Introduction to Cost-Effectiveness Analysis in Health

Health Economics Short Course

For more information and course dates, please visit our website: [http://go.unimelb.edu.au/tego](http://go.unimelb.edu.au/tego)
Or email us: health-economics@unimelb.edu.au

Module 1 – What is economics and economic evaluation?

Centre for Health Policy
Melbourne School of Population of Global Health

Overview of the day

- **Module 1**: Introduction to Health Economics
- **Module 2**: Identifying, Measuring, Valuing and Analysing Costs
- **Module 2**: Identifying, Measuring, Valuing and Analysing Outcome
- **Module 4**: Policy Use and Interpretation of Cost-effectiveness Analysis
- **Group exercise**: Application of Economic Evaluation Methods

Overview of presentation

- Food for thought
- What is economics?
- Types of economic evaluation

Australian Life Expectancy

![Average age at death](Source: ABS data (3105.0.65.001 Australian Historical Population Statistics, 2008))
Gains in Life Expectancy (Persons)

Incremental gains in life expectancy

Source: ABS data (3105.0.65.001 Australian Historical Population Statistics, 2008)

Food for thought:
Pharmaceutical Expenditure

Pharmaceutical expenditure as a proportion of GDP

Pharmaceutical Benefits Scheme Historic data, deflated using CPI.

First Intergenerational Report

Pharmaceutical expenditure as a proportion of GDP

Projected expenditure


Food for thought:
Productivity

Life Expectancy vs. Spending

Australia

Per Capita Health Care Spending in International Dollars

Source: UN Atlas of Global Inequality

Food for thought:
Health System Performance

Health outcomes are driven by productivity and cost effectiveness of interventions

Cumulative Health Outcomes

- Health System Performance
- Cochrane Library
- United Nations
- WHO
- Australian Institute of Health and Welfare

Cost: $
What is economics?

- Economics is concerned with the allocation of scarce resources.
- Resources (labour, materials, natural resources etc.) are broadly fixed at any moment in time.
- Therefore choices have to be made concerning how to use these resources:
  - more on housing or more on a car
  - more health care or tax cut

What is economic evaluation?

- Premise: scarce (health care) resources
- Aim: to maximise health gain with the available resources
- Method: compare cost and effectiveness of therapies
- Balance: about costs and effects
- Economic evaluation: explicit criteria for making choices.

Economics is...

- Not a cookbook…
  "...economics is a branch of logic, a way of thinking. The theory of economics does not furnish a body of settled conclusions, immediately applicable to policy. It is a method rather than a doctrine, an apparatus of the mind, a technique of thinking."
  - J. M. Keynes

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Cost of illness

- Form of cost analysis
- Attempts to quantify burden - lost productivity, costs of health care, social services, courts etc.
- Often used for advocacy
- Tells you the size of the problem, but not what you should do about it
- Partial analyses and rarely provides context of cost in relation to overall expenditure.

Cost of illness in 1906

"TUBERCULOSIS causes annually more than 150,000 deaths in the United States… If we assume that the net value of a year of human life … is at least $50, the real loss to the Nation… may be estimated at $240,000,000 per annum. These astounding and almost incomprehensible figures are far from being an exaggeration…"

($50 in 1906 ~ $1300 in 2016)

Source: Huber, Consumption: Its relation to man (1906)
“In addition to the tremendous human cost, chronic diseases exact a tremendous financial toll on our health care resources. Care for patients with diabetes costs $130 billion each year alone, and this amount is growing. Tackling chronic diseases is also straining our public health departments…”

Barack Obama, Health Care Plan, 2008

### Types of economic evaluation

<table>
<thead>
<tr>
<th>Is there good evidence on effectiveness of interventions being compared?</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is effectiveness of interventions equal?</td>
<td>YES</td>
<td>NO</td>
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<tr>
<td>Can all outcomes be valued in monetary terms (e.g. willingness to pay)?</td>
<td>YES</td>
<td>Cost-minimization study</td>
</tr>
<tr>
<td>NO</td>
<td>Cost-benefit analysis</td>
<td></td>
</tr>
<tr>
<td>Is there a measurable unidimensional outcome</td>
<td>YES</td>
<td>Cost-effectiveness analysis</td>
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<tr>
<td>NO</td>
<td>Cost-consequence analysis</td>
<td></td>
</tr>
<tr>
<td>Can outcomes be measured as quality adjusted life years?</td>
<td>YES</td>
<td>Cost-utility analysis</td>
</tr>
</tbody>
</table>

### Cost-minimisation

- Special form of cost effectiveness analysis
- Compare at least two treatments
- Used in pharmaceutical submissions to Pharmaceutical Benefits Advisory Committee
- Outcomes should be statistically equivalent
  - with sufficient power to say that they are the same; not just to say that there is no evidence of difference
- What minimizes costs today may not minimize costs tomorrow
- Cost-effectiveness analysis is preferable

### Cost-minimization in practice

- Clarke PM and Avery A. 2014

### Types of economic evaluation

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Cost-benefit analysis

- Measure outcomes and inputs in dollars
- Enables comparisons across sectors and different clinical outcomes
- Addresses issues such as net gain to society
- Addresses the question of whether the program is worthwhile to society.

In small Australian towns do you take the health services to the patients, or make patients come to health services?

- Travel costs can be used to measure the demand for a service and the gains from improving access.
- One of the only cost-benefit analyses in Australia is to determine which rural towns should receive mobile mammographic screening services

Cost-benefit example

### Table 1

<table>
<thead>
<tr>
<th>Town</th>
<th>Problem of being screened</th>
<th>Average CF</th>
<th>Total benefits</th>
<th>Total cost</th>
<th>Benefit-cost ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15 km</td>
<td>0.37</td>
<td>$1.40</td>
<td>$2521</td>
<td>$12.770</td>
</tr>
<tr>
<td>2</td>
<td>20 km</td>
<td>0.42</td>
<td>$2.50</td>
<td>$6743</td>
<td>$38.694</td>
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<tr>
<td>3</td>
<td>25 km</td>
<td>0.42</td>
<td>$4.79</td>
<td>$8386</td>
<td>$14.512</td>
</tr>
<tr>
<td>4</td>
<td>30 km</td>
<td>0.21</td>
<td>$2.07</td>
<td>$15.90</td>
<td>$10.997</td>
</tr>
<tr>
<td>5</td>
<td>35 km</td>
<td>0.32</td>
<td>$15.52</td>
<td>$15.95</td>
<td>$1.78</td>
</tr>
<tr>
<td>6</td>
<td>40 km</td>
<td>0.30</td>
<td>$24.20</td>
<td>$27.740</td>
<td>$0.877</td>
</tr>
<tr>
<td>7</td>
<td>45 km</td>
<td>0.58</td>
<td>$2.07</td>
<td>$14.70</td>
<td>$14.480</td>
</tr>
<tr>
<td>8</td>
<td>50 km</td>
<td>0.32</td>
<td>$4.13</td>
<td>$77.140</td>
<td>$22.201</td>
</tr>
<tr>
<td>9</td>
<td>55 km</td>
<td>0.39</td>
<td>$6.05</td>
<td>$80.024</td>
<td>$0.764</td>
</tr>
<tr>
<td>10</td>
<td>60 km</td>
<td>0.21</td>
<td>$4.20</td>
<td>$120.166</td>
<td>$0.345</td>
</tr>
</tbody>
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Types of economic evaluation

- Is there good evidence on effectiveness of interventions being compared?
  - Yes/No
  - Costing study

- Is effectiveness of interventions equal?
  - Yes/No
  - Cost-minimization study

- Can all outcomes be valued in monetary terms (e.g., willingness to pay)?
  - Yes
  - Cost-benefit analysis

- Is there a measurable unidimensional outcome?
  - Yes
  - Cost-effectiveness analysis

- Can outcomes be measured as quality adjusted life years?
  - No
  - Cost-consequence analysis

  - Yes
  - Cost-utility analysis

Cost-effectiveness analysis

- Most common used method of economic evaluation
- Compares costs and outcomes
- Requires a common, unambiguous outcome measure
  - cases detected
  - deaths prevented
  - life years gained

\[
\text{ICER} = \frac{\text{Cost(intervention)} - \text{Cost(comparator)}}{\text{Outcomes (intervention)} - \text{Outcomes (comparator)}}
\]

- ICER is Incremental cost-effectiveness ratio

**CEA example**

Cost-effectiveness of lowering blood pressure with a fixed combination of perindopril and indapamide in type 2 diabetes mellitus: an ADVANCE trial-based analysis

- Intervention involved use of blood pressure drugs in diabetes
- Intervention cost $1350 (over four years)
- Intervention group experienced lower hospital & other health care costs ~$800 in savings
- Net cost was around $502.
- Increase in life expectancy 0.05 life years over remaining lifetimes
Cost-effectiveness plane

- NW: Existing treatment dominates
- NE: New treatment dominates
- SW: New treatment less costly
- SE: New treatment more effective

Costs:
- $502

Effects:
- 0.05 years

Types of economic evaluation

- Is there good evidence on effectiveness of interventions being compared?
  - YES → Cost-effectiveness analysis
  - NO → Cost-consequence analysis

- Is effectiveness of interventions equal?
  - YES → Costing study
  - NO → Cost minimization study

- Can all outcomes be valued in monetary terms (e.g., willingness to pay)?
  - YES → Cost benefit analysis

- Is there a measurable unidimensional outcome?
  - YES → Cost-effectiveness analysis
  - NO → Cost-consequence analysis

- Can outcomes be measured as quality adjusted life years?
  - YES → Cost-utility analysis
  - NO → Cost-consequence analysis

Cost-utility analysis

- This is a form of economic evaluation in which the multi-dimensional outcomes are reported separately from costs.
- Provide information to the decision maker on the costs and consequences of an intervention
- Does not explicitly value outcomes relative to costs
- Mainly applied in complex public health interventions with multiple outcomes

Types of economic evaluation

- Using QALYs to measure outcomes

Example Evaluation of an Exercise Referral Scheme

- Costs
- Quality of life scale (0-1)

Health profile with intervention

Quality adjusted life years gained

Time (Years)

1 2 3

Health profile without intervention

Life expectancy

1 2 3

Truman cost Analysis 2015
• Early vs. late initiation of dialysis
• Early intervention more costly:
  $10,777 (95% CI $313 to $22,081)
• Less QALYs:
  -0.09 (-0.12, .31)

Late (existing) treatment dominates