

# **BASIC CONCEPTS IN PHARMACOECONOMICS**

## **Types of pharmacoeconomic evaluation 2**

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**Dr Eman A. Hammad  
Dr.Rimal Mousa**

# SO FAR ..

## ○ **Full economic evaluation**

- Must be a comparison of two or more alternatives
- Must be a comparison both the costs and consequences

## ○ **CMA**

- The outcomes of different interventions are the same
- Choose the intervention that costs the least

## ○ **CEA**

- Therapeutic outcomes of different interventions can be expressed in common natural units

## ○ **Dominance of an intervention**

- More effective and less costly compared to the control (existing alternative)

### 3. Cost Utility Analysis (CUA):

- It is a form of EE with particular attention on quality of the health gained
- The outcomes are measured in units of **utility**
- E.g.

Knowing that intervention A with cost of £500 can prevent a fall while intervention B with cost of £200 can reduce pain by 50% **How we could estimate the benefits using one generic outcome?**

# QUALITY OF LIFE

- Most modern medicine improves quality, rather than quantity, of life
- Many factors impact on QoL :
  - Functional
  - Social
  - Psychological
  - Cognitive

} Obtained through patient questionnaires
- The instruments used to measure QoL measures can be divided into
  - **generic**
  - **disease-specific**

} Non-preference based measures (QOL generated were not based on preference or choices between different health states)

- Disease-specific QoL instruments
  - Used to assess the impact on patients within specific disease,
  - such as the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire C30 (EORTC QLQ-C30)
  
- Generic measures can be used to compare outcomes in different patient groups with different diseases
  - The most commonly used questionnaire is the Short Form 36 (SF-36)
  
- The limitation with using these non-preference based specific or generic QoL questionnaires
  - These measures are not presented on interval or ratio scales to allow comparison between different group of patients with different illness or interventions, and thus are not suitable as an outcome measures in economic evaluations

# UTILITY

- Utility' score represents people's preferences towards a particular health state on an interval scale, where 0 represents state equal to dead and 1 represents full health, , **i.e. outcomes can't be expressed in monetary units.**
  - Adv: allow outcome comparison across different treatments and patient groups.
  - generate a 0 to 1 scale allows combining utility with life year gained to generate the quality adjusted life year (QALY)
- Utility is a subjective level of wellbeing that people experience in different states of health
- Different individuals may attach different values ("UTILITY") to the same health state.

# TYPE OF RESPONDENTS

- Responders who would undertake this valuation could be patients, those at risk of developing the condition, members of the public (community), or clinical staff

# UTILITY INSTRUMENT MEASUREMENT

EQ-5D has five dimensions:

- mobility,
- self-care,
- usual activities,
- pain/discomfort,
- anxiety/depression.

3 levels per dimension

This means there are 245 possible health states  
( $3^5 + \text{dead} + \text{unconscious}$ ).





## EQ-5D

By placing a tick  in one box in each group below, please indicate which statements best describe your own health state today.

### Mobility

- I have no problems in walking about
- I have some problems in walking about
- I am confined to bed

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

### Self-Care

- I have no problems with self-care
- I have some problems washing or dressing myself
- I am unable to wash or dress myself

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

### Usual Activities (e.g. work, study, housework, family or leisure activities)

- I have no problems with performing my usual activities
- I have some problems with performing my usual activities
- I am unable to perform my usual activities

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

### Pain/Discomfort

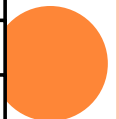
- I have no pain or discomfort
- I have moderate pain or discomfort
- I have extreme pain or discomfort

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

### Anxiety/Depression

- I am not anxious or depressed
- I am moderately anxious or depressed
- I am extremely anxious or depressed

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>



This is what 2 of these health states look like:

Health State 11111: (1.00)

No problems walking about

No problems with self-care

No problems performing usual activities

No pain or discomfort

Not anxious or depressed

Health State 21111: (0.85)

Some problems walking about

No problems with self-care

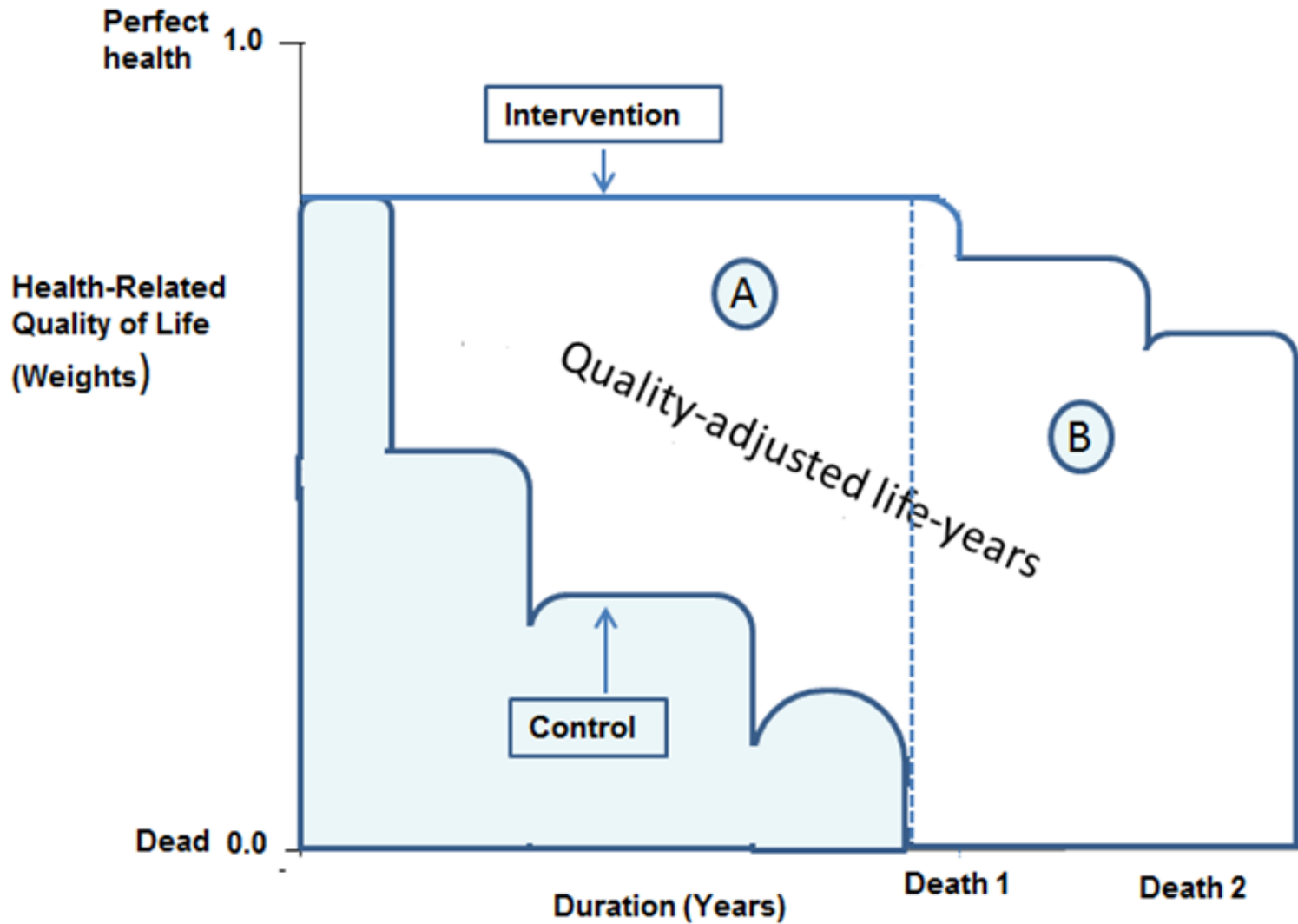
No problems performing usual activities

No pain or discomfort

Not anxious or depressed

Note: The EQ-5D health state are converted to utility score using  
a published values

- Results of CUA are commonly expressed as cost per quality-adjusted life years (QALYs) gained
- QALYs incorporate changes in both quantity (longevity/mortality) and quality (morbidity, psychological, functional, social, and other factors) of life. **i.e. quantity and the quality of life improved**
- QALYs are used to quantify the utility and are calculated by weighting the additional life years gained (LYG) by their utility values to obtain the QALY
  - QALY assigns to each period of time (LYG) a weight (Utility score) ranging from 0-1
  - A weight of 1 corresponds to optimal health and a weight of 0 corresponds to health state judged to be equivalent to death”



# EXAMPLES

## What do you think of these? How we can compare them

- Chemotherapy may increase survival but decrease well-being.
- Postmenopausal oestrogen therapy which improves patient quality of life, but may reduce survival
  - QALY is a generic outcome measure can help us to compare these interventions
  - 1 QALY means one year of perfect quality of life

## ANOTHER EXAMPLE

- New drug
  - New drug QALYs = 0.8
- Old drug
  - Old drug QALYs = 0.75

What is QALY gained?

$$\Delta \text{QALY gained} = 0.8 - .75 = 0.05$$

## CONTINUE-EXAMPLE

- New Drug Costs =£20,000
- Old Drug Costs =£10,000

Calculate ICER?

$$\text{ICER} = \frac{\text{Cost Drug B (new)} - \text{Cost Drug A (old)}}{\text{QALY Drug B (new)} - \text{QALY Drug A (old)}}$$

$$\text{ICER} = \frac{\text{£20,000} - \text{£10,000}}{0.05 \text{ QALY}}$$

$$\text{Cost per QALY} = \text{£200,000/QALY}$$

# STRENGTHS

## Strengths

- Comparing health outcome measures across different disease area and services with the health care system, i.e. new vaccination program or new heart disease medications



# LIMITATIONS

- What if
  - One treatment improves quality of life in a 10 year old child by 0.05 for life
  - Another improves quality of life in a 80 year old by 0.1 for 4 years
  - Which should we purchase assuming costs are the same?

## Limitations

- Ageist
  - QALYs are biased toward younger population since the LYG expected to be prolonged for younger population are longer than those for older population
- Depends on perspective or value
- Measuring patient utilities is difficult and preferences may change in the course of an illness

**What seems an intolerable burden to a healthy individual may not seem so bad to someone who might otherwise is nearly close to death**

# SUMMARY NOTES

- **Utility** is an economist's word for satisfaction, or sense of well being
  - Evaluate the quality of a state of health, and not just its quantity.
- Utility estimates often informed by measures of quality of life in different disease states (i.e. during the clinical course of the disease, the utility will change).
  - **integrate both quality and the quantity of life**
- The concept of the QALY has **advanced thinking on how to incorporate quality of life into economic evaluations.**

# CALCULATING QALYS - A SIMPLE EXAMPLE

## **With treatment X**

Estimated survival = 10 years

Estimated quality of life

(relative to 'perfect health') = 0.7

$$\text{QALYs} = (10 \times 0.7) = 7.0$$

## **Without treatment X**

Estimated survival = 5 years

Estimated quality of life

(relative to 'perfect health') = 0.5

$$\text{QALYs} = (5 \times 0.5) = 2.5$$

$$\text{QALY gain from treatment X} = 7 - 2.5 = 4.5 \text{ QALYs}$$

If the cost of treatment X is £18,000 then the cost per QALY is £4,000 per QALY (£18,000 divided between 4.5 additional QALY's)

## CHECK YOUR UNDERSTANDING

- If a treatment increases one's life expectancy by 2 years, but causes adverse effects or inconvenience, such that one's utility are decreased by 25%, the net gain or QALY gained will be

**Answer:  $2 \times 0.75 = 1.5$  QALYs.**

#### 4. Cost-benefit analysis (CBA):

- Both costs and benefits are quantified in monetary terms.
- Benefits are translated into dollars
- The 'perceived value' is used as the outcome, i.e. How much the patients valued the health outcome in monetary term
- Value is determined by asking patients how much they would be 'willing to pay'
- Subtract willing to pay for the cost from the benefit of therapy (choose alternative with highest net benefits)
- Both benefit and cost measured in the same unit, and thus ICER is not required to generated

# CBA

- The benefit measured as the associated economic benefit of an intervention

**Eg. monetary value of returning a worker to employment earlier), and hence both costs and benefits are expressed in money**

- CBA is considered the most comprehensive method of economic evaluation

## LIMITATION

- However,

**Think how much you are willing to pay for a shawerma sandwich if you are:**

- Hungry vs. not hungry
  - Vegetarian vs. big meat eater
  - You don't like shawerma at all
- 
- CBA can be highly biased



# LIMITATION

- Willingness to pay is dependent on:
  - Perceived need
  - Experience
  - Values
  - Personal wealth
  - CBA may also seem to discriminate against those in whom a return to productive employment is unlikely, eg the elderly, or the unemployed.
- Methodology difficult to overcome these biases



# VIRTUE OF CBA

- It allows comparisons to be made between very different areas, and not just medical, (Health versus non health sector, such as education, transportation)
  - e.g. cost benefits of expanding university education (benefits of improved education and hence productivity) compared to establishing a back pain service (enhancing productivity by returning patients to work).
- This approach is **not widely** used in health economics, although many
- **Economists argue that health should be another commodity, and not necessarily valued more than other possible uses of the resources.**

# CALCULATING RESULTS OF COSTS AND BENEFITS

- Net benefit or (Net cost)

Net benefit = total benefit - total costs

Net cost = Total costs - total benefits

Generally we accept to fund the intervention if Net benefit  $> 0$  or Net Cost  $< 0$

Overall Net benefit = Net benefit of intervention - Net benefit of control

# CHECK YOUR UNDERSTANDING

## Programme A

	Year				
	0	1	2	3	4
Costs (C)	300	50	50	50	50
Benefits (B)	100	150	200	200	200
<b>NPV (B-C)</b>	<b>-200</b>	<b>100</b>	<b>150</b>	<b>150</b>	<b>150</b>

1. What is the total net benefit over the duration of the programme as compared to intervention?

# ANSWERS

- The total net benefit (undiscounted) over the course of the programme = 350 JDs
  - $\Sigma -200, 100, 150, 150, 150$
- The benefit/ cost ratio =1.7
  - **850/500**

- Suppose decision maker had to choose between two proposals for implementation. Also assume that the projects are for 1 year
- Proposal A: Cost=\$1000; Benefit=\$2000
- Proposal B: Cost=\$5000; Benefit=\$7500
  
- Net benefit:
  - $A = \$2000 - \$1000 = \$1000$ ;  $B = \$7500 - \$5000 = \$2500$
- Net cost:
  - $A = \$1000 - \$2000 = -\$1000$ ;  $B = \$5000 - \$7500 = -\$2500$
- Differences in net benefit of B as compared to A
  - $2500 - 1000 = 1500$

<b>Method of economic evaluation</b>	<b>Measurement of outcome (health benefits)</b>	<b>Synthesis of costs and benefits</b>
Cost minimisation analysis Special type	Assumed to be equivalent and can take any form (e.g. number of cases detected, reductions in cholesterol levels, years of life saved)	Additional costs of therapy A relative to B
Cost effectiveness analysis	Health benefits across therapies are measured in similar natural units	Cost per life year gained Cost per patient cured, Cost per life saved, etc.
Cost utility analysis	Health benefits across therapies are valued in similar units based on individual preferences	Cost per QALY gained Cost per HYE gained
Cost benefit analysis	Measured in similar or different units and are always valued in monetary units (e.g., amount willing to pay to prevent a death, amount willing to pay to reduce exposure to a hazard)	Net benefits = Benefits minus costs Benefit- cost ratio = benefits/costs

# OTHER PE EVALUATION TYPES

- Other forms of **quasi-health economic** evaluation may be seen in the literature but are not true economic evaluations
  - They do not weigh costs and benefits in an incremental manner.

Most common example

- **Cost consequences analyses:** consider multiple outcomes, costs are presented in a disaggregated form. However, the result is not presented in an incremental cost-effectiveness ratio.
  - The reader or the decision maker has to make their own judgment regarding the relative importance of costs and outcomes.

## IN SUMMARY

- In cost effectiveness analysis, outcomes are expressed as measures of health improvement such as cost per patient whose blood pressure was brought under control.
- In cost utility analysis, the cost of an intervention is assessed with a particular measure of health improvement, the quality-adjusted life year.