

Early Childhood Development: Identifying Successful Interventions and the Mechanisms Behind Them

Background It is by now very well established that the early years in child development are extremely important for outcomes in later life. Events and experiences in the early years have long run consequences and deficits accumulated early on are very difficult and expensive to reverse in later life. The reasons for this are many. There is neurological evidence showing that crucial parts of the brain and its functions develop in the first two or three years of life. At the same time, it is clear that certain skills and attitudes acquired in the early years enable children to accumulate more effectively all types of skills.

It has been shown that well-targeted and well-designed interventions can have important impacts that are long lasting. One of the most rigorous and well-known such intervention is one which was designed and implemented in Jamaica by Sally Grantham-McGregor and colleagues. About 25 years ago a number of malnourished children living in Kingston, Jamaica were selected to participate in a study on the impact of nutrition and stimulation on child development. The children were aged between 9 and 18 months and were randomly assigned to four different groups. The first group was given a ‘stimulation’ intervention that consisted of weekly home visits by a social worker who delivered a structured curriculum based on games, songs and a number of other activities centred on the interaction between mother and child. The second group was given a nutritional supplement. A third group was provided with the stimulation and the nutrition supplement. A fourth group was kept as a control. The interventions lasted two years. All children involved in the study were observed at baseline (aged 9 to 18 months) and at the end of the study (aged 33 to 42 months), and then again four times up to the age 23-24. The results were remarkable, with significant impacts on the immediate cognitive development of the children, and effects sustained 22 years later with the stimulated children having better economic, cognitive and socio-emotional outcomes.

The challenge faced by policy makers is to identify interventions that achieve this type of results at a reasonable cost and that are sustainable in the longer run. Although a standard cost benefit analysis of an intervention such as the one above would indicate that in the long run it has high rates of return, in the short run it may be difficult to finance it if costs are excessive.

The Colombian study Given the evidence above, the study we are presenting attempted to design an intervention that could be scaled up at reasonable cost, given the policy context and the resources (financial and human) available in Colombia, and to evaluate its impact.

The intervention. The intervention was targeted at children aged between 12 and 24 months at the start of the study, living in households that were beneficiaries of the program Familias en Acción. The study was conducted in 96 municipalities (with between 5,000 and 20,000 inhabitants) in the following regions: (i) parts of Cundinamarca, Boyacá and Santander; (ii) parts of Antioquia, Risaralda and Caldas; (iii) Huila and Tolima. These choices were dictated by the desire to focus on relatively small communities in a large enough geographical area (and hence representative of various realities) and by our limited budget.

The intervention includes a stimulation and a nutrition component. The stimulation component consists of weekly home visits during which the home visitor shows the mother a number of activities she can carry out with the child. Mothers are encouraged to participate in the play and to continue the activities throughout the following week. The home visitors follow a curriculum that has a cognitive and language focus. In addition, mothers are encouraged to give positive feedback and praise to their child and to converse and play with them during their daily activities such as dressing, bathing and doing household work. The curriculum is organised in weekly components, each with a list of age-appropriate activities lasting about one hour. These include songs, nursery rhymes, books, puzzles and various toys. The toys are made from locally available recycling material such as plastic bottles and materials scraps. In addition, we designed and produced didactic materials (such as booklets, picture books, and puzzles) at relatively low cost, which were provided to the home visitors. The home visitor is instructed to start a child at a specific week depending on the age of the child and his/her level of development and to progress to subsequent activities as the child develops. Great attention is paid to ensuring that children are given activities appropriate to their stage of development rather than their age, and are moved up (or down) the curriculum as appropriate. The play materials used in the visit are left in the home of a child for a week and then rotated among children. The visitor is also instructed to seek for the participation of other family members (fathers, grandmothers, older siblings). Much attention is devoted to the interaction with the child.

The nutrition component consists of the provision of 'sprinkles', packaged in sachets that dissolve over food, and that have no taste, colour or smell. They provide iron, zinc, Vitamin A and Vitamin C in levels appropriate for children. The home visitors deliver the appropriate number of sachets to the home every two weeks and explain to/remind mothers how to administer them.

Whilst the intervention was based on the Jamaica study, it was adapted to the Colombian context in two important dimensions. First, the content of the curriculum was changed so as to make it culturally appropriate for Colombia and, in particular, for the families targeted by the study. Second, we tried to identify local home visitors drawn from the communities themselves that could deliver the curriculum. This reduces the costs considerably and may empower local communities to take ownership of the intervention itself, leading to beneficial spillovers.

The cultural adaptation was carried out in collaboration with Camila Fernández, a psychology Professor from the Universidad de los Andes, who has extensive experience in child development, and under the guidance of Sally Grantham-McGregor. This work led to the development of a modified, culturally appropriate curriculum suited to the Colombian context: for instance, books contained pictures familiar to children such as local fruits and vegetables and of local housing. The main emphasis of the curriculum, as in the Jamaican case, was on the interaction between mothers and children. The home visitor in charge of delivering the curriculum had to stress the important role of the mother in helping her child to develop by talk, play and her involvement in various everyday activities.

The second innovation of the study relative to the Jamaican study is the adaptation to the reality of Colombian social policy. The challenge was the identification of a network of local women that could constitute the core of the intervention in that they could be hired, trained and could

eventually take ownership of the intervention itself. We decided to work with one of the largest and most visible social programs run by the Colombian Government: Familias en Acción (FeA), a conditional cash transfer program, which is targeted at the poorest 20% of households in the country. The beneficiaries of FeA receive cash payments if they comply with certain conditions, which involve taking young children to check-up visits in health centres and sending older children to school.

The beneficiaries of FeA elect periodically a representative, called a Madre Líder (ML). Each ML represents about 50/60 beneficiaries. This implies that, on average, there are about 5 or 6 children aged between 12 and 24 months amongst the beneficiaries of each ML. The MLs acquire a de facto leadership role in their communities. Moreover, they are more entrepreneurial and have higher levels of education than other program beneficiaries. We targeted the MLs as possible 'home visitors'. In collaboration with the directorship of the FeA program, in the 96 towns in the study, we identified the MLs and randomly selected three. Out of all children aged between 12 and 24 months living in FeA beneficiary households corresponding to each selected MLs, we randomly selected 5 to be enrolled in the intervention and included in the study. The intended sample of children, therefore, is made of 1440 (=96x3x5).

We presented the MLs with the hypothetical situation of what their role as a home visitor would involve and assess their basic level of reading comprehension with a short exam. If a ML was not willing or able to participate, or was deemed not suitable for the job, she was substituted with a replacement (sometimes another ML; other times, another woman in the community). However, her children remained in the intervention and study sample. This was done so as to guarantee the representativeness of the sample. We recruited the available/suitable MLs (or other) to perform the weekly visits and, where relevant, to distribute the nutritional supplements. The process to recruit home visitors was identical in all 96 communities in the evaluation sample, so to preserve the experimental design we describe below.

The evaluation The study aimed at evaluating rigorously the impact of the intervention using an **experimental design**. For this reason, the 96 towns in the study were **randomly** allocated into four groups:

- a. a control group
- b. a stimulation group
- c. a nutrition group
- d. a nutrition and stimulation group

The evaluation started with a baseline data collection, which measured children's cognitive, motor and language development using the third version of the Bayley Scales of Infant Development, and a number of other indicators both at the household and at the individual level. In particular, we measured the availability of stimulation within the house (play activities and play materials) using the Family Care Indicator tool developed by UNICEF, maternal depression, and her time use. We also measured height, weight and haemoglobin of the children and their mothers. The socioeconomic questionnaire was extensive and designed to understand the mechanisms that were triggered by the program and that could make it effective.

The intervention lasted 18 months and was followed by another round of data collection on the same children. At follow up, we collected a variety of developmental indicators, including the Bayley test (for cognitive, language and motor development), the MacArthur Communicative Development Inventories (for vocabulary and expressive language), the Bates Infant Characteristics Questionnaire (for temperament), and the Rothbart Infant Behaviour Questionnaires (for attention focusing, inhibitory control and sociability amongst other socio-emotional traits). These data were again complemented by an extensive socio-economic questionnaire which included information on parental investments, time use and so on.

The randomized experimental design allows us to obtain rigorous and unbiased estimates of the impact of the stimulation and nutrition interventions and of their interaction. The random allocation, which as one would expect, was shown to have yielded a balanced sample (discussed later), guarantees that the comparison between treatment and control children provides us with such estimates.

The implementation of the intervention (and of the evaluation). As mentioned above, the intervention was designed in such a way that it should be scalable at reasonable cost, given the existing infrastructure and human resources. The main components of the intervention were:

1. The development of the curriculum.
2. The training of professionals that could train the home visitors in the field.
3. The supervision of the home visitors throughout the intervention (partially funded by IGC).

Six professionals were chosen among a number of applicants on the basis of their CV and an interview. They were trained in child development, home visiting and the curriculum for over one and a half months. The training also included practicing home visits in Soacha. These professionals, who will be referred to as “mentors” in what follows, then had the task to train the home visitors in the field – i.e. teach them the curriculum and the approach to home visiting – and mentor/supervise them throughout the intervention. To this end, each of them was assigned 8 towns, for a total of 24 home visitors each.

The training of the home visitors was split across two workshops. The first, lasting two weeks, covered the first part of the stimulation curriculum (activities for children ages 12 to 30 months) along with the fundamentals of child development, the importance of adequate care and stimulation, and toy construction workshops. Once this first round of training was completed, the home visitors were deemed ready to start the visits. This process took place at the same time as data collection (being careful in each village to ensure data collection had taken place before the intervention started), from February through June 2010, so by the end of June 2010 the intervention was fully phased-in across all treatment villages. The second phase of the training workshops took place between mid August and mid October 2010 over a one week period. In these sessions, the home visitor and the mentor covered the second half of the curriculum (activities for children aged 30 to 42 months), revised lessons covered in the first workshop, resolved doubts, and discussed any outstanding issues.

After that, the six mentors became, for the rest of the intervention, mentors and supervisors of the home visitors. They travelled around each of their 8 towns, spending up to a week in each,

overseeing visits of their assigned home visitors and providing them with advice, training, feedback, and support. This rotation scheme is such that each home visitor received about a week of interaction with her mentor once every 4-6 weeks. Furthermore, mentors and home visitors are in touch on a regular basis: the home visitors receive weekly to fortnightly telephone calls to discuss progress and problems; they receive weekly text messages to reinforce key messages to be conveyed during home visits, and they receive monthly one-page bulletins that reinforce material covered during training sessions. Overall, the mentors have played a very important role in the intervention.

The funding of the study The study, including the intervention and its evaluation, was funded with research funds from a variety of institutions. We first received a large grant from the Economic and Social Sciences Research Council in the UK. This grant was then supplemented with one from the IADB, one from the World Bank and one from the International Growth Centre in the UK.

Results

Baseline characteristics Table 1 shows the characteristics of children who remained in the study at follow-up, their mothers and their households. The groups were similar in maternal age and education, household characteristics and assets. The supplementation group tended to have lower levels of stunting (P value<0.1) and had lower proportions of single mothers but higher proportions of divorced mothers than the control group (both P values<0.05). These suggest slight imbalances in observables in the supplemented group. Children in the control group were an average of 18.28 months old (SD=4.02). The prevalence of anaemia was 46.30% and of stunting was 16.13%. Mothers' mean age was 27.65 years (SD=6.96) and 36.67% had completed secondary education or higher.

The children's Bayley-III scores were well balanced across groups (Table 2). For international comparison – though subject to caveats regarding norming to the US population – we also show the composite scores.

The aim of this project is not only to provide an estimate of the relevant impact but also to understand the mechanisms through which these impacts were obtained. Some of the main outcomes at follow-up are as follows (note that we are unable to detail the main results as they are under peer review at a medical journal).

1. The stimulation intervention had a significant and sizeable impact on a variety of outcomes, ranging from cognitive development, to receptive and expressive language, to behavioural problems and, interestingly, on monetary investments in children and stimulation in the home.
2. The impact of the nutrition supplementation intervention seems very limited.
3. The impacts of the stimulation intervention are larger on the slightly older children.

Further research The SIEF funding is being used to track the study children when they are 4.5-5.5 years old, to obtain in-depth measures of their development and to understand whether the program effects are sustained over time.

Table 1: Sample Characteristics at Baseline

	Control (n =319)	Stimulation (n =320)	Supplementation (n =309)	Both Interventions (n=319)
Child Characteristics				
Age in months	18.28 (4.02)	18.05 (3.76)	17.94 (3.62)	18.01 (3.73)
Male	49.53%	46.88%	53.72%	51.10%
Premature	19.06%	13.82%	17.50%	11.64%+
Birthweight in grammes	3222.48 (553.25)	3266.94 (477.07)	3245.29 (498.57)	3247.15 (514.63)
Height-for-Age Z-score	-0.99 (1.07)	-0.87 (1.12)	-0.74* (1.05)	-0.89 (1.04)
Stunted (Z-score Height-for-Age < -2SD)	16.13%	13.48%	10.78%+	13.65%
BMI Z-score	0.37 (0.96)	0.42 (1.05)	0.30 (0.98)	0.39 (0.94)
Haemoglobin (g/dL)	11.46 (1.30)	11.29 (1.29)	11.37 (1.28)	11.38 (1.30)
Anaemia	46.30%	47.17%	45.75%	44.59%
Parity = 1	42.01%	36.25%	42.39%	36.05%
Maternal Characteristics				
Age	27.65 (6.96)	28.31 (6.95)	27.49 (6.22)	27.92 (6.55)
Education in years	7.68 (3.52)	7.20 (3.41)	7.43 (3.53)	7.48 (3.43)
Less than Primary Completed	20.00%	22.88%	20.81%	16.72%
Primary Completed	16.67%	18.95%	17.79%	22.83%
Some Secondary Completed	26.67%	27.78%	29.53%	28.30%
Secondary Completed or More	36.67%	30.39%	31.88%	32.15%
Work (i.e. has occupation)	47.88%	43.99%	44.55%	46.96%
Married	68.40%	70.25%	69.31%	65.81%
Divorced	9.12%	11.39%	17.16%*	13.42%
Single	22.48%	18.35%	13.53%*	20.77%
Main Caregiver of Child	88.99%	92.19%	87.70%	87.77%
Household Characteristics				
Household (Hh) Size	5.22 (2.19)	5.37 (2.31)	5.23 (2.15)	5.22 (2.17)
Crowding (number of rooms over Hh size)	0.60 (0.30)	0.57 (0.29)	0.58 (0.27)	0.62 (0.32)
Home Ownership	33.86%	38.75%	40.13%	36.05%
Solid Walls	81.50%	81.25%	80.58%	83.07%
Asset Ownership				
Blender	60.50%	64.06%	64.40%	64.58%
Refrigerator	53.92%	59.06%	63.11%+	59.56%
Washing Machine	10.97%	15.31%	15.86%+	12.54%
Cellphone	90.28%	93.12%	90.94%	88.40%

N=1267 children that were administered the Bayley-III test at the end of the study. Data are % or mean (SD). +p-value of difference with respect to control group <0.10; *p-value of difference with respect to control group <0.05. p-values for difference in means adjusted for clustering standard errors (SEs) at the municipality level.

Table 2: Child Characteristics at Baseline

	Control (n =319)	Stimulation (n =320)	Supplementation (n =309)	Both Interventions (n=319)
Bayley-III (Raw Scores)				
Cognition	52.17 (7.74)	51.69 (7.31)	51.75 (7.39)	51.83 (7.41)
Receptive Language	20.55 (4.99)	20.46 (5.02)	20.17 (5.25)	19.97 (4.77)
Expressive Language	20.45 (6.30)	20.52 (6.69)	19.96 (6.18)	19.97 (6.14)
Fine Motor	34.83 (3.97)	34.61 (4.02)	34.29 (4.07)	34.08 (3.89)
Gross Motor	50.45 (7.02)	51.04 (7.25)	50.54 (6.34)	50.23 (6.90)
Bayley-III (Composite Scores)				
Cognition	98.15 (12.26)	97.80 (12.93)	98.33 (12.81)	98.43 (13.05)
Language	95.60 (14.59)	95.76 (13.73)	94.74 (14.95)	94.71 (14.91)
Motor	101.92 (14.19)	103.38 (15.46)	101.51 (13.83)	100.47 (15.67)
SMBCDI-I & SMBCDI-II				
Vocabulary	22.92 (23.38)	23.49 (22.70)	22.45 (21.90)	21.96 (22.04)

N=1267 children that were administered the Bayley-III test at the end of the study. Data are mean (SD). +p-value of difference with respect to control group <0.10; *p-value of difference with respect to control group <0.05. p-values for difference in means adjusted for clustering SEs at the municipality level. Bayley-III scores are expressed in raw scores and SMBCDI scores are expressed in number of words the child can say ("vocabulary"). SMBCDI-I was administered to 12-18 month old children; SMBCDI-II was administered to 19-24 month old children.