

# Health Economics

## Informing Decisions in Healthcare

Ian Jacob

Health Economics & Outcomes Research Ltd

Webinar

8<sup>th</sup> October 2019

# Aim for the Workshop

- Introduce the key concepts of health economics
- Consider practical, real world examples
- Questions & Answers

# What is Economics About?



**Scarcity**



**Choice**

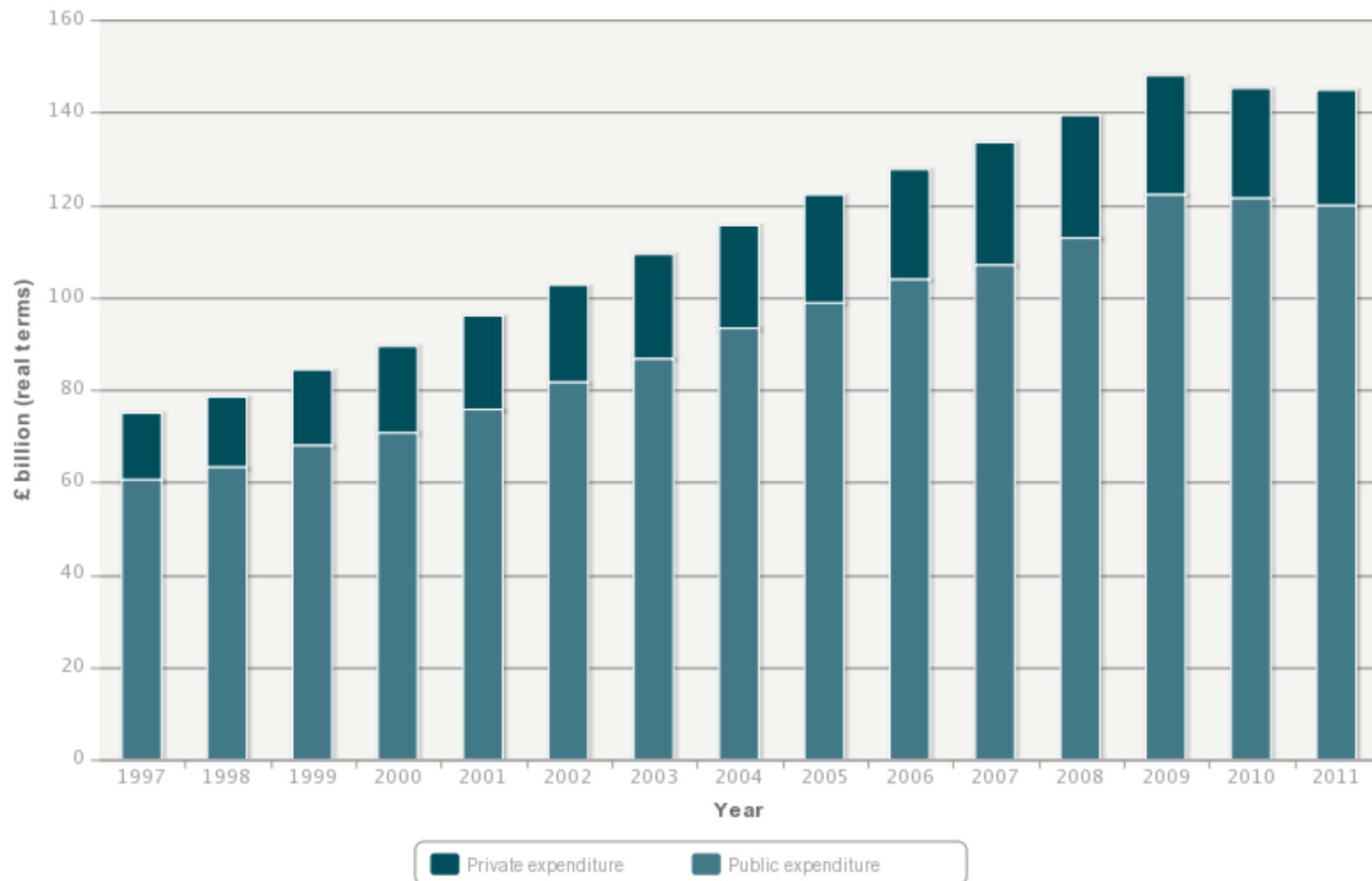


**Budget  
Constraint**

# Is health care economically important?

- Health expenditure in the USA:
  - passed \$1,000,000,000,000 (one trillion) by 1997
  - now accounts for just over 15% of USA GDP
  - is forecast to account for US\$3.6 trillion - nearly one fifth of all US economic activity - by 2014
  - will plausibly reach 33% of GDP by 2050
- Health expenditure in the UK:
  - comprises 17% of all Government spending
  - is a major consideration in fiscal management of the economy
- In every developed economy:
  - health care is a major component of spending, investment and employment
  - the economic performance of the health care system is crucially linked to the overall economic well-being of a country and its citizens

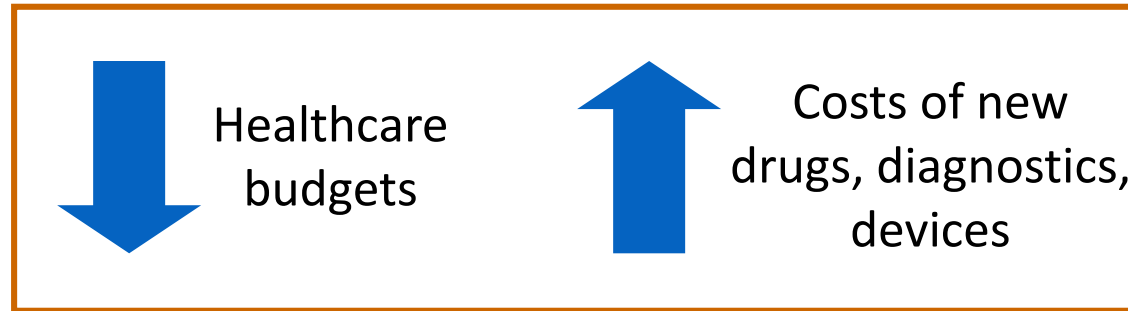
## UK spending on public and private health care: 1997 - 2011 (in real terms at 2011 prices)



© Nuffield Trust

# Why do we need health economics?

The problem:



Health economics is needed to inform decision-makers on which products to support in order to maximise the health of the **whole population**

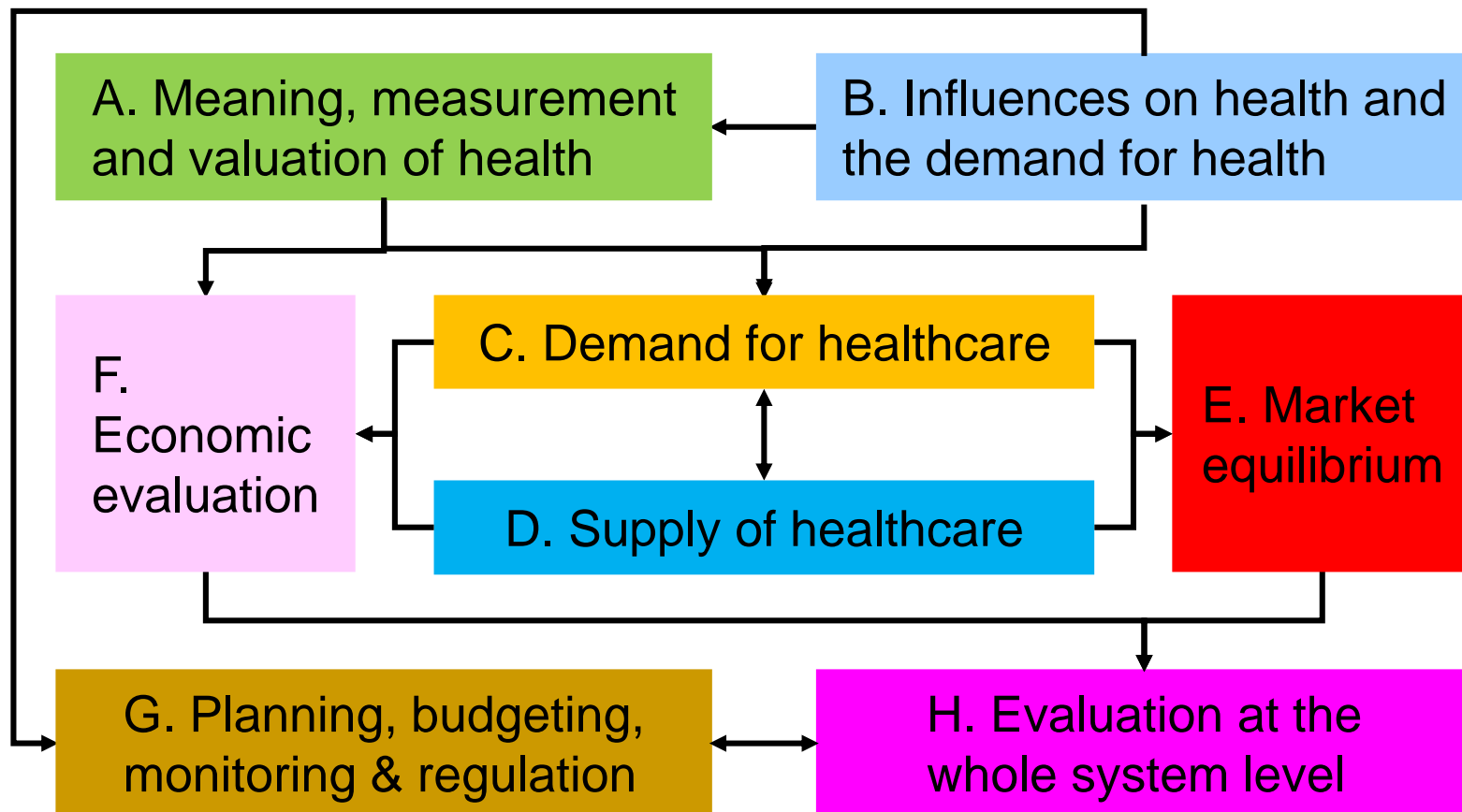
# Key Concepts in Health Economics

# Judging the use of health care resources

- **Efficiency** is *the allocation of scarce resources that maximises the achievement of aims*
- **Effectiveness** is *the extent to which health care services actually improve health (a Regulatory hurdle as well as a Health Economic challenge)*
- **Equity** is *fairness in the sharing of health care resources between people.*
- **Ethics** are *a code of widely-held normative criteria about the provision of health care*



# The Scope of Health Economics



# Principles of Economic Evaluation



**How do we determine value for money?**

# Opportunity Cost – and perspective

- The production and consumption of health care incurs real, human costs, as well as creating real, human benefits.
- Since resources are scarce relative to needs, the use of resources in one way prevents their use in other ways.
- The opportunity cost of investing in a healthcare intervention is best measured by the health benefits e.g. quality adjusted life years (QALYs) gained that could have been achieved had the money been spent on the next best alternative intervention or healthcare programme.
- The study perspective (societal, patient, etc) is critical since it determines which costs and effects to include in the evaluation.

# OPPORTUNITY COST

**A single course of IVF costs £2,700**

What is the opportunity cost .....

## Within healthcare sector?



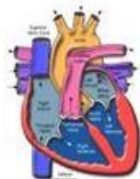
1/3 of a cochlear implant



150 vaccinations for Measles, Mumps and Rubella



11 cataract removals



1 heart bypass operation

## Beyond healthcare sector?



Half a junior school teaching assistant for a year



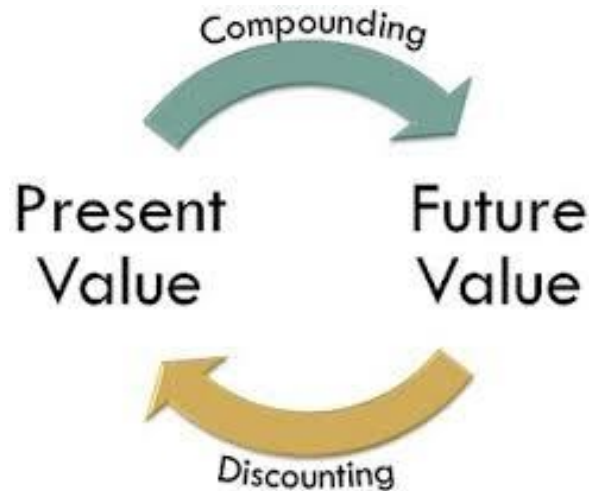
2000 school dinners



One-thousandth of a Challenger 2 military tank

Source: "Economic Analysis in Health Care" by Morris, Delvin & Parkin 2007

# Would you prefer to receive £1000 now or £1000 in 10 years?



Most people instinctively prefer to have the £1000 now.

£1000 will be worth more in 10 years time (due to inflation or investment returns)

Discounting transforms all costs into a ***present value***

# Cost-effectiveness or budget impact analyses?

## Cost-Effectiveness

- ***Determines whether an intervention is good value for money***
- Compares the value of one treatment versus another
- Is it worth paying more for a new treatment?

## Budget Impact

- ***Determine whether an intervention is affordable***
- Calculates the additional expenditure required (or indeed money saved)



# Budget impact analyses & Perspective



Medication

GP

Hospital

Community  
(e.g.  
rehab)

Patient  
(out-of-pocket)

Lost  
productivity

+ 300 €

+ 300 €

- 200 €

- 400 €

- 100 €

- 500 €

Total health care costs:

+400 € (more costly)

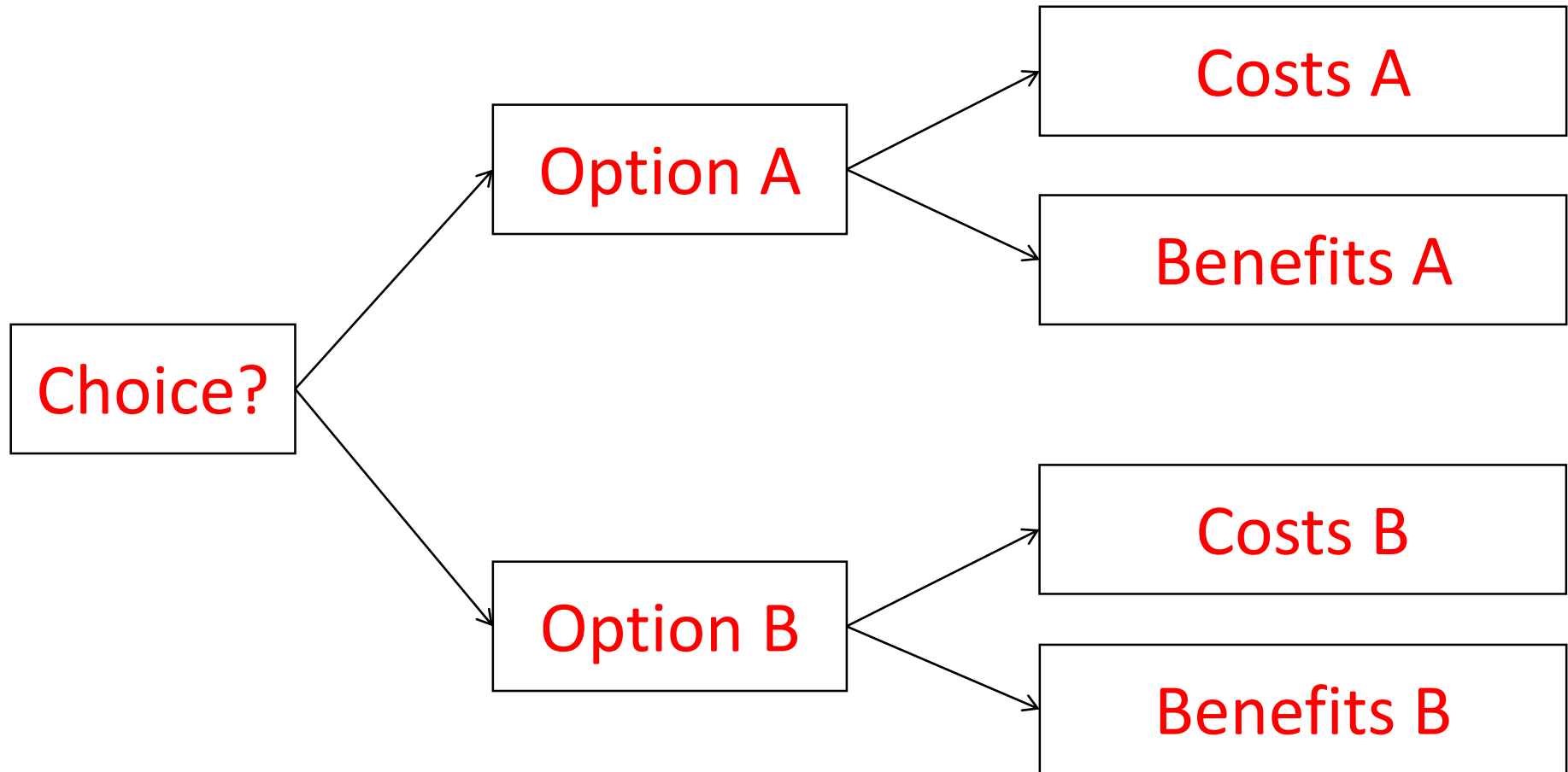
Total direct costs:

0 € (cost neutral)

Total costs incl. patient & production

-600 € (cost saving)

# How are choices made?



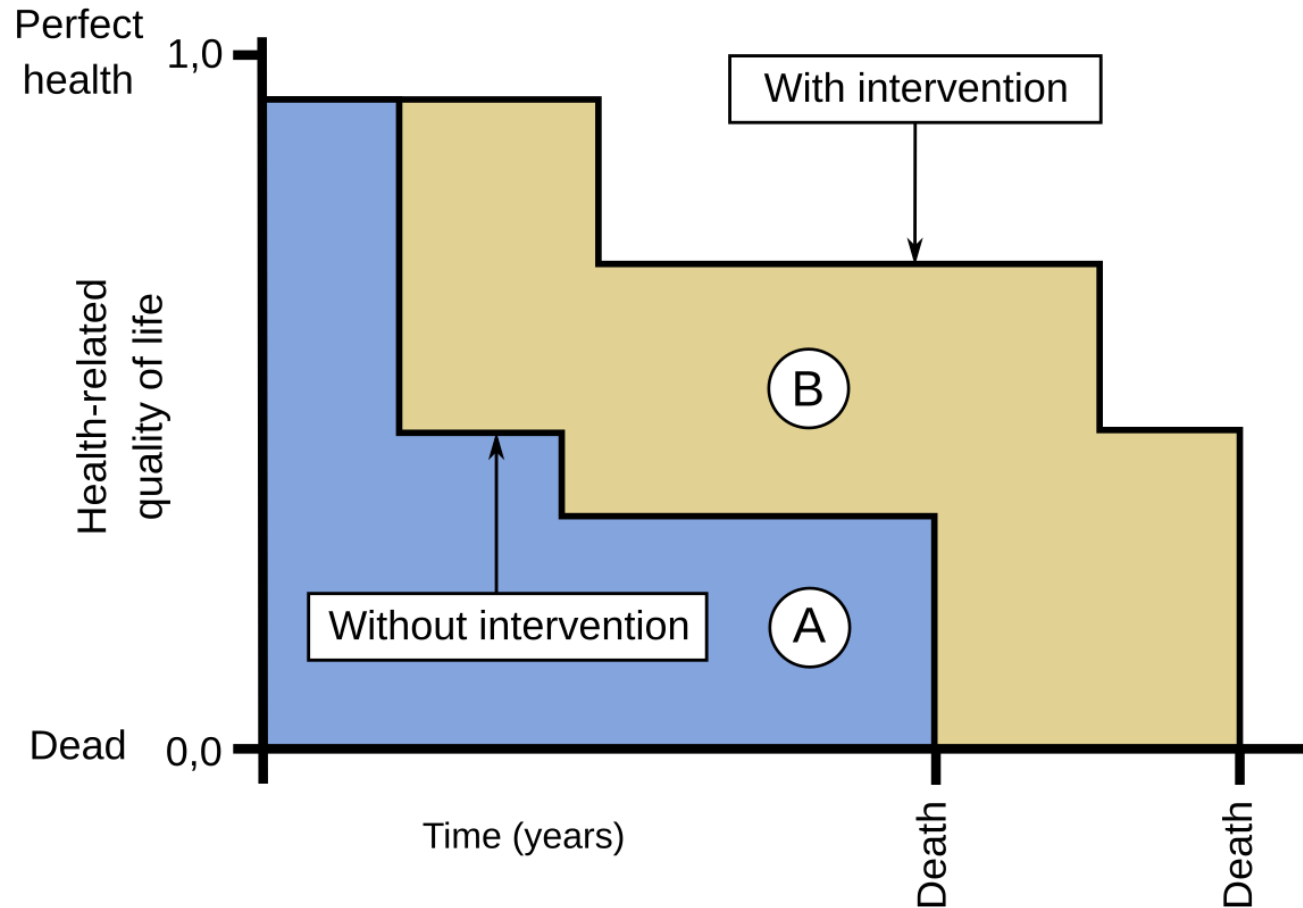


# Measuring Health Gain

## Quality Adjusted Life Year - QALY

- The **QALY** is a generic measure of disease burden, including both the quality and the quantity of life lived.
- The QALY is used in economic evaluation to assess the value for money of medical interventions.
- **One QALY equates to one year in perfect health.**

# One QALY equates to one year in perfect health



# Measuring Costs in Health Economic Evaluation

# Publicly available sources of cost data

- Hospital costs  
Reference costs (HRG based)
- Community costs  
Reference costs (very limited services)  
Personal Social Services Research Unit (PSSRU)
- Primary care  
PSSRU
- Pharmaceuticals  
British National Formulary
- Literature/Google

# HRGs and Reference Costs

- Inpatients (EL, NEL, DC)
- Critical care
- Outpatients and A&E
- Radiotherapy and chemotherapy
- Renal dialysis, spinal injuries, BMT, rehab, maternity
- Audiology, physiotherapy, OT, ST, dietetics, chiropody
- And many, many more.....
- Minor alterations every year, and a major overhaul has just been completed (HRG v3.5 to HRG v4)

# Elective inpatients

Code	Description	Activity	National Average Unit Cost	Lower Quartile Unit Cost	Upper Quartile Unit Cost	No.of Bed Days	Average Length of Stay Days	No. Data Submissions
DZ01Z	Lung Transplant	44	£39,757	£19,516	£68,062	506	11.50	5
DZ02A	Complex Thoracic Procedures with Major CC	467	£9,176	£7,238	£10,780	5,645	12.09	39
DZ02B	Complex Thoracic Procedures with CC	3,093	£6,895	£5,495	£8,009	22,922	7.41	70

# Day case chemotherapy

Code	Description	Activity	National Average Unit Cost	Lower Quartile Unit Cost	Upper Quartile Unit Cost	No. Data Submissions
SB11Z	Deliver exclusively Oral Chemotherapy	14,862	£201	£139	£272	60
SB12Z	Deliver simple Parenteral Chemotherapy at first attendance	47,346	£212	£116	£280	61
SB13Z	Deliver more complex Parenteral Chemotherapy at first attendance	18,604	£237	£124	£295	62
SB14Z	Deliver complex Chemotherapy, including prolonged infusional treatment at first attendance	80,426	£307	£211	£406	63
SB15Z	Deliver subsequent elements of a chemotherapy cycle	60,602	£220	£138	£277	62

# Consultant Led: Follow up Attendance Non-Admitted Face to Face

Code	Description	Activity	National Average Unit Cost	Lower Quartile Unit Cost	Upper Quartile Unit Cost	No. Data Submissions
100	General Surgery	1,304,236	£89	£67	£104	167
101	Urology	989,464	£82	£61	£95	165
102	Transplantation Surgery	59,876	£289	£184	£381	20
103	Breast Surgery	274,293	£86	£63	£100	79
104	Colorectal Surgery	97,588	£91	£72	£106	51
105	Hepatobiliary & Pancreatic Surgery	14,220	£119	£78	£190	11
106	Upper Gastrointestinal Surgery	34,497	£88	£71	£111	30



# Sources of non-UK cost data

- Choosing Interventions that are Cost Effective (WHO-CHOICE)
  - Costs for hospital inpatient and outpatient split by type of facility
  - Other programme costs; salaries, transportation, water/electricity, buildings, etc.
  - Every country in the world allocated to one of six regions and five mortality strata
- ‘Unit costs of Health Care Inputs in Low and Middle Income Regions’
  - Based around WHO-CHOICE data but gives additional explanations

# WHO-CHOICE costs

Cost per bed day by hospital level								
	India		Uganda		Egypt		UK	
	Int\$ 2000	LCU 2000	Int\$ 2000	LCU 2000	Int\$ 2000	LCU 2000	Int\$ 2000	LCU 2000
Primary	15	214	11	4,741	29	40	126	72
Secondary	19	279	14	6,185	38	52	164	107
Tertiary	26	382	19	8,448	51	71	224	146
Cost per visit								
Health centre	7	102	6	2,759	7	10	30	20

# Where to find them all

- Reference costs
  - [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_098945](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_098945)
- PSSRU
  - <http://www.pssru.ac.uk/uc/uc2008contents.htm>
- British National Formulary
  - <http://www.bnf.org/bnf/>
- WHO-CHOICE
  - <http://www.who.int/choice/costs/en/>
- 'Unit costs of Health Care Inputs in Low and Middle Income Regions'
  - <http://www.dcp2.org/file/24/wp9.pdf>

# Measuring and valuing health gain

# The measurement of health gain

- Health can be regarded as the product of the level of health and the length of time that it is experienced, in other words a measure of fully healthy time.
- If the level of health is quantified using the concept of HRQOL (Health related Quality of Life), we can consider variations in HRQOL over time, representing the prognoses with and without treatment.
- The most commonly used measure that follows this is the Quality Adjusted Life Year (QALY), calculated by multiplying the amount of time in a particular health state by the quality of life during that time, summing over all time periods and standardising to a year.

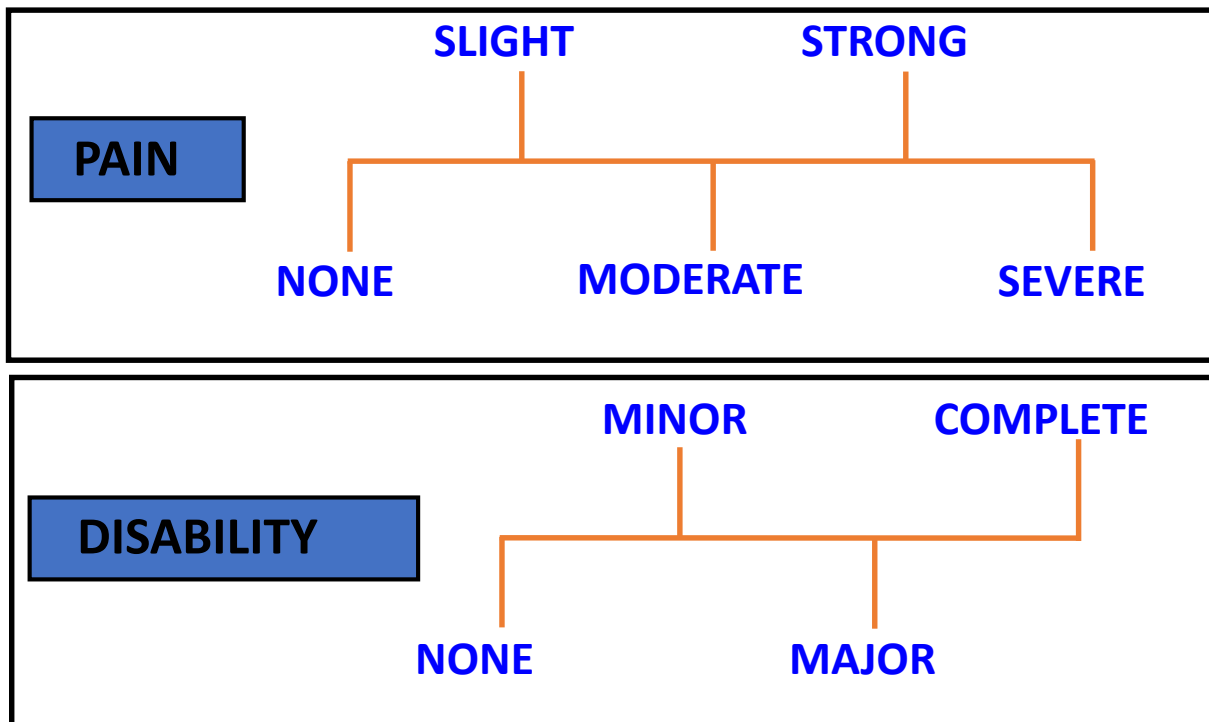
# The measurement of health gain

- We can define and measure our state of health using the concept of Health Related Quality of Life (HRQOL)
- If we plot HRQOL over time we can
  - consider the prognoses with and without treatment
  - or compare the benefit of treatment A to treatment B
- The most commonly used measure of health gain is the Quality Adjusted Life Year (QALY)  
One QALY equates to one year in perfect health

# The value of life

- It is possible to place monetary values on life itself, focussing on the value of changing the probability of deaths occurring. This has some applications in healthcare but is mainly used in areas of road safety and the environment.
- There are two main approaches:
  - human capital
  - statistical value of life

# Dimensions and levels within a health measurement instrument





# EQ-5D

- Indirect preference-based method to elicit health state utility values

By placing a tick in one box in each group, please indicate which statement best describes your health today.

**Mobility**

Have no problems in walking about ☒

Have some problems in walking about ☐

I am confined to bed ☐

**Self-Care**

Have no problems with self-care ☒

Have some problems washing or dressing myself ☐

I am unable to wash or dress myself ☐

**Usual Activities**

Have no problems with performing my usual activities ☒

Have some problems with performing my usual activities ☐

I am unable to perform my usual activities ☐

**Pain/Discomfort**

Have no pain or discomfort ☒

Have moderate pain or discomfort ☐

Have extreme pain or discomfort ☐

**Anxiety/Depression**

I am not anxious or depressed ☒

I am moderately anxious or depressed ☐

I am extremely anxious or depressed ☐

Levels of a perceived problem are coded as follows:

- ☒ Level 1 is coded as a "1"
- ☐ Level 2 is coded as a "2"
- ☐ Level 3 is coded as a "3"
- ☒ Level 3 is coded as a "3"
- ☒ Level 1 is coded as a "1"
- ☒ Ambiguous response is coded as an "8"
- ☐ Missing response is coded as a "9"

The health state is derived from the descriptive system.

health state	1	2	3	3	1
--------------	---	---	---	---	---

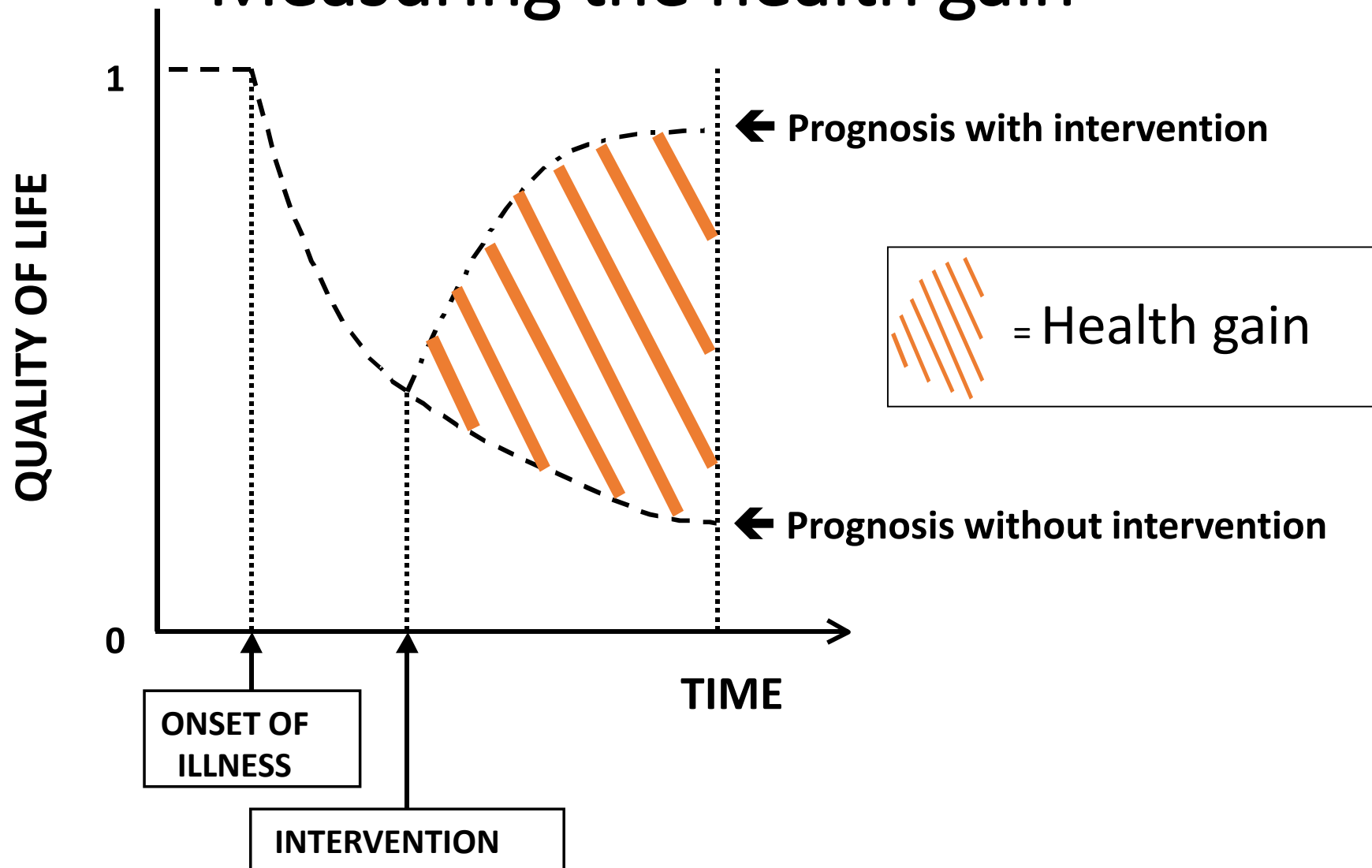
To score a health state you simply read off the corresponding value from a value set.

score	0.07
-------	------

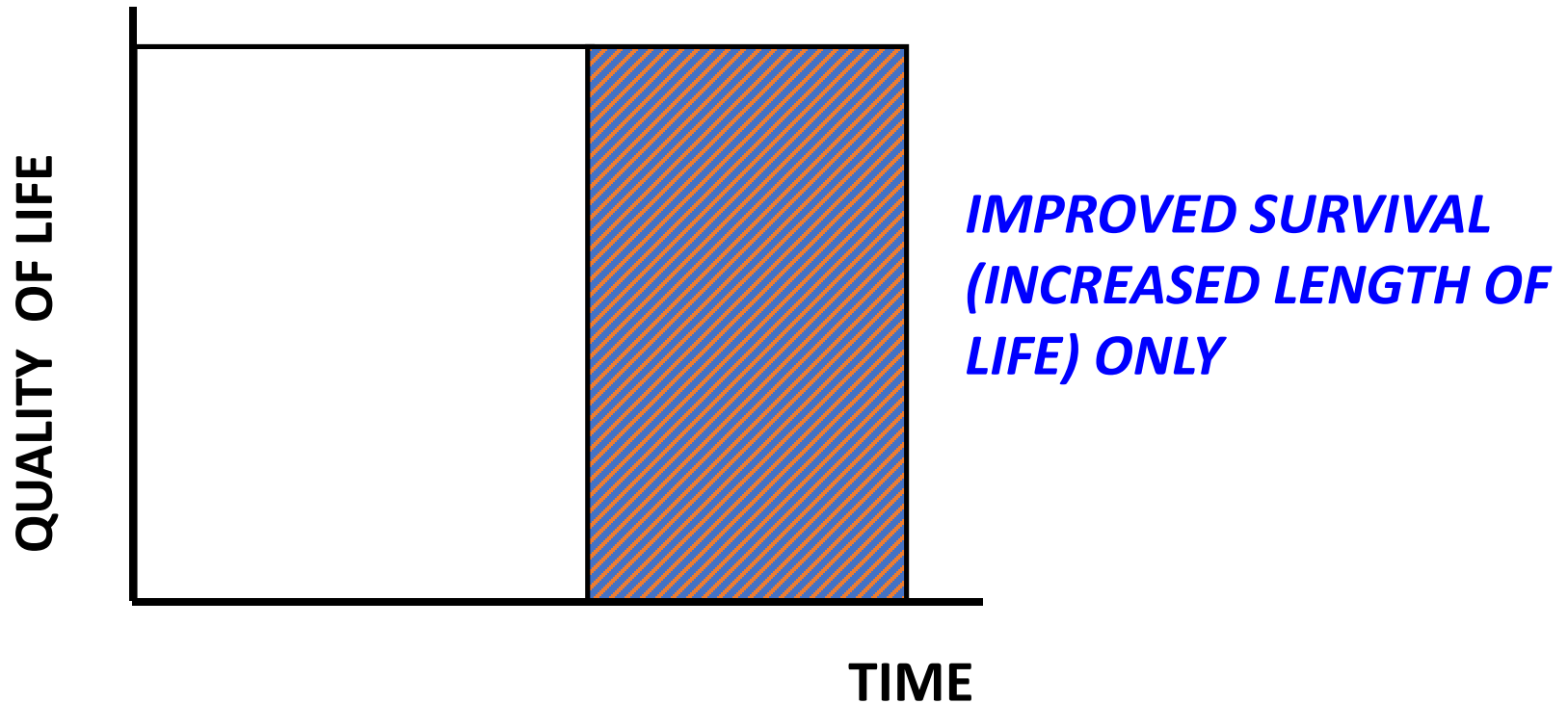
A value set:

1	2	3	2	3	0.09
1	2	3	3	1	0.07
1	2	3	3	2	0.00

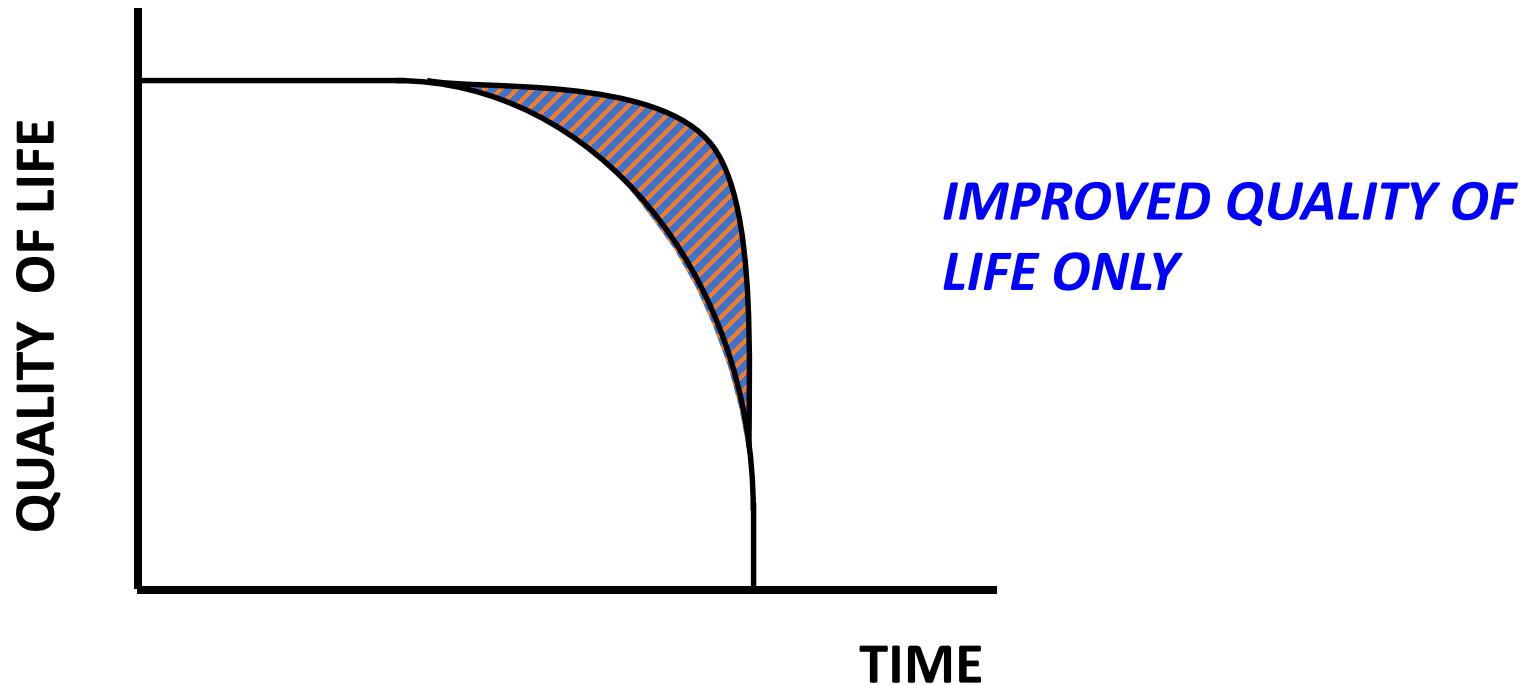
# Measuring the health gain



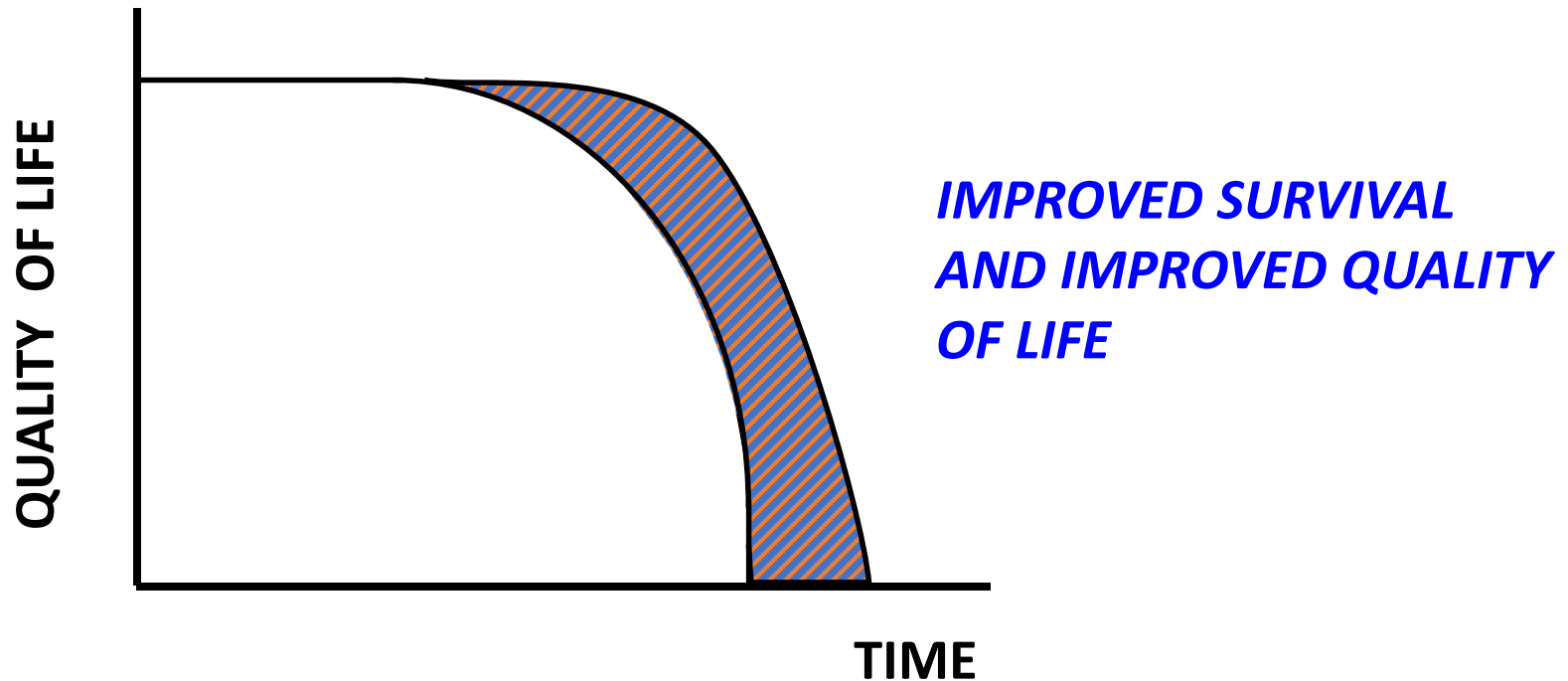
# Measuring gains from different types of intervention



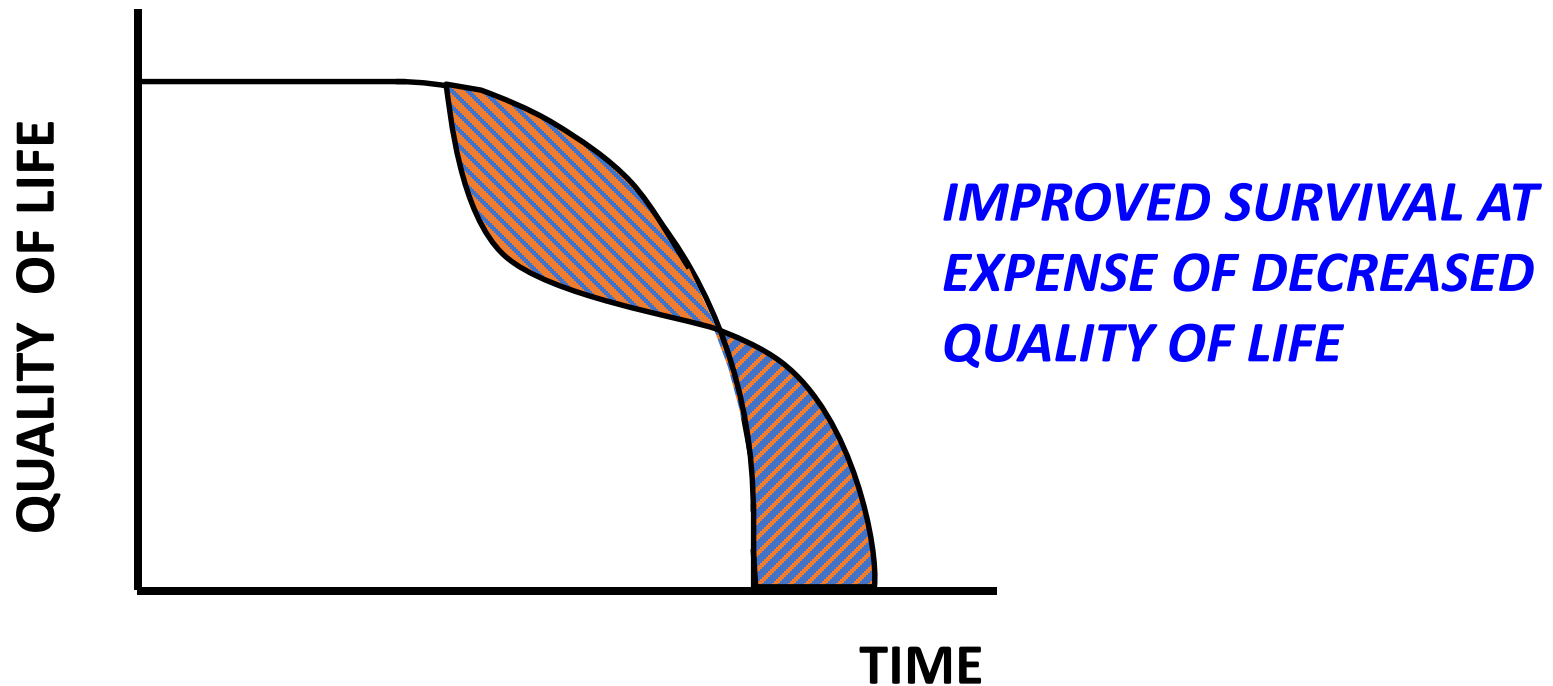
# Measuring gains from different types of intervention



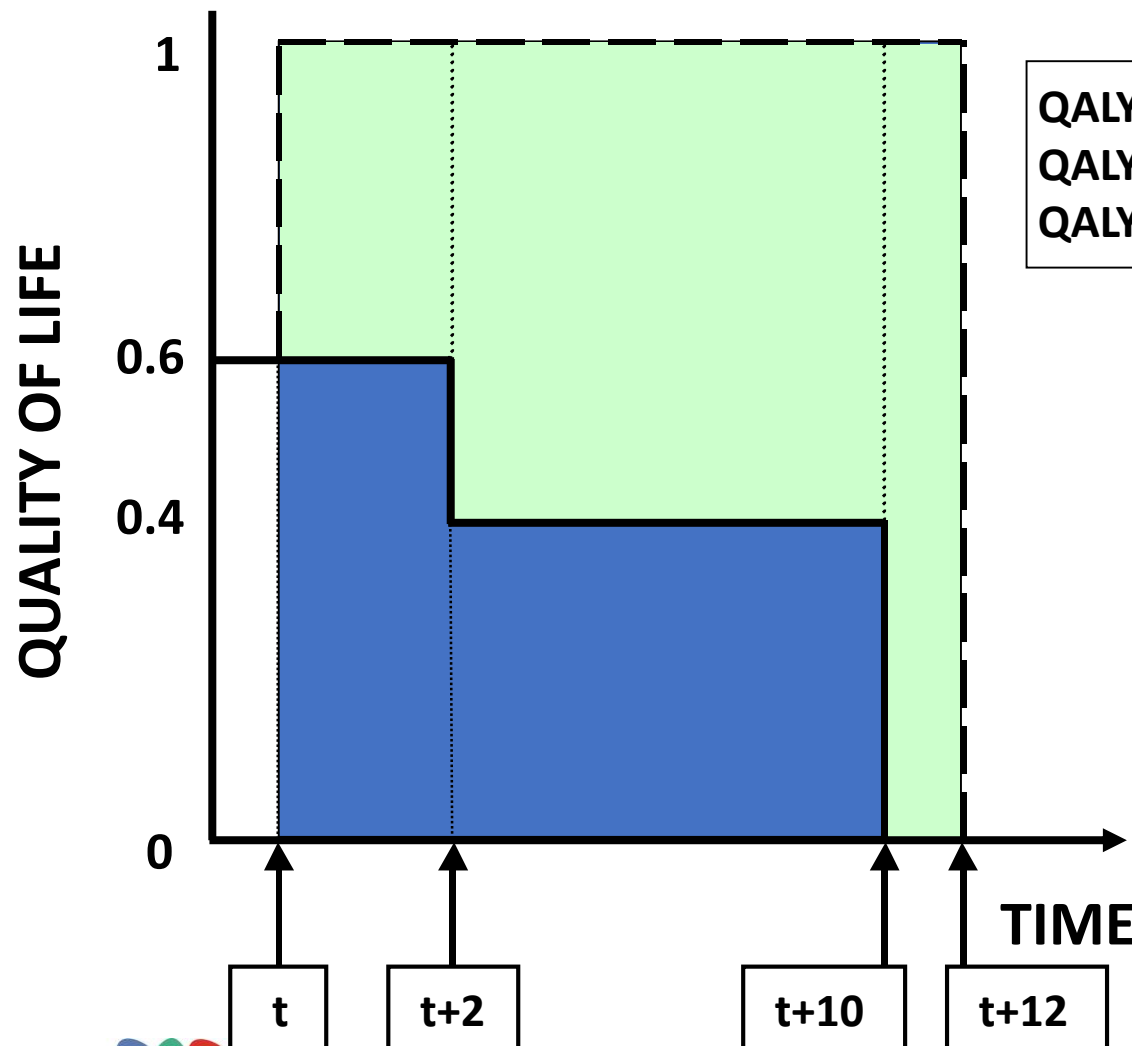
# Measuring gains from different types of intervention



# Measuring gains from different types of intervention



# Measuring QALY gains:



QALY without =  $2 \times 0.6 + 8 \times 0.4 = 4.4$

QALY with =  $1 \times 12 = 12$

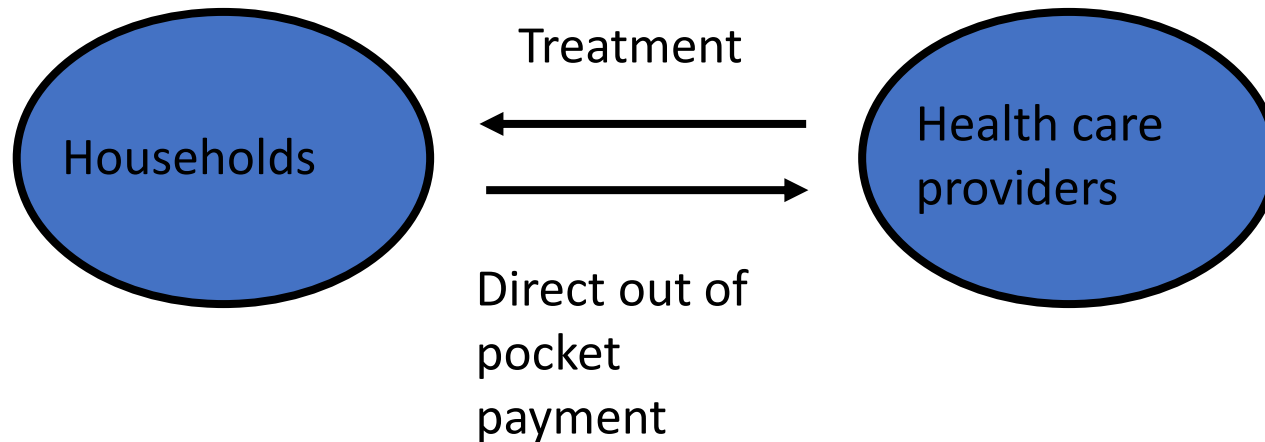
QALY gain =  $12 - 4.4 = 7.6$

$$\begin{aligned} \text{QALY gain} &= 0.4 \times 2 \\ &+ 0.6 \times 8 \\ &+ 1.0 \times 2 \\ &= 7.6 \end{aligned}$$

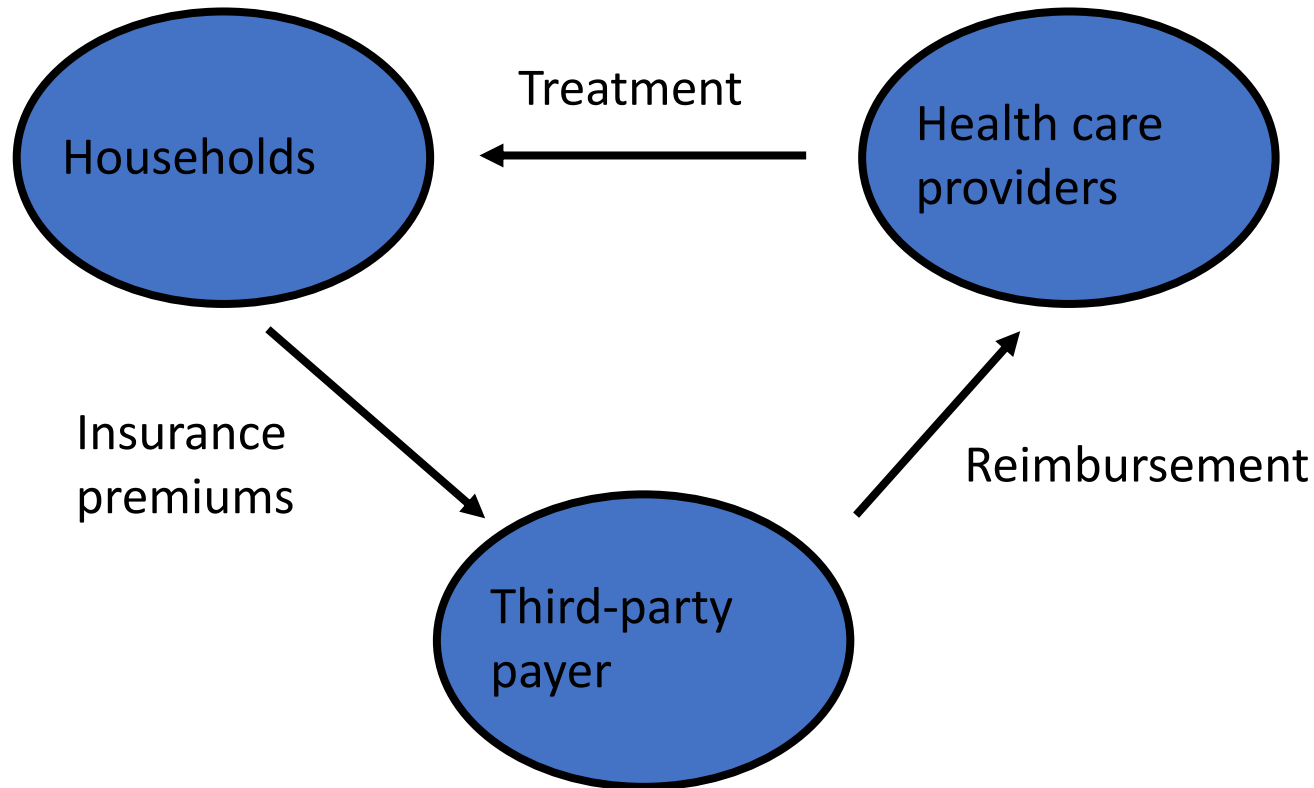
# Healthcare Market Models and Economic Evaluation



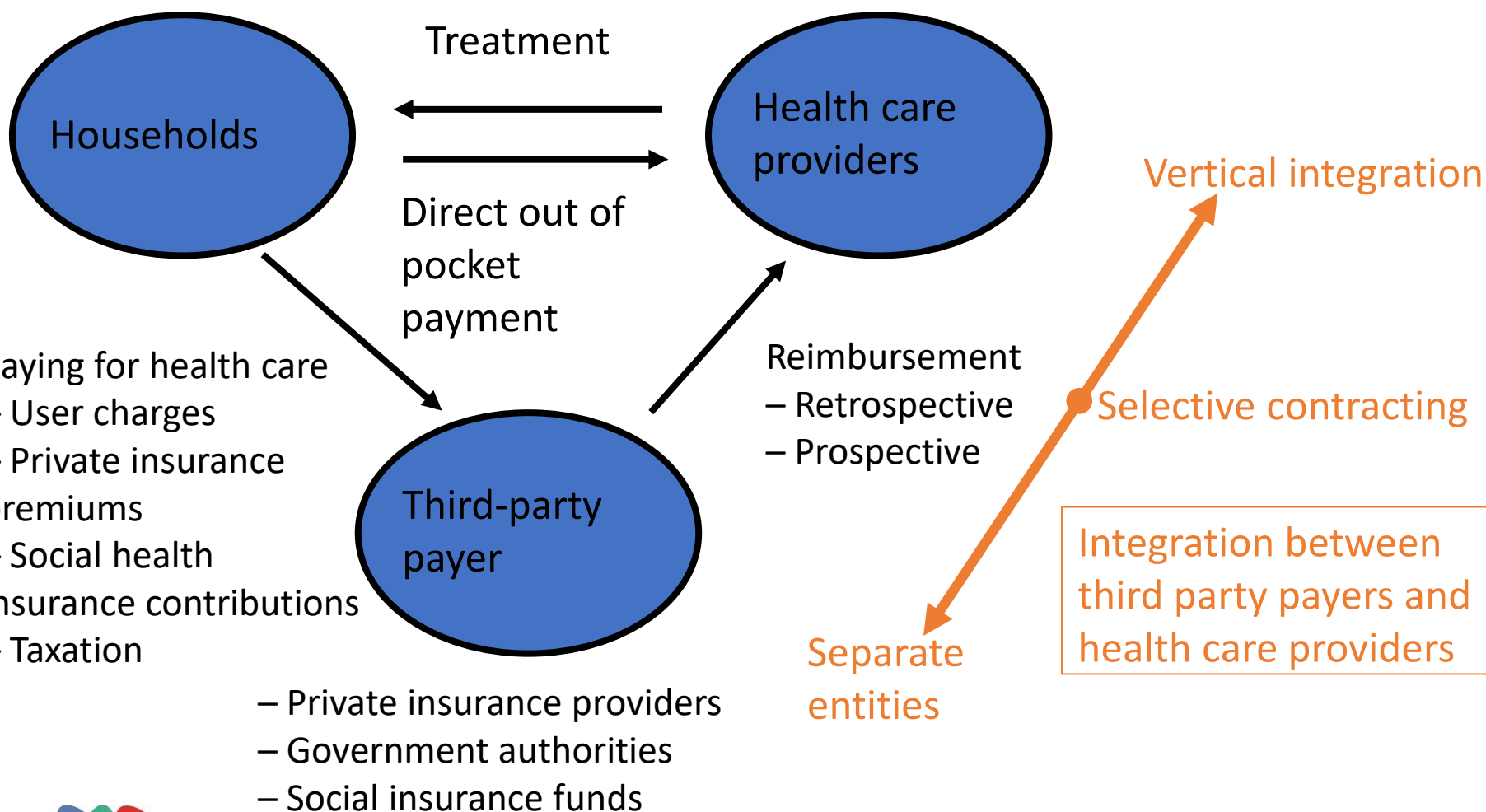
# Two-party health care market model



# Third-party health care market model



# Health care financing framework

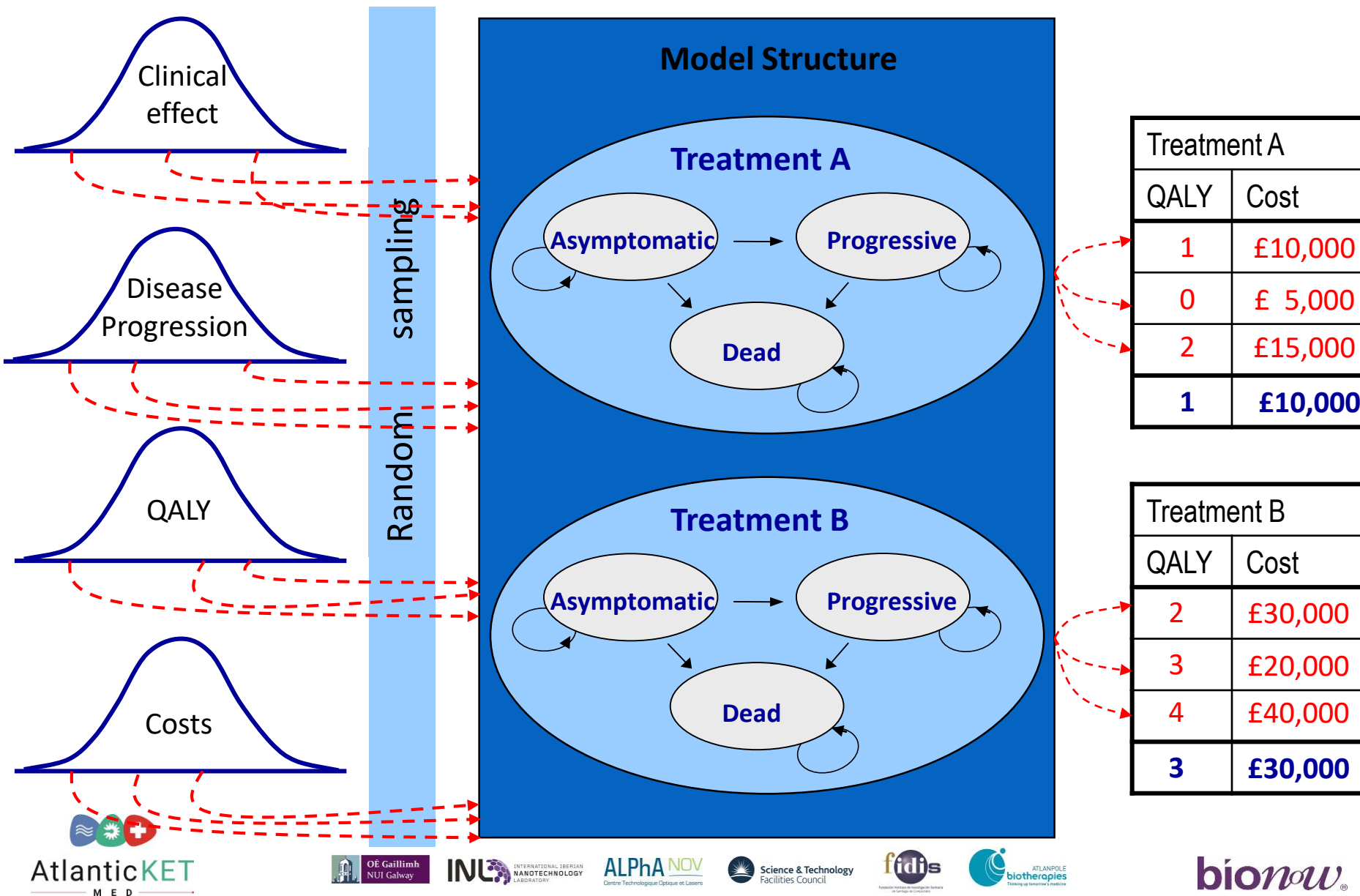


# Modelling-based economic evaluation

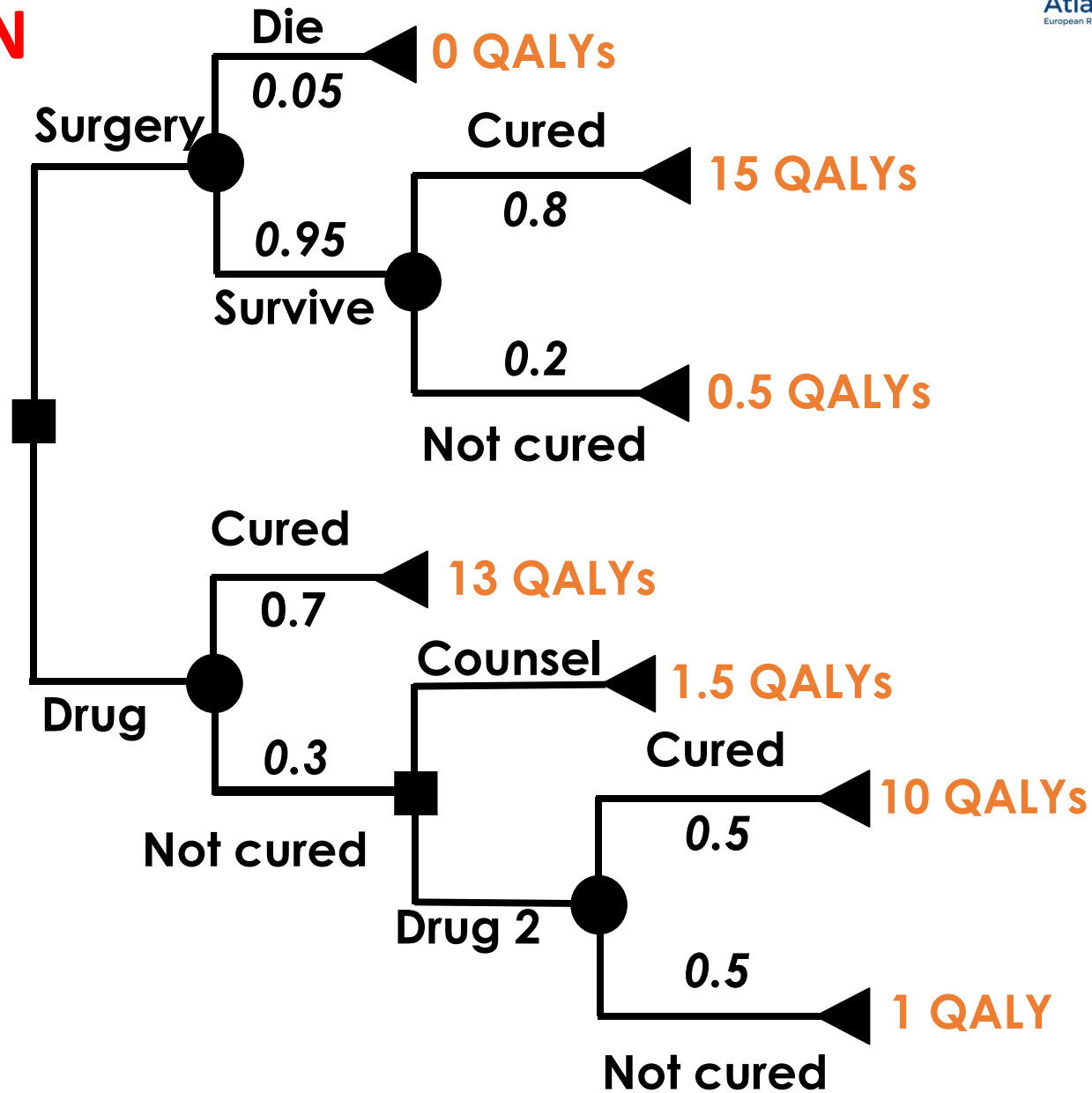
- Many sources of data which have to be linked together
  - Clinical evidence of effect
  - Progression of disease and events
  - Quality of life
  - Resource use and costs
- Uncertainty within the numerical information
- Established methodologies including
  - Decision Trees
  - Markov models - to model dynamic, real-world processes

} Cost per  
QALY gained

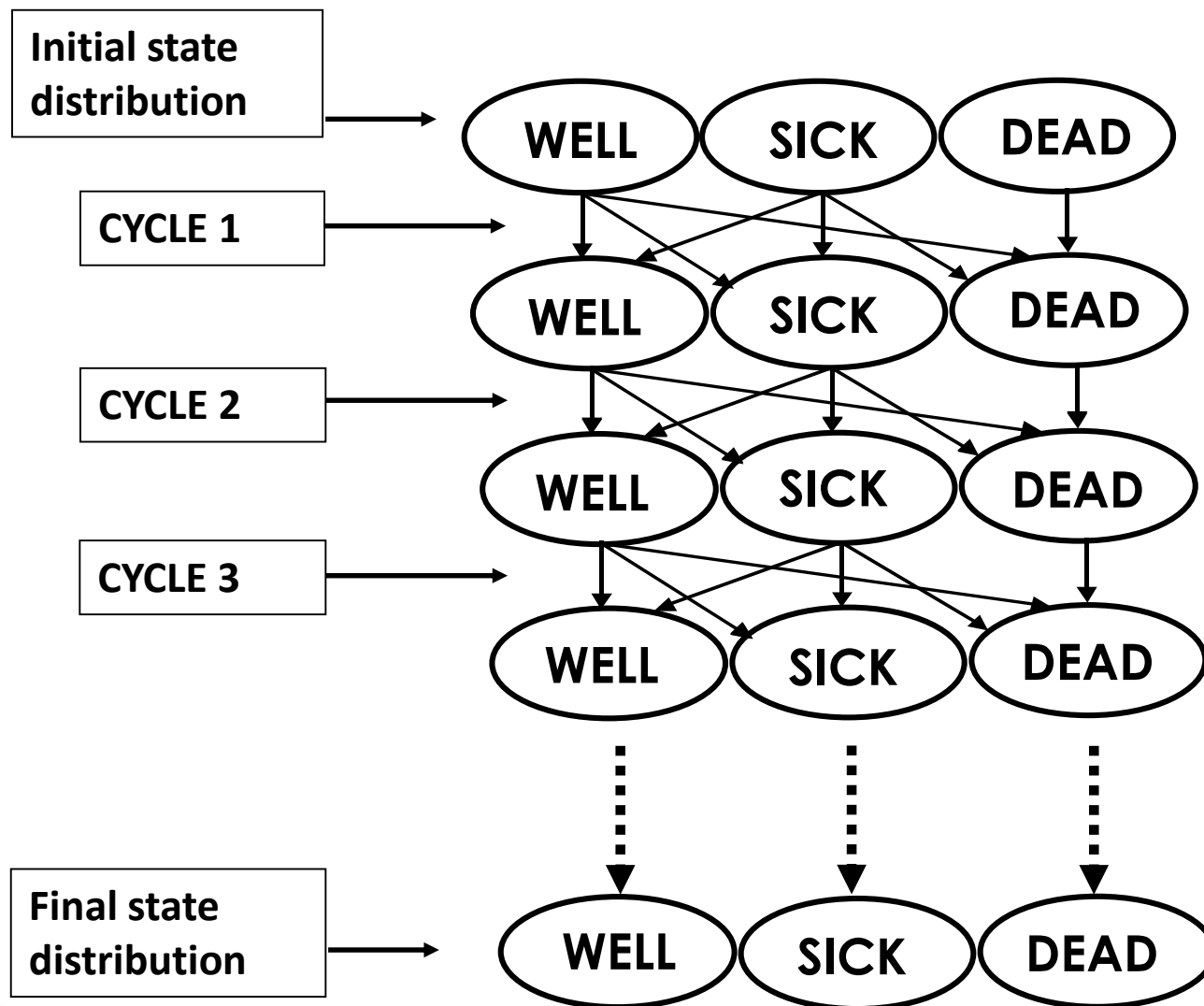
# Need to Combine evidence



# HEOR DECISION TREE



# Markov cycles

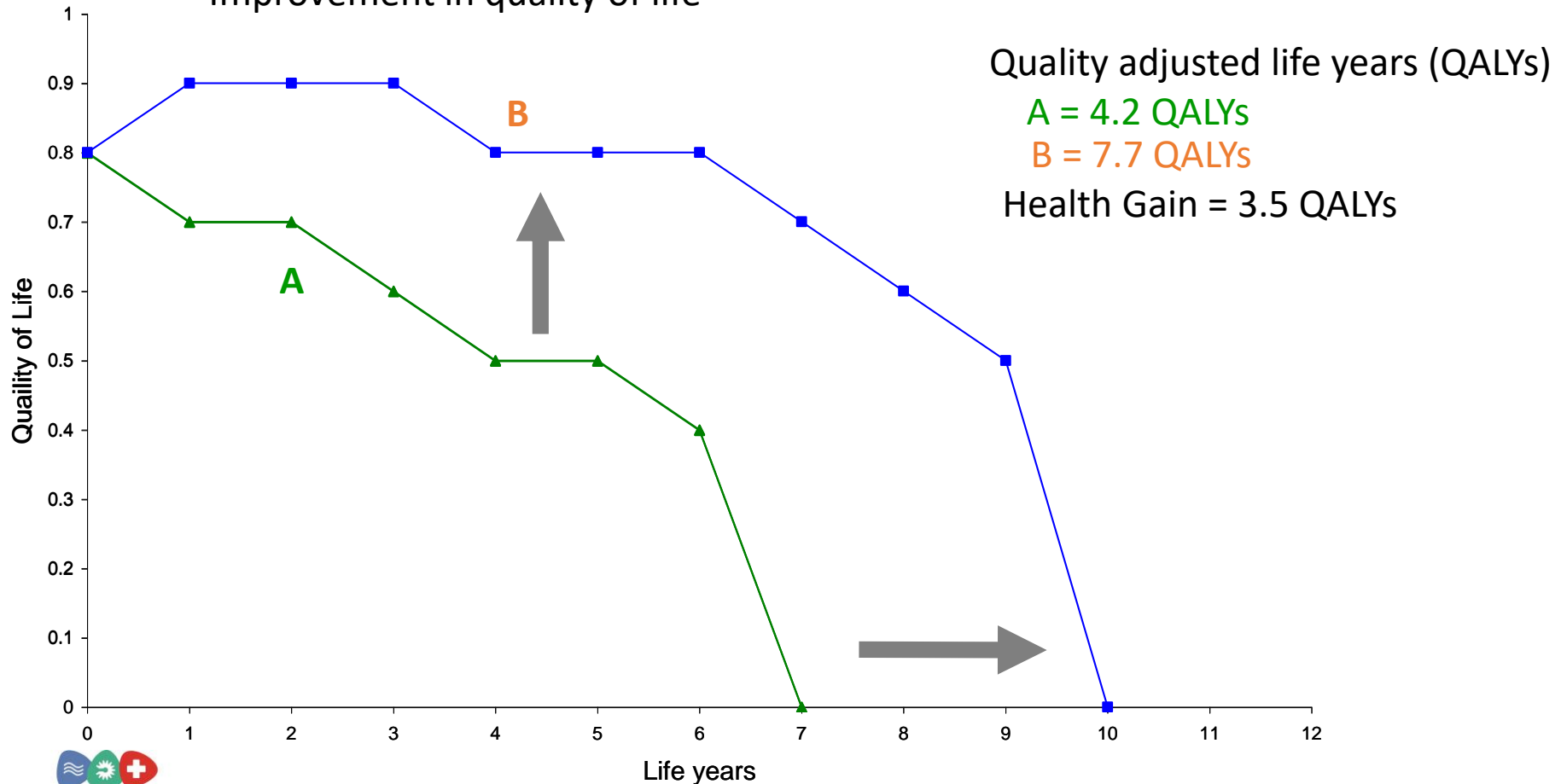


# Is it worthwhile?

# Does it improve health?

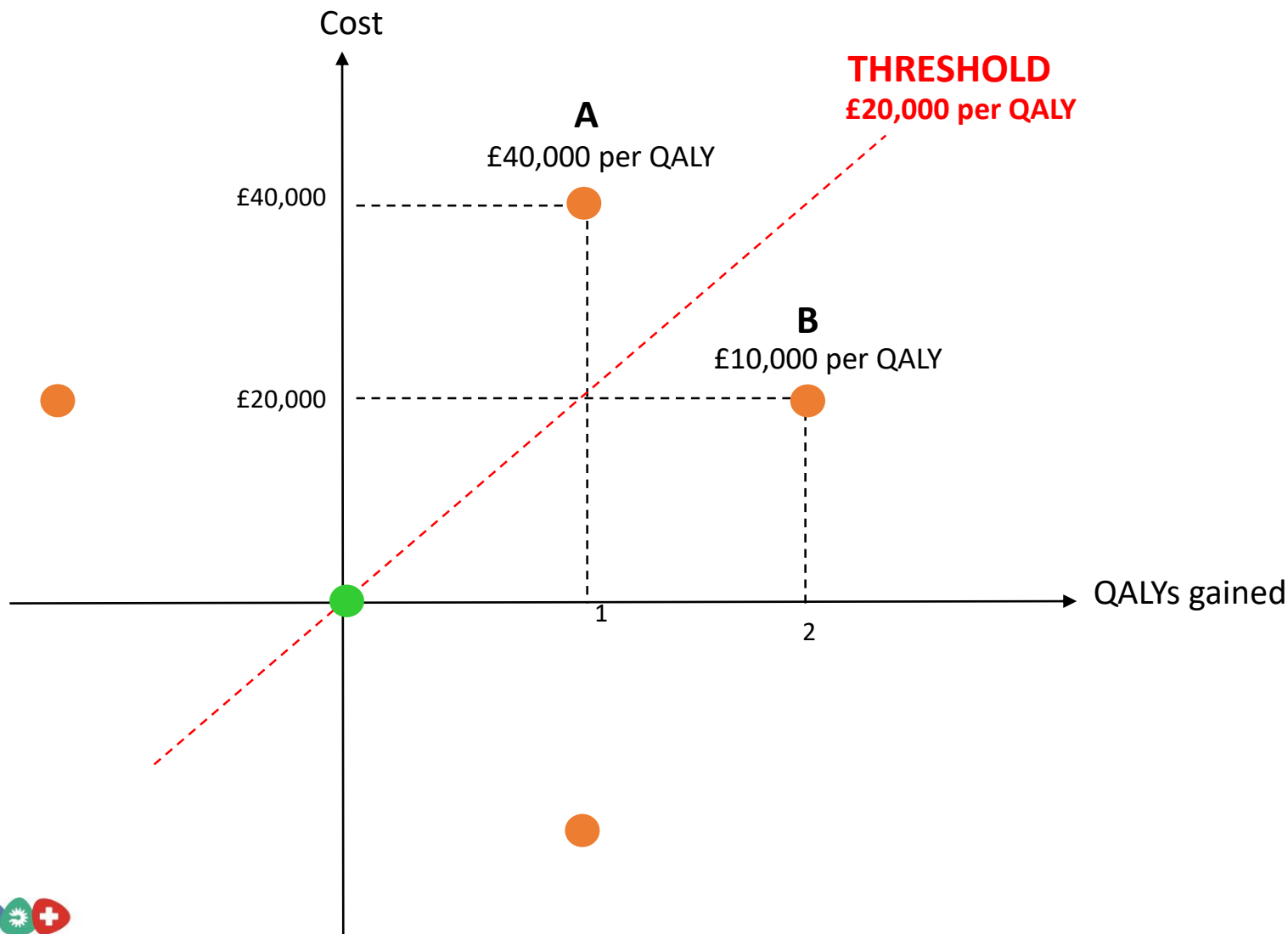
What is an improvement in health?

- Gain in life expectancy
- Improvement in quality of life





# But what about costs?



# Is it worthwhile? *Is it cost-effective?*

Is the ICER less than the cost-effectiveness threshold?

$$\text{ICER} = \frac{\text{Additional cost}}{\text{QALYs gained}} = \frac{\text{£20,000}}{2 \text{ QALYs}} = \text{£10,000 per QALY}$$

If the cost-effectiveness threshold is £20,000 per QALY, B is cost-effective

Is net benefit positive?

Net health benefit = QALYs gained – QALYs lost

$$= 2 - \frac{\text{£20,000}}{\text{£20,000}} = 2 - 1 = 1 \text{ QALY}$$

Net money benefit = £ value of QALYs gained – additional costs

$$= 2 \times \text{£20,000} - \text{£20,000} = \text{£20,000} = 1 \text{ QALY}$$

# Should a technology be adopted?

Treatment A	
QALY	Cost
1	£10,000
0	£ 5,000
2	£15,000
1	£10,000

$$ICER = \frac{\text{Additional cost}}{\text{QALYs gained}} = \frac{£20,000}{2 \text{ QALYs}} = £10,000 \text{ per QALY}$$

**Is the ICER less than the cost-effectiveness threshold?**

£10,000 per QALY < £20,000 per QALY, B is cost-effective

**Is net benefit positive?**

Net health benefit = QALYs gained – QALYs lost

$$= 2 - \frac{£20,000}{£20,000} = 2 - 1 = 1 \text{ QALY}$$

Net money benefit = £ value of QALYs gained – additional costs

$$= 2 \times £20,000 - £20,000 = £20,000 = 1 \text{ QALY}$$

Treatment B	
QALY	Cost
2	£30,000
3	£20,000
4	£40,000
3	£30,000

# Questions & Discussion

# Ian Jacob

**Senior Manager - Health Economics**  
**Health Economics & Outcomes Research Ltd**

<https://heor.co.uk>

✉ [ian.jacob@heor.co.uk](mailto:ian.jacob@heor.co.uk)

☎ +44 (0) 2920 399146

END