Module 1 – What is economics and economic evaluation?

Centre for Health Policy
Melbourne School of Population of Global Health

Insulin: A case study

- The discovery of insulin by Banting & Best turned a fatal disease (Type 1 Diabetes) into a chronic condition
- The first commercial insulin preparations contained numerous impurities
- 1930: Long acting insulins
- 1980s: Purified pork insulin/recombinant human insulin
- 1996: Diabetes Control and Complication trials demonstrated that intensive blood glucose control could reduce the complications of Type 1 Diabetes
- 2000s: Analogue insulins

Lung 2014 (PLOS One)

- The relative mortality of people with Type 1 Diabetes has improved
- Relative risk (pre-1971): 6 times general population
- Relative Risk (post-1990) : 3 times general population
- There is still a life expectancy gap of 11-13 years

Overview of the day

- Module 1: What is economics and economic evaluation?
- Module 2: Measuring health-related quality of life and use of clinical outcomes
- Module 3: Collecting relevant health system and patient cost data
- Module 4: Economic evaluation, uncertainty and modelling
- Module 5: Examples & getting projects funded
- Workshop of selected case studies

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Insulin analogues “afford more flexible treatment regimens with a lower risk of the development of hypoglycemia” (NEJM 2005)

- **Short acting insulin** (taken at meal time)
- **Long acting insulin** (taken daily)

What are the benefits of insulin analogues?

- It is necessary to focus on the incremental benefit relative to a comparator (human or animal insulin)
- Rapid acting analogues reduce postprandial hyperglycemia (high blood sugar after meals)
- Long acting analogues reduce the risk of hypoglycemia (low blood sugar, which impact on judgment and can lead to a diabetic coma)

What are the benefits of reducing “hypos”?

1) Quality of life
   - Patients value not having hypoglycemic episodes — they have reduced quality of life during an episode and in the long-term due to increased complications
   - Perhaps all people with Diabetes are affected by a “fear of hypos”

2) Clinical impact
   - There is emerging evidence of increased mortality (particularly after cardiovascular events)

Recent evidence of survival post CVD event

By 10 years follow-up, patients with a history of hypos had significantly lower survival rates compared to those without.

Are Analogues “value for money”?

- In Australia these decisions are made by the Pharmaceutical Benefits Advisory Council (PBAC) on the basis of cost-effectiveness.
- Example of Insulin Glargine:
  - Considered 5 times by the economic sub-committee of the PBAC
  - First considered by the PBAC in 2003
  - Finally listed in 2006
  - Company projected to cost $145 million over first four years (actual cost $263 million)
What the PBAC thought...

Comments from Oct 2005 Meeting:
“A number of problems with this analysis were identified during the evaluation, and the PBAC considered that the trial-based incremental costs per extra hypoglycaemic event avoided could be higher than estimated in the submission”

“The PBAC did not accept other assumptions in the economic model”

Recommendation: Reject

What evidence do we need to make a decision?

Information on:
• Outcomes – including assessment of Quality of Life (Module 2)
• Costs – not only of the therapy, but any savings (e.g. reduced hospitalisations caused by “hypos” at the time of event and subsequent secondary complications, e.g. organ damage) (Module 3)
• How would we extrapolate the long-term effects of a “hypo” on mortality? How do we bring it all together? (Module 4)
• Practical applications (Final session)

Food for thought: health system performance

Health outcomes are driven by productivity and cost-effectiveness of interventions

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 cuts

What is economic evaluation?

• Premise: scarce (health care) resources
• Aim: to maximise health gain with the available resources
• Method: compare the cost and effectiveness of therapies
• Balance: about costs and effects

Economic evaluation provides explicit criteria to aid in making choices
### Types of economic evaluation

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<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Costing study</th>
<th>Cost-minimization study</th>
<th>Cost-benefit analysis</th>
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### Cost of illness

- A form of cost analysis
- It attempts to quantify burden – lost productivity, costs of health care, social services, courts, etc.
- It is often used for advocacy
- It tells you the size of the problem, but not what you should do about it
- It provides a partial analysis and rarely provides the context of the cost in relation to overall expenditure

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### Osteoporosis - An Australian Example

**Osteoporosis Costing Data for Australia**

![Graph showing cost of osteoporosis in Australia](image)

*Watts et al., 2013*

### Cost-minimisation

- A special form of cost effectiveness analysis
- It compares at least two treatments
- Outcomes are measured using same measure (e.g., number of stroke events)
- Outcomes are statistically equivalent (with sufficient power to say that they are the same, not just to say that there is no evidence of difference)
- Cost-effectiveness analysis is preferable

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**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 ~ $1200 in 2008)

*Source: Huber, Consumption: It’s relation to man (1906)*

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"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

Cost-minimisation - Example

Cost-minimisation analysis for prostate resection

"Two systematic reviews based on the Meritree to December 2006 and February 2012, including up to now randomised controlled trials using the PVP 80-W (five trials) or 120-W system (four trials) and with up to 36-month follow-up, suggest PVP can generally be considered non-inferior to TURP for the management of symptomatic BPH."

However,

"Despite the apparent overall non-inferiority of PVP in functional and safety outcomes, there is some recent data suggesting that PVP may result in higher re-operation rates in some patient subgroups, particularly those with a larger prostate volume. Although Thangasamy et al. reported no statistically significant difference in unplanned re-operation rates between PVP and TURP in their review, there was a clear trend for a difference favouring TURP (RR 1.87, 95% CI 0.65–5.39). If true, this would likely have cost implications."

Cost-benefit analysis

- Measures inputs and outcomes 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

Cost-benefit analysis

The value of a quality-adjusted life year is estimated at $432,000

Value of a Quality-Adjusted Life Year ($)

- There are four main methodologies to measure the value of QALY:
  - Human capital - reflects society's willingness to generate earnings, but does not capture a social individual
  - Human capital (willingness to pay) - based on value of life in relation to non-occupied leisure time
  - Willingness to pay - reflects individuals' subjective value of life in relation to non-occupied leisure time
  - Willingness to pay - reflects individuals' subjective value of life in relation to non-occupied leisure time
- The median value across all studies is $432,000

Source: Mohan Review
### Types of economic evaluation

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### Cost-effectiveness analysis (CEA)

- The most commonly used method of economic evaluation
- Compares costs and outcomes
- Requires a common, unambiguous outcome measure
- Outcomes measured in natural unit:
  - cases detected
  - deaths prevented
  - life years gained

### Cost-effectiveness plane

- New treatment dominates
  - less costly
  - more effective
- New treatment less costly
  - more effective
  - less costly
- Existing treatment dominates
  - less costly
  - more effective

### 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**

- The intervention involved the use of blood pressure drugs in diabetes
- The intervention cost $1350 (over four years)
- The intervention group experienced lower hospital & other health care costs (~$800 in savings)
- The net cost was approximately $502.
- There was an increase in life expectancy of 0.05 life years over remaining lifetimes

### Cost-consequence analysis (CCA)

- 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
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### Using QALYs to measure outcomes

- **Time to first event**
- **Quality of life scale (0-1)**
- **Quality adjusted life years gained**
- **Life expectancy**

### CUA Example – Cardiac Devices

- **Comparison of implantable cardiac resynchronization devices** with (CTR-P) and without defibrillation (CTR-D)
  - CTR-D was more costly: £11,689
  - CTR-D was however more effective: 0.29 QALYs

### CUA Example – Cardiac Devices

- **Cost-effectiveness acceptability curve**
  - 26.3% of simulations cost effective
  - 7.8% of simulations cost effective

**Fox, 2007**