Cost-Effectiveness Analysis (CEA)

Julian Naidoo
Barry Kistnasamy
The Cost-Effectiveness Analysis

- A form of economic evaluation that allows for the comparison of the costs (in monetary units) and consequences (in natural units) of two or more alternatives.
- It is used when competing alternatives produce a common health consequence
  - When there is no evidence that the alternatives have a different effect on health, this analysis is used solely to find the alternative which has the greatest outcome per input
- It is useful when you have limited resources and are trying to make the most strategic choice.
CEA answers the following questions:

• Given that it has been decided that a goal is to be achieved, what is the best way of doing do?
• What is the best way of spending a given budget?
• Only for comparing two options with the same goal.
• It measures technical efficiency only – not allocative efficiency
Objectives of this session

- To understand the concepts of cost effectiveness analysis and sensitivity analysis
- To understand the steps involved in CEA and SA
- To be able to interpret cost effectiveness measures
- To equip participants with the Economic Evaluation check list
Cost-Effective Analysis

• It requires the identification of a standard to which the alternative health consequences can be compared. And requires DATA.

Examples of Measures of Effectiveness

<table>
<thead>
<tr>
<th>Program</th>
<th>Possible measures of effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment of Hypertension</td>
<td>Blood Pressure reduction in MmHg</td>
</tr>
<tr>
<td>PMTCT programme</td>
<td>% reduction in rate of Mother to Child Transmission</td>
</tr>
<tr>
<td>Treatment of Hypercholesterolemia</td>
<td>% reduction in blood cholesterol</td>
</tr>
<tr>
<td>Asthma</td>
<td>Days without attack</td>
</tr>
<tr>
<td>ARV treatment programme</td>
<td>Life years gained</td>
</tr>
</tbody>
</table>
1. STRUCTURING OF THE PROBLEM

Define:

1. Objective
2. Perspective
3. Time Frame
4. Analytical Horizon
2. IDENTIFICATION OF RELEVANT ALTERNATIVES

The alternatives should be:

1. Appropriate for the objective public
2. Comparable

Possible Alternatives:
1. Actual Practice
2. New Practice
3. Doing nothing
3. IDENTIFICATION OF METHODS FOR MEASURING RESULTS

   i. Result categories:

   Intervals

   Number of people using condoms as a result of an education intervention

   Final

   Number of HIV/AIDS infections avoided as a result of the intervention
3. IDENTIFICATION OF METHODS FOR MEASURING RESULTS Cont.

ii. Adverse Effects of the Intervention

iii. Identification of Costs

- Costs of the program/intervention

- Costs avoided or avoidable through the program/intervention

- Costs of lost productivity
Sources for CEA Data

• Cost data sources:
  – Retrospective data: financial records, activity data
  – Prospective data: obtain quantities (by types) of inputs required through interactive interviews with experts

• Effectiveness data sources: clinical trials, randomised controlled trials, whatever appropriate to the programme
  – Final health output (life years gained, number of heart attacks prevented, etc)
Design

• Data Collection
• Conceptual Model
  – Intervention flow diagram
  – Decision tree or another form to outline the process (Markov Model)
  – The quality of the results depends on the quality of the model
Cost Effectiveness Ratio

• Alternatives may differ in terms of costs and effects
• A ratio is produced for each alternative
  – The numerator is cost
  – The denominator is the health effects (e.g. life years saved)
• The cost-effectiveness ratio is a measure of “cost per unit of health effect”
• Distinction between average C/E ratio and incremental C/E ratio is essential!
• An **average C/E ratio** is equal to the total cost of a programme divided by the effectiveness of the programme compared to “doing nothing” (i.e. the base-case alternative)

• An incremental C/E ratio is the incremental cost of a programme divided by the incremental effectiveness compared to the next most effective programme

• If only one programme is compared with “doing nothing” then the incremental C/E ration = average C/E ratio
• Two programmes, A and B, are defined as independent if the costs and effectiveness of programme a (B) are not affected by whether programme B (A) is implemented or not.

• E.g. the treatment of ulcer patients and the treatment of arthritis patients

• Use AVERAGE cost-effectiveness
Incremental C/E ratio use

- For **mutually exclusive** programmes:
  - If implementing programme A (B) means that programme B (A) cannot also be implemented
  - If programmes A and B can both be implemented physically, but implementing a (B) means that the costs and/or effectiveness of B (A) change
- 3 alternatives: only A, only B, or both A and B
- Use INCREMENTAL cost-effectiveness
Characteristics of the CEA

Measurement of the Effectiveness of the Intervention:

- Efficiency of the intervention (treatment, vaccines)
- Sensitivity and specificity of laboratory exams
- Disease prevalence
- Risk factor prevalence
- Participation, coverage of a community activity
Characteristics of CEA

2. Risk of indirect effects of the intervention
3. Risk of disease or injury with and without the intervention
   - Risk of primary disease or injury avoided
   - Risk of complications or secondary injury or disease avoided
4. Net Costs of an Intervention
   – Medical and non-medical costs
     • Of the intervention
     • Of the disease
   – Loss of productivity
     • Of the intervention
     • Of the disease
Limitations of Incremental CEA

• Not generalisable across settings because the starting points might be different.
• Does not say if current practice is effective – only if the suggested incremental change is effective.
Limitations of CEA

- Where the programmes yield more than one kind of beneficial effect, CEA might not resolve the problem of option selection because it can only compare along one output type at a time.
- Cannot compare interventions which have differing impacts on both mortality and morbidity.
• Difficult to make policy decision based only on the comparison of the C/E ratios
• When using intermediate outcomes, it is often difficult to link these definitively with the final outcome eg reduction in HIV prevalence, reduction in AIDS-related deaths
• CEA cannot compare programmes with different goals!!
• Summary
Essentially we want two main outcomes from our HIV/AIDS Prevention and Treatment & Care programmes:

- A reduction in the number of infections; and
- An increase in the number of healthy years of life for those who are infected and receiving treatment and care.
Therefore, in evaluating the cost effectiveness of Prevention strategies we compare the cost of competing strategies per infections averted.
Similarly, in evaluating the cost effectiveness of Treatment & Care strategies we compare the cost of competing strategies per years of life gained.
Conclusion

- The information provided by cost-effectiveness analysis allows for:
  - identification of those interventions that have the potential to reduce the impact of the epidemic
  - more effective priority setting by providing choice from a viable range of options.
Discussion

- Should CEA include changes in productivity from the social perspective?
- Should it consider the consequences of future medical costs for people whose deaths were avoided?
Cost Effectiveness-Analysis (CEA) II – Sensitivity Analysis
• **Strong Dominance**
  – One program shows dominance over another if it is more effective and less costly

• **Extended Dominance (Weak Dominance)**
  – There is extended dominance when a combination of two programs shows greater cost-effectiveness than another
  – Extended dominance rules out any intervention that has an incremental cost-effectiveness ratio that is greater than that of a more effective intervention
FIGURE 5.5 Drummond
FIGURE 5.5 Drummond
1. Was a well-defined question posed in answerable form?

2. Was a comprehensive description of the competing alternatives given?

3. Was there evidence that the programs effectiveness (efficacy) had been established?

4. Were all important and relevant costs and consequences for each alternative identified?
5. Were costs and consequences measured accurately in appropriate physical units?

6. Were costs and consequences valued credibly?

7. Were costs and consequences adjusted for different timing?
8. Was an incremental analysis of cost and consequences of alternatives performed?

9. Was allowance made for uncertainty in the estimates of costs and consequences? (SA done?)

10. Did the presentation and discussion of study results include all issues of concern to users?
Software used for CEA

- SMLTREE
- Data 3.0
- DECISION MAKER
- DECAID
- TREE AGE
- Excel
With thanks to Teresa Guthrie (CEGAA), Susan Cleary (Health Economics Unit, UCT) and Atanacio Mendoza (INSP, Mexico)