PHARMACOECONOMICS METHODOLOGIES

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INTRODUCTION

There is often more than one way of doing something in healthcare.

For example, there may be

- two different drugs that can be used to treat depression
- two surgical techniques for the management of dysmenorrhea

Note: Sometimes interventions may be against a 'do nothing' scenario.

INTRODUCTION

There are different ways in which we can choose one of these options.

We may decide to pick the more effective surgical technique, or we may decide to select the less costly antidepressant.

INTRODUCTION

Economic evaluation is a generic term for techniques that are used to identify, measure and value both the costs and the outcomes of healthcare interventions.

An **economic evaluation** is concerned with identifying the differences in costs and outcomes between options.

It can be defined as a study that compares the costs and benefits of two or more alternative interventions; so, the main components are costs and benefits.

TYPES OF ECONOMIC EVALUATION

There are four main types of economic evaluation

- *Cost-minimization analysis (CMA)*
- *Cost-effectiveness analysis (CEA)*
- *Cost-utility analysis (CUA)*
- *Cost-benefit analysis (CBA)*

Although they employ similar methods to define and evaluate costs, they differ in the methods used to estimate the benefits from a program or intervention.

TYPES OF ECONOMIC EVALUATION

Table 1. Pharmacoeconomic Methodologies

Methodology	Cost Measurement Unit	Outcome Unit
Cost–benefit	dollars	dollars
Cost-effectiveness	dollars	natural units (life-years gained, mg/dL blood glucose, mm Hg blood pressure)
Cost-minimization	dollars	assume to be equivalent in comparative groups
Cost-utility	dollars	quality-adjusted life-year or other utilities

COMPONENTS OF ECONOMIC EVALUATION

It is clear that economic evaluations can be understood in terms of the inputs (costs) and outputs (benefits or outcomes) of a healthcare intervention (Figure 5.1).

Figure 5.1 Components of economic evaluation.

COMPONENTS OF ECONOMIC EVALUATION

Therefore, an economic evaluation requires the systematic identification of costs and consequences of the healthcare interventions to be compared (Figure 5.2).

Any healthcare intervention can be seen as a process in this way.

COMPONENTS OF ECONOMIC EVALUATION

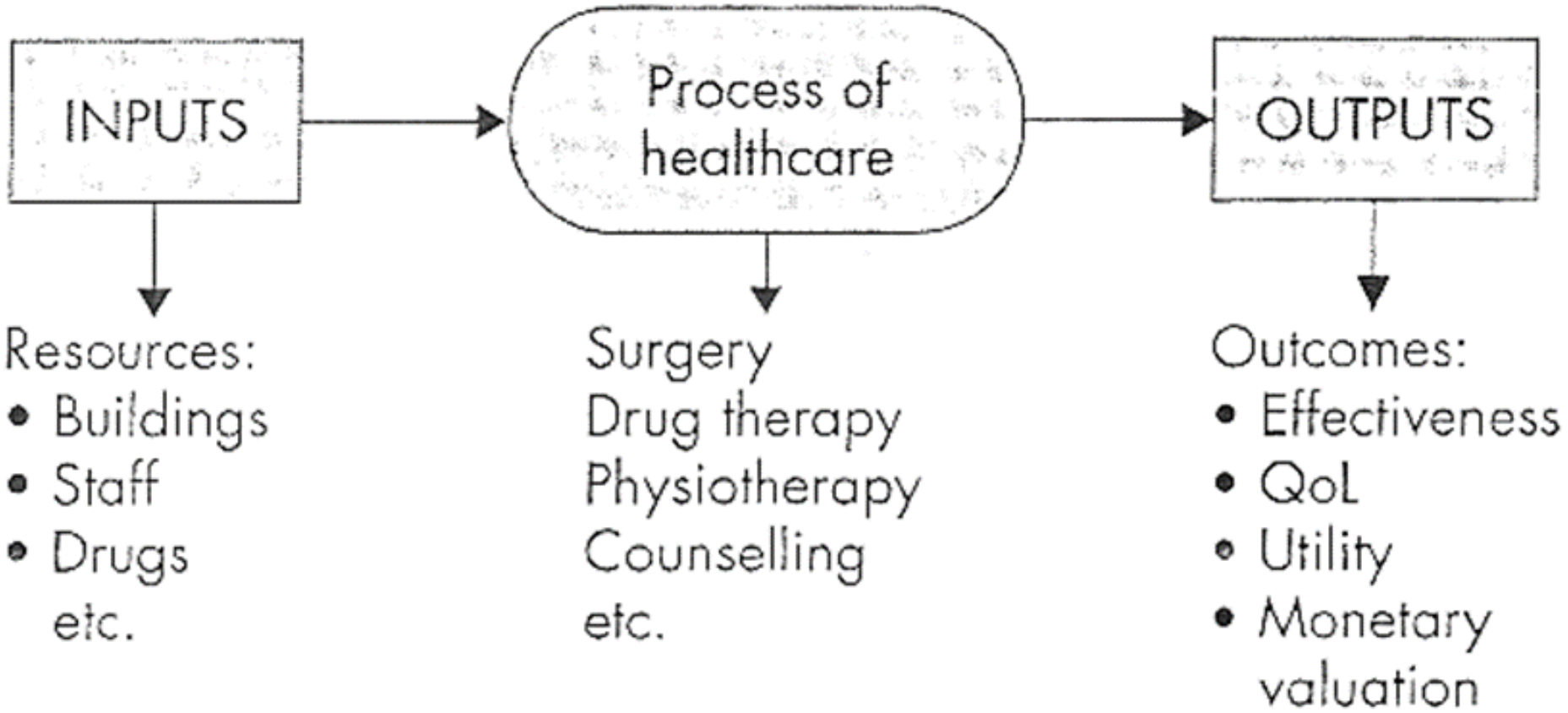

Figure 5.2 Seeing healthcare as a process.

Figure 5.3 illustrates how an operation can be shown as a process with inputs (resources consumed) and outputs (effect on the patient).

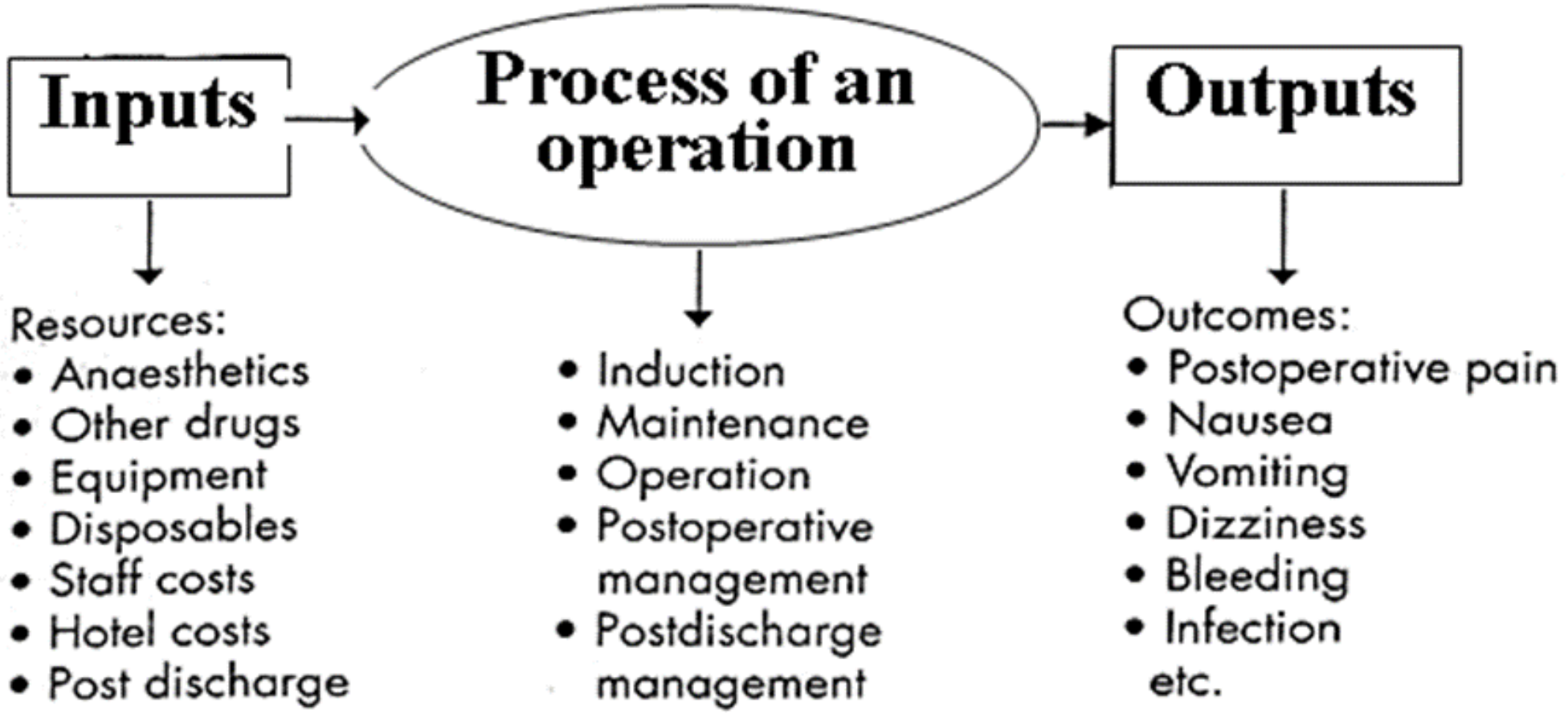

Figure 5.3 An example of a healthcare process: the process of an operation.

COST-MINIMIZATION ANALYSIS (CMA)

In CMA, the **outcome** of the treatments being compared is the **same**.

Having ensured that the outcomes between the comparators are equivalent, then the approach used is to consider the costs of each option.

The preferred option is the cheapest

COST-MINIMIZATION ANALYSIS (CMA)

For example, suppose two antibiotics, G and C, are equally effective in the treatment of Pseudomonas pneumonia, according to the current evidence.

Therefore, we should use the least costly alternative.

The following assumptions have been made:

- ***The two interventions are equally effective***
- ***All the costs were included***

COST-MINIMIZATION ANALYSIS (CMA)

In 2001, an economic evaluation of Atenolol versus Captopril in hypertensive patients with type 2 diabetes reported that there was no statistically significant difference in life expectancy between groups.

However, the mean cost per patient over the trial period was

- £6,485 in the Captopril group
- £5,550 in the Atenolol group

COST-MINIMIZATION ANALYSIS (CMA)

The cost difference between the two medications was statistically significant. Atenolol group showed less cost compared with the Captopril group owing to

- lower drug acquisition price
- fewer and shorter hospitalizations

The results from this CMA would suggest that Atenolol should be used in preference to Captopril in this group of patients.

COST-MINIMIZATION ANALYSIS (CMA)

Another common example of CMA is comparing medications that are the

- *same chemical entity*
- *same dose*
- *same pharmaceutical properties (i.e. they are bioequivalent)*

For instance,

- *brand versus generic*
- *(generic versus generic) generic made by one company compared with generic made by another company.*

In these cases **only the cost of the medication itself** needs to be compared because outcome should be the same

COST-MINIMIZATION ANALYSIS (CMA)

Another example of CMA includes measuring the cost of receiving the same medications in different setting.

For example researchers could measure the costs of receiving I.V. antibiotics in a hospital and compare this with receiving the same antibiotics (at same doses) at home via a home health care service.

COST-MINIMIZATION ANALYSIS (CMA)

CMA is the simplest of the four types of pharmacoeconomics analysis because the focus is on measuring the left-hand side of the pharmacoeconomics equation (the cost) and the right hand side of the equation (outcomes) is assumed to be the same.

This method is limited in use because it can only compare alternatives with the same outcomes.

COST-EFFECTIVENESS ANALYSIS

Cost-effectiveness analysis is a technique designed to assist a decision-maker in identifying a preferred choice among possible alternatives.

Generally, cost-effectiveness is defined as a series of analytical and mathematical procedures that aid in the selection of a course of action from various alternative approaches.

COST-EFFECTIVENESS ANALYSIS

Cost-effectiveness analysis has been applied to health matters where the program's inputs can be readily measured in dollars, but the program's outputs are more appropriately stated in terms of health improvement created (e.g., life-years extended, clinical cures)

OUTCOME MEASURES IN COST-EFFECTIVENESS ANALYSIS

In CEA, outcomes are reported in a single unit of measurement, and are given in natural units, for example mmHg for blood pressure reduction, or life years gained by transplantation.

The outcome measure is common to both alternatives, but may be achieved to different degrees (i.e. there is a difference in effectiveness).

OUTCOME MEASURES IN COST-EFFECTIVENESS ANALYSIS

An economic evaluation could examine the use of coronary artery bypass graft (CABG) surgery for ischemic heart disease compared with medical (drug therapy only) management.

The effectiveness of both treatment methods can be measured using mortality at 10 years. Evidence suggests that it is likely that mortality will be lower if CABG is used.

Therefore, cost-effectiveness analysis is the appropriate method to use because the outcome is common to the two alternatives, but there is a difference in effectiveness.

COST-EFFECTIVENESS RATIOS

Results from a CEA are typically expressed as a cost-effectiveness (C/E) ratio; the numerator of the ratio reflects total costs, while the denominator is the expression of the outcome variable.

Two forms of the C/E ratio exist:

(1) **average (simple)**

(2) **incremental (ICER)**

COST-EFFECTIVENESS RATIOS

The average (simple) C/E ratio is a straightforward approach, defined as follows:

$$\text{average (simple) C/E ratio} = \frac{\text{cost}}{\text{effect}}$$

COST-EFFECTIVENESS RATIOS

Although average C/E ratios provide useful information for analysts, incremental analyses are considered a hallmark of CEA.

In cost-effectiveness analysis (and cost-utility analysis) you will come across the regular use of incremental economic analysis.

This is a systematic method for identifying the difference (increment) in costs and outcomes between two healthcare interventions.

COST-EFFECTIVENESS RATIOS

The following questions are always asked:

- What is the difference in cost between the interventions?
- What is the difference in outcome between the interventions?

The answers to these questions allow the derivation of the

incremental cost-effectiveness ratio (ICER)

COST-EFFECTIVENESS RATIOS

Incremental cost/outcome ratios may be calculated using the following equation:

$$\frac{\text{Cost}_1 - \text{Cost}_2}{\text{Outcome}_1 - \text{Outcome}_2}$$

Outcome1 is the number of patients successfully treated with intervention 1.

Outcome 2 is the number of patients successfully treated with intervention 2.

Cost 1 is the cost of treating patients with intervention 1.

Cost 2 is the cost of treating patients with intervention 2.

COST-EFFECTIVENESS RATIOS

The ICER expresses the cost required to achieve each extra unit of outcome.

When one alternative is more effective but requires more resources, the ICER must be calculated.

In the situation when one alternative is more effective and less costly, this alternative is the **dominant therapy**.

When there is dominance, ICERs do not need to be generated.

EXAMPLE INCREMENTAL ECONOMIC ANALYSIS

An economic evaluation could examine the first-line management of community-acquired pneumonia using antibiotics A or C.

The effectiveness for both treatment methods can be measured using

'infections successfully treated'

EXAMPLE INCREMENTAL ECONOMIC ANALYSIS

The incremental economic analysis is carried out in the following way:

What are the costs associated with treatment

1. Antibiotic A [CostA]
2. Antibiotic C [Costc]

What are the outcomes associated with

1. Antibiotic A [Outcome A]
2. Antibiotic C [Outcome C]

EXAMPLE INCREMENTAL ECONOMIC ANALYSIS

What is the difference in cost between using antibiotic A and antibiotic C?

- [Cost A – Cost C]

What is the difference in outcome between using antibiotic A and antibiotic C?

- [Outcome A – Outcome C]

ICER for treating community-acquired pneumonia with antibiotic A instead of antibiotic C

$$\frac{[\text{Cost}_A - \text{Cost}_C]}{[\text{Outcome}_A - \text{Outcome}_C]}$$

Theoretical costs of treatment

	Cost of treating 100 patients (£)	*Effectiveness (percentage treatment of infections)*
Antibiotic A	7,000	75
Antibiotic C	8,000	80

So, it costs £1,000 more to treat 100 patients with antibiotic C. Five more pneumonias are successfully treated with antibiotic C. Therefore, the ICER is £200 per extra pneumonia successfully treated with antibiotic C.