They express outcome as a single, clinically-relevant measure.

In cost-effectiveness analysis, outcome is expressed in terms of an effect common to the interventions being compared, measured in a natural unit. Cost-effectiveness analysis is easily understood because it uses a clinically-relevant measure of outcome. However, because only one outcome is chosen, health benefits may be under- or over-valued. For example, if life years gained was chosen as the outcome measure but there was also a big difference in side effects that affected patients' quality of life, this would not be captured and the benefit of the intervention would be mis-valued. Also, results from one analysis cannot be compared with another that uses a different outcome measure, which can make it difficult for decision-makers to choose between spending options – particularly across different disease areas.

Cost-utility analysis attempts to overcome these problems by using a general outcome measure incorporating both duration of life and health-related quality of life. The most commonly used measure is quality adjusted life years – or QALYs. Others include DALYs and HYEs.

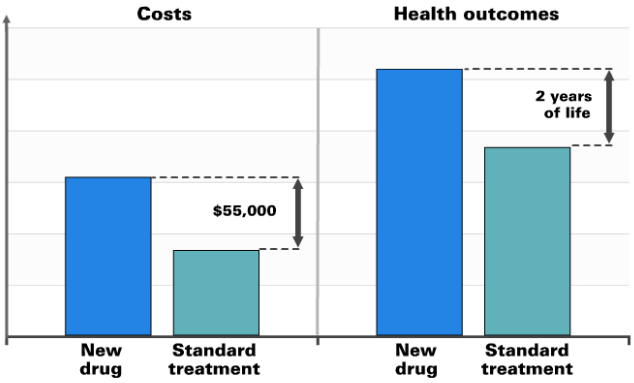
QALYs are calculated by taking duration of life and weighting it with a measure of quality of life called utility. For example, if a treatment extends life by 10 years with a quality of life that is 80% of full health, 8 QALYs will be gained.



Combining duration and quality of life is covered in detail in the 'Health measurement and QALYs' module, available from the main menu.

In both cost-effectiveness and cost-utility analysis the analysis results are expressed as an incremental cost-effectiveness ratio, or ICER. This is calculated by dividing the incremental cost by the incremental outcome – for example, giving the incremental cost per life year gained.

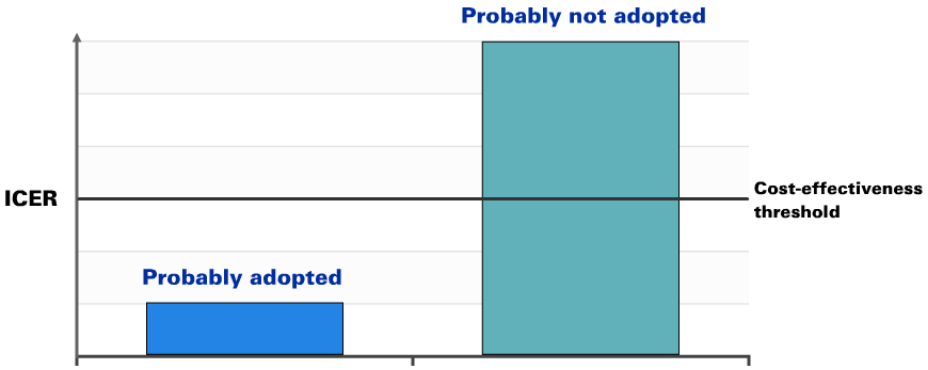
$$\text{ICER} = \frac{\text{Incremental cost}}{\text{Incremental outcome}}$$



$$\text{ICER} = \frac{\text{Incremental cost}}{\text{Incremental outcome}} = \frac{55{,}000}{2} = \$27{,}500/\text{life year gained}$$

The ICER is therefore a measure of the additional cost of an extra unit of health – for example a year of life – when using the intervention instead of the comparator.

However, in itself the ICER does not provide an answer to the question: 'are the outcomes worth the cost?' This will depend on the decision-maker's 'cost-effectiveness threshold', which is the maximum level at which they consider the outcomes of an intervention to be worth the cost. If the ICER for an intervention is below the threshold, the intervention is likely to be adopted; if it is above the threshold, it probably won't be.

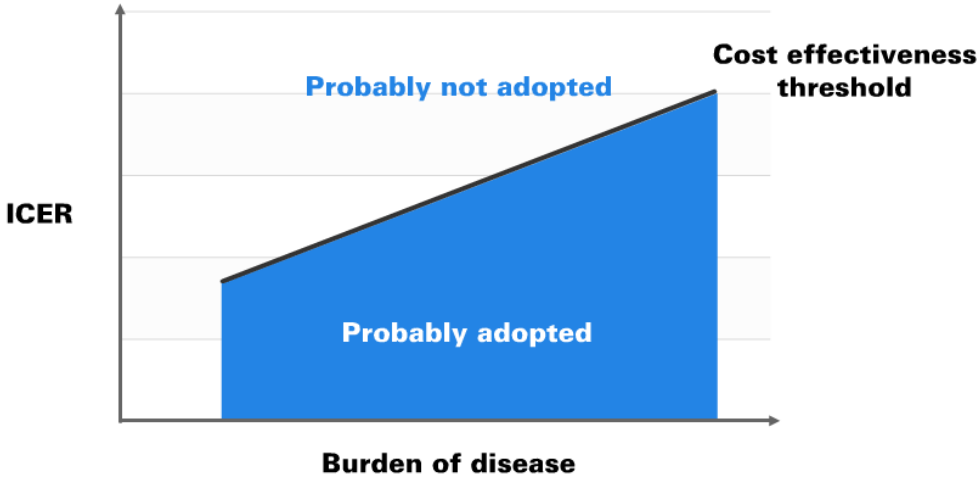


Cost-effectiveness thresholds should reflect society's 'willingness to pay' for health improvements. However, while this is an area of increasing interest to researchers, there is no evidence as to

what different societies are in fact willing to pay. Widely quoted thresholds have no empirical basis and any evidence that does exist suggests the figures should be higher.

In general, decision-making bodies do not explicitly state a cost-effectiveness threshold and their decisions are subject to other influences – such as the burden of disease and the availability or absence of alternative treatments. For example, a drug might have a relatively high ICER but if medical need is considered great – say if no other treatment options are available – it might still be considered worth adopting. Economic evaluation is important in understanding the value of a product, but is, however, just one part of the puzzle.

In reality, what society is willing to pay for health improvements may even be different for different conditions. For example, there has been discussion in the Netherlands about having a range of cost-effectiveness thresholds that increase as burden of disease increases.



Summary

As pressures on healthcare spending grow, economic evaluation is becoming an increasingly important means of informing and influencing decision-making – in fact in some circumstances it is now a mandatory requirement. It is therefore an essential tool for pharmaceutical manufacturers needing to convince decision-makers of the value of their products.

	Costs	Outcomes	Result
Cost-benefit	$	$	Net benefit
Cost-consequence	$	Multiple measures	List of costs & outcomes
Cost-minimisation	$	None	Net cost/saving
Cost-effectiveness	$	Natural unit e.g. life years	ICER
Cost-utility	$	General health measure e.g. QALYs	ICER

- Comparator choice – current standard treatment
- Perspective e.g. societal, payer
- Time horizon e.g. lifetime
- Costs – direct medical, direct non-medical and indirect
- Discounting