Home Visiting in Colombia: Impacts of a Scalable Intervention

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Human Capital Accumulation in Developing Countries

Introduction and Motivation

- In designing policies towards Human capital a key issue is when (and how) to intervene.
- The work on adult training (e.g. Heckman, LaLonde and Smith(1999)) and indeed on school quality often suggest that interventions work best for better equipped students (e.g. Machin, McNally and Meghir, 2010)
- A view is emerging that
  1. Investments over the life-cycle are complementary
  2. Early investments can have very high returns
  3. Early deficits are very hard/costly to reverse
- This idea has been formalized by Cunha, Heckman and Schennach (2010) by estimating HC production functions linking different parts of the life-cycle

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Introduction

- This brings forward the question of the role of policy and how this interacts with household behavior
  - Can policy be effective in this area?
  - Can impacts be achieved with sustainable costs at a reasonable level?
  - Does policy reinforce investments in children or does it crowd out resources?
  - Are the effects of policy sustainable in the longer run?

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Background

- There has now been a substantial amount of research on various early childhood interventions.
- Prominent studies include:
  - The Perry pre-school experiment
  - The ABCDerian
  - The Jamaica experiment of Sally Grantham-McGregor and co-authors.
- Both “Perry” and “Jamaica” have demonstrated incredibly strong results that are sustained in the long run.

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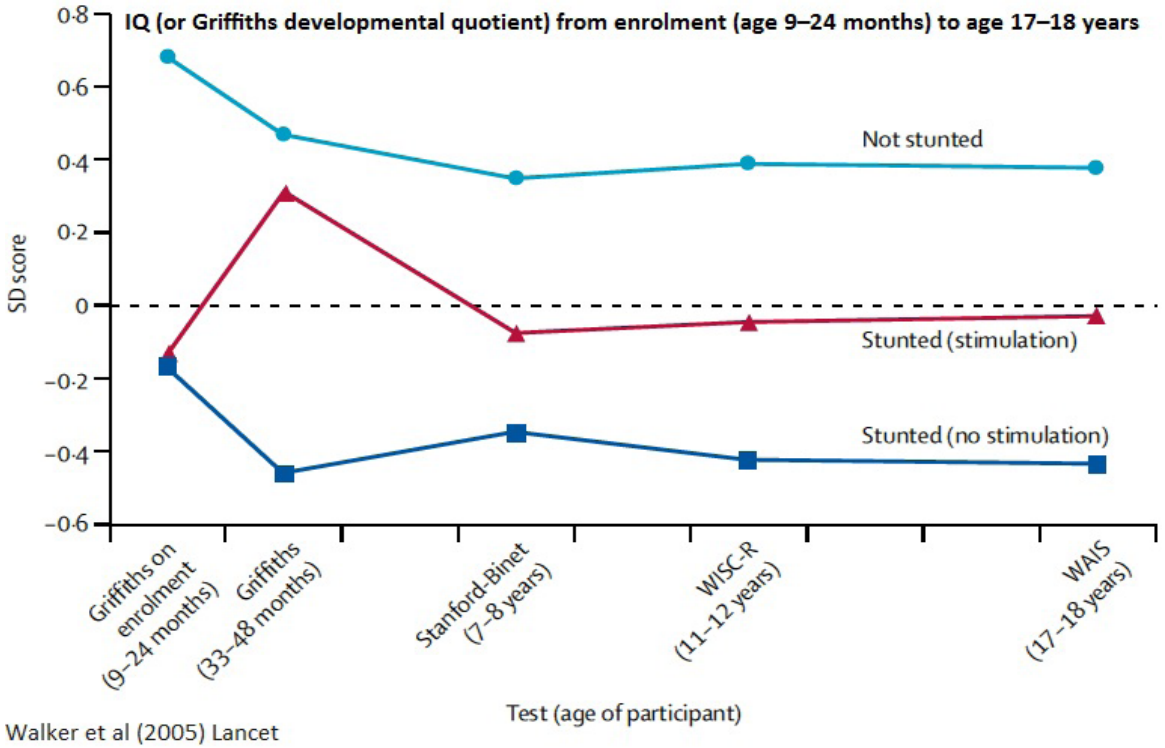
- Both “Perry” and “Jamaica” have demonstrated incredibly strong results that are sustained in the long run.

The Jamaica Experiment

- The Jamaica experiment included three treatments and a control group
- The treatments were:
  - Infant Stimulation
  - Nutrition (calories)
  - Both
- The stimulation followed a structured curriculum, that we will discuss later
- It was delivered by professional health assistants
- It targeted children from 9-24 months and the intervention lasted 2 years

The Jamaica Experiment

- Grantham-McGregor and colleagues have demonstrated using the Jamaica experiment that cognition effects are sustainable



Walker et al (2005) Lancet

- Recently Gertler, Heckman, McGregor et al. (2012) have shown that the effects are as important in labor market outcomes.

Some Important Questions

- The Jamaica experiment has demonstrated the potential of early childhood interventions for improving human capital.
- However we need to address to key questions:
  - How can we design scalable interventions that are cost effective and sustainable?
  - How do these interventions affect household behavior, in terms of investments in children, crowding-in or crowding-out of resources?
  - What kind of spillovers do these interventions have in the family and the broader community/network?
- We set out to answer at least some of these questions

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An Intervention in Colombia

- We designed a Stimulation and micronutrient supplementation intervention in Colombia
- The basic structure was guided by the Jamaica experiment by Sally Grantham-McGregor et al. 1991 - Lancet (SGM)
- However there are three important new elements:
  - Intervention: the emphasis on designing the program using local resources and existing infrastructure in a scalable fashion
  - Research Design: collect detailed household data to allow modeling the behavioral impact of the intervention to identify mechanisms
  - Evaluation: Community level randomization

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The Intervention

- Rather than using professional health workers we select local women to implement the intervention.
- These are elected mediators between the beneficiaries of the Colombian CCT program Familias en Accion and the government. They are termed “Madres Lideres” (ML).
  - better educated
  - leadership and entrerpeneurship
  - but still they are part of the community they are intended to serve.
- This is the key element for the scalability of the program.

Scaleability

- We therefore train and hire the ML to deliver the intervention
- This has a number of advantages:
  1. The intervention costs are low
  2. The local women may become agents of change within their communities
  3. The communities may take ownership of the intervention thus making it sustainable.

The Design

- We first train some graduates (psychology, education etc.) from Bogota in the curriculum:
  - They were the trainers of the visitors (ML)
  - Each trained the MLs in 8 towns.
- The MLs were trained for three weeks.
  - A scaled up intervention could do better and would have to have a regular update to the training
  - it could use local 'trainers'
- Upon completion of the training the trainers become mentors/supervisors that followed the intervention throughout.
- The intervention lasted for 18 months. Two years would probably be better but we had inadequate funds
- Each ML visited 5-6 children and their mothers and distributed the micronutrients.

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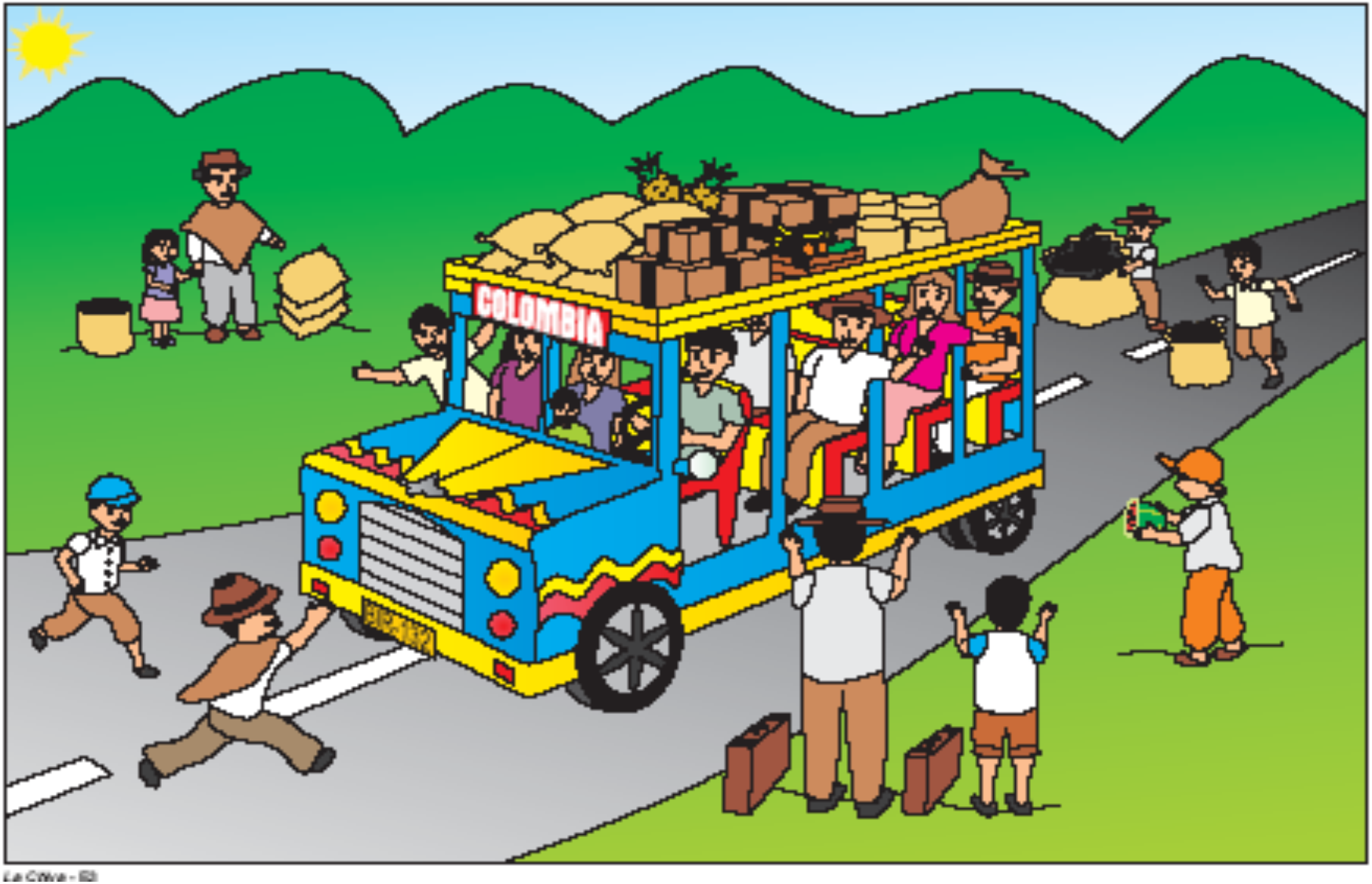
The Grantham-McGregor Curriculum for Colombia

- Promote child-development in an integrated manner:
  - motor, language, cognitive, socio-emotional
- Encourage mothers to teach her children based on events surrounding daily routine activities
- Involve other children or members of the family where possible – this could generate important spillovers.

Types of Activities – Culturally adapted

- Picture Books
- Pictures to stimulate conversation
- Puzzles
- Cubes/Blocks and patterns
- Toys from recycled material
- Language games and songs.

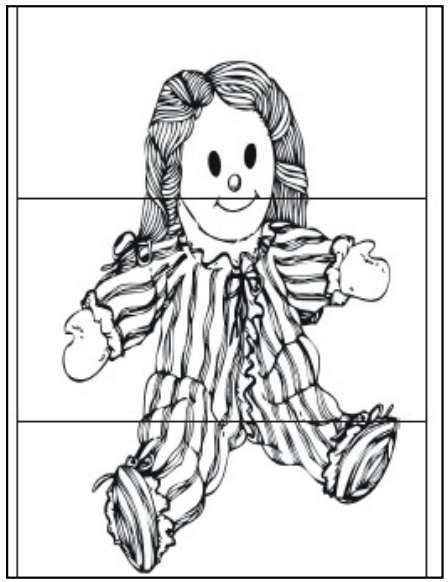
Conversation Scenes



Puzzles

Rompecabezas Pallaso

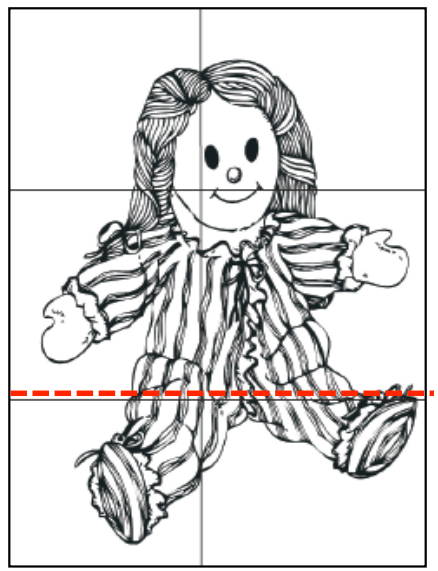
(21 meses en adelante)



Rompecabezas Muñeca

3 piezas (31 meses +)

6 piezas (41 meses +)



Toys

Home Visits

Research Questions

- At some level it is accepted that well designed ECD interventions can produce spectacular results
  - The Jamaica intervention is a leading example, but there are others, such as the Perry pre-school experiment and others.
- Here we pose some new research questions:
  - Can we make it work by drawing on local resources?
  - Why do these interventions work? How do households change their behavior? What is the HC production function and how does it change?
  - How do the effects vary by economic environment, gender etc.?

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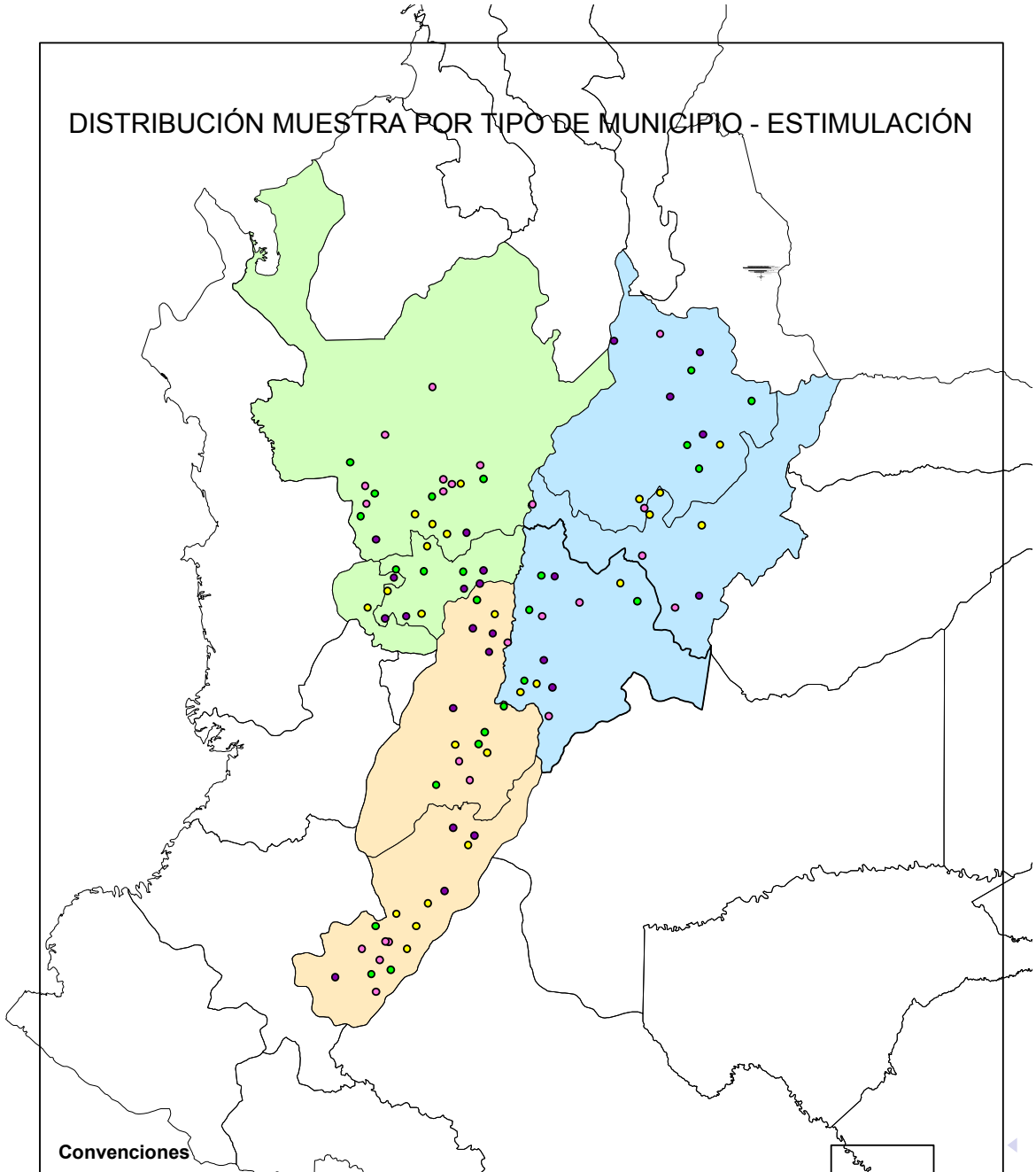
Evaluation Design

- To answer these questions we designed an RCT and collected rich household data
- 96 municipalities in 3 regions
- ~1440 children from 12 to 24 months at the start of the intervention
- Semi-urban localities with 5000 to 50000 inhabitants

Evaluation Design

- Random Assignment to four different groups
  - Stimulation
  - Micronutrient Supplementation
  - Stimulation and Micronutrients
  - Control (nothing - just observation)

The Random Assignment



Evaluation

- Choosing the children/families:
- In both treatment and control we drew randomly 3 MLs
- The families with children in the 1-2 year age group became our subject families (in both treatment and control)
- If the ML refused to participate we still kept the families so there is no selection bias between treatment and control. We just replaced the ML and kept the same families

Evaluation

- February – May 2010: Baseline Data Collected;
  - Socio-Economic questionnaire;
  - Developmental measures for the children;
  - Information about the mothers and child-rearing practices.
- All baseline data was completed before the start of the intervention
- September - December 2011: End of intervention and collection of follow up data
- Focus Groups

Data and Measurement

- Extensive socio-economic, psychometric and anthropometric data collection at:
  - baseline (Jan – March 2010): ~1400 children ages 12 to 24
  - after 18 months (June – Sept 2011): ~1400 children ages 30 to 42 months
- Phase-in of intervention (train facilitators) as baseline data is collected.

Measures of child development

- Bailey-III
  - Cognitive, Expressive and Receptive Language, Fine & Gross Motor Development
- MacArthur-Bates
  - Expressive Language
- Bates Temperament
  - Difficult, Unstoppable, Unadaptable, Unsociable
- Rothbart (3 scales at follow up only)
  - Attention, Inhibitory control, Sociability
- Height, weight, haemoglobin and Morbidity
- Family Care Indicator
  - Play material, play activities, books for adults.
- Food Intakes (target child and <6 children in household)
- Child care arrangements & Time Use (target child and <6 children in household)

Mother Questionnaire

- General Household Socio-economic Characteristics
- Education, labour supply and time use
- Reproductive History
- Health Condition
- Height, weight and haemoglobin
- Aversion to Inequality and to Risk
- Depression (CESD)
- Knowledge on Parenting
- Parenting Practices & the Home Environment

Home Visitor Questionnaire

- Education, labour supply and time use
- Health Condition
- Aversion to Inequality and to Risk
- Knowledge on Parenting & Children

Baseline Results

Mother's variables		Control	Home Stimulation	Nutrition + Home Stimulation	Nutrition	Total
Age	N	337	356	354	348	1395
	Mean	26.09	26.54	26.40	26.01	26.26
	Std. Error	0.38	0.36	0.35	0.33	0.18
Employed or self-employed	N	337	356	354	348	1395
	Mean	47.18%	43.82%	46.33%	44.83%	45.52%
	Std. Error	2.72%	2.63%	2.65%	2.67%	1.33%
Years of education	N	337	356	354	348	1395
	Mean	7.46	6.98	7.40	7.32	7.29
	Std. Error	0.20	0.19	0.19	0.20	0.10
Literacy	N	337	356	354	348	1395
	Mean	96.74%	95.22%	97.74%	96.84%	96.63%
	Std. Error	0.97%	1.13%	0.79%	0.94%	0.48%
Number of children	N	339	356	354	348	1397
	Mean	2.19	2.54	2.28	2.26	2.32
	Std. Error	0.08	0.09	0.08	0.08	0.04
==1 if mother goes to school/university	N	337	356	354	348	1395
	Mean	12.17%	9.55%	11.58%	7.18%*	10.11%
	Std. Error	1.78%	1.56%	1.70%	1.39%	0.81%

Baseline Results

Mother's Health

Mother's variables		Home Stimulation	Nutrition + Home Stimulation	Nutrition	Control
Anaemia	Mean	23.42%	19.71%	22.29%	20.12%
	Std. Error	2.32%	2.16%	2.29%	2.23%
BMI	Mean	25.29	24.99	24.59	25.16
	Std. Error	0.27	0.26	0.24	0.26
CESD 10	Mean	8.41	8.91	9.57	9.36
	Std. Error	0.30	0.29	0.30	0.31
Depressed	Mean	38.44%	42.35%	44.88%	46.44%
	Std. Error	2.67%	2.68%	2.73%	2.78%

Baseline Results

Child Health

- There are clear nutritional deficiencies
- Substantial stunting relative to international standard
- Height deficiency, but BMI above international standard

Z-scores		Control	Home Stimulation	Nutrition + Home Stimulation	Nutrition
Weight for age	Mean	-0.26	-0.16	-0.18	-0.17
	Std. Error	0.05	0.06	0.05	0.05
Lenght (height) for age	Mean	-0.83	-0.73	-0.74	-0.58*
	Std. Error	0.06	0.06	0.06	0.06
BMI for age	Mean	0.35	0.39	0.37	0.25
	Std. Error	0.05	0.06	0.05	0.05
weight/lenght for age	Mean	0.20	0.25	0.23	0.15
	Std. Error	0.05	0.06	0.05	0.05

Baseline Results

Child Health

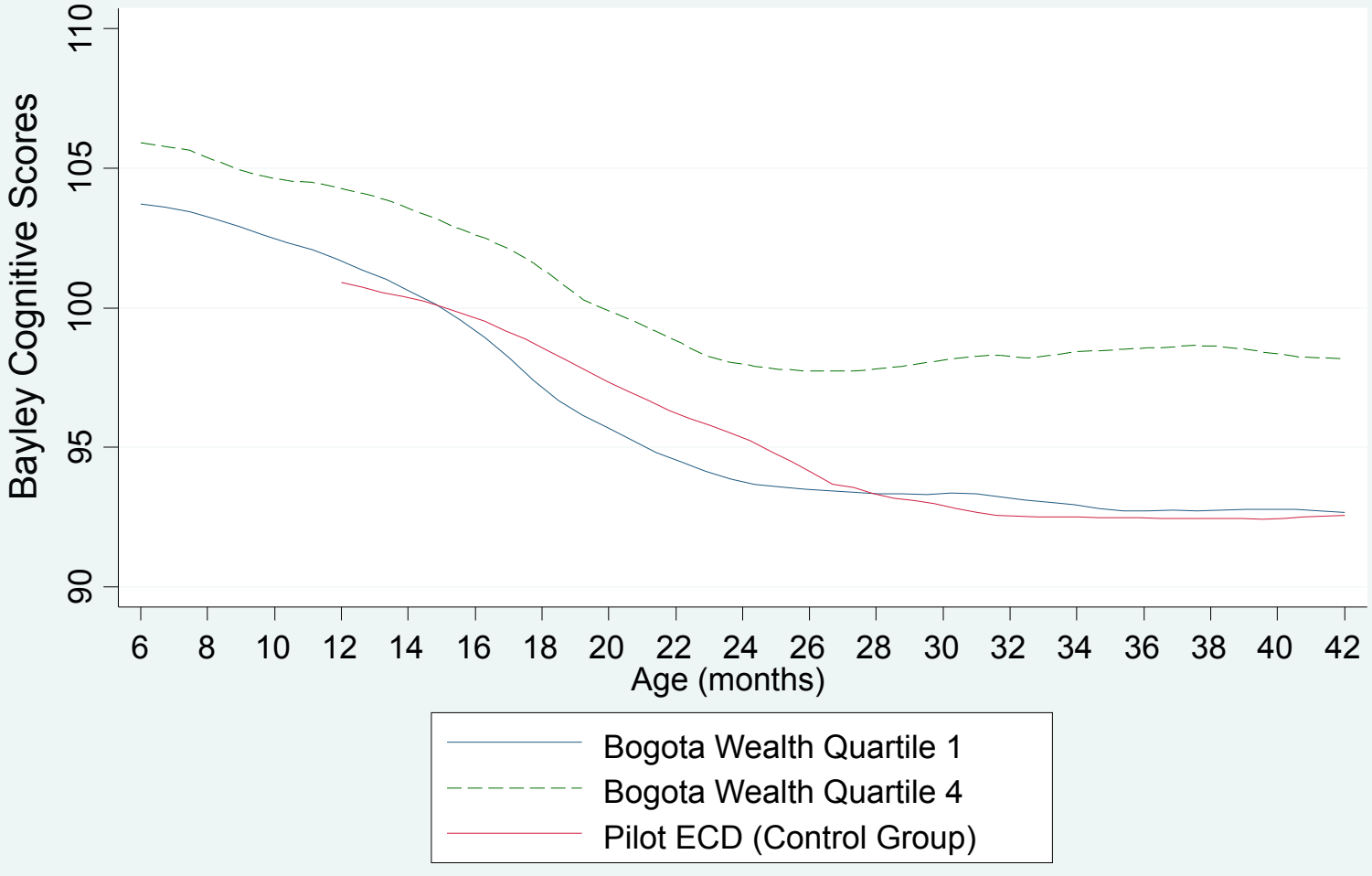
Variable		Control	Home Stimulation	Nutrition + Home Stimulation	Nutrition
Diarrhea (last 15 days)	Mean	37.01%	34.47%	33.33%	37.93%
	Std. Error	2.64%	2.54%	2.51%	2.60%
Stunting	Mean	12.24%	11.11%	10.73%	8.33%
	Std. Error	1.79%	1.68%	1.65%	1.48%
Wasting	Mean	0.60%	2.84%*	1.41%	1.15%
	Std. Error	0.42%	0.89%	0.63%	0.57%
Undernourishing	Mean	2.69%	4.56%	3.95%	1.44%
	Std. Error	0.88%	1.11%	1.04%	0.64%
Anaemia	Mean	41.49%	41.31%	38.98%	41.67%
	Std. Error	2.70%	2.63%	2.60%	2.65%

Baseline Results

	Congnitive	Language	Motor
	b/se	b/se	b/se
Gender (==1 if male)	-0.872	-4.429***	-1.057
	(0.58)	(0.7)	(0.76)
Age	-0.698***	-0.346**	0.444***
	(0.1)	(0.11)	(0.11)
Kid is anaemic	-1.395*	-0.945	-0.522
	(0.57)	(0.65)	(0.83)
Kid is wasted	-1.707	-1.68	-3.189
	(2.94)	(2.72)	(3.33)
Kid is stunted	-2.945**	-3.007**	-2.914*
	(0.94)	(1.08)	(1.35)
kid is undernourished	-2.952	-0.999	-3.539
	(2.76)	(2.48)	(2.97)
Years of education Mother	0.325***	0.430***	0.228*
	(0.09)	(0.09)	(0.1)
Factor: Utilities	0.572	0.208	-0.028
	(0.31)	(0.41)	(0.41)
Factor: Possesions	0.468*	0.427	0.664**
	(0.18)	(0.25)	(0.23)
Number of children under 6 years	-1.022*	-2.507***	-1.246**
	(0.44)	(0.52)	(0.43)
Weight at birth	0	0	0
	(0)	(0)	(0)
Was he breastfed?	4.187*	0.953	3.392
	(2.1)	(1.78)	(2.58)
constant	101.981***	99.237***	83.833***
	(3.78)	(4.63)	(5.33)

Wealth Gap - Age and Cognition

Comparison with Bogota Study Data on Wealth Gradien



Attrition

- Sample Loss between household survey and Bayley test Baseline: 9 children (0.62%). Follow Up : 55 children (4.13%)
- Attrition between survey rounds (18 months): Household Survey: 3.52%.
- Bayley Test: 7.51% small imbalance (under investigation...)

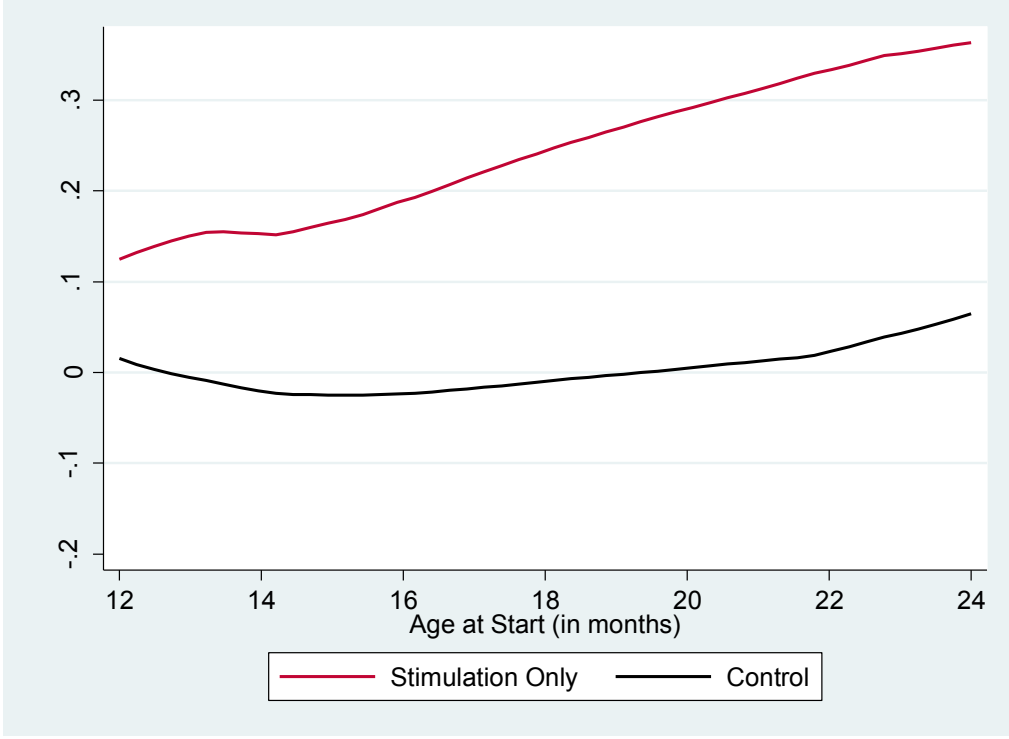
Spatial dependence and Precision

- The design consists overall of 24 communities in each branch and about 15 children per community
- It was quite hard to predict spatial correlation in advance given the kind of outcomes we were considering
- It turns out that the spatial correlation once we condition on baseline characteristics is down to about 0.04 or less (depending on the outcome).
- So this implies an effective sample size of about 220 per variant (880 overall)
- This implies that our study has much larger effective sample size than the Jamaica study (for example) where the total sample size was 129 (32 observations per variant)

Effects on Cognition (Bayley) by Age at Intervention Start

	All	12-18 mths	18-24 mths
Stim (in SD)	0.251**	0.197+	0.357**
	(0.073)	(0.111)	(0.092)

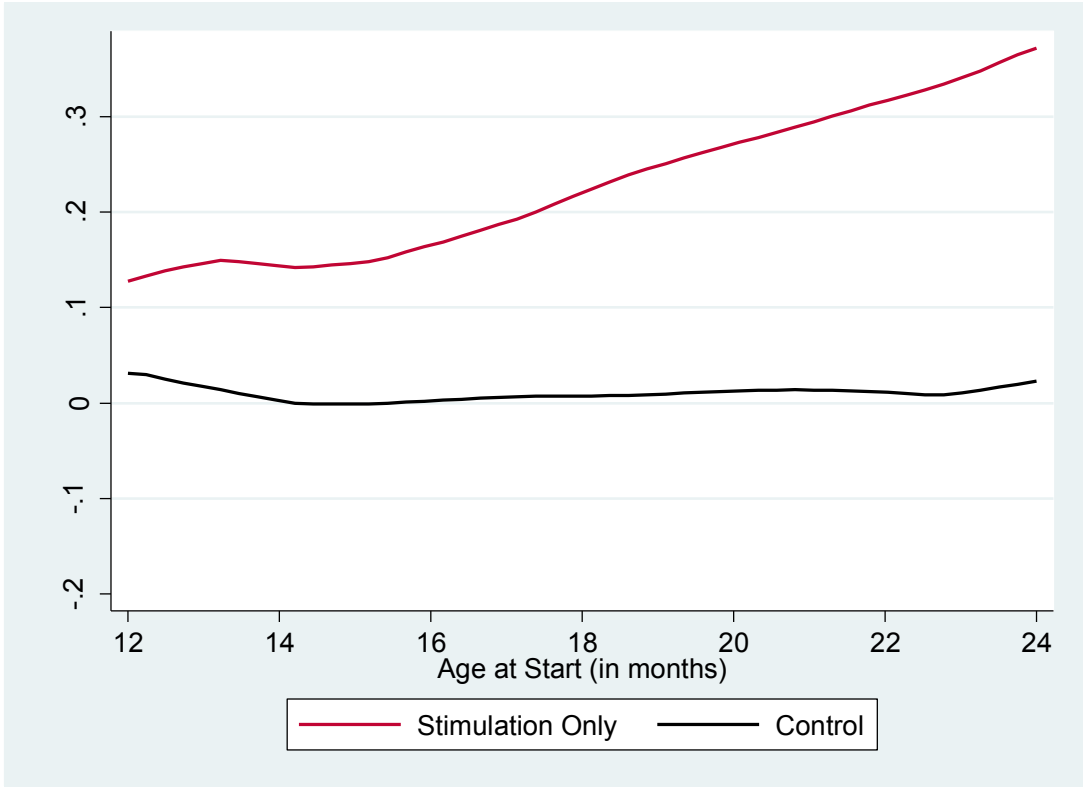
n = 1267; +significant at 10%, *significant at 5%, **significant at 1%



Effects on Receptive Language (Bayley) by Age at Start

	All	12-18 mths	18-24 mths
Stim (in SD)	0.188**	0.174	0.258*
	(0.080)	(0.113)	(0.120)

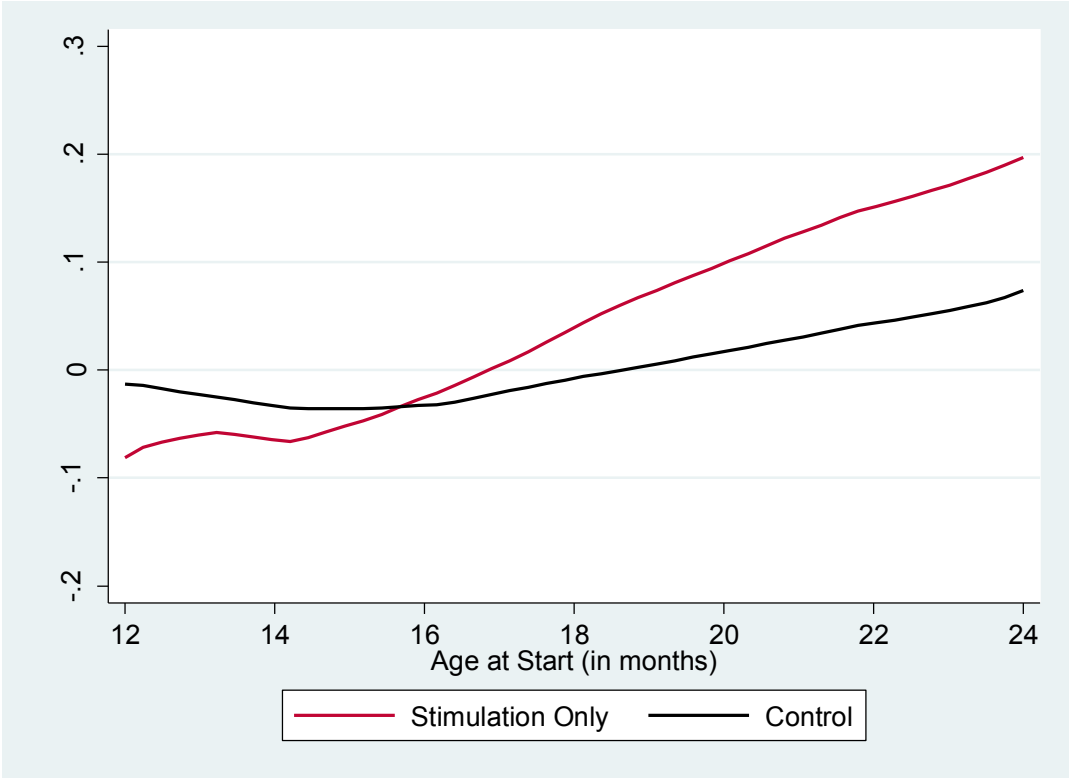
n = 1267; +significant at 10%, *significant at 5%, **significant at 1%



Effects on Expressive Language (Bayley) by Age at Start

	All	12-18 mths	18-24 mths
Stim (in SD)	0.059	0.023	0.191
	(0.073)	(0.122)	(0.159)

n = 1267; +significant at 10%, *significant at 5%, **significant at 1%



Effects on Expressive Language : MacArthur-Bates (maternal report)

	NUMBER WORDS CHILD CAN SAY		
	All	**12-18 mths**	**18-24 mths**
Stimulation Only	4.238*	1.232	5.266*
	(2.116)	(2.754)	(2.592)
Mean Dep Var (Controls)	55.46	48.04	61.20

n =1325; *significant at 5%

	NUMBER OF COMPLEX SENTENCES		
	All	**12-18 mths**	**18-24 mths**
Stimulation Only	0.365	0.0582	0.275
	(0.381)	(0.526)	(0.533)
Mean Dep Var (Controls)	5.43	4.53	6.69

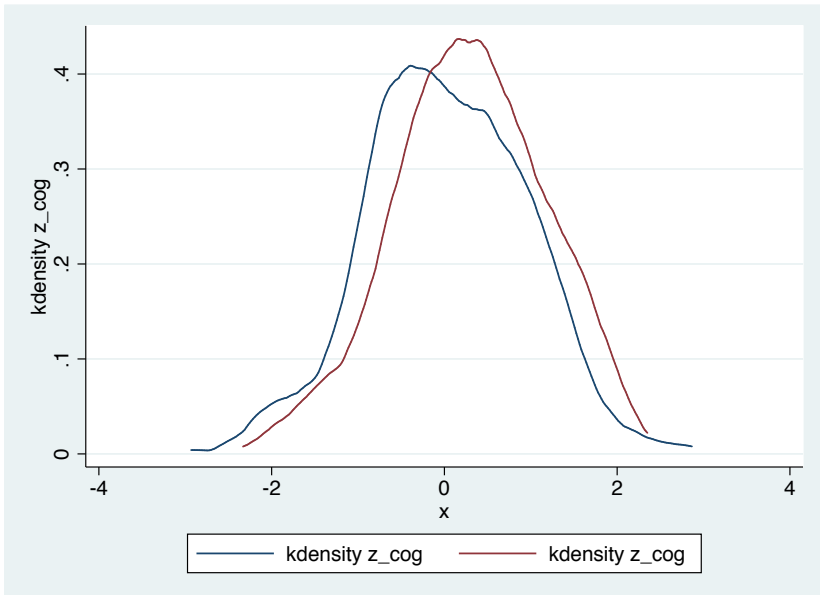
n =1325

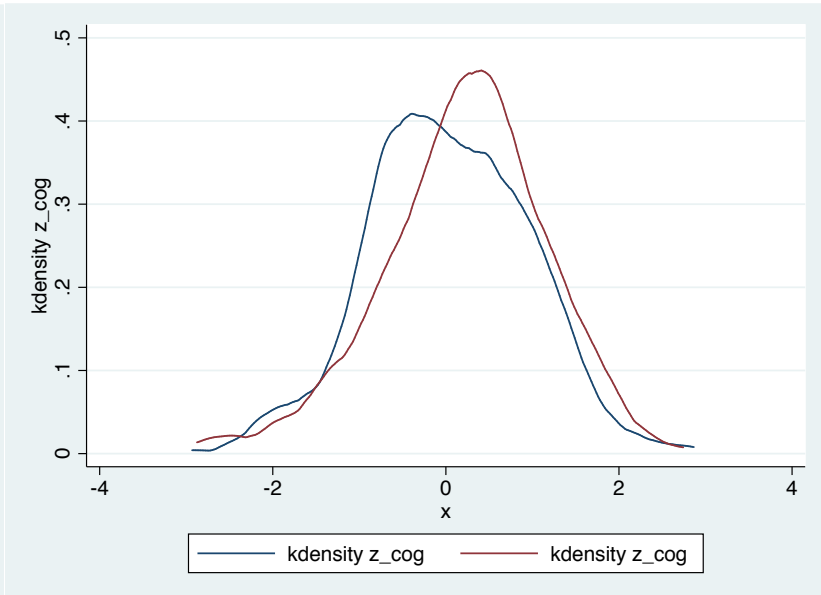
Effects by Treatment Group – All Children

	COGNITION (Bayley)	RECEPTIVE LANGUAGE (Bayley)	EXPRESSIVE LANGUAGE (Bayley)	NUMBER WORDS (MacArthur)	DIFFICULT CHILD (Bates)
Stimulation	0.251**	0.188**	0.0592	3.830+	-0.541+
	(0.073)	(0.080)	(0.073)	(2.008)	(0.288)
Stim + Micronutr	0.205**	0.163*	0.0826	4.238*	-0.161
	(0.070)	(0.073)	(0.083)	(2.116)	(0.251)
Micronutrients	0.0467	0.0393	0.0836	3.634+	-0.0597
	(0.059)	(0.084)	(0.087)	(1.911)	(0.262)
N	1,267	1,267	1,267	1,325	1,325

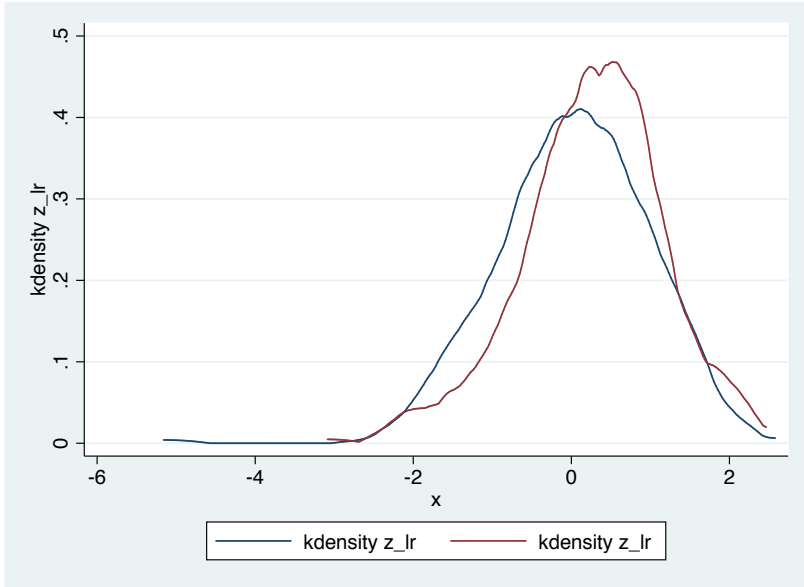
+significant at 10%, *significant at 5%, **significant at 1%

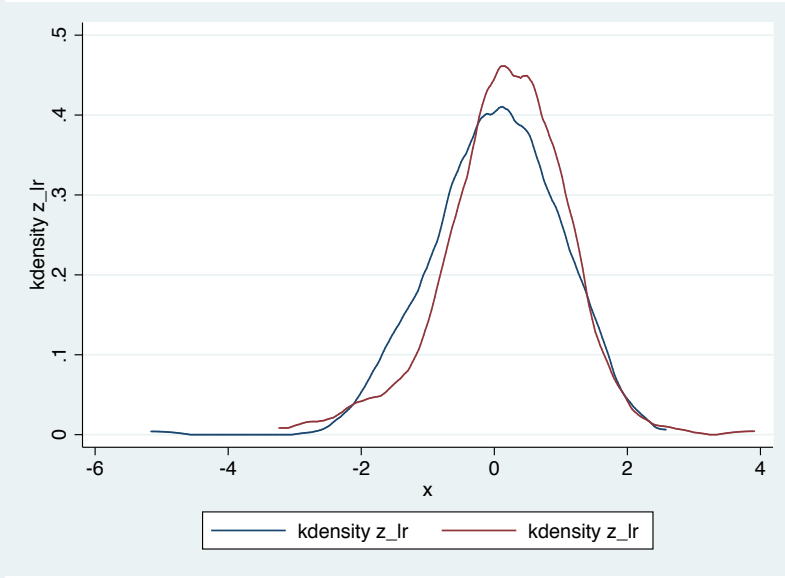
Impacts along the distribution - Cognition





Impacts along the distribution - Language





First Hint at Mechanisms: Increased Parental Investment in Children

	Home Made Toys	Bought Toys	Play Materials	Play Activities (previous 3 days)	Books for Adults
Stimulation	0.914**	0.284*	0.556**	0.564**	0.0188
	(0.180)	(0.134)	(0.128)	(0.152)	(0.081)
Stim + Micronutr	0.719**	0.167	0.452**	0.731**	0.140
	(0.189)	(0.133)	(0.137)	(0.153)	(0.087)
Micronutrients	0.0886	0.337*	0.213	0.217	0.104
	(0.187)	(0.151)	(0.167)	(0.153)	(0.087)

n =1329; *significant at 5%; **significant at 1%

Conclusions: Towards a model

- In the current preliminary version of the results we have established the potential of ECD intervention
- The next step is to set this up in a frame that will allow us to understand better the way the intervention operates.
- Consider an organizing framework

$$Q = F(K_p, K_c, I|C)$$

- This is a production function with parental (K_p) and child initial (K_I) capital as well as investments(I) as inputs
- The intervention will change investments.
- Another channel of change will be the productivity of a given set of inputs given the intervention C.
- The combination of the randomization and structural assumptions will allow us to provide an insight of how such interventions work.