Cost-effectiveness modelling for TB interventions

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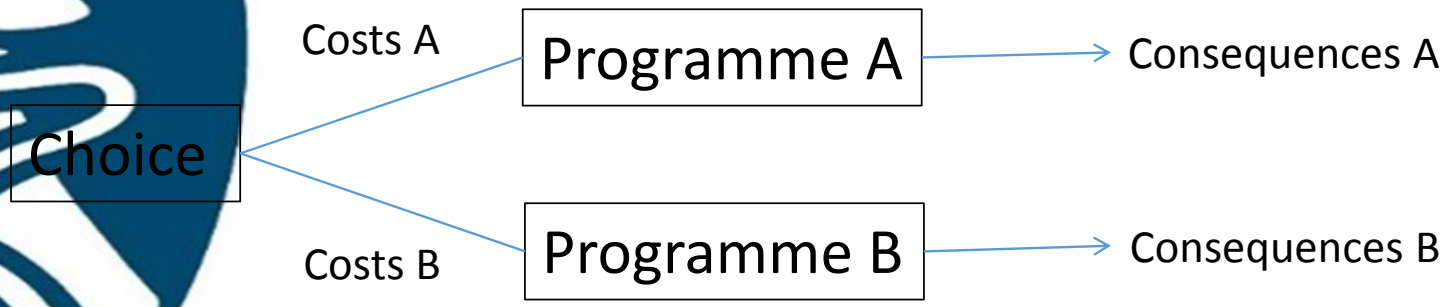
An Introduction to tuberculosis modelling post-graduate course

TB Union Conference, Guadalajara, 11th October 2017

Improving health worldwide

What is economic evaluation?

- The use of analytical methods to identify, measure, value and compare the costs and consequences of alternative interventions



Drummond et *al.* (2005)

Why is cost-effectiveness important?

- Decision support tool
- Resources are scarce, therefore we must make the best choices about how to use them:
  - –evaluate whether our choices are <u>efficient</u>

    are they being used in a way that maximises good health?
  - evaluate our choices in a transparent, systematic way

    demonstrate to others that resources are being used well

Stages of an economic evaluation

- Defining the question
- Identifying, quantifying and valuing the resources required (costs)
- Identifying, quantifying and valuing the outcomes required (utilities)
- Analysing, presenting and interpreting the evidence for decision making

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What is the question?

- Strategic level
  - Should INH preventative therapy be given to those with HIV/AIDS?
  - Should we screen for TB outside symptomatic clinic attendees?
- Tactical level
  - Should three sputum examinations be carried out?
  - Should expanded case-finding be facility- or community-based?
- Defining comparisons
  - New services against do nothing
  - New technology against status quo technology
  - Multiple options/resource allocation (more realistic)
  - Doing less

What perspective should we take?

- When are patient/societal costs important?
- Change in resource use between intervention and alternatives?
- What do we mean by provider?
  - Health services/systems
  - Budgetary implications

Prioritising interventions - Q

Q: You are your country's Minister of Finance. The TB programme sends you a request for additional funding for Xpert and EPI sends a proposal for adding a second dose of measles vaccination to the U5 immunisation schedule. Of course there isn't enough money to do both but they both sound worthwhile…

What aspects of the problem would you consider to make a decision?

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Prioritising interventions - A

Impact of health problems

Resources needed for intervention

Prioritising interventions - A

Impact of health problems

- Number of cases
- Number of deaths
- Disability, pain or suffering
- People with a risk factor
- Money spent on a health problem
- Lost income due to health problem

Resources needed for intervention

- Personnel
- Buildings/space
- Equipment
- Supplies & pharmaceuticals
- Transportation
- Training
- Social mobilisation and communication

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Financial vs economic costs

- Financial costs
  - Price tag
- Economic costs
  - Opportunity costs

Classifying costs

	Direct	Indirect
Programme	**Recurrent/Variable** • Staff / Personnel, Supplies, Utilities, Admin, Travel, Other operating cost **Capital/Fixed** • Buildings, Equipment, Vehicles, Furniture, Once-off training	Community wide loss of production ?
Patient	• Medical (consultations, hospital, admission, drugs) • Travel	• Waiting time • Pain • Illness related absenteeism

Counting the costs - Q

Q: The following slide shows an image from a lab

What resource items in the picture should be added up and valued to calculate the cost per test?

And what resources are not in the picture but are still necessary to deliver the intervention?

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What is utility?

- Sense of wellbeing/satisfaction associated with health states
- Used to describe (and measure) preferences for health states

Measuring effects - Q

Q: Case-finding, early diagnosis and linkage to treatment can prevent morbidity and deaths from TB. The question is how do we measure and value the benefits of avoiding these negative outcomes

How do you measure the impact of the death from TB of a mother of three, who was the only school teacher in the village?

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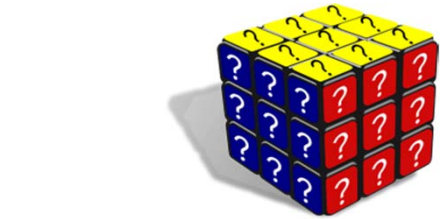

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Measuring effects - A

How do you measure the impact of the death from TB of a mother of three, who was the only school teacher in the village?

- A 'case' of TB mortality
- The number of years she has lost from premature death
- The value of her wages her family has lost
- The effect of the loss of her wages on her children's schooling – school fees can no longer be afforded
- Pain and suffering to her husband and children
- Loss of the investment her parents made toward her education
- Loss to the school system which now has to hire and train a replacement

QALYs

Utility weights derived through direct elicitation or indirectly from general population surveys (e.g. EQ-5D) and then applied to different conditions

Example:

Treatment A extends life by 10 years in perfect health:

QALYs=10*1=10

Treatment B extends life by 10 years in a state with 0.5 utility

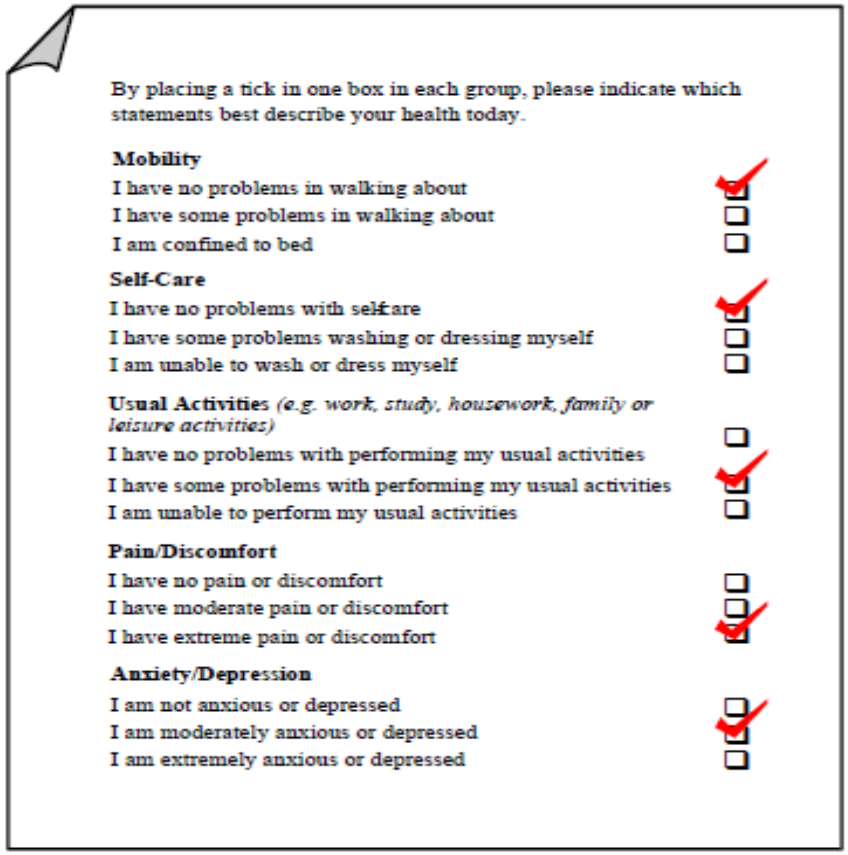
QALYs=10*0.5=5

Direct methods

- Person trade-off
  - *Extend by one year the lives of 200 people, or extend the lives of 1000 people with one year living confined to bed?*
- Standard gamble
  - *Would you rather live with TB, or undergo treatment that can restore health with a 20% risk of death?*
- Time trade-off
  - *20 years of living with a physical disability compared to 10 years of healthy life?*
- Visual analogue scale
  - *How well are you feeling today?*

Indirect methods

The EQ-5D 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 ☑
- I have some problems in walking about ☐
- I am confined to bed ☐

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 ☐

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 ☐

Pain/Discomfort
- I have no pain or discomfort ☐
- I have moderate pain or discomfort ☐
- I 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 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 <u>one</u> response for each dimension.

This example identifies the state 11232.

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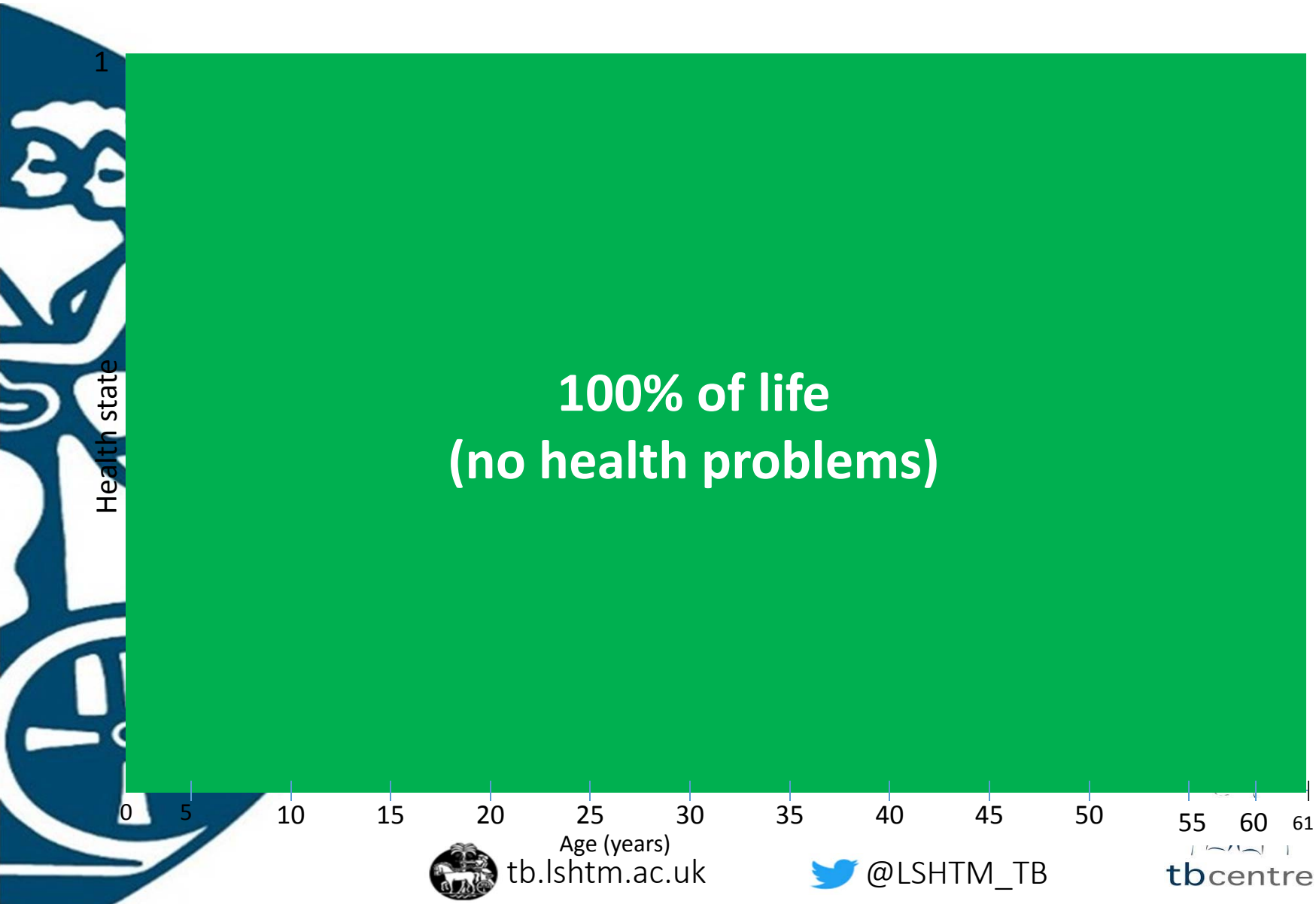
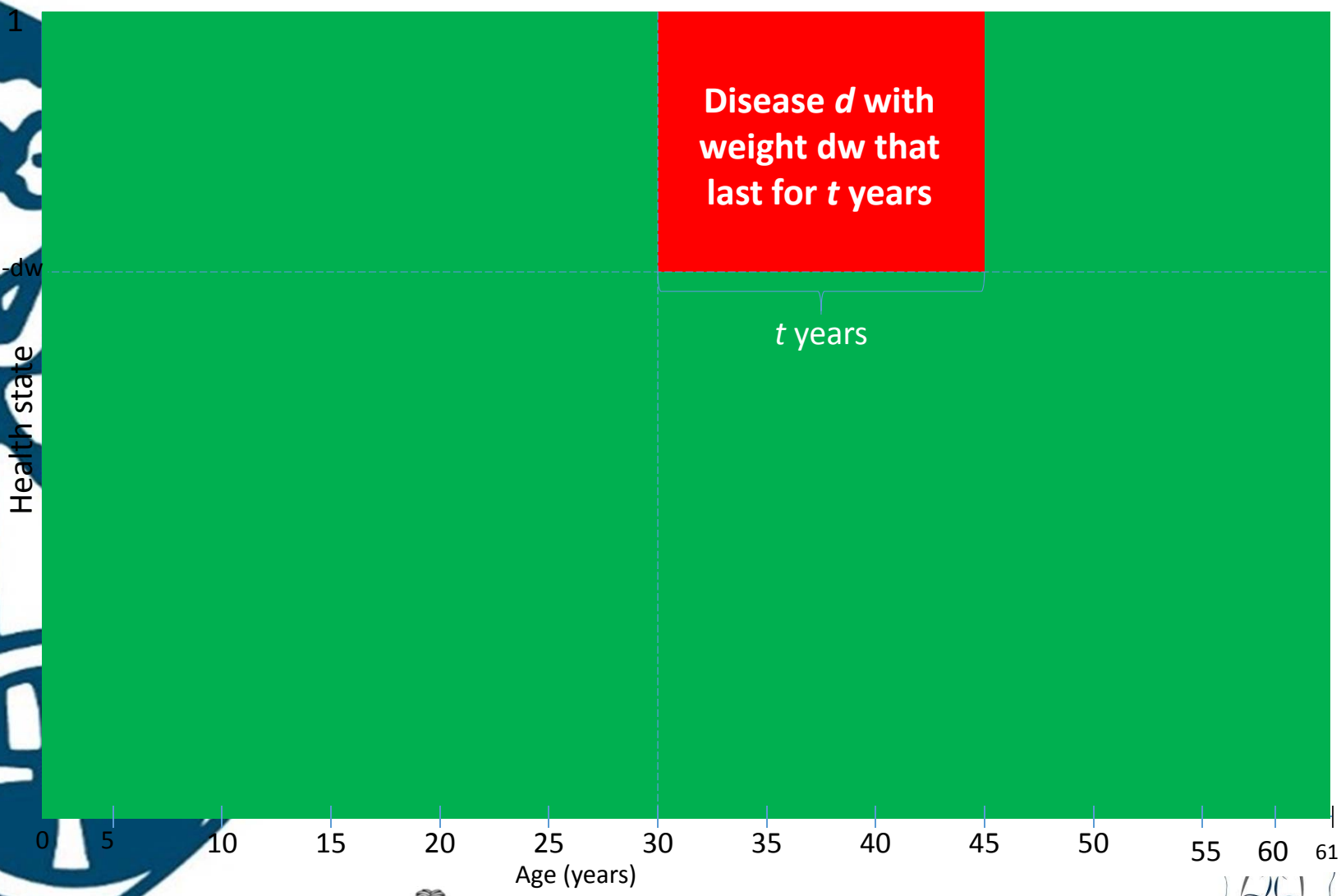
DALYs

- Sum of the years of life lost due to premature mortality (YLLs) and years of life lost due to time lived in health states less than ideal health/disability (YLDs)
- They are a measure of the health gap between actual health and a defined ideal for health achievement
- DALYs are a ‘bad’ and health interventions should aim to avoid them


1
Health state
100% of life
(no health problems)
0
5
10
15
20
25
30
35
40
45
50
55
60
61
Age (years)



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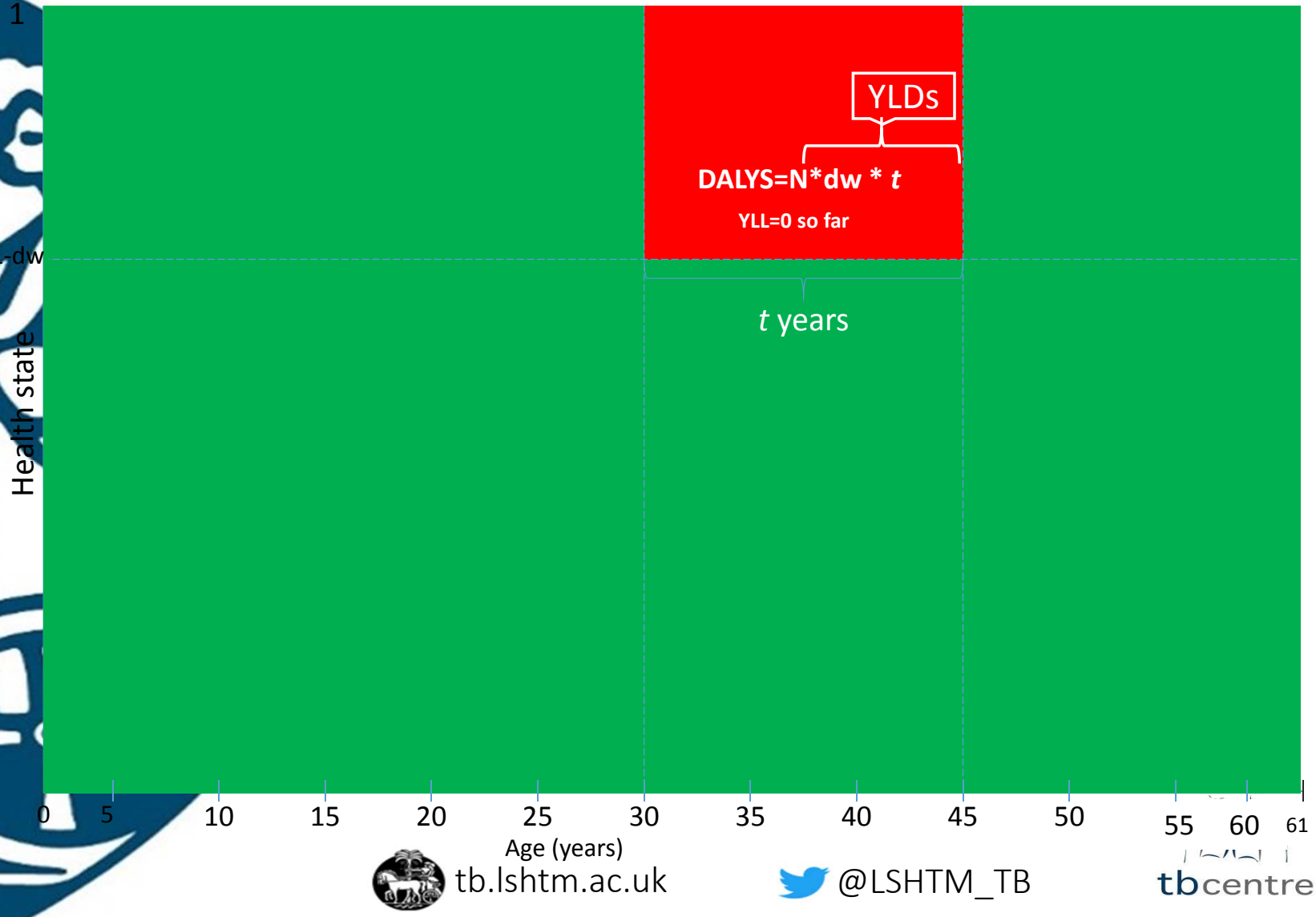

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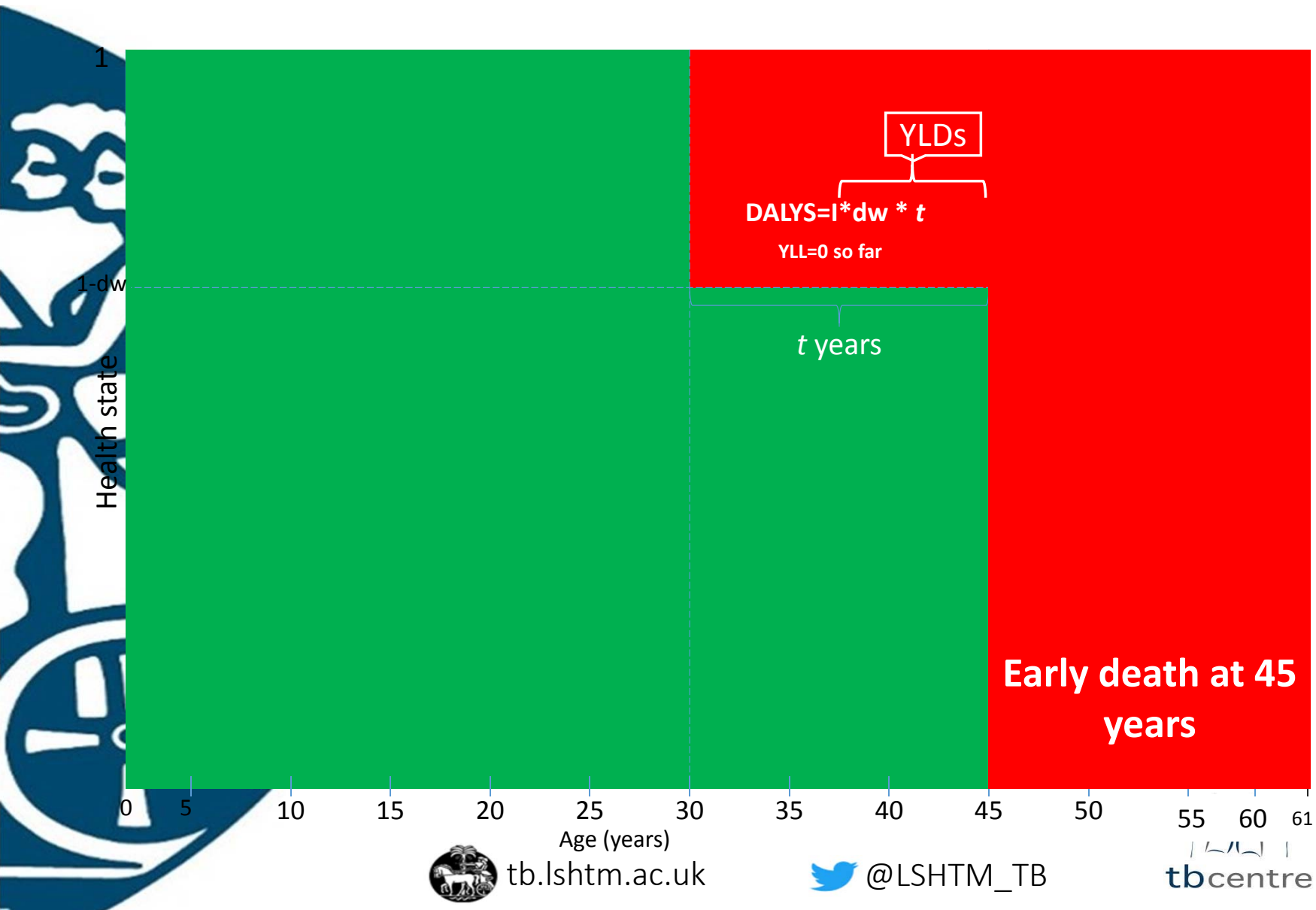

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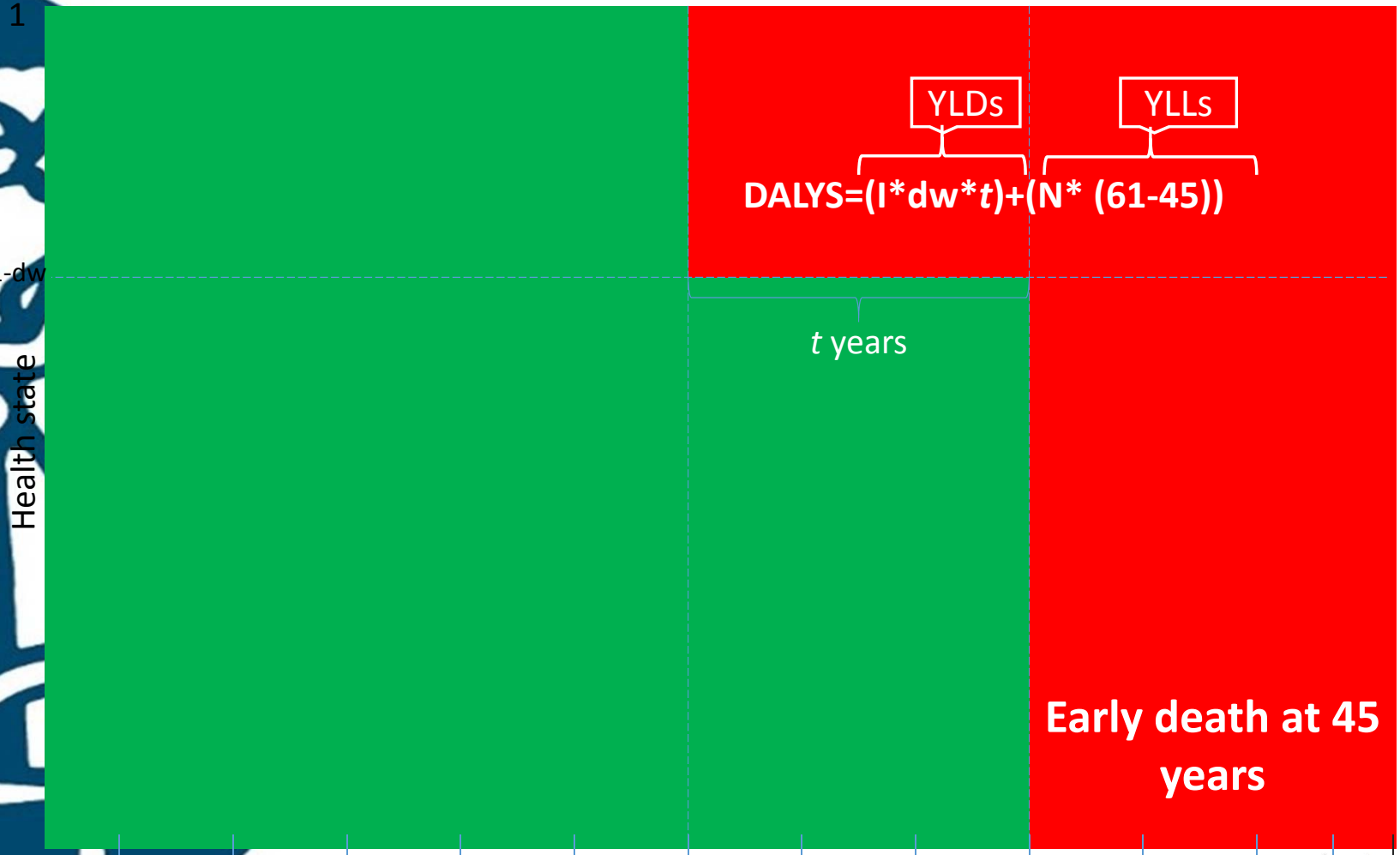

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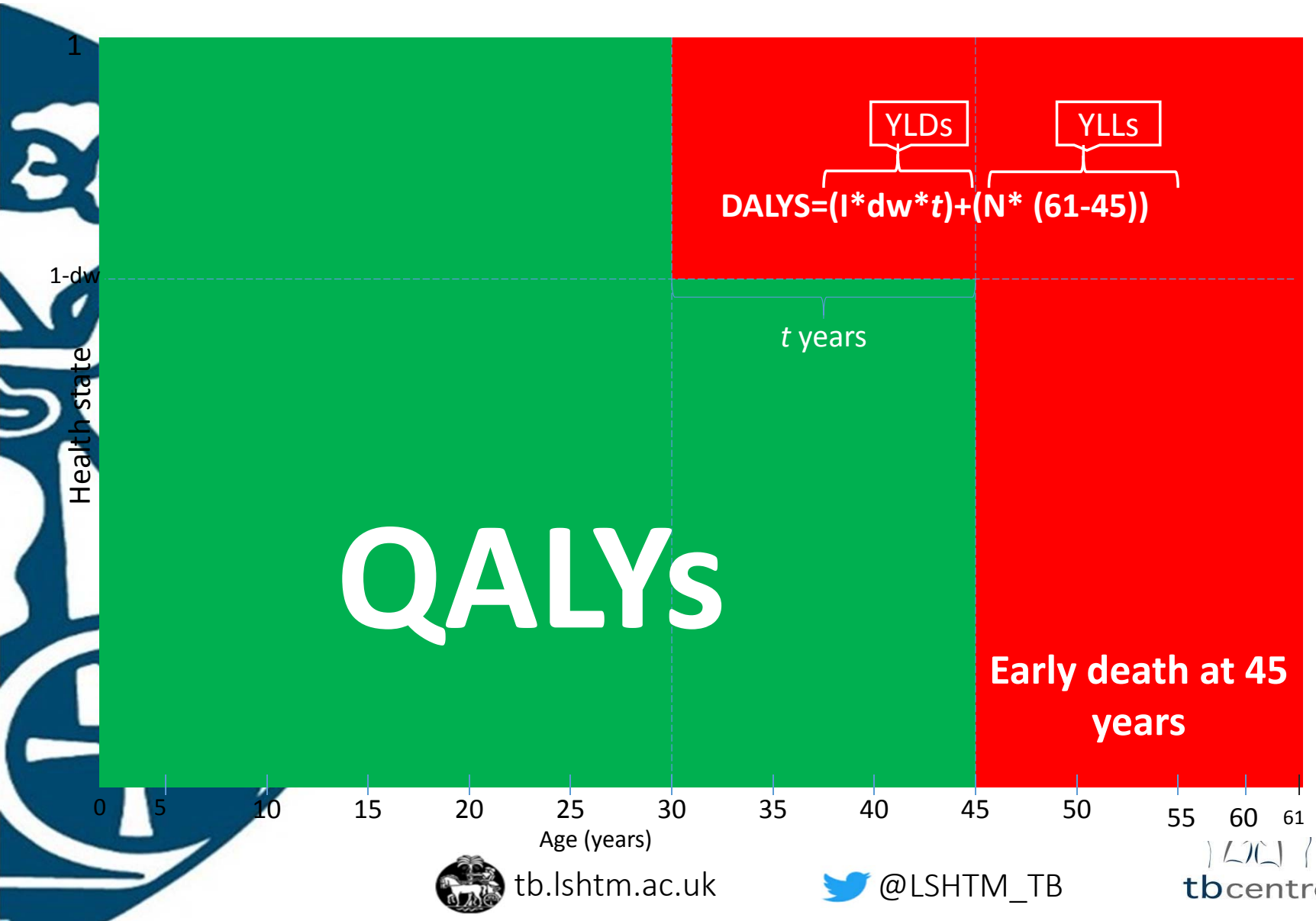

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Model choice

- Empirical/ single study
  - Cost and effects measured as part of trial – all costs and effects fall on the participants of the trial within the time frame of the trial
- Extending time period
  - Use of cohort models to project long-term costs and effects
- Extending populations and time period
  - Use of transmission models
- Extending scope
  - Use of health systems models
- Combination
  - Complexity vs comprehensiveness

Cost-effectiveness ratios

- Average cost effectiveness ratio (ACER)

Total cost of intervention A/Total impact of intervention A

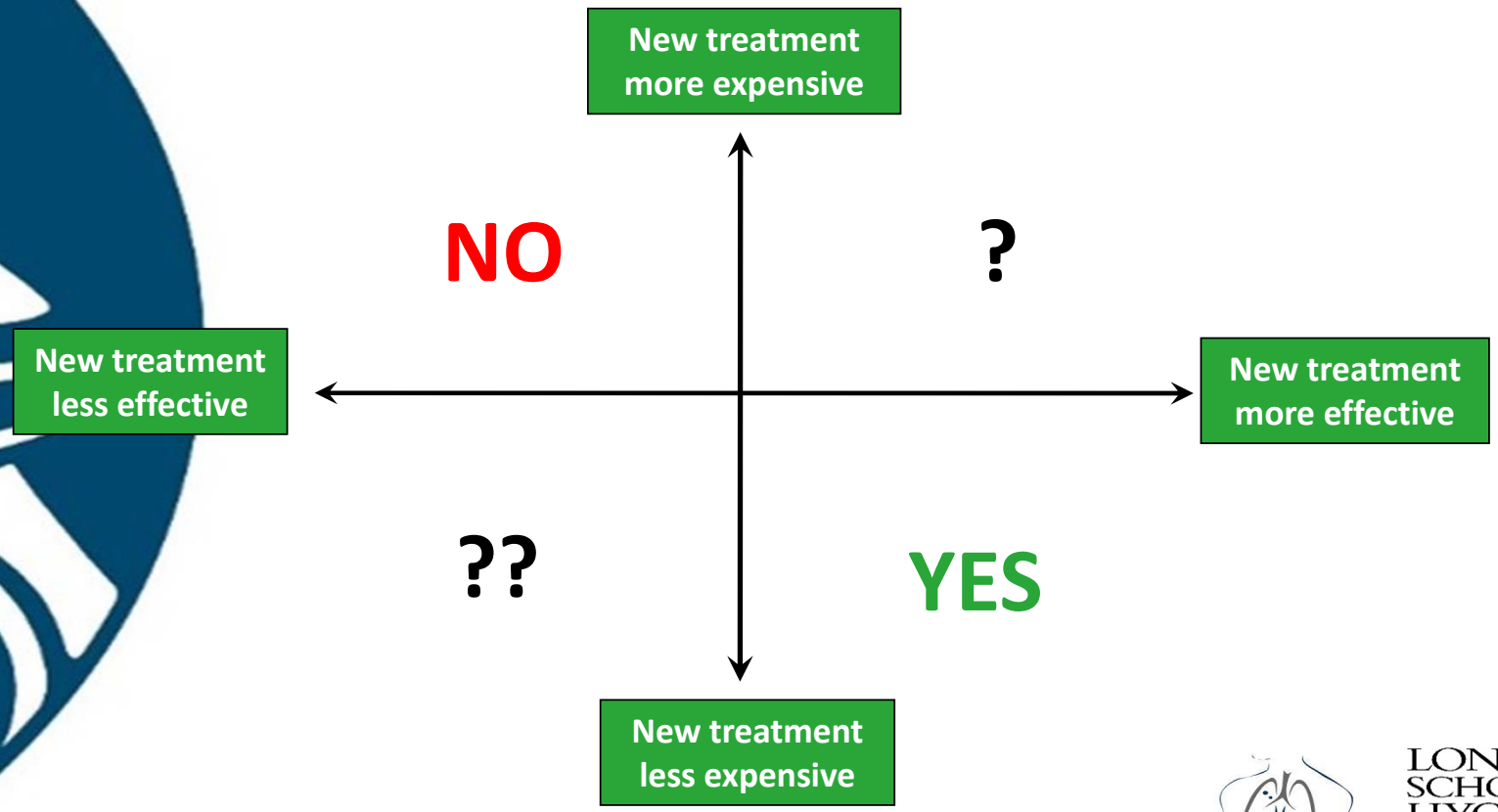
Total cost of intervention B/Total impact of intervention B

- Incremental cost effectiveness ratio (ICER)

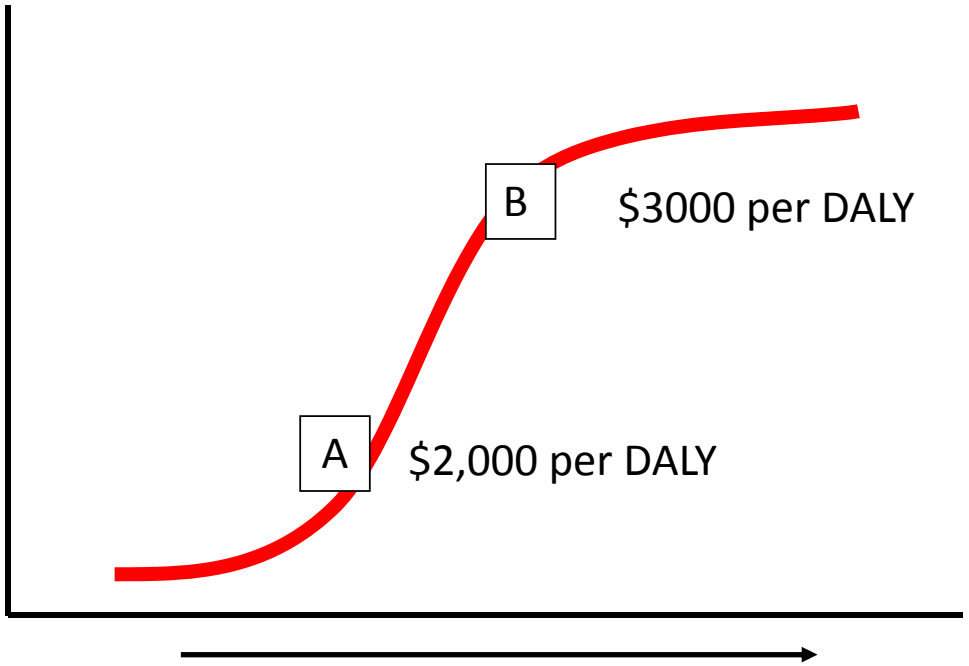
(Total cost of intervention A – Total cost of intervention B)/

(Total impact of intervention A – Total impact of intervention B)

Cost-effectiveness plane



Willingness-to-pay thresholds



Issues and alternatives

- Aspirational or reflective of budget constraint
- Elicited or observed

Alternatives

- Ranking
- Combinations under a budget constraint
- Scenarios/ choice sets or optimisation

Other values

Summary

- Cost-effectiveness not formulaic
- Decisions, values, uncertainty
- Transparency is key
- Models can assist in improving clarity from complexity
- But lots of moving parts and data scarcity, so important to be clear about each decision and uncertainty