# 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/8eqn

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

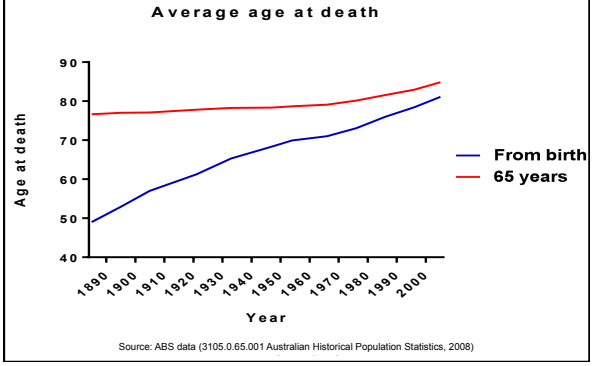

## Overview of the day

- **Module 1:** *Introduction to Health Economics*
- **Module 2:** *Identifying, Measuring, Valuing and Analysing Costs*
- **Module 3:** *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

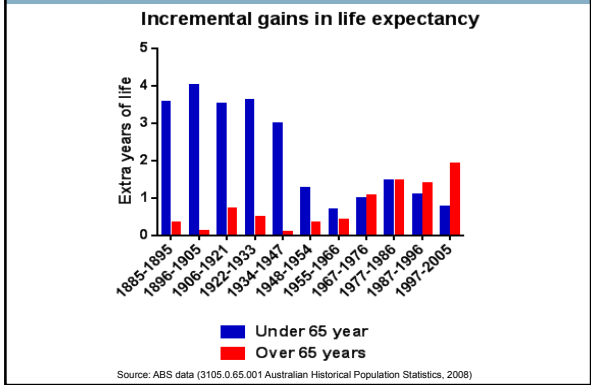
- Food for thought
- What is economics?
- Types of economic evaluation

## Australian Life Expectancy



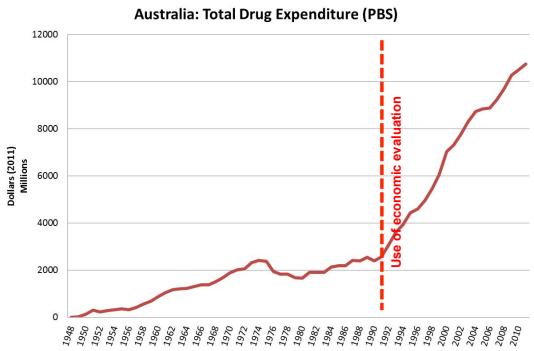

Source: ABS data (3105.0.65.001 Australian Historical Population Statistics, 2008)

## Gains in Life Expectancy (Persons)



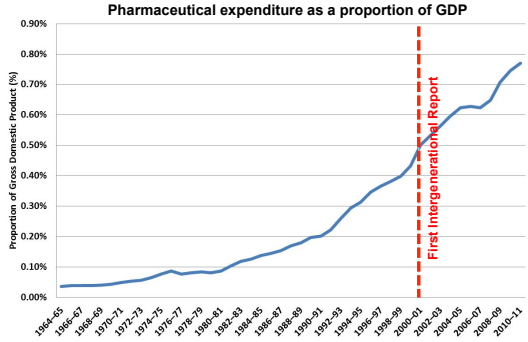

Source: ABS data (3105.0.65.001 Australian Historical Population Statistics, 2008)

## Food for thought: Pharmaceutical Expenditure



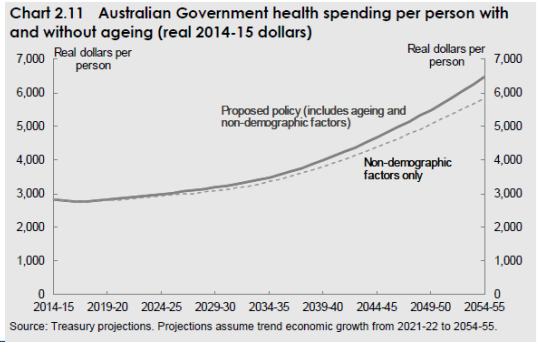

Pharmaceutical Benefits Scheme Historic data, Deflated using CPI.

## Food for thought: Pharmaceutical Expenditure




Pharmaceutical Benefits Scheme Historic data, divided by Gross Domestic Product

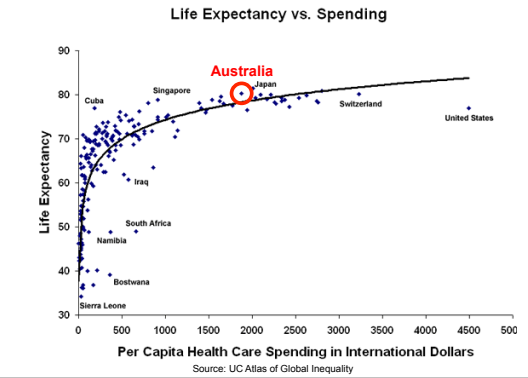
## Projected expenditure




Source: Treasury projections. Projections assume trend economic growth from 2021-22 to 2054-55.

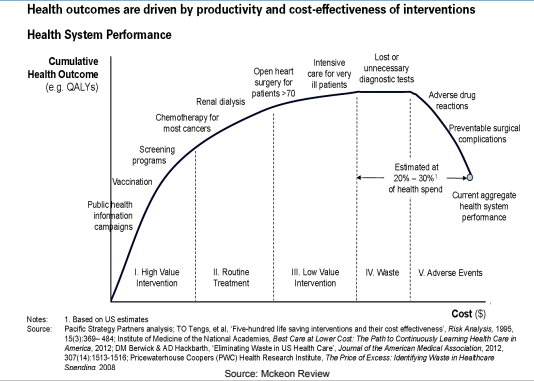
Treasury: Intergenerational report 2015

## Food for thought: Productivity




Source: UC Atlas of Global Inequality

## Food for thought: Health System Performance




Notes: 1. Based on US estimates

Source: Pacific Strategy Partners analysis; TO Tengs, et al, 'Five-hundred life saving interventions and their cost effectiveness', *Risk Analysis*, 1995, 15(3):369– 484; Institute of Medicine of the National Academies, *Best Care at Lower Cost: The Path to Continuously Learning Health Care in America*, 2012; DM Berwick & AD Hackbarth, 'Eliminating Waste in US Health Care', *Journal of the American Medical Association*, 2012, 307(14):1513-1516; Pricewaterhouse Coopers (PWC) Health Research Institute, *The Price of Excess: Identifying Waste in Healthcare Spending*, 2008

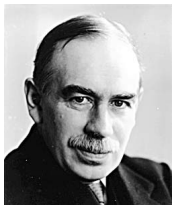
Source: Mckeon Review

## 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

## Economics is...

- Not a cookbook….



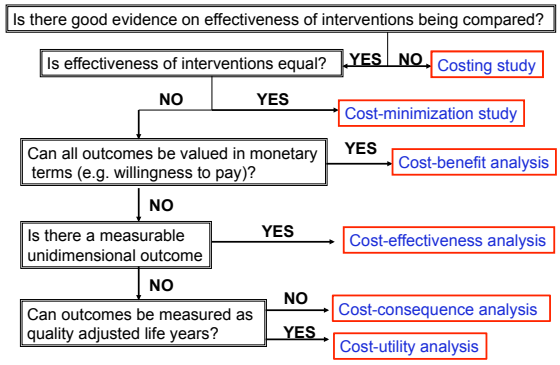
J. M. Keynes

*"...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."*

## 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.

## Types of economic evaluation




## 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: It's relation to man (1906)

## A century later…

*"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

## An Australian example

Table 1 **Annual costs of foodborne illness in Australia**

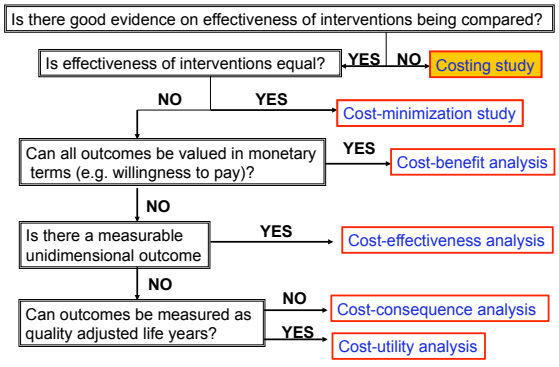
| Area to which costs apply | Cost ($ million) |
|---|---|
| **Individuals and business:** all productivity and lifestyle | 771.6 |
| **Individuals:** premature mortality | 231.5 |
| **Health care services** | 221.9 |
| **Business:** food safety recalls | 14.0 |
| **Governments:** foodborne illness surveillance and investigation, and maintaining food safety systems | 10.0 |
| **Total** | 1,249.0 |

The annual cost of foodborne illness in Australia, DOHA 2006

Economic impact ~1% GDP ; ~0.2% of total health spending

771/998.274 221/94.000

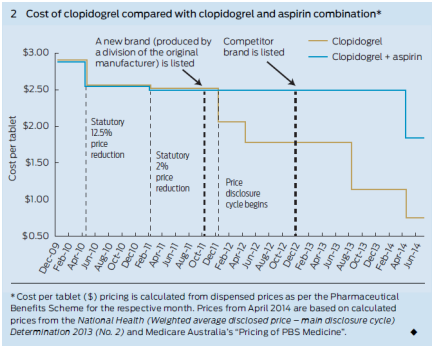
## Types of economic evaluation




## Cost-minimisation

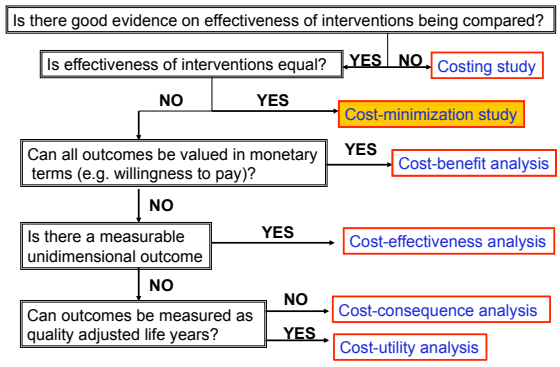
- Special form of cost effectiveness analysis
- Compare at least *two* treatments
- Used in pharmaceutical submissions to Pharmaceutical Benefits Advisory Committee
- Outcomes should be statistically equivalent
  - with sufficient power to say that they are the same; not just to say that there is no 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



## 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.

## Evaluation of Mobile Mammographic Screening

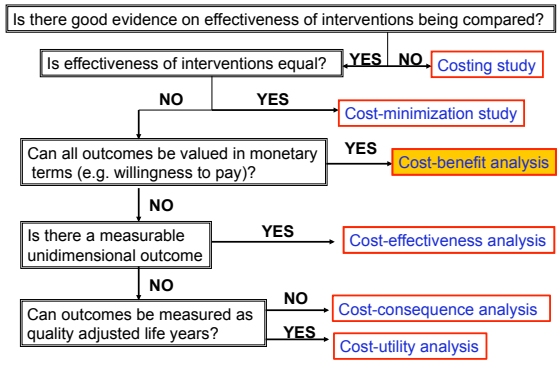
- In small Australian towns do you take the health services to the patients, or make patients come to health services?
- Travel costs can be used to measure the demand for a service and the gains from improving access.
- One of the only cost-benefit analyses in Australia is to determine which rural towns should receive mobile mammographic screening services

## Cost-benefit example

Table 3
Benefits and costs of mobile screening

| Town | | Problem of being screened (average) | | Average *CV* | Total benefits $\Sigma CV$ | Total cost | Benefit–cost ratio |
|---|---|---|---|---|---|---|---|
| No. | Distance | Fixed unit | Mobile unit | | | | |
| 1 | 15 km | 0.37 | 0.37 | $1.46 | $2521 | $12 776 | 0.2 |
| 2 | 20 km | 0.24 | 0.27 | $3.59 | $8743 | $18 484 | 0.5 |
| 3 | 20 km | 0.32 | 0.34 | $4.75 | $8346 | $14 513 | 0.6 |
| 4 | 50 km | 0.38 | 0.42 | $20.37 | $35 803 | $19 897 | 1.8 |
| 5 | 50 km | 0.28 | 0.32 | $15.59 | $16 516 | $9874 | 1.7 |
| 6 | 65 km | 0.32 | 0.36 | $24.39 | $37 546 | $15 579 | 2.4 |
| 7 | 95 km | 0.26 | 0.35 | $32.65 | $34 503 | $14 340 | 2.4 |
| 8 | 130 km | 0.23 | 0.32 | $43.11 | $77 144 | $23 210 | 3.3 |
| 9 | 135 km | 0.19 | 0.29 | $39.05 | $80 024 | $26 845 | 2.9 |
| 10 | 160 km | 0.21 | 0.32 | $48.20 | $120 436 | $36 056 | 3.3 |

## Types of economic evaluation




## 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

$$ICER = Cost(intervention) - Cost(comparator) / Outcomes(interv$$

- ICER is Incremental cost-effectiveness ratio

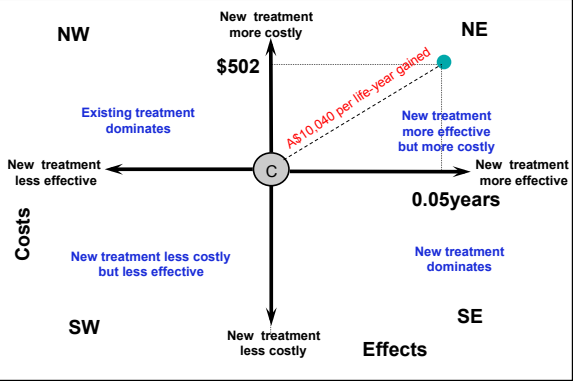
## CEA example

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

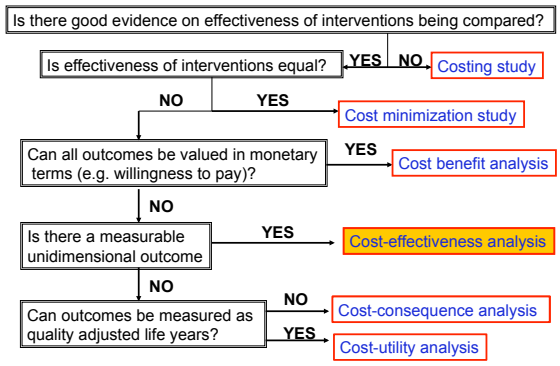
Paul P Glasziou, Philip Clarke, Jan Alexander, Mohana Rajmokan, Elaine Beller, Mark Woodward, John Chalmers, Neil Poulter and Anushka Patel

- 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



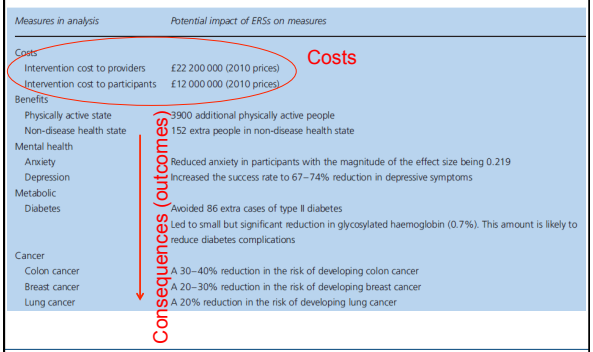

## Types of economic evaluation




## Cost- consequence analysis (CCA)

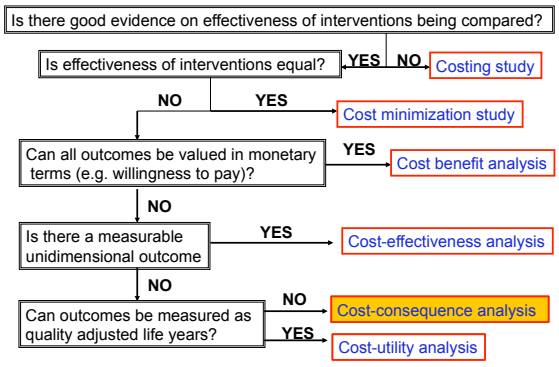
- This is a form of economic evaluation in which the multi-dimensional outcomes are reported separately from costs.
- Provide information to the decision maker on the costs and consequences of an intervention
- Does not explicitly value outcomes relative to costs
- Mainly applied in complex public health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

## Example Evaluation of an Exercise Referral Scheme

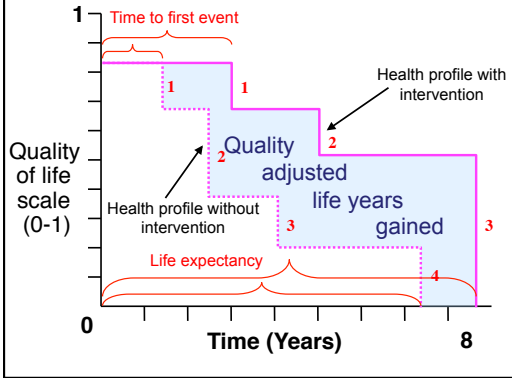



Trueman and Anokye 2013

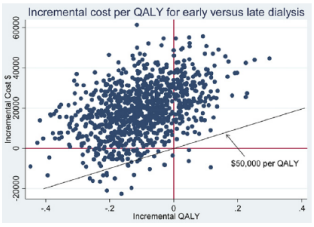
## Types of economic evaluation




## Using QALYs to measure outcomes



## CUA Example - IDEAL




Source: Harris et.al. 2011

Late (existing) treatment dominates

- 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)