COST-UTILITY ANALYSIS (CUA)

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WHAT IS COST-UTILITY ANALYSIS?

CUA is a formal economic technique for assessing the efficiency of healthcare interventions.

It is considered by some to be a specific type of cost-effectiveness analysis in which the measure of effectiveness is a **utility**- or **preference-adjusted outcome**.

Utility is the value or worth placed on a level of health status, or improvement in health status, as **measured** by the **preferences** of **individuals** or **society**.

WHAT IS COST-UTILITY ANALYSIS?

Measurement of health state utilities or preference values is necessary for calculation of the most commonly used outcome measure in this type of analysis:

quality-adjusted life-years (QALYs) gained

WHAT IS COST-UTILITY ANALYSIS?

CUA has some distinct advantages over cost-effectiveness analysis.

Cost-effectiveness analysis is limited by the inability to simultaneously incorporate multiple outcomes from the same intervention or to compare interventions with different outcomes.

In cost-effectiveness analysis, although the outcome measure is in natural units (e.g., **life years saved**), no attempt is made to value the consequence or outcome in terms of **quality** or **desirability**.

WHAT IS COST-UTILITY ANALYSIS?

In contrast, CUA incorporates the **quality of** (or preference for) the **health outcome** achieved.

CUA, using QALYs gained as the outcome measure, is the most common approach to combining **quantity** and **quality-of-life** outcomes in economic evaluations.

In a cost-utility analysis (CUA) the outcomes of the two alternatives are measured using **utility values**, that is, the value attached to the health states produced by the two interventions.

WHAT IS COST-UTILITY ANALYSIS?

The value may be attached by

- *Patients*
- *Health professionals*
- *The general population* (is preferred)

CUA is actually a form of cost-effectiveness analysis but utility is used instead of natural units to measure outcomes.

WHEN IS COST-UTILITY ANALYSIS APPROPRIATE?

There are several circumstances in which CUA may be the most appropriate analytic approach:

1. When **health-related quality of life** is the **important outcome.**

   For example, when comparing interventions that are not expected to have an impact on mortality, but a potential impact on patient function and well-being (e.g., **treatments for osteoarthritis**).

WHEN IS COST-UTILITY ANALYSIS APPROPRIATE?

2. When **health-related quality of life** is an **important outcome.**

   for example, evaluation of the outcomes associated with the treatment of acute myocardial infarction.

   Not only is lives saved an important outcome measure, but also the quality of the lives saved.

WHEN IS COST-UTILITY ANALYSIS APPROPRIATE?

3. When the intervention affects both **morbidity** and **mortality** and a combined **unit of outcome** is **desired**.

   For example, evaluation of a therapy, such as estrogen use by postmenopausal women, that can improve quality of life, may reduce mortality from certain conditions (e.g., heart disease), but may increase mortality from other conditions (e.g., uterine cancer).

WHEN IS COST-UTILITY ANALYSIS APPROPRIATE?

4. When the interventions being compared have a wide range of potential outcomes and there is a need to have a common unit of outcome for comparison.

   This is most commonly the case when a decision-maker must allocate limited resources among interventions that have different objectives and resultant benefits—for example, the choice between providing increased prenatal care or expanding a hypertension screening and treatment program.

5. When the objective is to compare an intervention with others that have already been evaluated in terms of **cost per QALY** (or equivalent) gained.

WORKED EXAMPLE

Economic evaluation of management of anemia in hemodialysis patients

Patients with chronic renal failure who are on hemodialysis suffer from profound anemia, which is often extremely debilitating.

This is due to a reduction in the production of erythropoietin in these patients, and loss of blood during hemodialysis.

WORKED EXAMPLE

Historically, these patients have been managed by the use of blood transfusions.

Now, synthetic erythropoietin is available. It is considered to be highly effective, but is very expensive.

So the alternatives are to either give erythropoietin or to give blood transfusions when the patient's "haemoglobin level is below 8g/dl.

WORKED EXAMPLE

Cost information

Total costs to manage the 1000 patients for 1 year using blood transfusions:

£3,128,000

Total costs to manage the 1000 patients for 1 year using erythropoietin:

£5,547,100

WORKED EXAMPLE

Outcome information

Utility data for the two alternatives available from the literature suggest that patients maintained on erythropoietin value their health states at a higher level than those maintained on blood transfusions.

In a study, 100 patients stated that for a treatment period of 10 years, their utility value for each year (when valued from 0 to 1) on **erythropoietin** was **0.80**, whereas on **blood transfusions** it was **0.75**.

WORKED EXAMPLE

1. What is the difference in cost between the two alternatives for the 1000 patients?

£2,419,100.

2. What is the difference in utility production of the two alternatives, i.e. how many extra QALYs are produced by erythropoietin per year of treatment, for the 1000 patients?

Change in utility = 0.80 - 0.75

= 0.05 QALYs per patient per annum

= 50 QALYs per 1000 patients per annum.

Figure. illustrates the difference in utility production for the two alternatives.

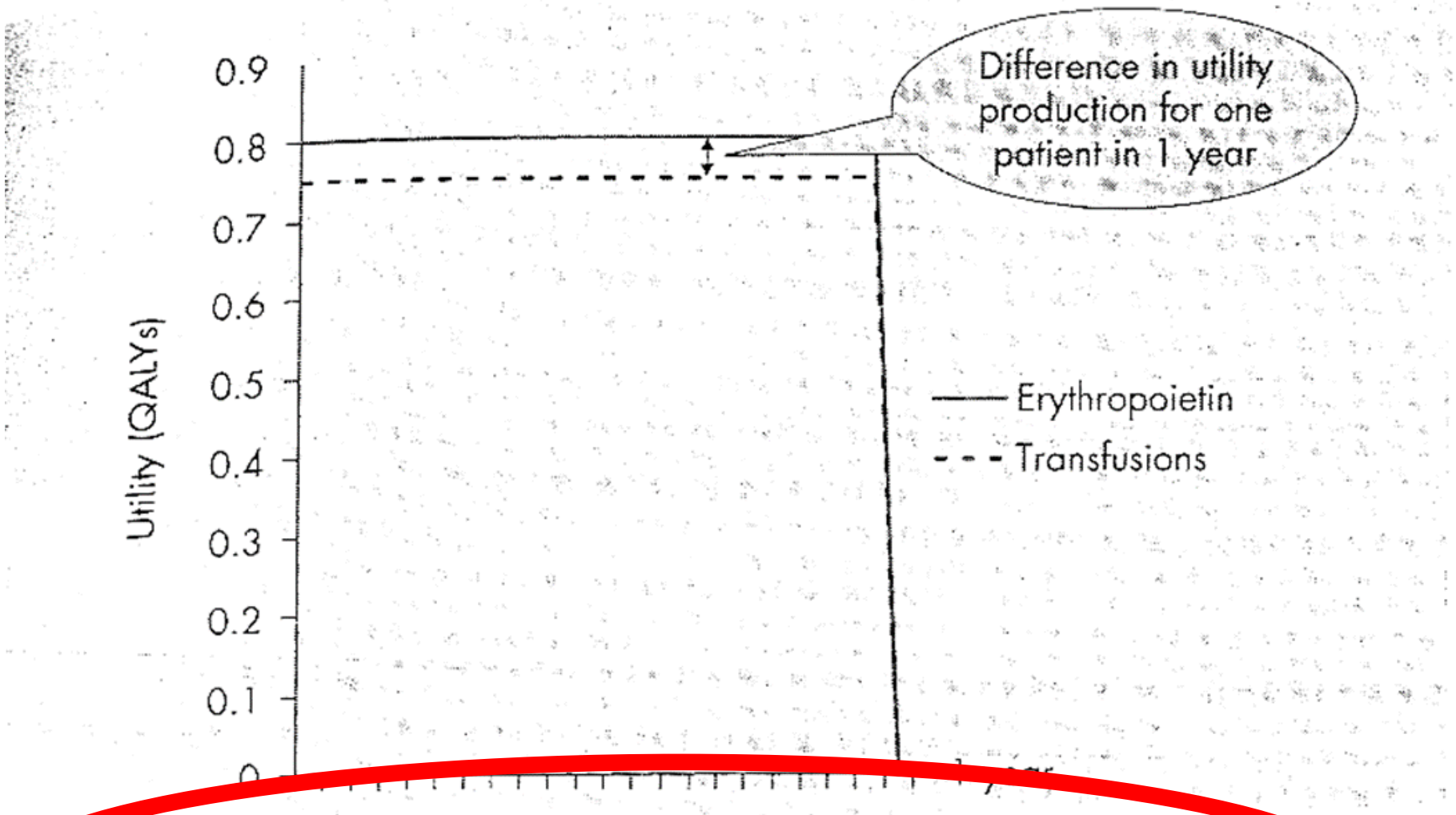


Figure 6.1 Utility produced over 1 year for erythropoietin vs blood transfusions.

WORKED EXAMPLE

3. Calculate an incremental cost–utility ratio for erythropoietin.

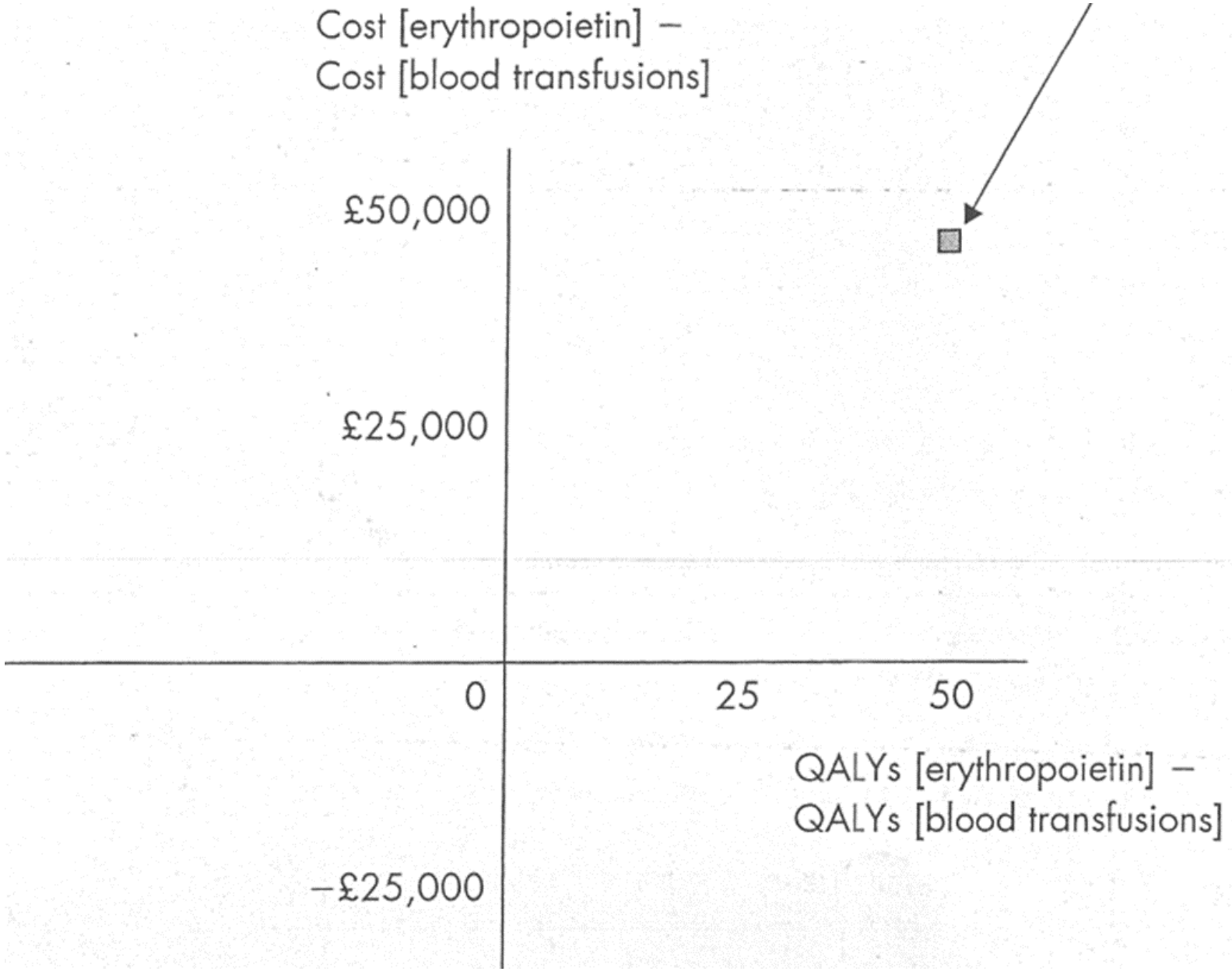
$$\text{ICER} = \frac{\text{Change in cost}}{\text{Change in outcome (utility)}}$$

$$= \frac{£2,419,100}{50}$$

$$= £48,382 \text{ per extra QALY gained by erythropoietin.}$$

This cost per QALY can be plotted on a cost-effectiveness plane (Figure 6.2). You can see that this ICER is in the northeast quadrant because erythropoietin is more effective and more costly.

Cost-effectiveness plane for erythropoietin vs blood transfusions



WORKED EXAMPLE 2..

A group of community nurses (**Group A**) wants to set up an asthma patient monitoring service for a GP practice which has 200 asthma patients.

Results from a study suggest that the practice will have **cost reductions** and the patients will have **improved outcomes** (see the coming table).

WORKED EXAMPLE 2..

Impact of a nurse-led asthma monitoring services

Costs and outcome measures for 1 year	Before asthma service	With asthma service	Difference
Prescribing costs (£)	20,000	16,000	- 4,000
Hospital costs (£)	2,000	1,000	- 1000
Nurse services costs (£)	0	4,000	4,000
Total costs (£)	22,000	21,000	- 1,000
Emergency hospital admission due to asthma	20	10	- 10

WORKED EXAMPLE 2..

Another group pf community nurses (**Group B**) wants to set up an ischemic heart disease (IHD) patient monitoring services for the same GP practice, which has 250 IHD patients.

Results from a study suggest that the service will be **cost neutral** and the patients will have **improved outcome**.

WORKED EXAMPLE 2..

Impact of a nurse-led ischemic heart disease monitoring services

Costs and outcome measures for 1 year	Before IHD service	With IHD service	Difference
Prescribing costs (£)	25,000	20,000	- 5,000
Hospital costs (£)	10,000	5,000	- 5,000
Nurse services costs (£)	0	10,000	10,000
Total costs (£)	35,000	35,000	0
Emergency hospital admission due to chest pain	50	25	- 25

WORKED EXAMPLE 2..

The practice has to decide whether

to reduce **emergency admissions** due to **asthma** by

10 a year and save £1,000

reduce **emergency admissions** due to **chest pain**

by 25 a year at no change in costs

WORKED EXAMPLE 2..

How can the GP objectively compare and choose between improving the health of asthma and IHD patients?

Groups A and B elicit utility values from the 200 asthma and 250 IHD patients.

Time trade-off was used to elicit the utility values and these were used to calculate QALYs.

WORKED EXAMPLE 2..

The groups obtain the following results:

	Asthma patients	IHD patients
Mean QALYs before intervention	0.75	0.60
Mean QALYs after intervention	0.85	0.75
Incremental QALY change caused by intervention	0.10	0.15

WORKED EXAMPLE 2..

The results refer to a 1-year period.

The **asthma** patients improved their **quality of life per year** by

0.10 QALYs each

The **IHD** patients improved their **quality of life per year** by

0.15 QALYs each

WORKED EXAMPLE 2..

Incremental cost-effectiveness ratio (ICER):

$$\frac{\Delta \text{Cost}}{\Delta \text{QALY}} = \frac{\text{Cost}_{\text{IHD service}} - \text{Cost}_{\text{asthma service}}}{\text{QALY}_{\text{IHD service}} - \text{QALY}_{\text{asthma service}}}$$

$$= \frac{0 - (-1000)}{(250 \times 0.15) - (200 \times 0.10)} = \frac{1000}{17.5}$$

= £57 per QALY gained from the IHD service over the asthma service.

WORKED EXAMPLE 2..

If the GP practice funds the IHD service it will cost them **£1,000 per year** more than the asthma service, but they will obtain **17.5** more **QALYs** for their patients.

EXERCISE 1: CALCULATING A COST PER QALY

Several treatments exist to treat fungal toenail infections. Four oral medicines used are drugs A, B, C and D.

The table below shows the costs (£) associated with treating one patient with each of these four treatments:

	Drug A	Drug B	Drug C	Drug D
Total costs (£)	1,301	1,503	1,570	1,200

EXERCISE 1: CALCULATING A COST PER QALY

You then find some evidence to suggest that two of these agents have differing effects on patients' quality of life owing to difference in their side-effect profiles.

This evidence is summarized below:

Agents	Increase in QALYs per patient per year
Drug C	0.10
Drug D	0.05

EXERCISE 1: CALCULATING A COST PER QALY

What is the difference in utility production of the two alternatives, per year of treatment for the 100 patients?

0.05 QALYs per patient per year = 5 QALYs per 100 patients per year.

Calculate an incremental cost-utility ratio for drug C compared with drug D.

$$\text{ICER} = \frac{\text{Cost (drug C)} - \text{Cost (drug D)}}{\text{Outcome (drug C)} - \text{Outcome (drug D)}}$$

$$= \frac{100(1{,}570 - 1{,}200)}{10 - 5} = \frac{37{,}000}{5}$$

= £7,400 per extra QALY.

Draw a cost-effectiveness plane and place the ICER you have calculated on that graph. You should have a point plotted in the northeast quadrant (Figure 6.4).

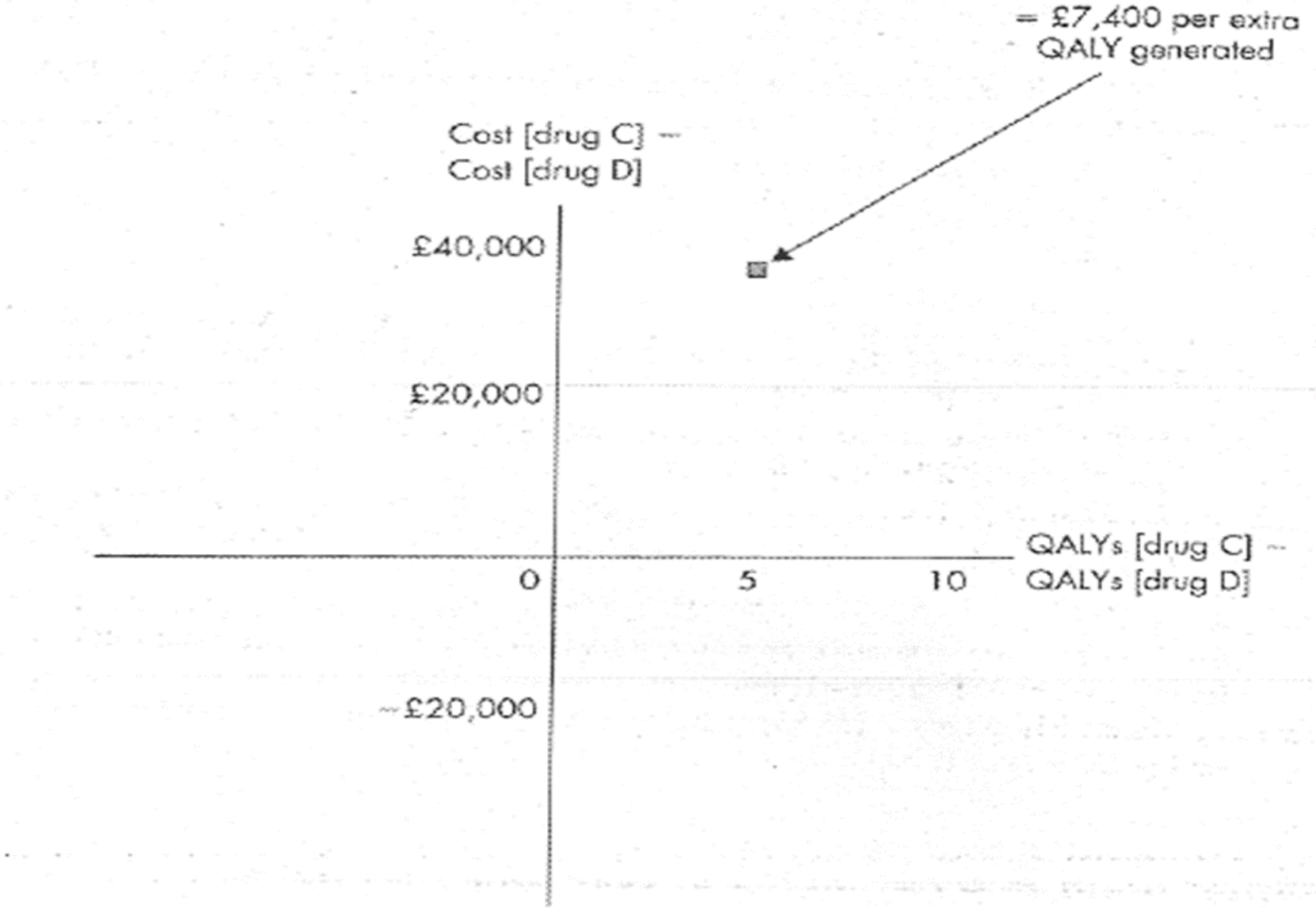


Figure 6.4 Cost-effectiveness plane for drug C versus drug D.

EXERCISE 1: CALCULATING A COST PER QALY

Which treatment will you recommend to your Trust, and why?

Either could be recommended, depending on the driving force for the choice.

Is cost containment most important?

Then choose drug D.

Is improved patient outcome most important?

Then choose drug C.


Thanks!