

DECIDE

Introduction to Health Interventions, Policy and Services

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Economic Evaluation of Healthcare Technologies – Part I

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Summary

- Basics of Health Economics and the Importance of Economic Evaluation
- Generic Steps in an Economic Evaluation
- Types of Economic Evaluation
 - Economic Impact Analysis (Cost-of-Illness studies) and Cost Analysis
 - Cost Minimisation Analysis
 - Cost-Benefit Analysis

Basics of Health Economics and the Importance of Economic Evaluation

How Economists view the world...



- Pessimist: bottle $\frac{1}{2}$ empty
- Optimist: bottle $\frac{1}{2}$ full
- Economist: bottle $\frac{1}{2}$ **WASTED!!**


The 'Health Economic' problem

- Unlimited healthcare “demands/needs/wishes” with rapid growth in health expenditure.
- Scarce or limited health sector resources.
- Choosing between “demands/needs/wishes” we can “afford” given our available resources or “budget”.
- These are important problems for a wide range of stakeholders from policy makers and managers to healthcare professionals, patients and the society.



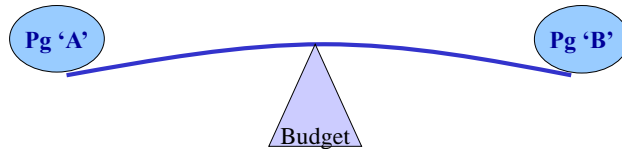
Concept of opportunity cost

- “The value of forgone benefit which could be obtained from a resource in its next-best alternative use”.



Opportunity Cost Formula = Return of Next Best Alternative Not Chosen - Return of the Option Chosen

- The aim is to choose interventions where benefits outweigh opportunity cost.



What is Health Economics?

- Theoretical framework to help healthcare professionals, decision-makers or governments to make choices on...

...HOW to **maximize the health of population given constrained health care resources.**

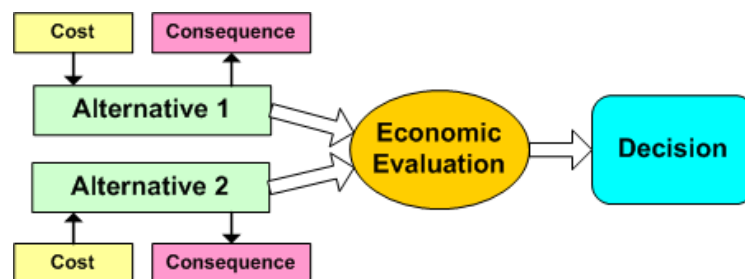
- The main goals of health economists are...
 - To understand the relationship between **resources used** and **health outcomes** achieved by alternative options.
 - ...and compare!

Economic Evaluation

- Economic evaluation is used to ensure that limited resources are allocated **as efficiently as possible**.
 - **Technical efficiency**: meeting a given objective at least cost.
 - **Allocative efficiency**: producing exactly what society wants.
- Society may have other goals when allocating resources: **equity or ethical issues**.
 - **Horizontal equity**: 'equal treatment of equals'.
 - **Vertical equity**: 'unequal treatment of unequals'.
- Promoting **cost consciousness** – the economic judgement of health care operations – impacts the clinical decision making processes

Economic evaluation is...

- “The comparative analysis of alternative courses of action in terms of both their costs and consequences in order to assist policy decisions” (Drummond et al,1997)



- Economic evaluation is **not** “choosing the cheapest”.

Economic Evaluation

- An **Economic Evaluation** is an **explicit, formal, systematic and quantitative approach** used in the **comparative analysis of alternative courses of action** in terms of **both** their **costs** and **consequences** in order to **support policy decisions** regarding **allocation and distribution of the scarce resources** available, and the analysis of its **determinants** and **outcomes**
- A **Complete Economic Evaluation** is the **comparative analysis** of alternative courses of action or interventions in terms of both their **costs** and **consequences**; as opposed to a **Partial Economic Evaluation**, where only **costs** are considered

Economic Evaluation

- The fundamental aspects of a **Complete Economic Evaluation** are:
 - The adequate measurement and analysis of the **consequences** (health outcomes or health effects) of the different alternatives or interventions
 - The adequate measurement and analysis of the **costs** of the different alternatives or interventions

Economic Evaluation

- Different **types of studies** when analysing **consequences** and **costs** of alternatives:
 1. Descriptive or comparative studies analysing only costs of one or more alternatives – **Partial Economic Evaluation – Economic Impact Analysis (Cost-of-Illness study) or Cost Analysis**
 2. Comparative studies analysing costs and consequences of two or more alternatives – **Complete Economic Evaluation (Cost-Minimization, Cost-Benefit, Cost-Effectiveness and Cost-Utility Analysis)**

Generic Steps in an Economic Evaluation

Operational phases in economic evaluations

Framing the decision-making process and deciding upon the study question



Assessment of costs and consequences



Incremental analysis, adjustment for time preferences and assessment and exploration of uncertainty



Presentation and dissemination of conclusions supporting the decision-making process

Framing the decision-making process and deciding upon the study question

- Identifying the **decision-making problem** and aims of evaluation
 - What is the problem?
 - Why is this problem important?
 - What aspects of the problem need to be explained?
- Choosing the **alternative options**
 - Describing the interventions accurately.
 - Defining the counterfactual intervention (comparator).
- Defining the **audience**
 - Defining the info needs of the audience.
 - Considering how the audience will use the study results.

Framing the decision-making process and deciding upon the study question

- Defining the **perspective of the study**
 - Patient / Providers / Payers / Healthcare system / Society.
 - Choosing a perspective depends on the audience.
- Defining the **time frame and analytic time horizon**
 - Analytic horizon > Time frame.
- Choosing the **type of study and study design**
 - Type of study: COIA / CA / CMA / CBA / CEA / CUA
 - Prospective / Retrospective / Model
 - Depends on data, time and resources available.

Assessment of costs

- **Identification** of costs
 - *Cost type*: direct vs indirect vs intangible
- **Measurement**
 - Measure in natural physical units (e.g. hours of labour time)
- **Valuation**
 - Market prices (e.g. wage rates) used unless strong belief they do not reflect opportunity cost (e.g. volunteers)
- **Calculation**
 - Multiply unit of measurement by unit cost (e.g. 2 hours of time at \$5 per hour = \$10 labour cost)

Assessment of health effects

➤ Identification

- Which outcome measure is employed depends on the objective of the evaluation.

➤ Measurement

- Measure *effectiveness* not *efficacy* in natural physical units.

➤ Valuation *if appropriate in terms of*

- Natural physical units (e.g. Life Years, Mortality, Disability)
- Utility (e.g. QALY, DALY, HYE)
- Money (e.g. WTP)

Incremental analysis, time preferences and assessment and exploration of uncertainty

▪ Incremental analysis

- **Incremental analysis** of costs and consequences (e.g. ICER, INB)

▪ Discounting – adjustments for time preferences

- Prefer to have benefits now and bear costs in the future – “**time preference**”
- Rate of time preference is termed “discount rate”
- To **allow for differential timing of costs (and benefits)** between programmes all future costs (and benefits) should be stated in terms of **their present value** using discount rate.
- Thus, future costs given less weight than present costs.

Incremental analysis, time preferences and assessment and exploration of uncertainty

▪ Annuitization of capital costs

- Capital costs represent an **investment at start-up** in an asset which is used and **depreciated over time**.
- Annualise the initial capital outlay over the useful life of asset.

▪ Assessment and exploration of uncertainty

- Process of **assessing the robustness** of an economic evaluation by considering the **effects of uncertainty**, consisting in:
 - Identifying the (uncertain) variables.
 - Specifying the plausible range over which they should vary.
 - Performing Sensitivity Analysis:
 - One-way analysis / Multi-way analysis
 - Extreme scenario analysis
 - Threshold analysis
 - Deterministic / Probabilistic

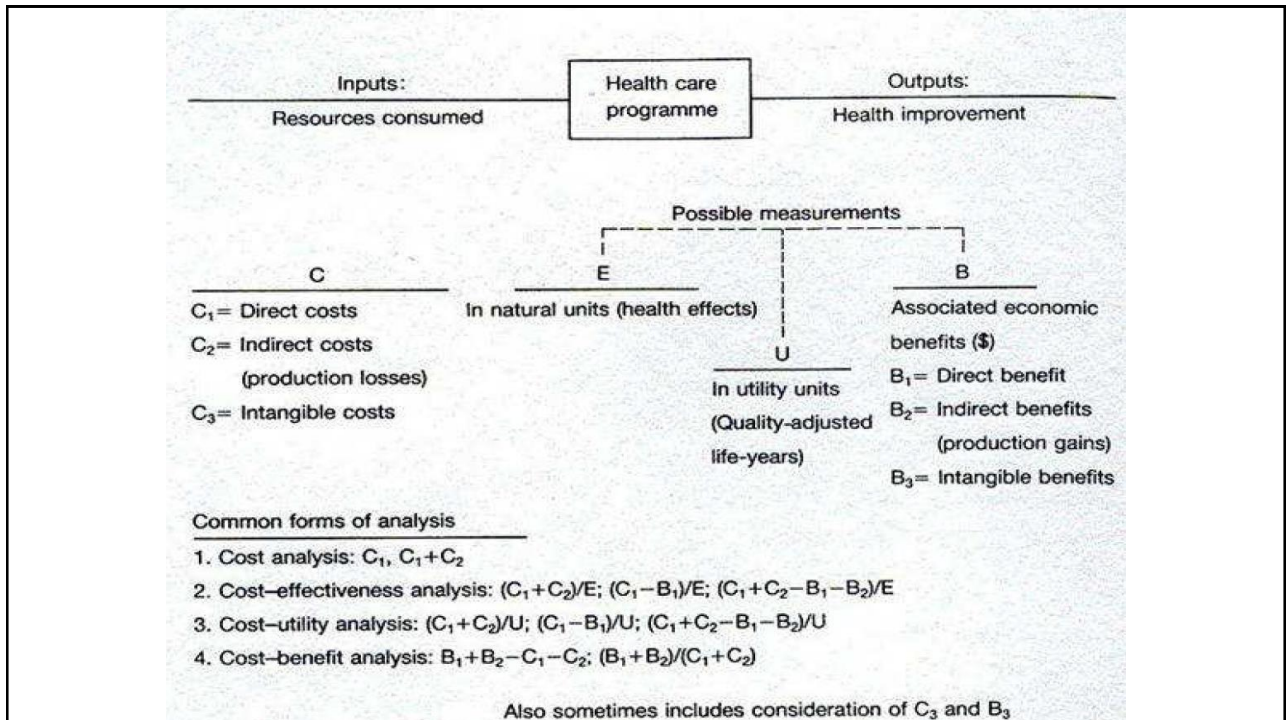
Types of Economic Evaluation

Economic Impact Analysis and Cost Analysis

- In **economic impact analysis (cost-of-illness study)** and **cost analysis** **only costs are assessed** and consequences or health effects of alternatives are not considered in the analysis
- **Economic impact analysis**
 - An economic impact analysis or cost-of-illness study estimates total costs of a disease, condition or clinical context
 - Medical and non-medical costs
 - Productivity losses
 - Generally reported as cost:
 - Annual total cost
 - Average patient lifetime cost
 - Shows potential benefits of technologies, interventions or programs

Economic Impact Analysis and Cost Analysis

- **Cost analysis**
 - First step of a full economic evaluation
 - Estimates total costs of a technology, intervention or program or compares different alternatives considering only their costs
 - Estimates total program costs and determines who incurs those costs
 - Programmatic cost analyses include all the resources required to implement an intervention, such as personnel, space and utilities, travel, materials, and supplies.
 - Offers foundation for budget justification, decision-making, and forecasting

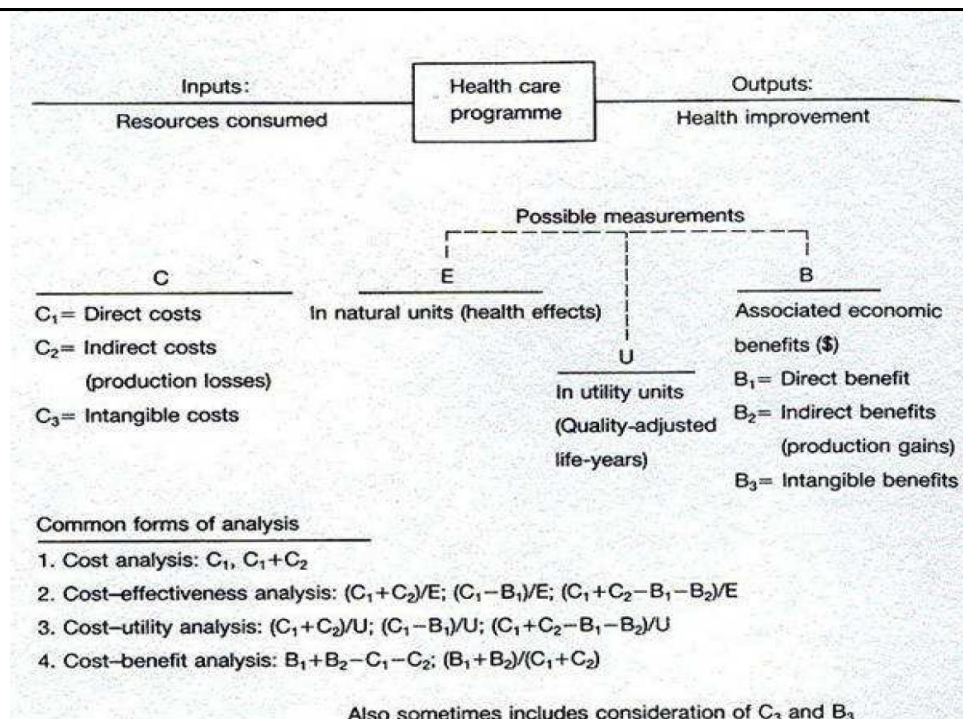


Cost Minimisation Analysis

- **Comparative analysis of two or more alternatives** taking into account their **costs and consequences**
- **However, in this type of study consequences or health effects of the alternatives are assumed equal**
- Ideally, this assumption should be based on **scientific evidence showing the non-inferiority or equivalence of alternatives**
- **Ultimately, only costs are considered in the comparative analysis of the alternatives**

Cost Minimisation Analysis

- In this type of analysis we aim to answer the following question:
Which of the alternatives has lower costs assuming they are equally effective?
- Results should be presented in monetary units in the form of **differences or ratios of costs** between the alternatives



Practical example

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Alternatives	Costs	Effectiveness (Average survival – Life Years)	Effectiveness (Utilities associated with the health states resulting from each alternative)	Effectiveness (Quality-Adjusted Life Years - QALYs)	Benefit (monetary value of the health effects of the alternatives)
A	\$20000	4,5 years	0,90	4,05 QALYs	\$40000
B	\$10000	3,5 years	0,80	2,80 QALYs	\$20000

Cost Minimisation Analysis

Comparative analysis of costs if we assume equal effectiveness / benefit of alternatives

In this example we would choose B, because it has lower costs than A

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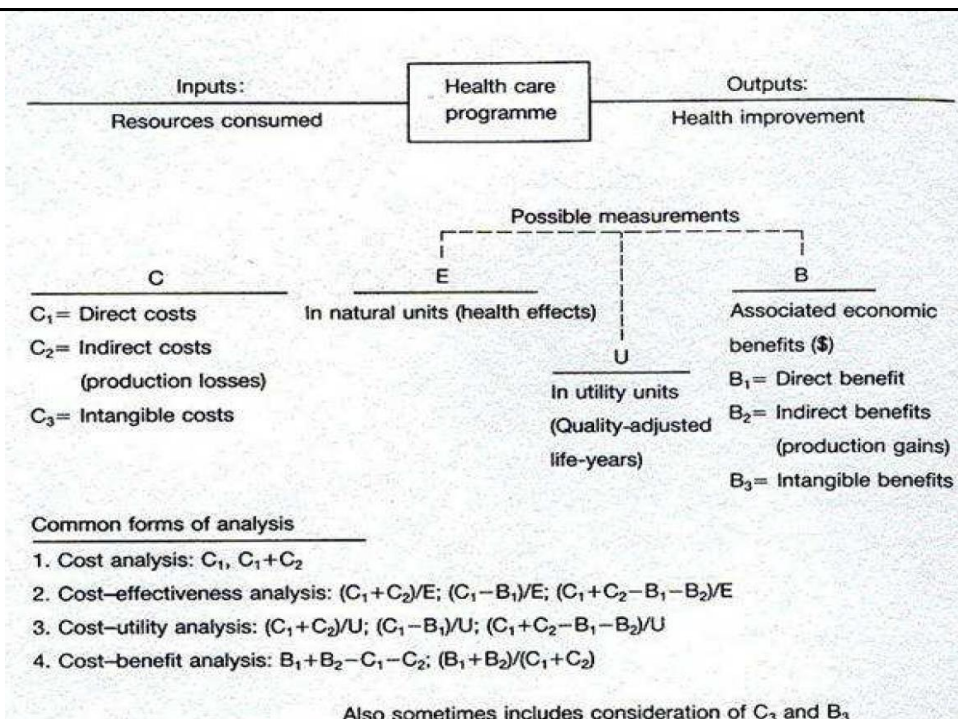
Cost-Benefit Analysis

- Cost-benefit analysis is a form of **complete economic evaluation**
- **Comparative analysis** of two or more alternatives taking into account their **costs and consequences or health effects**
- In this type of analysis the **consequences or health effects** of alternatives are **measured in monetary units**
- **Lists all costs and benefits over time**
 - Can have different time lines for costs and benefits
 - Can include non-health benefits

Cost-Benefit Analysis

- In this context, **Benefits** are defined as the **consequences, effectiveness or health effects of alternatives translated into monetary units**, which are then directly comparable to the monetary units of costs
- In this type of analysis we aim to answer the following question:

Is this program or intervention better than the alternative taking into account their costs and benefits (consequences, effectiveness or health effects of alternatives translated into monetary units)?



Cost-Benefit Analysis

- Assessing program benefits in a cost-benefit analysis is a little more challenging than assessing program costs
- Benefits can be direct, indirect, or intangible
 - Direct benefits
 - E.g. Medical expenditures saved for other purposes
 - Indirect benefits
 - E.g. Potential increased earnings or productivity gains
 - Intangible benefits
 - E.g. Psychological benefits of health, satisfaction with life

Cost-Benefit Analysis

- The main challenge in a cost-benefit analysis is to **translate the consequences, effectiveness, health effects or health outcomes of alternatives into monetary units**
- Example of a **hard and ethically complex task** is the **translation into monetary units of:**
 - Quantity of human life – Life-years of survival
 - Quality of human life
 - Satisfaction, pain or suffering of individuals

Cost-Benefit Analysis

- Conceptual frameworks and methodological proposals to translate consequences, effectiveness, health effects or health outcomes of alternatives into monetary units:
 - Valuing the **direct benefits** of a program, such as medical savings, follows the same methods used to estimate costs
 - Valuing **indirect benefits** in terms of **productivity gains** follows also similar methods as the estimation of productivity costs, using the **human capital method**
 - In addition, **three other methods can be used** for valuing benefits – **Friction cost method**, **Revealed preferences** and **Stated preferences**

Cost-Benefit Analysis

1) The human capital approach

- The human capital approach for valuing indirect benefits in a benefit-cost analysis is based on the theory of investment. People are viewed as capital investments whose sole purpose is to produce for society at large.
- Assumes that workers have a value equal to their earnings, because the fair market workplace would not pay workers more than they are worth. The value of their production potential in society is based on the wages they earn, including all the benefits associated with those wages. Some adjustments for their production potential within the household are usually included as well.
- If a disease, injury, or illness affects a person's productivity, the cost to society is valued in terms of lost earnings. Thus, the human capital approach is fairly straightforward when valuing a death associated with a disease. However, morbidity is more complicated to value (absenteeism and presenteeism) and may be dependent on occupation

Cost-Benefit Analysis

1) The human capital approach

- An example of how you would estimate the indirect benefits associated with a hypertension prevention program that increased productivity:
 - If annual income is 40,000 dollars and the fringe rate is 25 percent, then total earnings are 50,000 dollars.
 - If you assume 250 working days in the year, then the average total earnings, including fringe benefits, are 200 dollars per day.
 - Before the program, participants missed an average of 20 days of work per year, but after the program, the average was only 7 days.
 - Thus, the program gained 13 days of productivity potential per year.
 - The value of this benefit is 2,600 dollars.

Cost-Benefit Analysis

2) The Friction Cost Method

- An alternative to measuring productivity loss by the human capital approach which is more frequently used in Europe.
- This method is based on valuing productivity loss in the costs required to replace a given worker and the loss in productivity during the time it takes to do so.
- In the case of a short-term illness, a firm has no production loss if sick individuals make up the lost production on their return to work or if there is a pool of permanent reserve labour that can cover the sick worker. A firm has a production loss if there is a lasting drop in production while the sick individual is away from work.
- The sick person's lost production is compensated for by overtime payments on his or her return to work, overtime to colleagues, or temporary workers. In reality, unemployment exists in most societies, so there is always a pool of workers to draw from, and the opportunity cost of labour is zero after replacement.
- Hence, the value of productivity loss using the friction cost approach should be less than the value using the human capital approach. In fact, in many studies, the friction cost approach comes to 18 to 44 percent of costs valued using the human capital approach.

Cost-Benefit Analysis

3) The Revealed Preferences Method

- In this approach, you assess market goods to infer a value for non-market goods. The approach is based on real consumer choices for goods that may be similar to the non-market goods under consideration, such as a reduction in mortality risk.
- For example, we could look to the labour market to see how much people are willing to accept in extra compensation to have an increased risk of on-the-job fatality. This will help us infer how much they're willing to pay for a statistical life.
- Suppose a person is willing to trade Job A, which pays 40,000 dollars with no risk of death, for Job B, which pays 42,000 dollars with a 1 in 1,000 risk of death. That person is willing to accept 2,000 dollars to take a 0.001 risk of death. Therefore, society, which is defined as 1,000 people, values one statistical death at 2 million dollars.
- The problem with this approach is that the compensation people are willing to take for increased mortality risk varies widely, based on the context of the occupation. Many other factors may influence these decisions.
- Examples of revealed preferences valuations are insurance premium calculations or legal/civil compensation calculations

Cost-Benefit Analysis

4) The Stated Preferences Method or Contingent Valuation

- Another alternative to valuing benefits in a benefit-cost analysis is simply to ask people to state how much they are willing to pay. This is accomplished through sophisticated survey methodology.
- Respondents are presented with a hypothetical scenario, such as a risk of cardiovascular disease, and asked how much they would pay for a risk reduction in that scenario, or how much they would have to be paid to take an increased risk.
- How much respondents are willing to pay is contingent on the scenario presented, so it's called a contingent valuation.
- Stated preference, although used extensively in valuing non-market goods in environmental health, has not been widely applied in other biomedical fields.

Practical example

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Cost-Benefit Analysis

Results are expressed in monetary units

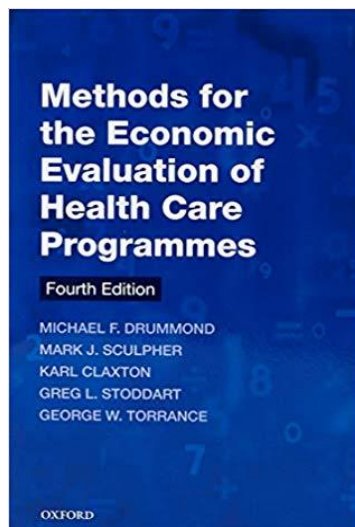
Monetary value of the health effects of the alternative A is \$ 40000; and for B it is \$ 20000

Ratio (A vs. B) benefit-cost (Ratio B-C): $(40000-20000)/(20000-10000)= 2$

Difference (A vs. B) benefit-cost (Incremental Net benefit): $(40000-20000)-(20000-10000)= 10000 \$$

Recommended readings

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HEALTH ECONOMICS AND DECISIONS IN HEALTH CARE SCIENCE



Drummond, M.F., Sculpher, M.J., Claxton, K., Stoddart, G.L., & Torrance, GW

Methods for the economic evaluation of health care programmes (4rd ed).

Oxford ; New York: Oxford University Press, 2015.