Health economic analysis in research

A guide for surgeons

Ben O’Sullivan

Satisfying the educationalists

1. Who am I?
2. Macro- health economics and opportunity cost
3. Micro- health economics – economic evaluation
4. Presentation of data
5. Modelling (briefly!)

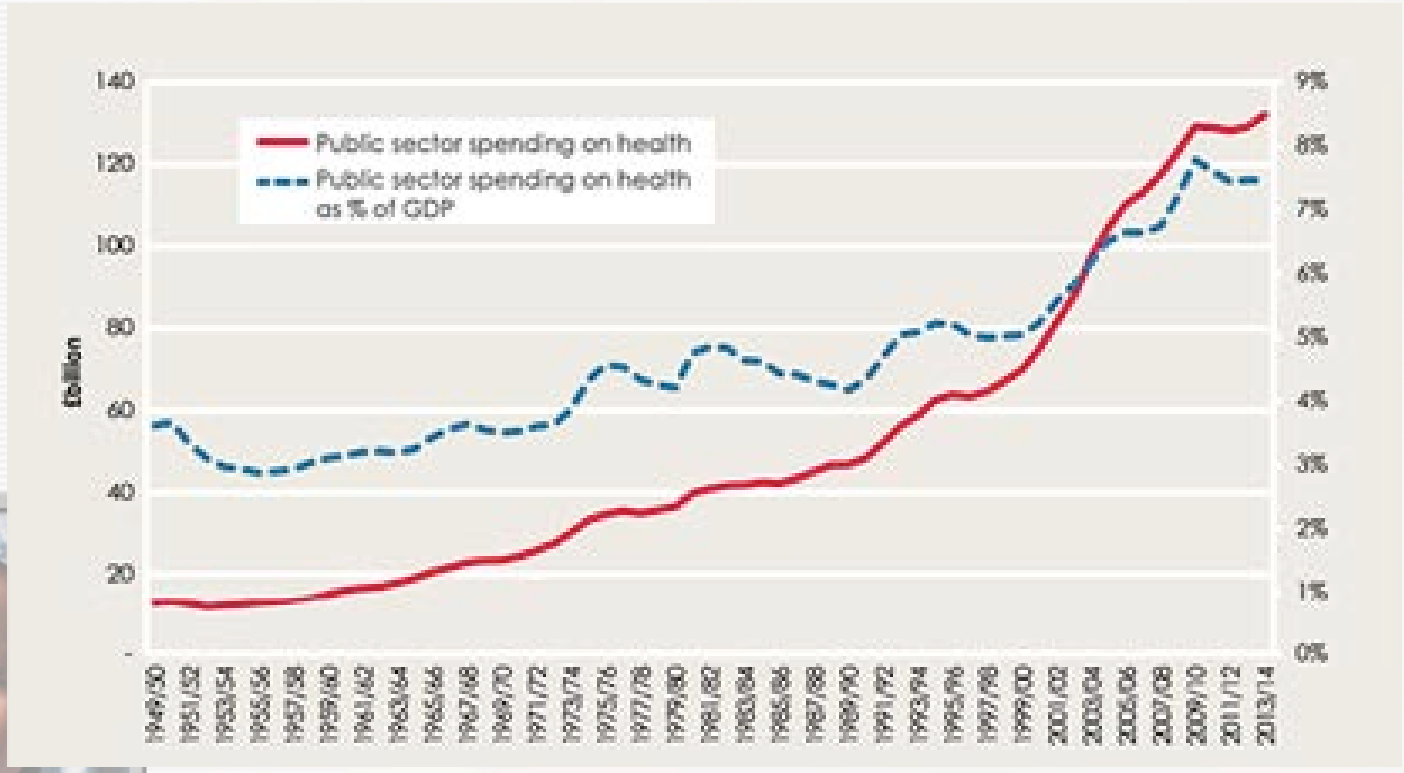
All about me

- ST5 Birmingham and national TRIPS rep
- MSc Health Economics and Health Policy at HEU, University of Birmingham:
    1. Introduction to Health Economics*
    2. Statistics modules (x2!)
    3. Economic evaluation in health care
    4. Modelling for Health Economics
    5. Policy and Economics of Healthcare delivery
    6. Clinical trials
- Dissertation:

    Opportunity costs of delayed transfers of care

Health Economics

- Assist decision-makers needing to ration scarce resources



Health Economics

- Assist decision-makers needing to ration scarce resources

- Changes in demand – victims of our own success:

1. Increasing age of population
2. Increasing co-morbidities
3. Increasing cost of new technologies

- Expectation/UK politics – health (not medical care) as a ‘merit’ or ‘public’ good, or even a ‘right’

Health Economics

- Assist decision-makers needing to ration scarce resources

- Health Economics and Economic Evaluation evolved:
  - Macro- health economics – allocative efficiency
  - Micro- health economics – technical efficiency
  - Economic modelling/econometrics

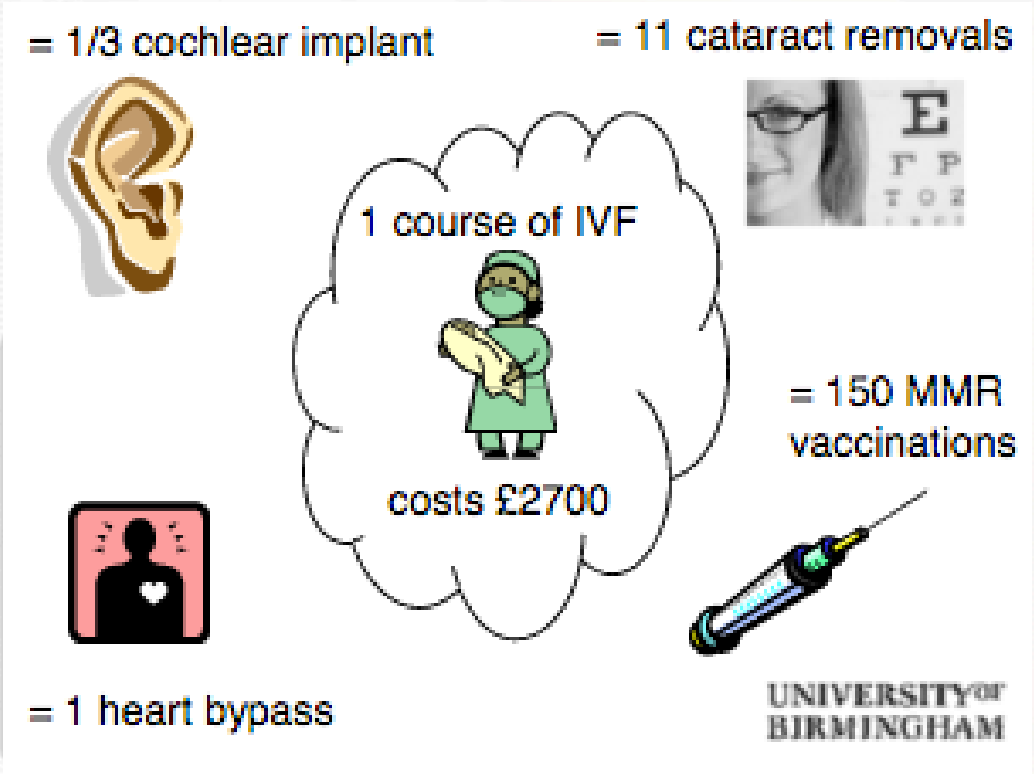
- Comparison of healthcare systems (purchaser/provider) – creation of quasi-internal markets

- Natural bridge between evidence-based medicine and healthcare policy
- Failed to enter either arena entirely successfully

Macro- health economics

- Deals with performance, structure, behaviour and decision-making of the economy as whole

- Where would you put it?:



Opportunity cost:

Cost of the things you've foregone by making a choice (whether monetary or in lives lost or otherwise)

Inaction has an opportunity cost!!!!

Externalities…

Marginal benefit/costs and maximisation of utility

Table 2 Total health benefits (QALYs) from different health service options at particular levels of expenditure:

	Tai Chi for falls	Screening for prostate cancer	Antibiotics for TB	Surgery for cataract
	total	total	total	total
£10000	1.5	5.0	8.0	7.8
£20000	2.2	6.2	12.0	9.0
£30000	2.8	7.1	15.0	9.8
£40000	3.3	7.7	17.2	10.4
£50000	3.7	8.0	19.2	10.6
£60000	4.0	8.0	21.0	10.8
£70000	4.2	7.8	22.1	10.9
£80000	4.3	7.4	23.0	10.8
£90000	4.35	6.8	23.4	10.4
£100000	4.4	6.0	23.6	9.8

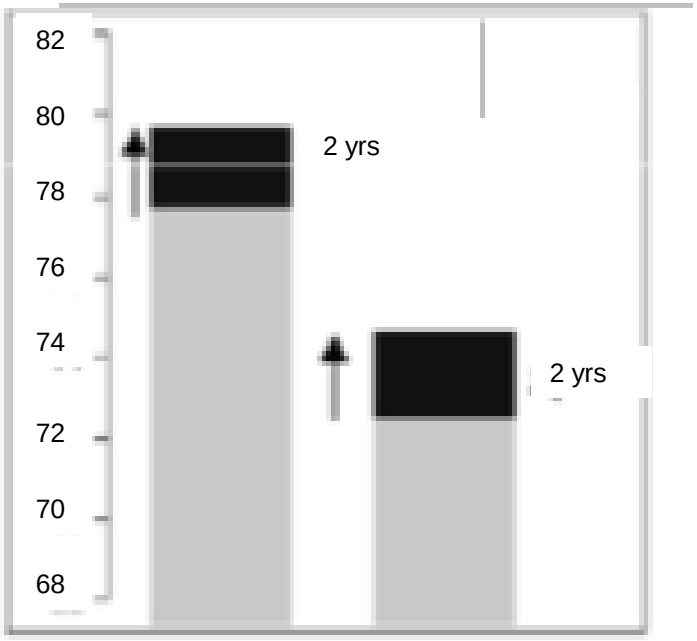
- You are given £110,000. What would you buy?
- Basis for foundation of economic analysis – comparing incremental gain of different options using a common unit of outcome

Value-based judgements – not all about the money…

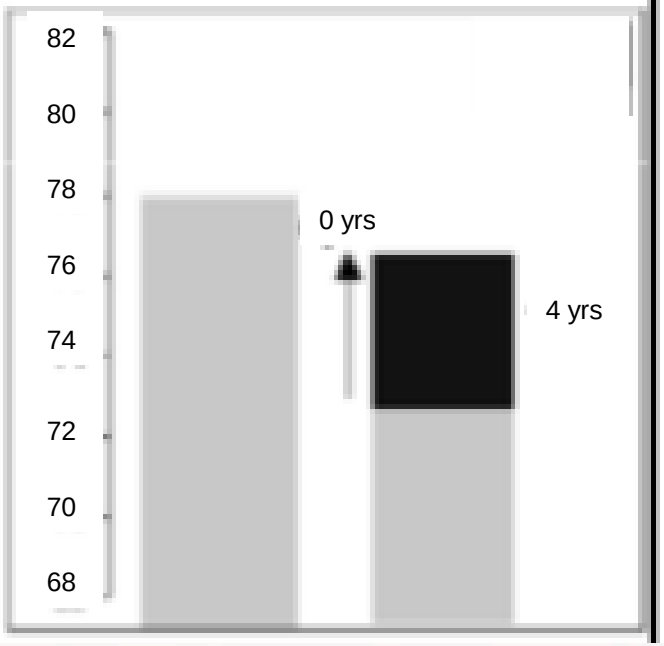
Who would you treat?

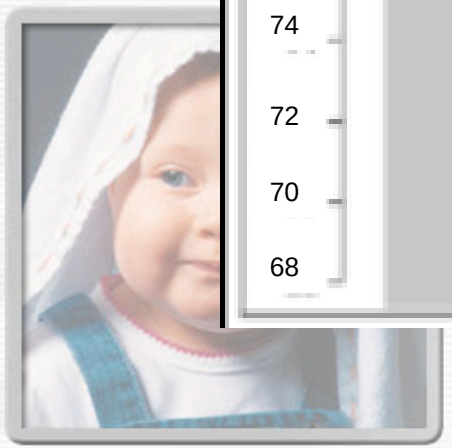
(Tsuchiya and Dolan, 2007)

Scenario A



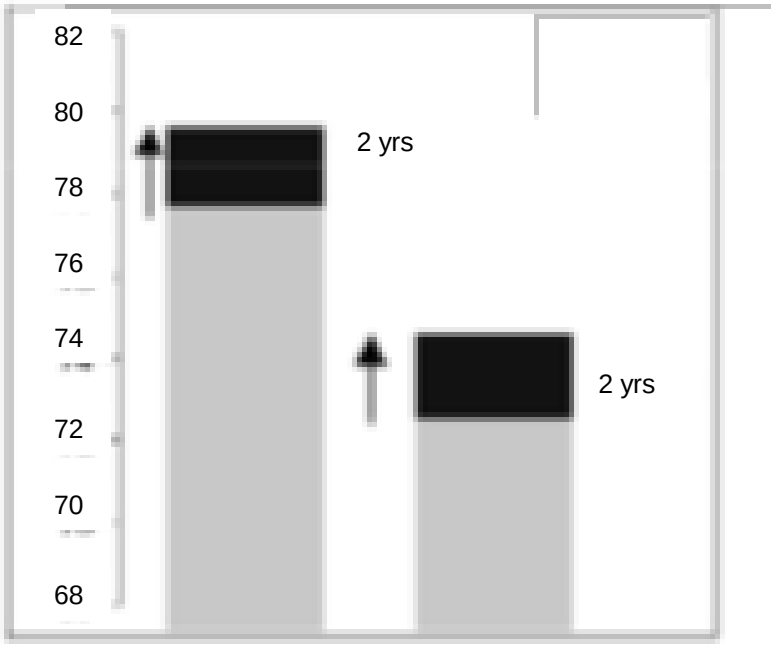
Scenario B



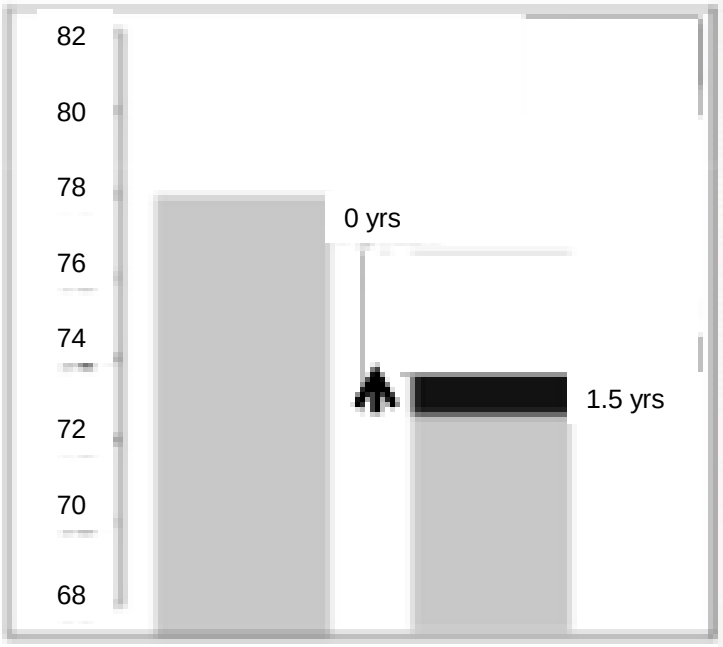


For those who chose Programme B only, who would you treat now? (Tsuchiya and Dolan, 2007)

Scenario A



Scenario C



Results of study

	General public (n = 271) (%)	NHS personnel (n = 220) (%)
Non-target, i.e. chose the programme that increases the life expectancy of both the highest and lowest social classes by the same amount **Scenario A**	42.4	51.5
Trade-off, i.e. chose to initially target the lowest social class but switched to programme A when the sacrifice in overall health was seen as being too great **Scenario B**	48.3	40.9
Non-switching, i.e. always choosing to target social class 5 even if this means less absolute benefit **Scenario C**	9.2	7.6

(Tsuchiya and Dolan, 2007)

Macroeconomics & Rationing

What happens when everyone can't get what they need, when they need it?

Rationing of healthcare – implicit or explicit:

- Value-based judgement – e.g. Cancer Drugs fund
- Economic evaluation – e.g. NICE
- Third agency decision – e.g. medical insurer
- Screen recipients – e.g. organ transplant recipients
- Waiting lists
- Postcode lotteries
- Fees – prescription fees

Microeconomics

- Study of behaviour of dependent variables (individuals/firms) in narrowly defined markets

e.g.

BMJ

RESEARCH

Cost effectiveness analysis of minimally invasive internal thoracic artery bypass versus percutaneous revascularisation for isolated lesions of the left anterior descending artery

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ABSTRACT

Objective To compare the cost effectiveness of percutaneous transluminal coronary artery stenting with minimally invasive internal thoracic artery bypass for isolated lesions of the left anterior descending artery.

Design Cost effectiveness analysis.

Data sources Embase, Medline, Cochrane, Google Scholar, and Health Technology Assessment databases (1966-2005), and reference sources for utility values and economical variables.

Methods Decision analytical modelling and Markov simulation were used to model medium and long term costs, quality of life, and cost effectiveness after either intervention using data from referenced sources. Probabilistic sensitivity and alternative analyses were used to investigate the effect of uncertainty about the value of model variables and model structure.

Results Stenting was the dominant strategy in the first two years, being both more effective and less costly than bypass surgery. In the third year bypass surgery still remained more expensive but became marginally more effective. As the incremental cost effectiveness was £1 108 130.40

cardiothoracic surgeons as affected patients are generally younger and have fewer comorbidities than those with multiple vessel disease.[1] Current treatment options include percutaneous revascularisation with stenting or surgical bypass with a left internal thoracic coronary artery to left anterior descending artery anastomosis. With advances in minimally invasive direct coronary artery bypass, morbidity from surgical revascularisation has been noticeably reduced making it even more relevant to compare the cost effectiveness of stenting with that of surgical bypass.[2,3]

A recent meta-analysis of randomised trials comparing minimally invasive internal thoracic artery bypass with transluminal stenting suggested that surgical revascularisation for isolated lesions of the left anterior descending artery resulted in fewer complications in the mid-term.[4] However, a real need remains to compare the cost effectiveness of the two procedures, which traditionally has not been possible because of a failure of the published literature to adequately tackle elements crucial to such evaluations.[5] We used an evidence synthesis approach combining meta-analysis, decision analysis, and cost

Microeconomics – Economic Evaluation

Economic Evaluation:

•Quantitative comparative analysis of costs and consequences of alternative treatment strategies

•Gold-standard prospective EE ‘piggy-back’ on to an RCT

Purpose:

•A more persuasive argument when petitioning for a change in the way in which surgeons manage conditions, EVEN IF IT COSTS MORE!

- Now mandatory for NICE to consider recommending your drug

Types of Economic Evaluation

Types based on UNIT of measurement of consequence:

1. Cost-benefit analysis – traditional welfarist economic analysis; WTP (£)

2. Cost-effectiveness analysis – most common economic evaluation in healthcare; 'natural' units

3. Cost-utility analysis – QALY

4. Cost-minimisation analysis – no longer considered valid; equal outcomes but one is cheaper

Aim:

What is the difference in costs and consequences of option A compared to option B?

Economic evaluation – outcome measures

Example:

Cost-effectiveness analysis – larval therapy versus hydrogel therapy in management of leg ulcers

Cost:	**Hydrogel**	**Larvae**
Mean cost (£) per patient	1976.4	2073.1
Effect:		
Mean time to healing (days)	206.5	204.1

Cost-effectiveness:

$$\frac{2073.1-1976.4}{204.1-206.5} = \text{£40 per ulcer free day}$$

Economic evaluation – outcome measures

Example:

Cost-utility analysis – acupuncture vs. usual care over 24 months for persistent low back pain

Cost:	**Usual care**	**Acupuncture**
Mean cost (£) per patient	345.21	459.71
Effect:		
QALYs gained	1.426	1.453

Cost-effectiveness:

$$\frac{459.71-345.21}{1.453-1.426} = £4{,}241 \text{ per QALY gained}$$

Output/Units of Economic Evaluation

- ICER – incremental cost-effectiveness ratio:

$$\frac{\text{Difference in costs}}{\text{Difference in consequences}}$$

- ICER is ALWAYS a rate (£ per…)

- The lower the ICER, the better (e.g. £10 per additional QALY gained, better than £10,000 per additional QALY gained)

- Using these methods, a utilitarian approach is accepted:

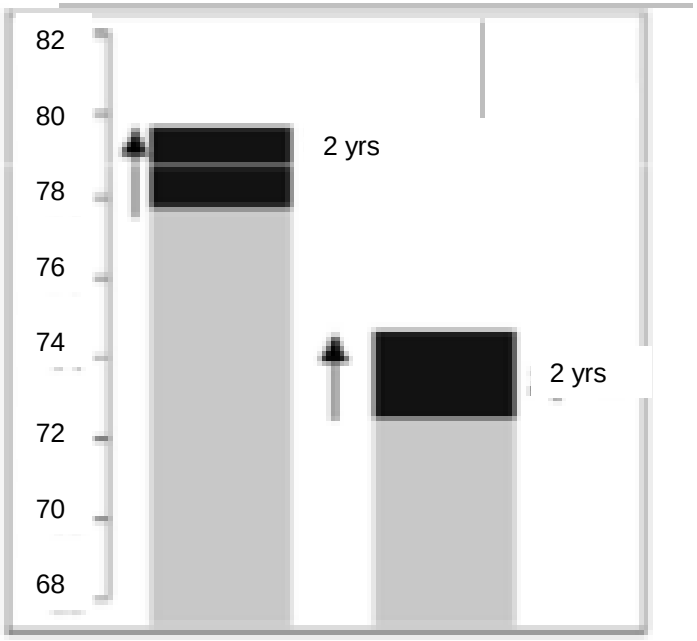
Eg. for a set £, a total improvement in QALY of 0.2 is taken over a gain of 0.15 QALYs. Even if the latter benefits 15 people, and the former benefits only 1

Value-based judgements – not all about the money…

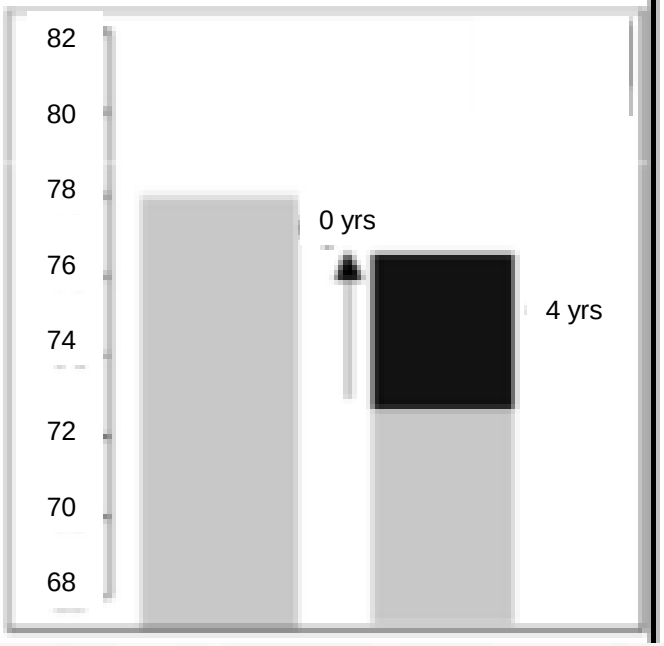
Who would you treat?

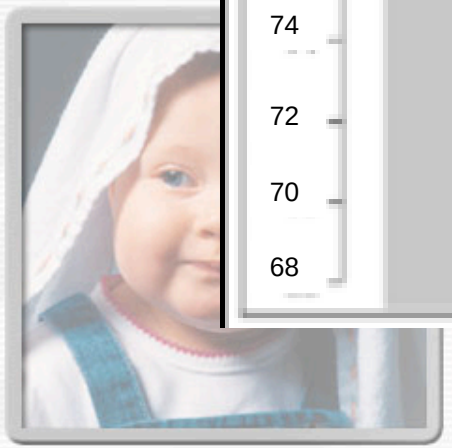
(Tsuchiya and Dolan, 2007)

Scenario A



Scenario B





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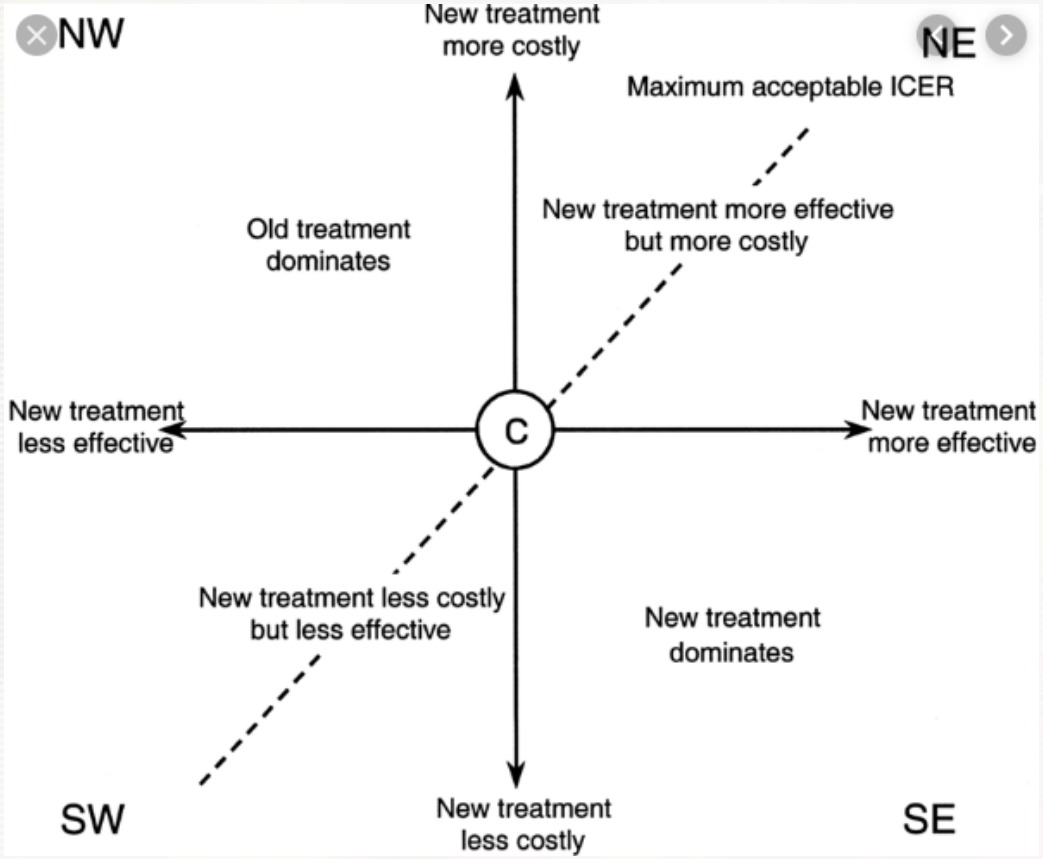
- A QALY is a QALY is a QALY

Presentation of data

Cost-effectiveness plane:



Output/Units of Economic Evaluation

- ICER – incremental cost-effectiveness ratio:

$$\frac{\text{Difference in costs}}{\text{Difference in consequences}}$$

- ICER is ALWAYS a rate (£ per…)
- Any negative ICER demonstrates dominance of one of the interventions
- A positive ICER needs plotting

- ICER does not consider ‘statistically significant differences’ between options. Instead health economists use UNCERTAINTY
- Pragmatic – much more of a focus

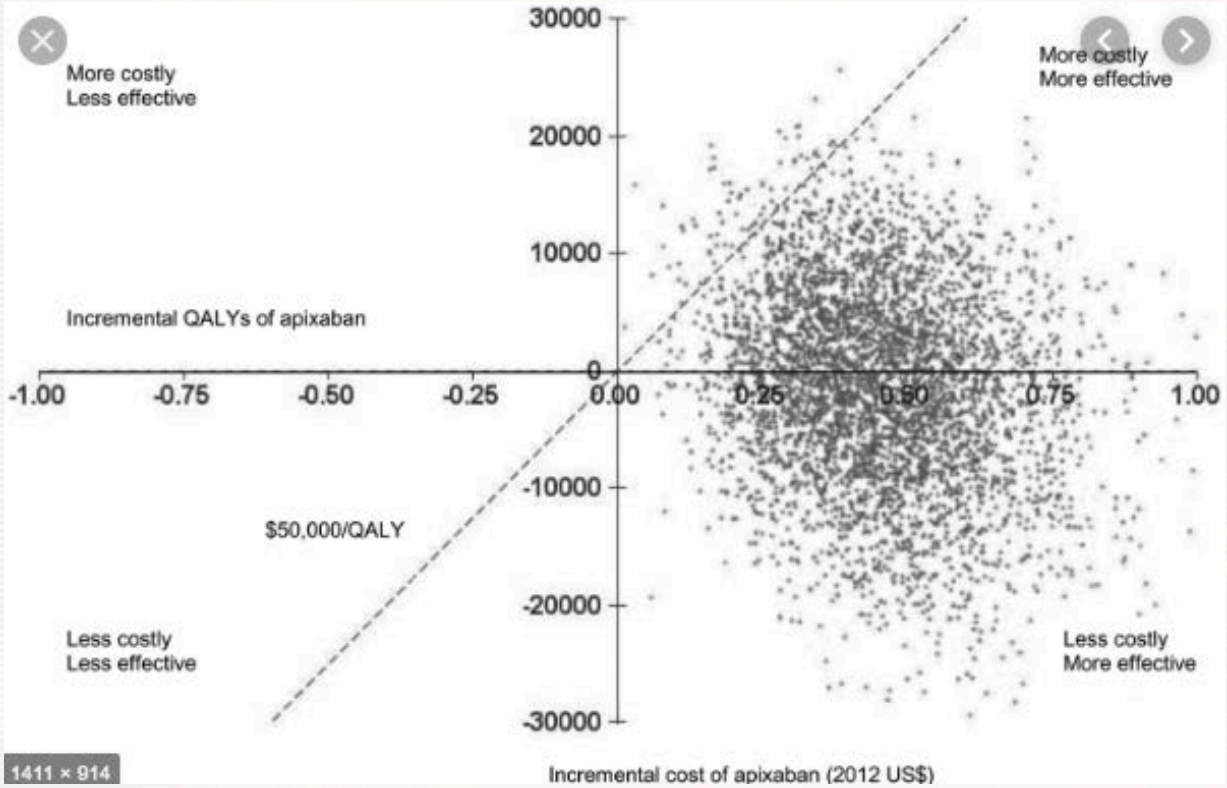
Presentation of data – handling of uncertainty

Bootstrapping:

- The figures used in production of the ICER are averages of a sample (both cost and effectiveness)
- As with all samples, these will come with statistical variation and therefore standard errors
- Using original data, possible to repeatedly resample data and calculate ‘new’ average cost, ‘new’ ICER and then plot this figure on C-E plane
- Creates distribution around the sample mean

Presentation of data

Bootstrapping:

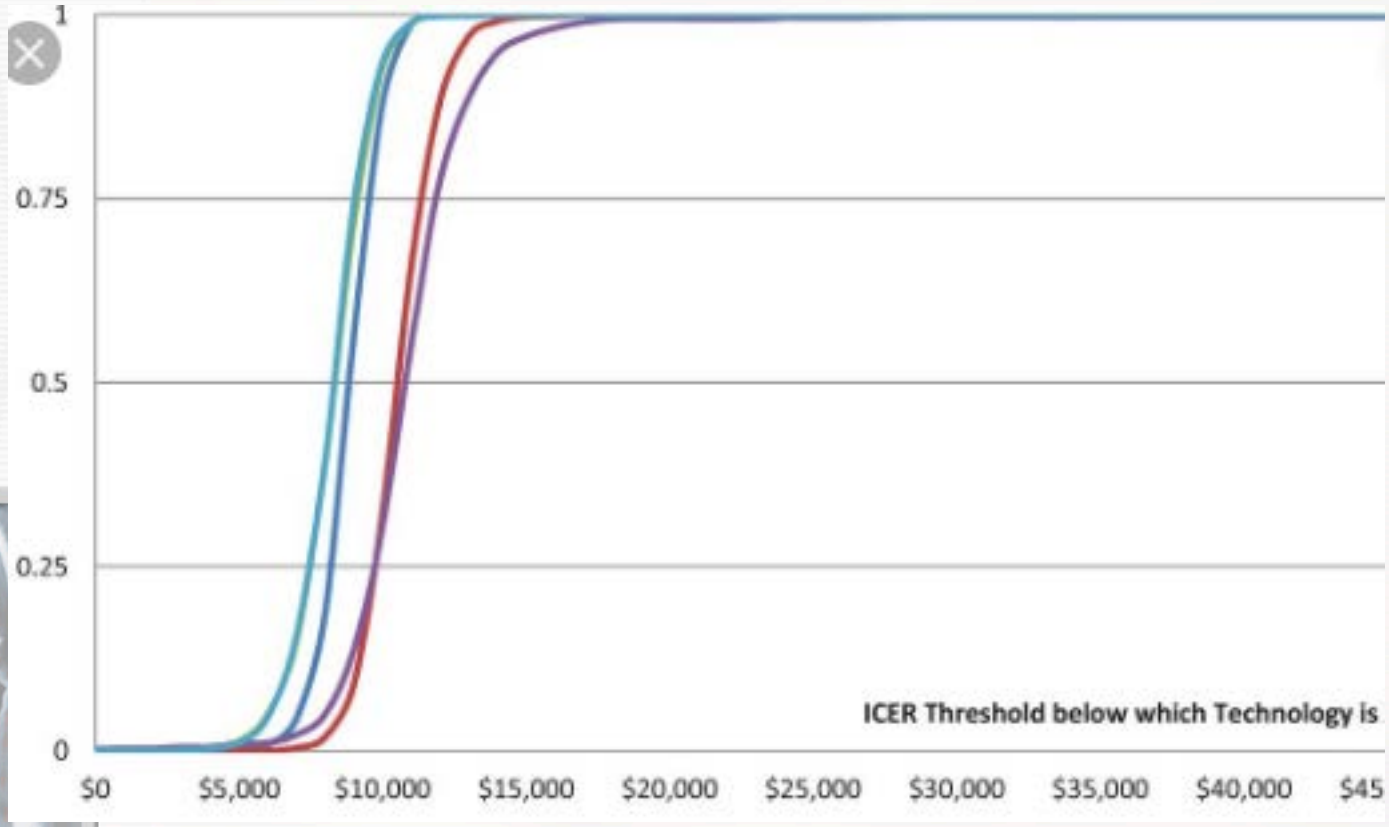


- Interested in where central 95% of points lie
- Alternatively, what percentage of points lie below the line
- Degree of certainty we can give to decision-makers that new treatment is preferable

Presentation of data

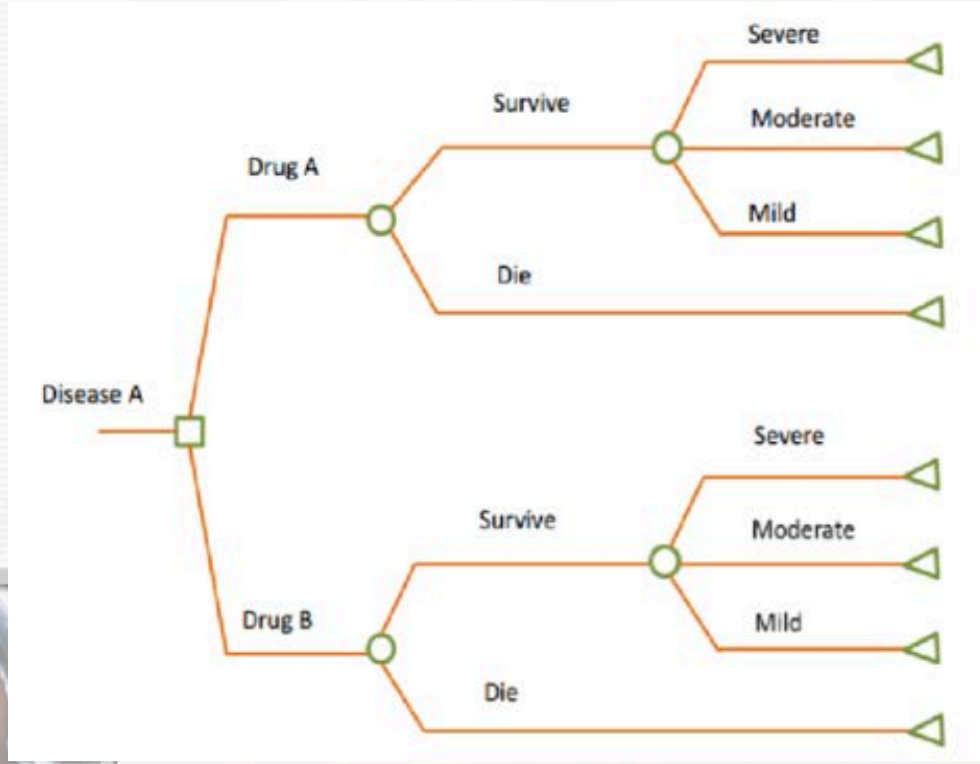
Cost-effectiveness acceptability curve:

•Decision-maker says what if we're not sure about our threshold?



Modelling – an entire topic

Decision-tree:



Nodes:

□ decision point between treatment options

○ possible events that patients experienced

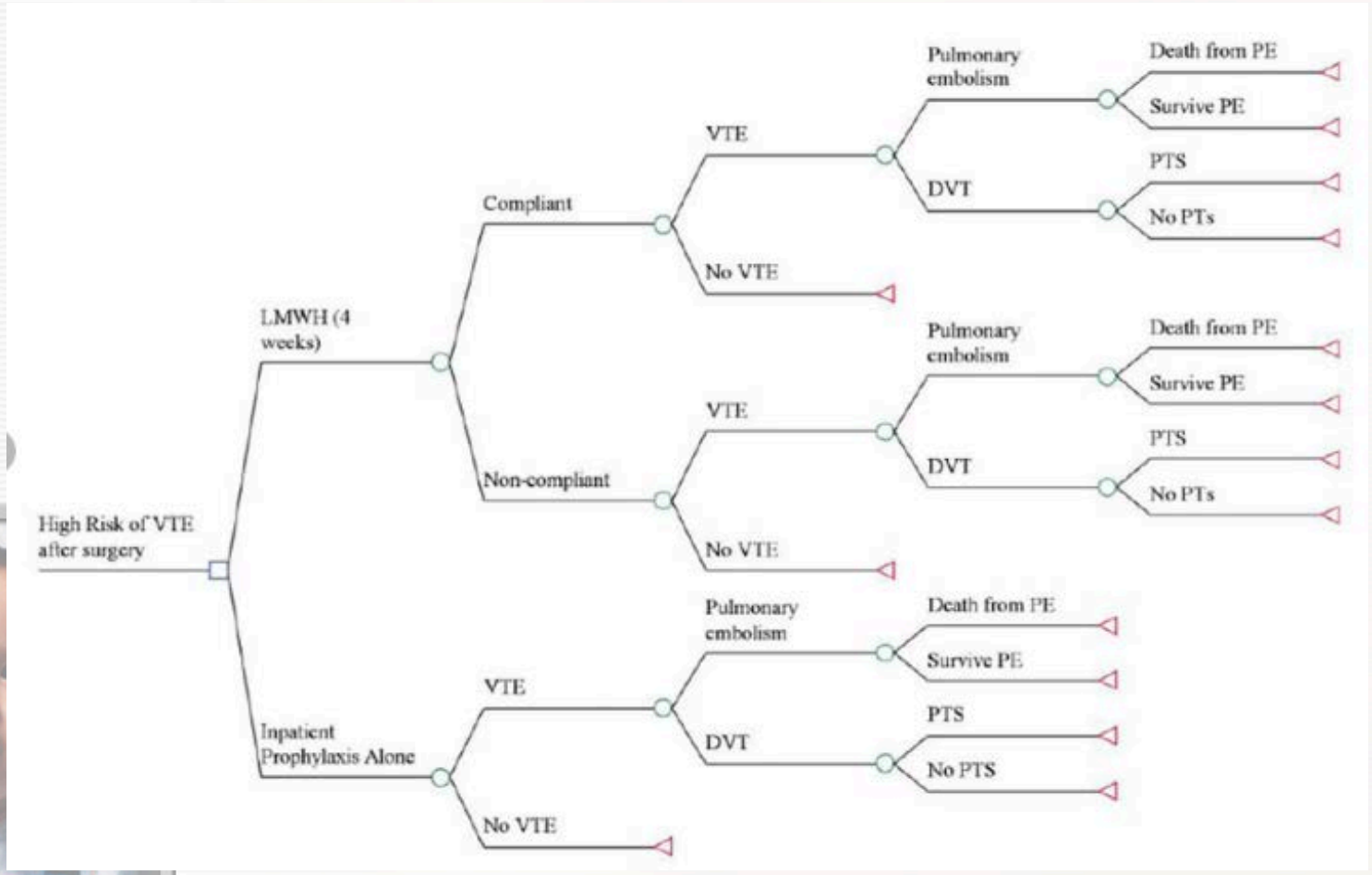
◁ terminal nodes

**Mutually exclusive for pathway*

**probability should be 1.0 in the end*

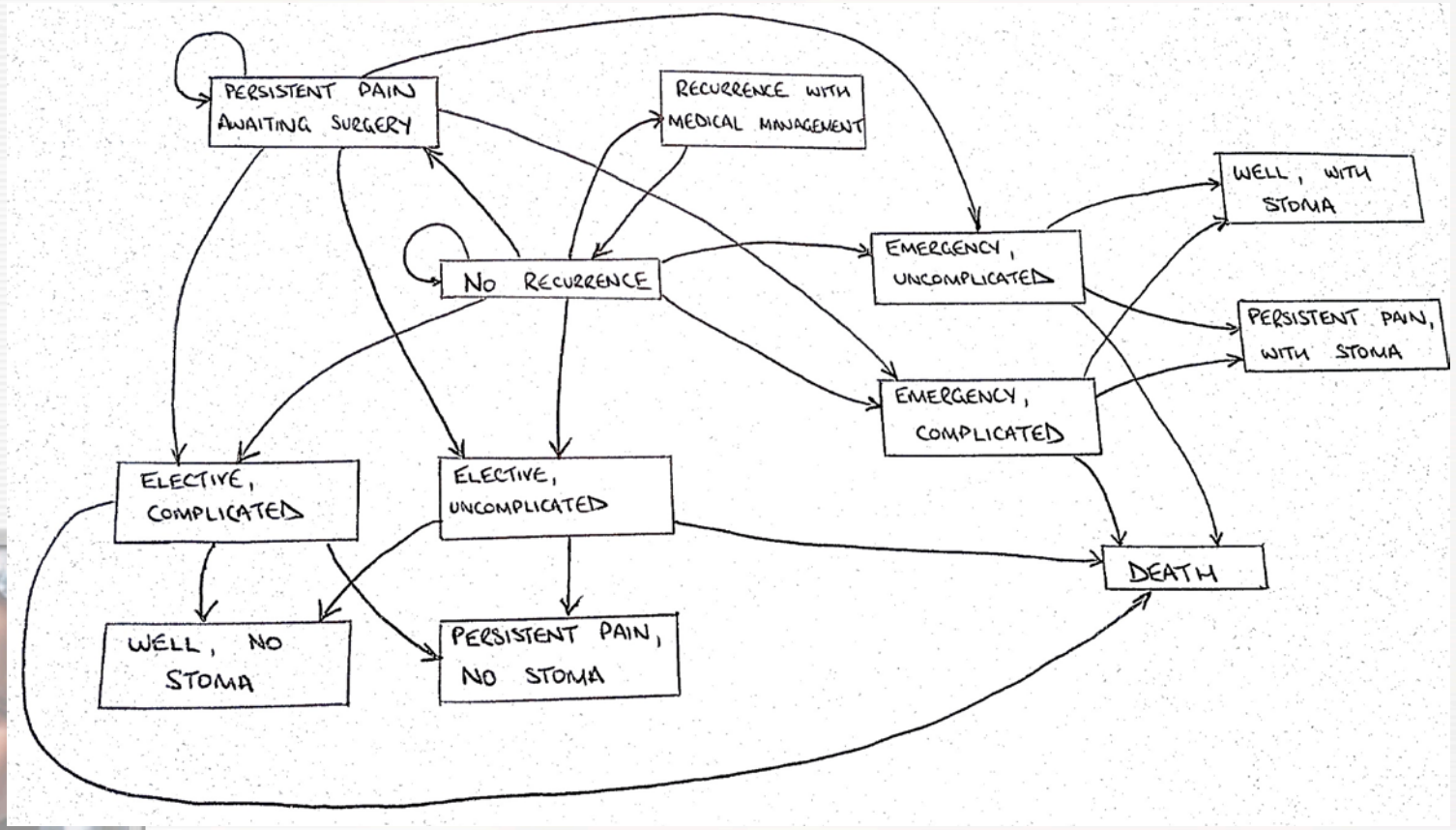
Modelling

Decision-tree:



Modelling – an entire topic

Markov modelling:



Satisfying the educationalists Summary

1. Macro- health economics and opportunity cost
2. Micro- health economics – economic evaluation
3. Presentation of data
4. Modelling (briefly!)

CHEERS checklist:

Husereau D, Drummond M, Petrou S et al. Consolidated health economic evaluation reporting standards (CHEERS) – Explanation and elaboration: A report of the ISPOR health economic evaluations publication guidelines good reporting practices task force. *Value Health* 2013; 16: 231-250

Roberts TE and the ECMO Economics Working Group on behalf of the ECMO Trial Steering Group. Economic Evaluation and randomised controlled trial of extracorporeal membrane oxygenation: UK collaborative trial *BMJ* 1998; 911-916

Any questions?

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