Disability Adjusted Life Years
Possibilities and Problems

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Plan of the lecture

• What are DALYs?
• What is the Global Burden of Disease?
• What can they be used for?
• How are DALYs constructed?
• Are DALYs valid?
• Are DALYs just?
• Summary
What are DALYs?

- DALYs = Disability Adjusted Life Years
- A common measurement unit for morbidity and mortality
- Facilitates comparisons of all types of health outcomes
Possible use of DALYs

- Quantitative analysis of the burden of disease
- Analysis of cost-effectiveness of alternative interventions
- Selection of a package or list of interventions deliverable within the available budget

JL Bobadilla, WHO: 1996
What is the Global Burden of Disease study?

• Backed by the WHO and the World Bank
• A quantitative overview of the burden of disease world-wide
• Combines information about loss of quality of life with traditional epidemiological information on mortality
• All health outcomes are expressed in DALYs
Possible use of the Global Burden of Disease Study

- Epidemiological surveillance of trends across borders and over time
- Projections for future burden of disease
- Basis of information for decision-making on priorities in health research and health policy
Disease burden measured in Disability-Adjusted Life Years (DALYS)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cause</th>
<th>% total</th>
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<tbody>
<tr>
<td>1</td>
<td>Lower respiratory infections</td>
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<tr>
<td>2</td>
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<td>7.2</td>
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<tr>
<td>3</td>
<td>Perinatal conditions</td>
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<td>4</td>
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<td>6</td>
<td>Cerebrovascular disease</td>
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<td>7</td>
<td>Tuberculosis</td>
<td>2.8</td>
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<tr>
<td>8</td>
<td>Measles</td>
<td>2.7</td>
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<tr>
<td>9</td>
<td>Road traffic accidents</td>
<td>2.5</td>
</tr>
<tr>
<td>10</td>
<td>Congenital abnormalities</td>
<td>2.4</td>
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<table>
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<tr>
<th>Rank</th>
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<td>Road traffic accidents</td>
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<td>4</td>
<td>Cerebrovascular disease</td>
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<td>Chronic obs pulmonary disease</td>
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<tr>
<td>6</td>
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<td>Diarrhoeal diseases</td>
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<tr>
<td>10</td>
<td>HIV</td>
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In females and developing countries, unipolar major depression is projected as becoming the leading cause of disease burden.
How are DALYs constructed?

• A DALY is a health outcome measure with two main components
  – Quality of life reduced due to a disability
  – Lifetime lost due to premature mortality.
DALYs due to living with disability
(Red area measures DALYs. Red + white is a “normal” life)

82.5 YEARS

NO DISABILITY

82.5 YEARS
DALYs due to early death
(Red area measures DALYs. Red + white is a standard life)

NO DISABILITY

82.5 YEARS
DALYs due to disability and premature death combined.
Calculation of DALYs
(age-weighting and discounting are omitted for didactic reasons)

• The calculation of DALYs of a woman who has been deaf since she was 5 and dies when she is 50: (Disability weight of deafness is set at 0.33):

  Number of healthy life years $\times$ the disability weight of full health (0) + life years with disability (50) $\times$ disability weight for deafness (0.33) + life years lost (30) $\times$ the weighting of death (1)

• $5 \times 0 + 45 \times 0.33 + 30 \times 1 = 47.35$ DALYs
DALYs and QALYs

- DALY is a modification of QALY (Quality Adjusted Life Years).
- Both concepts combine information about length of life and quality of life.
- A DALY is a negative QALY.
Relation between QALYs and DALYs
DALYs = healthy years lost
QALYs = healthy years gained

NO DISABILITY

DALYs

QALYs

82.5 YEARS
How are disability adjustments made?

The methods used to assign a disability weightings to life years is a critical part of the DALY approach.

– Diagnostic groups must be chosen and defined.
– Descriptions of those diagnostic groups are developed.
– The health states are assigned a disability weight to indicate the relative severity of each health state.
Current method used for weighting disability

- Disability weights are obtained by posing two different Person Trade-Off (PTO) questions to expert panels
- PTO1 compares life extensions for disabled and healthy people
- PTO2 compares cures for illness with extension of life
Other choices behind DALY

- In addition to adjusting the value of life years with disability weights, and choosing a particular life expectancy, the value of a life year is modified by
- Discounting
  - the value of a life year now is set higher than the value of future life years
- Age weighting
  - life years of children and old people are counted less
Age-weights

Value of a year of life
Relative value of a year of life at age x

Source: World Bank data.
The effect of age-weighs and discounting

**Diagram:**

**DALYs lost by death at given year (females)**

Disability-adjusted life years (DALYs)

<table>
<thead>
<tr>
<th>Age at death in years</th>
<th>DALYs</th>
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<tr>
<td>0</td>
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<tr>
<td>10</td>
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<td>80</td>
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<td>90</td>
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Calculating DALY score, with age weighting and discounting.

- Girl, 5 years old, with below-knee amputation who lives until she is 82,5:
  - DALYs= life years lived with disease (77,5) × disability weight (0,3) × age-weight (a₁)× discounting factor (d²)
  - 77.5 × 0.3 × a₁ × d² = 10.5 DALYs
PROBLEMS of the DALY approach

• Is it true?
  – Questions of the validity of the results

• Is it just?
  – Questions of the distribution between groups
General problems of validity

- What is “Quality of Life” or “Disability weighting of life years”?
- Can quality of life be measured in a single and precise number?
- Does the same health problem have equal impact on different persons or groups?
- Is there a general agreement to underlying value choices: discounting, age weighting and choice of life expectancy?
Validity problems of the current PTO protocol

• Lack of simplicity, difficult to understand
• Forced consistency between two questions that are essentially different
• Impossible to answer that all individuals are equally valuable
• The expert panel may not represent the values of other people
Validity problems of epidemiological estimates

• Epidemiological data for Africa, Latin America and Asia are crude estimates.

• The uncertainty of the figures of prevalence, may be hidden in the seemingly mathematical rigor of the results.

• Lack of uniform diagnostic criteria. I.e. what do we mean by “depression”? 
Justice

• The DALY approach has been criticised for discriminating
  – the young
  – the elderly
  – future generations (future health benefits)
  – the disabled
  – women
The young

• The 5-year-old girl in the example above yielded 10,5 DALYs.

• However, the DALY score without age-weight and discounting would be

• $77.5 \times 0.3 = 23.3$ DALYs

• This result is twice as high, and would give her a higher priority.
The elderly

• In the literature on justice in health care, many agree that given a choice, it is more important to save young adults than the very old.

• This view is captured by the DALY (as a time based measure) itself.

• Additional weights implies ‘double counting’, and remains controversial.
Future generations

• The practice of discounting future benefits is also controversial.

• From society’s viewpoint, why should a life year now be of more value than a life year twenty years ahead?

• The implications for preventive services versus curative services are significant. Preventive interventions are given less weight.
The disabled

• The DALY approach opens for including chronic illnesses and disabilities in cost-utility calculation. This is an improvement.

• On the other hand, the current person trade-off protocol explicitly assumes that lives of disabled people have less value and

• implies that disabled people are less entitled to health resources to extend their lives
Example of results

- In the protocol behind the present Global Burden of Disease, a life year for 1000 healthy people has been set as equally valuable as one life year for
  - 9524 people with quadriplegia
  - 2660 blind people
  - 1686 people with Down's syndrome without cardiac malformation
  - 1499 deaf people
  - 1236 infertile people
- WHO has announced a change in approach.
Women

• Underlying value choice: Standard expectation of life at birth is 82.5 years for women, 80 years for men
• The ‘true’ gender gap is greater
• Gender gap is adjusted to correspond to ‘biological differences in survival potential’
• Critique: Might underestimate burden of disease for females relative to males
Summary

• The Global Burden of Disease study provides a quantitative overview of the burden of disease world-wide, expressed in DALYs.

• The DALY combines traditional epidemiological information on mortality with information about loss of quality of life and several value choices.

• The value choices, as well as the epidemiological data underlying the study are heavily debated.

• This lecture has reviewed some critical aspects of the validity of DALYs and some implications for distributive justice.
REFERENCE LIST


