

Costing of Early Childhood Education

Pamela Jervis, PostDoc Fellow Research at Institute for
Fiscal Studies

Overview of the talk

- Facts about Costing of ECE
- Why is Cost Analysis Important?
- What Should Cost Data Look Like?
- Capturing Costs
- Analyzing Costs

Facts about Costing of ECE

- One of the major objectives of IE is to provide evidence to policymakers on what works and does not work in the fight against poverty, so they can use scientific evidence to determine which policies and programs to adopt and invest in.
- There isn't much cost analysis in impact evaluations. In McEwan's [review of 77 randomized experiments in education](#), he found that "56% of treatments reported no details on incremental costs, while most of the rest reported minimal details."
- Problem → policymakers may decide to ignore such evidence altogether and go back to relying on their instincts on what works or does not work, or selectively choose studies that support their instincts or predetermined choices.

Overview of the talk

- Facts about Costing of ECE
- **Why is Cost Analysis of ECE Important?**
- What Should Cost Data Look Like
- Capturing Costs
- Analyzing Costs

Why is Costing of ECE Important?



Good Investments



Identifying Good Investment

One way to encourage policymakers is to present scientific evidence in the form of a cost analysis:

- Cost-benefit analysis (CBA) examines the rate of return of an intervention: For example, what is the present value of lifetime benefits (**the monetary gains in social surplus**) of a program set against the costs?
- Cost-effectiveness analysis (CEA) examines the cost-per-benefit (**non-monetary units**) of an intervention: For example, how much does it cost to achieve an additional standard deviation of student preschool participation?

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

- Cost Utility Analysis (CUA) examines the cost in terms of utilities, especially quantity and quality of life. This analysis is often implemented as an extension of CEA. The measure used is the Quality Adjusted Life Years (QALY)

Which “investment” would you implement?

Invest in general package of “Hardware”

Impact on Portuguese score = 8.97

Cost per student = \$16.06

Cost Effectiveness Ratio = $\$16.06/8.97 =$
\$1.79 to raise score 1pt per child

Investment in writing materials

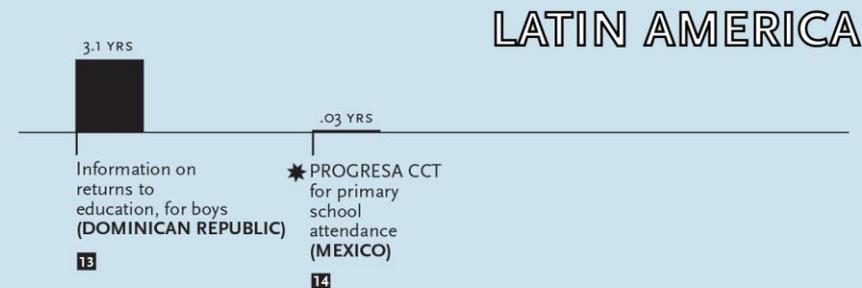
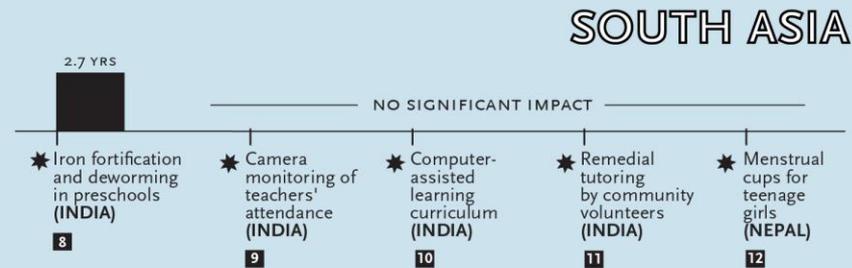
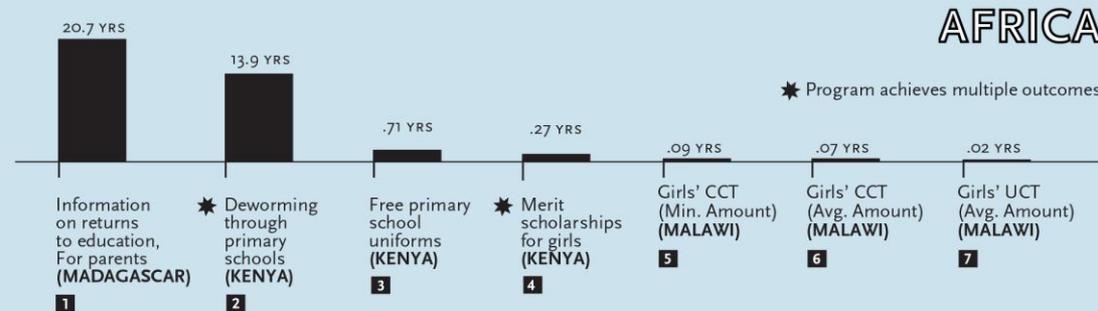
Impact on Portuguese score = 4.70

Cost per student = \$1.76

Cost Effectiveness Ratio = $\$1.76/4.70 =$
\$0.37 to raise score 1pt per child

Which “investment” would you implement?

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



Which “investment” would you implement?

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 Girls' CCT (Min. Amount)	Malawi	2 years	0.03	0.09	0.16
6 Girls' CCT (Avg. Amount)	Malawi	2 years	0.03	0.07	0.12
7 Girls' UCT (Avg. Amount)	Malawi	2 years	0.00	0.02	0.04
8 Iron Fortification and Deworming in Preschools	India	1 year	0.10	2.7	5.3
9 Camera Monitoring of Teachers' Attendance	India	–	NO SIGNIFICANT IMPACT		
10 Computer-Assisted Learning Curriculum	India	–	NO SIGNIFICANT IMPACT		
11 Remedial Tutoring by Community Volunteers	India	–	NO SIGNIFICANT IMPACT		
12 Menstrual Cups for Teenage Girls	Nepal	–	NO SIGNIFICANT IMPACT		
13 Information Session on Returns to Education, for Boys	Dominican Republic	4 years	1.0	3.1	5.2
14 PROGRESA CCT for Primary School Attendance	Mexico	4 years	0.02	0.03	0.04

Opportunities for Saving

Challenges in Designing ECE Interventions

The Jamaica experiment in the 1980s, intervention targeted to 129 stunted children 9-24 months in Kingston that lasted for 2 years, demonstrates the potential of early childhood interventions.

However, some **outstanding key questions** to address:

1. How to design scalable interventions that are both:
 - ✓ cost-effective?
 - ✓ sustainable in the long run?
2. Can (how) these interventions affect household behaviour?
3. Externalities in knowledge transmission: spillovers of these interventions in the family and the broader community?

Cluster Randomised Trial of the effect of Timing and Duration of Early Childhood Interventions in Odisha - India

1. Policy questions:

- What is the best timing or duration of interventions under 6?
- Are interventions better at age 1-3 or 3-6?
- Will children intervened <3 benefit more from interventions when 3-6?
- Can children who begin ECI at 3 catch-up?

2. Proposal

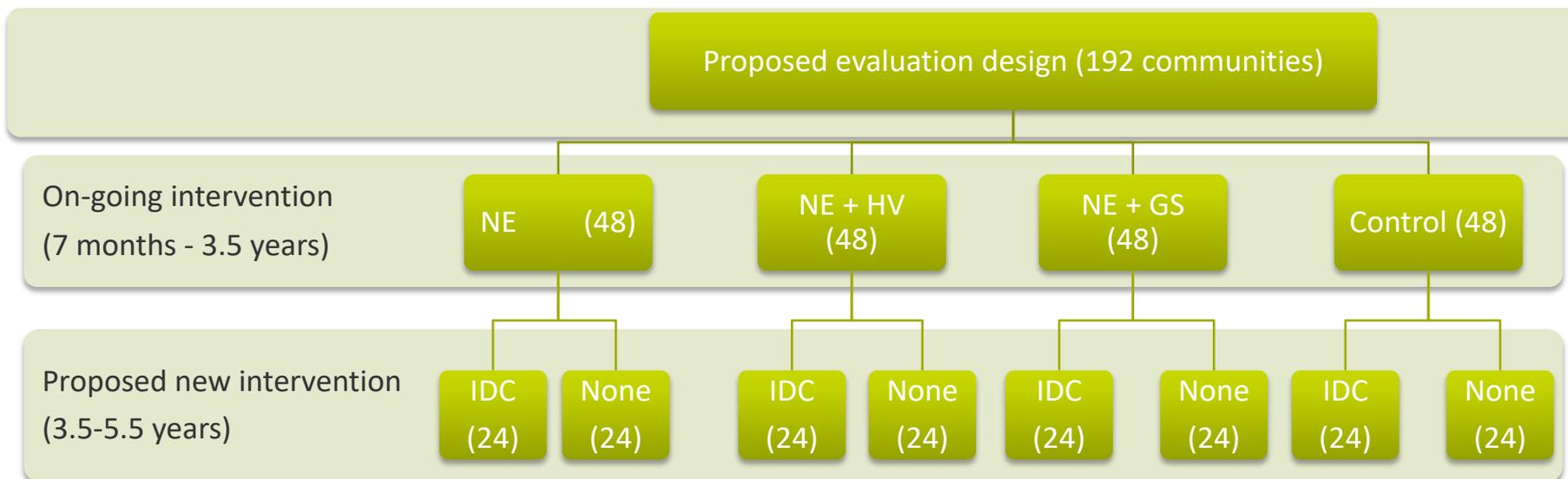
- We propose to design a pre-school intervention for children aged 3-6 building on an ECI experimental evaluation we are completing for children <3 in Odisha.

3. Output

- We aim to establish the best age to start intervention (in the 1st year or at 3) and the value of continuing to intervene from the 1st year up to school entry.

Cluster Randomised Trial of the effect of Timing and Duration of Early Childhood Interventions in Odisha - India

4. Evaluation Design



We now have a **unique opportunity** to evaluate how the proposed Enhanced Preschool Program **interacts** with participation in the Stimulation & Nutrition Education Program

Cluster Randomised Trial of the effect of Timing and Duration of Early Childhood Interventions in Odisha - India



Opportunities for Savings

- To work with local partners → this poses important issues if one wanted to scale up the program
- Interventions to be delivered by women in the villages trained by mentors from local partners (well-known in locality, leadership/networking skills)
- Supervision and mentoring (through the local partners personnel; in-service training) play a very prominent role → Make mid-intervention adjustments
- Starting point: Complement the services offered by the local educational government → curriculum design, training, equipment, etc – THIS IMPLY WORKING IN CLOSE AND ON-GOING COLLABORATION WITH LOCAL GOVERNMENT
- The interventions rely on materials that are locally available or have the potential of innovative local contextual modifications
- Introduction of new technologies

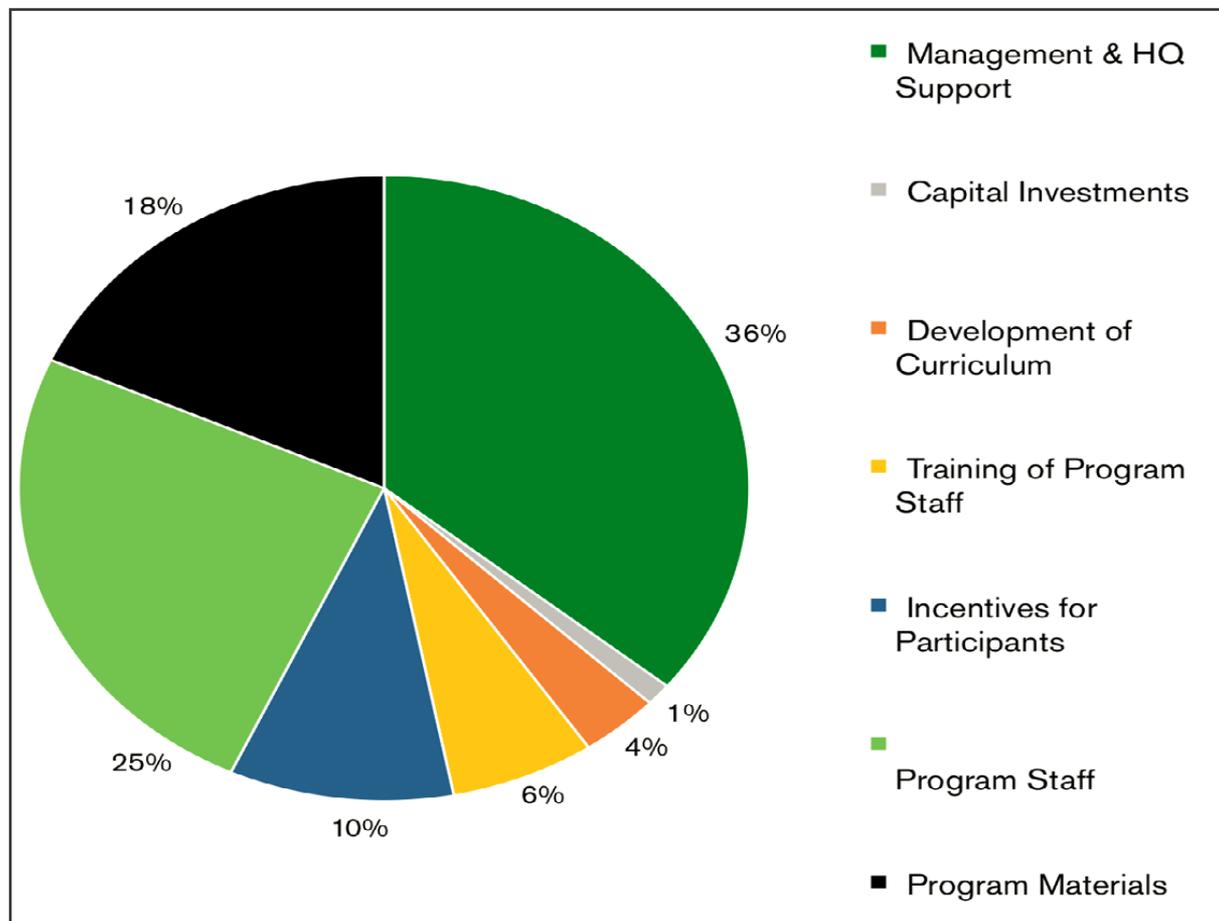


Inform Scale-Up Costs

How a Program Could Be Improved During Future Implementation?

Insights:

- Increase Scale → increased program efficiency
- Cheap opportunities for quality improvements



Overview of the talk

- Facts about Costing of ECE
- Why is Cost Analysis of ECE Important
- **What Should Cost Data Look Like**
- Capturing Costs
- Analyzing Costs

What Should Cost Data Look Like?

Disaggregate!
Disaggregate!
Disaggregate!

A program's budget and financial information must be disaggregated using the **ingredients method** if you want to gain insights from cost analysis

*You can also think of it as an **investigation** into the cost details of an intervention*



Pre Analysis Plan for Costing

What if we DO NOT Disaggregate?

Cost different activities within the same program?

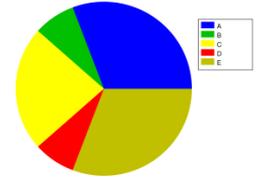
Differentiate marginal costs from total program costs

Achieve accuracy and precision

Show how costs evolve over time

Identify cost savings

Conduct sensitivity analysis or help scale-up program



What if we DO NOT Disaggregate?

BUDGET		
		TOTALS USD
Staff		\$145,684
Other Staff - Intervention Technical Expertise		\$20,000
Other Costs		\$34,748
Implementation		\$90,036
Data collection		\$216,000
GRAND TOTAL		\$506,469

What is this data missing?

What if we DO NOT Disaggregate?

BUDGET		TOTALS USD
Staff	Principal Investigators	\$24,269
	Senior Research Assistants	\$30,064
	Research Assistants	\$45,800

Particulars	Unit	# of units	Cost USD	# per year	Total
Reviews & Trainings					
Training for Mentors (Training for 60 days)(10 mentors+20%extra+3 district coordinators+3 project manager and associates+1 helper+2 trainers)	person	21	2.1	60	\$2,646
Training for Anganwadi helpers (Training for 55 days)(100 anganwadi helpers+10% extra+10 mentors+3 district coordinators+3 project manager and associates+1 helper+2 trainers)	person	129	2	55	\$10,643
Accommodation for trainers (facilitators team)	night	5	6	115	\$3,450
Community meetings (before and after the intervention)	person	100	2	1	\$150
Review meetings with the anganwadi helpers (100 anganwadi helpers+10 mentors+3 district coordinators+3 project manager and associates)	person	116	1	12	\$696
SUB-TOTAL Reviews & Trainings					\$17,930
	Data collection - baseline		\$72,000		
	Data collection - midline		\$72,000		
	Data collection - endline		\$72,000		
	SUB-TOTAL Data Collection		\$216,000		
GRAND TOTAL			\$506,469		

An Ingredients Approach to costing impact evaluations

Essentially, an Investigation that uncovers, quantifies and values all resources and efforts required to make an intervention happen

The Ingredients Method

In determining costs, important questions include

- What are the criteria for determining costs?
- How complete are the costs? Do they cover all of the requirements needed to produce the effects on which benefits are based?
- Do the costs use comparable prices for comparison (e.g., local versus national prices for goods and services can vary dramatically in price)?
- Is the information adequate for an observer to replicate results?

The Ingredients Method

List All Inputs to the Program (obtain from budgets, papers, interviews, expenditure reports, grant docs)

Tag inputs with ingredients: Personnel, Equipment/capital goods, supplies, admin and overhead, etc.

Valuing ingredients: quantities and prices, nature of unit cost.

Timeline

Allocation Percentage (obtain from interviews with project team, or regular reporting on time and effort data)

Input / Activity
Partial honorarium for 3-4 years intervention's teachers (Gross)

Item category
Personnel - frontline/direct delivery

Nature of unit cost	Number of units		Nominal unit price	
	2016	2017	2016	2017
Teacher months	1040	1240	1250	1250

Number of units		Nominal unit price		Allocation to Intervention		Nominal estimated cost	
2016	2017	2016	2017	2016	2017	2016	2017

Allocation to Intervention	
2016	2017
50%	50%

Costing Input / Activity	Nature of unit cost	Tracking necessary? (y/N)	Fixed / Lumpy / Variable	Data Source	Item category	Number of units		Nominal unit price		Allocation to Intervention		Nominal estimated cost	
						2016	2017	2016	2017	2016	2017	2016	2017
Partial honorarium for 3-4 years intervention's	Teacher months	Monthly	Variable	SCI ECCD	Personnel - frontline/direct	1040	1240	1250	1250	50%	50%	650,000	775,000

The Ingredients Method

In determining costs, key information for **Disaggregated Costs**

1. Log-frames (list of activities, outputs, outcomes)
2. Quantity and price data
3. Time and effort data
4. Budget and actuals data
5. Interviews with project staff
6. Observational data

The Ingredients Method

In determining costs, key information for **Disaggregated Costs**

1. Log-frames (list of activities, outputs, outcomes)
2. Quantity and price data
3. Time and effort data
4. Budget and actuals data
5. Interviews with project staff
6. Observational data

How off can you be if not disaggregate!

Reading Module for Children

Aggregate Salary (from budget)						
Budget Line	Schools	Personnel Cost Per School	Spending			
School Personnel	467	\$ 5,643.00	\$ 2,635,281.0			
Salaries Disaggregated						
Cost Ingredient	Price (Gross monthly Salary)	Quantity (number of personnel working on reading module)	Time (Months worked in which reading module implemented)	Effort (percent of hours spent on reading module during months implemented)	Total	
School Teacher	\$ 404.04	432	6.21	31%	\$ 336,017.12	
School Principals	\$ 943.00	41	5.23	15%	\$ 30,331.12	
TOTAL					\$ 366,348.24	
<i>How do we get the data on Time and Effort? The below template is distributed to all headmasters</i>						
Time and Effort Collection Template (to be answered by school headmaster)						
Question					Time/Effort Amount	
During how many months in the last quarter was the reading module implemented						
During the months it was taught, how many days per week was the reading module conducted						
During the days it was taught, what percentage of work hours did teachers devote to the reading module						
How many months did you personally have to monitor and supervise the reading module intervention						
During the months that you monitored and supervised the reading module, what percentage of your time did you devote to the intervention						

Overview of the talk

- Facts about Costing of ECE
- Why is Cost Analysis of ECE Important
- What Should Cost Data Look Like
- **Capturing Costs**
- Analyzing Costs

Four Steps

1. Take stock of budgets

U.S. Agency or Department	FY 2009 actual	FY 2010 estimate	FY 2011 proposed	Percent change
Defense	81,121	81,090	77,548	-5.4
Natl and other HHS R&D	41,858	31,177	32,168	2.9
Energy	13,268	10,693	11,219	3.8
NASA	11,677	9,286	10,989	17.0
NSF	7,576	5,892	5,571	-8.2
Agriculture	2,613	2,591	2,448	-6.5
Commerce	1,969	1,516	1,727	12.7
Homeland Security	1,096	1,150	1,040	-10.0
Innovation	715	755	712	-1.1
EPA	559	622	651	3.5
Other Agencies and Departments	3,159	3,381	3,072	-4.5
TOTAL	165,471	147,353	147,696	-9.9

- Ascertain all relevant budget and financial material and discuss data sources with program team

2. Ex-Ante Analysis



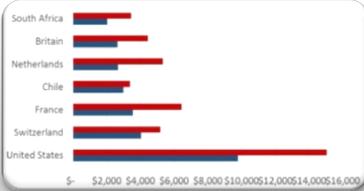
- Assess the state of all existing financial data about the project, and whether the structure of this data can answer all important questions about the cost structure of the program

3. Data Collection Plan



- Determine what data needs to be collected in real-time to ensure accuracy of cost projection

4. Finalize Cost Estimate

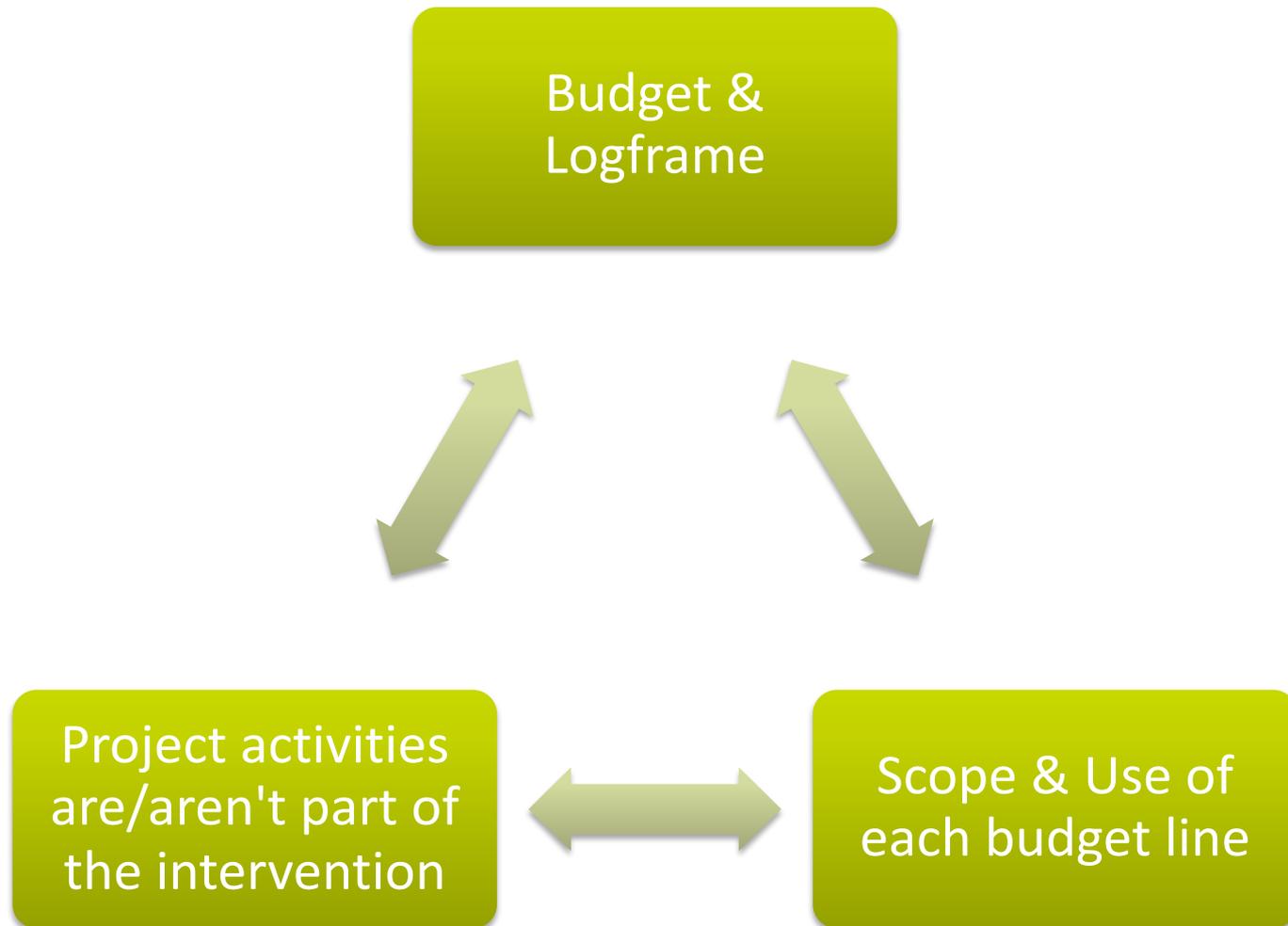


- Fill in cost model with final actual expenditure data, as well as time, effort, quantity and price data; Generate final unit cost estimates

Steps 1-3 have to happen before the intervention even starts!

1. Take Stock of Budgets

Take Stock of Budgets

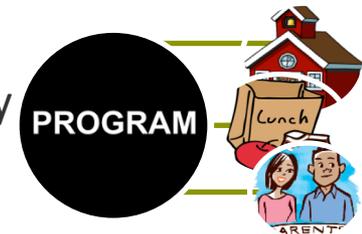


Some questions to ask the Project Team

- Which orgs are funding and implementing?
- Evaluate program as a whole, or each component separately
- What sources of data are available, and how are these sources organized and updated
- Are there major funding sources or resources that do not need to be considered, such as construction costs



VS.

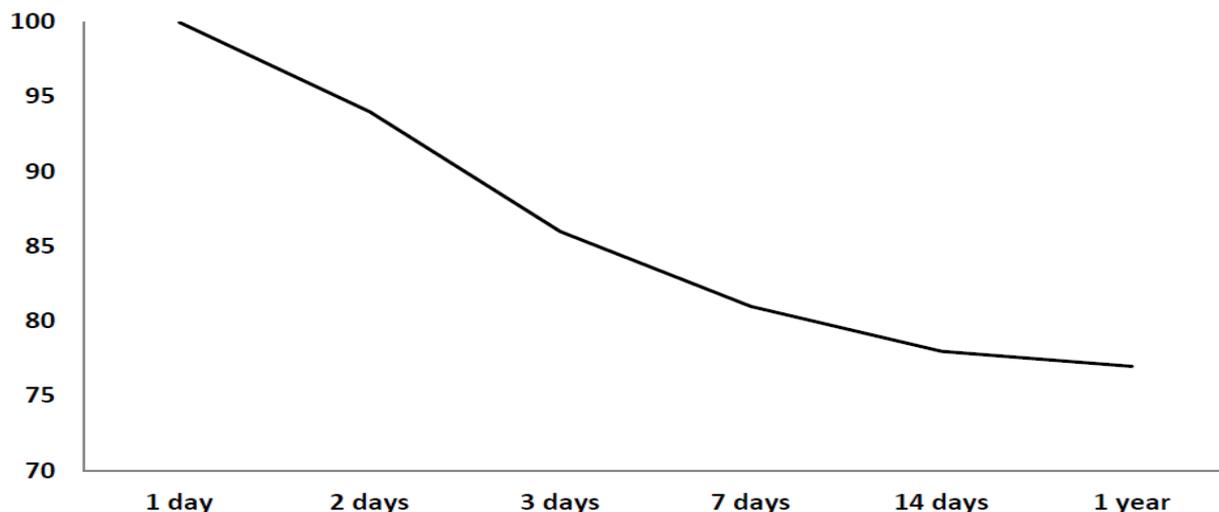


2. Ex-Ante Analysis (Pre Analysis Plan)

Ex-Ante Analysis

- Analytical investigation leading up to the ingredients method, and all conducted **BEFORE** the intervention
- Most costing done after close of interventions (**retrospective / ex-post analysis**).
- Retrospective analysis is likely very inaccurate in many interventions. **Recall bias** + sources are hard to track down after intervention close.

Figure 13: Expenditure Recall in Ghana



Source: Adapted from Scott & Amenuvegbe 1990.

Ex-Ante Analysis: Goals

- Compare marginal cost-effectiveness of full program with a private school initiative measuring same outputs
- Be able to project cost of implementing program in a different geographic location
- Financial planning on a 3-10 year time horizon for the Minister of Education
- Determine how cost-effective the program would be at scale

Ex-Ante Analysis: Goals

How does a program's marginal cost change when scaled?

- | | |
|--|-----------------------------------|
| <input type="checkbox"/> Curriculum development | <input type="checkbox"/> Fixed |
| <input type="checkbox"/> Textbooks for students | <input type="checkbox"/> Variable |
| <input type="checkbox"/> Software license | <input type="checkbox"/> Fixed |
| <input type="checkbox"/> Cash transfers to beneficiaries | <input type="checkbox"/> Variable |
| <input type="checkbox"/> Construction of new schools | <input type="checkbox"/> Lumpy |
| <input type="checkbox"/> Investments in municipal institutions | <input type="checkbox"/> Lumpy |

Ex-Ante Analysis: Issues – Scope of Analysis

Be careful when there is significant variation in:

- Service Delivery (different type or intensity of services provided)
- Geographic analysis (i.e. program implemented differently across locations)
- Administrative Analysis (different models for management)



Consider choosing between **Activity Based** costing and **Variant (geographic/population) Based** costing

3. Data Collection Plan

A monthly or quarterly data collection plan may be required based on what you discover in your ex-ante analysis

Data Collection Plan

- Regularly reporting data can allow cost experts, finance personnel, or research teams to generate expenditure analyses in real-time!
- This can help project teams realize:
 - Savings, and
 - Make mid-intervention adjustments

Time & effort again!

Problem: unclear % of work hrs school staff put into a reading module being costed

Monthly Logs

- Teachers fill out monthly log estimating 1) number of days worked on reading module and 2) how many hours were typically spent on the reading module on days where it was taught.

School Report (Quarterly)

- Principals compile monthly logs in school-wide report
- Principals record percent of their own time spent on managing reading module over the quarter
- Principals record quarterly estimate of supplies and equipment used for reading module

HQ Report

- Finance staffer responsible for cost reporting compiles all principal reports into a master report on time and effort
- Allocation percentages generated for the cost model based on master report

4. Finalize Cost Estimate



Finalize Cost Estimate

- Replicate the steps taken in the ex-ante analysis with the finalized actual expenditure data.
- Determine total cost for each relevant Intervention you are costing.
- Develop a final model that analyzes costs and breaks them down into categories.
- PUBLISH findings of cost-effectiveness.

When a project closes, you should already be able to estimate cost!

Overview of the talk

- Facts about Costing of ECE
- Why is Cost Analysis of ECE Important
- What Should Cost Data Look Like
- Capturing Costs
- **Analyzing Costs**

Cost Sensitivities

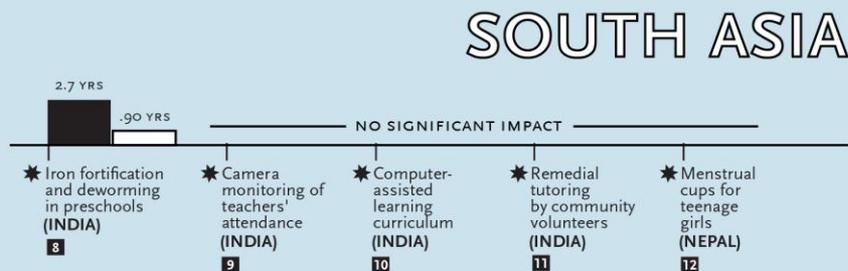
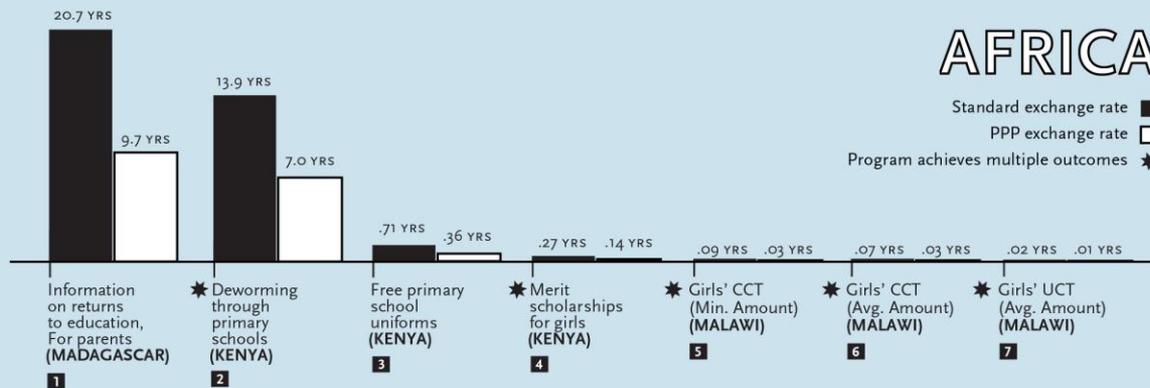
- Discount rates
- Price fluctuations (or price differences across locations)
- Changing costs over time
- Does the “margin” change when the program is scaled
- Currency

Is the model detailed enough?!

Sensitivity Analysis

COST-EFFECTIVENESS: SENSITIVITY TO EXCHANGE RATES

(Additional years of education per \$100 spent)



Greater return on investment

\$1 → **\$7**

Invest **Return**

Every dollar invested on prenatal and early child development yields a seven-dollar return to society.



Invest

Invest in educational and developmental resources for disadvantaged families to provide equal access to successful early human development.



Develop

Develop cognitive skills and social skills in children early—from birth to age five when it matters most.



Sustain

Sustain early development with effective education through adulthood.



Gain

Gain more capable, productive and valuable citizens that pay dividends to America for generations to come.

SOURCE: HECKMANEQUATION.ORG

References

- Dhaliwal, JPAL Presentation
- Horton, S., H. Alderman, and J. Rivera. 2008. “Hunger and Malnutrition.” Copenhagen Consensus 2008 Challenge Paper. Copenhagen Consensus Center.
- IRC Brief, “Cost Effectiveness Analysis: Improving Parenting Practices in Liberia and Thailand” International Rescue Committee.
- Iqbal Dhaliwal, Esther Duflo, Rachel Glennerster, Caitlin Tulloch, “Comparative Cost-Effectiveness Analysis to Inform Policy in Developing Countries: A General Framework with Applications for Education”, JPAL, 2012.
- Joshua Angrist, Eric Bettinger, Erik Bloom, Elizabeth King, Michael Kremer, “Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment,” *The American Economic Review*, Vol. 92 No. 5.
- Levin, McEwan, “Cost Effectiveness Analysis: Methods and Applications (2nd edition),” Sage Publications Inc., 2001.
- McEwan, P. 2012. CEA of Education and Health in Developing Countries. *Journal of Development Effectiveness*
- B. Warburton and R. Cullen, “Cost-effectiveness of different Possum control methods,” Wellington, N.Z.: Dept. of Conservation, 1995. 1 v. ; 30 cm. (Science for conservation, 1173–2946 ; 4.