

Introduction to Economic Evaluations

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Outline

Lecture 1

- Economic evaluation: what it is & why we need it
- Growth of economic evaluations
- Some examples of its use in practice and policy at different levels

Lecture 2

- Measuring Costs

Lecture 3

- Measuring Outcomes
- (Representing uncertainty)

What is economic evaluation?

- “Economic evaluation is the comparative analysis of alternative courses of action in terms of both their *costs* and their *consequences*.” (Drummond et al. 2005)
- “Based on the common sense notion that a decision to do or not to do something should depend weighing up the advantages (benefits) and disadvantages (costs)” (Morris et al 2007)

We Cannot Afford Everything That is Clinically Effective

- “The NHS, just like every other healthcare system in the world—public or private—has to set priorities and make choices. The issue is not whether there are choices to be made, but how those choices are made. There is not a service in the world, defence, education or health, where this is not the case.”

UK Parliamentary Health Committee

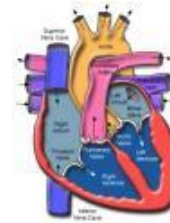
Government choice...

- NHS could fund one IVF (£3,000) course or...



One-third of a cochlear implant

1 heart bypass operation



11 cataract removals

150 MMR vaccinations



One-thousandth of a Challenger 2 tank

Why Economic Evaluation?

- In perfectly competitive private markets, allocation of goods and services is left to market forces
 - Interaction of supply and demand
 - Leading to efficient allocation of resources
- Market allocation of health care ‘fails’
 - Imperfect information, externalities etc
- Provision of health care therefore not left entirely to the market

Why Economic Evaluation?

- Therefore some level of Government / non-market intervention in health care
- But basic problem of limited resources remains
- Decisions still needed on what to buy
- Information on '*value for money*' is still needed
 - In a non-market situation, this information is missing
- How to generate this information?
 - Economic Evaluation – a technique of measuring efficiency in areas where there is no market

Types of Economic Evaluation

Method	Cost	Outcome Measure
Cost Minimisation	Monetary Value (\$)	None, as outcome options between options are the same
Cost Effectiveness	Monetary Value (\$)	Natural Units, eg death averted, child immunized
Cost Benefit	Monetary Value (\$)	Monetary Value (\$)
Cost Utility	Monetary Value (\$)	Utility values (eg QALYs /DALYs)

Types of economic evaluation

- CMA: which of two RV vaccines, demonstrated to have equivalent effectiveness, is cheapest
- CEA: Hib vaccine vs. pneumo vaccine in terms of \$ per pneumonia case averted
- CUA: HPV vaccine vs. other healthcare in terms of \$ per DALY averted
- CBA: healthcare vs. education in terms \$

Why do we need economic evaluation?

- Resources are finite and have an 'opportunity cost'
- Therefore prioritisation / rationing is both desirable and inevitable
- Economic evaluation is a systematic and transparent framework for assessing efficiency
- Population based decision making better than person by person based?
- What's the alternative?

Goal of economic evaluation: efficiency

- Technical Efficiency (*doing things right*)
 - maximise the achievement of a given objective within a given budget
- Allocative Efficiency (*doing the right things*)
 - allocate resources between objectives to produce the greatest gain to society

Summary

- Prioritisation / rationing is both desirable and inevitable
- Economic evaluation is a systematic and transparent framework for assessing efficiency
- But they tell us nothing about?

But they tell us nothing about.....

- affordability
- funding sources
- acceptability
- equity
- ethical concerns
- political feasibility

Basic tasks of economic evaluation

- **Identify** (which resources? which outcomes?)
- **Measure** (resource quantities, health status)
- **Value** (unit costs, preference weightings)
- **Compare** (at least two programmes)
- **Account for uncertainty** (sensitivity analysis)
- **Present & Interpret**

Emerging trends

- The USA is the biggest producer of economic evaluations
- Preference for CEA / CUA over CBA has emerged
- In high-income countries the majority of studies have covered tertiary care, while in LMICs the main focus has been preventive programmes
- Some 'frequent' publishers, i.e. journals (e.g. Bull WHO, BMJ, JAMA) and authors (e.g. Drummond & Weinstein)

Use of economic evaluation

- International level
- National level
- Local level

WDR 1993 (& DCP1)

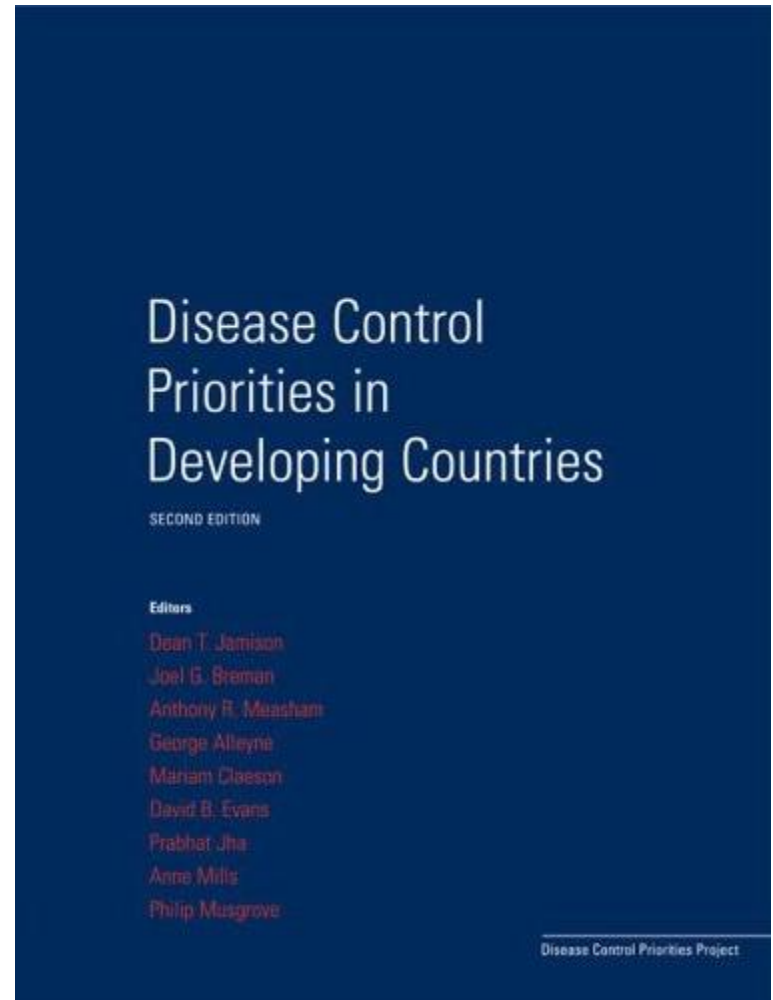
- **The 1993 WDR, Investing in Health, suggested policies to assist governments of developing countries in improving the health of their populations**
- **Epidemiological and economic analyses formed the basis for a global priority-setting exercise, leading to a recommended essential package for LMICs**
- **The report asserted that the provision of cost-effective packages of essential interventions “...reaching 80% of the population could result in a 32% reduction in the burden of disease in low-income countries and 15% in middle-income countries.”**

Table 4.7 Costs and health benefits of public health packages in low- and middle-income countries, 1990

<i>Country group and component of package</i>	<i>Annual cost (dollars)</i>			<i>Disease burden averted (percent)^a</i>
	<i>Per participant</i>	<i>Per capita</i>	<i>Per DALY</i>	
<i>Low-income (income per capita = \$350)</i>				
EPI Plus	14.6	0.5	12–17	6.0
School health program	3.6	0.3	20–25	0.1
Other public health programs (including family planning, health, and nutrition information) ^b	2.4	1.4	— ^c	— ^c
Tobacco and alcohol control program	0.3	0.3	35–50	0.1 ^d
AIDS prevention program ^e	112.2	1.7	3–5	2.0
Total	—	4.2 (1.2)	—	8.2
<i>Middle-income (income per capita = \$2,500)</i>				
EPI Plus	28.6	0.8	25–30	1.0
School health program	6.5	0.6	38–43	0.4
Other public health programs (including family planning, health, and nutrition information) ^b	5.2	3.1	— ^c	— ^c
Tobacco and alcohol control program	0.3	0.3	45–55	0.3 ^d
AIDS prevention program ^e	132.3	2.0	13–18	2.3
Total	—	6.8 (0.3)	—	4.0

DCP2

- 73 chapters written by more than 350 specialists in diverse fields from around the world
- www.dcp2.org
- Laxminarayan R et al. Advancement of global health: key messages from the Disease Control Priorities Project. Lancet. 2006; 367(9517): 1193-1208



	Cost per DALY averted (\$)*	Thousands of DALYs averted* † per 20% increase in coverage	Burden of target diseases (millions of DALYs)*
Neglected low-cost opportunities in south Asia			
Childhood immunisation			
Increased coverage of traditional EPI programme	8	Not assessed	28.4
HIV/AIDS			
Voluntary counselling and testing	9-126	Not assessed	7.4
Peer-based programmes for at-risk groups (eg, commercial sex workers) to disseminate information, services (clean needles and condoms), and teach specific skills			
School-based interventions to disseminate information			
Prevention of mother-to-child transmission with antiretroviral therapy			
Surgical services and emergency care			
Surgical ward in district hospital, primarily for obstetrics, trauma, and injury	6-212	≥1.8	48.0-146.3
Staffed community ambulance			
Training of lay first-responders and volunteer paramedics			
Tuberculosis			
Childhood vaccination against endemic disease	8-263	Not assessed	13.9
Directly observed short-course chemotherapy			
Isoniazid treatment of epidemic disease			
Management of drug resistance			
Lower acute respiratory illnesses of children younger than age 5 years			
Community-based or facility-based case management of non-severe cases	28-264	0.7-1.8	9.7-26.4
Case management package, including community-based and facility-based care for non-severe cases and hospital-based care for severe cases			
Cardiovascular diseases			
Management of acute myocardial infarction with aspirin and β blocker	9-304	≥0.1	25.9-39.1
Primary prevention of coronary artery disease with legislation, substituting 2% of trans fat with polyunsaturated fat, at \$0.50 per adult			
Secondary prevention of congestive heart failure with ACE inhibitors and β blockers incremental to diuretics			
Secondary prevention of myocardial infarction and stroke with polypill, containing aspirin, β blocker, thiazide diuretic, ACE inhibitor, and statin			
Tobacco use and addiction			
Tax policy to increase price of cigarettes by 33%	14-374	≥2.5	15.7
Advertising bans, health information dissemination, tobacco supply reductions, and smoking restrictions			
Nicotine replacement therapy			
Maternal and neonatal care			

What is HTA?

- Health Technology Assessment: “a multi-disciplinary field of policy analysis, which studies the medical, social, ethical and economic implications of development, diffusion and use of health technology.”

International Network of Agencies for Health Technology Assessment (INAHTA)

What is HTA?

- Comparative clinical effectiveness
- Comparative cost-effectiveness
- Service delivery organisation aspects
- Legal framework
- Overall budget
- Ethical, social implications – equity, fairness and other values

Use of economic evaluation in practice and policy: national level

- **Australia:** submission of CE data on pharmaceuticals when companies apply for public subsidies of their products became mandatory in 1993
- **UK:** NICE was established in 1999 to appraise new and existing technologies to decide which should be provided by the NHS
- Many countries have used CE data to define packages of essential care, e.g. **Bangladesh, Mexico**

Use of economic evaluation in practice and policy: local level

Tanzania Essential Health Interventions Project (TEHIP):



- Two districts, Rufiji and Morogoro
- Hypothesis: resolving the health care crisis depends not just upon new funding but also upon applying those funds to cost-effective interventions that address the greatest contributors to burden of disease
- Child mortality rates fell by more than 40%
- While more money is certainly needed to tackle poor countries' health problems, how it is spent is more important than how much is spent
- www.idrc.ca/tehip/

Conclusions

- Issues for debate include
 - which perspective should be adopted?
 - how long should the time-frame be?
 - precision vs. pragmatism: how detailed should cost measurement be?

Introduction to Economic Evaluations

Costs in economic evaluation

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Aim

- To provide conceptual and practical insight into how to do costing in an economic evaluation
- Identify which costs to include
- How to measure resource use?
- How to value resource use?

Why consider costs?

- There are not, never have been and never will be enough resources to meet all of society's needs or wants
- Scarcity implies choice between alternatives
- Cost is one factor which enables choice

What do we mean by cost?

Which costs to include?



Types of resources / costs

- Vaccines
- Vehicles
- Buildings
- Personnel
- Cold chain equipment
- Sterilisation equipment
- Waste
- Supplies
- Furniture
- Training
- Etc.

How can we categorise these
costs?

Classification of costs

- Capital items: those that last longer than a year
- Recurrent items: those that are used up in the course of a year and are usually purchased regularly
- Examples?

Classification of costs

- **Fixed costs**
 - do not change when the quantity of output produced changes
- **Semi-fixed costs**
- **Variable costs**
 - change according to how much output produced
- Examples?
- In the long-run it is assumed that all costs are variable

Shared costs

- The resources that you are costing may not be fully used in the specific cost centre that is being examined
- In this case, a decision needs to be made about what proportion of the resources should be allocated to the specific cost centre that is being costed and the way it should be allocated

Shared costs

- What are some examples of typical shared costs?
- What allocation rules might be used to distribute these costs to specific cost centres?
E.g. in a hospital, how might we allocate the costs of the kitchen to different wards?

Other costs?

- So far focussed on programme costs
- What other costs might we consider in, for example, an economic evaluation of a treatment against malaria?

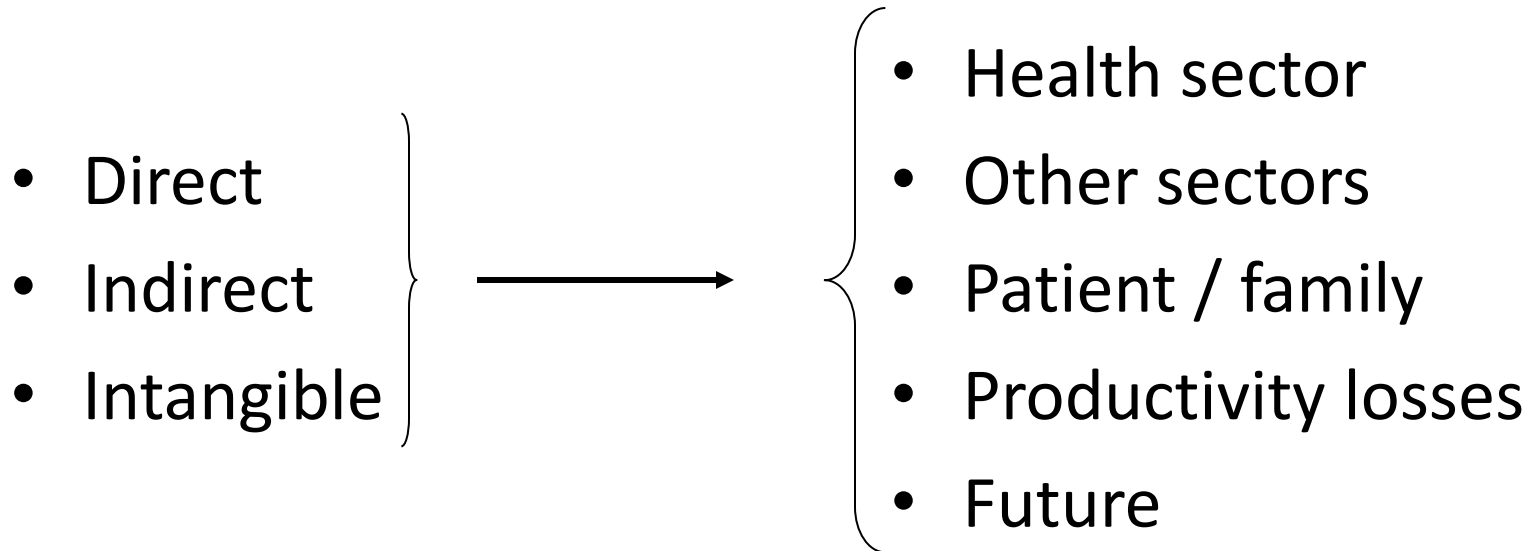


Other costs?

- Cost of accessing the health centre, e.g. transportation, time
- Days off work to care for a sick child
- Cost of possible side-effects
- Etc.

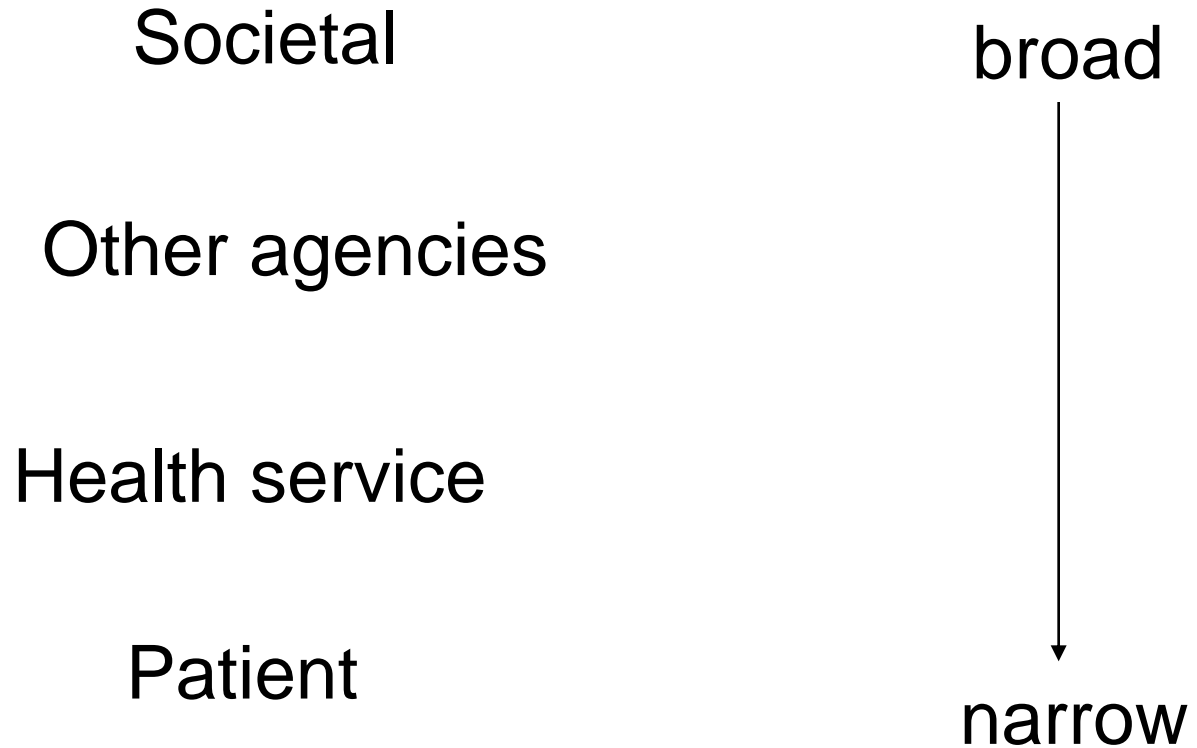


Classification of costs



Which costs to include?

Perspective of analysis



Which costs to include?

Perspective of analysis

	Range of costs		
Perspective	Inpatient days & outpatient visits	Special education	Days off work
Provider - Health service	✓	✗	✗
Provider - Health service & other agencies	✓	✓	✗
Societal	✓	✓	✓

Which costs to include?

- **Quantitative importance**
 - big-ticket items first
 - will inclusion of additional costs affect the conclusions?
- **Attribution**
 - does the resource use consumed relate to the disease (intervention)?

How to measure
resource use?

How to measure resource use?

Different study designs

- Possible methods for gathering resource use data:

- RCTs
- observational studies
- literature
- administrative databases
- expert opinion

Most reliable



Least reliable

- Best source of data depends on:
 - study question
 - research resources
- Economic evaluations usually use a range of methods

DeMTAP pictorial diaries

- Consumption and expenditure data
- Health and non-health
- 12-month period
- Includes home-produced consumption
- Prompts in the form of a checklist and aide mémoire



Wiseman W, Conteh L, Matovu F. Using diaries to collect data in resource-poor settings: questions on design and implementation. *Health Policy Plan.* 2005; 20(6): 394-404

DeMTAP Study Diary No.

Date Compound No.

Hhd No. Village/Block No.



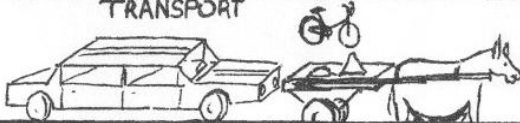
HEALTHCARE



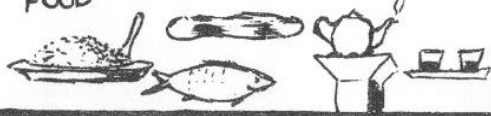
EDUCATION



TRANSPORT



FOOD



HOUSEHOLD GOODS



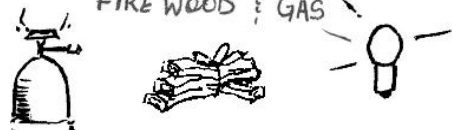
CLOTHING

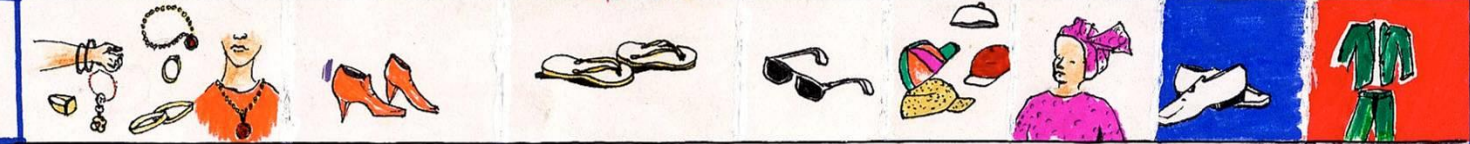
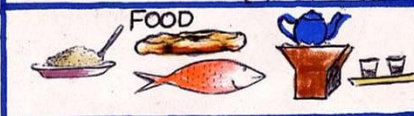
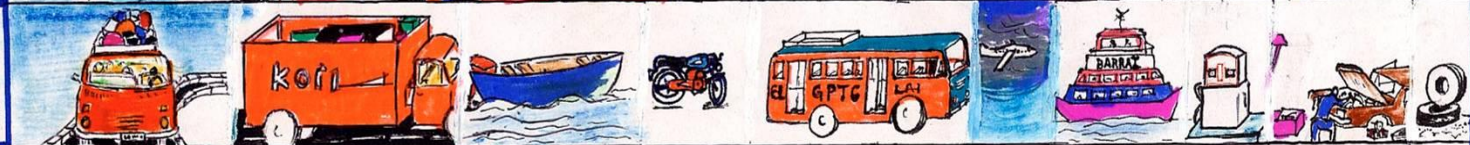


FARMING

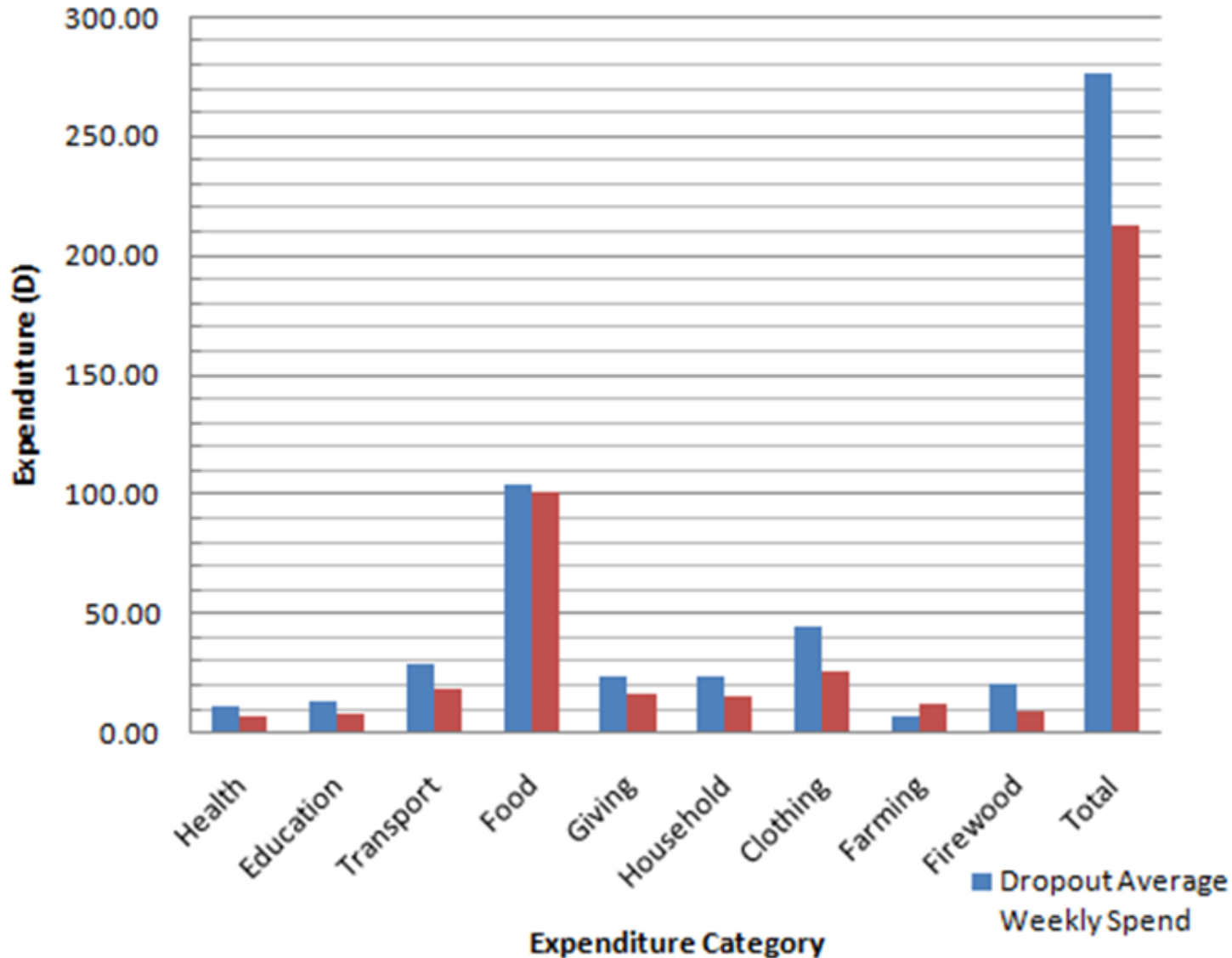


FIRE WOOD & GAS





Average weekly expenditure breakdown for dropouts and non-dropouts



How to value resource use?

How to value resource use?

Principles involved

- **Opportunity cost** (= economic cost)
 - cost is foregone benefit of a resource in its best alternative use
- Well, that's the theory at least ...
- In practice, most studies use unadjusted market prices

How to value resource use?

Principles involved

- Average vs. marginal cost?
- Marginal costs only cover the costs of producing one additional unit of output
- Choice depends on time-frame of analysis
 - short-term, few items are variable, e.g. drugs, tests
 - long-term, all items are variable including labour and capital
- Economists often take long-run perspective

Example

- Say, for example, 60% of children in Nepal are fully vaccinated at a cost per child of \$15
- The National Immunisation Programme in Nepal aims to fully vaccinate 85% of children.
- When coverage reaches 80% do you think the marginal cost per additional child fully vaccinated will be $<$, $=$ or $>$ than \$15? Why?

How to value resource use? Sources for health service unit costs

- Administrative databases (DRGs, reference costs), e.g. www.who.int/choice/country/en/index.html
- Manuals, e.g. www.pssru.ac.uk/uc/uc2006contents.htm
- Published literature
- Specific estimation

Conclusions

- Good costing needs to:
 - be explicit about assumptions
 - define the perspective adopted
 - apply the opportunity cost principle
 - recognise the importance of the time-frame

Conclusions

- Issues for debate include
 - which perspective should be adopted?
 - how long should the time-frame be?
 - precision vs. pragmatism: how detailed should cost measurement be?

Introduction to Economic Evaluations

Outcomes in economic evaluation

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Objectives

- To present the advantages and disadvantages of different types of indicators of effectiveness
- To illustrate how to calculate DALYs
- To illustrate how to calculate QALYs

Outline

- Types of outcome indicators
 - process / output
 - intermediate
 - disease-specific
 - final
 - generic
 - what is a DALY?
 - what is a QALY?
 - monetary values

Strengths and weaknesses of different outcome measures

Outcome measure	Strengths	Weaknesses
Process / output, e.g. children vaccinated	ease of collection as often part of routine monitoring,	routine statistics may be unreliable, incomplete or biased, no measure of impact on disease transmission / health
Intermediate, e.g. children fully immunised	relative ease of measurement and interpretation, may give some indication of impact,	no measure of impact on disease transmission / health

Strengths and weaknesses of different outcome measures

Outcome measure	Strengths	Weaknesses
Disease-specific, e.g. cases of malaria averted	comparisons across different prevention strategies are possible, DALYs can be derived with adequate information on mortality and life expectancy	unable to compare across health interventions, may not include indirect consequences of intervention, don't include mortality
Final, e.g. deaths averted	cross-programme and cross-intervention comparisons are possible, i.e. quasi-allocative efficiency, DALYs can be derived with adequate information on morbidity and life expectancy	may not include indirect consequences of intervention, don't include morbidity

Strengths and weaknesses of different outcome measures

Outcome measure	Strengths	Weaknesses
Generic, e.g. DALYs averted	cross-programme and cross-intervention comparisons are possible, i.e. quasi-allocative efficiency, morbidity and mortality effects combined in one measure	based on subjective measures of quality / disability, debate over their validity, not widely recognised outside the health sector
Monetary (US\$)	cross-sector comparisons are possible, i.e., allocative efficiency	places a money value on life

Types of outcome indicators & types of economic evaluation

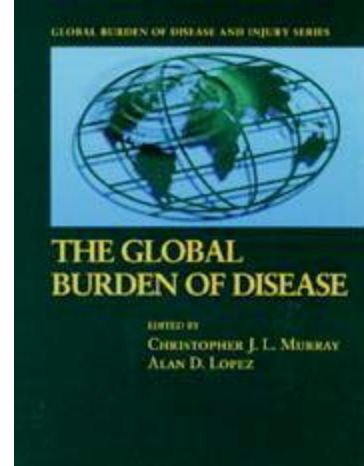
	Outcomes	Types of outcome indicators
CMA	NA	NA
CEA	Natural Units	Process / output Intermediate Disease-specific Final
CUA	QALYs, DALYs,	
CBA	\$	Monetary

What is a DALY?

- Disability-Adjusted Life Year
- Incorporates measure of both premature death (years of life lost - YLLs) and disability or morbidity (years of life lived with disability - YLDs)
- Each disability or morbidity state is given a weight
- Adjustments are made for assumptions about the impact of age and future time

.....DALY = 1 bad news..... DALY = 0 full health

DALYs: Value Judgements



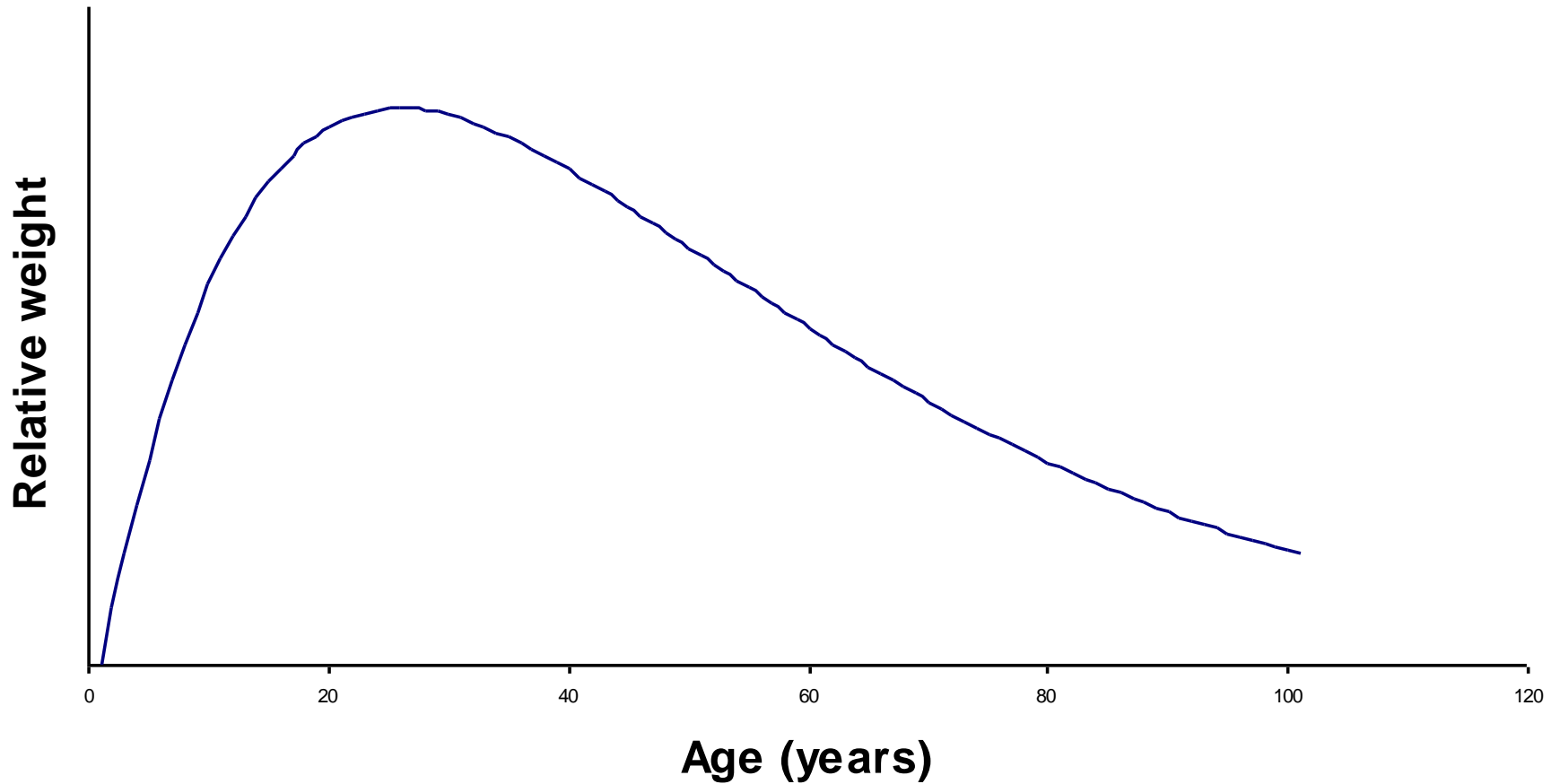
Disability weighting

- derived from Global Burden of Disease Study
- carried out by international panels of health care workers who were asked to rank the severity of 22 disabling conditions
- this weighting then produced 7 categories, ranging from mild to very severe disability

DALYs: Value Judgements

- Age weighting
 - the DALY assumes that if people are forced to choose between saving the life of a 2-year old and saving the life of a 22-year old, they will choose the 22 year old
 - largely because adults are thought to play a key role in the community and family
 - values of the age weighting therefore rise from 0 at birth to a peak at about age 22 and decline steadily from there

Relative value of a year of life lived at different ages incorporated into DALYs



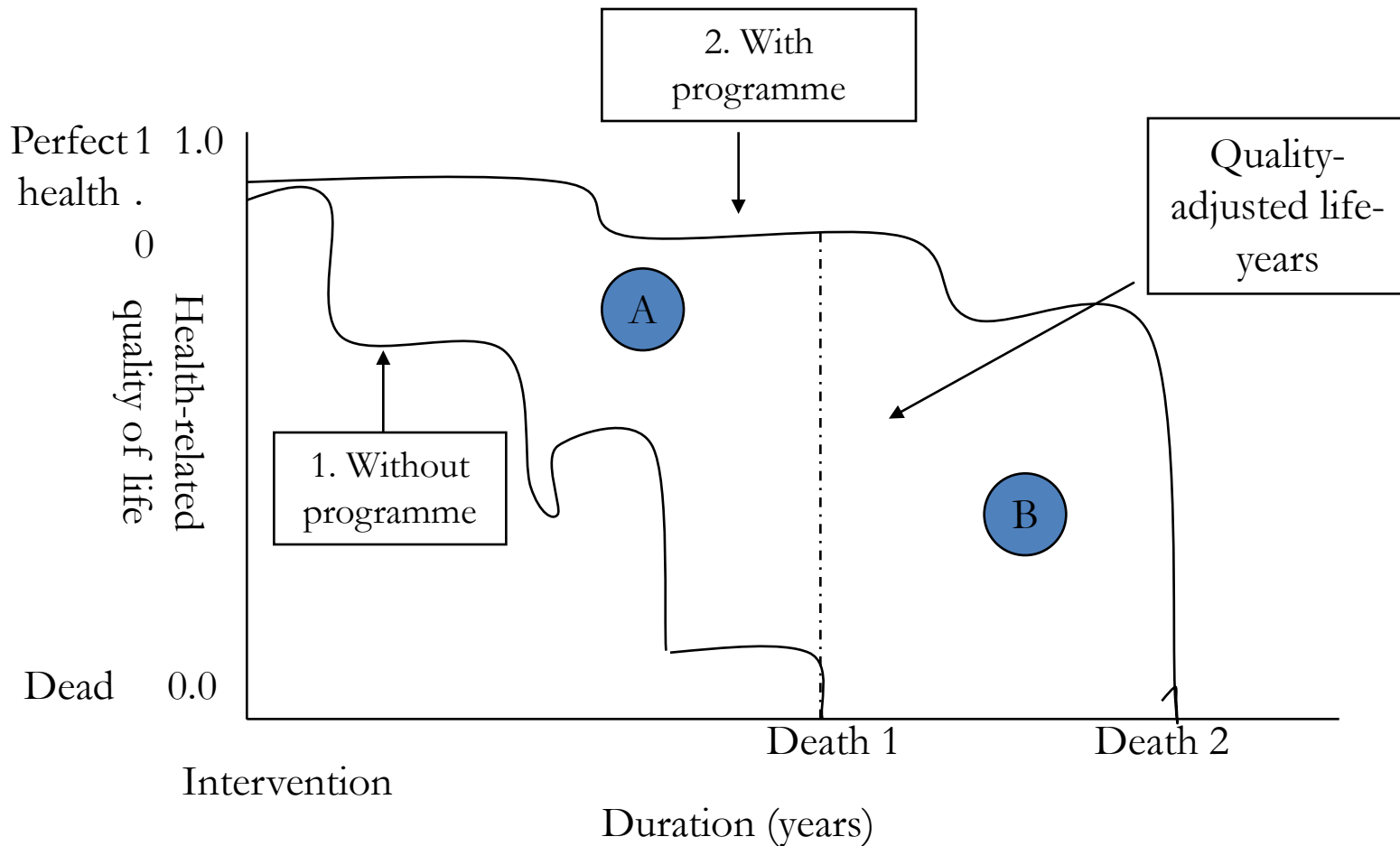
DALYs: Value Judgements

- Discounting
 - basic idea is that we prefer benefits which occur sooner rather than later and we incorporate a 'discount rate' to lower the value of future benefits (and costs) to reflect this time preference
 - in the DALY a discount rate of 3% is used
 - much debate over whether a year of healthy life can be treated in the same way as a dollar
 - results of CEA often sensitive to discount rate

What is a QALY?

- Quality-Adjusted Life Year
- Combine expected length of life with expected health-related quality of life (HRQL)
- Facilitate comparison of diagnosis, treatment & management of different conditions
- HRQL measured on a 0-1 scale
- QALYs are estimated by weighting time spent in the relevant health states by the HRQL
- $QALY = 1 =$ good news..... $QALY = 0 =$ death

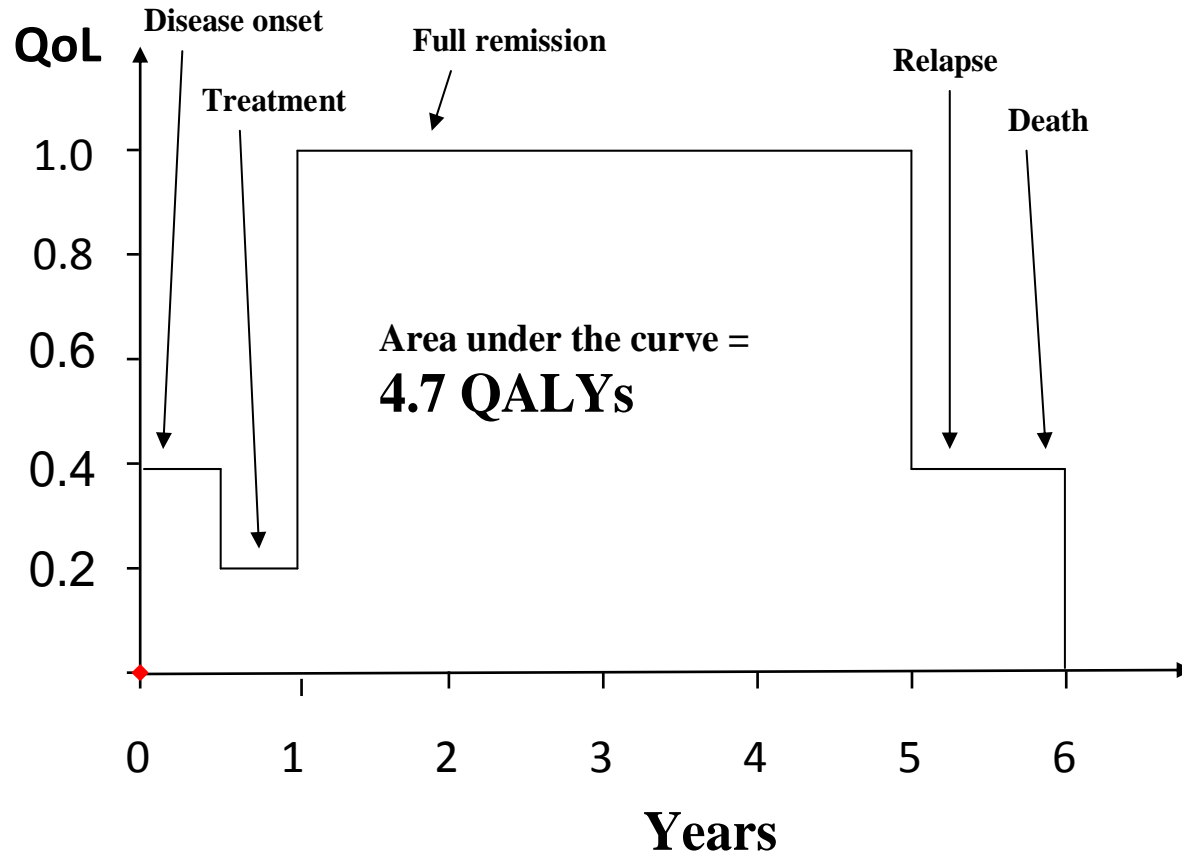
QALY from an intervention



Example

- A patient is diagnosed with a rare type of lymphoma
- The patient's prognosis from onset is that they are quite sick with the disease for 6 months and they are even sicker for the next 6 months while they undergo a chemotherapy regimen
- The therapy is successful so they return to full health for 4 years but then they relapse and die after a further year
- The Figure shows the expected quality of life on the y-axis and the duration of life on the x-axis

Example



- The number of QALYs is equal to the area under the curve in the graph
- The patient's expected life years
 $0.5 + 0.5 + 4 + 1$
 $= 6$ years
- The patient's expected QALYs
 $(0.5 * 0.4) + (0.5 * 0.2) + (4 * 1) + (1 * 0.4)$
 $= 0.2 + 0.1 + 4 + 0.4$
 $= 4.7$ quality-adjusted years

Valuing health states: issues

- **Difficulty in determining preferences for hypothetical states**
- **Are we really neutral between gains in longevity (YLLs) and disability (YLDs)?**
- **Different techniques give different values**
- **Whose values should count? (patients, medical professionals, general public)**
- **Valuation of health state may vary over time**
- **Are health states “cardinal”?**
- **Is a QALY the same value no matter who gains it? (e.g. small improvement for somebody who is seriously chronically ill)?**
- **Can improvements across individuals be compared?**
- **Are valuations of health states “global”?**

Summary

- A wide range of outcomes indicators exist
- However, cost per QALY gained or DALY averted remains the preferred means of assessing efficiency on the grounds of facilitating comparison between different uses of resources
- DALYs or QALYs for decision-making?
 - QALYs in high-income countries
 - DALYs or QALYs in middle-income countries
 - DALYs in low-income countries