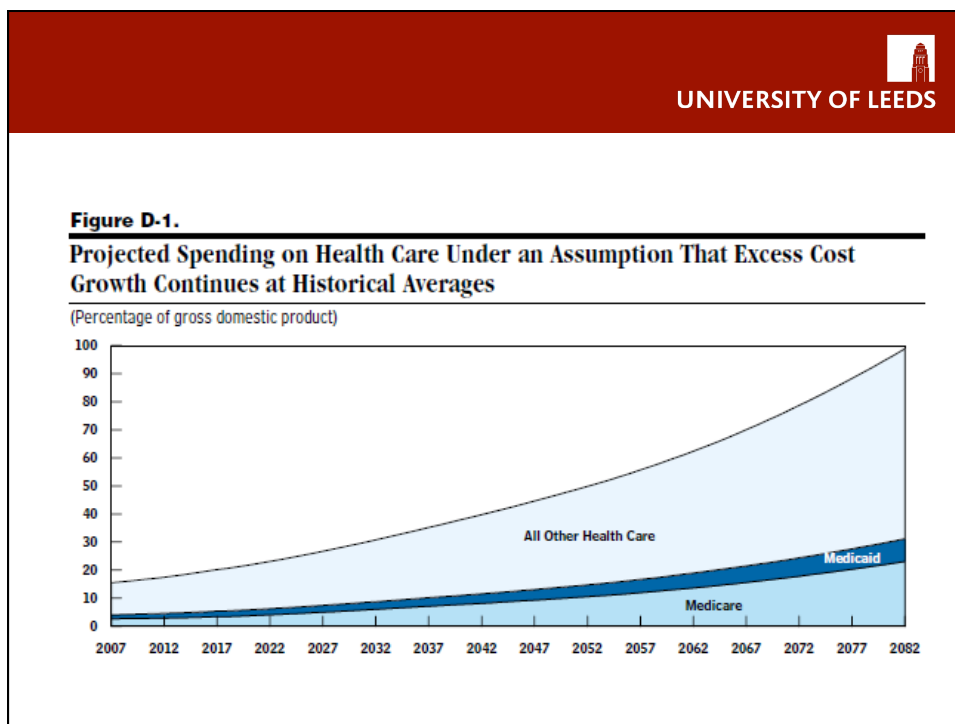
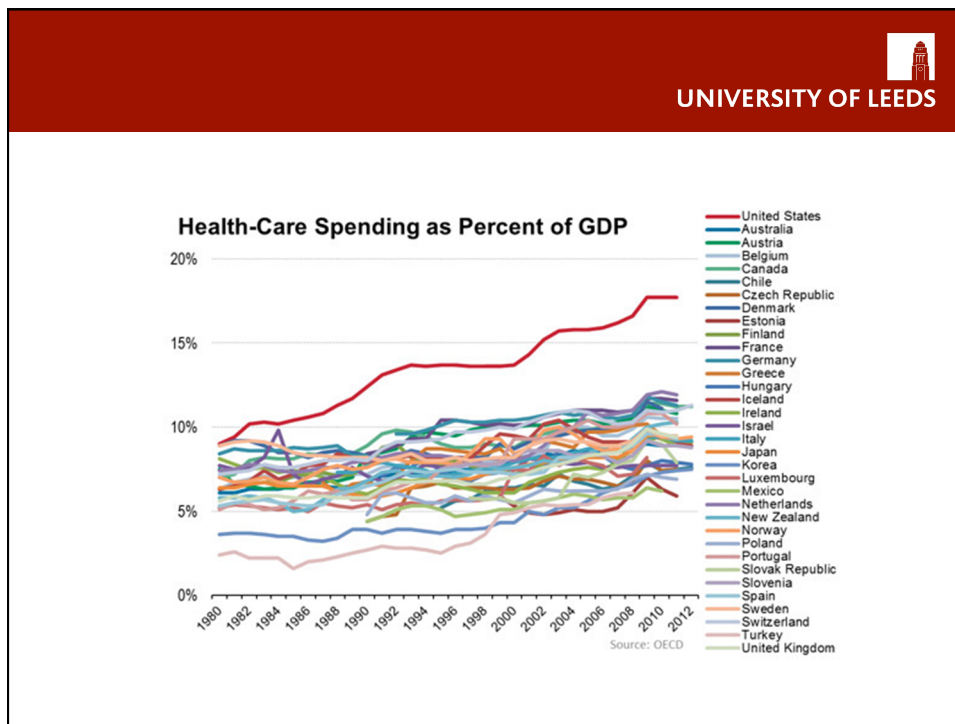


Fat Chance :- A Marriage of Health and Sports Economics?

Chris Bojke
ESEA 2016, 2nd September, Groningen

General Overview

- Give general landscape of current framework of Economic Evaluation in Health Economics
- Identify and develop obvious links between strands of sports economics research and health economics
- Maybe plan a few seeds regarding the general 'decision-making' orientated approach enshrined in health economics.



The underlying problem



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- There is an infinite demand for healthcare.
- There is a finite amount of resources with which to provide healthcare.
 - Even if it's not 100% of GDP
- This is the 'classic' rationale for economics – the science of scarcity
 - A scientific approach to maximising 'outcomes' given limited resources.
 - Still means difficult decisions need to be made, but makes them explicit.
 - ***A pragmatic approach to making better decisions!***
- ***The acid test Are you making better decisions about healthcare spending???***

Application of Health Economics in real-life decision problems



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- England (NICE)
 - <http://www.nice.org.uk/article/pmg9/resources/non-guidance-guide-to-the-methods-of-technology-appraisal-2013-pdf>
- France (HAS)
 - http://www.has-sante.fr/portail/upload/docs/application/pdf/2012-10/choices_in_methods_for_economic_evaluation.pdf
- Sweden (TLV)
 - <http://www.tlv.se/Upload/English/Guidelines-for-economic-evaluations-LFNAR-2003-2.pdf>
- Netherlands (CVZ)
- Germany (IQWiG)
 - https://www.iqwig.de/download/General_Methods_for_the_Assessment_of_the_Relation_of_Benefits_to_Costs.pdf

And in the US



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- The Patient Protection and Affordable Care Act 2010
 - Creates Patient-Centred Outcomes Research Institute (PCORI) to conduct CE research
 - But effectively forbids use of results in decision making

“The notion that the country can avoid the difficult trade-offs that cost-utility analysis helps us to illuminate ... pretends that we can avert our eyes from such choices ... It represents another example of our country’s avoidance of unpleasant truths about resource constraints” [and] “helps to perpetuate the current system of implicit rationing and hidden biases”

Neumann PJ and Weinstein MC (2010) Legislating against use of cost-effectiveness information *N Eng J Med* 363:16

Common features

















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- Maximise Health-Related Quality of Life subject to a budget constraint
 - Probably wrong objective function – other things matter e.g equity
 - Money only valuable via opportunity cost
- A common measure of Health Outcome
- An emphasis on practical significance
 - A hugely increased role for modelling
 - Converting statistical parameters into realistic valued metrics
 - A very different role for uncertainty
- A consensus on how to compare the impact on costs and outcomes

Olympic Games Rio 2016

OVERVIEW SPORTS SCHEDULE ATHLETES MEDALS COUNTRIES

Medal standings

Country				
1  United States	46	37	38	121
2  Great Britain	27	23	17	67
3  China	26	18	26	70
4  Russia	19	18	19	56
5  Germany	17	10	15	42
6  Japan	12	8	21	41
7  France	10	18	14	42
8  South Korea	9	3	9	21
9  Italy	8	12	8	28
10  Australia	8	11	10	29

All countries 

The Obesity Crisis (in the UK)

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- NHS England said around £16 billion a year is spent on the direct medical costs of diabetes and conditions related to being overweight or obese.
 - Diabetes
 - CHD
 - Stroke
 - General Health
 - Some Cancers
 - Dementia

Diabetes

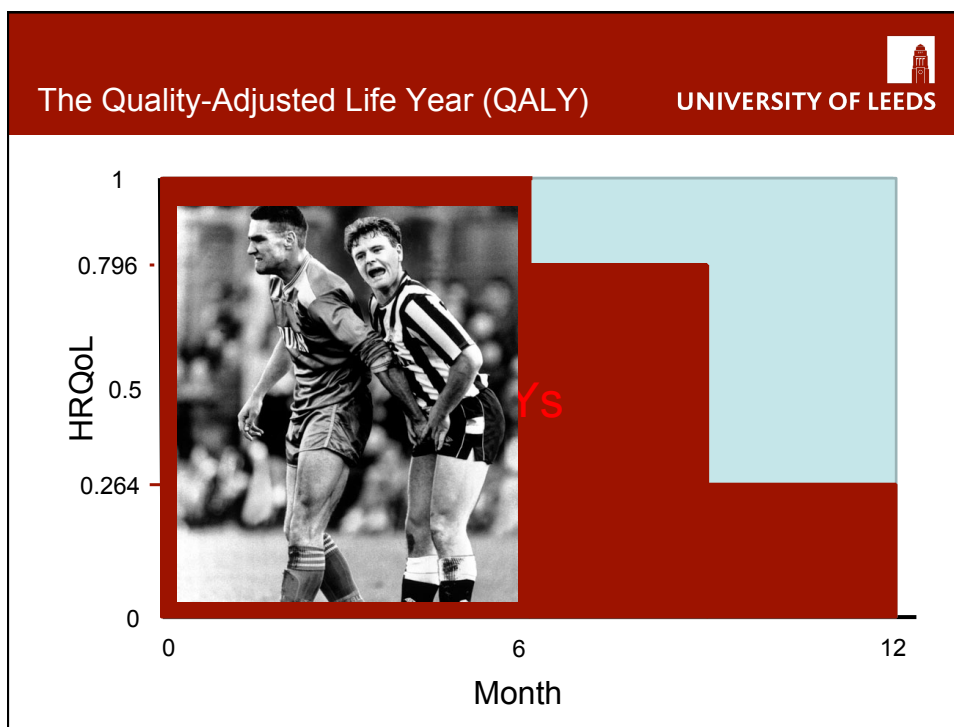


- Diabetes alone accounts for some £10bn
- Mainly as a result of complications of diabetes
 - In Britain, diabetes causes 7,000 amputations a year – 135 legs are cut off every week and rising.
- Non-medical costs relatively high
 - Lesniowska et al (2013) estimate that indirect costs are approximately 75% of costs due to diabetes in Poland
- Largest costs associated with complications rather than treatment of diabetes per se
 - Lesniowska op cite find direct costs of treating complications are up to five times that of treatment of diabetes per se

How do we measure Health Benefit?



- To make pragmatic decisions on resource allocation across the 1,000's of potential options across 1,000's of diseases we need some common metric or some means of weighting outcomes.
- It would also be helpful if the measure had some meaningful context.
- Health Economists have come up with the concept of the Quality-Adjusted Life Year (QALY) a mixture of utility and duration.



Incremental Differences UNIVERSITY OF LEEDS

- HRQoL difference between experiences
 - $1 - 0.765 = 0.235$ QALYs
- Suppose you had a medication that could avoid that ailment
 - Control \rightarrow 50% avoid ailment
 - Treatment \rightarrow 80% avoid ailment
- Incremental QALY gain, ΔE
 - $(0.8 \cdot 1 + 0.2 \cdot 0.765) - (0.5 \cdot 1 + 0.5 \cdot 0.765) = 0.0705$ QALYs

So what do we use around the world?



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- UK, Canada, Australia?
 - QALYs
- US?
 - U.S. Panel on Cost-Effectiveness in Health and Medicine 1996
 - QALYs
- Denmark?
 - Sundhedsstyrelsen Health Technology Assessment Handbook 2007
 - QALYs
- France?
 - HAS
 - www.has-sante.fr/portail/upload/docs/application/pdf/2012-10/choices_in_methods_for_economic_evaluation.pdf
 - QALYs or Life Years
- Germany
 - IQWiG
 - www.iqwig.de/download/General_Methods_for_the_Assessment_of_the_Relation_of_Benefits_to_Costs.pdf
 - Fundamental rejection of the QALY approach – use disease specific measures

EuroQoL 5 Dimension Generic Instrument



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The EQ-5D-3L descriptive system should be scored as follows:

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

Mobility	
I have no problems in walking about	<input checked="" type="checkbox"/>
I have some problems in walking about	<input type="checkbox"/>
I am confined to bed	<input type="checkbox"/>
Self-Care	
I have no problems with self-care	<input checked="" type="checkbox"/>
I have some problems washing or dressing myself	<input type="checkbox"/>
I am unable to wash or dress myself	<input type="checkbox"/>
Usual Activities (e.g. work, study, housework, family or leisure activities)	
I have no problems with performing my usual activities	<input checked="" type="checkbox"/>
I have some problems with performing my usual activities	<input type="checkbox"/>
I am unable to perform my usual activities	<input type="checkbox"/>
Pain/Discomfort	
I have no pain or discomfort	<input type="checkbox"/>
I have moderate pain or discomfort	<input checked="" type="checkbox"/>
I have extreme pain or discomfort	<input type="checkbox"/>
Anxiety/Depression	
I am not anxious or depressed	<input checked="" type="checkbox"/>
I am moderately anxious or depressed	<input type="checkbox"/>
I am extremely anxious or depressed	<input type="checkbox"/>

Levels of perceived problems 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'
-


NB: There should be only one response for each dimension.

This example identifies the state 11232.

NB: Missing values can be coded as '9'.

NB: Ambiguous values (e.g. 2 boxes are ticked for a single dimension) should be treated as missing values.

EQ-5D TTO Tariff		
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Response	UK Utility Decrement	Dutch Utility Decrement
Any deviation from 11111	-0.081	-0.071
Some Mobility problems	-0.069	-0.036
Severe Mobility problems	-0.314	-0.161
Some Self-Care problems	-0.104	-0.082
Severe Self-Care problems	-0.214	-0.152
Some Usual Activity problems	-0.036	-0.032
Severe Usual Activity problems	-0.094	-0.057
Some Pain/Discomfort	-0.123	-0.086
Severe Pain/Discomfort	-0.386	-0.329
Some Anxiety/Depression	-0.071	-0.124
Severe Anxiety/Depression	-0.236	-0.325
Any Severe Problems	-0.269	-0.234
11211	0.883	0.897
11121	0.796	0.843
33333	-0.594	-0.329

Utility and Diabetes		
 UNIVERSITY OF LEEDS		
<ul style="list-style-type: none"> Davies MJ, Chubb BD, Smith IC, Valentine WJ. Cost-utility analysis of liraglutide compared with sulphonylurea or sitagliptin, all as add-on to metformin monotherapy in Type 2 diabetes mellitus. <i>Diabetic Medicine</i> 2012; 29(3): 313-320 		
(selection of) Event	Utility	Dis-Utility
Diabetes, no complications	0.814	-
Angina	0.682	-
Active Ulcer	0.600	-
Amputation, year of event	-	-0.109
Amputation, 2+ years after event	0.680	-

Costs

- Some variation in usage across countries
- Mainly perspective regarding which costs to include
 - Payer perspective – only NHS e.g. NICE
 - Societal perspective – all costs (inc. productivity loss) e.g. Sweden
- All methods incorporate offset costs
 - i.e. hospitalisations avoided
- May make big difference for obesity related analyses

Costs and Diabetes

- Davies et al (2012)

(selection of) Event	Cost
Angina (1 st year)	£2,548
Angina (2 nd + years)	£842
Standard uninfected Ulcer	£1,402
Amputation	£9,832
Amputation prosthesis	£625

Modelling



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- 'All models are wrong, but some are useful'
 - George Box, 1987
- 'In fact, models are not only useful, but essential for a number of reasons'
 - Milton Weinstein, 2011

Diabetes & Modelling

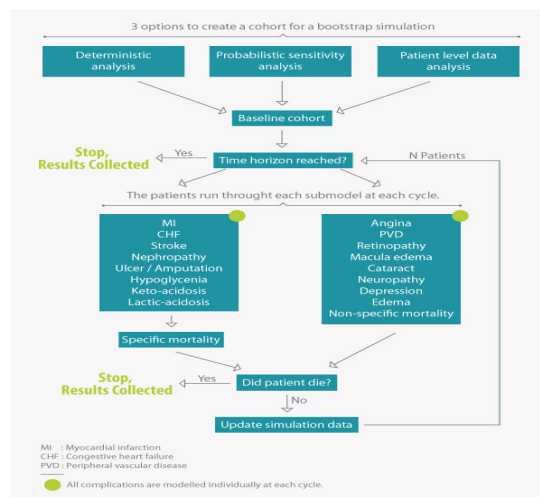


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- No simple model
 - Long time frame
 - Lots of complications that may interact with each other
 - Not realistic to expect bespoke model
- Choice of several available models
 - CORE
 - Markov model with Monte Carlo simulation based on UKPDS
 - Others are available
 - UKPDS; Sheffield

CORE Diabetes Model

- The IMS Health CDM comprises 17 inter-dependent sub-models, using Markov modelling with tracker variables running in yearly cycles. The time horizon can vary between one and fifty years. Direct and indirect costs can be incorporated, so both health system and societal perspectives can be modelled.



CORE Diabetes Model

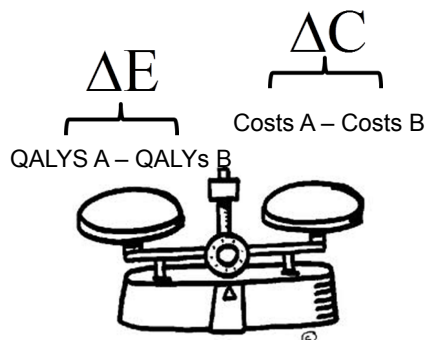
- Probabilities of events driven by Hb1ac, blood pressure, cholesterol, BMI, other patient characteristics and comorbidities
- Stick impact of physical activity on expectations of BMI and run through model to understand cost & QALY implications

Composite Models

The image shows two screenshots. On the left is the NICE Physical Activity tool interface, which includes a 'Parameter Menu' for selecting a location (London, Middlesbrough) and a 'Calculate Current Package' button. On the right is the MOVES Tool flowchart, which illustrates the process from 'DATA INPUTS' (Demographics, Frequency of exposure, Type & intensity of sports, Hours per week, Advantages and prep set) through 'MOVES TOOL PROCESSES DATA' to 'RETURN ON INVESTMENT OUTCOMES' (Costs per QALY, Cost savings through disease aversion, Quality of life years gained, Cases of diseases averted).

Comparing costs and benefits

- EE measures the **incremental** (not average) costs and benefits of specific treatments relative to the provision of alternative treatments, by comparing expected **counterfactual outcomes**.



Decision Rules

- If $\Delta C < 0$ and $\Delta E > 0$ then new technology dominates and should be adopted
- If $\Delta C > 0$ and $\Delta E < 0$ then new technology dominated and should not be adopted
- If $\Delta C > 0$ and $\Delta E > 0$ then new technology should be adopted if Incremental Cost-Effectiveness Ratio (ICER) is less than a Maximum Willingness to Pay for a QALY

$$\Delta C / \Delta E \leq \lambda$$

- And vice versa if $\Delta C < 0$ and $\Delta E < 0$

Willingness to Pay for a QALY?

- Also known as threshold value and denoted by λ
- And you may have heard of some values
 - England - £20k to £50k cost per QALY
 - Australia - AU\$ 69,900 per QALY
 - Netherlands – €80,000 per QALY
 - Sweden – €90,000 per QALY
 - US - \$50k per QALY
 - WHO – 3% GDP per capita
- But what does it represent?

The Threshold Value

- Prices?
 - Only available where there is a market

- Willingness to Pay?
 - What is the hypothetical stated preference of patients/society?
 - Sweden TLV uses this

- Shadow Prices?
 - What does it generally cost to produce unit of output?
 - Not really a value, more a measure of **opportunity cost**
 - This is what NICE use
 - Claxton et al 2015 estimate it currently costs the NHS approx £13,000 to produce a QALY

Alternative formulations of ICER

- Incremental Net Monetary Benefit
 - $INMB = \lambda * \Delta E - \Delta C$
 - Converts argument into monetary metric
 - If $INMB > 0$ then cost-effective

- Incremental Net Health Benefit
 - $INHB = \Delta E - (\Delta C / \lambda)$
 - Converts argument into QALY metric
 - If $INHB > 0$ then cost-effective

Use of the Threshold Value



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- Its not a guillotine
 - Other criteria also influence results
 - Certainty
 - Available alternatives
 - End of Life
 - Children

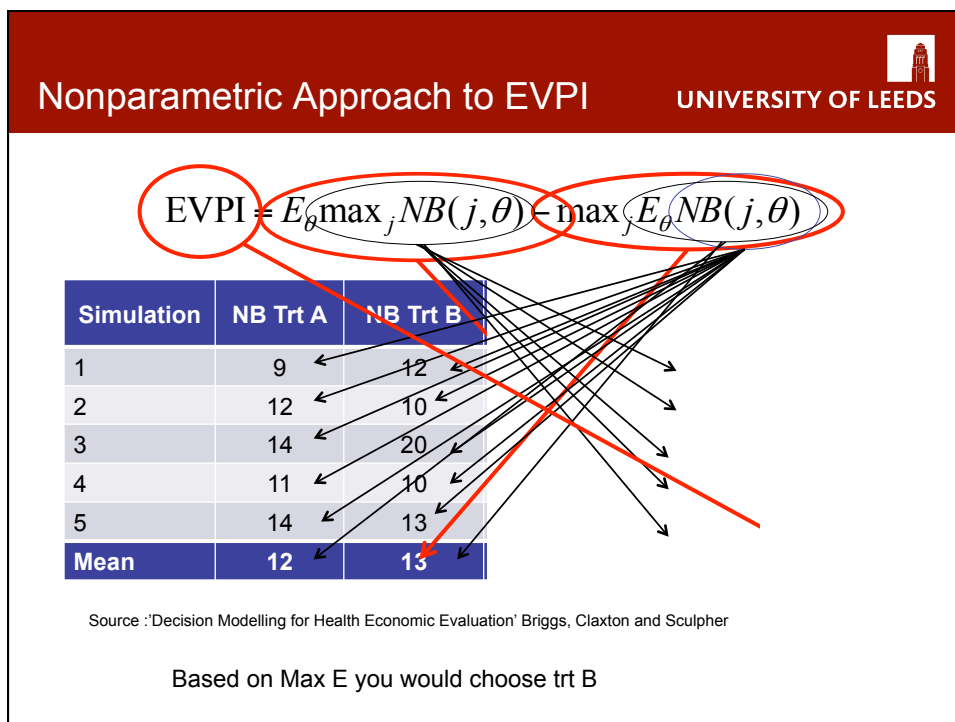
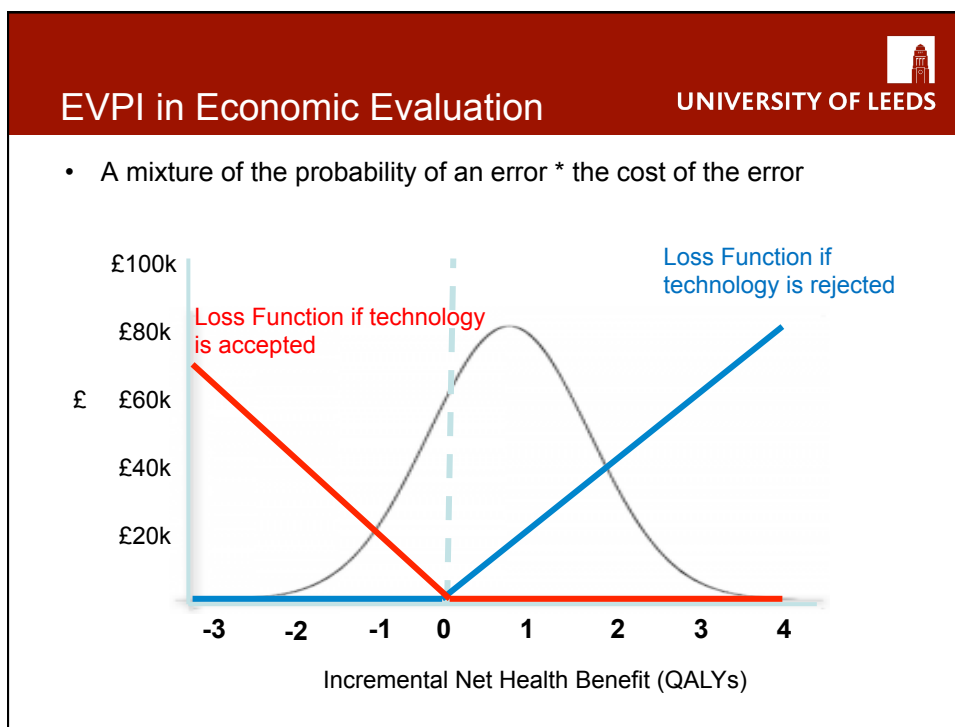
- Thresholds can be used as a signal that reimbursement requires additional (non-economic) support

Treatment of Uncertainty



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- No real role for statistical significance
- Uncertainty matters because there is a cost associated with making an incorrect decision
 - A function of degree of probability of making error & cost of error
 - Illustrated by Loss Function
- Sensitivity analysis a major component of HE.
- May impact on decision to adopt
 - Is trt expected to be cost-effective based on best available evidence?
 - Non-reversible large set-up costs ?
 - Probability of collecting new data?
- Most likely to impact on decision to collect new data and then re-consider decision



Related Concepts



- Expected Value of Perfect Parameter Information
 - EVPPI
 - The costs of uncertainty around a specific parameter in the model
 - Helps identify where further research is required

- Expected Value of Sample Information
 - EVSI
 - Not all uncertainty may be removed by further research
 - Helps measure the value of further research
 - If value of research > costs of research then compelling reason to fund research!

Conclusions



- Methods developed in HE are far from perfect, but they almost certainly lead to better decision making

- Obesity crisis creates clear link between health and sports economics research

- Any sports study that wishes to address 'health benefits' should probably adopt at least elements of HE evaluation framework i.e. QALYs

- The greater emphasis on practical rather than statistical significance in meaningful metrics has helped entrench the impact of economics in decision making.

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