



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/begm>

Or email us: health-economics@unimelb.edu.au



COMMONWEALTH OF AUSTRALIA

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Module 2 – Identifying, Measuring, Valuing and Analysing Costs

Centre for Health Policy
Melbourne School of Population and Global Health



Overview

1. What is a cost?
2. Identifying costs
3. Measuring costs
4. Valuing costs
5. Analysing costs



What is a cost?

- Cost
 - to be obtained at a **price** of
 - to involve in **expenditure** of
 - to be required to be **laid out** or suffered or lost
- Financial cost
 - the total **money** expenditure required to achieve a goal
- Economic cost
 - = **opportunity cost**: what must be sacrificed in order to achieve a goal; the value of the resources in their **next best use**
 - if you do A, you cannot do B
 - the cost of doing A, is the **foregone value** of B



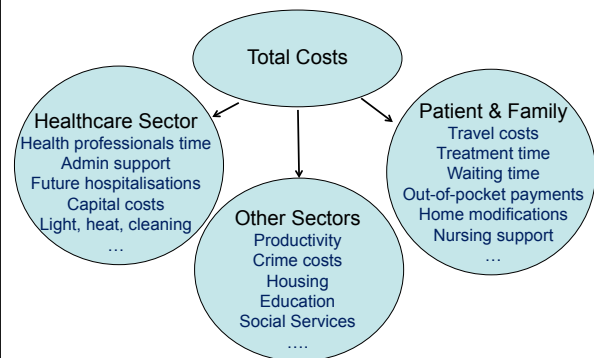
Economic costs

- The “costs” are the **economic inputs** required to produce a certain intervention
- Four factors of production
 - **Labour** (doctors, admin, physiotherapists, **patient time**...)
 - **Consumables** (drugs, educational materials, heating,...)
 - **Capital** (buildings, machines, ...)
 - **Land**

Study Viewpoint

- **Societal:** all costs to whomsoever they accrue
 - **Health Sector:** costs to the government and private sector
 - **Government:** Commonwealth and/or State/Territory
 - **Third Party Funder:** public or private (insurance company,...)
 - **Healthcare Provider:** Hospital, GP
 - **Patients/Carers:** out of pocket expenses, travel, waiting time
 - **Other sectors:** (Social Services; Justice;...)

How are resources/costs categorized according to perspective/sector?



Study Viewpoint

“Societal” perspective is ideal

- Policy makers often want a narrower perspective
 - budgets are fixed and there are incentives to shift costs

Examples of **cost shifting**:

- When evaluating whether to centralize all cancer services to make efficiency savings we should consider the additional travel costs to patients and family
- Impact of GP co-payments (Federal) on ED and hospital admissions (State)

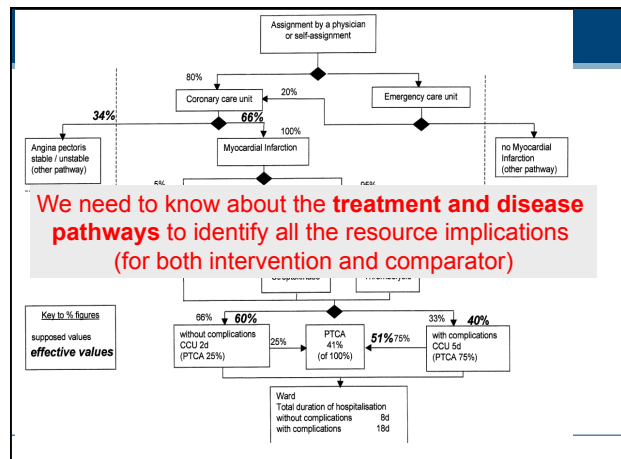
Process of Costing

Three steps:

1. **Identification** of the appropriate costs to include in the appraisal (i.e. the inclusion/exclusion criteria based on **perspective** adopted)
2. **Measurement** of the **quantity** (in appropriate units) of resources used and saved by the program alternatives
3. **Valuation** of the resources used (and saved) in appropriate **prices** per unit for comparison

Identifying Resources

- Important to be able to accurately describe **all the elements/resources** that are **needed to make a program work** in its intended form
- **Downstream resource use** may also differ between programs and this **needs to be recorded/estimated**
 - Future hospitalisations, GP visits, drug use,...
 - At home support services, carer time, home modifications, ...



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Fixed versus Variable costs

- Fixed costs:** accrued no matter how big the program (educational materials, machines, program set-up costs)
- Variable costs:** rise the bigger the program - more patients increase the total cost (drugs, GP time)
- When predicting the cost of a program we want to **estimate** the program cost for its **intended form**
 - We are trying to inform a future decision not a past decision

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Scaling up

We record the costs involved in this

Pilot

Project

Variable Costs

Fixed Cost

But we want to predict the costs involved in this

Variable Costs

Intended Program

Fixed Cost

Important to separate fixed and variable costs

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Measuring Resources

- Collecting resources use information is **costly**
- Focus on the **key cost drivers**
 - Weigh up the likely **importance** of the “cost” versus the “cost” of collecting
- Make use of **routinely collected data** wherever possible to estimate the costs
 - Link to PBS, MBS records
 - Linked hospital data for future hospitalisations
 - Use patients postcode and treatment postcode to estimate travel time

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Measuring Resources

- Many different instruments** are used to collect resource use
- A UK project created an open-access instrument database <http://www.dirum.org/>
- The idea is to standardise questions where possible

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Measuring Resources

Section M

In this section we will be asking you some questions about the services you have used and anything you have had to buy because of your recent hip replacement. We are doing this to find out whether the type of anaesthetic you had during surgery alters the cost of treatment. Please do not include details of any visits to Southmead Hospital as we have this information and please only include events relating to your hip replacement.

M1a Have you used any non Southmead Hospital NHS services since your initial discharge from the Avon Orthopaedic Centre (AOC) for reasons related to your hip replacement?

No

Yes

If No go to question M2a

M1b If yes please complete the following.

Type of service	Have you used this service? Please tick either yes or no for each type of service	If yes please record total number of visits/contacts since your initial discharge from the AOC following your hip replacement
i. GP surgery visit	Yes ☐ No ☐	(a)
ii. GP Home visit	Yes ☐ No ☐	(b)
iii. Phoned GP for advice	Yes ☐ No ☐	(c)
iv. GP Practice nurse visit	Yes ☐ No ☐	(d)
v. Phoned GP practice nurse for advice	Yes ☐ No ☐	(e)
vi. Got a repeat prescription (without seeing doctor)	Yes ☐ No ☐	(f)
vii. District nurse	Yes ☐ No ☐	(g)
viii. Occupational therapist at home	Yes ☐ No ☐	(h)
ix. Occupational therapist at the GP surgery/ clinic	Yes ☐ No ☐	(i)
x. Community Physiotherapist at Home	Yes ☐ No ☐	(j)
xi. Physiotherapist at the GP surgery/ clinic	Yes ☐ No ☐	(k)

One of the DIRUM instruments for hip replacement procedures

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Measuring Resources

Use of Social Services

M2a Have you been visited by a Home Care Worker (Home help) since your initial discharge from the AOC for reasons related to your hip replacement?

No

Yes

If No go to question M5a

If yes:

M2b Please complete:

i) In the first two weeks following discharge I had visits per week

ii) In weeks 3-6 following discharge I had visits per week

iii) Now I have visits per week

M2c Did you have to pay for this service: Yes ☐ No ☐

If yes

M2d How much did you have to pay per visit: £

M2e Have you used the food at home service (meals on wheels) since your initial discharge from the AOC for reasons related to your hip replacement?

No

Yes

If No go to question M5a

If yes:

M2f Please complete:

i) In the first two weeks following discharge I had meals per week

ii) In weeks 3-6 following discharge I had meals per week

iii) Now I have meals per week

M2g Did you have to pay for this service: Yes ☐ No ☐

If yes

M2h Approximately how much did you have to pay per week: £

Not only health care usage but also other social service use

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Valuing Resources

- Once we have estimated the resources used within and after the program we then have to place a 'value' on each resource
- How valuable (\$) is;
 - 1 hr of a GP's time?
 - the use of a operating theatre for 1 hr?
 - 1 hr of a volunteer's time?
 - preventing an A&E visit?
 - reducing a patient's treatment time by 1 hr?
 - reducing family and friends travel time by 2 hrs?

Valuing Resources

- Opportunity Cost
 - how valuable would the resources be if they were used in the next best process instead?
- Often the price paid for a resource represents a reasonable estimate of its opportunity cost; but not always
 - Volunteer time; Volunteer's could be engaged in some other valuable activity
 - Patient & Family travel time; how valuable do patients regard having services close to their home?

Volunteer and patient time often costed at $\frac{1}{3}$ of average wage

Valuing Resources

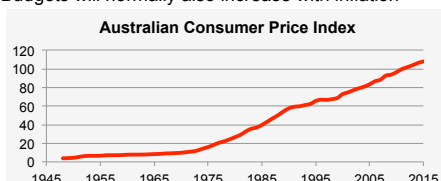
- Some Australian health cost information
 - Independent Hospital Pricing Authority
<https://www.ihoa.gov.au/>
 - "Manual of Resource and their Associated Cost" from DoHA; for use in PBAC submissions
<http://www.pbs.gov.au/info/industry/useful-resources/manual>
 - Victorian hospital cost information
<https://www2.health.vic.gov.au/hospitals-and-health-services/funding-performance-accountability/activity-based-funding/cost-weight-calculators>

Types of costing approaches

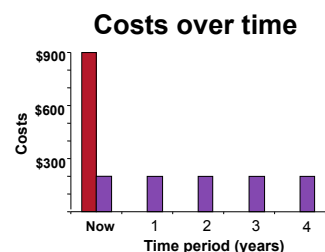
- | | |
|--|--|
| <ul style="list-style-type: none"> Micro costing <ul style="list-style-type: none"> Ingredients method Bottom up costing <ul style="list-style-type: none"> E.g. – number of tests ordered, time with counsellor, dosing minutes, visits Type and number of medications <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> More Accurate More Costly to collect </div> | <ul style="list-style-type: none"> Macro costing <ul style="list-style-type: none"> Top down Ignores variation <ul style="list-style-type: none"> Average per day DRG cost weight MBS fee PBS fee <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> Less Costly to collect Hidden Uncertainty Less Accurate </div> |
|--|--|

Key issues in costs

- All (\$) values should be the current resource cost rather than their past cost
- We ignore **inflation** - covert all costs into "**real dollars**" based on what a current dollar is worth
 - Even though we expect the nominal wage of a GP to increase over time we consider the current GP wage
 - Budgets will normally also increase with inflation



Key issues in costing: Discounting



Treatment A- surgery

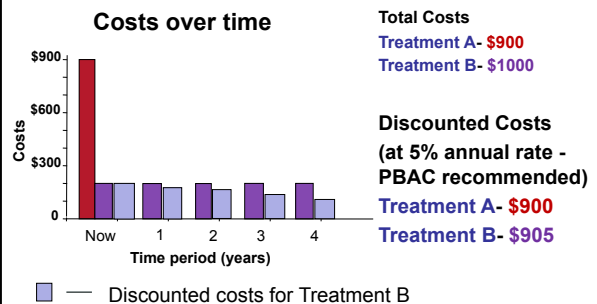
Treatment B- fitness program for five years

Key issues in costing: Discounting

- Delaying costs is valuable as these funds could be invested elsewhere now and gain **"returns"**
- We wish to convert future costs into the "equivalent" cost today = **present value**
 - How much would you need to save & invest today in order to be able to pay for these future costs tomorrow?

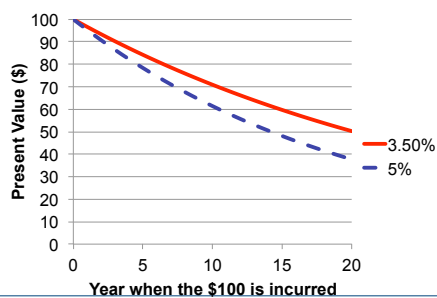
We also discount future outcomes

Key issues in costing: Discounting



Importance of discounting

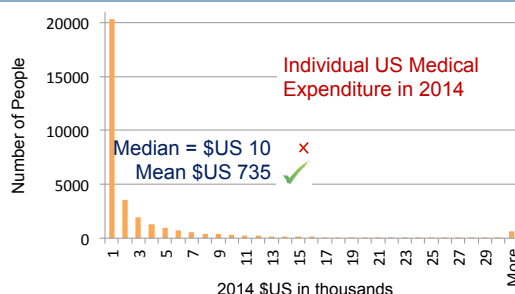
- Difference between 5% (AUS) and 3.5% (UK) discount rates for \$100 of future cost savings



Analysing Costs

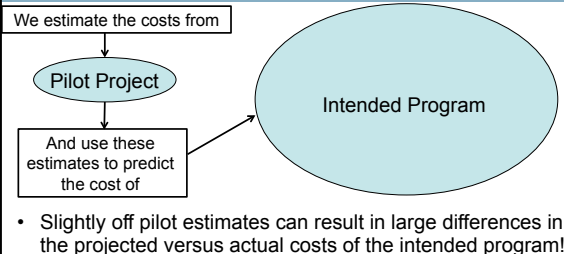
- Costs are often "skewed" - a few patients "cause" some very large costs
 - But these costs are important as they can strongly influence the total cost of the intervention
- The **median** (middle cost) is **NOT** a good indicator
 - The mean cost is often a lot higher than the median
- In cost-effectiveness we mostly use the **MEAN** as this is what is relevant to a funder

US Medical Expenditure Survey 2014



Approximately 5% of the sample accounted for over 56% of the total medical costs recorded

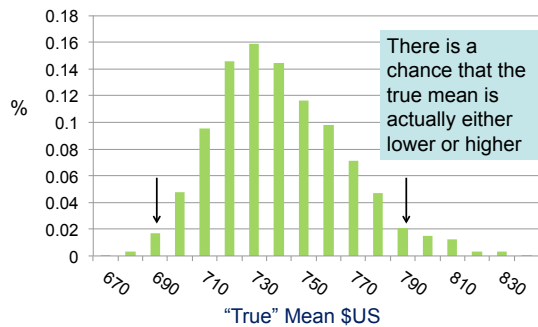
Analysing Costs (capturing the uncertainty)



Knowing the uncertainty allows us to quantify the financial risk to budgets and the risk of whether it is cost-effective

US Medical Expenditure 2014 Survey

Sample Mean \$US 735 (Uncertainty around the "true" mean)



Analysing Costs (capturing the uncertainty)

Total Medical Expenditure if the "true" average cost was \$US 690

\$US 213 billion

Total Medical Expenditure if the "true" average cost was \$US 770

\$US 237 billion

A \$US 24 billion difference

Analysing Costs (Sensitivity)

- It is wise to undertake a number of sensitivity (**what if**) tests around some of the key assumptions
 - What if fewer/more patients get seen than expected?
 - What if a more effective intervention becomes available in the near future?
 - What if a machine lasts for fewer years than expected?

Reporting Costs

- Key assumptions** regarding the costs should be clearly stated and justified
- Fixed and variable costs** should be reported separately
- Cost should be **broken down into components** (clearly state **who will bear each cost**)
- The **mean** and **uncertainty** (95% confidence intervals) around the costs along with **other sensitivity analysis** should be reported