Cost-effectiveness Analysis

Iqbal Dhaliwal
Deputy Director
J-PAL
Outline

• From effectiveness to cost-effectiveness
• What is CEA? (vs. CBA)
• Using CEA in decision making
• Key challenges in doing CEA

Disclaimer:
• Graphs and Data are illustrative only and may not be accurate
• No “one right” method to do a CEA
The Immunization Challenge in Udaipur, India – Supply Side

- Immunization is really low in Rajasthan (less than 5% in Udaipur)

- One possibility is that the supply channel is the problem:
  - Hilly, tribal region with low attendance by city based health staff to local health clinics (45% absenteeism)
The Demand Side of Immunization

- Second possibility: There is a problem of demand:
  - People not interested in immunization, scared?
  - Opportunity cost of going for 5 rounds of vaccination
  - Can demand be affected?
Evaluating Supply and Demand

- Supply: Conducted monthly immunization camps in 60 villages: regular camps held rain or shine from 11a-2p (95% held)

- Demand: Provided 1 kilogram of lentils for each immunization (Rs. 40 – one day’s wage) plus plate set for full course

- Treatment 1: Reliable camps
  – 30 villages

- Treatment 2: Reliable camps + incentives
  – 30 villages

- Control group
  – 60 villages
Regular Supply Increased Immunization, Incentives Helped it Even More

**Figure 2:** Percentage of children aged 1-3 years fully immunized by treatment status.

- Comparison Group: 6%
- Immunization Camps: 18%
- Camps + Incentives: 39%
Which treatment was more cost effective?

A. Reliable Camps
B. Reliable Camps + Incentives
C. Could go either way
D. Don’t know

**FIGURE 2: PERCENTAGE OF CHILDREN AGED 1-3 YEARS FULLY IMMUNIZED BY TREATMENT STATUS**

- Comparison Group: 6%
- Immunization: 12%
- Reliable Camps: 29%
- Reliable Camps + Incentives: 41%
- D. Don’t know: 18%
Giving incentives was twice as cost-effective.
Outline

• From effectiveness to cost-effectiveness
• What is CEA? (vs. CBA)
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• Key challenges in doing CEA
Cost-effectiveness Analysis (CEA)

- Cost-effectiveness analysis measures the ratio of the costs of a program to the effects it has on one outcome.
  - Measure the cost for a given level of effectiveness: e.g. cost to increase school attendance by 1 year.
  - Or, measure the level of effectiveness for a given cost: years of additional attendance induced by spending $100.
Comparative CEA

- Comparative cost-effectiveness then compares this cost-effectiveness ratio from this one program to a similar ratio for many other programs
  - Example: Years of schooling gained per $100 spent
Comparative CEA

• Good way to help decision makers synthesize information from many evaluations
  – Provides a summary of a single program in terms of its costs and effects on one outcome
  – Can be used to compare many programs, find the most cost-effective option

• Must compute costs and benefits using similar methodology for all programs being compared
Cost-Effectiveness (CEA) vs. Cost-Benefit Analysis (CBA)

- CEA: Ratio of costs to effect on one outcome
- CBA: Ratio of costs to monetary value of effects on all outcomes
  - Can deliver absolute judgment on whether a program is worth the investment.
  - Requires assumptions about the monetary value of all the different benefits. (cost of life, disability, lower crime among school kids)

- Advantage of CEA is its simplicity:
  - Allows user to choose an objective outcome measure (e.g. cost to induce an additional day of schooling) – no need for making judgments on monetary value of that schooling
  - Easier for policymakers to compare programs when they are primarily concerned about one outcome of interest (e.g. increasing school attendance, not child health)
Which of the following is NOT a necessary ingredient in a comparative CEA?

A. Several different programs looking at the same outcome
B. Accurate impact estimates
C. An estimate of monetary value of programs’ benefits
D. Information on the cost of the program

17% 11% 67% 6%
What info is needed to do an CEA?

• **Take impact measures from rigorous impact evaluations**
  – Need some other info, like number of beneficiaries, when impacts were measured

• **Take cost data from...?**
  – Most projects don’t record their implementation costs
  – Need fairly disaggregated specific data on exactly what items were purchased, how much staff time was spent (on what), transportation costs, etc.
# Tally the full Costs of the Program – Ingredients Method

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Details</th>
<th>Camps with Incentives</th>
<th>% of Total</th>
<th>Camps without Incentives</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary</td>
<td>Team of 4 GNM's and 4 GNM Assistants + Coordinators Salary</td>
<td>558,500</td>
<td>29%</td>
<td>558,500</td>
<td>46%</td>
</tr>
<tr>
<td>Travel</td>
<td>Staff and Incentive transport to camps</td>
<td>171,460</td>
<td>9%</td>
<td>63,460</td>
<td>5%</td>
</tr>
<tr>
<td>Honourarium</td>
<td>USD 0.26 per child under 2 yrs per shot, given to village workers.</td>
<td>119,580</td>
<td>6%</td>
<td>62,370</td>
<td>5%</td>
</tr>
<tr>
<td>Daily allowance</td>
<td>USD 1.10 for attending bi monthly meetings, given to village workers</td>
<td>19,500</td>
<td>1%</td>
<td>19,500</td>
<td>2%</td>
</tr>
<tr>
<td>Consultancy fees</td>
<td>Paid for training of nurses and assistants.</td>
<td>2,200</td>
<td>0%</td>
<td>2,200</td>
<td>0%</td>
</tr>
<tr>
<td>Lodging &amp; boarding</td>
<td>Expenses incurred during trainings.</td>
<td>7,333</td>
<td>0%</td>
<td>7,333</td>
<td>1%</td>
</tr>
<tr>
<td>Travel</td>
<td>For village worker’s transport to trainings.</td>
<td>4,645</td>
<td>0%</td>
<td>4,645</td>
<td>0%</td>
</tr>
<tr>
<td>Training Material</td>
<td>Office supplies disbursed during trainings.</td>
<td>1,500</td>
<td>0%</td>
<td>1,500</td>
<td>0%</td>
</tr>
<tr>
<td>Medicines</td>
<td>Includes paracetemol, syringes and needles, needle cutters, blood pressure instruments, and stethoscopes.</td>
<td>43,925</td>
<td>2%</td>
<td>15,320</td>
<td>1%</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>Four for vaccine storage.</td>
<td>25,178</td>
<td>1%</td>
<td>25,178</td>
<td>2%</td>
</tr>
<tr>
<td>Cost of Monitoring</td>
<td>Includes cameras, film, and manpower required for monitoring camps, entering, and analyzing data.</td>
<td>446,480</td>
<td>23%</td>
<td>446,480</td>
<td>37%</td>
</tr>
<tr>
<td>Incentive</td>
<td>Utensils and lentils (includes storage boxes)</td>
<td>550,164</td>
<td>28%</td>
<td>-</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1,950,465</strong></td>
<td><strong>100%</strong></td>
<td><strong>1,206,486</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Divide the Cost by the Number of Children Immunized to get CEA numbers

**FIGURE 3: COSTS PER FULLY IMMUNIZED CHILD**

- **Rs. 2,202**
  - **COST OF CAMP**
  - **COST OF INCENTIVES**

- **Rs. 372**
  - **Camps**

- **Rs. 730**
  - **Incentives**

**Immunization Camps**

**Camps + Incentives**
Camps + incentives was more cost effective than camps alone because:

A. It had the largest impact
B. The impact increased more than the cost
C. The societal benefits of full immunization is higher than individual one-off immunizations
D. The total cost was the highest
E. Total cost was the lowest
Outline

• From effectiveness to cost-effectiveness
• What is CEA? (vs. CBA)
• Using CEA in decision making
• Key challenges in doing CEA
A. When you have multiple programs that all have a positive impact on an outcome of interest, and you're trying to choose between them.

B. When you have multiple outcomes addressed by a single program and you want to know which outcome is most cost effective.

C. You want to convince a decision maker that a non-obvious program is a good idea.

D. All of the above.

E. A & B

F. A & C
When is cost-effectiveness analysis most useful in decision making?

• You have a specific outcome measure you want to affect
  – There are many possible interventions to address this goal, and you are unsure which will get the most impact at the least cost

• You want to convince a decision maker that a non-obvious program is a good idea

• You want to understand how the CE of a program could vary with contextual and implementation factors
Common CEA Uses

• Retrospective analysis of pilot programs
  – “Exactly how cost-effective was that pilot program?”

• Prospective analysis of pilot programs
  – “Roughly how cost-effective could this proposed pilot be?”
  – “How big an impact must this achieve to meet our threshold?”

• Prospective analysis of programs at scale
  – “Roughly how cost-effective might this proposed national program be?”
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<th>Weaknesses</th>
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<td>Cost data from exact program that was evaluated</td>
<td>Gives precise estimates of how cost-effective a program was in that context</td>
<td>Still suffers from external validity problem for cost and impact estimates</td>
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<td>Rigorous impact estimates</td>
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**Retrospective Analysis of Pilot Programs**
## Common CEA Uses

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<th>Analysis Type</th>
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<tr>
<td>Retrospective Analysis of Pilot Programs</td>
<td>• Cost data from exact program that was evaluated&lt;br&gt;• Rigorous impact estimates</td>
<td>Gives precise estimates of how cost-effective a program was in that context</td>
<td>Still suffers from external validity problem for cost and impact estimates</td>
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<td>Prospective Analysis of Pilot Programs</td>
<td>• Projected costs&lt;br&gt;• Impact estimates from a similar program</td>
<td>Even rough calculations can help rule out programs that can’t be cost-effective</td>
<td>Cost projections and impact estimates from similar programs may not be accurate</td>
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### Common CEA Uses

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</tr>
<tr>
<td><strong>Prospective Analysis of Programs at Scale</strong></td>
<td>• Projected cost data for program at scale&lt;br&gt;• Rigorous impact estimates from pilot evaluation</td>
<td>Producing customized prospective estimates are a powerful tool when speaking with country governments</td>
</tr>
</tbody>
</table>
Cost effectiveness Analysis:

A. Can be conducted after a program’s impact has been accurately measured
B. Can be conducted after the program’s actual costs have been realized
C. Can help us decide whether piloting a new, untested innovation would be worth the effort
D. All of the above
E. A & B
F. None of the above
Outline

• From effectiveness to cost-effectiveness
• What is CEA? (vs. CBA)
• Using CEA in decision making
• Key challenges in doing CEA
Three Key Challenges in Doing CEAs

I. Absence of incentives to do CEA:
   - What if the program was effective but not really cost-effective?
   - No editorial requirement to show CEA in most social science journals
Three Key Challenges in Doing CEAs

II. Costs are hard to gather:
   - Collecting cost data not seen as key part of evaluation unlike impact measures
   - Cost data is surprisingly hard to collect from implementers (budgets different from implementation costs; hard to divvy up overhead and existing costs to project)
   - Hard to get cost data from other authors for a comparative CEA
   - Impact measures and cost collection often not harmonized
Three Key Challenges in Doing CEAs

III. To be Actionable for Large Funding Decisions, Analysis needs to be much more precise and that is not straightforward:

– Numerous assumptions are needed to complete the analysis (e.g. multiple outcomes, transfers, spillover effects, exchange rates, inflation etc.)

– No one “right” way, but consistency is important!
Gathering Cost Data - Retrospectively

• Retrospectively:
  – J-PAL mostly uses “ingredients” method

• Gather cost data from multiple sources:
  – Research paper for description of program structure, ingredients and local conditions like wages
  – Interview researchers for additional ingredients, their costs, additional documents like budgets
  – Program staff and field research staff for unit cost data
  – Supplement with public sources (e.g. local wages, transportation costs etc.)
Retrospective vs. Prospective Cost Gathering

• Challenges with retrospective approach:
  – Data not originally collected by implementer or evaluator and key field staff are hard to locate or do not respond
  – Many important costs are forgotten, or hard to estimate after long lag
  – Program as implemented may be very different from how it was budgeted
  – Aggregate cost data is much less useful for sensitivity analysis or scale-up

• Prospectively:
  – Overcomes challenges of retrospective cost gathering
  – Providing standard templates helps in data collection
  – Harmonization (outcomes, costs, methodology) makes it easier to do comparative CEA
Assumptions for CEA

• What are you calculating the cost-effectiveness of?
  – The program, during pilot phase
  – The program, if it was scaled up
  – Some component of the program

• How will you deal with...
  – Exchange, inflation, discounting
  – Spillover effects
  – Multiple outcomes
  – Costs shared with a partner organization
  – Fuzzy costs: administration, overhead, and management
CEA as a starting point for discussions on evidence based policy

### Africa
- Information on returns to education for parents (Madagascar)
  - Cost-effectiveness: 20.7 yrs
- Deworming through primary schools (Kenya)
  - Cost-effectiveness: 13.9 yrs
- Free primary school uniforms (Kenya)
  - Cost-effectiveness: .71 yrs
- Merit scholarships for girls (Kenya)
  - Cost-effectiveness: .27 yrs

*Program achieves multiple outcomes*

### South Asia
- Iron fortification and deworming in preschools (India)
  - Cost-effectiveness: 2.7 yrs

*No significant impact*

### Latin America
- Information on returns to education for boys (Dominican Republic)
  - Cost-effectiveness: 3.1 yrs
- ProCreda CCT for primary school attendance (Mexico)
  - Cost-effectiveness: .03 yrs

Abdul Latif Jameel Poverty Action Lab (J-PAL)
www.povertyactionlab.org
CEA graph is just the start – it is supplemented by many more details

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>COUNTRY</th>
<th>TIME FRAME</th>
<th>LOWER Bound</th>
<th>PT. ESTIMATE</th>
<th>UPPER Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Session on Returns to Education, for Parents</td>
<td>Madagascar</td>
<td>1 year</td>
<td>1.1</td>
<td>20.7</td>
<td>40.3</td>
</tr>
<tr>
<td>Deworming Through Primary Schools</td>
<td>Kenya</td>
<td>1 year</td>
<td>5.7</td>
<td>13.9</td>
<td>22.1</td>
</tr>
<tr>
<td>Free Primary School Uniforms</td>
<td>Kenya</td>
<td>1 year</td>
<td>0.33</td>
<td>0.71</td>
<td>1.10</td>
</tr>
<tr>
<td>Merit Scholarships for Girls</td>
<td>Kenya</td>
<td>3 years</td>
<td>0.02</td>
<td>0.27</td>
<td>0.52</td>
</tr>
<tr>
<td>Iron Fortification and Deworming in Preschools</td>
<td>India</td>
<td>1 year</td>
<td>0.10</td>
<td>2.7</td>
<td>5.3</td>
</tr>
<tr>
<td>Camera Monitoring of Teachers’ Attendance</td>
<td>India</td>
<td>–</td>
<td></td>
<td></td>
<td>NO SIGNIFICANT IMPACT</td>
</tr>
<tr>
<td>Computer-Assisted Learning Curriculum</td>
<td>India</td>
<td>–</td>
<td></td>
<td></td>
<td>NO SIGNIFICANT IMPACT</td>
</tr>
<tr>
<td>Remedial Tutoring by Community Volunteers</td>
<td>India</td>
<td>–</td>
<td></td>
<td></td>
<td>NO SIGNIFICANT IMPACT</td>
</tr>
<tr>
<td>Menstrual Cups for Teenage Girls</td>
<td>Nepal</td>
<td>–</td>
<td></td>
<td></td>
<td>NO SIGNIFICANT IMPACT</td>
</tr>
<tr>
<td>Information Session on Returns to Education, for Boys</td>
<td>Dominican Republic</td>
<td>4 years</td>
<td>1.0</td>
<td>3.1</td>
<td>5.2</td>
</tr>
<tr>
<td>PROGRESA CCT for Primary School Attendance</td>
<td>Mexico</td>
<td>4 years</td>
<td>0.02</td>
<td>0.03</td>
<td>0.04</td>
</tr>
</tbody>
</table>
Sensitivity to Contextual Factors
Sensitivity to Assumptions

COST-EFFECTIVENESS: SENSITIVITY TO EXCHANGE RATES
(additional years of education per $100 spent)

AFRICA

- standard exchange rate
- ppp exchange rate
- program achieves multiple outcomes

1. INFORMATION ON RETURNS TO EDUCATION FOR PARENTS (MADAGASCAR)
   - 20.7 YRS

2. DEWORMING THROUGH PRIMARY SCHOOLS (KENYA)
   - 13.9 YRS

3. FREE PRIMARY SCHOOL UNIFORMS (KENYA)
   - .71 YRS
   - .36 YRS

4. MERIT SCHOLARSHIPS FOR GIRLS (KENYA)
   - .27 YRS
   - .14 YRS
Issues to Consider in Cost Effectiveness Analysis – there is no one right way

- **Present Value**: Real discount rate of 10% is used to discount costs and benefits to control for time value of money

- **Inflation**: Adjust costs to today’s prices

- **Across Countries**: Standard exchange rates are used to adjust to US$

- **Multiple Outcome**: Can only examine one type of benefit at a time, which is how many policies are framed anyway
Issues to Consider in Cost Effectiveness Analysis – there is no one right way

– Total vs. Sunk Costs: Only consider incremental cost to the existing infrastructure (material, personnel, oversight)

– Proximal Success vs. Final Impact of Programs: Use global measures to translate proximal outcomes into final outcomes

– There is no one right way of doing a CEA. But we need to make choices (be transparent about assumptions) and apply the same standard across all studies in an analysis.
Should participant "opportunity costs" be included when conducting a CEA?

A. Yes, all "Economic costs" should be included

B. No, only the program costs incurred by the implementer should be included

C. Either, it depends on whether we're considering societal costs, or just those for a specific organization, as long as we're consistent across programs included

25%  13%  63%
Issues to Consider in Cost Effectiveness Analysis – there is no one right way

- Transfers: Not a cost to the society but are they a part of the program cost?
  - International Donors vs. Local Governments
  - Additional Problems of Non-Cash Transfers

Figure 1:
IMPACT ON MORTALITY: cost per child death averted
Issues to Consider in Cost Effectiveness Analysis – there is no one right way

- **Significance of Effects**: Only report results at 10% level of significance and show confidence intervals.

- **Point Estimates vs. Range**: Show range around point estimates to make distinction between a set of cost effective programs vs. a set of not so cost efficient programs.

- **Context**: If costs depend a lot on specific contexts (e.g. population density) provide ranges of cost effectiveness based on these parameters.
Final Issues to Consider in Scale Ups – there are no easy answers

- Spillover Effects: Spillovers may be different in a pilot vs. scaled program.

- Partial vs. General Equilibrium: Very hard to measure precise nature or direction of such effects

- Experimental vs. Scalable Mode: Costs of inputs may become endogenous to the scale up

- Hard to Control Contextual Differences: Quality of infrastructure, motivation of local partners and beneficiaries, price differences, cultural differences, local parameters
One challenge of CEA is that:

A. There is no one way to do CEA
B. It does not consider the economic “opportunity cost” of people’s time
C. It does not consider core costs of an organization independent of the program being evaluated
D. The cost of living differences of different program locations are not accounted for
E. All of the above
Some Resources for CEA

- J-PAL paper on CE methodology:
  - Why CEA is valuable
  - What assumptions are necessary to perform CEA
  - Common problems or mistakes in calculating CEA

- www.povertyactionlab.org/publication/cost-effectiveness

- Also includes some very basic templates for cost-gathering and doing CEA
Conclusion

• CEA can be a great complement to impact estimates
• It is a useful first step in comparing alternate programs that are aimed at the same outcome
• Simplicity allows for greater use of evidence in policymaking but need to make user aware of assumptions
• Sensitivity Analysis around C EAs allow policy makers to see the effect of modifying assumptions and local conditions
• Cost Collection process is far more accurate and easier when done prospectively rather than retrospectively