

What is health economics?

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- Economics is the science of scarcity and prioritisation. The application of health economics reflects a universal desire to obtain **maximum value for money** by ensuring not only the clinical effectiveness, but also the cost-effectiveness of healthcare provision.
- Achieving 'value for money' implies either a desire to achieve a predetermined objective at least cost or a desire to maximise the benefit to the population of patients served from a limited amount of resources. This requires services to be evaluated for '**cost-effectiveness**'.
- An associated concept is that of **efficiency**, which measures how well resources are used in order to achieve a desired outcome.
- **Opportunity cost** represents an invaluable mode of thought in health economics, as it makes clear the explicit trade-offs that underlie resource use in the health services. The true cost of using scarce healthcare resources in one manner is their unavailability to fund alternative beneficial services.
- All economic evaluations have a common structure that involves explicit measurement of inputs ('**costs**') and outcomes ('**benefits**').
- Health economics can help to inform and improve decision-making through the systematic and objective application of '**applied common sense**'.
- Such 'applied common sense', which symmetrically balances costs and benefits, represents a valuable mode of thinking for **decision-makers**, irrespective of whether a formal economic evaluation is undertaken.

What is health economics?

Economics is the science of scarcity and prioritisation. It analyses how choices are structured and prioritised to maximise welfare within constrained resources (Box 1). We all use the principles of economics on a daily basis ('Do I buy the cheaper car, or pay a bit more for the nicer one?') as we work within our own resource constraints (our desires say, 'Buy the nicer one'; our resources say, 'Buy the cheaper one'). By comparing the costs and benefits arising from the purchase of the competing cars, we are able to optimise our decision-making. If we routinely use such economic techniques in our daily lives, then surely it is not too great a 'leap of faith' to apply them in our lives as healthcare professionals? This simple use of 'applied common sense' represents the fundamental basis of health economics.

The tools of health economics are used to improve the health of the population by enabling health policy to maximise health outcomes from the limited healthcare resources available. Health economists apply economic and analytical techniques to help inform the decision-making processes of healthcare professionals. Furthermore, the application of health economics can be used to evaluate how certain social and welfare problems can impact upon the health of the population.¹ However, it is important to recognise that healthcare exhibits a range of special characteristics that will fundamentally affect such analyses. Health economics reflects a universal desire to obtain maximum value for money by ensuring not only the clinical effectiveness, but also the cost-effectiveness of healthcare provision.

It is universally acknowledged that the technical ability of healthcare systems to provide care (the wide array of new and expensive health technologies available) far exceeds the ability of any healthcare system to afford all such technologies. Once healthcare decision-makers have accepted the need for choice, they must inform that choice by prioritising competing interventions through the analysis of their costs and benefits. This forms the basis of health technology assessment (HTA), which has health economic evaluation at its very core. Since the establishment of the

Box 1. Scarcity, choice and prioritisation

Scarcity of resources requires individuals to choose which goods and services they consume. The basis for their choice is the relative value that they place on each good or service. The structure of these relative values is the basis for their system of prioritisation

National Institute for Health and Care Excellence in the UK in 1999, HTA has become globally recognised as a crucial element in evaluating and controlling the introduction of new healthcare technologies (particularly drugs) into national healthcare systems. This has enormously increased both the quantity and quality of health economic evaluations undertaken, as such evaluations have become of fundamental importance in delineating the clinical and cost-effectiveness of new health technologies. The manner in which this is done forms the basis of the remainder of this article.

Cost-effectiveness

Health economics is dominated by a simple theoretical concept, that of cost-effectiveness (this is explored in greater detail in *What is cost-effectiveness?*).² In general, the concept of cost-effectiveness implies either a desire to achieve a predetermined objective at least cost or a desire to maximise the benefit to the population of patients served from a limited amount of resources. To achieve this aim, we use the tools of economic evaluation to select the most cost-effective options from a range of healthcare alternatives. An associated concept is that of efficiency.

Efficiency

Efficiency evaluates how well resources are used to achieve a desired outcome. It has a multitude of different aspects.

Allocative efficiency measures the extent to which resources are allocated to the groups or individuals who can benefit most.

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For example, the benefits of statin treatment provided to high-risk patients (for example, patients who have already had a heart attack) are far in excess of the benefits that arise when they are prescribed to low-risk patients. Allocative efficiency, therefore, requires the high-risk patients to be targeted as a priority (primary prevention), resulting in an improved level of health associated with statin treatment.

Technical efficiency measures either the extent to which resources are combined to achieve maximum outcome, or alternatively, the minimum amounts of resources that are combined to achieve a given outcome (for example, identifying the least expensive way to effectively heal a peptic ulcer). The prescribing of unnecessarily long courses of drugs or unnecessarily expensive drugs implies the existence of technical inefficiency.

Defining and measuring 'health outcomes'

Defining and measuring health outcomes is fraught with difficulties, but such measures are the essential foundation of health-economic evaluations (Box 2). In addressing outcomes, health economists talk in terms of utility, which measures the strength of an individual's preferences for specific health-related outcomes (see *What are health utilities?*³ for further discussion). Outcomes are assessed in terms of change in survival and change in quality of life (QoL). There are a range of measures to assess the impact of treatment on survival (lives saved, life-years gained or five-year survival rates), but increasingly health services are focusing on improving QoL (reduced pain, greater mobility, improved sensory function). Health-related QoL analyses measure the impact of treatments on the social, emotional and physical aspects of life from the patient perspective (see *What is quality of life?*⁴ for further discussion). Many techniques have been developed to place values on various states of health that can be held to be representative of the values of society as a whole.^{4,5} These QoL 'weights' are then integrated with survival data to produce a single combined measure of the quantity and quality of life generated by

Box 2. Definition of health

Health has no generally accepted definition, but has a wide range of physical, mental and social characteristics. The breadth of such characteristics and their essentially subjective nature emphasises the difficulties inherent in deriving an operational definition for this concept

Box 3. Resources

When we consider the resources available to us, we normally think about financial resources. The economist's definition, however, is far wider and encompasses the time, energy and skills exhibited by the individual, together with the buildings and equipment that they may possess. A resource may therefore be consumed (time and effort expended in developing an idea) even if there is no associated financial payment

healthcare interventions. Quality-adjusted life-years (QALYs) apply weights that reflect the QoL being experienced by the patient (perfect health is equivalent to 1, death is equivalent to 0 and health states that may be regarded as worse than death have negative valuations). It is important to recognise, however, that such analyses are still at an early stage of development and many methodological difficulties remain to be resolved (see *What is a QALY?*⁶ for further technical discussion). An entertaining but informative introduction to the debate concerning the social value of the QALY can be read in an article by Brouwer *et al.*⁷

Defining and measuring 'cost'

A distinction must be made between financial and economic concepts of cost. Financial costs relate to monetary payments associated with the price of a good or service traded in the marketplace. Economic costs relate to the wider concept of resource consumption, irrespective of whether such resources are traded in the marketplace (Box 3). Thus, the time spent by patients and their families in a hospital waiting room represents a real cost to them – despite the fact that no financial payment arises.

The economic concept of cost is based on the awareness that, when resources are consumed in a certain way, those same

resources become unavailable for alternative uses, and hence the benefits that would have arisen have to be foregone. In economics, these outcomes that are foregone are referred to as the 'opportunity cost' (Box 4). Again, this is a concept familiar to all of us from our personal finances. If the resources at my disposal would allow me to either buy a car or take a foreign holiday, in a very real sense, the true opportunity cost of buying the car is the foregone benefit of taking the holiday.

In this manner, although the foregone benefits are difficult to measure in practice, opportunity cost represents a very useful mode of thought in health economics, as it emphasises the explicit trade-offs that underlie resource use in the health services.

Techniques of economic evaluation

Economic evaluation provides a systematic and objective framework for drawing up a balance sheet of costs and benefits that can assist decision-makers to make more informed choices. All economic evaluations have a common structure that involves explicit measurement of inputs ('costs') and outcomes ('benefits'). The four main methods of economic evaluation vary in terms of their evaluation of health outcomes. Each method is described briefly in Table 1. The appropriate analytical tool to choose in any given circumstance depends upon three main issues. First, what is the context in which the analysis is being undertaken? Second, what is the focus of the economic evaluation being undertaken? Third, what is the nature of the comparative outcome arising from the competing therapeutic options? Knowledge of these three issues will provide a guide to the appropriate economic tool to be employed for any particular analysis.

Cost-minimisation analysis

Cost-minimisation analysis is restricted to situations in which the health benefits of the alternative healthcare treatments have been proven to be identical. An example would be a decision to prescribe a generic drug instead of a brand-name drug, achieving the same outcome at less cost. Frequently,

Box 4. Opportunity cost

The economist perceives the true cost of any good or service in relation to the resources that are consumed to provide that good or service. The cost of the resources consumed is expressed as the value of the output that would arise through their next best alternative use

therefore, this technique is perceived as being the easiest to apply, but such a perception is misleading. Cost-minimisation analysis does not ignore health outcomes, but actually requires proof that outcomes are clinically equivalent to legitimise the use of this technique. This opens up a new and complex array of issues that need to be addressed before utilising this technique. What do we mean by 'clinical equivalence' and what evidence is required to support such equivalence (non-inferiority trials, equivalence trials or real-world audit data)? Such theoretical considerations need to be addressed if cost-minimisation analysis is to be appropriately employed as a valid technique of economic evaluation. What is clear, however, is that it is highly inappropriate to simply assume clinical equivalence between competing therapies as a justification for the use of cost-minimisation analysis (see *What is cost-minimisation analysis?*⁷⁸ for further discussion).

Cost-effectiveness analysis

The term 'cost-effectiveness analysis' usually refers to an economic evaluation where the outcomes are one-dimensional. Cost-effectiveness analysis is, therefore, used in health economics to compare the financial costs of therapies whose outcomes can be measured purely in terms of health effect (for example, years of life saved, ulcers healed). For instance, if we wanted to compare the use of a proton pump inhibitor to relieve severe reflux oesophagitis with the use of H₂ blockers to achieve the same end, we could calculate the costs per patient relieved of symptoms for each therapy. Cost-effectiveness analysis is the most commonly applied form of economic analysis in the health economics literature and is frequently used in drug therapy.

Table 1. Structures of economic evaluation

Method	Outcome measure	Application/interpretation
Cost-minimisation analysis	Evidence is available that outcomes for competing therapies are equivalent	Given the evidence of output equivalence (and only when such evidence is available), the cheapest therapy is preferred
Cost-effectiveness analysis	Health benefits are measured in natural units, reflecting a dominant common therapeutic goal for competing therapies	How much more does it cost (incremental cost) to achieve an additional unit (incremental effectiveness) of the common therapeutic good (incremental cost-effectiveness ratio)?
Cost-utility analysis	In the absence of a common therapeutic goal, outcome is measured through the effect of any intervention on mortality (quantity of life) and morbidity (quality of life)	The quality-adjusted life-year measures the number of additional life-years weighted by the quality of life (value) of the health state experienced in each year
Cost-benefit analysis	Both costs and benefits are measured in the same unit – money – with the financial value of the costs being compared with the financial value of the benefits	An intervention should be undertaken if the (financial) value of the benefits exceeds the (financial) value of the costs. If only one intervention can be funded, choose the activity with the highest excess financial benefit over costs

However, it does not allow comparisons to be made between courses of action that have different therapeutic outcomes (see *What is cost-effectiveness?*² for further discussion).

Cost-utility analysis

Cost-utility analysis is similar to cost-effectiveness analysis in that there is a defined outcome, and the cost to achieve that outcome is measured in money. However, in cost-utility analysis, the outcome is measured in terms of survival and QoL (for example, using QALYs; Box 5). Since the endpoint may not be directly dependent on the disease state, cost-utility analysis can, in theory, compare courses of action in different areas of medicine. In practice, this is not so easy, since QALYs remain subject to much philosophical and technical criticism (see *What is cost-utility analysis?*⁹ for further discussion).

Cost-benefit analysis

In cost-benefit analysis, the benefit is measured as the associated economic benefit of an intervention, and hence both costs and benefits are expressed in money. Cost-benefit analysis may ignore many intangible but very important benefits that are difficult to measure in monetary terms (for example, relief of anxiety). It could also be seen to discriminate against those for whom a return to productive employment is unlikely (for example, the elderly or the unemployed). However, the virtue of this analysis is that it enables comparisons to be

Box 5. Quality-adjusted life-years

The concept of the quality-adjusted life-year (QALY) is based on the belief that the aim of any health service intervention can be dichotomised between improving survival (increasing the quantity of life) and improving the ability to enjoy life (enhancing quality of life). By applying 'quality weights' to each additional year of life experienced after treatment, the QALY attempts to incorporate both of these elements into a single measure (see *What is a QALY?*)⁶

made between schemes in very different areas of healthcare, and even with schemes outside the field of medicine. For example, using cost-benefit analysis, the costs and benefits of expanding university education (the benefits of improved education and hence productivity) can be compared with establishing a back pain service (enhancing productivity by returning patients to work). This approach is not widely accepted for use in health economics.

Marginal analysis – a little bit more, a little bit less

Marginal costs measure the additional cost increases or savings arising as a consequence of small output changes within a healthcare programme. For instance, if a new treatment enables patients to be discharged from hospital a day earlier, it would be tempting (but wrong) to apply the average cost per bed-day as the associated saving of resources. This is because, unfortunately, all the fixed-

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cost elements (laboratories, kitchens and building maintenance) will be largely unaffected, with the only altered costs being those associated with the physical occupation of the bed (patients' meals and other 'hotel' costs). These are the marginal costs, where resource use is directly related to a change in the scale of service provision – the additional resource required to treat one additional patient, or conversely, the level of resource directly saved by treating one fewer patient.

The importance of perspective

A key point to consider in planning an economic evaluation is the point of view from which the study should be conducted: from that of the health service, in which case only direct costs are considered; or from a societal viewpoint, in which case indirect costs (for example, productivity losses arising from ill health) should also be included. In general, the societal perspective is preferred, as it reduces the likelihood that important costs will be excluded from the analysis simply because they fall outside the focus of the study. However, a healthcare manager faced with a limited budget has an obvious incentive to concentrate entirely on costs that have an immediate impact on their own budget.

Employing a societal perspective also incorporates the costs and benefits directly experienced by the patient. For example, the development of an insulin delivery system that reduced the total number of injections or provided greater flexibility of the timing of injections would be likely to reduce the costs experienced by a diabetes patient, by reducing the pain and inconvenience associated with their ill health and providing them with greater control – and, hence, an improved ability to plan and structure their lives. These privately borne costs might be overlooked from a solely health service perspective, but they represent a vital component of the economic analysis: their reduction is likely to be a fundamental determinant of patient compliance which, in turn, would lead to improved glycaemic control and a reduction in the health and financial burden

associated with poorly controlled diabetes. For this reason, economic analyses should take the widest possible perspective, to ensure consistency and precision when conducting economic evaluations for healthcare decision-making.

Discounting

There is often a significant time lag between the investment of health service resources and the arrival of the associated health gain. In general, we prefer to receive benefits now and pay costs in the future. To reflect this in economic evaluation, both future costs and benefits are discounted. The rate currently set by the UK Treasury to discount streams of future costs and benefits to their net present value is 3.5%.¹⁰

Uncertainty

Economics operates in the realm of the behavioural sciences and, as such, is beset with uncertainty concerning the exact values of estimated costs and benefits. To minimise such uncertainty, it is necessary to reflect accurately the balance of scientific evidence on clinical- and cost-effectiveness through the application of evidence-based medicine (see *What is evidence-based medicine?*¹¹ for further discussion). Great care must be taken to utilise a balanced and impartial summary of the evidence with regard to anticipated treatment outcomes, ideally in the form of a systematic review (see *What is a systematic review?*¹² for further discussion). Where possible, a meta-analysis should be used to obtain a precise quantitative estimate of treatment effect (see *What is meta-analysis?*¹³ for further discussion).

However, there will inevitably remain certain areas where clinical evidence is either limited or entirely missing, and hence it becomes necessary to make assumptions to supplement the structure of evidence obtained from clinical trials and other sources. All pharmacoeconomic analyses should, therefore, include a detailed sensitivity analysis to assess the robustness of the study results in relation to variations in the underlying assumptions. The economic appraisal can be said to be robust if the results are not influenced to any great

extent by feasible variations in the value of any of the key underlying assumptions. If feasible variations in key assumptions lead to a different underlying conclusion, then the economic analysis is not robust (see *What are confidence intervals and p-values?*¹⁴ for further discussion).

Conclusion

Health economics represents a valuable tool for improving the information base upon which healthcare decisions are made. It can help to inform and improve decision-making, as a systematic and objective system of thought. The very process of identifying alternative options to meet prespecified objectives and balancing resources and benefits represents a valuable mode of thinking for decision-making, irrespective of whether a formal economic evaluation is undertaken •

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