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# **COST ANALYSIS**

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## **Beyond impacts**

**Bénédicte de la Brière**  
**The World Bank**

# Objectives of this session

- 1 The problem
- 2 Framework and definition
- 3 Measuring effects
- 4 Measuring costs
- 5 Comparing CE of different interventions
- 6 Common pitfalls

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# The problem: **Impacts alone are not enough for policy-makers**

Rigorous IE is more frequent but cost analysis is rarer

- Very little cost-benefit analysis in WB projects and even less in education and health
- “How much will it cost?” Impact alone does not allow a policy-maker to choose between options for interventions

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# The problem: Which costs are we talking about?

HD interventions involve a **range of actors**: the government, NGOs, clients (beneficiaries), affected non-clients

- Cost of “free” volunteers or client time?
- Transfer payments (cash transfers)?
- Measurement of positive/negative externalities?

# Cost-Benefit Analysis (CBA)



Quantifies the benefits and costs of an activity, in the same metric (money)

- **to respond:** is the intervention producing sufficient benefits to outweigh the costs? Is society richer after making this investment, and
- **to inform** the worth of a single intervention and compare interventions within and across sectors when benefits can be monetized.

# Cost-Benefit Analysis (CBA)



Net present value:

$$\sum_{t=0}^n \frac{B_t}{(1+r)^t} - \sum_{t=0}^n \frac{C_t}{(1+r)^t}$$

- $B_t$  and  $C_t$ : incremental benefits/costs at year  $t$
- $t$ : benefits and costs may occur between now ( $t=0$ ) and  $n$  years
- $r$ : the discount rate.
- *Internal rate of return*: rate of return at which NPV=0
- *B-C ratio*:



# CBA (example)

Intervention	Cost/person/year	Benefit:cost ratio
1. Breast-feeding promotion	US\$ 0.30 to 4/birth	5 to 67:1
2. Vitamin A supplements	US\$ 0.20	4 to 43:1
3. Therapeutic zinc supplements	US\$ 0.47 (10 days)	
4. Deworming (school age)	US\$ 0.32 to 0.49	3 to 60:1
5. Iron supplements and Folic acid supplements	US\$\$ 10-50 US\$ 0.01 (folate fortification)	6 to 14:1 12 to 39:1
6. Iron fortification of staples	US\$ 0.10-0.12	7.8:1
7. Salt iodization	US\$ 0.05	30:1
8. Iodine supplements		15 to 120:1

Source: Horton, Alderman, Rivera 2008

# Cost-Effectiveness Analysis (CEA)



Determines the non-monetary effects per money spent,

- **to respond:** how much effect did the Ministry get per \$ spent? how much did it cost to attain one unit of impact? and
- **to inform** comparisons of interventions within sectors, with comparable effects

# CEA (example)



Intervention	Source (experiment)	Cost per student (US\$)	Test score effect (s.d)	Cost per .2 s.d. (US\$)
Class size reduction - All students	STAR	11,865	.15	15,820
- African students		11,865	.24	9,888
Teach for America	Mathematics	1,374	.15 (math only)	1,832
Success for All	Borman	2,789	.21 - .36	1,549 – 2,656

Source: Loeb and McEwan (2010)

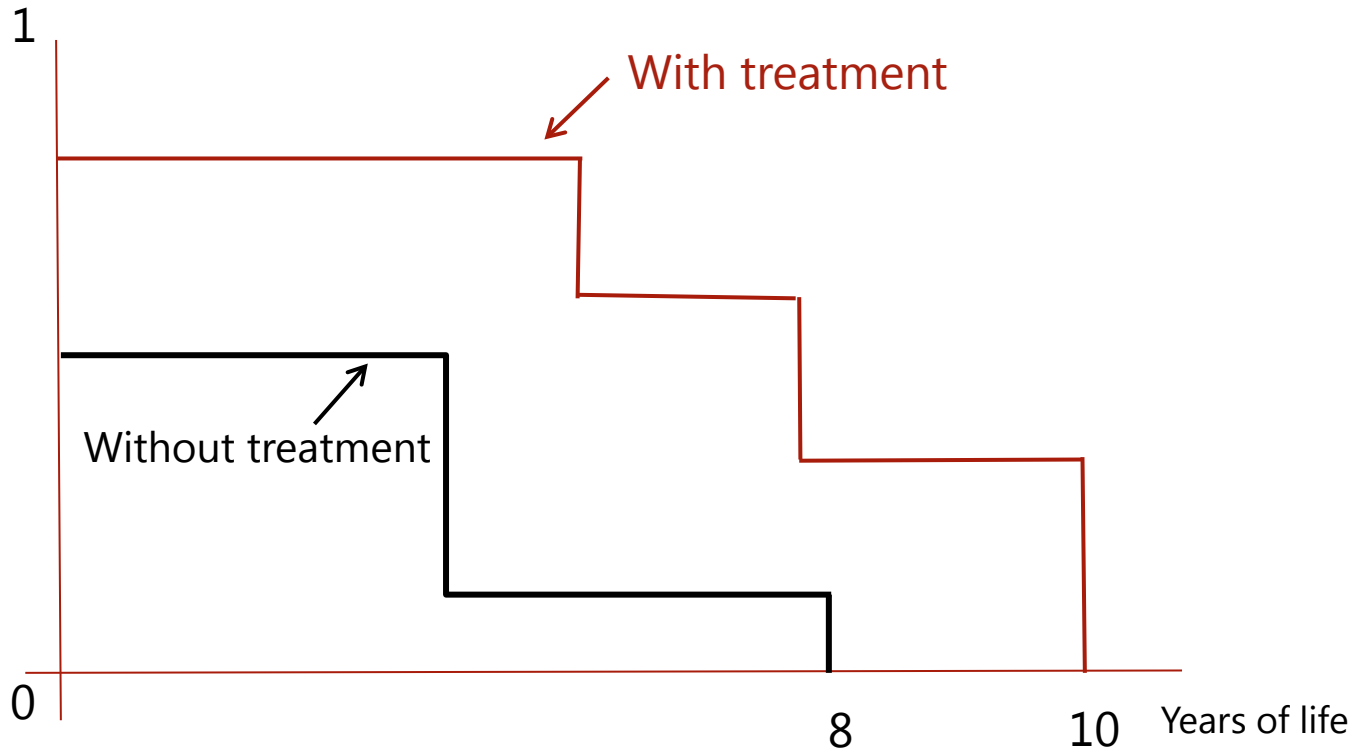
# Cost-Utility Analysis (CUA)



Determines the non-monetary utility gains per money spent (similar to CEA)

- **to respond:** how much more utility (quality of life) did the Ministry of health get per \$ spent? how much did it cost to attain one more utility? and
- **to inform** comparisons of interventions especially in health, with comparable effects

# CUA (example)



Source: Loeb and McEwan (2010)

# Summary – Pros and cons

Method	Advantages	Disadvantages
Cost Benefit Analysis	Widely understood Single intervention Useful for comparing interventions w/ multiple outcomes	Monetization requires assumptions Uncertainty about long-run
Cost Effectiveness Analysis	Useful for comparing interventions w/ same measure of effectiveness If costs and impact data available, easy to apply	Need at least 2 interventions w/ same objectives
Cost Utility Analysis	Useful for combining different measures, w/ "utility" weights Huge literature in health economics	Estimating "utility weights" require assumptions

Source: Loeb and McEwan (2010)

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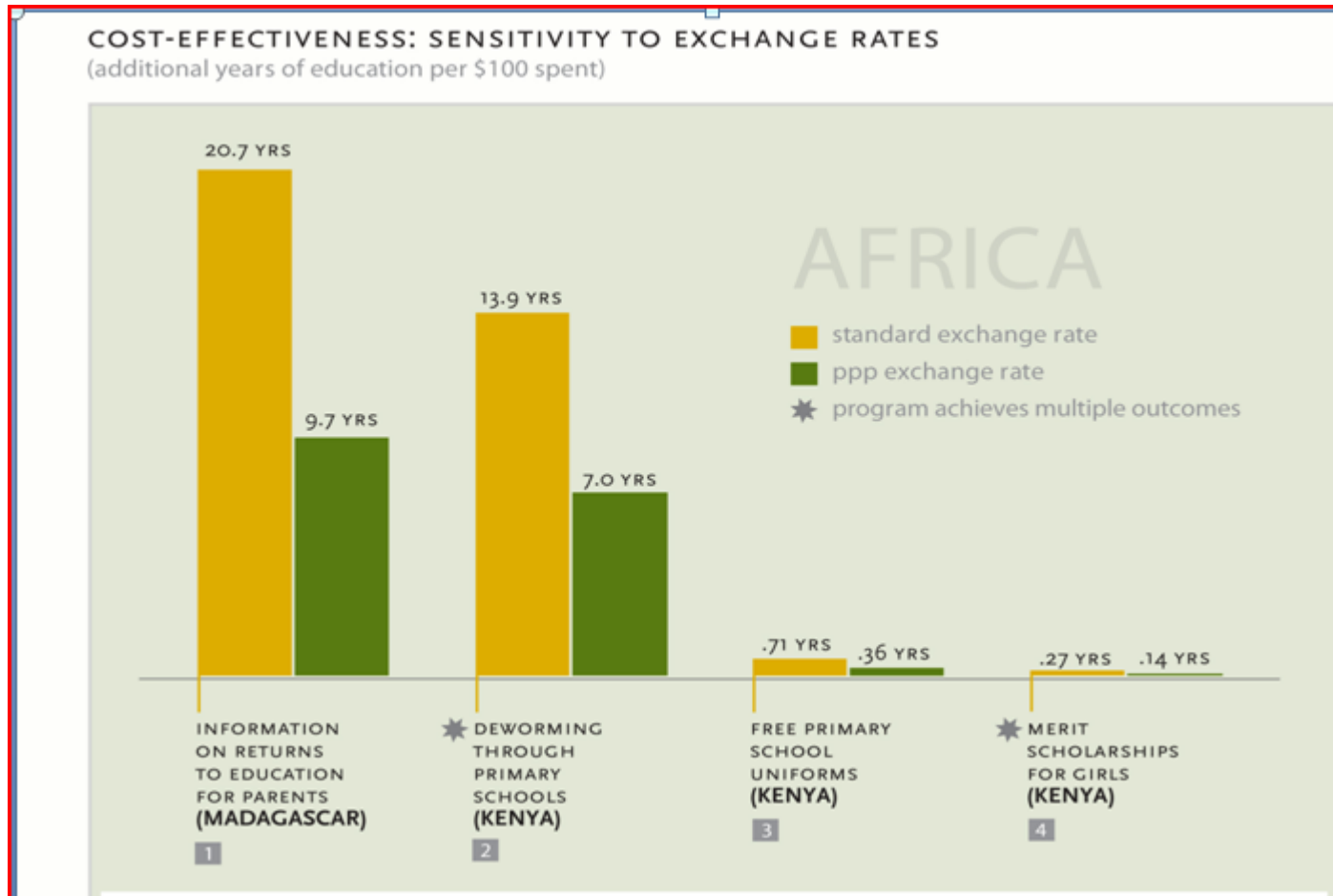
# Measuring effects

- Impact evaluation design
- Comparing effects across studies
  - Scaling effects taking into account contextual differences, methodological assumptions
  - Converting to a common metric
    - From water chlorination rates or hand-washing to incidence of child diarrhea
    - From test scores to earnings
    - Short-term and long-term



# Comparing effects across studies

- Methodological assumptions



Source: J-PAL

# Comparing effects across studies

1

Intervention	Source (experiment)	Cost per student (US\$)	Test score effect ( s.d)
Class size reduction - All students	STAR	11,865	.15

2 Literature: 1 s.d. in test scores increases earnings by 20 percent (Neal and Johnson, 1996)

3 Obtain earning estimates from US Current Population Survey

4 IRR = 5.2%

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# Measuring and analyzing costs

- Opportunity costs
- The “ingredients” method
  1. Exhaustively identifying ingredients
  2. Valuing ingredients
  3. Analyzing costs
- Cost data is hard to get. Why bother?  
Why not take budgets?

# 1. Identifying ingredients

- Personnel, facilities, equipments and materials, client inputs, administration and overhead
- Sources:
  - Academic papers
  - Interviews (staff, field research staff)
  - Program documents
  - Public sources (local wages)
- Issues
  - Plan vs. reality: budget vs. costs
  - Time period of the evaluation

## 2. Valuing ingredients

- Full cost of personnel: salary and fringe benefits
- Value of infrastructure and durable ingredients (maintenance /construction)
  - Use an existing school or build an additional class rooms
- Use market costs of free ingredients
- Use economic costs (e.g. user time if user is required to attend)
- Transfer payments

# 3. Analyzing costs

- Discount rate
- Price inflation
- Currency
  - Nominal vs. purchasing power parity exchange rates
  - Rate to buy the same amount of goods and services in two different countries

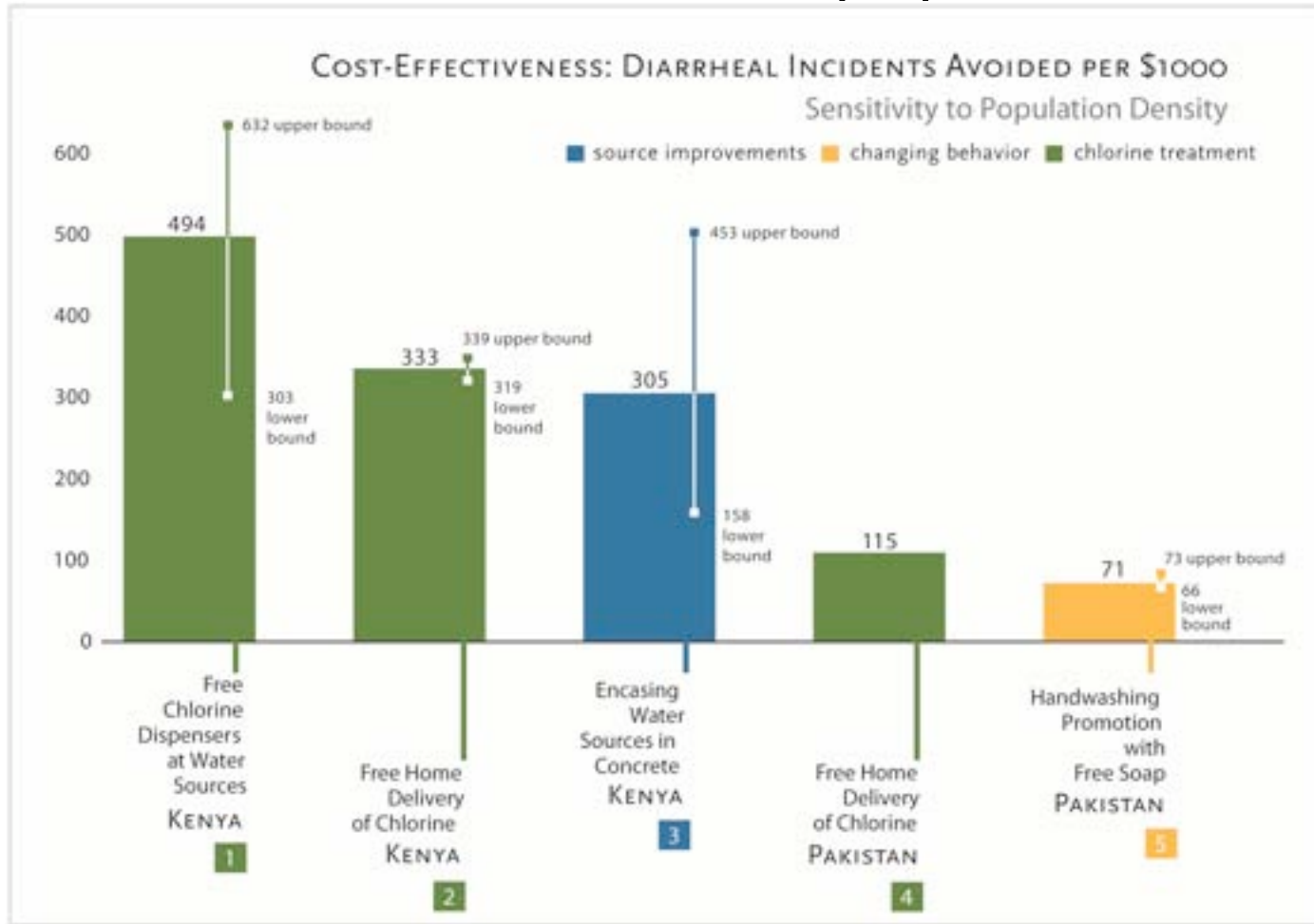
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# Sensitivity analysis

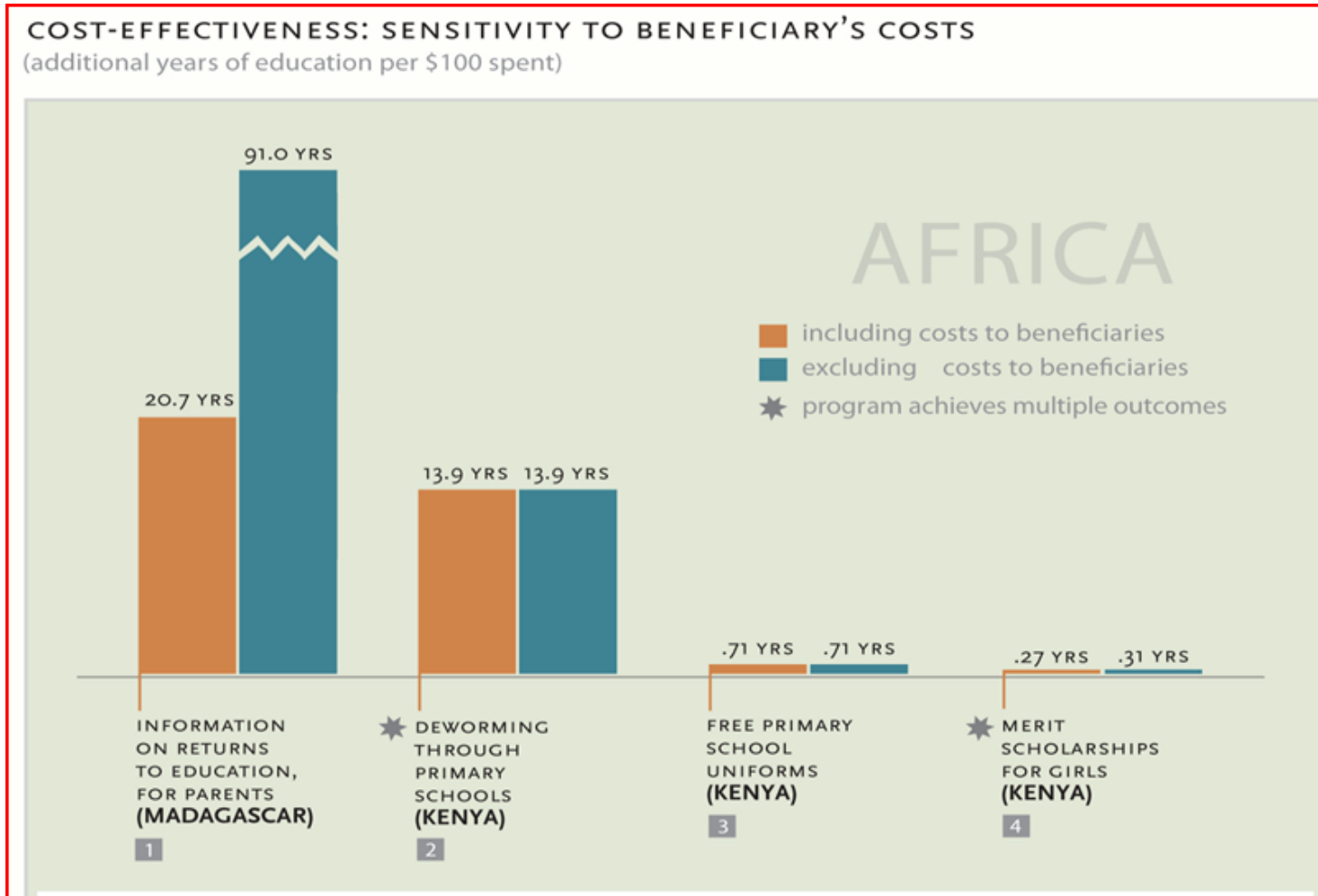
- Contextual differences: population density



Source: J-PAL

# Sensitivity analysis

## Costs to beneficiaries:



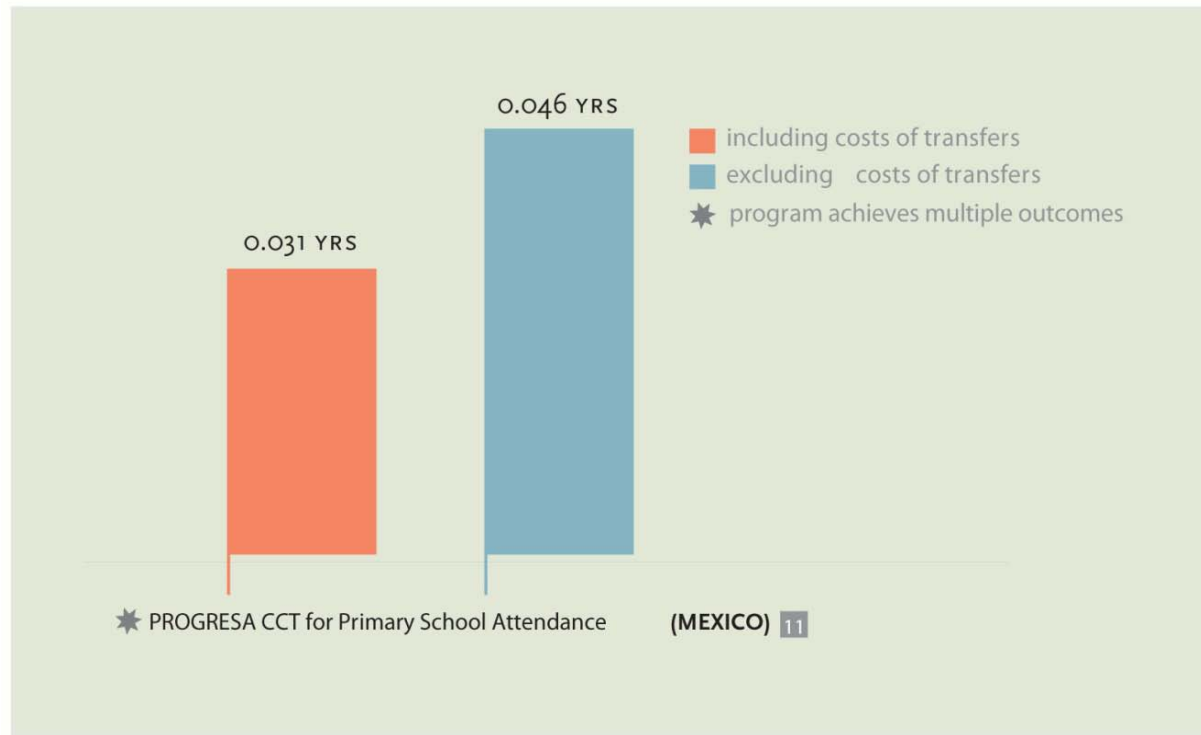
Source: J-PAL

# Sensitivity analysis

## Transfer payments

COST-EFFECTIVENESS: SENSITIVITY TO TRANSFER COSTS

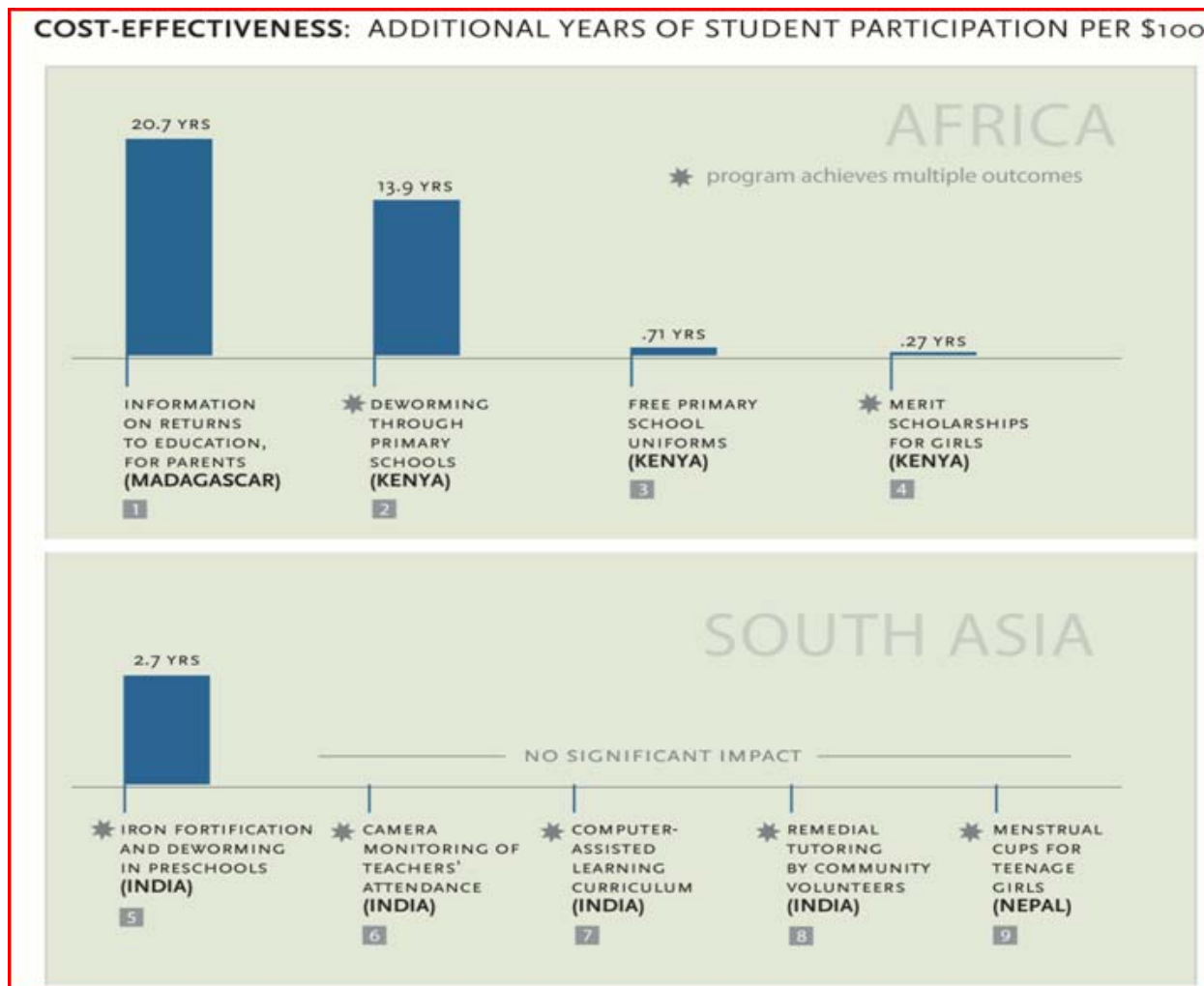
(additional years of education per \$100 spent)



Source: J-PAL

# Sensitivity analysis

## Multiple outcomes



Source: J-PAL

# Sensitivity analysis

## ● External validity

- Experimental vs. **scalable** costs (are they really economies of scale in procurement?)
- The “**margin**” may change when you scale-up (going from school with computers to schools without)
- High upfront costs and low recurring costs may make a program more cost-effective at scale-up

# Other issues

## ● Distribution of Effects

- Do we think it is better to provide:
  - One more year of schooling to 100 students
  - Five more years to 20 students?
- If there are clear threshold effects such as primary completion rate then measure that effect and not years of schooling.
- School scholarship in Cambodia increase enrolment/attendance of lower ability students (no impact on tests scores) (Filmer, Schady 2009)

# Other issues

- **Short term costs / Long-term benefits**
  - Malnutrition interventions

**Table 3. Base Estimates of Present Discounted Values (PDV) of Seven Major Classes of Benefits of Shifting one LBW Infant to non-LBW Status, with 5% Discount Rate**

	PDV	% of Column
1. Reduced infant mortality	\$92.86	16%
2. Reduced neonatal care	\$41.80	7%
3. Reduced costs of infant/child illness	\$38.10	7%
4. Productivity gain from reduced stunting	\$99.34	17%
5. Productivity gain from increased ability	\$239.31	41%
6. Reduction in costs of chronic diseases	\$23.29	4%
7. Intergenerational benefits	45.12	8%
Sum of PDV of seven benefits	\$579.82	100%

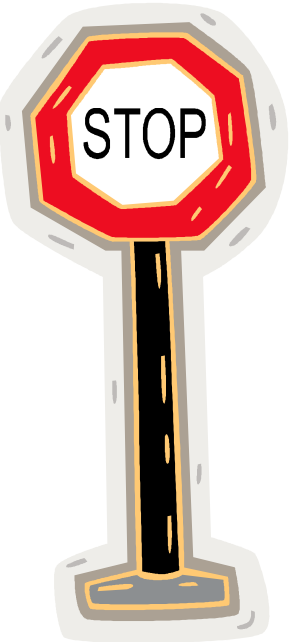
Source: Alderman and Behrman (2003, Table 2).

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# Watch for (CBA and CEA)



Ignoring:

1. Categories of ingredients: facilities, equipments, clients inputs
2. Time and discounting
3. Sensitivity
4. Currency adjustments
5. Reality (costing ideal vs actual program).
6. **Not providing enough details to verify 1 to 5**

# Conclusions

- CEA is useful to examine alternate programs aimed at the same outcome
- CBA enables to monetize a whole series of different impacts
- Collecting costs is a data collection activity in itself
- Need to make user aware of assumptions
- Sensitivity analysis allows policy makers to see the impact of modifying assumptions and local conditions

# References

- Levin, H.M. and P. McEwan. 2001. Cost-Effectiveness Analysis: Methods and application. Sage.
- McEwan, P. 2012. CEA of Education and Health in Developing Countries. *Journal of Development Effectiveness*
- <http://www.povertyactionlab.org/publication/cost-effectiveness> (education)
- Horton, S., H. Alderman, and J. Rivera. 2008. "Hunger and Malnutrition." Copenhagen Consensus 2008 Challenge Paper. Copenhagen Consensus Center.



**Thank You**



**Q & A**