Cost Benefit Analysis

ECN 240

CMD
What is economic evaluation?

If the government is going to take on a project or intervene, we need ways to compare the costs and benefits of the project/intervention for decision-making:

- whether to take on a project or not
- which of several possible projects is best
Prevention is often not cheaper than cure

- Prevention targets more people than will ever get the disease, so even if per person prevention is cheaper, there are more people involved.
- Some interventions aren’t very effective at changing behavior.
- Prevention makes people live longer, thus increasing health care expenses, social security and Medicare, but not economic productivity.

Implications:

- Need economic evaluation before decisions are made.
- Careful economic evaluation should take into account the appropriate costs and benefits.
## Costs of interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Costs per Life-year ($1993)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza vaccine for all citizens</td>
<td>140</td>
</tr>
<tr>
<td>Mammography for women age 50</td>
<td>810</td>
</tr>
<tr>
<td>Random motor vehicle inspections</td>
<td>1,500</td>
</tr>
<tr>
<td>Water chlorination</td>
<td>4,200</td>
</tr>
<tr>
<td>Pneumonia vaccination</td>
<td>12,000</td>
</tr>
<tr>
<td>Strengthening of buildings in earthquake-prone areas</td>
<td>18 million</td>
</tr>
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Cost Benefit Analysis

- Compare costs (C) and benefits (B) of public investment
- If $B - C > 0$, then invest
- Or choose approach with highest $B/C$ ratio
CBA – details

- Opportunity costs:
  - what you pay (flu shot costs)
  - what you give up (time of workers getting shot)

- Benefits:
  - to recipient (person who got flu shot)
  - to external party (not immunized who has less exposure to flu)
Take into account ALL costs:

- Direct medical care costs
  Def:

- Direct nonmedical costs
  Def:

- Indirect costs
  Def:

Examples of Total Costs:
Which would you prefer?

1) $100 today or $100 in two months?
Discounting

Which would you prefer?

1) $100 today or $100 in two months?
2) $50 today or $100 in two months?
Discounting

Which would you prefer?

1) $100 today or $100 in two months?
2) $50 today or $100 in two months?

Money today and money in two months may have a different value to you. This is called discounting.
Discounting

If project has future costs and benefits, need to discount

\[
NPV = \sum_{t=1}^{T} \frac{B_t - C_t}{(1 + r)^t}
\]  

- \(NPV\) - Net Present Value
- \(B_t\) - Benefit at time \(t\)
- \(C_t\) - Cost at time \(t\)
- \(r\) - discount rate (ex. annual rate of interest)
- \(T\) number of years in calculation
Discounting

- discount rate $r$ is important—determines the rate at which the benefits fall off
- if too high then the future doesn’t matter as much and you’ll choose short-term benefit projects
- if too low then you only care about the future and choose long-term benefit projects
Example of CBA

Should college students be vaccinated against meningococcal disease?

Costs:
- cost of vaccine + admin cost = $30.53 per dose
- 2.3 million freshmen enter college every year
- 80 percent would receive vaccine
- 1 severe reaction per 100,000 students vaccinated at cost of $1830 per case

What is the total cost?
Example of CBA, cont.

Benefits:

- direct medical benefits per case (diverted costs) = $8145
- Suppose college student rate of disease = 2.6*national average (76 nonfatal cases avoided)
- value of life of 20 year old = $1 million
- 12 lives saved

What is the total benefit?
Example of CBA, cont.

- Benefit - Cost = ?
- program would save lives, but do the benefits outweigh the costs?
Example of CBA, cont.

- Benefit - Cost = ?
- Program would save lives, but do the benefits outweigh the costs?

Rate of infection needs to be at least 13x the national average.
Cost Effectiveness Analysis

- Estimates costs associated with 2 or more medical treatment options for a given health care objective
  - cost effectiveness ratio = $\frac{C_1 - C_0}{E_1 - E_0}$
  - $C_1 - C_0 =$ change in social costs incurred due to treatment
  - $E_1 - E_0 =$ gain in health outcome
    - in life-years or quality-adjusted life years
- Advantage over CBA: don’t need to convert benefit to dollars
  Note: still need to discount because life in 2 years is worth less than life today
QALYs

QALY (quality-adjusted life years) = life expectancy * measure of the quality of remaining life-years

- health utility index usually between 0 (death) and 1 (full health)
- developed from survey answers (respondents rate various health outcomes, or have to choose between 2 alternative health outcomes)
- mostly US, UK, and Canada surveys
Drawbacks of QALYs

- survey methods may be biased
- does not tell us whether society is better off (as with CBA)
- values older people less because successful treatment of older person saves fewer life-years
### CEA Calculations

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- **CE ratio (w/o quality adjustment)**: 
  \[
  \frac{110,000 - 20,000}{8 - 2} = $15,000
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- **CE ratio (w/ quality adjustment)**: 
  \[
  \frac{110,000 - 20,000}{3.2 - 1.4} = $50,000
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Higher cost per QALY because quality of life is lower with new procedure; maybe shouldn't be adopted.
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Example of CEA/CUA

Autologous vs. traditional community blood donations

- Autologous donation (donor and recipient are same person) are safer but admin and collection costs are higher.
- Is the increased safety worth the costs? Case is total hip replacement surgery.
  - Additional cost per unit of autologous blood transfused = $68
  - QALY saved per unit transfused = 0.00029 (2.5 hours of perfect health)
  - CU ratio = \( \frac{\$68}{0.00029} = \$234,483 \)
- Costly way of saving a life.