ABDUL LATIF JAMEEL
Poverty Action Lab

TRANSLATING RESEARCH INTO ACTION

Cost-effectiveness analysis and scaling up

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J-PAL

Course Overview

1. What is Evaluation?
2. Measurement
3. Why Randomize? And Common Critiques
4. How to Randomize?
5. Sampling and Sample Size
6. Threats and Analysis
7. Project from Start to Finish
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

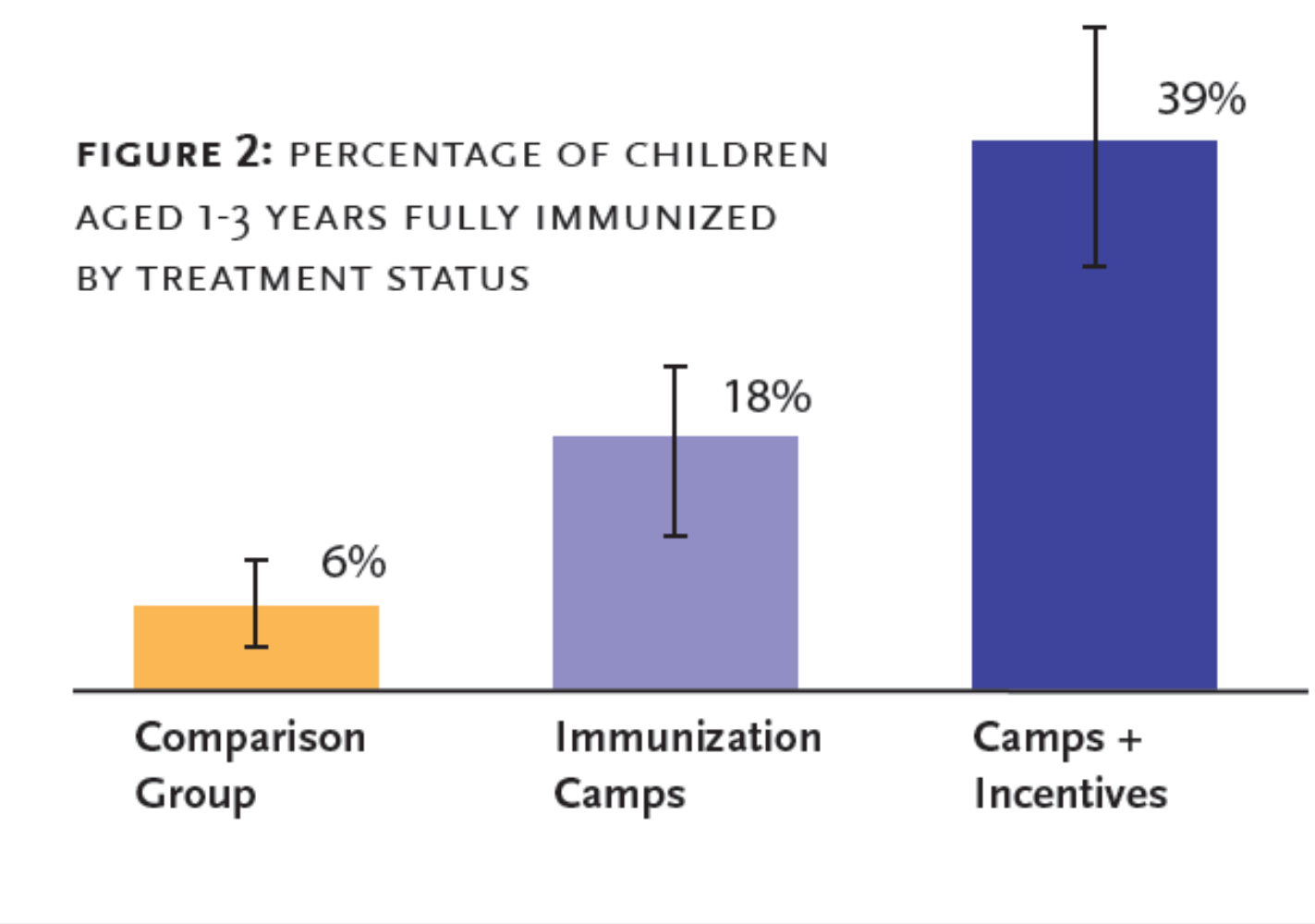
- Immunization camps (supply): Conducted monthly immunization camps held rain or shine from 11a-2p
  - Used cameras to monitor attendance of ANMs

Immunization Camps: Addressing Supply and Demand

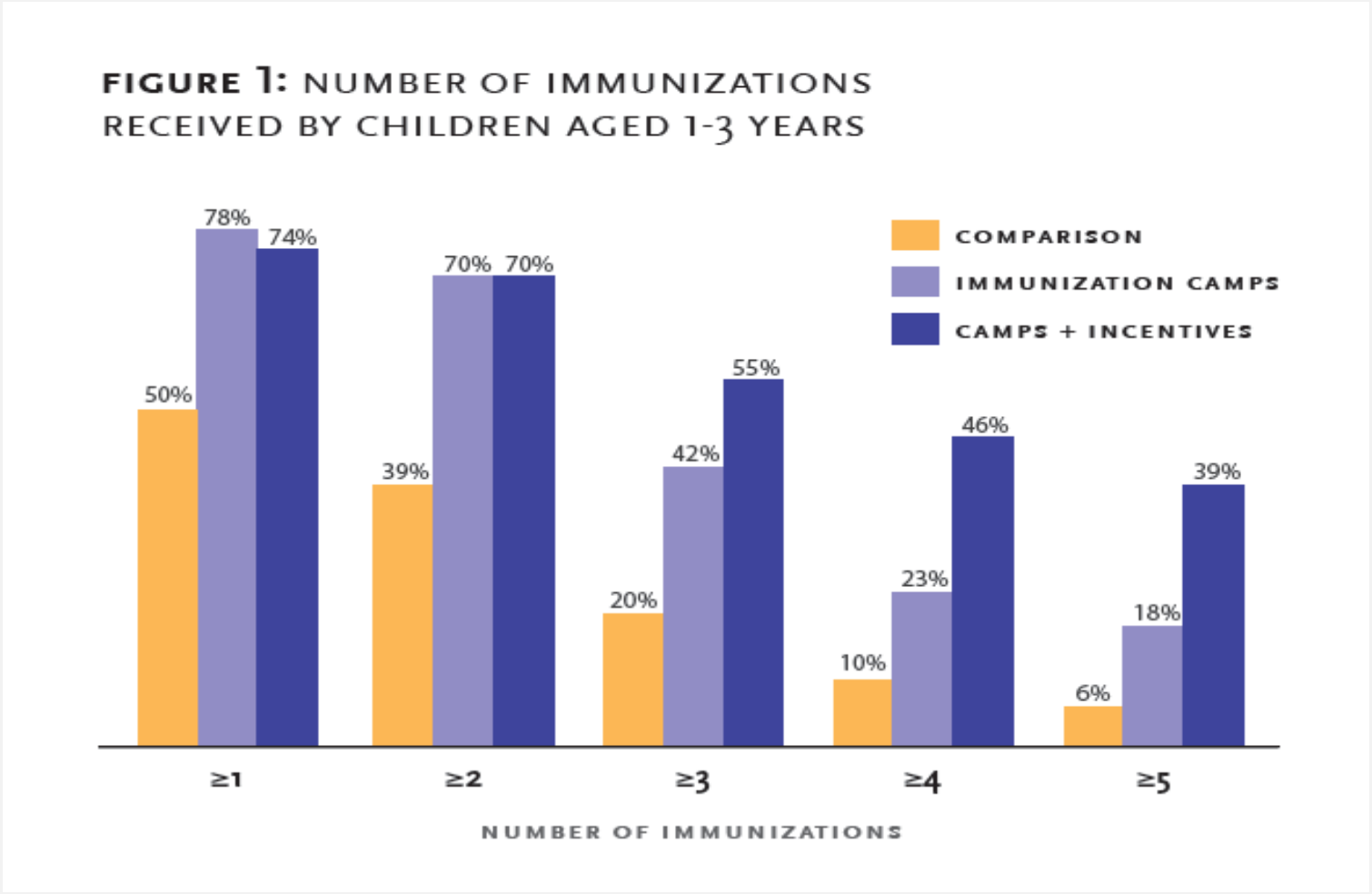
- Extra incentive: provided one kilogram of lentils for each immunization (Rs. 40, about one day's wage) plus plate set for completed all 5

Evaluation Design

Regular Supply Increased Immunization, Incentives Helped it Even More

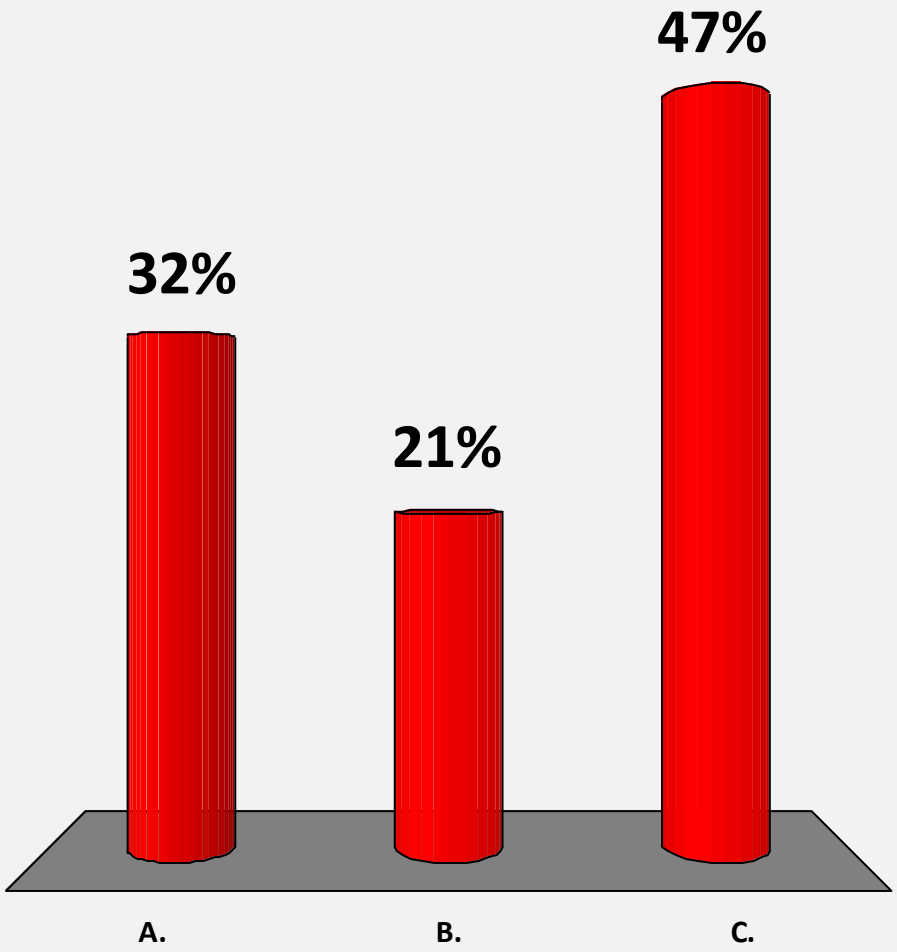


Regular Supply Increased Immunization, Incentives Helped it Even More

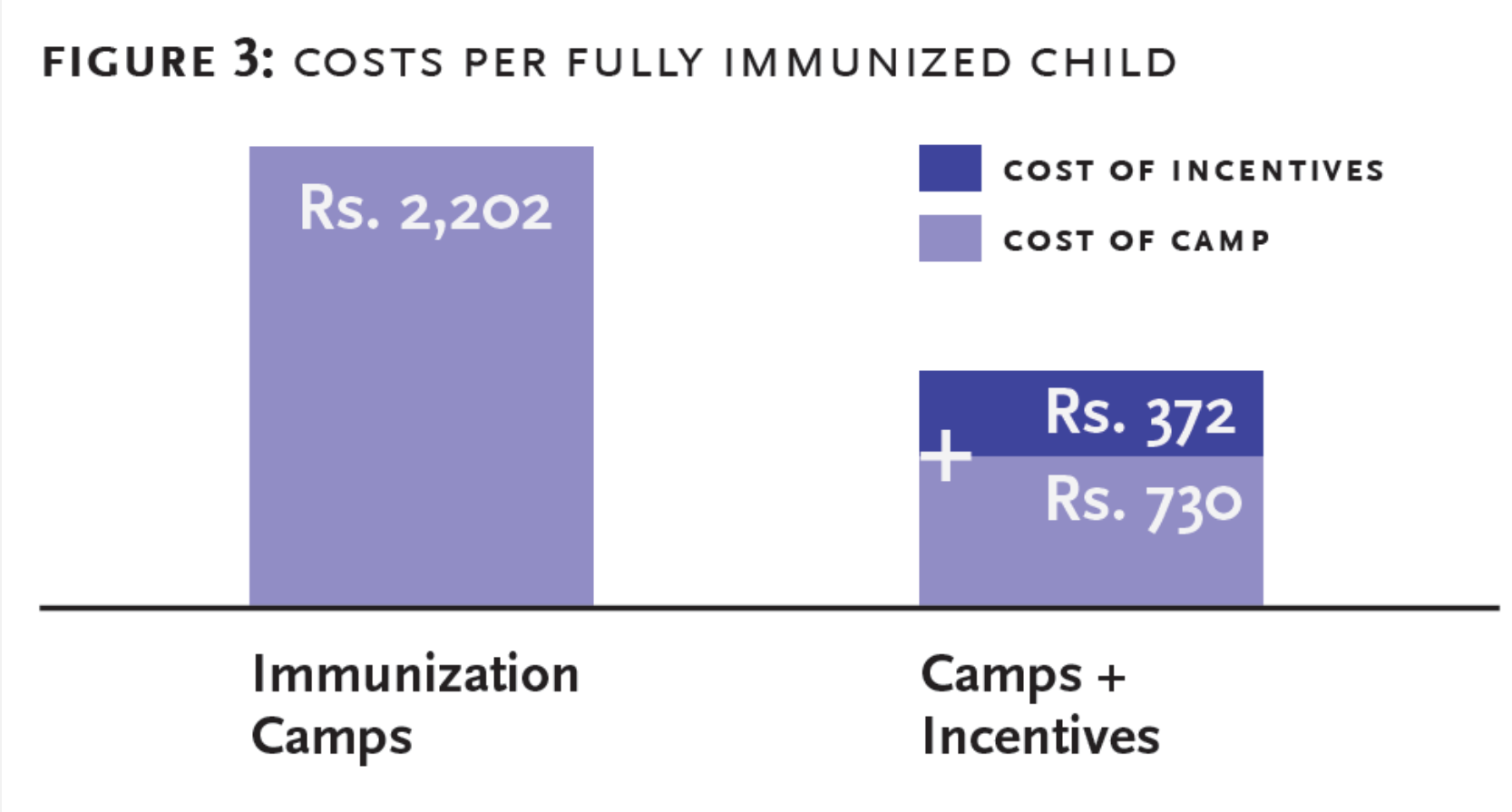


Which treatment was more cost-effective?

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



Giving incentives was twice as cost-effective



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Which would you choose?

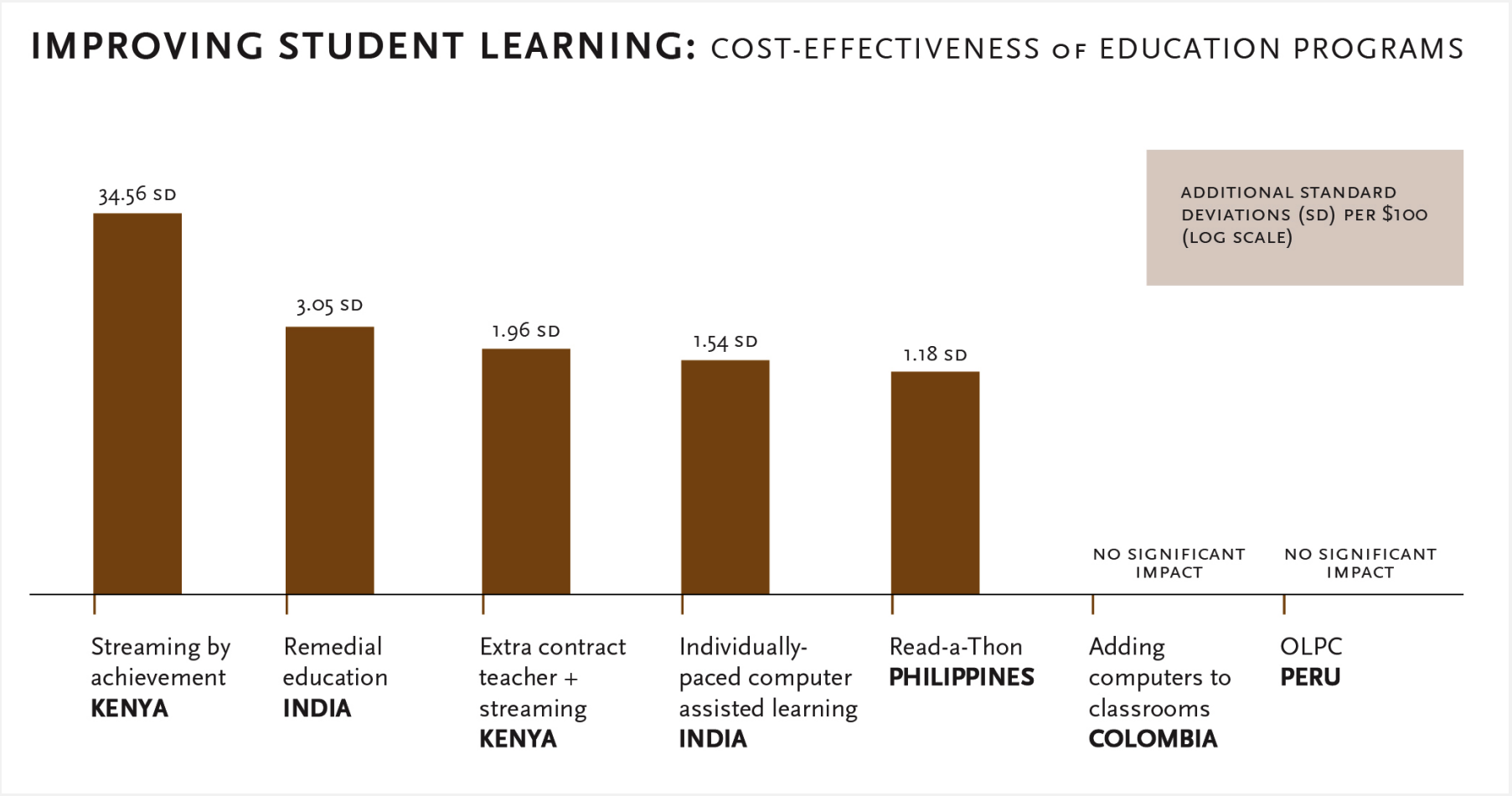
$10

$10

Cost-effectiveness analysis (CEA) summarizes a complex program in terms of a simple ratio of costs to impacts

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

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

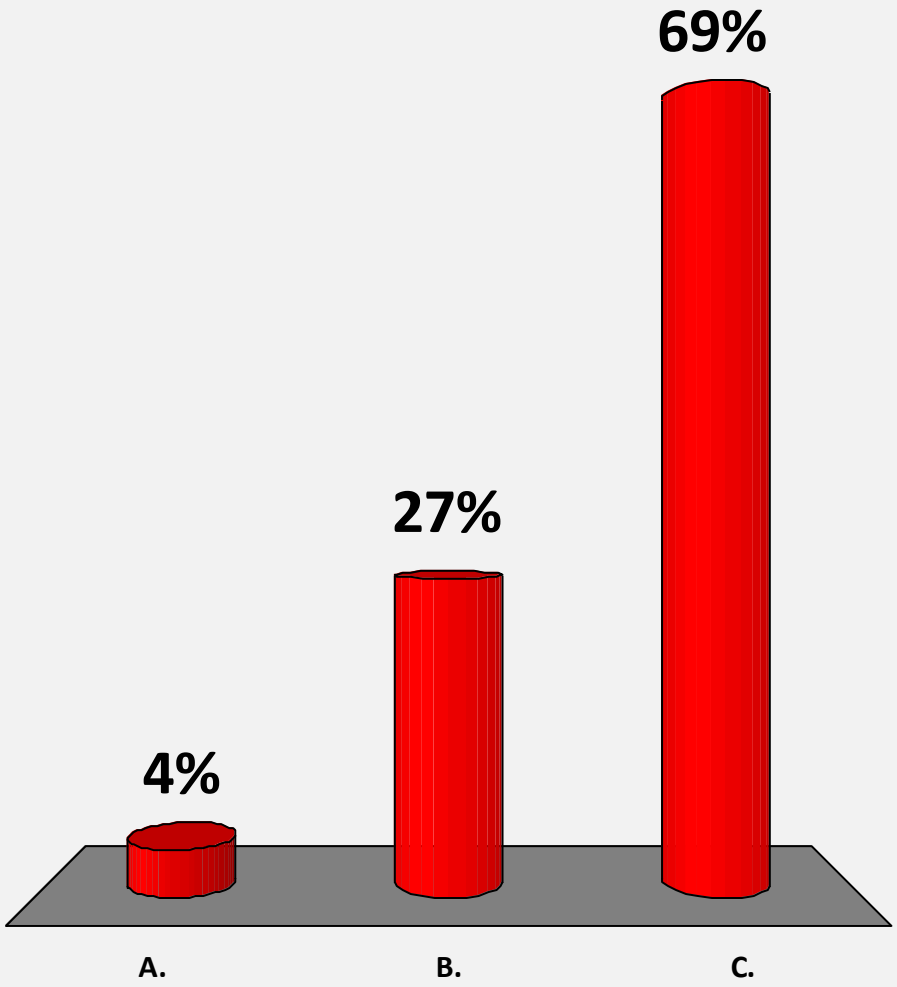
Cost-effectiveness analysis

$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?

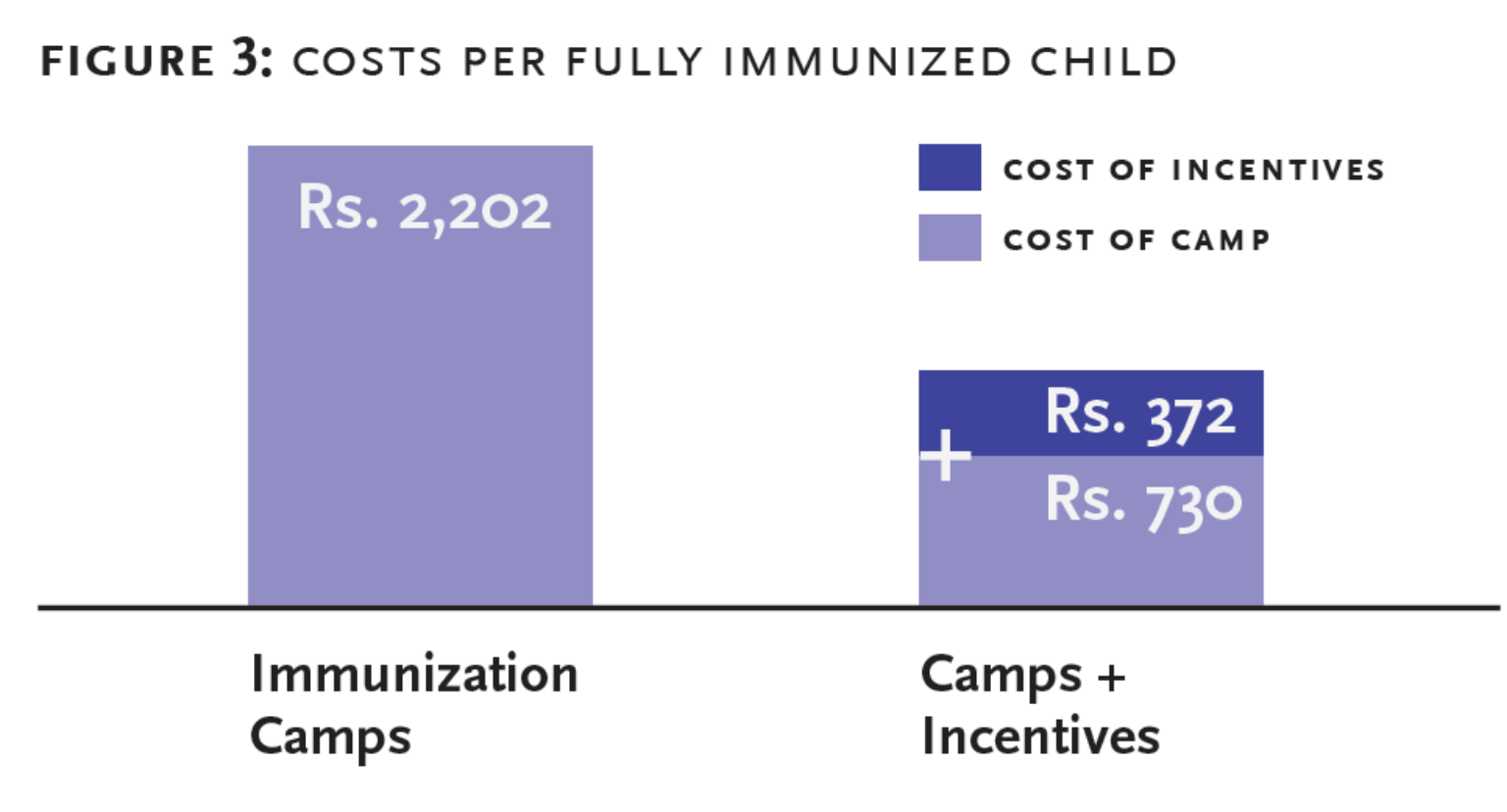
- Take **total** impact measures from rigorous impact evaluations
  - Need information other than impact estimate: number of beneficiaries, when impacts were measured, what tools were used to measure the impact, etc.

- 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 paraceptemol, 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



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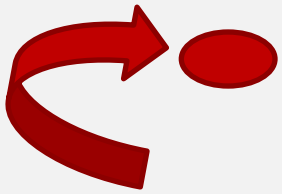
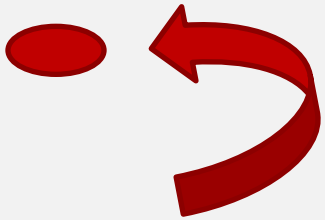
Common CEA Uses

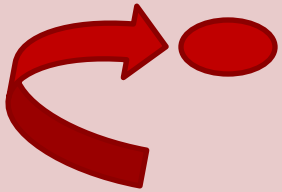


A. Prospective analysis of planned programs
   A. "Roughly how cost-effective could this proposed program be?"
   B. "How big an impact must this achieve to be a cost-effective investment?"

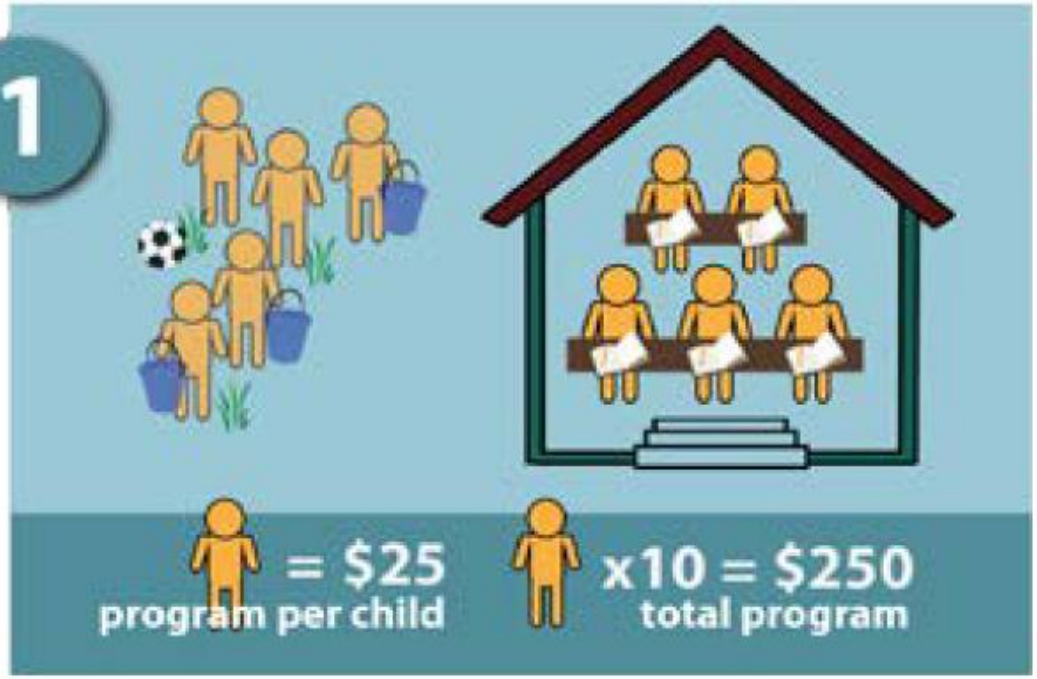


A. Retrospective analysis of completed programs
   A. "Exactly how cost-effective was that program?"

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

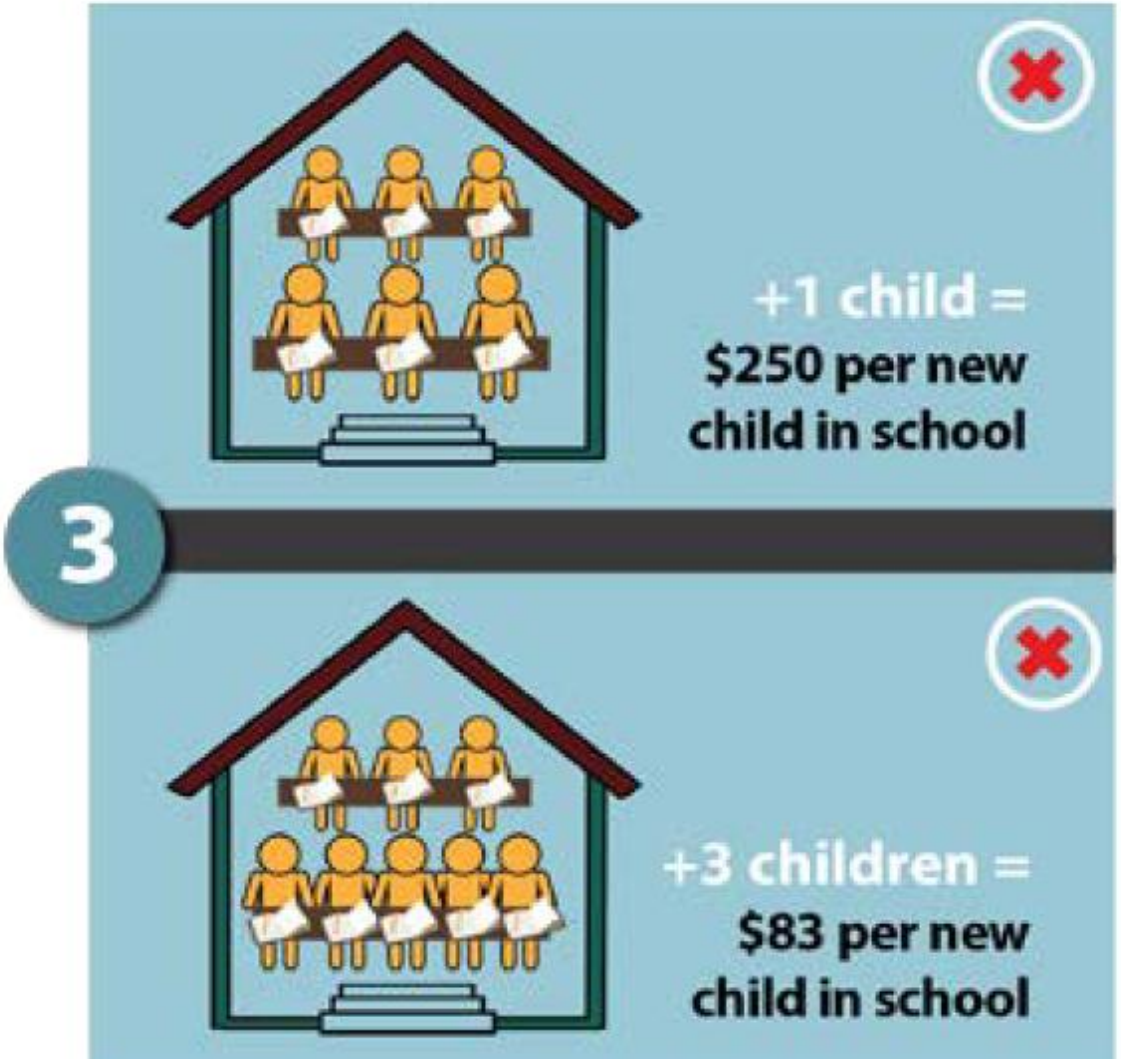


How much will the program cost?

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

What is threshold for cost-effectiveness?

Using thresholds to assess cost-effectiveness

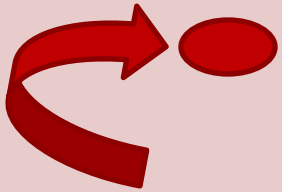
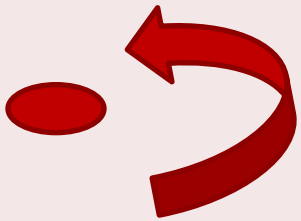


How large an effect is necessary to meet that threshold?

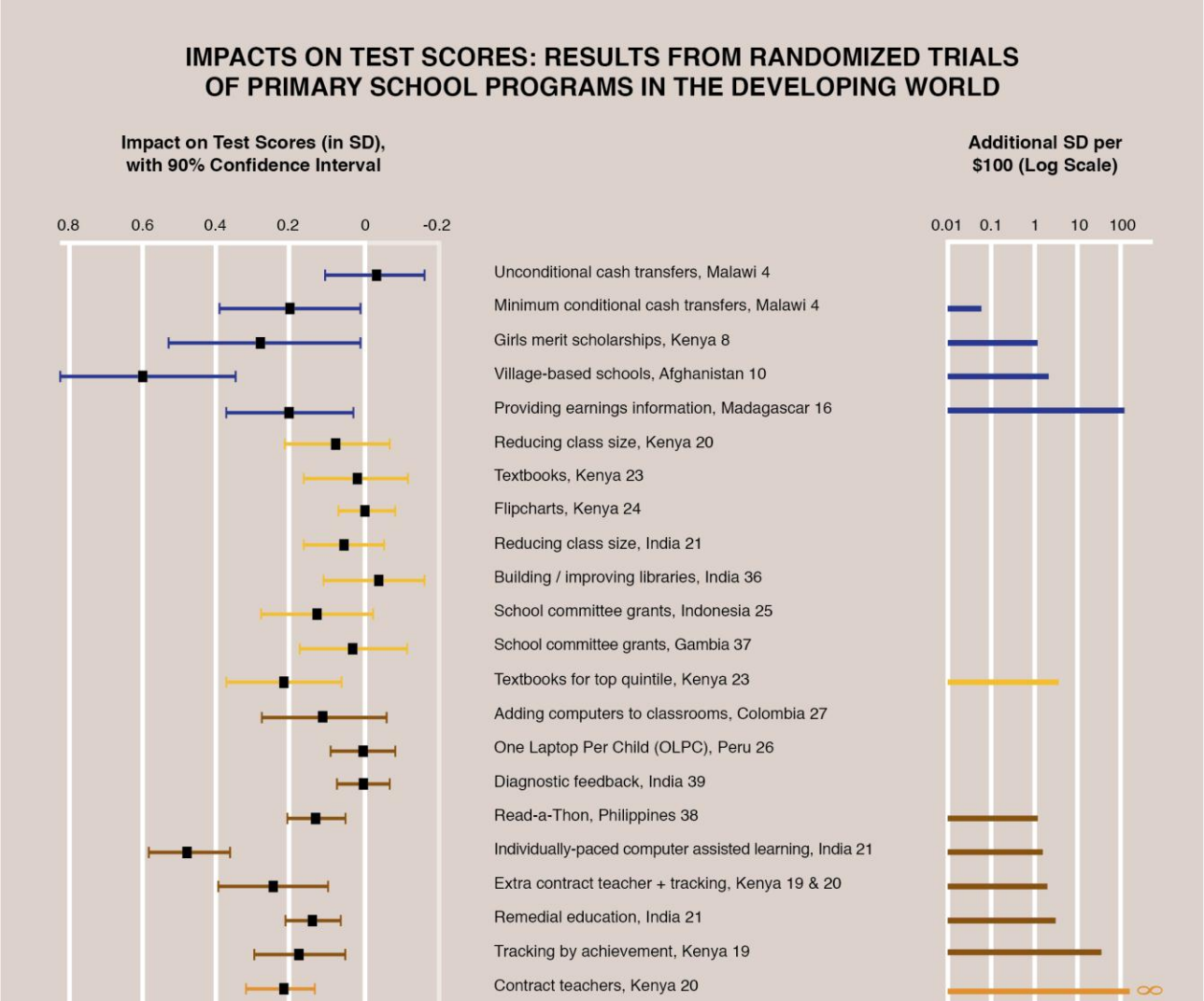
Using thresholds to assess cost-effectiveness

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

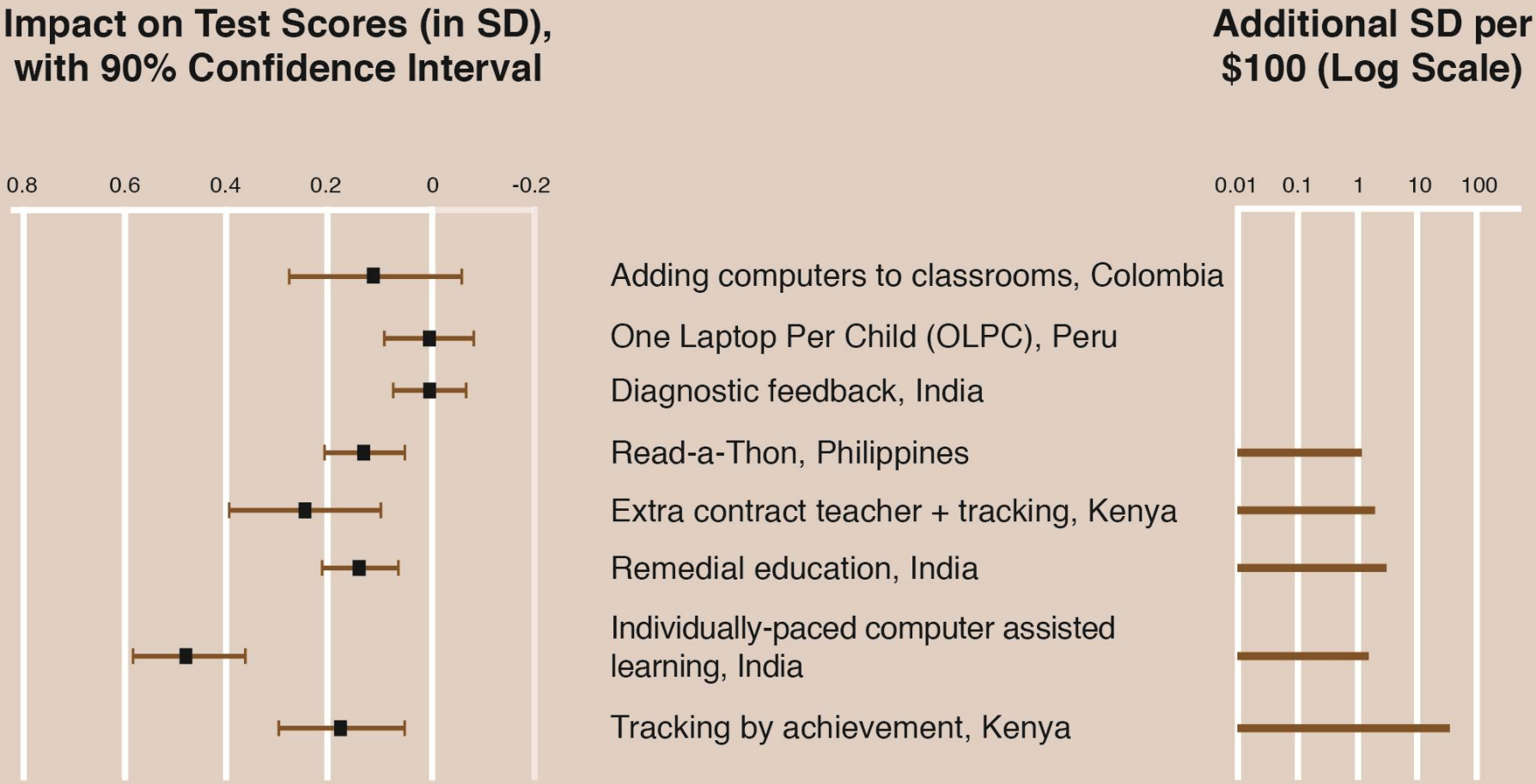
Comparing cost-effectiveness

- 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


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
Unconditional cash transfers, Malawi 4
Minimum conditional cash transfers, Malawi 4
Girls merit scholarships, Kenya 8
Village-based schools, Afghanistan 10
Providing earnings information, Madagascar 16
Reducing class size, Kenya 20
Textbooks, Kenya 23
Flipcharts, Kenya 24
Reducing class size, India 21
Building / improving libraries, India 36
School committee grants, Indonesia 25
School committee grants, Gambia 37
Textbooks for top quintile, Kenya 23
Adding computers to classrooms, Colombia 27
One Laptop Per Child (OLPC), Peru 26
Diagnostic feedback, India 39
Read-a-Thon, Philippines 38
Individually-paced computer assisted learning, India 21
Extra contract teacher + tracking, Kenya 19 & 20
Remedial education, India 21
Tracking by achievement, Kenya 19
Contract teachers, Kenya 20
Teacher incentives (year 1), Kenya 30
Teacher incentives (long-run), Kenya 30
Camera monitoring, India 28
Teacher incentives (year 2), Kenya 30
Training for school committees, Indonesia 25
Grants & training for school cmte, Gambia 37
Electing school cmte & linking to local govt, Indonesia 25
Linking school cmte to local govt, Indonesia 25
∞
90% Upper Bound
Impact
90% Lower Bound
Access to Education
Business as Usual Inputs
Pedagogical Innovations
Teacher Accountability
School-Based Management

Pedagogical Innovations



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).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School-Based Management

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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

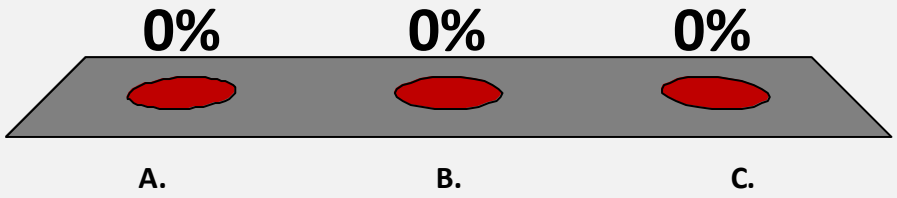
II. Not straightforward

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

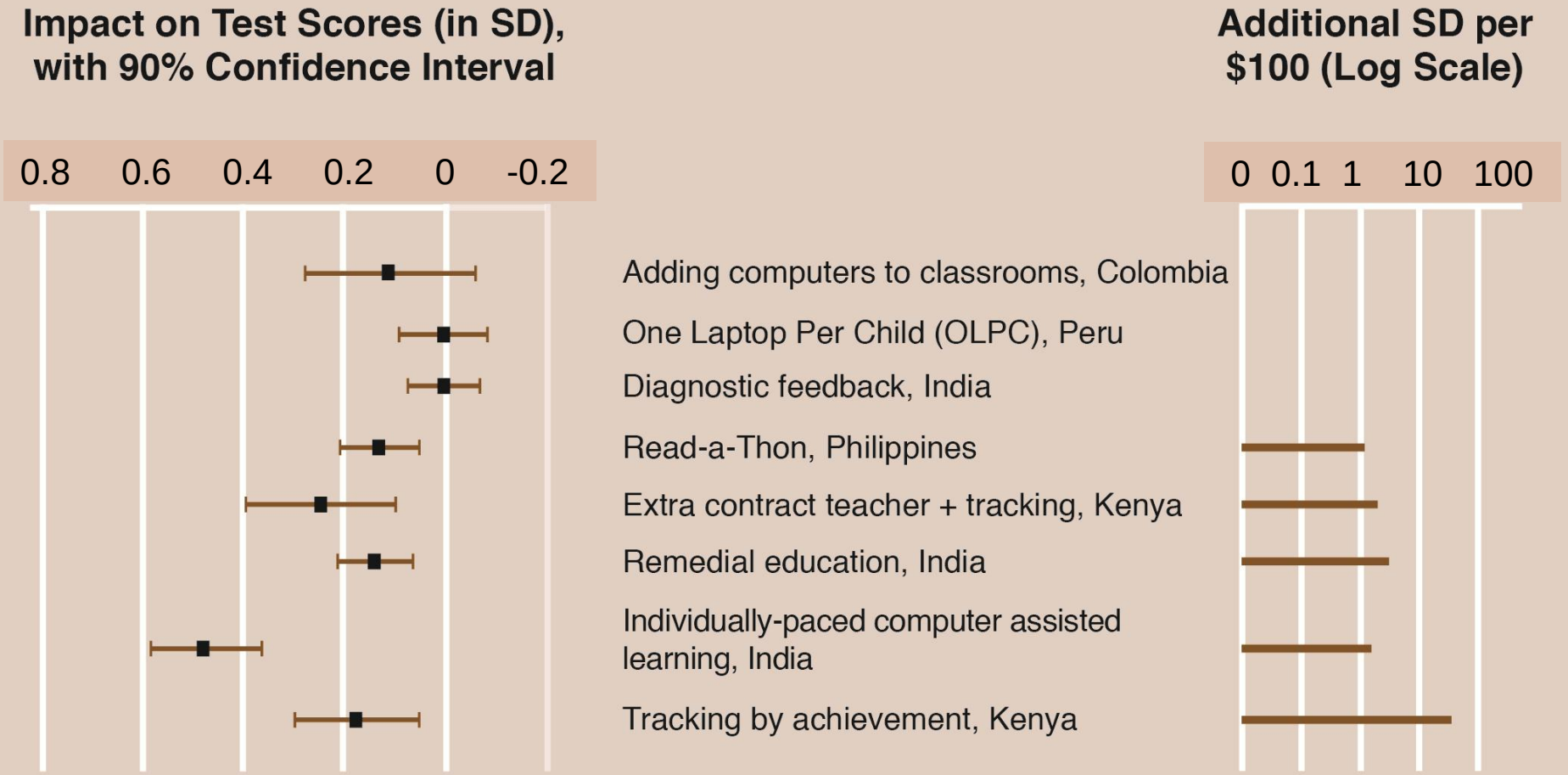
Issues to Consider in CEA– *there is no one right way… as long as you articulate assumptions*

- *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 <u>one</u> 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



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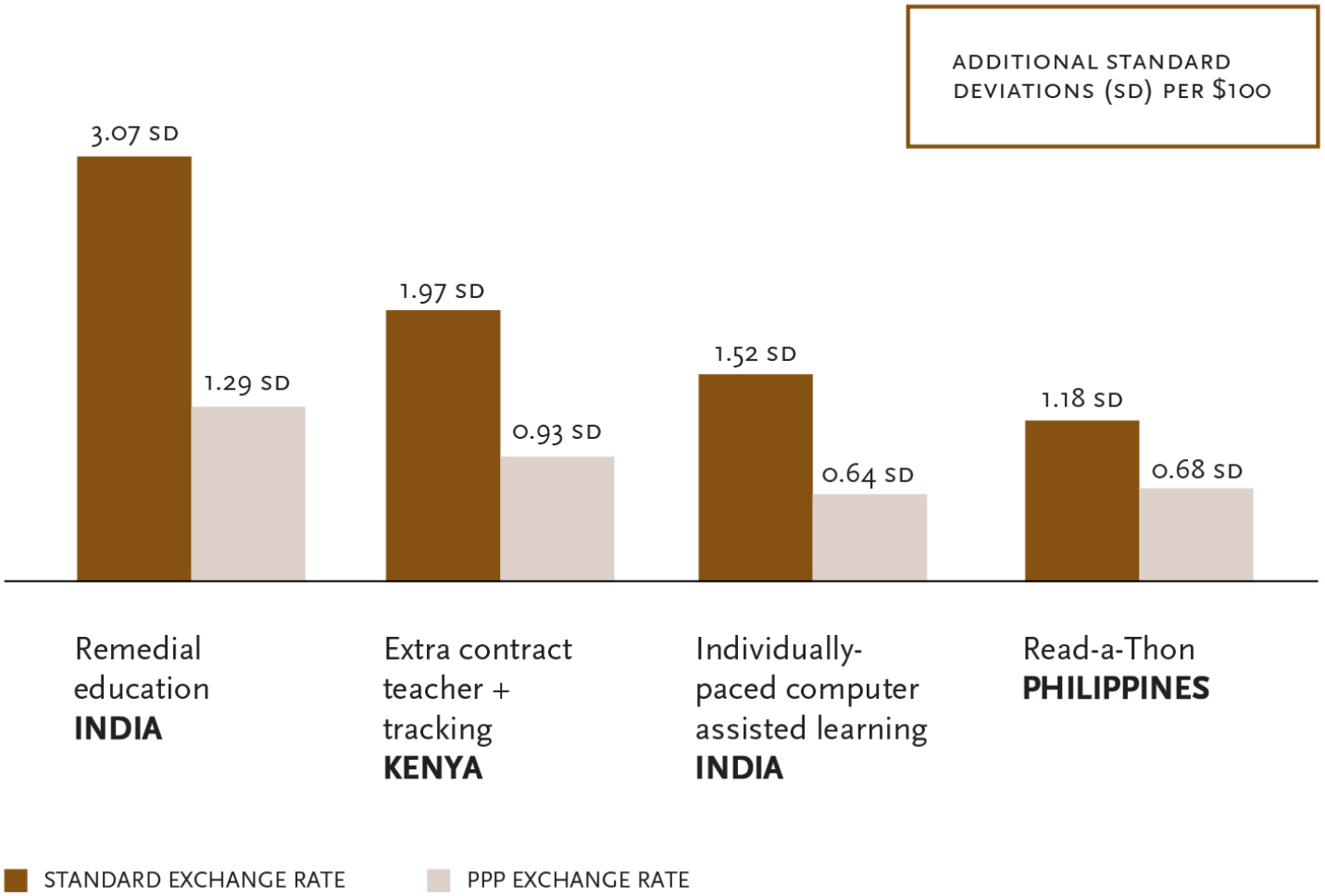
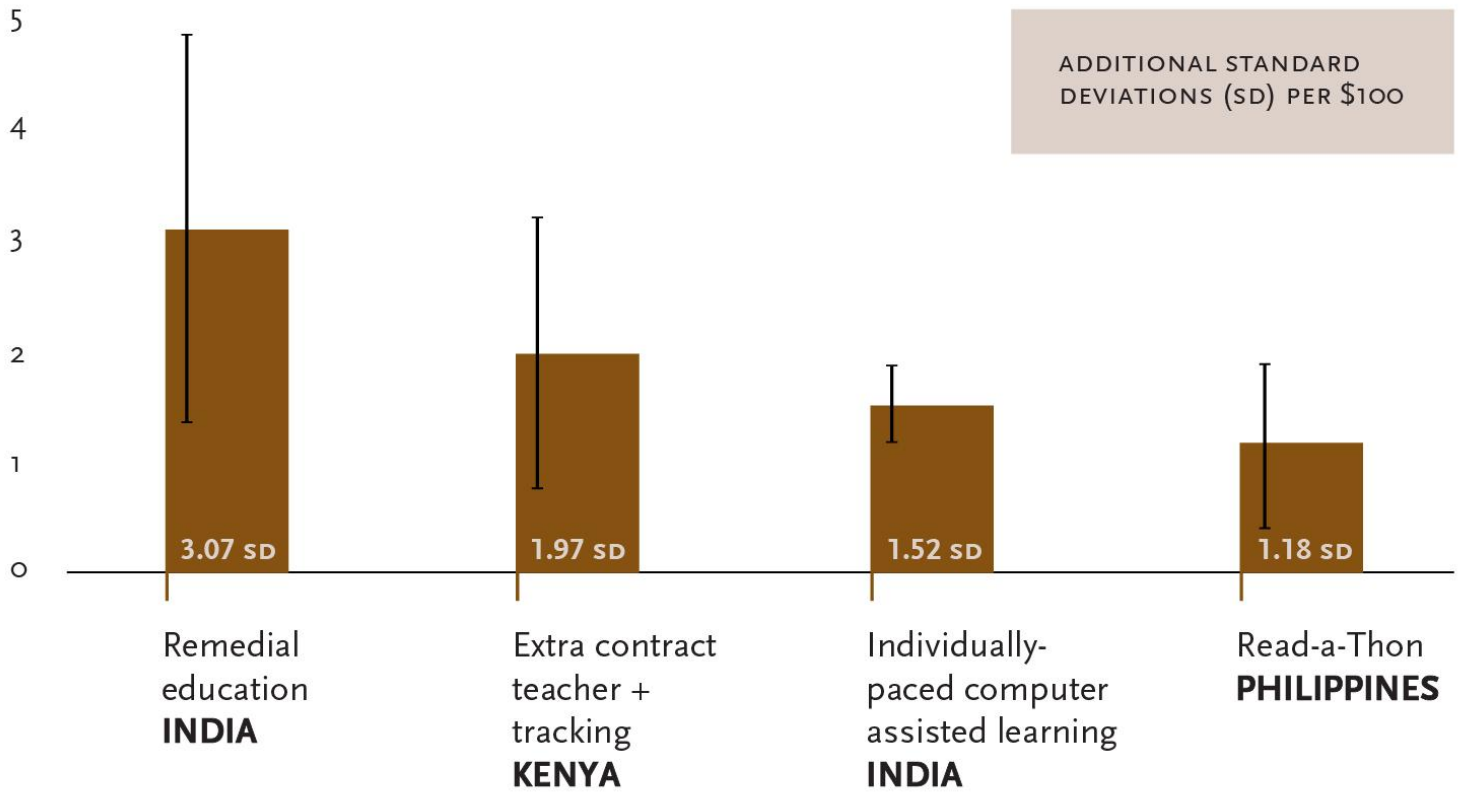
COST-EFFECTIVENESS: SENSITIVITY TO EXCHANGE RATES



COST-EFFECTIVENESS: IMPRECISION IN IMPACT ESTIMATES

90% CONFIDENCE INTERVALS



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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)

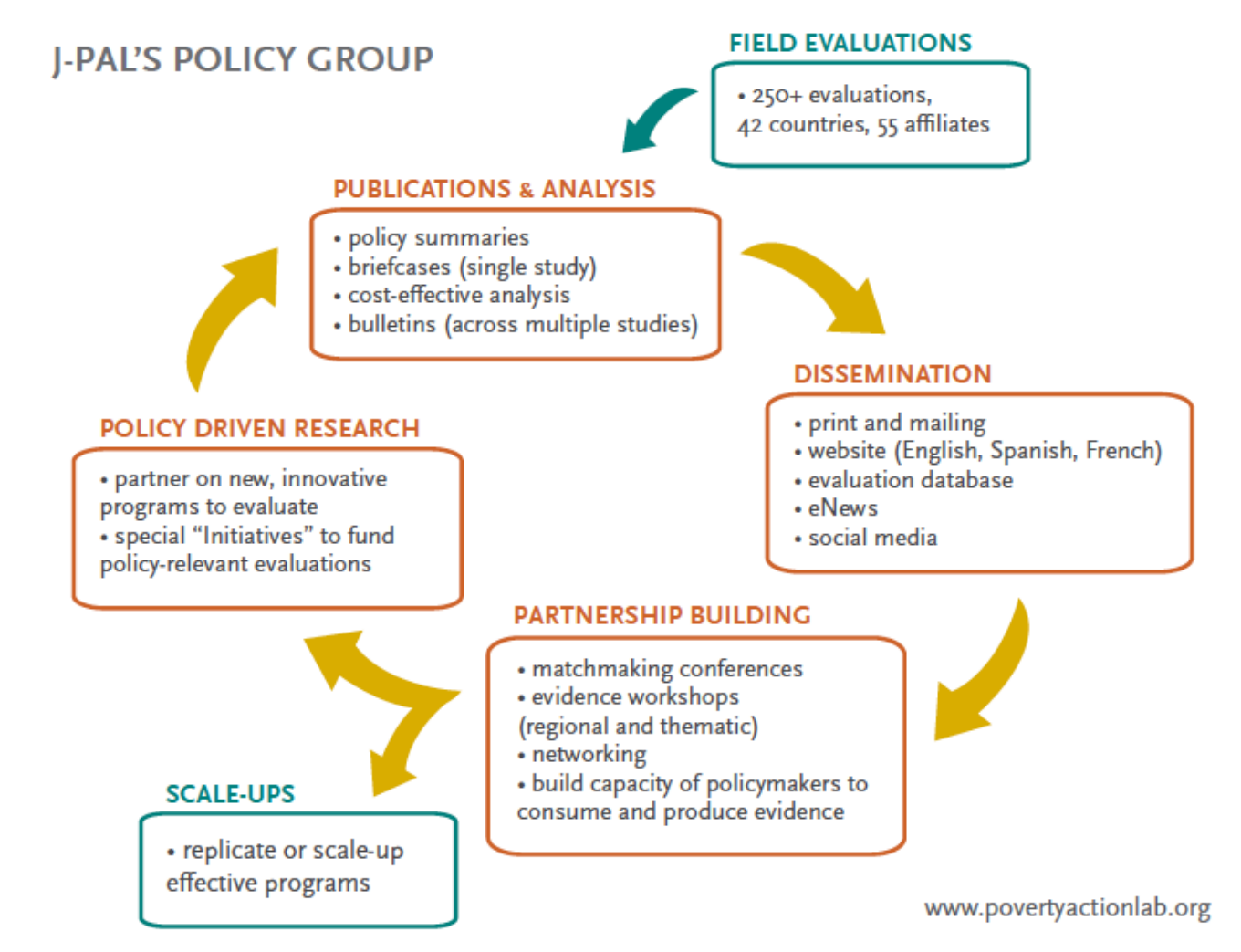
There are Different Paths from Impact Evaluations to Scale-Ups

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

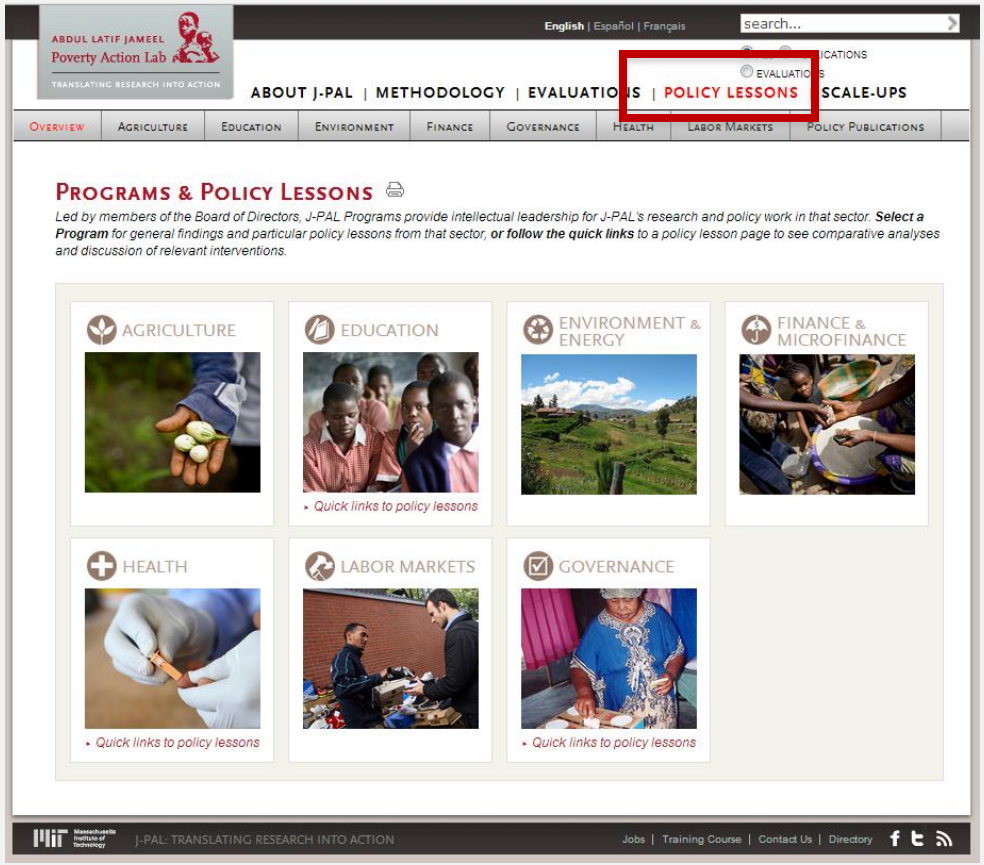
Comparative Cost-Effectiveness Analysis to Inform Policy in Developing Countries:

A General Framework with Applications for Education

Iqbal Dhaliwal, Esther Duflo, Rachel Glennerster, Caitlin Tulloch[1]

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

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



www.povertyactionlab.org/policy-lessons

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EVALUATIONS

Search our database of 574 randomized evaluations conducted by our affiliates in 61 countries using keywords, filters, or the region-theme matrix. Our publication search is here.

SEARCH

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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

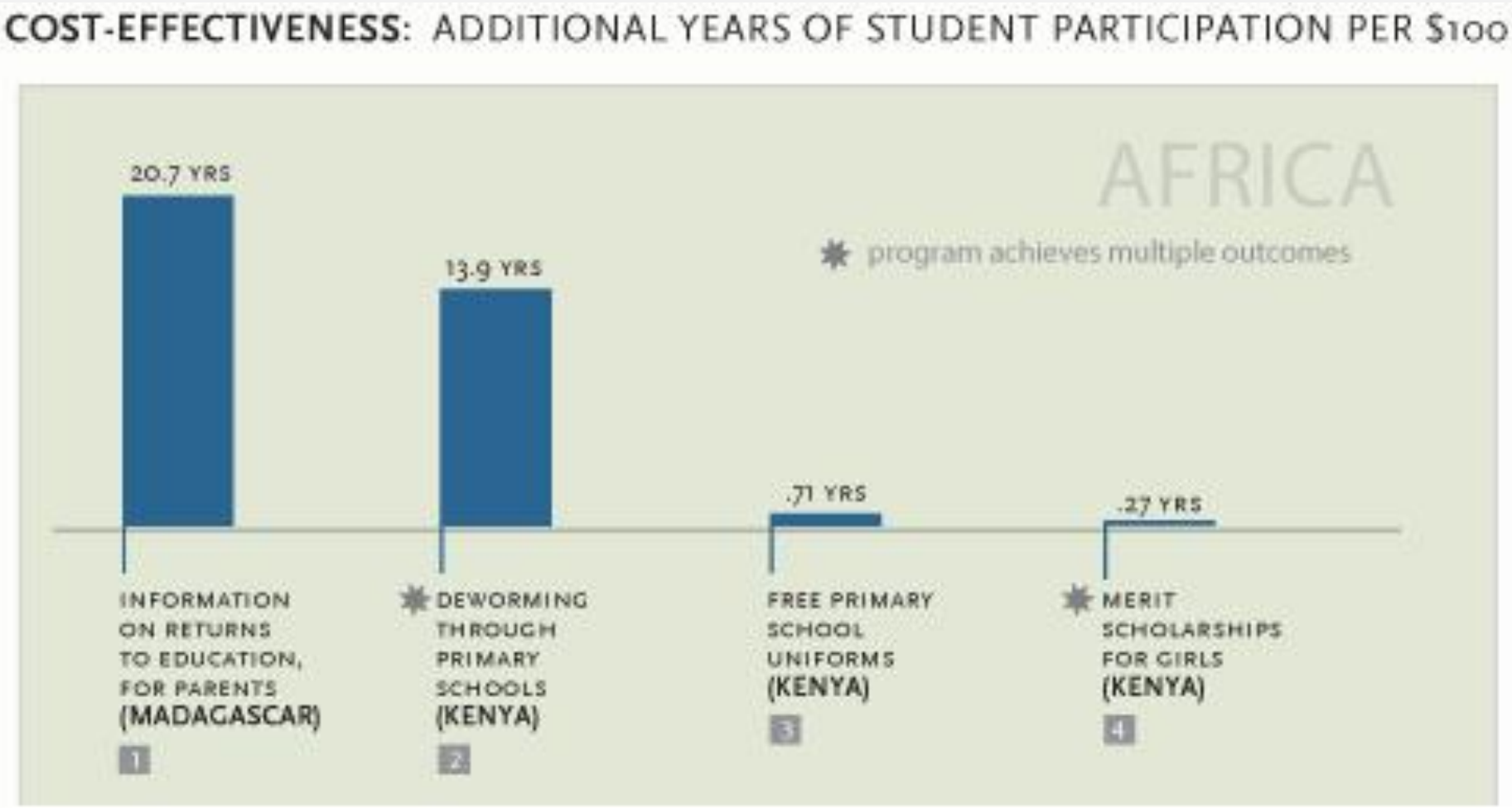
Researchers provided randomly selected ultra-poor households in one of the poorest districts of West Bengal, India with this combination of carefully sequenced supports over 18 months. The program led to increases in income, consumption, food security, and other measures of well-being that persisted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

www.povertyactionlab.org/evaluations

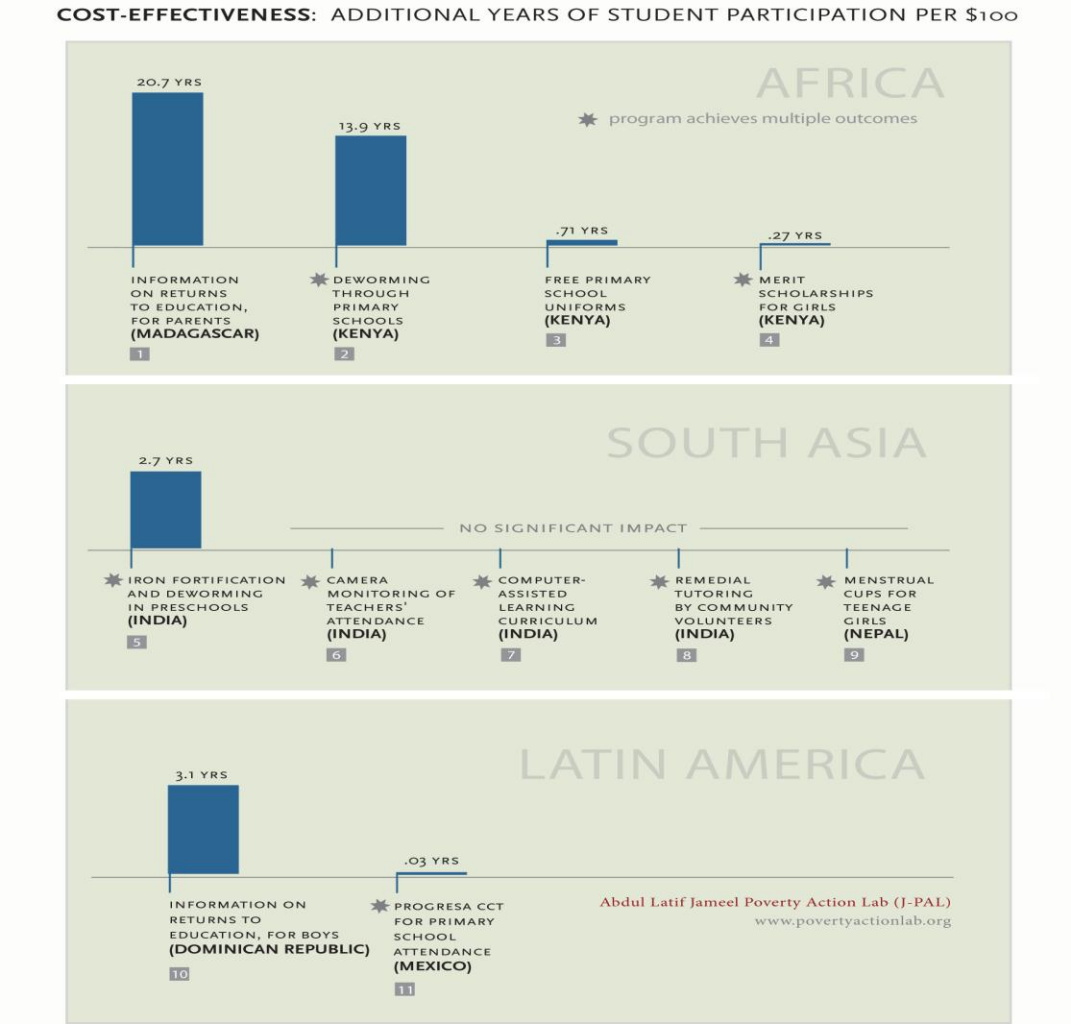
Thank You!

Questions and comments?

Reading Cost-Effectiveness Results



CEA as a starting point for discussions on evidence based policy



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

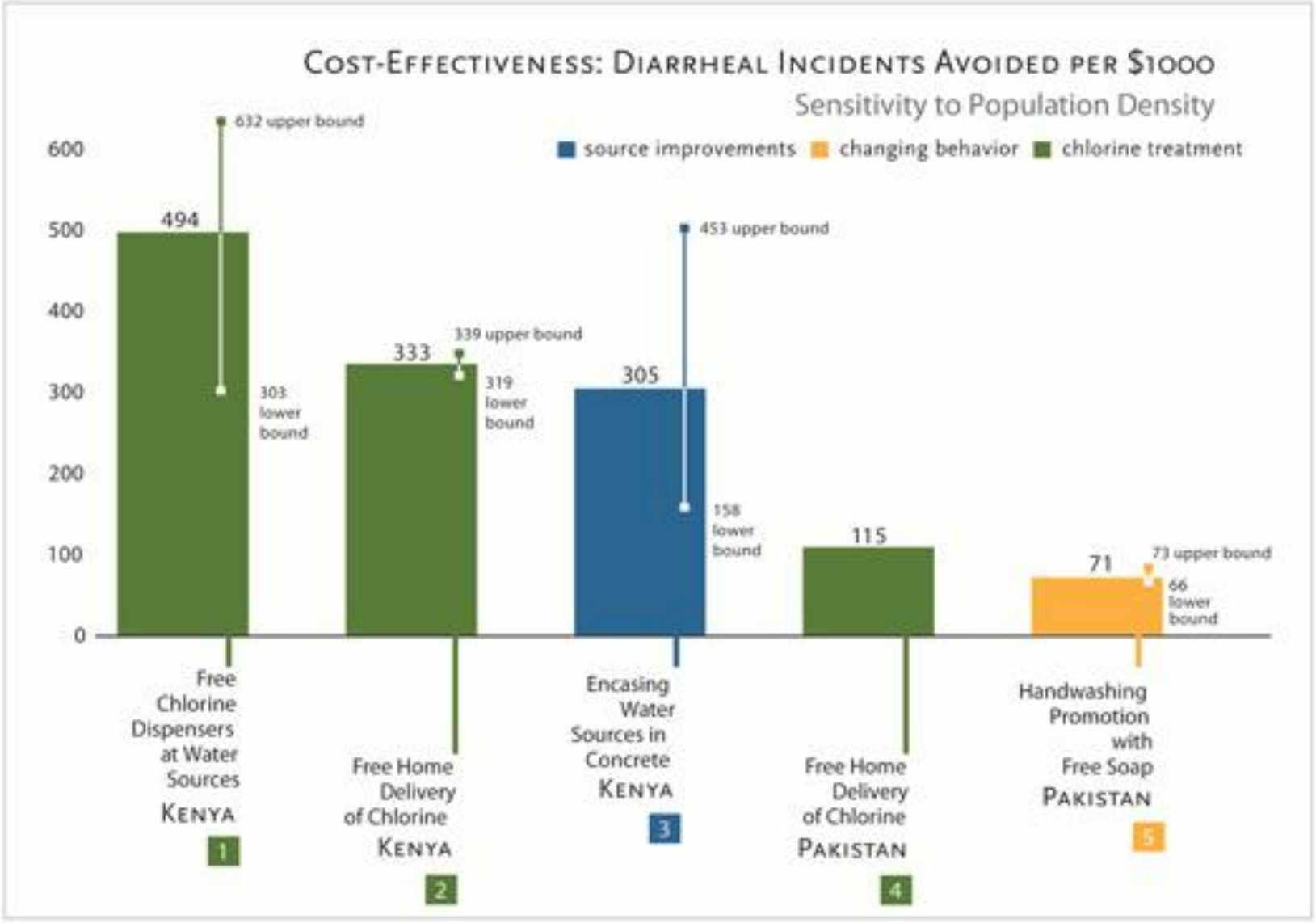
CONFIDENCE INTERVALS OF COST-EFFECTIVENESS: ADDITIONAL YEARS OF EDUCATION PER $100 SPENT

RANGES BASED ON 90% CONFIDENCE INTERVAL OF PROGRAM IMPACT

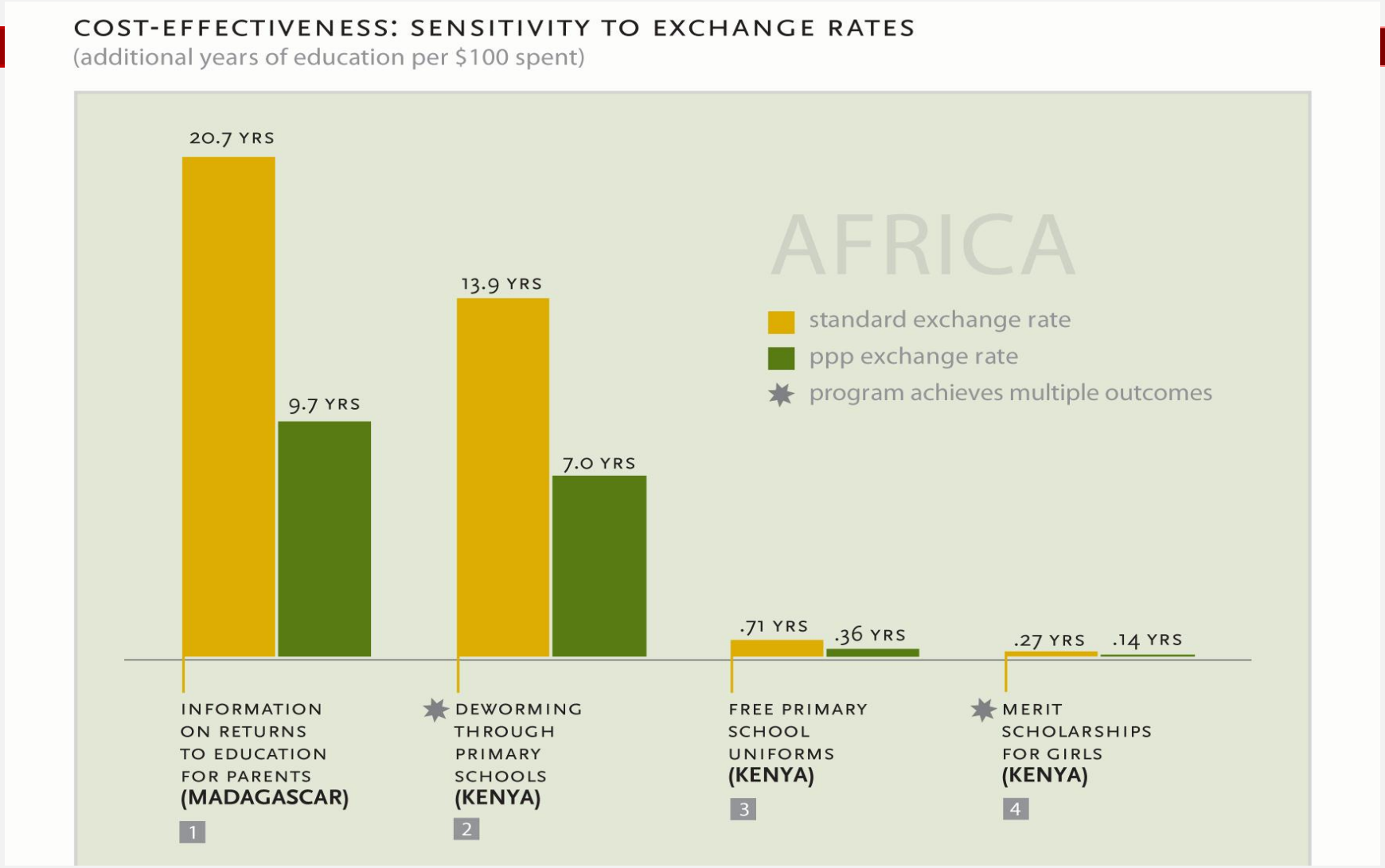
Abdul Latif Jameel Poverty Action Lab (J-PAL)
www.povertyactionlab.org

	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



Demand Incentives Most Effective For Later Rounds of Immunizations

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

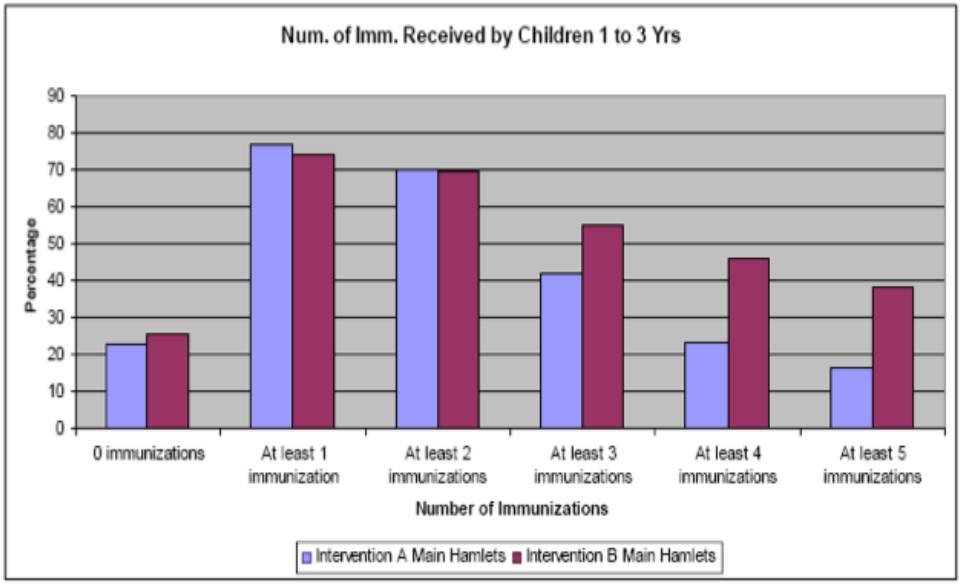
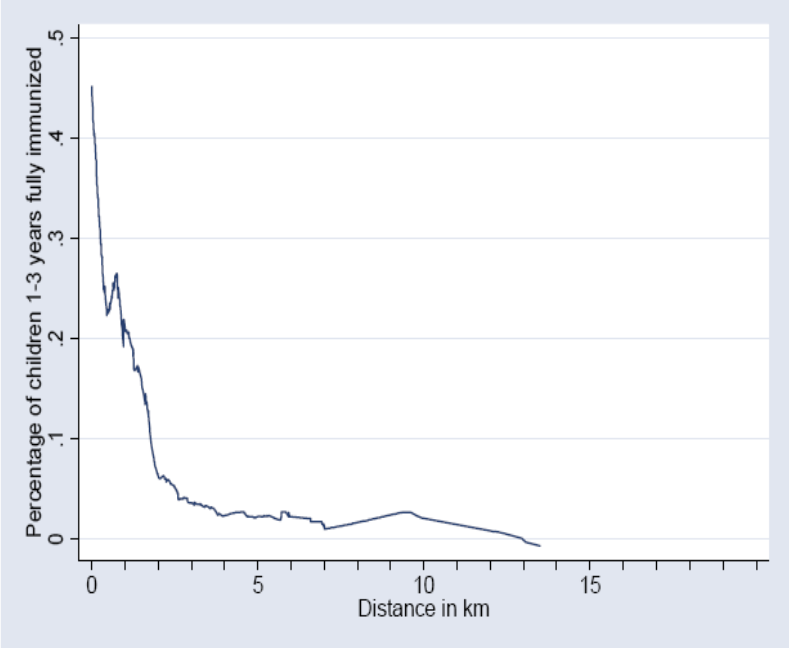
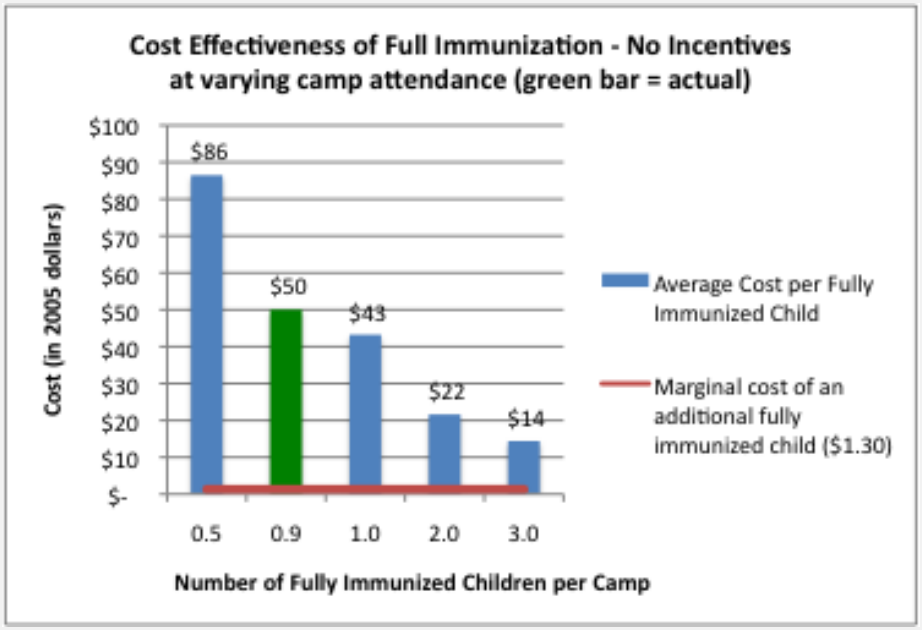
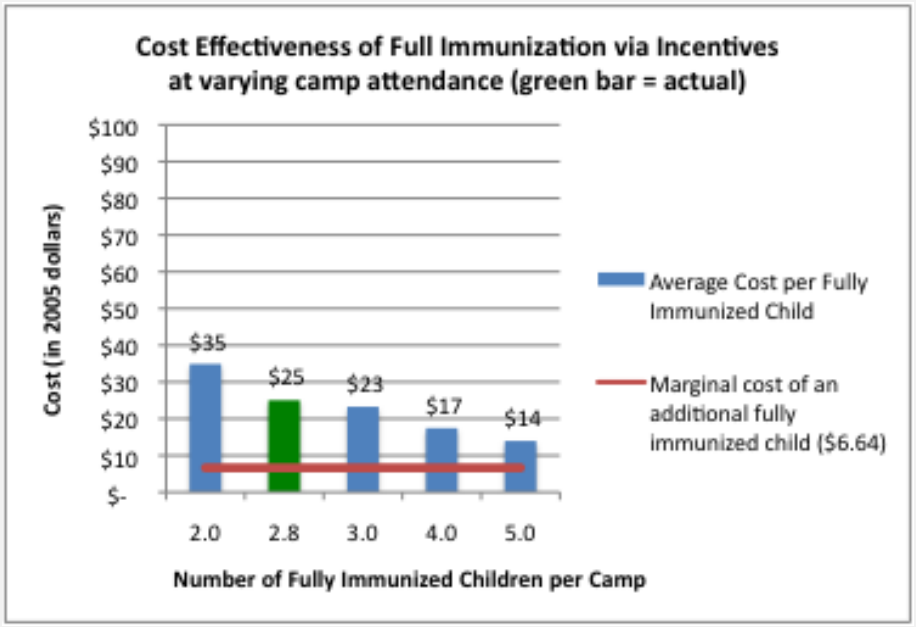


Figure 4: Immunization status as a function of distance from Intervention B camps

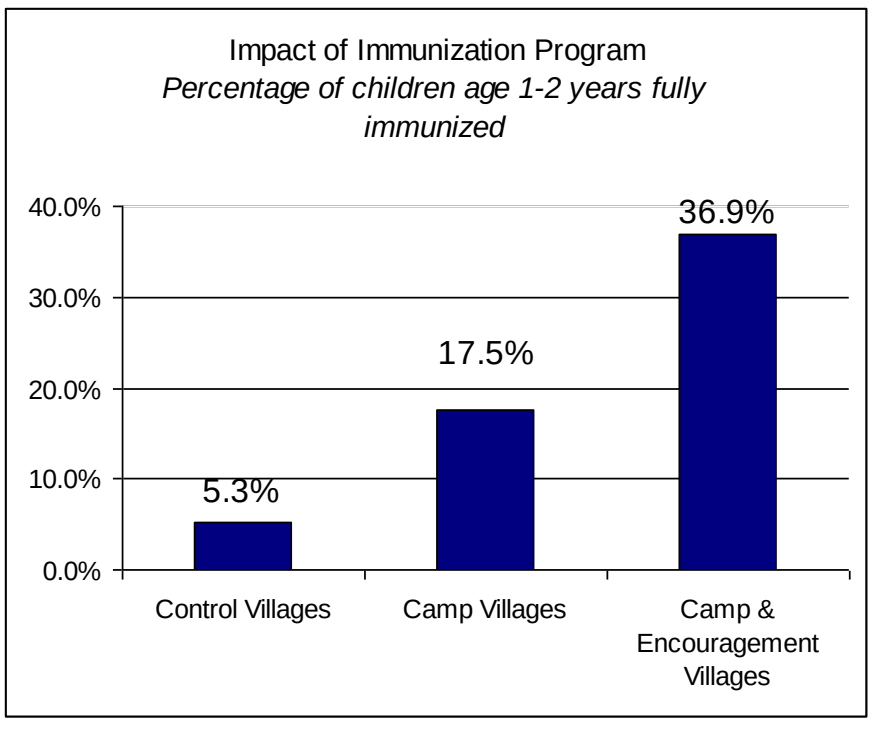


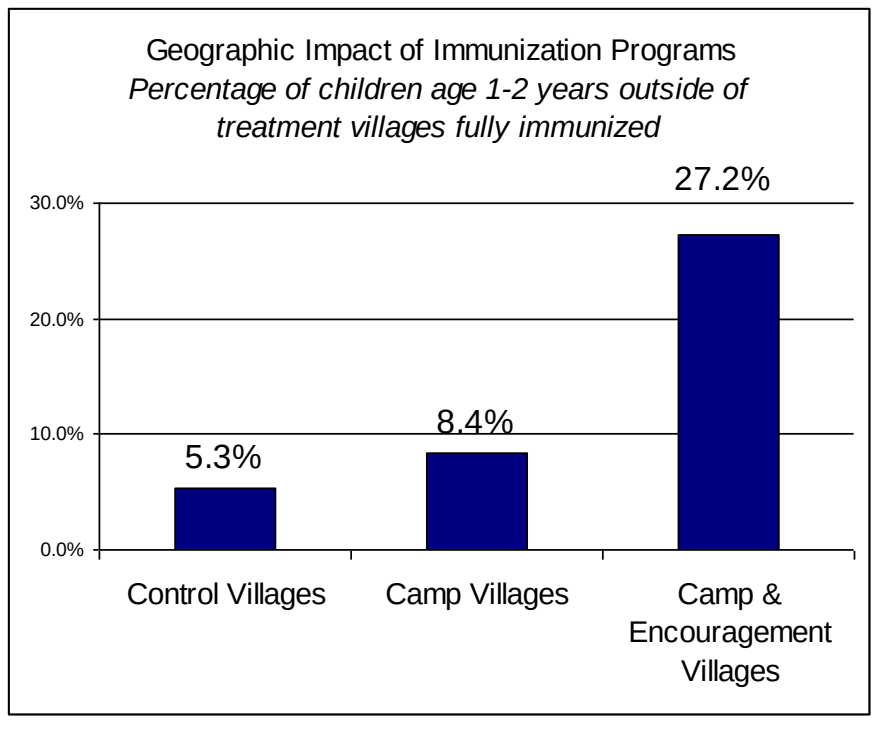
Divide the Costs by the Number of Fully Immunized Children to get the Cost Effectiveness of Camps and Incentives





Regular Supply Increased Immunization, Incentives Helped it Even More





Prospective CEA - Harmonization

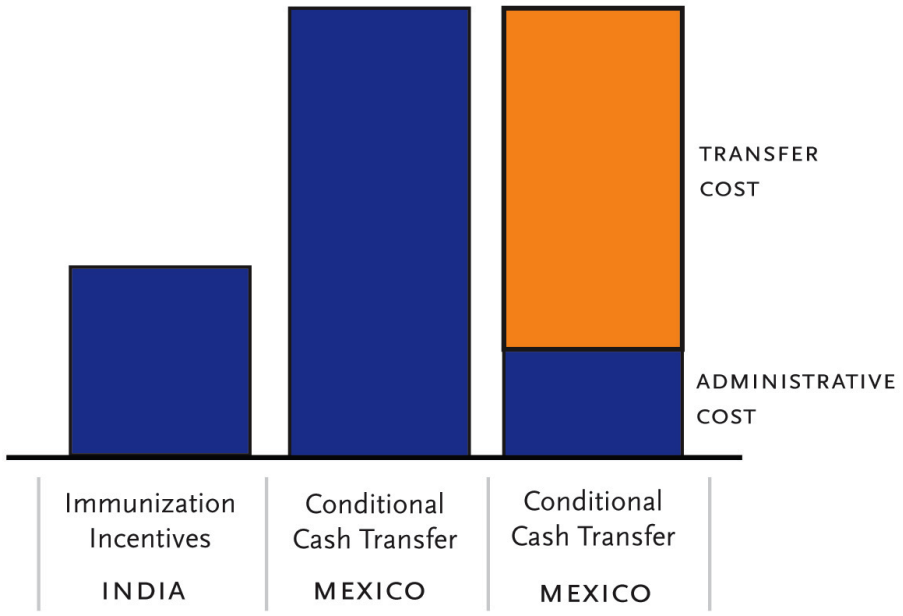
- Outcome Harmonization:
  - Student Attendance: Attendance (random head count) vs. increased enrollment; or Participation (both attendance and enrollment)
  - Learning outcomes: Standardized tests (e.g. PISA or Pratham's rapid assessment) vs. standard deviation of scores
  - Duration of intervention (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

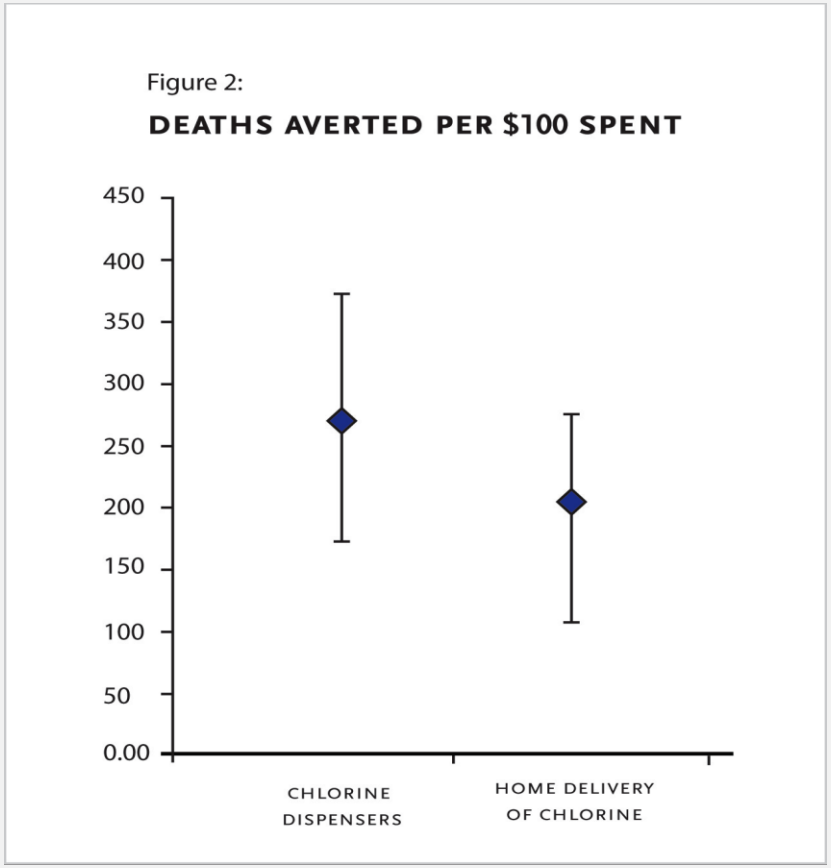


Issues to Consider in Cost Effectiveness Analysis – *there is no one right way*

- *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