Cost Effectiveness and Costing

Bénédicte de la Brière
World Bank

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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 getting more frequent but cost analysis is rarer

- "How much will it cost?" Impact alone does not allow a policy-maker to choose between options for interventions
- "Who pays those costs?" HD interventions involve a range of actors: The government, NGOs, clients (beneficiaries), affected non-clients
  - Cost of volunteers, externalities, transfers

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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. Deworming (school age)	US$ 0.32 to 0.49	3 to 60:1
4.Iron supplements and Folic acid supplements	US$$ 10-50 US$ 0.01 (folate fortification)	6 to 14:1 12 to 39:1
5. Iron fortification of staples	US$ 0.10-0.12	7.8:1
6. Salt iodization	US$ 0.05	30:1

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	Mathe-matica	1,374	.15 (math only)	1,832
Success for All	Borman	2,789	.21 - .36	1,549 – 2,656

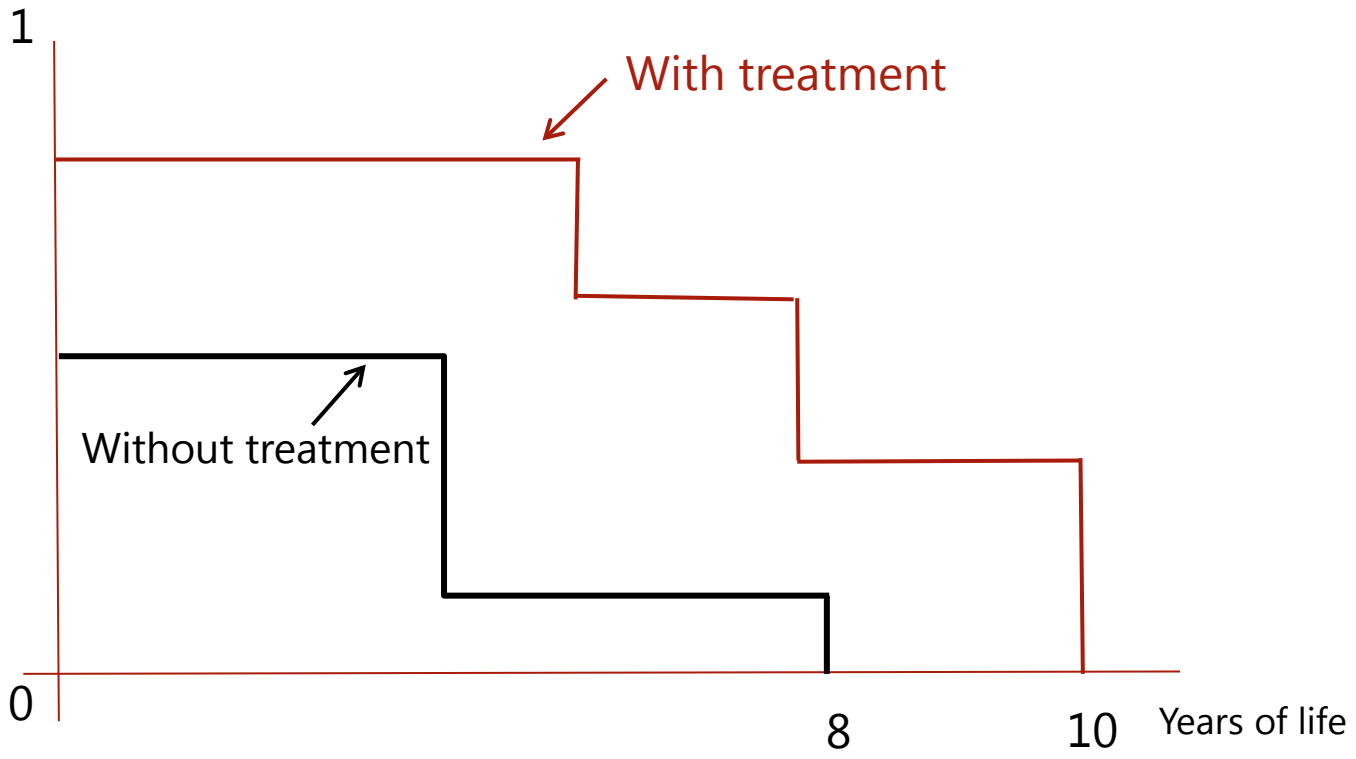
Source: Loeb and McEwan (2010)

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

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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 (1)

- 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

2. Valuing ingredients (2)

- Cost categories must include
  - Inputs
  - Functions and activities
  - Sources of funds
  - Level of supply
- Categories must be complete (exhaustive) with no repetition
- Distinguish capital and recurrent costs

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/ provinces

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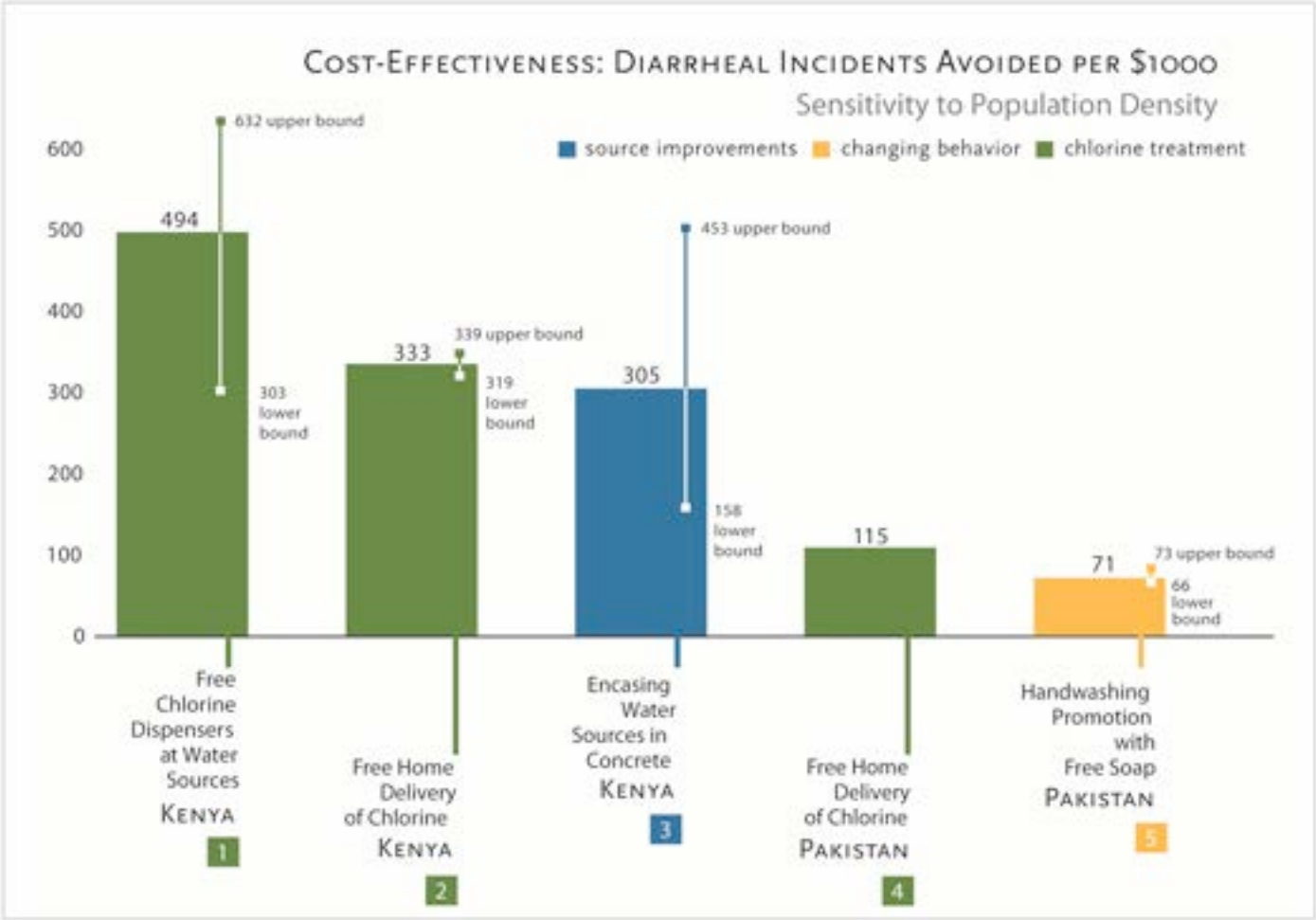
Sensitivity analysis

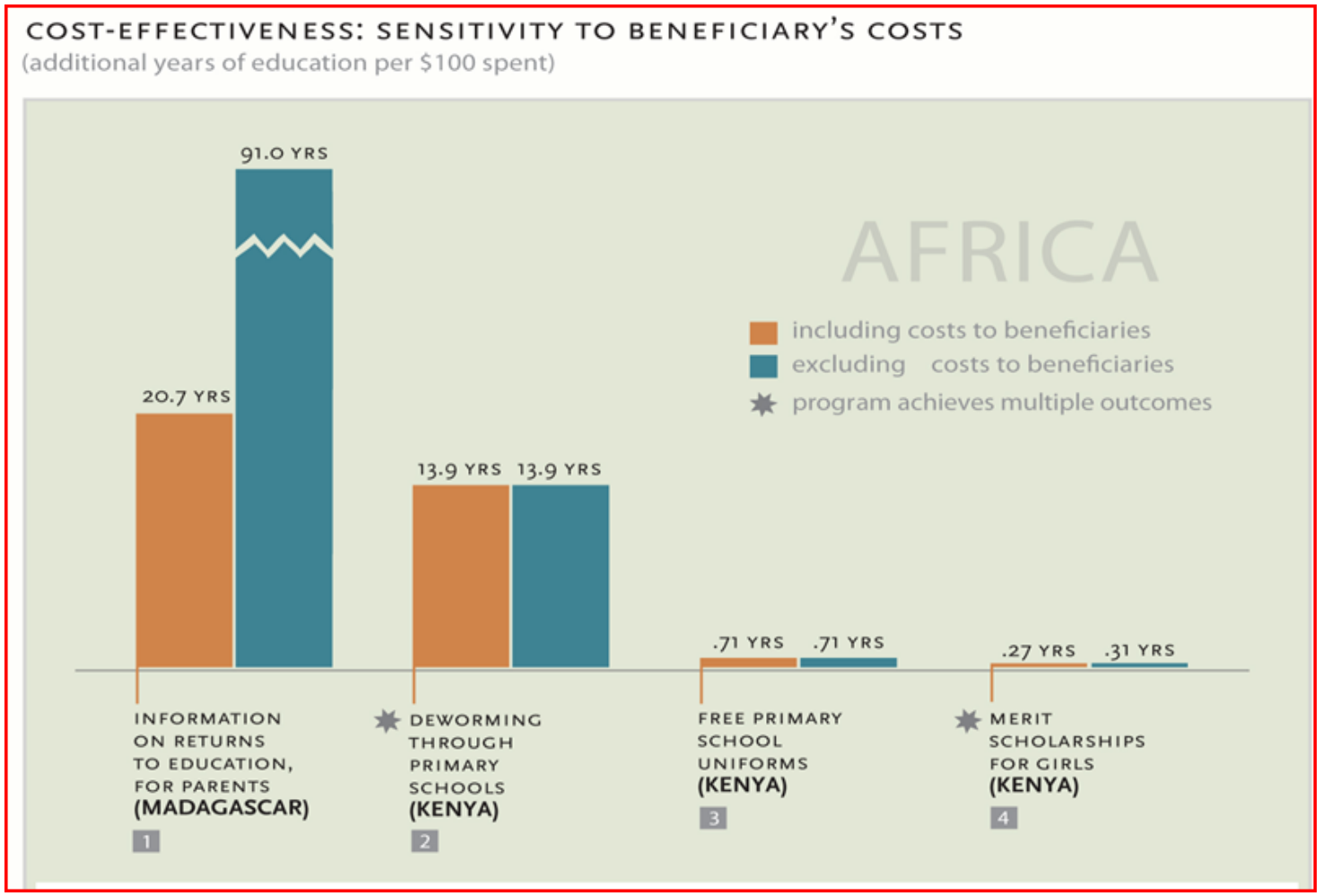
- **Contextual differences**: population density



Source: J-PAL

Sensitivity analysis

- **Costs to beneficiaries**:



Source: J-PAL

Sensitivity analysis

- External validity:
  - Pilot vs. at-scale costs: are there real economies of scale or new coordination costs?
  - The "margin" may change when the intervention scales-up (going from schools w/ computers to schools w/o them)
  - High set-up/upfront costs and low recurrent costs may make a program more cost-effective at scale.

Source: J-PAL

Ex: Uganda –HPV vaccine scale-up

- **Activities and inputs**

Activities	Inputs
Visits for micro-planning Training Comunication and mobilization Cold chain and vaccines Maintenance Monitoring of implementation Implementation vaccine and logistical support	Gasoline and car maintenance Staff costs (per diem) Transport payments Administration Syringes Energy (electricity) Radio airtime HMIS Inputs for MIS Safes Other inputs (kerosene and cotton) Co-payments for the vaccine

Source: C. Levin, PATH

*This analysis only includes the operational costs to scale-up and maintain the implementation. Capital costs and depreciation are excluded.

Ex: Uganda – HPV vaccine scale-up

- **Pilot and program**

Costs	Pilot PATH	Scaled-up national program
Start-up per girl*	$6.61	$2.82†
Operations per dose	$0.56	$1.27
Operations per girl	$3.45	$3.81
Total per girl	$10.06	$6.63

* Per girl means with full vaccine (3 doses) in the pilot and per eligible girl in the program.
† Launching costs after two years of pilot and one year of bridging.

Source: C. Levin, PATH

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: Present Discounted Values of 7 major benefits of shifting one LBW infant to non LBW status, with 5% discount rate

	PDV	% of Column
Reduction in :		
1. Infant mortality	$ 92.86	16%
2. Neo-natal care	$ 41.80	7%
3. Infant/child illness costs	$ 38.10	7%
4. Costs of chronic diseases	$ 23.29	4%
Productivity gains from		
5. Chronic malnutrition	$ 99.34	17%
6. Increased ability	$ 239.31	41%
7. Inter-generational benefits	$ 45.12	8%
Total	$ **579.82**	100%

Source: Alderman and Behrman, 2003

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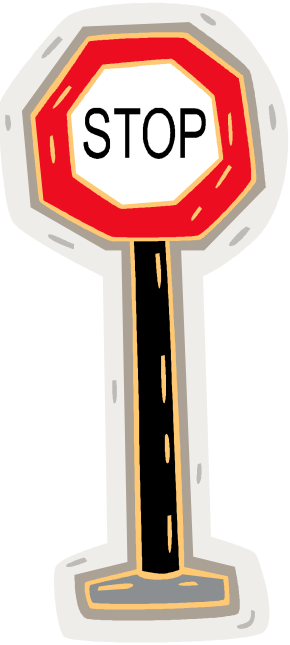
Watch for (CBA and CEA)



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

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