

7 Assessing cost effectiveness

Health economics is about improving the health of the population through the efficient use of resources, so it necessarily applies at all levels, including individual clinical decisions. Clinicians already take resources and value for money into account when making clinical decisions; the incorporation of good-quality health-economic evidence into clinical guidelines can help to make this more consistent.

The Guideline Development Group (GDG) is required to make decisions based on the best available evidence of both clinical and cost effectiveness. This chapter describes the role of the health economist in the development of NICE clinical guidelines, and suggests possible approaches to considering economic evidence as part of the guideline development process. It also sets out the principles for conducting new economic modelling studies if there is insufficient evidence in the literature to assess the cost effectiveness of key interventions.

Guideline recommendations should be based on the estimated costs of the treatment options in relation to their expected health benefits (that is, their 'cost effectiveness'), rather than on the total cost or resource impact of implementing them. Thus, if the evidence suggests that an intervention provides significant health benefits at an acceptable cost per patient treated, it should be recommended even if it would be expensive to implement across the whole population.

When implementing a guideline's recommendations, commissioners and trusts also need to know the resource and cost implications for their organisations. NICE undertakes a separate, but parallel, cost-impact analysis during the consultation period of the clinical guideline. Costing tools are published at the same time as the guideline, to allow organisations to estimate implementation costs (see section 13.1.3).

7.1 *The role of the health economist in clinical guideline development*

The health economist is a core member of the GDG alongside the rest of the National Collaborating Centre (NCC) technical team, and should be involved at the earliest opportunity – from the beginning of scoping if possible (see chapter 2). The health economist should attend all GDG meetings.

Although the health economist has skills in economic analysis, the expertise of all of the GDG members will be necessary to ensure that economic evidence is underpinned by the most plausible assumptions and the best available clinical evidence. Similarly, the health economist may be able to provide useful input into the interpretation of clinical data.

The role of the health economist in clinical guideline development is to:

- advise on economic issues
- review economic evaluations
- prioritise questions for further economic analysis
- conduct economic evaluations
- liaise with the costing analyst at NICE to ensure consistency between the cost-effectiveness and cost-impact assessments.

The relative amounts of time spent by the health economist on each of these tasks will vary between guidelines. There are likely to be large differences between clinical guideline topics in the amount, relevance and quality of the economic literature. In some topic areas there may be high-quality data that can be used in economic models, whereas in other areas there will be little information.

Defining the economic priorities for each clinical guideline should start during scoping, and proceed alongside development of the review questions. The NCC prepares an economic plan, which contains a preliminary overview of the relevant economic literature. The plan also identifies the initial priorities for further economic analysis and the proposed methods for addressing these questions (see section 7.1.3). This document is prepared by the health economist in consultation with the rest of the NCC technical team and the GDG, and is discussed and signed off by NICE, usually within 3 months of the first GDG meeting. The economic plan is likely to be modified during guideline development. For example, as the clinical evidence is reviewed it may become apparent that further evaluation is not necessary for some aspects that were initially prioritised for economic analysis. Any key changes in the economic plan should be agreed between the NCC and NICE. The rationale for the final choice of priorities for economic modelling should be explained in the full guideline.

7.1.1 Advising on economic issues

The health economist should encourage the GDG to consider the economic consequences of the guideline recommendations as well as the clinical implications. A formal presentation outlining the basic principles of health economics is given at the first GDG meeting, and further presentations may be useful later in the guideline development process. It is particularly important that the GDG members understand that economic analysis is not simply a matter of estimating the consequences of a guideline recommendation in terms of use of resources, but is concerned with the evaluation of both costs and health benefits. GDG members also need to understand that economic evaluation should compare the costs and consequences of alternative courses of action. 'Cost of illness' or 'burden of disease' studies are not useful for decision-making when developing clinical guidelines.

Cost effectiveness is assessed in order to maximise health gain from available resources. If resources are used for interventions that are not cost effective, then less health gain is achievable across the whole population (that is, there

is a greater 'opportunity cost'). Within the context of the principles outlined in the document 'Social value judgements: principles for the development of NICE guidance'¹ (see also section 1.1.1), the GDG should be encouraged to consider recommendations for interventions that:

- are less effective than current practice but free up a substantial amount of resources that can be re-invested in the NHS, or
- increase clinical effectiveness at an acceptable level of increased cost (see section 7.3).

The GDG members may find it useful if the health economist discusses with them other economic concepts, such as incremental analysis, the NHS and personal social services (PSS) perspective, and measurement of quality of life (QoL) and quality-adjusted life years (QALYs). The British Medical Journal has published a series of 'economics notes' describing other concepts that the health economist may wish to explore with the GDG (Raftery 1999–2001).

7.1.2 Reviewing economic evaluations

Examining relevant published economic information is an important component of clinical guideline development. Processes for searching for, selecting, appraising and summarising economic evaluations are discussed in sections 5.3, 6.1.2, 6.2.3 and 6.2.4.

The general approach to reviewing economic evaluations should be systematic but focused. If a high-quality economic analysis that addresses a key clinical issue and is relevant to current NHS practice has already been published, then further modelling by the health economist will not be necessary. This frees up time for modelling on other questions. However, many published economic evaluations will not be relevant; for example, costs in non-UK studies may differ from those in the NHS. Time should not be wasted on critically appraising studies that are not likely to provide useful information for guideline decision-making. Search strategies and inclusion criteria for economic evaluations should be designed to filter out such papers (see section 5.3).

7.1.3 Prioritising questions for further economic analysis

Only rarely will the health economic literature be comprehensive enough and conclusive enough that no further analysis is required. Additional economic analyses will usually be needed, in which case new models should be developed selectively, unless an existing model can easily be adapted to answer the question.

¹ www.nice.org.uk/aboutnice/howwework/socialvaluejudgements/socialvaluejudgements.jsp

Close collaboration between the health economist and the rest of the GDG is essential early in the guideline development process to ensure that:

- the most important questions are selected for economic analysis
- the overall modelling approach is appropriate
- all of the important health effects and resource costs are included
- the clinical, epidemiological and resource evidence used is the best available and the model assumptions are plausible
- the results of the analysis are interpreted appropriately and the limitations acknowledged.

Economic analysis is potentially useful for any question in which one intervention or programme is compared with another. This includes comparisons of methods for prevention, screening, risk assessment, diagnosis, monitoring, rehabilitation and follow-up, as well as treatment. It may also be appropriate for comparisons of different combinations or sequences of interventions, as well as individual components of the patient management algorithm. However, given the broad scope of many clinical guidelines, it will not be possible to conduct original analyses for every component. Selecting questions for further economic analysis, including modelling, should be a joint decision between the health economist and the other GDG members. Selection should be based on systematic consideration of the potential value of economic analysis across all key clinical issues.

An economic analysis will be more useful if it is likely to influence a recommendation, and if the health and financial consequences of the recommendation are large. The value of an economic analysis thus depends on:

- the overall 'importance' of the recommendation (which is a function of the number of patients affected and the potential impact on costs and health outcomes per patient)
- the current extent of uncertainty over cost effectiveness, and the likelihood that economic analysis will reduce this uncertainty.

For a particular question, economic modelling may not be warranted if, for example, the clinical evidence is so uncertain that it is not possible to give even a rough estimate of cost effectiveness. Alternatively, the published evidence on cost effectiveness may be so reliable that further economic analysis would be superfluous. Economic analysis may also not be a priority when it is obvious that the resource implications are modest in relation to the expected health gains.

7.2 Modelling approaches

Economic evaluation will usually be conducted in the form of a cost-effectiveness analysis, with the health effects being measured using an appropriate non-monetary outcome indicator. In circumstances for which cost-effectiveness analysis is not appropriate, other validated methods may be used.

Cost-effectiveness analysis with the units of effectiveness expressed in QALYs (cost–utility analysis) is widely recognised as a useful approach for measuring and comparing the efficiency of different health interventions. QALYs are an overall measure of health outcome that weight the life expectancy of a patient with an estimate of their health-related QoL (measured on a 0–1 scale). There are well documented methodological problems with QALYs, but this is also true of other approaches. The NICE technology appraisal programme (see section 8.1) uses the QALY approach. If suitable data are available, this approach should also be followed in clinical guideline development. If there are not sufficient data to estimate QALYs gained, an alternative measure of effectiveness may be considered for the cost-effectiveness analysis (such as life years gained or cases averted, or a more disease-specific outcome).

A cost-effectiveness analysis could be modelled around a single well-conducted randomised controlled trial, or by using decision-analytic techniques with probability, cost and health outcome data from a variety of published sources. In clinical guidelines there is often a trade-off between the range of new analyses that the health economist can conduct and the complexity of each piece of analysis. Simple methods may be used if these can provide the GDG with sufficient information on which to base a decision. For example, if an intervention is associated with better health outcomes and fewer adverse effects, then an estimate of cost may be all that is needed. Or a simple decision tree may provide a sufficiently reliable estimate of cost effectiveness. In other situations a more complex approach, such as Markov modelling or discrete event simulation, may be warranted.

Specific guidance on methods of cost-effectiveness analysis can be found in NICE's 'Guide to the methods of technology appraisal'. This includes a 'reference case' which specifies the methods considered by NICE to be the most appropriate for technology appraisals, and which is consistent with the NHS objective of maximising health gain from limited resources (see table 7.1). Economic analyses conducted for NICE clinical guidelines should usually follow this same reference case. Departures from the reference case may sometimes be appropriate in clinical guidelines, for example when there are insufficient data to estimate QALYs gained. Any such departures must be highlighted in the full guideline and reasons given.

Table 7.1 Summary of the reference case²

Element of health technology assessment	Reference case
Defining the decision problem	The scope developed by the Institute
Comparator	Therapies routinely used in the NHS, including technologies regarded as current best practice
Perspective on costs	NHS and PSS
Perspective on outcomes	All health effects on individuals
Type of economic evaluation	Cost-effectiveness analysis
Synthesis of evidence on outcomes	Based on a systematic review
Measure of health effects	QALYs
Source of data for measurement of HRQoL	Reported directly by patients and/or carers
Source of preference data for valuation of changes in HRQL	Representative sample of the public
Discount rate	An annual rate of 3.5% on both costs and health effects
Equity weighting	An additional QALY has the same weight regardless of the other characteristics of the individuals receiving the health benefit
HRQoL, health-related quality of life; PSS, personal social services; QALYs, quality-adjusted life years.	

The 'Guide to the methods of technology appraisals' also states:

'For the reference case, the perspective on outcomes should be all direct health effects, whether for patients or, when relevant, other people (principally carers). The perspective on costs should be that of the NHS and PSS. Some interventions may have a substantial impact on non-health outcomes or costs to other government bodies (for example, treatments to reduce illicit drug misuse may have the effect of reducing drug-related crime). If costs to other government bodies are believed to be significant, they may be included in a sensitivity analysis and presented alongside the reference case results. Productivity costs and costs borne by

² This is table 5.1 in 'Guide to the methods of technology appraisal' (updated June 2008); available at:

www.nice.org.uk/aboutnice/howwework/devnicetech/technologyappraisalprocessguides/guide-to-themethodsoftechnologyappraisal.jsp. Further detail about these methods is provided in a series of briefing papers that are available on the NICE website.

patients and carers that are not reimbursed by the NHS or PSS should not be included in any analyses.

‘Sensitivity analysis should be used to explore the impact of potential sources of bias and uncertainty on model results. Potential bias resulting from key structural assumptions should be explored through deterministic sensitivity analyses, testing whether and how the model results change under alternative plausible scenarios. Deterministic sensitivity analysis should also be used to test the impact of potential bias resulting from the selection of data sources for key model parameters. Probabilistic sensitivity analysis is preferred for exploring uncertainty arising from imprecision in model parameters. This enables the uncertainty associated with all parameters to be reflected simultaneously in the results. In non-linear decision models, probabilistic methods also provide the best estimates of mean costs and outcomes. However, models incorporating probabilistic methods are more time-consuming to construct and may not always be a priority for health economists working on clinical guidelines. In such cases, the decision not to use probabilistic methods should be clearly stated and justified in the full guideline, and the impact of parameter uncertainty should be thoroughly explored through deterministic sensitivity analysis.’

The 'Guide to the methods of technology appraisal' includes other useful advice for health economists developing economic models for use in clinical guidelines.

7.2.1 General principles

Regardless of the modelling approach taken, the following principles should be observed.

- The question for the economic analysis should be clearly specified and appropriate, with comparison of all relevant alternatives for specified groups of patients.
- Analysis should be carried out by the health economist in collaboration with the rest of the GDG.
- An economic analysis should be underpinned by the best-quality clinical evidence.
- There should be the highest level of transparency in the reporting of methods and results. Conventions on reporting economic evaluations should be followed (see Drummond and Jefferson 1996).
- Potential sources of bias and uncertainty should be explored using appropriate sensitivity analysis and discussed with the GDG.
- Limitations of the approach taken and methods used should be discussed with the GDG.

7.2.2 Identification and selection of model inputs

The NICE reference case (table 7.1) states that evidence on health outcomes should be obtained from a systematic review. It is not necessary to conduct formal systematic literature searches for all types of information required for economic modelling. However, health economists should use transparent processes for identifying other model inputs, assure their quality and justify their inclusion.

Information on unit costs should be routinely obtained from national list prices such as the 'NHS drug tariff', the PSSRU (Personal Social Services Research Unit) 'Unit costs of health and social care' report or the Department of Health tariff. Information on costing can also be found in the NICE document 'Developing costing tools: methods guide'³ and through discussion with the NICE costing analyst for the guideline. Some information about epidemiology or health service use might also be better obtained from national statistics or databases than from studies in the literature.

Although it is desirable to conduct systematic literature reviews for other model inputs, this is time-consuming, and there is an opportunity cost in terms of both the health economist's and the information specialist's time. Therefore, before requesting additional literature searches from the information specialist, the health economist should look at pragmatic options for identifying inputs. Examples include using the clinical evidence for that key clinical issue (and perhaps other relevant issues) and liaising with the systematic reviewer, other GDG members and other experts. If an additional literature search is necessary, the health economist should discuss this with the information specialist. If longer-term follow-up data are required, a literature search to identify cohort studies may be appropriate. It has been suggested (Cooper et al. 2007) that other search methods may be more efficient for identifying information for economic models. The report by Philips and co-workers (2004) is a useful guide to searching methods for economic models.

QoL data are often needed for economic models. Many of the QoL search filters available are highly sensitive and so, although they identify relevant literature, they also detect a large amount of irrelevant literature. An initial broad QoL literature search may be a good option, but the amount of information identified may be unmanageable (depending on the key clinical issue being addressed). It may be more appropriate and manageable to incorporate a QoL search filter when executing additional searches for key clinical issues of high economic priority. The provision of QoL data should be guided by the health economist at an early stage in the guideline development process so that the information specialist can adopt an appropriate strategy. Another resource for identifying useful sources of utility data for economic modelling is the database of preference weights on the CEA (Cost-Effectiveness Analysis) Registry website⁴.

³ www.nice.org.uk/aboutnice/howwework/developingniceclinicalguidelines

⁴ <http://160.109.101.132/cearegistry/default.asp>

7.3 Economic evidence and guideline recommendations

For an economic analysis to be useful, it must inform the guideline recommendations. Cost effectiveness and clinical effectiveness should be discussed in parallel when formulating recommendations.

If there is strong evidence that one clinical strategy 'dominates' the alternatives (that is, it is both more effective and less costly), clearly this strategy should be recommended for appropriate patients. However, if, as is often the case, one strategy is more effective but also more costly, then the magnitude of the incremental cost-effectiveness ratio (ICER) should be considered. For example, the cost per QALY gained is calculated as the difference in mean cost divided by the difference in mean QALYs for one strategy compared with the next most effective alternative strategy.

If one intervention appears to be more effective than another, the GDG will have to decide whether the increase in cost associated with the increase in effectiveness represents reasonable 'value for money'. In doing so, it should make reference to the principles outlined in NICE's report 'Social value judgements: principles for the development of NICE guidance'⁵. This states the following:

'NICE has never identified an ICER above which interventions should not be recommended and below which they should. However, in general, interventions with an ICER of less than £20,000 per QALY gained are considered to be cost effective. Where advisory bodies consider that particular interventions with an ICER of less than £20,000 per QALY gained should not be provided by the NHS they should provide explicit reasons (for example that there are significant limitations to the generalisability of the evidence for effectiveness). Above a most plausible ICER of £20,000 per QALY gained, judgements about the acceptability of the intervention as an effective use of NHS resources will specifically take account of the following factors.

- The degree of certainty around the ICER. In particular, advisory bodies will be more cautious about recommending a technology when they are less certain about the ICERs presented in the cost-effectiveness analysis.
- The presence of strong reasons indicating that the assessment of the change in the quality of life is inadequately captured, and may therefore misrepresent, the health gain.
- When the intervention is an innovation that adds demonstrable and distinct substantial benefits that may not have been adequately captured in the measurement of health gain.

As the ICER of an intervention increases in the £20,000 to £30,000 range, an advisory body's judgement about its acceptability as an effective use of NHS resources should make explicit reference to the

⁵ www.nice.org.uk/aboutnice/howwework/socialvaluejudgements/socialvaluejudgements.jsp

relevant factors considered above. Above a most plausible ICER of £30,000 per QALY gained, advisory bodies will need to make an increasingly stronger case for supporting the intervention as an effective use of NHS resources with respect to the factors considered above.'

Decisions about whether to recommend an intervention should not be based on cost effectiveness alone. The GDG should also take into account other factors, including the requirements to prevent discrimination and to promote equality⁶. As described in chapter 9, these factors should be explained in the 'evidence to recommendations' sections of the full guideline.

If a key clinical issue has not been prioritised for new economic analysis, the GDG should still consider the likely cost effectiveness of associated recommendations. This assessment may be based on published estimates of cost effectiveness if available, or a qualitative judgement if necessary.

7.4 Further reading

Briggs A, Claxton K, Sculpher K (2006) *Decision modelling for health economic evaluation*. Oxford: Oxford University Press.

Cooper NJ, Sutton AJ, Ades AE et al. (2007) Use of evidence in economic decision models: practical issues and methodological challenges. *Health Economics* 16: 1277–86

Drummond MF, Jefferson TO (1996) Guidelines for authors and peer reviewers of economic submissions to the BMJ. *British Medical Journal* 313: 275–83.

Drummond MF, McGuire A (2001) *Economic evaluation in health care: merging theory with practice*. Oxford: Oxford University Press.

Drummond MF, Sculpher MJ, Torrance GW et al. (2005) *Methods for the economic evaluation of health care programmes*, 3rd edition. Oxford: Oxford University Press.

Eccles M, Mason J (2001) How to develop cost-conscious guidelines. *Health Technology Assessment* 5: 1–69.

NHS Centre for Reviews and Dissemination (2001) *Improving access to cost-effectiveness information for health care decision making: the NHS Economic Evaluation Database*. CRD report number 6, 2nd edition. York: NHS Centre for Reviews and Dissemination, University of York. (Superseded by the 2007 NHS EED handbook: www.york.ac.uk/inst/crd/pdf/nhseed-handb07.pdf)

⁶ See NICE's equality scheme: www.nice.org.uk/aboutnice/howwework/NICEEqualityScheme.jsp

Philips Z, Ginnelly L, Sculpher M et al. (2004) Review of good practice in decision-analytic modelling in health technology assessment. *Health Technology Assessment* 8: 1–158.

Raftery J, editor (1999–2001) *Economics notes series*. British Medical Journal. Available from: www.bmj.com