

Cost-effectiveness analysis and scaling up

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J-PAL

Course Overview



1. Introduction to Impact Evaluation
2. Measurement
3. Example of a Youth Evaluation Program in Uganda
4. How to Randomize
5. Sampling and Sample Size
6. Threats and Analysis
7. Example of a Youth Employment Evaluation from Kenya
8. **Cost-Effectiveness Analysis and Scaling Up**

Outline

1. **Example: From impact to cost-effectiveness analysis (CEA)**
2. What is CEA? (vs. cost benefit analysis)
3. Common uses of CEA
4. Key challenges in doing CEA
5. Scaling Up



Evaluating Immunization Camps and Incentives in Udaipur, India

- Immunization rates were very low (around 5% in Udaipur). Why?
- One possibility: supply problem.
 - Hilly, tribal region with low attendance by city based health staff to local health clinics (45% absenteeism)
 - Maybe we can improve attendance?



Evaluating Immunization Camps and Incentives in Udaipur, India

- Immunization rates were very low (around 5% in Udaipur). Why?
- One possibility: that the supply channel is the problem.
- Second possibility: There is a demand problem.
 - People not interested in immunization, scared?
 - Opportunity cost of going for 5 rounds of vaccination?
 - How can we increase demand?



Immunization Camps:

Addressing Supply and Demand

- Immunization camps (supply): Conducted monthly immunization camps held rain or shine from 11a-2p
 - Used cameras to monitor attendance of ANMs

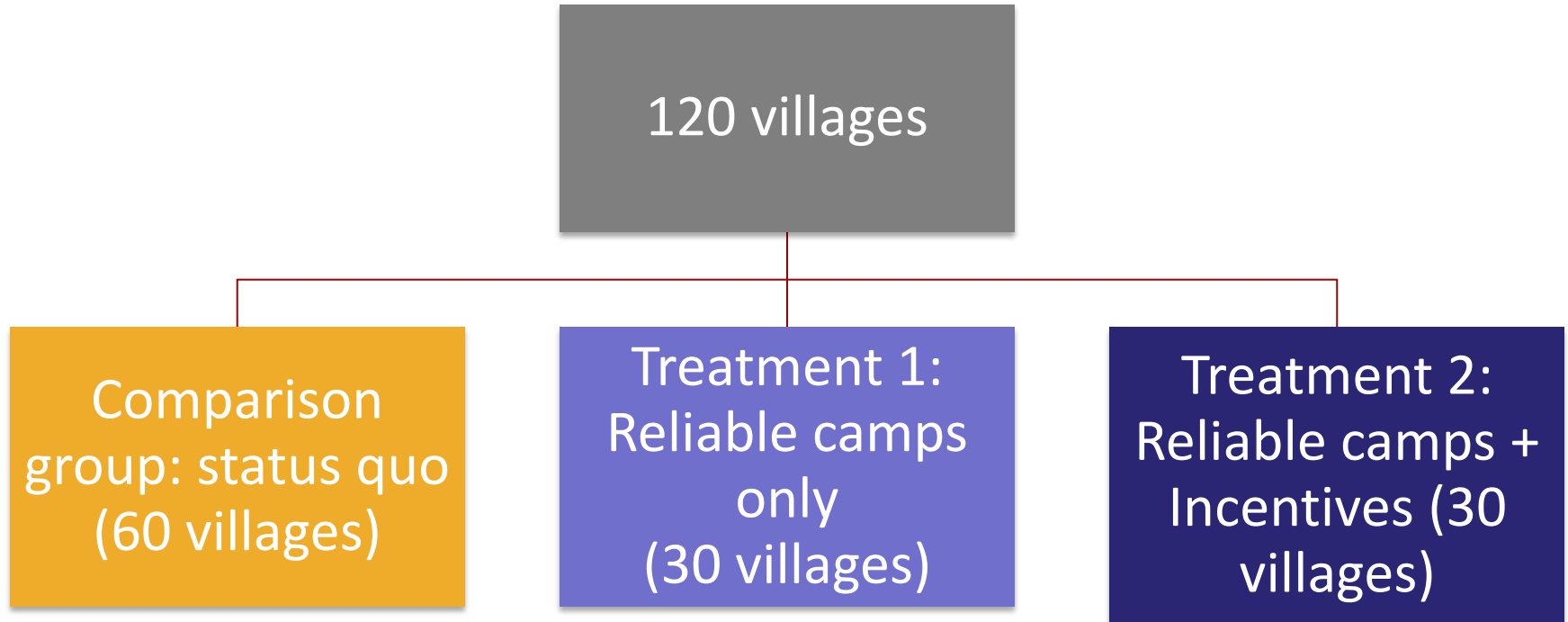


Immunization Camps: Addressing Supply and Demand

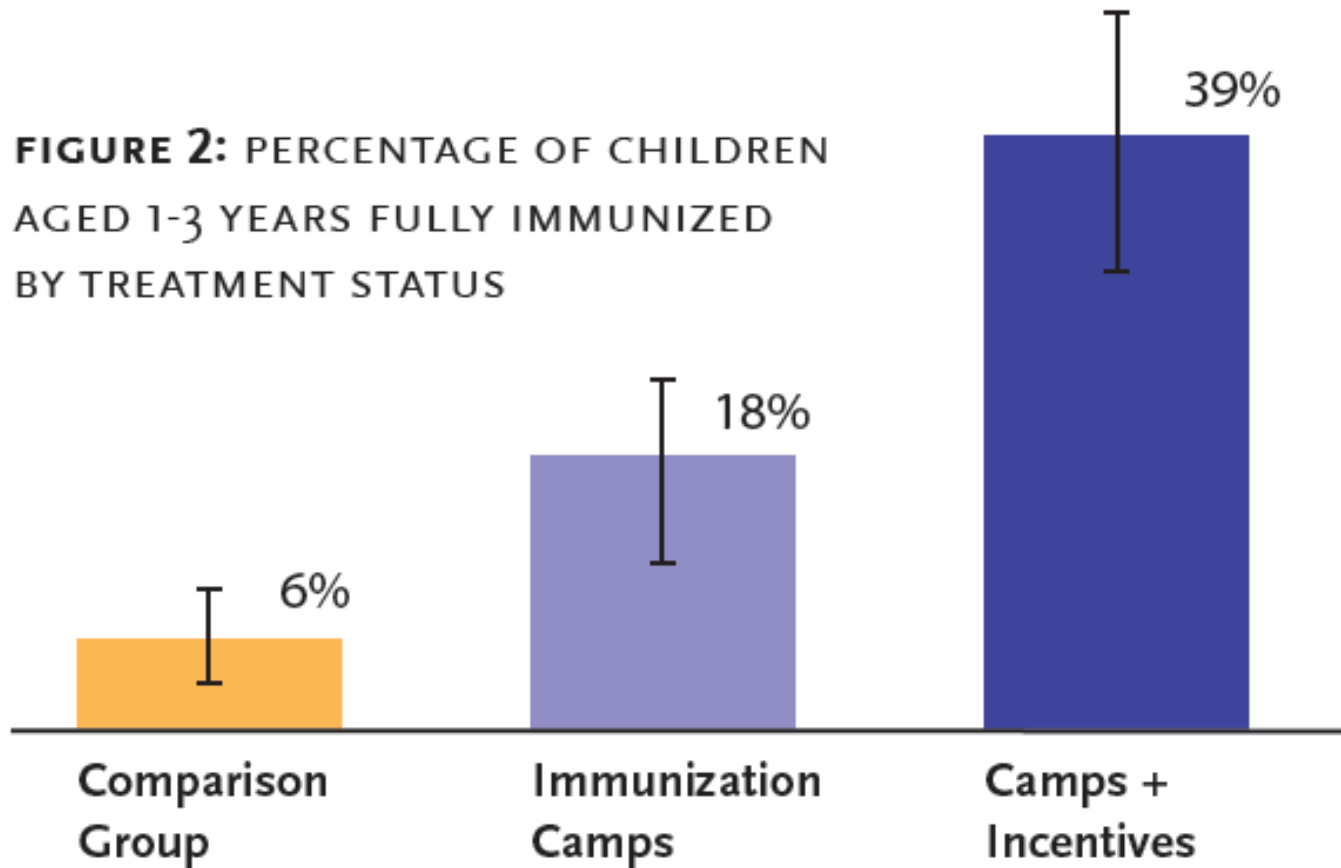
- Extra incentive: provided one kilogram of lentils for each immunization (Rs. 40, about one day's wage) plus plate set for completed all 5



Evaluation Design

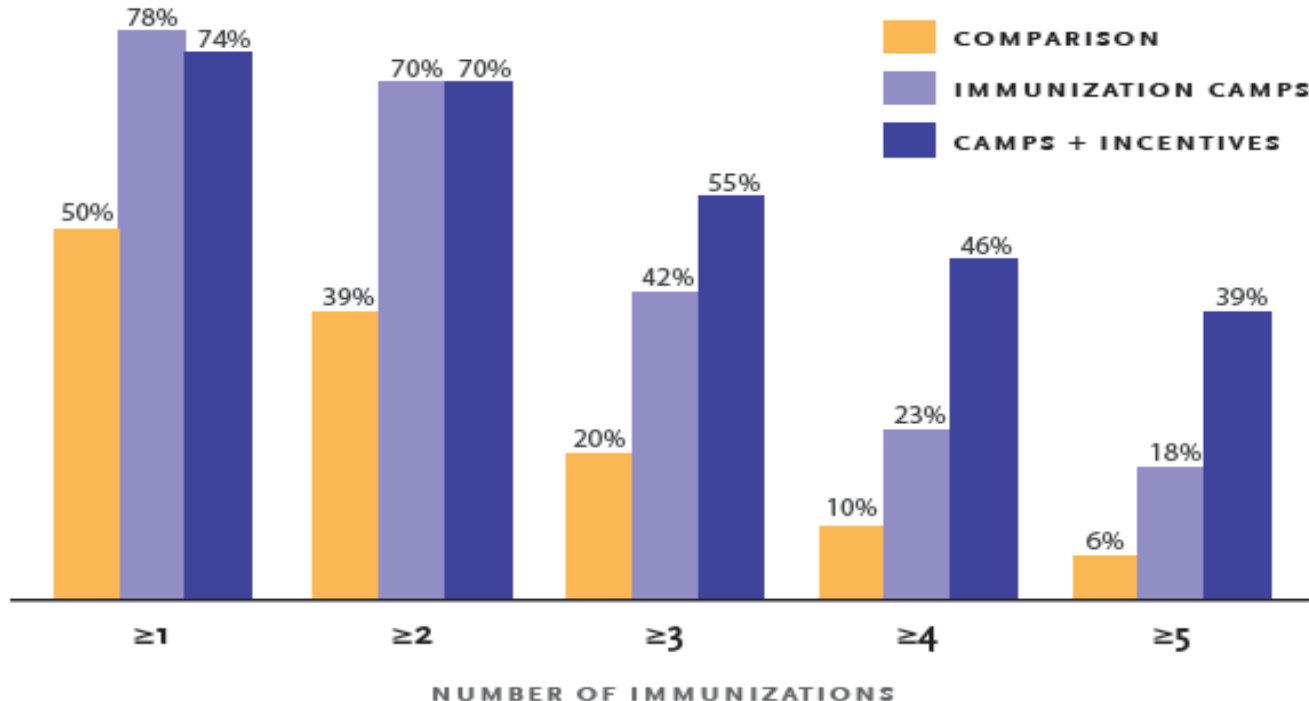


Regular Supply Increased Immunization, Incentives Helped it Even More



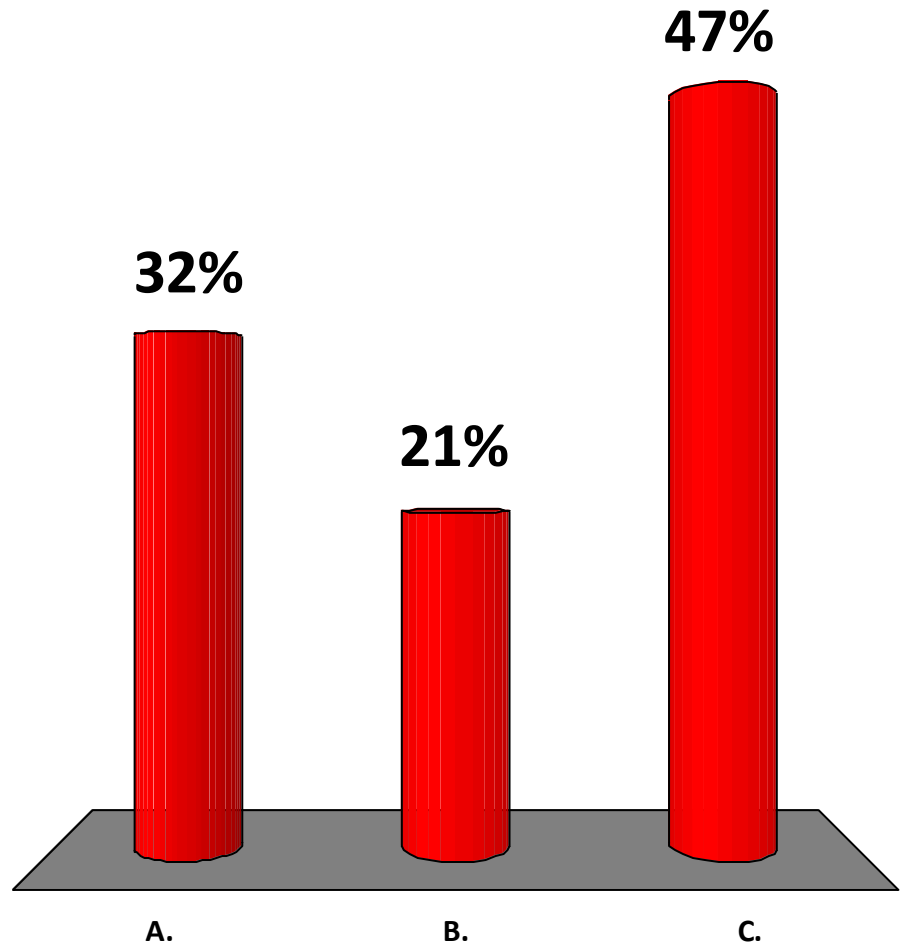
Regular Supply Increased Immunization, Incentives Helped it Even More

**FIGURE 1: NUMBER OF IMMUNIZATIONS
RECEIVED BY CHILDREN AGED 1-3 YEARS**



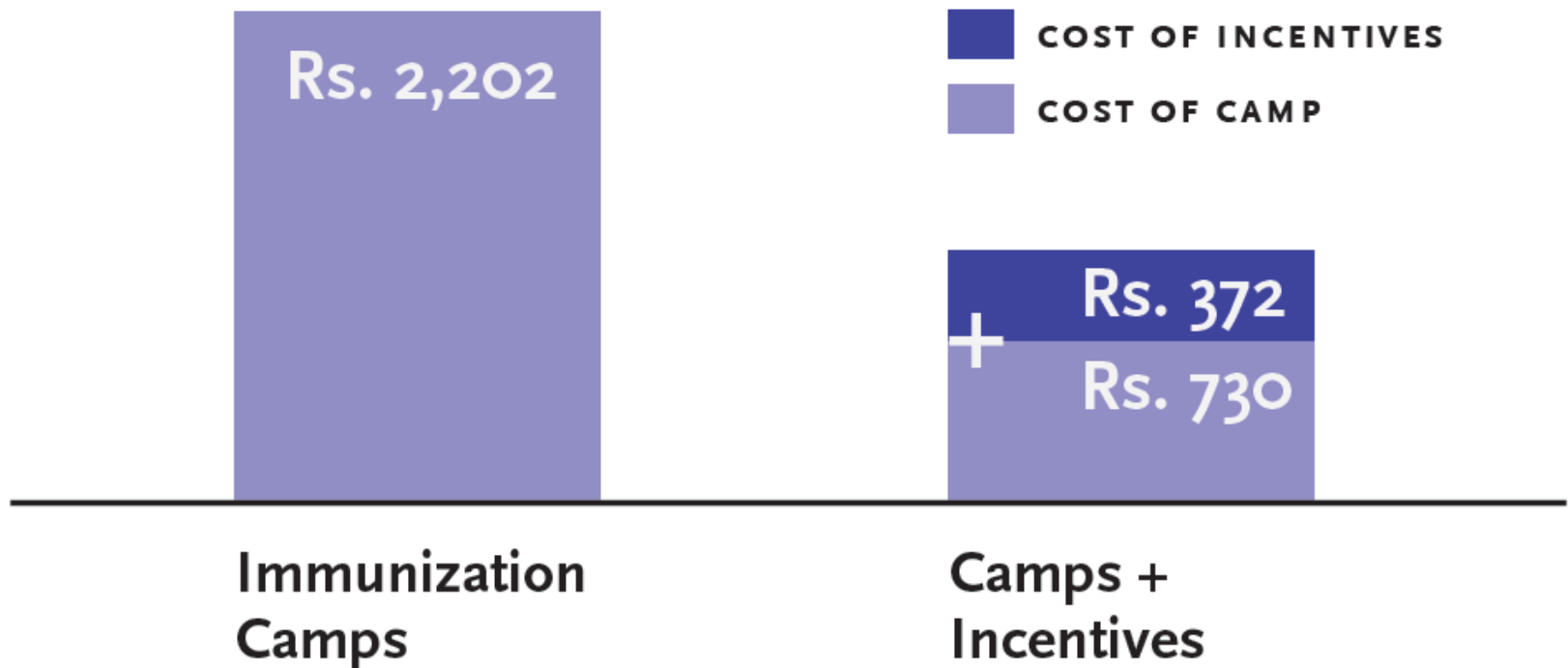
Which treatment was more cost-effective?

- A. Reliable Camps
- B. Reliable Camps + Incentives
- C. Could go either way



Giving incentives was twice as cost-effective

FIGURE 3: COSTS PER FULLY IMMUNIZED CHILD



Outline

1. Example: From impact to cost-effectiveness analysis
2. **What is CEA? (vs. CBA)**
3. Common uses of CEA
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Which would you choose?



\$10



\$10

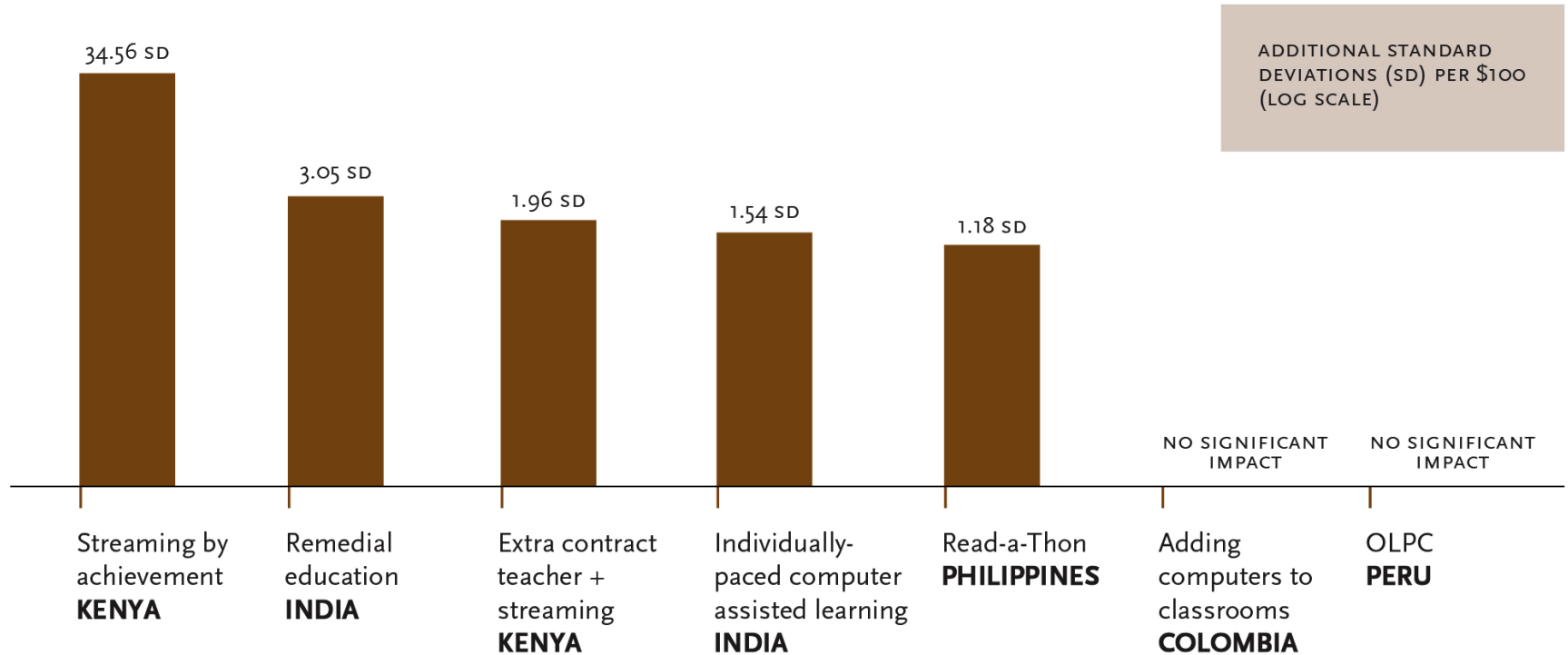
Cost-effectiveness analysis (CEA)

summarizes a complex program in terms of a simple ratio of costs to impacts

$$CE \text{ Ratio} = \frac{\text{Total Impact of Program}}{\text{Total Cost of Program}}$$

Comparative CEA then compares this cost-effectiveness ratio for multiple programs

IMPROVING STUDENT LEARNING: COST-EFFECTIVENESS OF EDUCATION PROGRAMS



Comparative CEA then compares this cost-effectiveness ratio for multiple programs

- Can be a good way to help policymakers 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 (comparative analysis)
- **MUST** use comparable methodology for calculating cost and impacts for all programs



Cost-Effectiveness Analysis (CEA) vs. Cost-Benefit Analysis (CBA)

- *Cost-effectiveness analysis* – **effect** of program on a **single outcome** measure for a given cost incurred
- *Cost-benefit analysis* – translates **all benefits and costs** of a program onto **one (monetary) scale**

Cost-effectiveness analysis



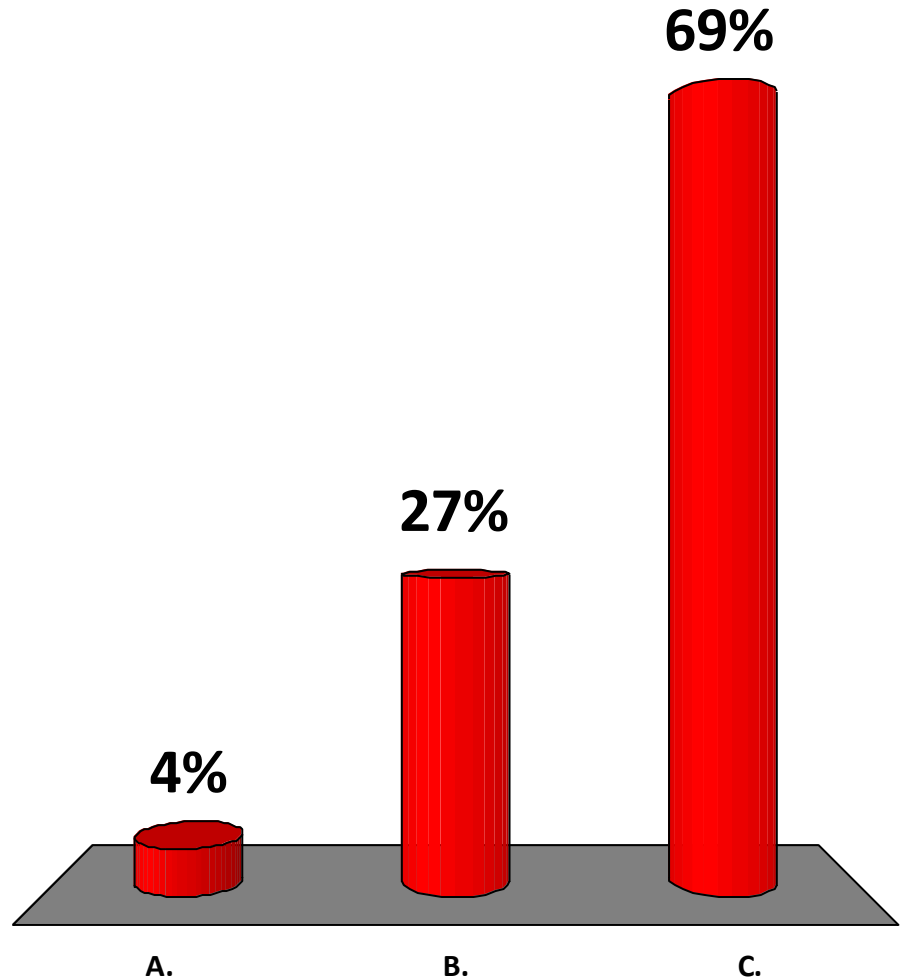
\$10

Cost-benefit analysis



Which approach is more useful?

- A. Cost-effectiveness analysis
- B. Cost-benefit analysis
- C. Depends on the decision you face.



Cost-Effectiveness Analysis (CEA) vs. Cost-Benefit Analysis (CBA)

- CBA translates all benefits and costs of a program onto one (monetary) scale
 - Can deliver absolute judgment on whether a program is worth the investment.
 - But, also 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)

When is cost-effectiveness analysis useful?

- 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 (example: Deworming)
- You want to understand how the CE of a program could vary with contextual and implementation factors

What info is needed?

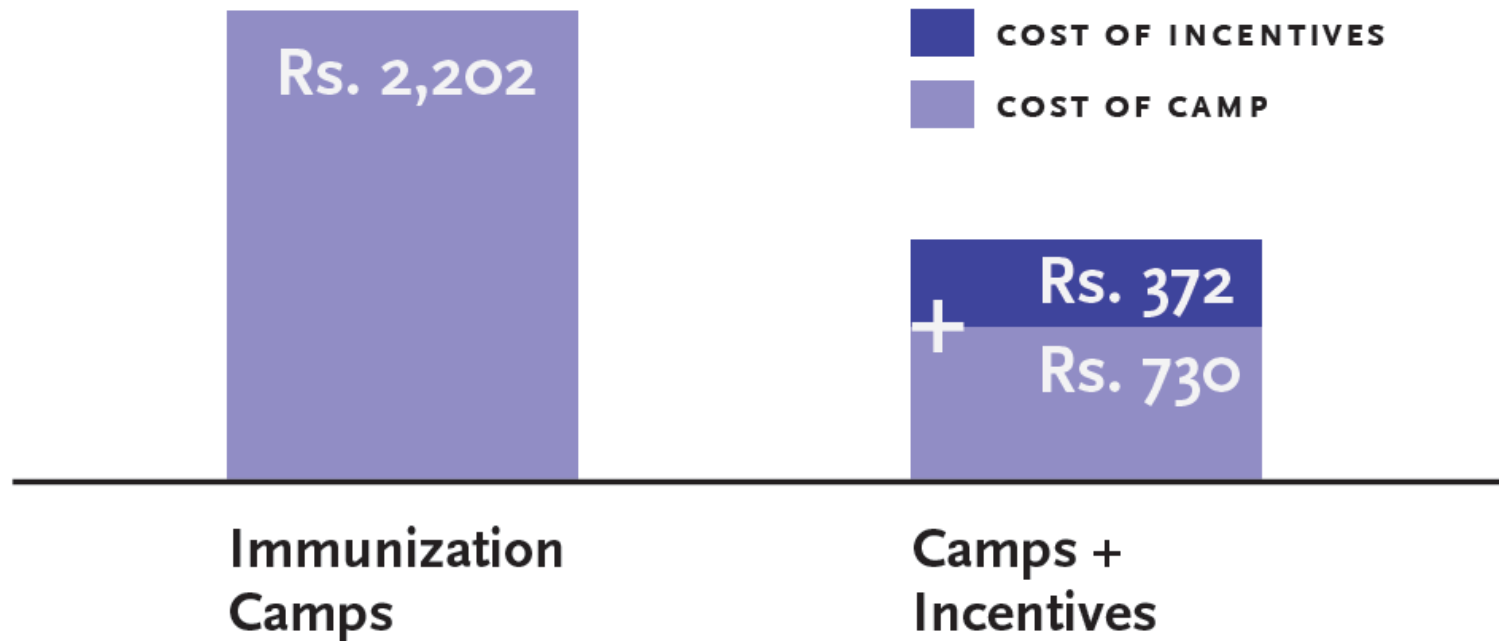
- Take **total** impact measures from rigorous impact evaluations
 - Need information other than impact estimate: number of beneficiaries, when impacts were measured, what tools were used to measure the impact, etc.
- Take **total** cost data from...?
 - Most projects don't record their implementation costs
 - Need fairly disaggregated specific data on exactly what items were purchased, how much staff time was spent (on what), transportation costs, etc. (Why?)

Tally the full Costs of the Program – Ingredients Method

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

Giving incentives was twice as cost-effective

FIGURE 3: COSTS PER FULLY IMMUNIZED CHILD

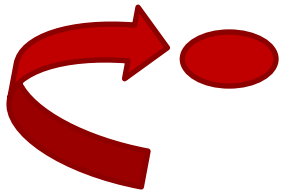


Outline

1. Example: From impact to cost-effectiveness analysis
2. What is CEA? (vs. CBA)
- 3. Common uses of CEA**
4. Key challenges in doing CEA
5. Scaling Up

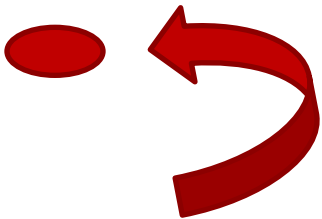


Common CEA Uses



A. Prospective analysis of planned programs

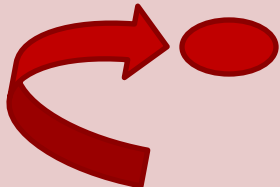
- A. “Roughly how cost-effective could this proposed program be?”
- B. “How big an impact must this achieve to be a cost-effective investment?”



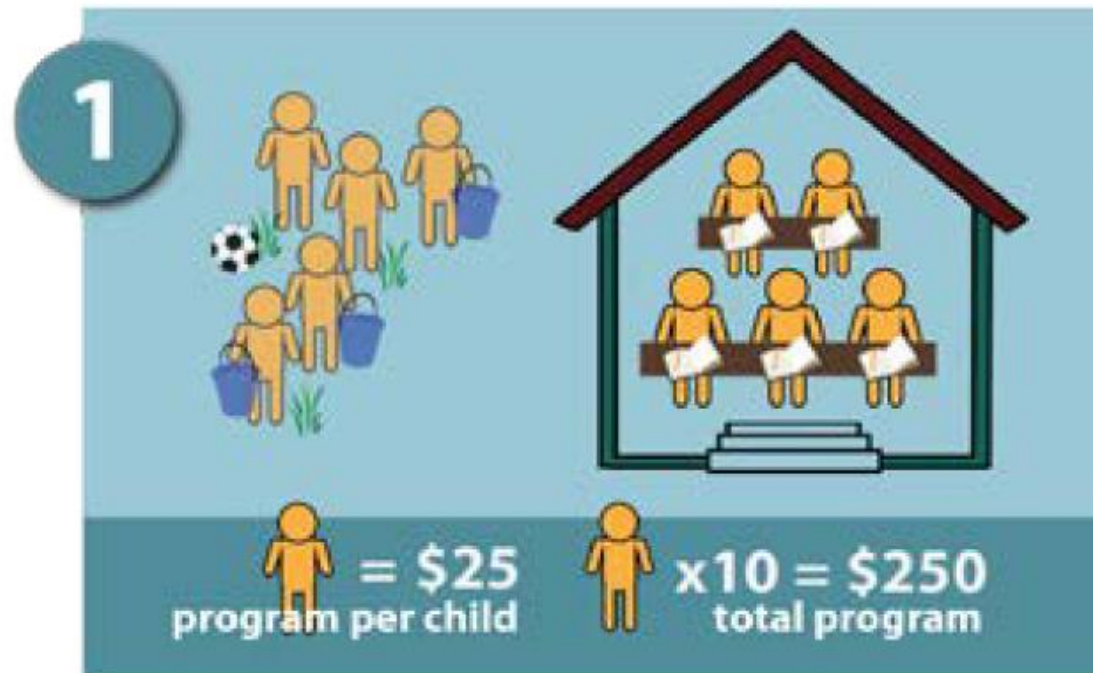
A. Retrospective analysis of completed programs

- A. “Exactly how cost-effective was that program?”

Common CEA Uses

		Necessary Data	Strengths	Weaknesses
	Prospective Analysis of Planned Programs	• Projected costs • Impact estimates from a similar program in a similar context	Even rough calculations can help rule out programs that are unlikely to be cost-effective	Cost projections and impact estimates from similar programs are rough estimates

Using thresholds to assess cost-effectiveness

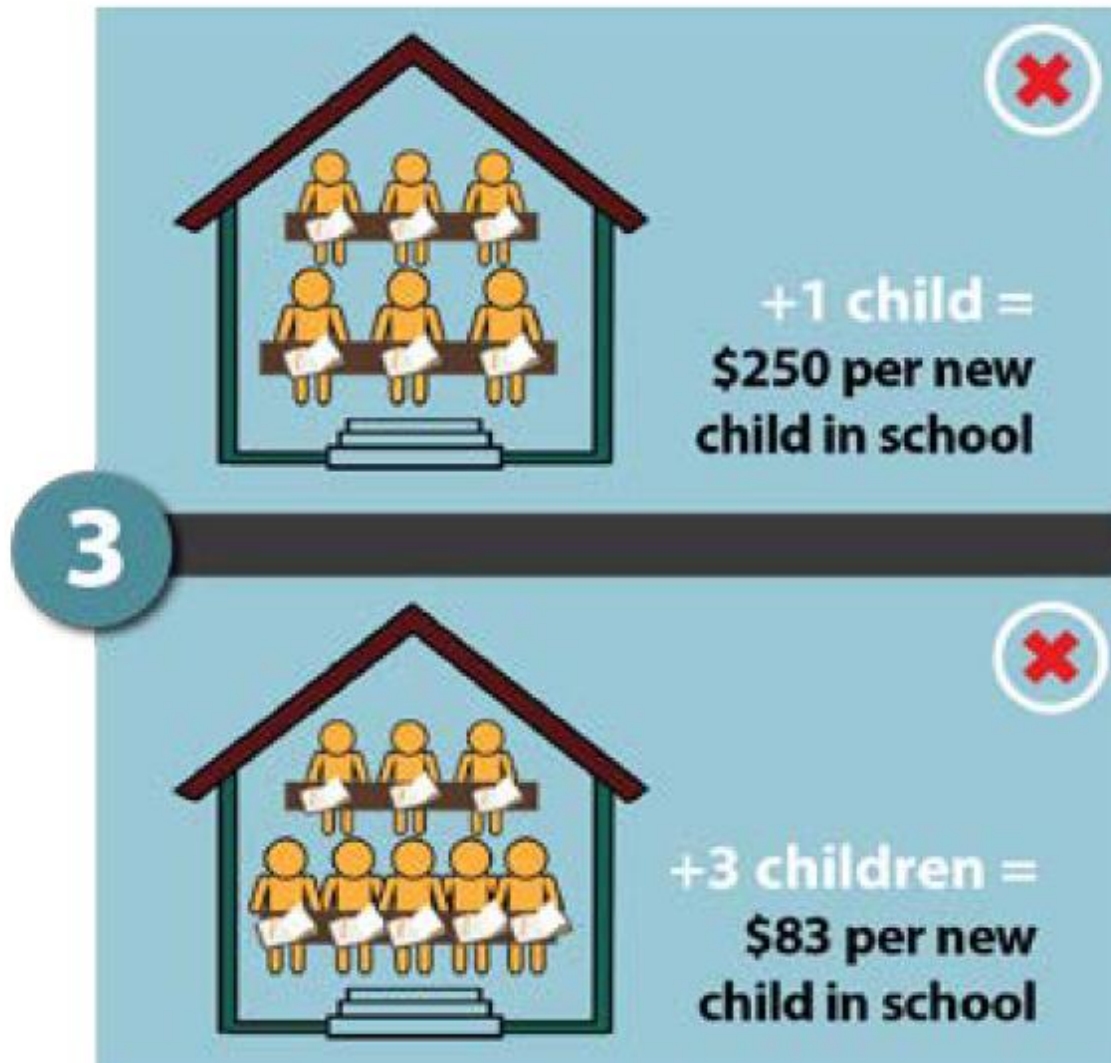


How much will the program cost?

2 threshold: no more than \$50 per additional child in school

What is threshold for cost-effectiveness?

Using thresholds to assess cost-effectiveness



How large an effect
is necessary to meet
that threshold?

Using thresholds to assess cost-effectiveness

4



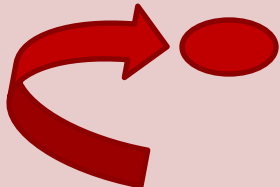
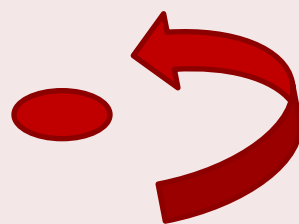
**+5 children =
\$50 per new
child in school**

**100% increase in school attendance is only
way to reach goal → is this attainable?**

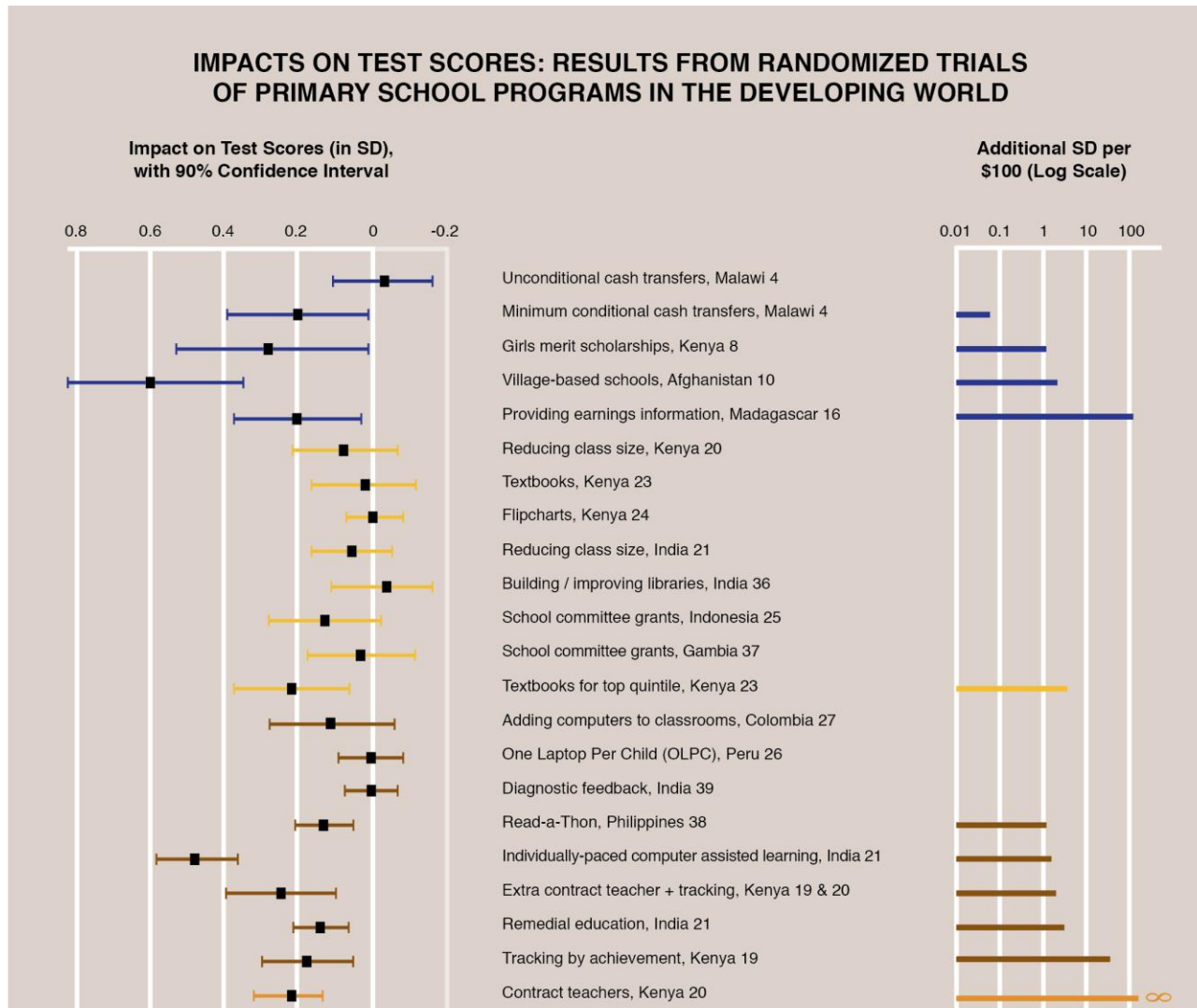


Is that effect
size likely?

Common CEA Uses

		Necessary Data	Strengths	Weaknesses
	Prospective Analysis of Planned Programs	- Projected costs - Impact estimates from a similar program	Even rough calculations can help rule out programs that can't be cost-effective	Cost projections and impact estimates from similar programs are rough estimates
	Retrospective Analysis of Implemented Programs	- Cost data from exact program that was evaluated - Rigorous impact estimates	Gives precise estimates of how cost-effective a program was in that context Can provide a useful starting point for customized prospective analyses	Still suffers from external validity problem for cost and impact estimates

Interpreting Comparative Cost-Effectiveness Results



Example: Student Learning

- Most regions of world have achieved near-universal enrollment in primary school.
- However, being in school does not guarantee that students are learning
 - In India, 4 out of 5 students in grade 3 cannot read grade 2 level text (2012 ASER)
 - In Kenya, 2/3 of grade 3 students cannot read a grade 2 level story (2011 Uwezo annual assessment)
- Numerous strategies to improve student learning, and costs and impacts of programs vary considerably

Comparing results across studies

- Results from randomized evaluations
 - Test score as outcome
 - Detailed cost data made available by authors
 - Based on Kremer, Brannen & Glennerster 2013
- Impacts measured in standard deviations of test scores
 - 0.2 SD often seen as an “effective program”
 - 0.2 SD moves a child from 50th to 58th percentile
 - Children move between 0.5-0.9 SD in a year at school

Comparing cost-effectiveness

- Cost-effectiveness measured in SDs per \$100
 - Even 1 SD per \$100 is good value for money
 - Compare to maximum 1 SD for a year of schooling
- Cost-effectiveness shown on a log scale
 - Distance between 1 and 10 same as between 10 and 100



Pedagogical Innovations

**Impact on Test Scores (in SD),
with 90% Confidence Interval**

**Additional SD per
\$100 (Log Scale)**

0.8 0.6 0.4 0.2 0 -0.2

0.01 0.1 1 10 100

Adding computers to classrooms, Colombia

One Laptop Per Child (OLPC), Peru

Diagnostic feedback, India

Read-a-Thon, Philippines

Extra contract teacher + tracking, Kenya

Remedial education, India

Individually-paced computer assisted
learning, India

Tracking by achievement, Kenya

Sources: Barrera-Osorio and Linden (2009); Cristia et al. (2012); Muralidharan and Sundararaman (2010); Abeberese, Kumler, and Linden (2012); Duflo, Dupas, and Kremer (2011); Duflo, Dupas and Kremer (2012); Banerjee et al. (2007).



Outline

1. Example: From impact to cost-effectiveness analysis
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5. Scaling Up



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

II. Not straightforward:

- Number of 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!

Not Straightforward

Must build assumptions into CEA

- What version of the program 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

Three Key Challenges in Doing CEAs



I. Absence of incentives to do CEA

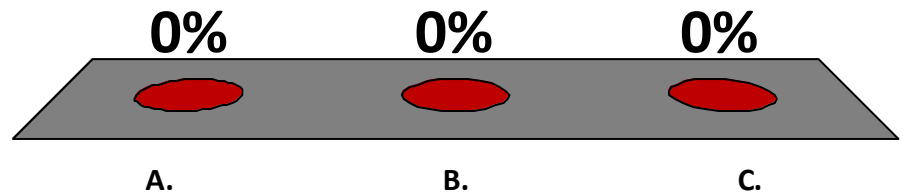
II. Not straightforward

III. 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
- What costs do we even include?

What costs should we include?

- A. Costs incurred by the implementing organization
- B. Implementation costs + Costs to participants
- C. Don't know



Gathering Cost Data

- Retrospective analysis of implemented programs:
 - J-PAL mostly uses “ingredients” method (Levin and McEwan 2001)
- Gather cost data from multiple sources:
 - Academic 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.)

Gathering Cost Data

- Challenges:
 - 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
- Advanced planning is key:
 - Planning to collect cost information **during the impact evaluation's design stage** overcomes challenges of chasing cost information after the fact
 - J-PAL Initiatives provide standard templates to assist in data collection
 - Harmonization makes it easier to do *comparative* CEA

Issues to Consider in CEA— *there is no one right way... as long as you articulate assumptions*

- *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 Outcomes*: Can only examine one type of benefit at a time, which is how many policies are framed anyway



Issues to Consider in CEA— *there is no one right way... as long as you articulate assumptions*

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

Pedagogical Innovations

Impact on Test Scores (in SD),
with 90% Confidence Interval

0.8 0.6 0.4 0.2 0 -0.2

Additional SD per
\$100 (Log Scale)

0 0.1 1 10 100

Adding computers to classrooms, Colombia

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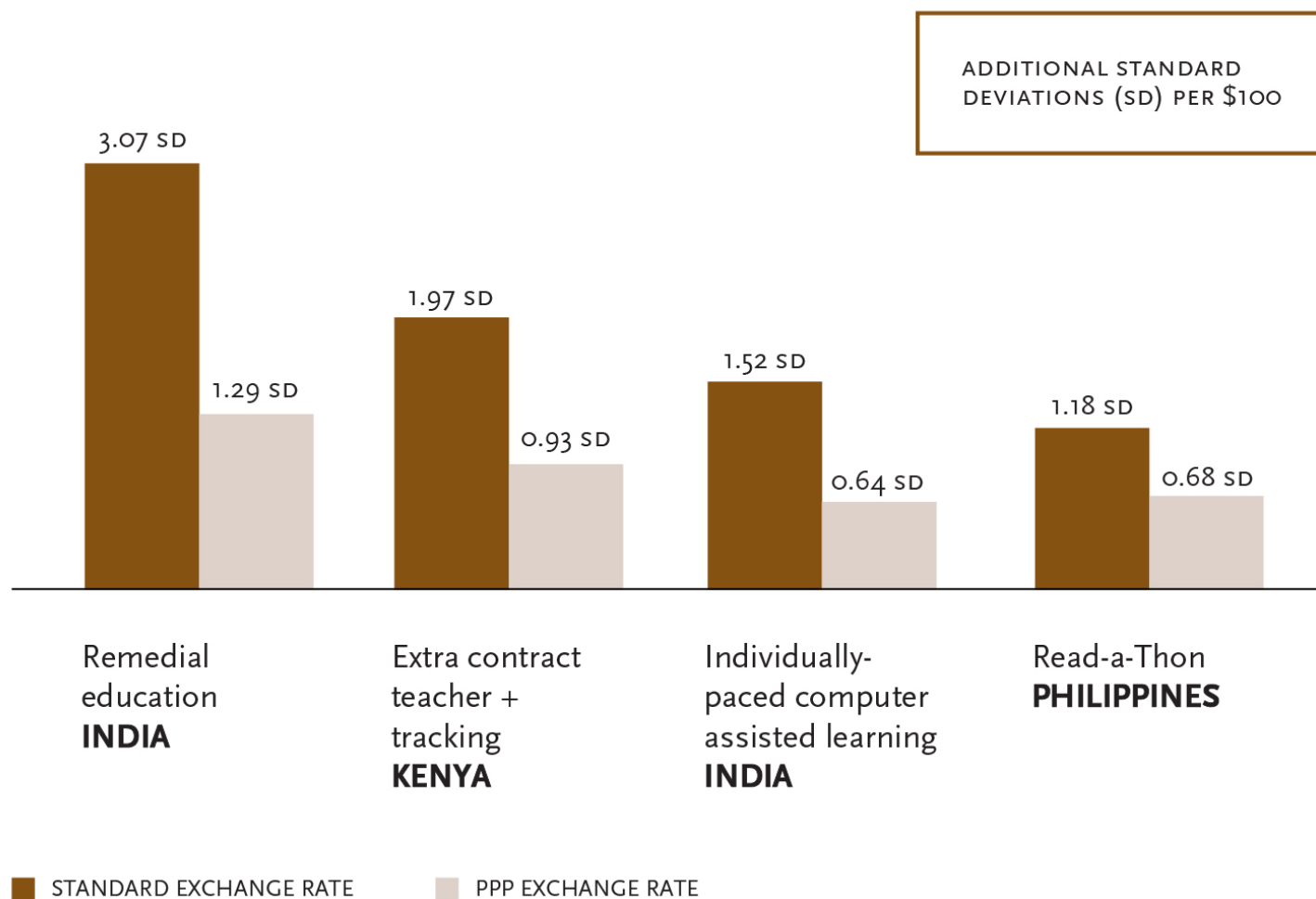
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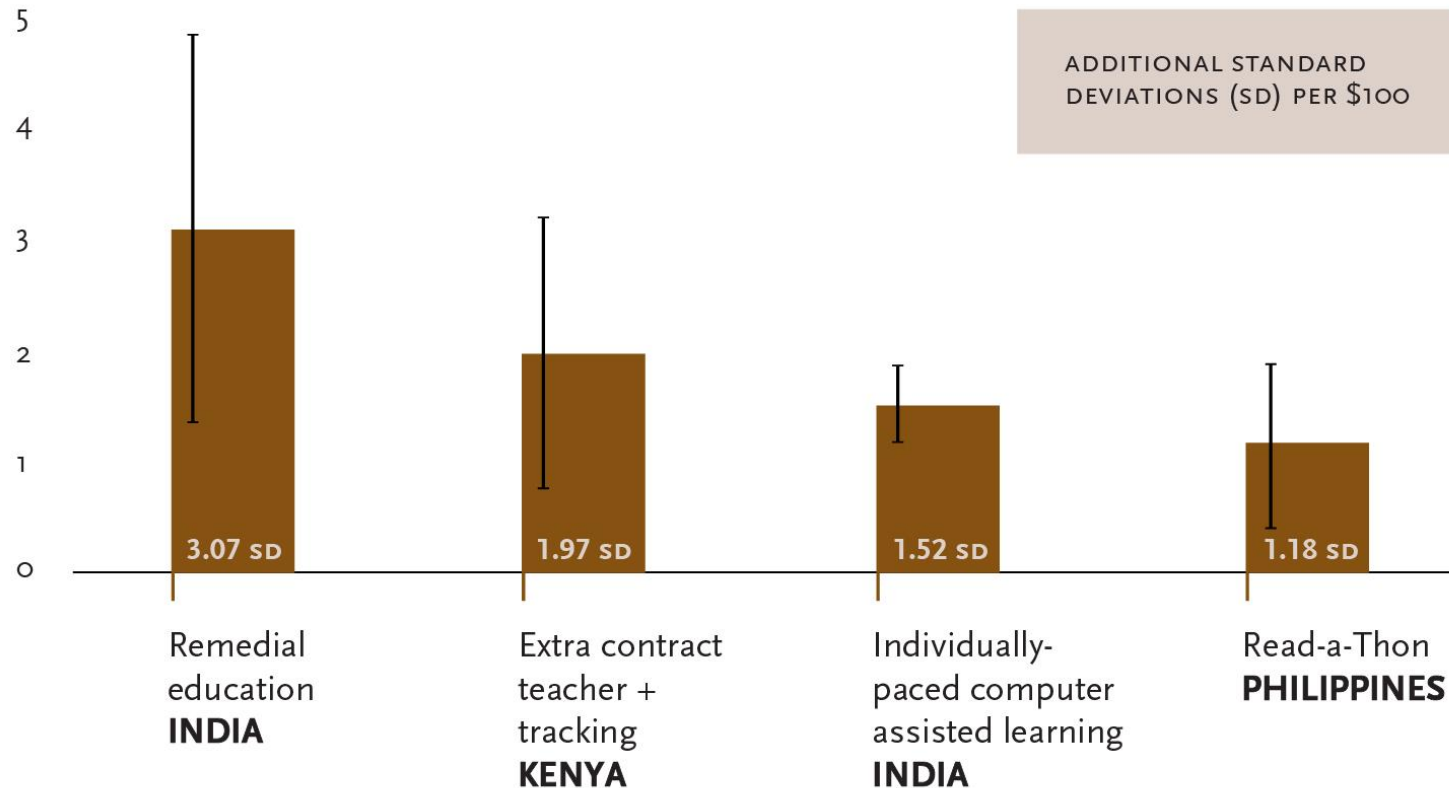
Sources: Barrera-Osorio and Linden (2009); Cristia et al. (2012); Muralidharan and Sundararaman (2010); Abeberese, Kumler, and Linden (2012); Duflo, Dupas, and Kremer (2011); Duflo, Dupas and Kremer (2012); Banerjee et al. (2007).

COST-EFFECTIVENESS: SENSITIVITY TO EXCHANGE RATES



COST-EFFECTIVENESS: IMPRECISION IN IMPACT ESTIMATES

90% CONFIDENCE INTERVALS



Outline

1. Example: From impact to cost-effectiveness analysis
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There are Different Paths from Impact Evaluations to Scale-Ups

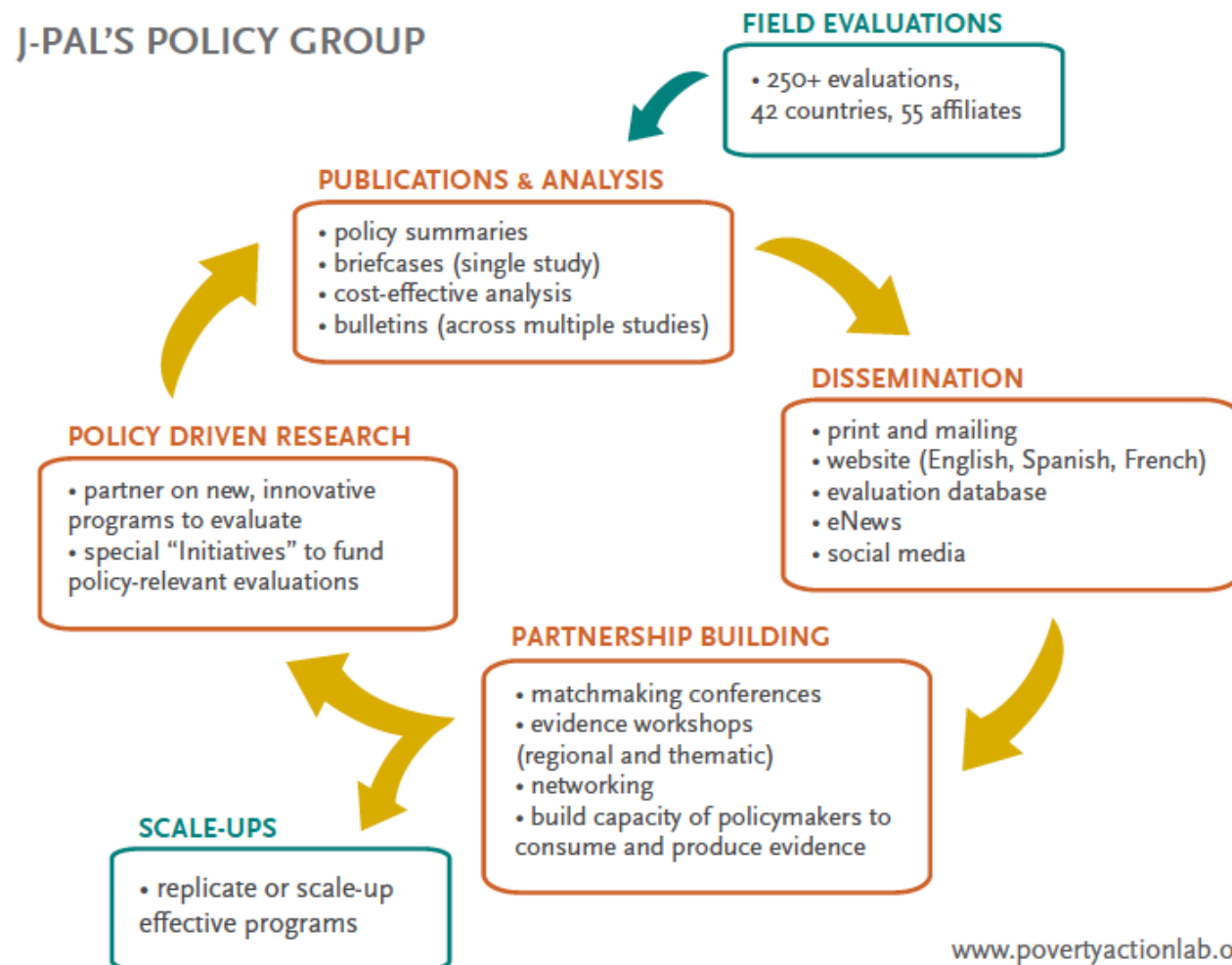
1. Governments evaluate their pilot programs to demonstrate usefulness to public, gather support for their expansion and learn lessons to make it more effective (e.g. Progresa, Raskin ID cards)
2. Leveraging evidence by implementing organization to expand existing programs and get more funding (e.g. Pratham)
3. Independent organizations can use evidence to replicate or scale-up programs found to be highly cost-effective, and/or simple to implement (e.g. Deworm the World)

There are Different Paths from Impact Evaluations to Scale-Ups



- 4.If an evaluation helps provide evidence on a very policy relevant and salient topic, it gets a huge amount of traction very easily (e.g. Pricing)
- 5.Careful study of the new context, collaboration with original evaluator and implementer and a pilot replication (e.g. TCAI: remedial education in India and Ghana; Targeting the Ultra Poor)
- 4.Institutionalizing evidence-based approach (commissions in Chile and Peru, Government of Tamil Nadu fund of evaluation “fail early”)

There are Different Paths from Impact Evaluations to Scale-Ups – Here is One



Final Issues to Consider in Scale Ups – *there are no easy answers*

- *Spillover Effects*: Spillovers may be different in a pilot vs. scaled program. (Counseling program could create displacement effects)
- *Partial vs. General Equilibrium*: Very hard to measure precise nature or direction of such effects. (Job training programs)
- *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

Key Take-Aways from CEA and Scaling Up

- CEA 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 be **very clear** on assumptions built into analysis
- Sensitivity analysis around CEAs allow policymakers to see the effect of modifying assumptions and local conditions
- Cost collection process is far more accurate and easier when planned for during the evaluation design.
- The journey from impact evaluation to scale-ups is neither automatic nor easy. But, we are learning more about the process and collecting more success stories.

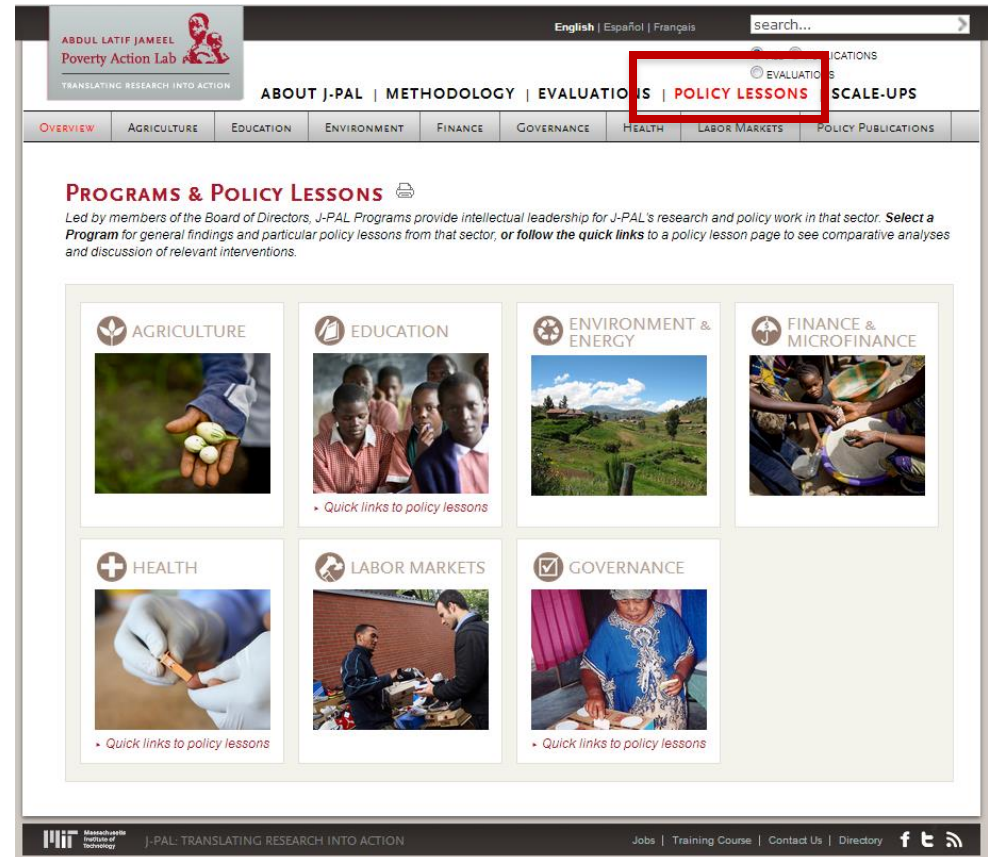
Additional Resources from J-PAL

Comparative Cost-Effectiveness Analysis to Inform Policy in Developing Countries: A General Framework with Applications for Education

Iqbal Dhaliwal, Esther Duflo, Rachel Glennerster, Caitlin Tulloch¹

Abdul Latif Jameel Poverty Action Lab (J-PAL), MIT

<http://www.povertyactionlab.org/publication/cost-effectiveness>



www.povertyactionlab.org/policy-lessons

EVALUATIONS

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SEARCH

Keyword: 

To refine displayed results, select one or more of the categories below:

Theme

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FEATURED EVALUATIONS

Encouraging Adoption of Rainwater Harvesting Tanks Through Collateralized Loans in Kenya



When dairy farmers in Western Kenya were offered a loan to purchase a rainwater harvesting tank, allowing them to use the tank as collateral significantly increased take-up of the loan, which subsequently had positive effects on dairy production, time use, and girls' school enrollment

Researchers: Joost De Laat, William Jack, Michael Kremer, Tavneet Suri

Targeting the Ultra-Poor in West Bengal, India



Researchers provided randomly selected ultra-poor households in one of the poorest districts of West Bengal, India with this combination of carefully sequenced supports over 18 months. The program led to increases in income, consumption, food security, and other measures of well-being that persisted one year after the program

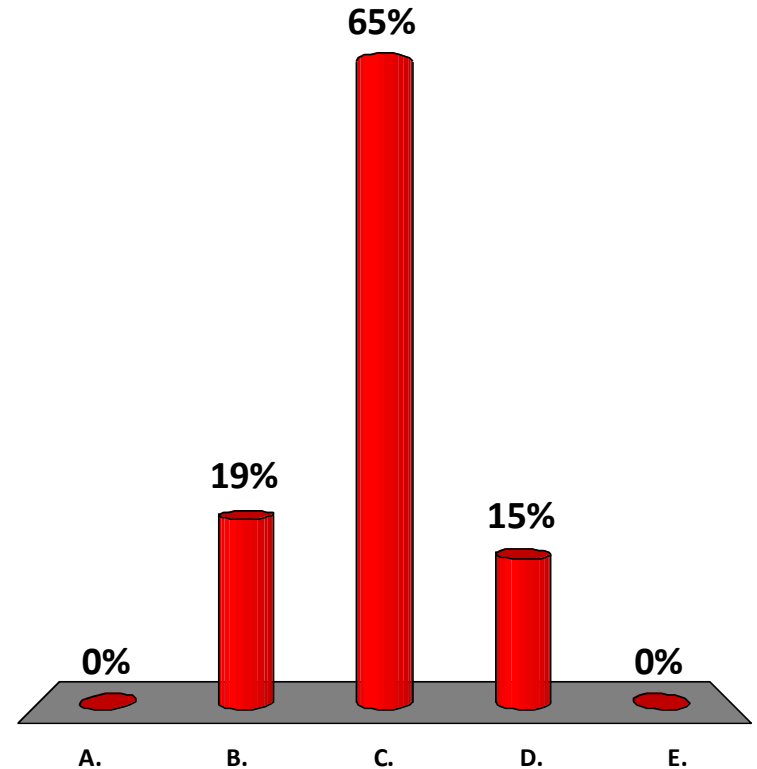


Thank You!

Questions and comments?

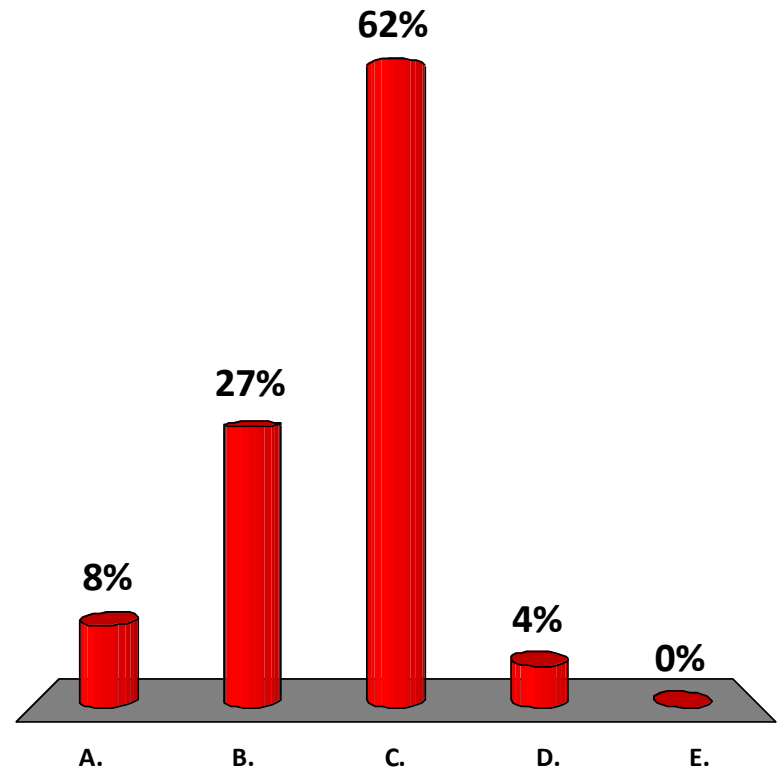
How was the length of this presentation?

- A. Unbearably long
- B. Too long
- C. Just right
- D. Not long enough
- E. Too short – more time, please!



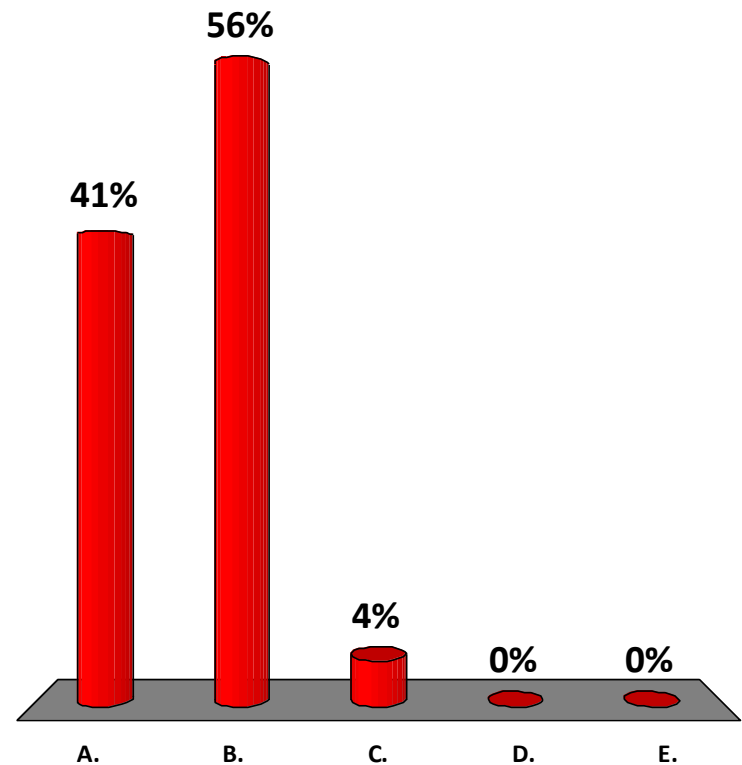
How was the pace of this presentation?

- A. Too fast! I couldn't keep up.
- B. Rushed
- C. Just right
- D. Slow
- E. Too slow, I fell asleep.



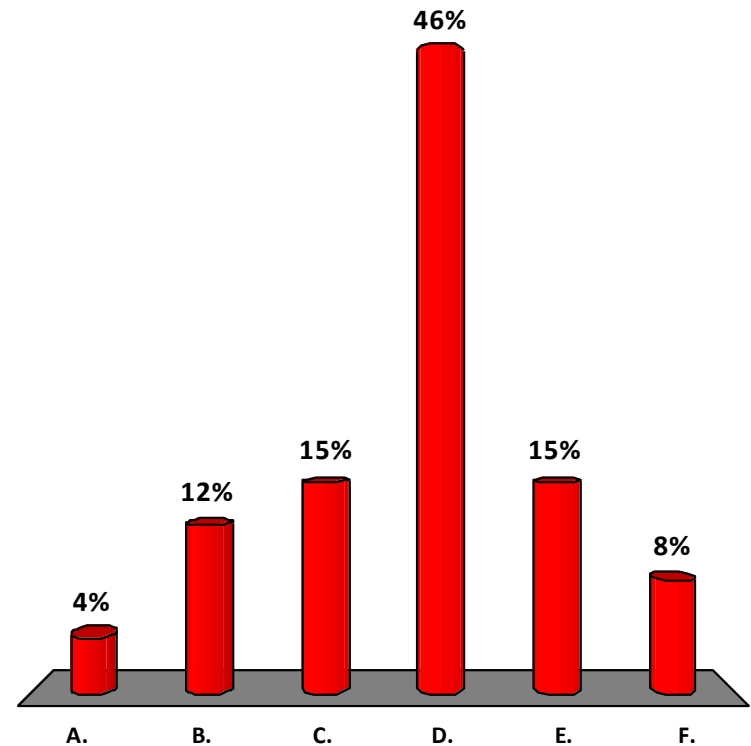
Was the content relevant to your work?

- A. Very relevant
- B. Quite useful
- C. Perhaps
- D. Not really
- E. No – not useful at all.



Before today, how much of this material did you already feel comfortable/ proficient in?

- A. 100%
- B. 80%
- C. 60%
- D. 40%
- E. 20%
- F. < 20%



After this presentation, how much of this material do you feel proficient in?

A. 100%

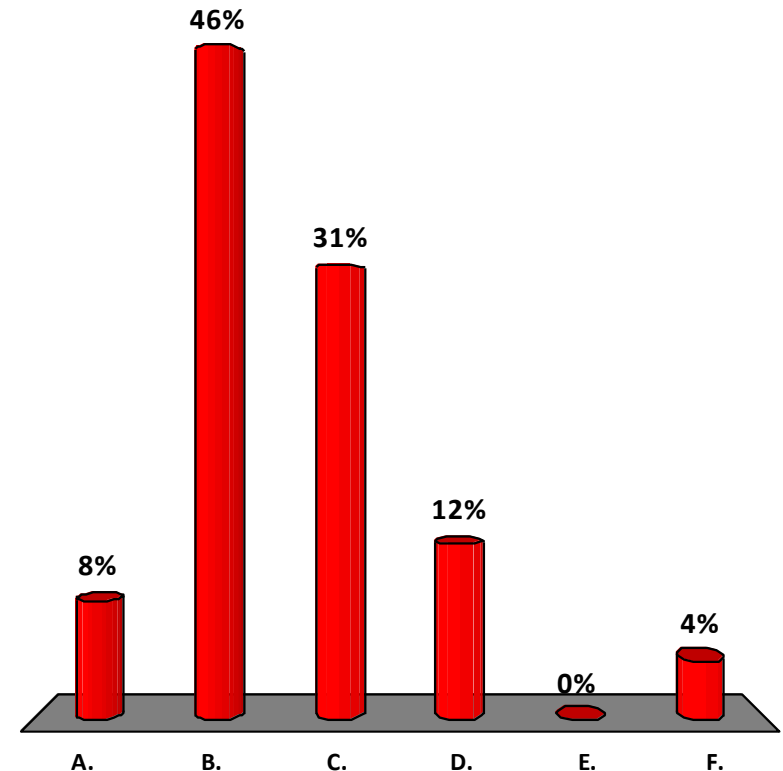
B. 80%

C. 60%

D. 40%

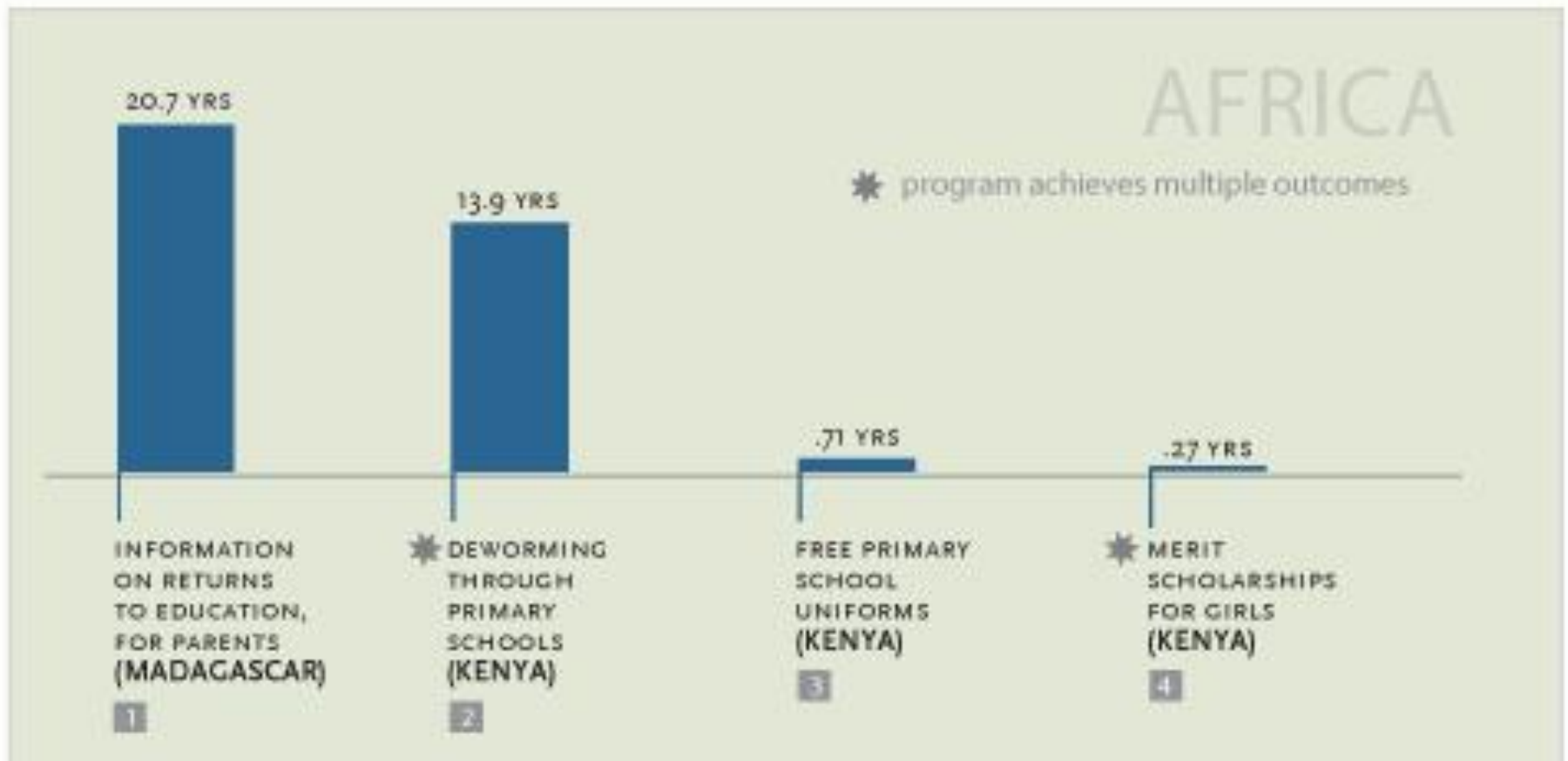
E. 20%

F. < 20%



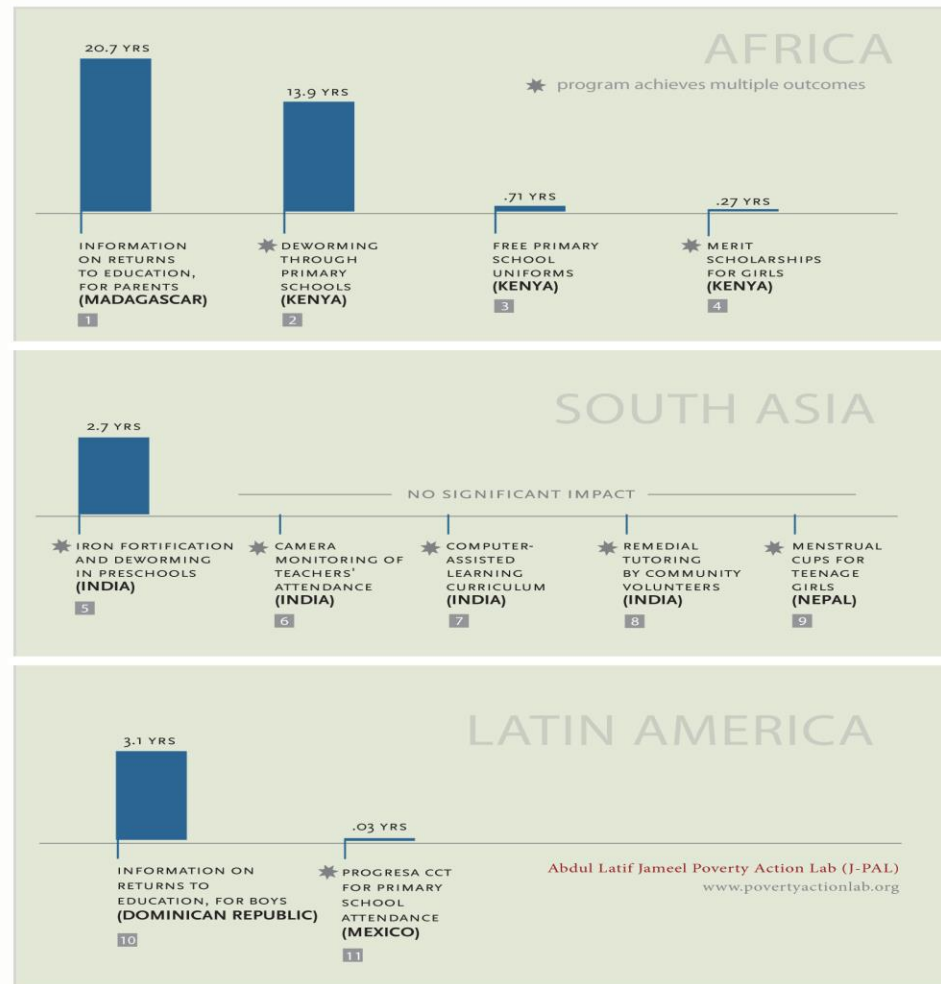
Reading Cost-Effectiveness Results

COST-EFFECTIVENESS: ADDITIONAL YEARS OF STUDENT PARTICIPATION PER \$100



CEA as a starting point for discussions on evidence based policy

COST-EFFECTIVENESS: ADDITIONAL YEARS OF STUDENT PARTICIPATION PER \$100



CEA graph is just the start – it is supplemented by many more details

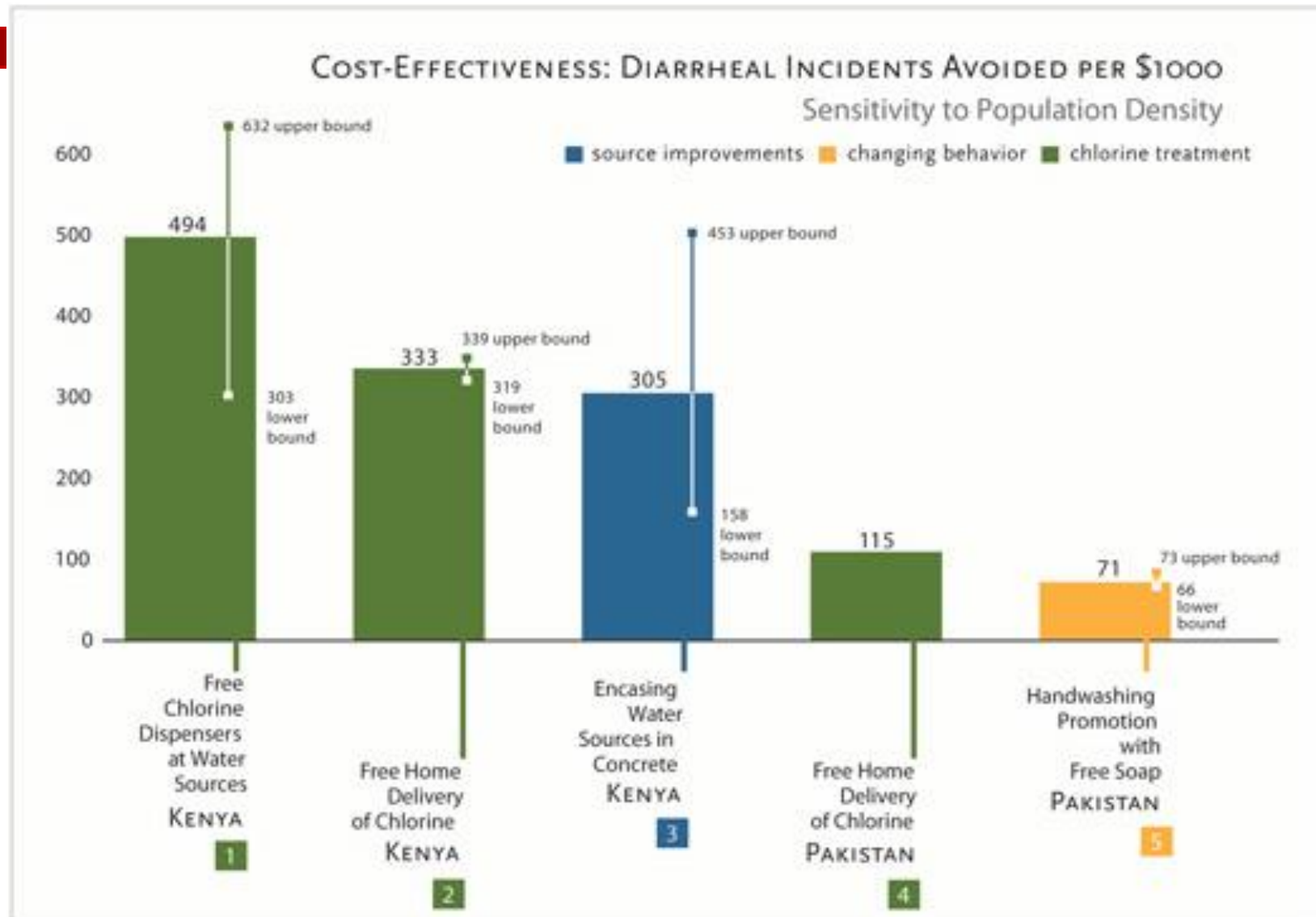
CONFIDENCE INTERVALS OF COST-EFFECTIVENESS: ADDITIONAL YEARS OF EDUCATION PER \$100 SPENT RANGES BASED ON 90% CONFIDENCE INTERVAL OF PROGRAM IMPACT

Abdul Latif Jameel Poverty Action Lab (J-PAL)

www.povertyactionlab.org

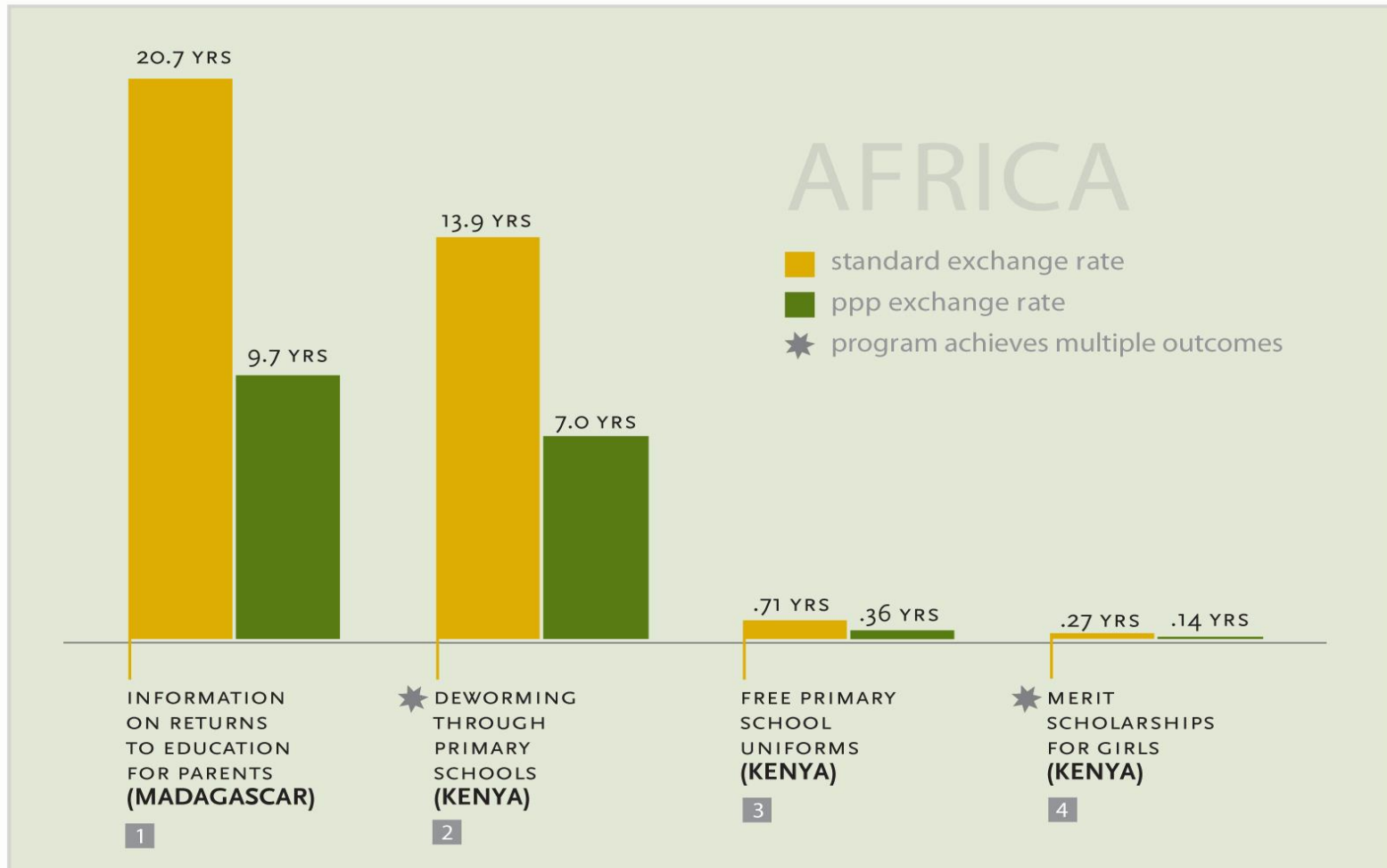
PROGRAM	COUNTRY	TIME FRAME	LOWER BOUND	PT. ESTIMATE	UPPER BOUND
1 Information Session on Returns to Education, for Parents	Madagascar	1 year	1.1	20.7	40.3
2 Deworming Through Primary Schools	Kenya	1 year	5.7	13.9	22.1
3 Free Primary School Uniforms	Kenya	1 year	0.33	0.71	1.10
4 Merit Scholarships for Girls	Kenya	3 years	0.02	0.27	0.52
5 Iron Fortification and Deworming in Preschools	India	1 year	0.10	2.7	5.3
6 Camera Monitoring of Teachers' Attendance	India	–	NO SIGNIFICANT IMPACT		
7 Computer-Assisted Learning Curriculum	India	–	NO SIGNIFICANT IMPACT		
8 Remedial Tutoring by Community Volunteers	India	–	NO SIGNIFICANT IMPACT		
9 Menstrual Cups for Teenage Girls	Nepal	–	NO SIGNIFICANT IMPACT		
10 Information Session on Returns to Education, for Boys	Dominican Republic	4 years	1.0	3.1	5.2
11 PROGRESA CCT for Primary School Attendance	Mexico	4 years	0.02	0.03	0.04

Sensitivity to Contextual Factors



Sensitivity to Assumptions

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



Demand Incentives Most Effective For Later Rounds of Immunizations

Figure 3: Number of immunizations received by children 1-3 years

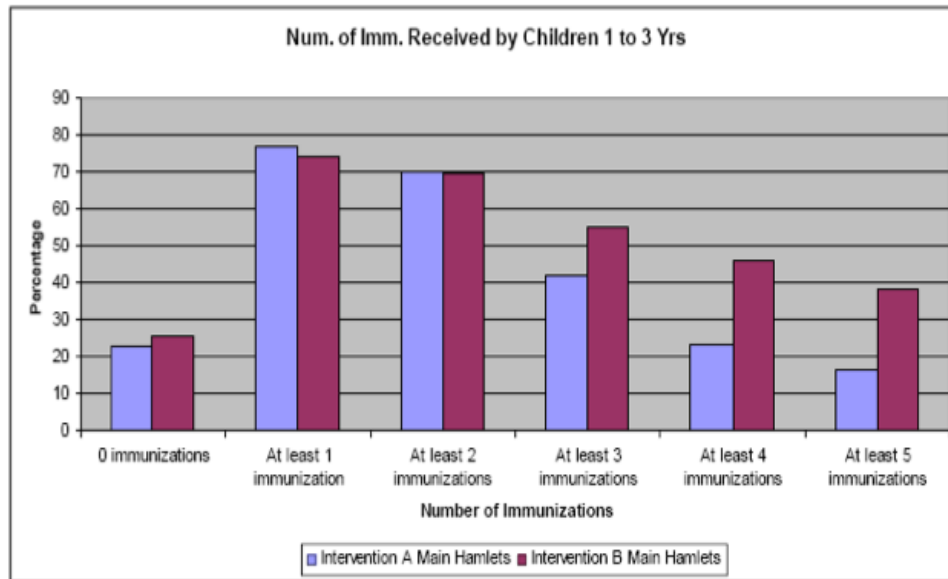
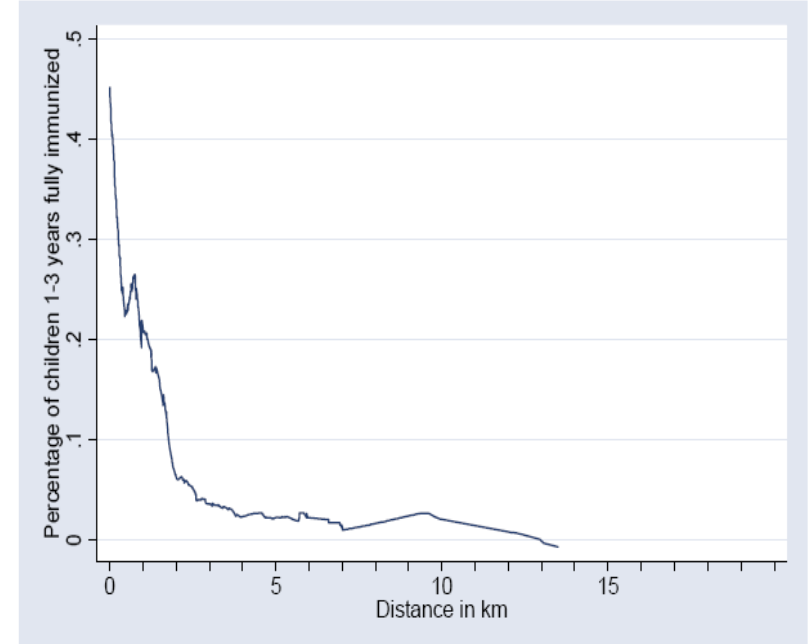
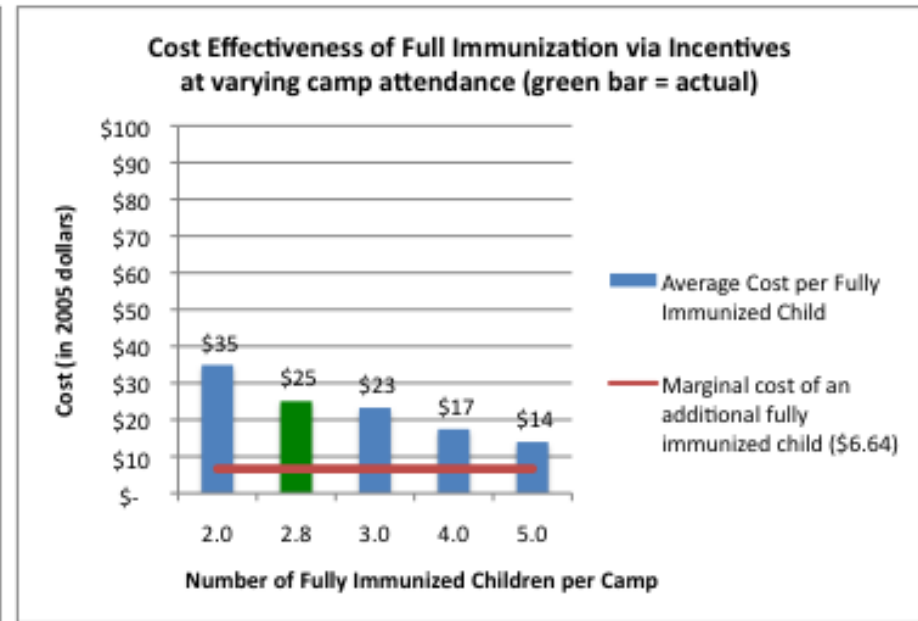
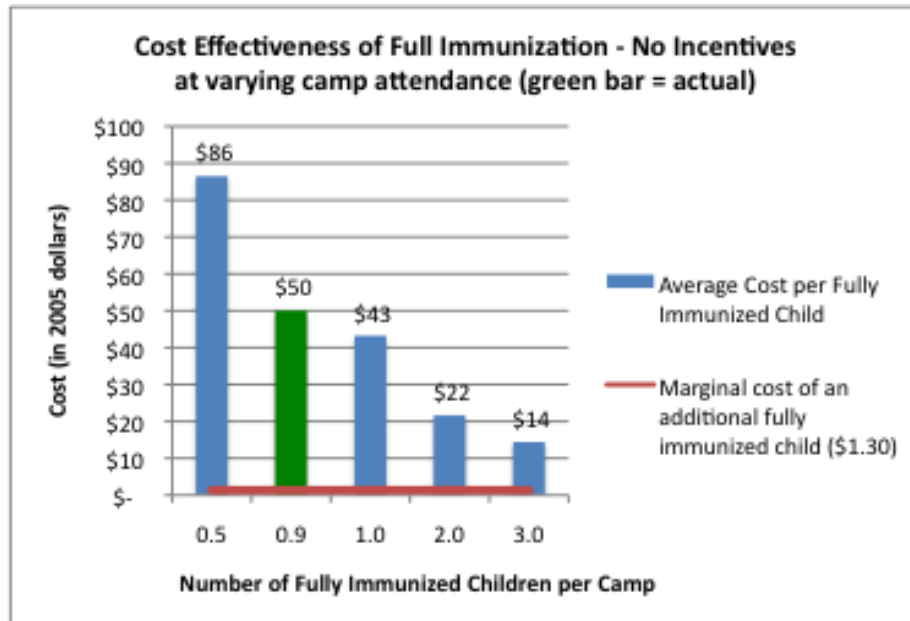


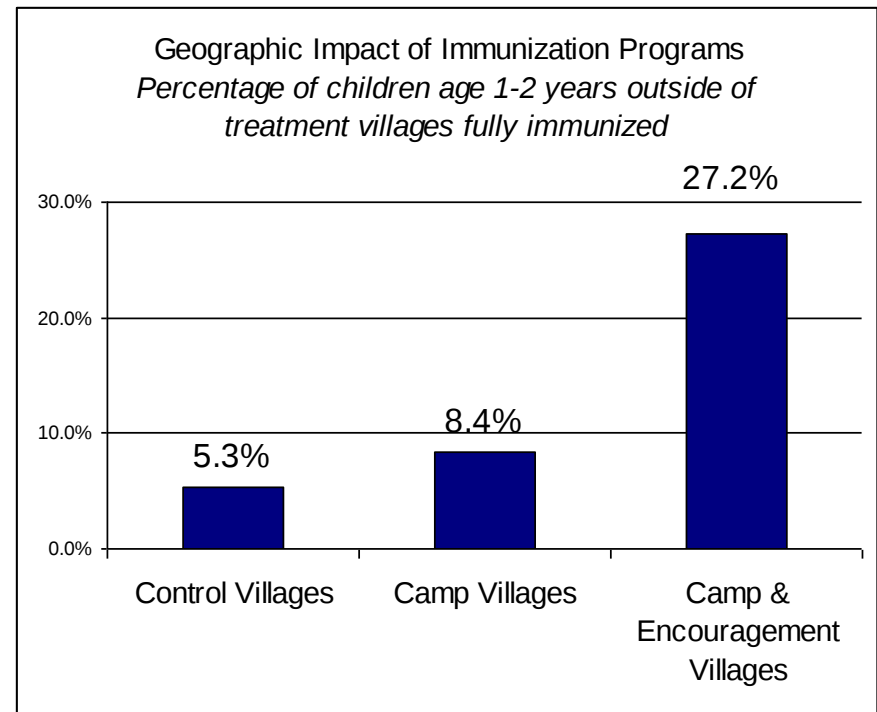
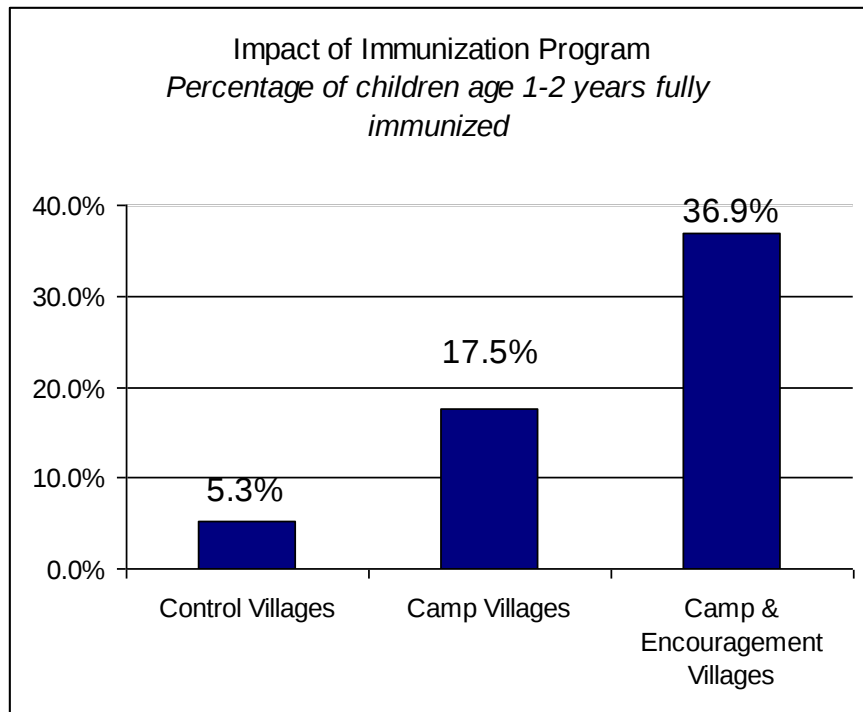
Figure 4: Immunization status as a function of distance from Intervention B camps



Divide the Costs by the Number of Fully Immunized Children to get the Cost Effectiveness of Camps and Incentives



Regular Supply Increased Immunization, Incentives Helped it Even More



Prospective CEA - Harmonization

- Outcome Harmonization:
 - Student Attendance: Attendance (random head count) vs. increased enrollment; or Participation (both attendance and enrollment)
 - Learning outcomes: Standardized tests (e.g. PISA or Pratham's rapid assessment) vs. standard deviation of scores
 - Duration of intervention (measuring impact after a few months or a few years)
 - Prevalence vs. Incidence (health)
- Cost Harmonization:
 - Which costs to gather and include (e.g. existing infrastructure, high level overhead, user fees etc.)
 - Ensure both costs and impacts are over entire program duration
- CEA Methodology Harmonization
 - Not on today's agenda!

Issues to Consider in Cost Effectiveness Analysis – *there is no one right way*

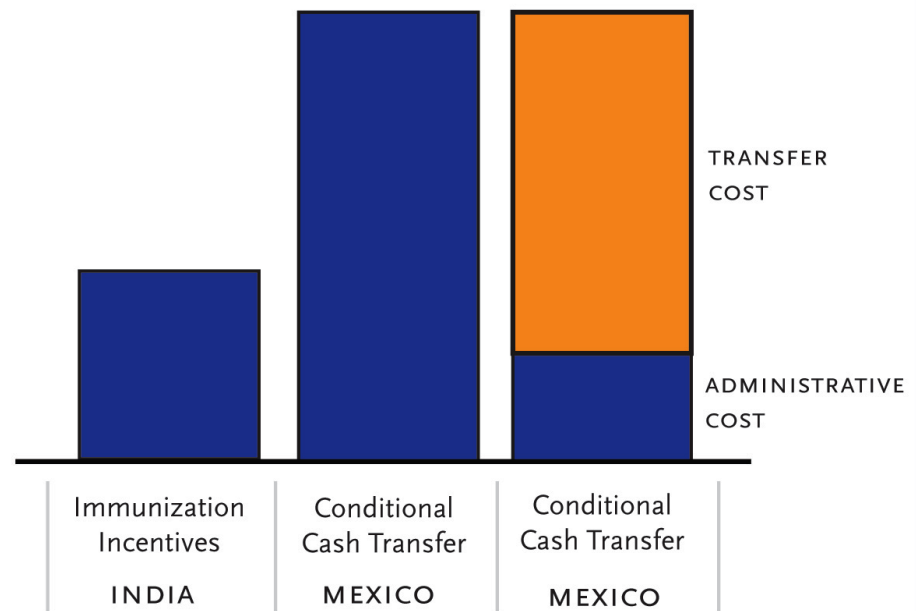
- *Transfers*: Not a cost to the society but are they a part of the program cost?

- International Donors vs. Local Governments

- Additional Problems of Non-Cash Transfers

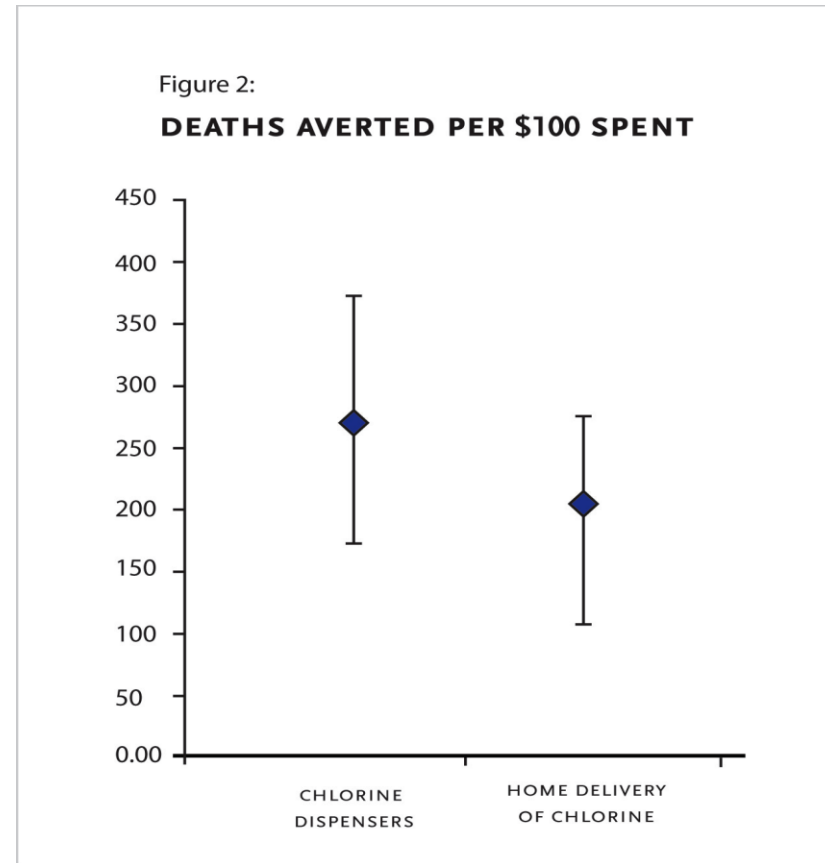
Figure 1:

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



Comparing Your Estimate Against the Benchmark for Cost-Effectiveness

