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# Interpreting economic evaluations of healthcare interventions

## a simple guide

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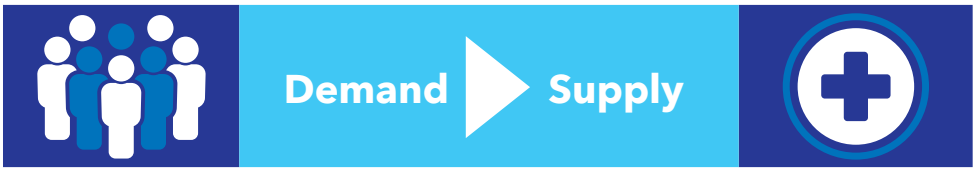
## This guide aims to help healthcare professionals of all backgrounds make sense of economic evaluations to determine whether interventions represent value for money




Healthcare resources are limited, but demand for healthcare services is increasing. This makes it necessary to choose between various treatment options (e.g. type of compression therapy).

Economic evaluations are frameworks used to explicitly compare the costs and outcomes of two or more available treatment options (*Figure 1*). The aim is to inform decisions between alternative courses of action to maximise improvements in health status given the resources available.

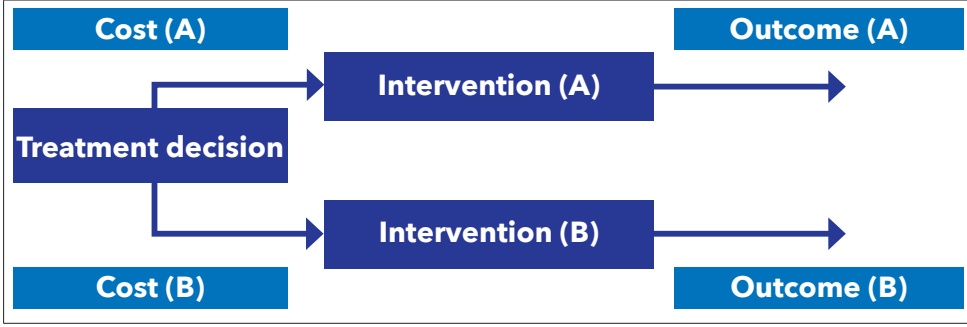
This information is used by stakeholders (such as the National Institute for Health and Care Excellence (NICE), commissioners, etc) to inform clinical guidelines and reimbursement decisions. This guide aims to simplify economic evaluations in healthcare for those who are not health economists.

### The benefits of economic evaluation in healthcare

Formal economic evaluations provide a systematic and transparent analysis of all the costs and outcomes relevant to a particular decision problem, as opposed to using a rule of thumb or informal decision criteria.

Outcomes of formal evaluations will include an identification of relevant alternative

**Figure 1. Alternative courses of action[1]**



treatments, clarification about the analysis perspective (i.e. who is the relevant decision-maker, and what information do they require?) and quantifications of both costs and outcomes. Transparency in formal evaluations makes all assumptions explicit and exposes value judgements to challenge.

**Table 1. Types of economic and affordability evaluation**

| Analysis type | Measurement of costs | Measurement of outcomes | Summary measure |
|---|---|---|---|
| **Full economic evaluations** | | | |
| **CEA** | Pounds sterling (£) | Natural unit/clinical outcomes (e.g. average time to heal, life-years gained, blood glucose level reduction) | Cost-effectiveness ratio (e.g. Pounds sterling (£) per life year gained) |
| **CUA** | Pounds sterling (£) | Healthy years or quality-adjusted life years (QALYs) that consider both quality and quantity of life | Cost-utility ratio (e.g. Pounds sterling (£) per QALYs gained) |
| **CBA** | Pounds sterling (£) | Pounds sterling (£) estimated through e.g. human capital and friction cost method approaches | Pounds sterling (£) difference in benefits and costs |
| **CCA** | Pounds sterling (£) | Natural unit/clinical outcomes | Disaggregated costs and outcomes |
| **Partial economic evaluations** | | | |
| **CMA** | Pounds sterling (£) | None (equivalent efficacy and safety between treatments) | Pounds sterling (£) difference in costs between alternatives |
| **Outcome description** | None (only considers outcomes) | Natural unit/clinical outcomes or healthy years/QALYs or Pounds sterling (£) | Description of health consequences (i.e. burden of disease studies) |
| **Cost-outcome description** | Pounds sterling (£) | Natural unit/clinical outcomes or healthy years/QALYs or Pounds sterling (£) | Description of both outcomes and costs of a single intervention without comparison to alternatives |
| **Cost description** | Pounds sterling (£) | None (only considers costs) | Description of resource costs (i.e. cost of illness studies) without comparison to alternatives |
| **Cost-comparison analysis** | Pounds sterling (£) | None (only considers costs) | Description of the costs of alternative interventions |
| **Affordability evaluation** | | | |
| **Budget impact analysis** | Pounds sterling (£) | Pounds sterling (£) (only effects which can be monetised) | Estimate of the cost impact on a decision maker's budget from investing in a new intervention |

CMA=cost-minimisation analysis; CEA=cost-effectiveness analysis; CUA=cost-utility analysis; CBA=cost-benefit analysis, CCA=cost-consequence analysis

## Techniques of economic evaluations

There are different approaches used for economic evaluations (*Table 1*).[1] All types of economic evaluations identify different treatment options. Cost-minimisation analysis (CMA), although not very common, is used to examine the differences in costs when the outcomes of two or more treatments are assumed (based on evidence) to be the same. For example, CMA has been used to examine different negative pressure wound therapies.[2]

Other types of economic evaluations, including cost-effectiveness analysis (CEA), cost-utility analysis (CUA) and cost-benefit analysis (CBA), quantify the relevant costs and outcomes to maximise improvements in health given the available budget. The differences between CEA, CUA and CBA lie in the way outcomes are measured and valued.

It is difficult to measure health outcomes in monetary units as required for CBA (e.g. how much are you willing to pay to avoid a heart attack?). This is why CEA/CUA are more commonly used. CEA/CUA calculate the relative cost-effectiveness of alternatives using an incremental cost-effectiveness ratio (ICER):

$$\text{ICER} = \frac{\text{Costs}_A - \text{Costs}_B}{\text{Outcomes}_A - \text{Outcomes}_B}$$

An ICER is interpreted as the additional (incremental) cost per additional unit of outcome gained. For CEA, this is in terms of natural units e.g. cost per ulcer-free day. For CUA, this is in terms of healthy years e.g. cost per quality-adjusted life years (QALYs) gained. QALYs are a measure of healthy life years that includes both the quality and the quantity of life lived.

Cost-consequence analysis (CCA) is a descriptive exercise of enumerating the costs and outcomes of alternatives without any attempt to directly compare them; comparison is left to the decision-maker's judgement.

Partial economic evaluations are commonly conducted when there is a lack of available evidence to conduct full evaluations. Examples include:

1. Cost description studies that only report the costs of a single treatment or multiple treatments without consideration of outcomes

2. Effectiveness/efficacy evaluation studies that only report the effectiveness of a single treatment or multiple treatments without consideration of costs.

## Evidence for economic evaluations

In healthcare decision-making, priority is given to high-quality studies found further up the hierarchy of evidence (i.e. systematic reviews) rather than expert opinions or editorials.

Economic evaluations have traditionally been conducted within single clinical studies where most of the necessary costs and outcome data is collected (e.g. clinical trials and routine databases). Such economic analyses are commonly limited to what data is and is not

**Table 2. Types of uncertainty in economic evaluations**

| Type of uncertainty | Reason for uncertainty | Example of uncertainty | Methods for assessing uncertainty |
|---|---|---|---|
| **Variability** | Unexplained differences between people | People may have different recovery times due to unknown genetic factors | Standard deviations associated with mean estimates |
| **Heterogeneity** | Explained differences between people | People may have different recovery times due to age, sex, ethnicity, etc | Subgroup analysis can examine the impact of a treatment on a subset of people (e.g. elderly people) |
| **Parameter uncertainty** | The choice of specific inputs into the evaluation | The unit costs attached to specific healthcare resource use may be out of date | Monte Carlo probabilistic analysis (i.e. varying all parameters based on their distributions) can examine the impact of using different parameter values on the evaluation results. Deterministic sensitivity analysis (i.e. varying one parameter whilst keeping others constant) is an alternative approach. |
| **Structural uncertainty** | The choice of assumptions within the evaluation | The choice of treatment comparator(s) may not reflect clinical practice in different parts of the country | Scenario analysis can examine the impact of structural uncertainty. Decision models can also be used to assess the impact of structural uncertainty. |

collected (e.g. clinical trials are often not fully representative of clinical practice). Consequently, there has been a growing use of methods that synthesise high-quality evidence together, such as decision models.

All economic evaluations contain **uncertainty**,[14] which can be assessed through different methods (*Table 2*).

## Assessing the quality of economic evaluations

People reading economic evaluations of healthcare interventions often face difficulties in assessing the quality of the research and the validity of the findings. Resultingly, authors have developed checklists of the key criteria economic evaluations should report to assess with strengths and weaknesses of studies.

The Consolidated Health Economic Evaluation Reporting Standards 2022 (**CHEERS 2022**) checklist contains 28 items with accompanying descriptions[3] and separately reported definitions for the interpretation of each item.[4] The checklist is designed for any type of economic evaluation, and items are subdivided into the following categories: title, abstract, introduction, methods, results, discussion and other relevant information.

It is unlikely that every study will satisfy all the checklist criteria. The aim of the

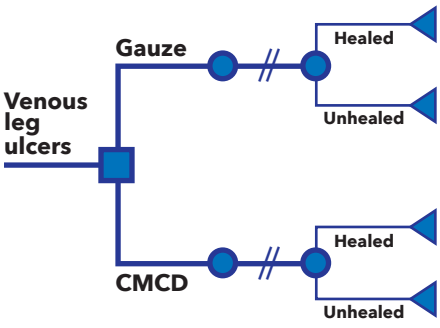
CHEERS checklist is to act as a screening tool to quickly identify the quality of reporting of the key strengths and weaknesses of an evaluation.

## Decision models for economic evaluation

Decision-analytic models[5] are a vehicle for economic evaluations. They use mathematical frameworks of disease progression to **synthesise** the best available evidence together (i.e. clinical trials, literature etc.). Models simulate different clinical pathways in which a patient might progress when using alternative treatments. This allows for long-term costs and health outcomes to be calculated and compared for different treatments. The full complexities of decision models are beyond the scope of this guide, but a basic understanding is required to identify some of the CHEERS checklist items.

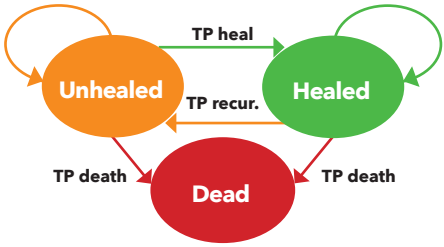
In accordance with reporting guidance,[3] authors should justify why a model is used; describe the model structure and input parameters used; and discuss the validity of the model to predict healthcare costs and outcomes over a specified time horizon. Here are examples of two common decision model structures for wound care:

**Figure 2. Simplified decision tree[6]**




CMCD=carboxymethylcellulose dressing

**Figure 3. State-transition model[7]**




TP=transition probability

1 *Figure 2* is an example of a decision tree to evaluate the cost-effectiveness of different types of dressings for venous leg ulcers.[6] Patients progress from left to right along the treatment branches of the tree. Different **transition probabilities** are applied along the tree depending on the treatment options. Health outcomes (healed or unhealed) and the associated costs are determined at the end of the time period.

2 *Figure 3* is an example of a **state-transition model** to evaluate the cost-effectiveness of different high-compression bandages and hosieries.[7] Cohorts of patients transition between health states – unhealed, healed and dead (cannot transition out of the dead state) – as their condition changes over time, given different treatment options that alter the **probability of transitions**. Costs and health

outcomes are derived over each cycle (i.e. a meaningful time period where transitions between health states may occur) and accumulative across all the cycles over the time period. Markov models are preferred for reoccurring events.

## Hartmann's health economics studies

Zetuvit® Plus Silicone (Paul Hartmann Ltd, UK) is a superabsorbent dressing, which has been reported to be an effective[8] and cost-effective[9] treatment to manage exudate and undisturbed wounds.

Hartmann has funded multiple research studies to explore the health economics of wound care, including three **CEAs** in different settings[9-11] and three methodological contributions. Of these, two are reviews of **risk prediction** tools to help prevent and manage the development of hard-to-heal (chronic) wounds;[12,13] and one is a discussion paper on characterising **uncertainty** in the evaluation of hard-to-heal wound management.[14]

**Table 3. Description of the Zetuvit® Plus Silicone economic evaluations**

| PICOS | Description |
|---|---|
| **Population** | Patients with moderate-to-high exudating leg ulcers |
| **Intervention** | Zetuvit® Plus Silicone |
| **Comparator** | Standard of care – UK & Germany: other superabsorbent (36%), antimicrobials (30%), foams (20%), alginates (9%), other dressings (5%); France: foams (100%) |
| **Outcome** | Quality-adjusted life week (QALW) |
| **Study design** | Cost-utility analysis |

## Cost-effectiveness of Zetuvit® Plus Silicone

The cost-effectiveness of Zetuvit® Plus Silicone was evaluated in England,[9] France,[10] and Germany[11] from the perspective of the healthcare provider. A descriptive summary of the economic evaluations is shown in *Table 3*.

The cost-effectiveness studies used patient-level microsimulation models (status of ulcer-defined health states: infected, deteriorating, static and healing). Microsimulation models are a type of state-transition model, similar to Markov models, but simulate individual patients rather than cohorts of patients.

In England and Wales, an ICER below the NICE threshold range of £20,000-£30,000 per QALY gained is considered to be cost-effective[15]. The English study reported that Zetuvit® Plus Silicone was cost-saving compared with standard of care by £222 per person over a 6-month period and resulted in an additional 0.081 quality-adjusted life weeks (QALWs). This corresponds to an ICER of approximately –£2741 per QALW gained. Zetuvit® Plus Silicone would be considered dominant compared to standard of care (i.e. it is likely to represent good value for money to the healthcare system).

A negative ICER is sometimes misleading because it can refer to a cost-saving situation (lower costs and better outcomes) or a not cost-effective situation (higher costs and worse outcomes). Many countries have their own health technology assessment (HTA) bodies with different willingness-to-pay thresholds.

## Conclusion

Health economic evaluations are important to assess the cost-effectiveness of new healthcare interventions. There are several techniques and vehicles for economic evaluation. Decision analytical modelling is a common method for conducting economic evaluations. Models are only as

**Glossary of key terms**

| Term | Definition |
|---|---|
| **Cost-benefit analysis** | Type of economic evaluation that compares the costs and consequences of alternative health interventions where consequences are measured in monetary units |
| **Cost-consequence analysis** | Type of economic evaluation that allows the reader to form their judgement about the importance of disaggregated costs and a range of disaggregated consequences |
| **Cost-effectiveness analysis** | Type of economic evaluation that compares the costs and health outcomes of alternative health interventions where health outcomes are measured in natural units (i.e. life years) |
| **Cost-minimisation analysis** | Type of economic evaluation that compares the costs of alternative health interventions assuming the health outcomes are equivalent |
| **Cost-utility analysis** | Special type of cost-effectiveness analysis that measures health outcomes in healthy years (i.e. QALYs) |
| **Economic evaluation** | Assessing the costs and outcomes of alternative courses of action |
| **Hierarchy of evidence** | Ranking of study types based on their academic rigour and quality of evidence; typically, meta-analysis and systematic reviews are seen as the highest quality and opinion pieces as the lowest quality |
| **Incremental cost-effectiveness ratio** | Summary measure of the economic value of an intervention compared to an alternative |
| **National Institute for Health and Care Excellence (NICE)** | Institute that provides national guidance and advice to improve health and social care in England |
| **Parameter** | A numerical factor that is used to define a particular input (e.g. health utilities, transition probabilities etc.) |
| **Perspective** | The analysis perspective is the point of view in which the decision problem is assessed. This can affect the types of costs and outcomes examined |
| **Quality-adjusted life years (QALYs)** | Measure of the length of life and the quality of life; one QALY is equal to one year in perfect health |
| **Randomised controlled trials (RCTs)** | Experiments used to control factors not under direct experimental control to elicit the effect of an intervention |
| **State transition model** | An approach to decision analytical modelling whereby individuals (microsimulation) or cohorts (Markov) transition through states |
| **Threshold** | The maximum amount a decision-maker is willing to pay for a unit of health outcome, e.g. £X per QALYs |

A more extensive list can be found on the York Health Economics Consortium's website[16]

good as their inputs and will always produce uncertain outcomes to some degree. There are methods to communicate uncertainty in terms of the impact on cost-effectiveness. This guide was written to provide an introduction to economic evaluations in healthcare. Economic evaluation checklists such as CHEERS are recommended to assess the quality of studies.

**Acknowledgment:** Review and feedback provided by Vladica Veličković, Head of Global Evidence Generation at Hartmann

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Latest date of revision: 12.07.2023