Panel Session 1
Background: QALYs and Thresholds

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Outline

- What is a threshold?
- What is a QALY?
- How does it relate to WTP?
  - Must relate to preferences
- How does it relate to Opportunity cost of health care?
  - Must relate to health benefit derived
- How are either related to thresholds?

Incremental cost-effectiveness ratio (ICER)

$$ICER = \frac{\Delta \text{ costs}}{\Delta \text{ effectiveness}} = \frac{Cost_{\text{int}} - Cost_{comp}}{Eff_{\text{int}} - Eff_{comp}}$$

- Higher *ICERs* indicate lower cost-effectiveness
- But what does this *ICER* tell the decision makers?
- A new intervention is found to be more effective and more expensive but…..
- It is necessary to have further information to determine whether society considers this additional benefit to be worth the additional cost involved

- To do this, an **external value** system is needed - something to compare the *ICER* to:
  - 'Cut-off point' , 'ceiling value', threshold (λ) for the *ICER*
  - λ represents the maximum amount society is willing to pay for a unit increase in health benefits (**maximum price (WTP) or shadow price of a unit increase in the health benefits**)

$$ICER = \frac{Cost_{\text{int}} - Cost_{comp}}{Eff_{\text{int}} - Eff_{comp}} < \lambda$$

QALYs & WTP (Broome, 1993)

- Fairly well known that QALYs find it difficult to meet the axioms of expected utility
- Broome (1993) picks up on a number of issues
- Discounting implies separability $V(q_1, q_2, \ldots, q_y) = v(q_1) + r_2 v(q_2) + \cdots + r_y v(q_y).$
  - Where *v* are value functions measuring good/benefit of each *q*
  - Separability can hold if individual risk-neutral
- Then we get the EU function $E(u(V(q_1, q_2, \ldots, q_y))) = E(u(v(q_1) + r_2 v(q_2) + \cdots + r_y v(q_y)))$
- Note that the EUs [*u(.)…]* are attached to the *v(.)s* and it is the *v(.)s* that are additively separable
  - And therefore linearly transformable and therefore *cardinal* measures
  - It is NOT the *"q"s* (the quality of life measures) that are cardinal measures
- He reconciles by introducing goodness or benefit measures of "*q*"

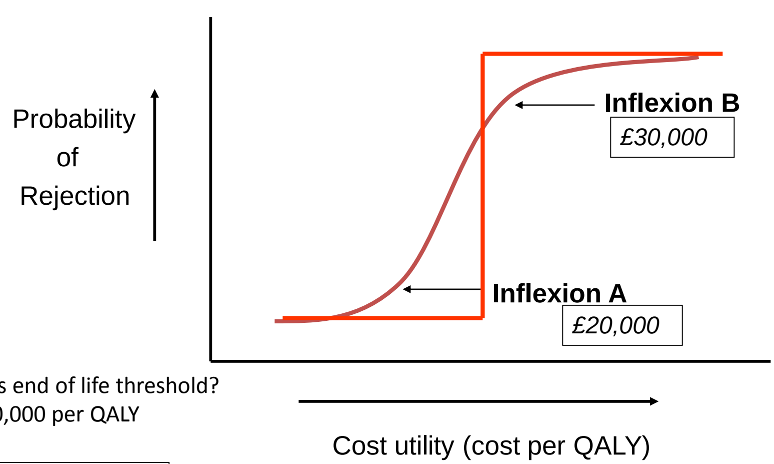
$$D(q_1, q_2, \ldots, q_y) = g(q_1) + \rho_1 g(q_1) + \cdots + \rho_y g(q_y).$$

ρ=discount rate

QALYs & WTP (Broome, 1993)

- So the *g(.)* & *v(.)* functions are related through some transformation
- The QALY [*v(.)*] is some transform of the good/benefit [*g(.)*] function
- QALYs assign values to these "states of health" but are determined by how people feel in these states of health, their preferences or by some objective principle
- We simply do not know how QALYs relate to preferences
- Moreover in adjudicating *across* individuals we need additional weights
- Difficult to come by if we do not know the *v(.)* to *g(.)* transform
- Basically QALYs cannot easily be related to WTP and require additional information to represent "societal" values
- Could relate to value of a statistical life – but really?

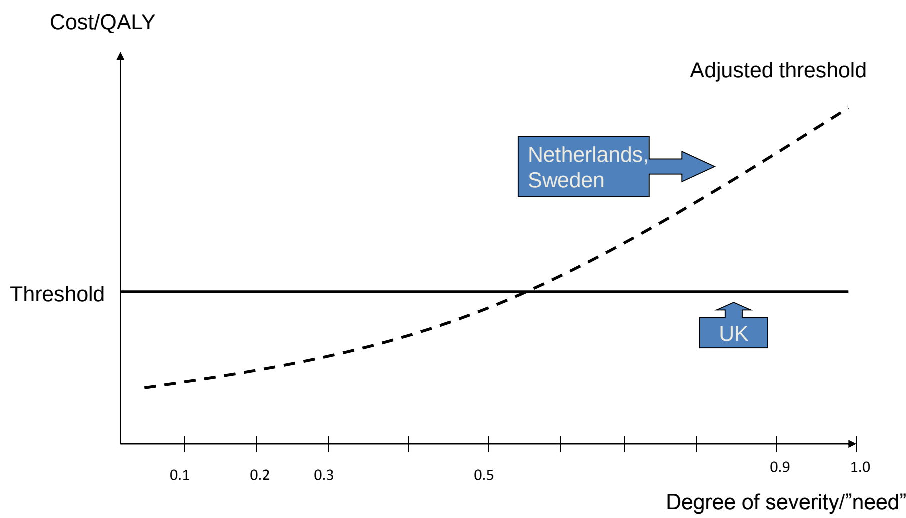
The Cost Effectiveness (WTP) Threshold and how NICE works it out



Plus end of life threshold?
£50,000 per QALY

Source: Cookson, 2007

Explicit Value Judgements: Equity /"need" adjusted reimbursement decisions compared with a constant cost-effectiveness threshold



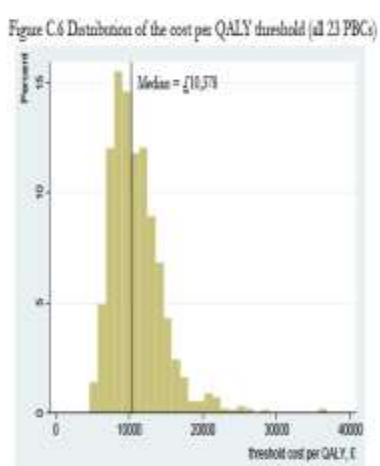
QALYs and opportunity cost

- QALYs can be taken as value to individual of state of health as it relates to health benefit
- Easier jump to make that any "valuation" can be made on a revealed preference basis
- Value of the opportunity cost of resources currently devoted to producing a health state
- Assumes "rationality" in decision making

QALYs and opportunity cost

- In England approach to take QALYs =f(health expenditure)
- Martin et al (2008), Klaxton (2013)
- Essentially QALYs related to 23 programme budget areas within the NHS
- Econometrically derived
- Say essentially
- $H_{ij}=\alpha + \beta x_{ij}+\phi n_{ij}+\varepsilon_{ij}$ (with a related expenditure equation)
- H=QALY; x=expenditure; n=population health needs
- Still being worked on
  - Data (needs, QALY conversions, assigning "overheads", etc etc)
  - Endogeneity issues
  - IV estimates
  - Essential equations based on mortality changes converted into LYG, then QALYs
- But first systematic attempt to produce opportunity cost based QALY thresholds
- Lots of estimates based on various assumptions

QALYs and opportunity cost



Source: Claxton et al, 2013

- Estimated for 23 programme budget areas
  - Give different values
  - Inefficient or Inconsistent?
  - Or diseases weighted differently?
- Could pick any number of estimates
- Let's take the median after a number of adjustments to be £10,378 per QALY
- Tested for model & parameter uncertainty
- Relatively stable
  - Well below current threshold
  - Correct?

Conclusions

- QALY difficult to define formally as a preference
- Therefore difficult to define as WTP
- Could be under a number of assumptions
- QALY must have an opportunity cost
- Difficulties in measuring this
- In both case societal weights required

Conclusion

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