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Original/Pediatría
Effectiveness of the Brazilian Conditional Cash Transfer Program - Bolsa Alimentação - on the variation of linear and ponderal increment in children from northeast of Brazil

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Abstract

Background: Social programs can improve the conditions required for families provide sufficient care and attention for an adequate health and nutrition.

Objective: This study evaluates the effectiveness of the Brazilian’s conditional cash transfer program - Bolsa Alimentação (PBA) on children anthropometric status.

Methods: A cohort of 1847 children, followed for 12 months: 1615 PBA children; 232 non-PBA. There were 316 (14.6%) missing children during the study. A quasi-experimental study adopting the before-after strategy was applied and the effectiveness approach was used to assess the impact of the program on children nutritional status. Multilevel analysis with three levels was used in the statistical analysis. The mean increment variations of height-for-age and weight-for-age were the outcome variables and the participation in the PBA was the exposure. Four participation groups were established: children not exposed to the program (internal control group); exposed to the program throughout the 12 months, exposed to the program only in the last 6 months; and exposed to the program only in the first 6 months. Repeated measures were obtained at baseline and at 12 months.

Results: It was found that the exposure to the program was associated to a mean variation in weight-for-age of 0.34 Z-score (IC=0.05; 0.70) for children who were regular program beneficiaries during the follow-up. The exposure to the program in other periods was not statistically associated with a mean variation in the indicators.

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Conclusions: Cash transfers direct to the family were associated to anthropometric deficits reduction in childhood.

(Key words: Conditional cash transfer program. Brazilian’s Program Bolsa Alimentação (PBA). Program evaluation. Child growth. Effectiveness. Quasi-experimental study.)

Introduction

The nutritional and health state in childhood is determined by a complex relationship between biological, social, economic and cultural factors. Under adverse conditions, the availability and access to food is limited and basic services are inaccessible, forcing the family into a state of poverty and vulnerability. Poverty is multi-dimensional, restricting the family’s capacity to provide the child the care and attention needed to ensure potential development and contributing to mortality and morbidity characterized by high rates of infectious, parasitic, protein-energy malnutrition and micronutrient deficiencies.

Many countries, including some Latin American countries such as Mexico, Nicaragua, Colombia and Honduras, have adopted strategies that include conditional cash transfer (CCT), combined with education and health actions to reduce the burden of morbidity and nutritional deficits produced by poverty.

Based on these efforts, Brazil set up the national CCT program Bolsa Alimentação (PBA) in 2001 to benefit families with monthly per capita income less than half a minimum wage (US$27.97/month at the time). The PBA was the largest Brazilian CCT program at that time and it was a national intervention that included supportive strategies to improve the health and nutritional status of pregnant and lactating women and children from six to 72 months old.

Thus, each family received R$15.00 (US$4.20) per beneficiary, up to a maximum of R$45.00 (US$12.60). This monthly allowance was transferred directly to the mother’s “magnetic card” (the mother was usually the beneficiary responsible) and could be withdrawn at a bank or lottery agency. Some families also received other federal cash transfer programs (Bolsa Escola and gas for cooking) that were also developed concurrently with the PBA. And in 2004 the PBA was replaced by other federal cash transfer program (the Bolsa Família program) that involved all other cash transfer activities by the Brazilian government. Therefore, the PBA was the first cash transfer program in relation to the children’s health with specific objectives in the food and nutrition field.

The PBA is an inclusive program, with predominant ly preventative focus, targeting not only individuals who are malnourished or with nutritional deficits, but also those who are at nutritional risk. It has as conditions for receiving benefits the compliance with such health-related actions as maintaining childhood immunizations up-to-date, participation in growth monitoring and nutrition education activities and pre-natal care. It is consensus that programs with this focus improve the nutritional status of mothers and children in poor countries. Unfortunately, records of PBA assessment on child health and nutrition are still insufficient to cover all dimensions of the possible effects of this program. On the other hand, the results found in the literature are sometimes contradictory. Moris et al. has registered negative impact on weight for children under 3 years old exposed to the PBA in some communities in Northeastern Brazil. However, publication of the Brazilian government reported positive effects of the PBA on the weight and height recovery in malnourished or at risk children when compared to those excluded of the program. Studies produced have identified positive results of CCT program on the Colombian children linear gain and decline in the stunting rate among Columbians, Mexican and Nicaraguan children from 1 to 59 months old.

This intervention aimed to evaluate the program effectiveness under actual operational conditions and adopted an inference strategy about plausibility assessment by controlling biological, economics and social variables.

Materials and methods

Study Design

This investigation was structured as a follow-up study and employed the quasi-experimental approach, carried from October 2002 to November 2003. It was adopted the inference based plausibility assessment strategy in order to evaluate the program effectiveness under actual operational conditions on the basis of Habicht et al recommendation.

Selection of districts and population study

A sample of municipal districts of Brazil (Cipó, Pirai do Norte, and Iraí) was selected for convenience and included those that had been part of the PBA in October 2002 to February 2003, for the collection of baseline information. Additional selection criteria included: location within 350 km from Salvador city (the capital of the Bahia state); population between 10,000 and 30,000; and municipalities located in different geographical regions
with similar socioeconomic characteristics, including rising poverty levels.

The district of Irará is located in northern Bahia and 64% of its 25,000 inhabitants live in poverty conditions. Cipó is in the arid Northeast, has 13,376 inhabitants and 52.4% of its families live in poverty. Pirai do Norte is located in the Southern part of the state, has 20,183 inhabitants and 44% of its families live in poverty.

At the beginning of the study, 1,414 families from the three districts were registered on the Program, although 186 (13.15%) could not be located. We counted 2,163 children at 72 months old from the 1,228 identified families in both urban and rural areas. At the beginning of the follow-up 1,571 children had been receiving program benefits for less than 30 days and 592 had not received any benefits yet.

At 12 months of follow-up 1,847 children were evaluated which 1,615 had received program benefits continuously for 12 months while 232 had not. We recorded a loss of 316 (14.6%) children previously identified (Fig. 1). Children were evaluated at baseline (October 2002 to February 2003) and at 12 month follow-up (September to November 2003).

Creating study groups

The PBA’s strategic policy is based on universal coverage for low income families; therefore, it was not possible to adopt a methodological strategy of randomized intervention or deliberately create a comparison group based on the exclusion of the program, which would have been unethical.

However, during the data analyses, we were able to set up four groups with different intensities of the PBA exposure, including an internal control group composed by children who did not receive program benefits, due to municipal administrative failures despite being enrolled and fulfilling PBA eligibility criteria.

Such administrative problems included failure to send the information necessary to authorize creation of the Social Identification Number needed to receive payment; and incorrect names and/or addresses (including missing and/or additional accent or cedillas incompatible with the computer system).

Some PBA families who had been receiving benefits from the program were inexplicably removed. In these cases, the condition ‘exposed’ was changed to ‘not exposed’. The reverse situation also occurred, in which case the child’s condition was changed front of “not exposed” to “exposed”. Once the child had been in the same situation for 6 months or more in the program they were included in the group correspondent. This period of 6 months is considered sufficient for the physiological impact of a cash transfer program on the child’s anthropometric status. Furthermore, it is the point at which the family must be assessed to ascertain whether it still meets PBA requirements. The duration of child participation in the PBA can be extended if these requirements are met and the family continues to be meet economic eligibility criteria.

We created four program exposure groups but similar in the main characteristics evaluated and with different levels of intervention intensity: (1) a group of children who were continuously benefited from the program throughout the 12 months of follow-up; (2) children whose families had been receiving benefits but who were excluded from the PBA in the last 6 months of the follow-up; (3) children whose families were recipients during the last 6 months of the follow-up; and (4) children who were non-recipient during the 12 month period (internal control).

Data collection

The weight and height measurements were made in duplicate at baseline and at 12 months follow-up and were standardized according WHO (World Health Organization) recommendations.

To measure weight we used electronic scales with 100g precision (Fillizola, model E-150/3P). To measure the height of children 2 or more years old we used the...
terviewees to recall the size of portions served
other investigations of our group, was used to enable in
and standard liquid measurements, produced and used in
in accordance with Willet15. A booklet containing pictures of food
standard and liquid measurements, produced and used in
other investigations of our group, was used to enable in-
terviewees to recall the size of portions served16. Dietary
intake at school or crèche was also noted and included in
the form of dietary consumption of each child. Approp-
riately trained nutritionists gathered all data.

Data analysis

The anthropometric indicators (weight-for-age and
height-for-age) were the outcome measured. These out-
come variables were defined as variations in anthropo-
nmetric indicators (changes in weight-for-age and hei-
ght-for-age) throughout the follow-up period, expressed
in Z-scores17. Both variables were considered the main
dependent variable, time-variant and were included as
continuous variables in the statistical analysis. The PBA
exposure was the main independent variable. Differentia-
ted duration of exposition to PBA was considered in the
group’s compositions.

Covariates were represented by a range of factors, in-
cluding: child age and sex, residence area, the family’s
social and economic conditions, physical and sanitary
home conditions, diarrhea and coughs history, as repor-
ted by the mother within 15 days prior to interview, food
intake, income received from other programs (Bolsa Es-
cola and gas for cooking), weekly food expenditure and
seasonality. The season was defined according to the in-
tervals in which the anthropometric measurements were
taken15.

The physical and sanitary home conditions, family
structure, food intake and morbidity burden variables
were introduced in the model as variant in the time. All
other variables in this block were treated as invariant in
the time.

Interaction terms (exposure of program versus age;
exposure of program versus season and exposure of pro-
gram versus participation in other social programs) were
tested in the multivariate analysis. When appropriate, the
variable was transformed into its respective dummy.

Hierarchical linear model derived from a multilevel
analysis with level-3 model was used in the statistical
analysis18,19. The level 1 was represented for the house-
hold level; level 2 for children; and level 3 for the munici-
palities. An appropriate correlation matrix for database
with imbalanced data and results derived from robust
statistics was adopted. Two different multivariate regres-
sion models were subsequently specified for variations in
weight-for-age and height-for-age.

We adopted the forward technique in selecting which
variables to include in each level of the model20. The co-
variates were included in the statistics analysis as defined
in table I. The qui-square test was used to compare the
main characteristics between the groups. Covariates that
were significantly associated with the outcome, were re-
tained in the end. A two-tailed test was used in the analy-
sis.

Anthropometric status was evaluated using the pro-
gram ANTHRO21. Information on food consumption
was processed by Virtual Nutri software21 and statistical
analyses were performed by Stata for Windows.

Ethical aspects

The Ethics Committee of the Federal University of
Bahia approved the study protocol. Consenting mothers
or guardians were asked to authorize the child’s partici-
pation by signing an informed consent form. If the child
presented any nutritional disorders, they were offered
appropriate assistance and, when necessary, referred to
the local health service.

Results

A total of 2163 children up to 72 months old were ori-
iginally included in the study, but 316 (14.6%) were lost
during the follow-up. Subject losses were due to family
migration to other districts or due the child absence from
home at the time of the interview. Except for the partici-
pation in other social programs - whose losses were hi-
ghest amongst children who were not program recipients
- no other characteristic differed between the followed
and lost groups (data not shown in tables).

The municipalities’ variables included were child mor-
tality rate, maternal education, the municipality clean
water percentage, and the Gini coefficient, a measure to
evaluate the degree of income concentration. However,
these variables were homogeneously distributed among
municipalities not allowing the convergence of the corre-
lations. And so in the multilevel analysis it was not possi-
ble to include the level 3.

We evaluated the validity of the assumptions criteria
for the hierarchical modeling by the absence of multico-
linearity demonstrated by the Variance Inflation Factor
(VIF) and the normality of dependent variables distribu-
tion indicated by the residue analysis. We also evaluated
the existence of interaction and none of the tested terms
of interaction was significant21.

Household environment, biological, social, health and
nutritional children characteristics at the ending of the
Table I
Household environment, biological, social, health and nutritional characteristics of children from the Bolsa Alimentação program according to program participation, Bahia, Northeast Brazil, 2002-2003

<table>
<thead>
<tr>
<th>Variables</th>
<th>Recipient (%)</th>
<th>Non-recipient (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential area (1849)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>465 (85.2)</td>
<td>81 (14.8)</td>
<td>0.05</td>
</tr>
<tr>
<td>Rural</td>
<td>1152 (88.4)</td>
<td>151 (11.6)</td>
<td></td>
</tr>
<tr>
<td>Gender of child</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>827 (87.1)</td>
<td>122 (12.9)</td>
<td>0.68</td>
</tr>
<tr>
<td>Female</td>
<td>790 (87.8)</td>
<td>110 (12.2)</td>
<td></td>
</tr>
<tr>
<td>Child’s age (months)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 36</td>
<td>585 (86.7)</td>
<td>90 (13.3)</td>
<td>0.45</td>
</tr>
<tr>
<td>≥ 36</td>
<td>1023 (87.9)</td>
<td>141 (12.1)</td>
<td></td>
</tr>
<tr>
<td>Gender of head of household</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>335 (89.1)</td>
<td>41 (10.9)</td>
<td>0.28</td>
</tr>
<tr>
<td>Female</td>
<td>1282 (87.0)</td>
<td>191 (13.0)</td>
<td></td>
</tr>
<tr>
<td>Maternal schooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 4 years of school</td>
<td>1158 (87.5)</td>
<td>165 (12.5)</td>
<td>0.88</td>
</tr>
<tr>
<td>&gt; 4 years of school</td>
<td>459 (87.3)</td>
<td>67 (12.7)</td>
<td></td>
</tr>
<tr>
<td>Water supply in home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate</td>
<td>530 (88.9)</td>
<td>66 (11.1)</td>
<td>0.19</td>
</tr>
<tr>
<td>Inadequate</td>
<td>1087 (86.8)</td>
<td>166 (13.2)</td>
<td></td>
</tr>
<tr>
<td>Sanitary conditions in home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate</td>
<td>272 (88.3)</td>
<td>36 (11.7)</td>
<td>0.62</td>
</tr>
<tr>
<td>Inadequate</td>
<td>1345 (87.3)</td>
<td>196 (12.7)</td>
<td></td>
</tr>
<tr>
<td>Garbage disposal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate</td>
<td>523 (88.8)</td>
<td>66 (11.2)</td>
<td>0.23</td>
</tr>
<tr>
<td>Inadequate</td>
<td>1094 (86.8)</td>
<td>166 (13.2)</td>
<td></td>
</tr>
<tr>
<td>Flooring in home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate</td>
<td>146 (89.0)</td>
<td>18 (11.0)</td>
<td>0.52</td>
</tr>
<tr>
<td>Inadequate</td>
<td>1471 (87.3)</td>
<td>214 (12.7)</td>
<td></td>
</tr>
<tr>
<td>N° of bedrooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 2</td>
<td>255 (86.1)</td>
<td>41 (13.9)</td>
<td>0.45</td>
</tr>
<tr>
<td>≥ 2</td>
<td>1351 (87.7)</td>
<td>189 (12.3)</td>
<td></td>
</tr>
<tr>
<td>Indoor toilet facility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>878 (88.7)</td>
<td>112 (11.3)</td>
<td>0.09</td>
</tr>
<tr>
<td>No</td>
<td>715 (86.0)</td>
<td>116 (14.0)</td>
<td></td>
</tr>
<tr>
<td>Electricity in home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1241 (86.8)</td>
<td>188 (13.2)</td>
<td>0.07</td>
</tr>
<tr>
<td>No</td>
<td>367 (90.2)</td>
<td>40 (9.8)</td>
<td></td>
</tr>
<tr>
<td>Sibling &lt;5 years old</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>638 (88.5)</td>
<td>83 (11.5)</td>
<td>0.88</td>
</tr>
<tr>
<td>≥ 2</td>
<td>804 (88.3)</td>
<td>107 (11.7)</td>
<td></td>
</tr>
<tr>
<td>No of inhabitants in home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 5</td>
<td>524 (89.4)</td>
<td>62 (10.6)</td>
<td>0.08</td>
</tr>
<tr>
<td>≥ 5</td>
<td>1093 (86.5)</td>
<td>170 (13.5)</td>
<td></td>
</tr>
<tr>
<td>Participation in other social programs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1381 (87.7)</td>
<td>194 (12.3)</td>
<td>0.47</td>
</tr>
<tr>
<td>No</td>
<td>229 (86.1)</td>
<td>37 (13.9)</td>
<td></td>
</tr>
<tr>
<td>Weekly food expenditure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st tertile (&gt;63.6)</td>
<td>22 (91.7)</td>
<td>2 (8.3)</td>
<td></td>
</tr>
<tr>
<td>2nd tertile (&gt;42.4 a 63.6)</td>
<td>17 (65.4)</td>
<td>9 (34.6)</td>
<td></td>
</tr>
<tr>
<td>3rd tertile (≤42.4)</td>
<td>1578 (87.7)</td>
<td>221 (12.3)</td>
<td></td>
</tr>
</tbody>
</table>
The impact assessments of the Brazilian CCT program - *Bolsa Alimentação* - PBA on the child’s health and nutrition are scarce. So far, this seems to be the only non-governmental publication from this program that in a quasi-experimental study with 12 months of follow-up. For shorter PBA participation the variation in these anthropometric indicators were not significantly different between participating groups.

We note that the positive influence on target children’s growth occurred regardless of the age and sex and that no interaction statistically significant was observed between program levels participation and these variables.

The physiological mechanisms of catch-up growth in childhood are not completely known. Traditional studies were originated at 60’s, 80’s, and 90’s years and most of them were done with hospitalized children. But even for these children is not surprising a high catch-up growth rate when the weight-for-height ratio reaches approximately 80%, which occurs towards the end of the fifth or sixth treatment month, when started to be registered the weight gain deceleration and the linear growth speed increase. The longitudinal catch-up growth tends to start after the weight recovery, but than begins to be two to three times greater than normal for an infant of the same age, reaching average speeds of up to 30g per kilogram of weight per day.

Perhaps for this reason the investigators Morris and colleagues - studying brazilian mothers and children weigh at the sixth month of the follow-up who participated in the PBA - have sharply concluded that the sixth month weight were probably in the deceleration phase of physiological weight growth with consequent decline of the weight gain speed ratio. And the authors comment: “Many (probably the majority) of the mothers in our sample had previously been beneficiaries of this program had been once enforced in the Brazilian federal program called Incentive to Combat Nutritional Deficiencies, which made milk powder available to underweight children’s mothers, and there have been anecdotal-and-impossible to substantiate reports of beneficiary mothers deliberately keeping their malnourished children to qualify for the benefits” (p.2340). But there are not scientific reports that Brazilian mothers of these programs are wicked. These improvements in target children between six months to 72 months old for height-for-age and weight-for-age at 12 months of exposure at PBA when compared to growth in non-recipient children in a quasi-experimental study with 12 months of follow-up. For shorter PBA participation the variation in these anthropometric indicators were not significantly different between participating groups.

We note that the positive influence on target children’s growth occurred regardless of the age and sex and that no interaction statistically significant was observed between program levels participation and these variables.

The influence of the home level in the impact for weight-for-age and height-for-age was respectively 45% and 48%, while the child level contributed 55% and 52% for the increase in the weight-for-age and height-for-age indicators, respectively. These results indicate the variability among the households and children scores and the relevance of using the multilevel model in statistical analysis.

### Discussion

The impact assessments of the Brazilian CCT program - *Bolsa Alimentação* - PBA on the child’s health and nutrition are scarce. So far, this seems to be the only non-governmental publication from this program that includes data from baseline and robust design on the impact of anthropometric status of Brazilian children. We report a significant impact of PBA in anthropometric indicators...
Effectiveness of the Brazilian Conditional Cash Transfer Program...

**Table II**

Bivariate multilevel linear analysis for weight-for-age anthropometric indicator and covariates of children participating in the Brazilian Bolsa Alimentação program. Bahia, Northeast Brazil, 2002-2003

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>SE</th>
<th>CI(95%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 – Household</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Participation</td>
<td>0.13</td>
<td>0.06</td>
<td>0.00; -0.25</td>
<td>0.05</td>
</tr>
<tr>
<td>Environmental Index (tercile 1)</td>
<td>-0.46</td>
<td>0.07</td>
<td>-0.60; -0.32</td>
<td>0.00</td>
</tr>
<tr>
<td>Environmental Index (tercile 2)</td>
<td>-0.21</td>
<td>0.07</td>
<td>-0.36; -0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Maternal Education</td>
<td>-0.35</td>
<td>0.07</td>
<td>-0.47; -0.22</td>
<td>0.00</td>
</tr>
<tr>
<td>Electricity</td>
<td>-0.42</td>
<td>0.07</td>
<td>-0.56; -0.29</td>
<td>0.00</td>
</tr>
<tr>
<td>Floor</td>
<td>-0.49</td>
<td>0.11</td>
<td>-0.69; -0.28</td>
<td>0.00</td>
</tr>
<tr>
<td>Wall</td>
<td>-0.31</td>
<td>0.06</td>
<td>-0.43; -0.19</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Level 2 – Child</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>0.13</td>
<td>0.05</td>
<td>0.04; 0.22</td>
<td>0.006</td>
</tr>
<tr>
<td>Bolsa Alimentação (PBA):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuously benefited</td>
<td>0.29</td>
<td>0.14</td>
<td>0.00; 0.57</td>
<td>0.048</td>
</tr>
<tr>
<td>Not recipient/recipient</td>
<td>0.13</td>
<td>0.15</td>
<td>-0.17; 0.43</td>
<td>0.392</td>
</tr>
<tr>
<td>Recipient/not recipient</td>
<td>0.22</td>
<td>0.18</td>
<td>-0.13; 0.56</td>
<td>0.217</td>
</tr>
<tr>
<td>Siblings &lt;5 y old</td>
<td>-0.40</td>
<td>0.61</td>
<td>-0.52; -0.28</td>
<td>0.000</td>
</tr>
<tr>
<td>Calorie (tercile 1)</td>
<td>-0.31</td>
<td>0.07</td>
<td>-0.45; -0.18</td>
<td>0.000</td>
</tr>
<tr>
<td>Calorie (tercile 2)</td>
<td>-0.22</td>
<td>0.07</td>
<td>-0.35; -0.09</td>
<td>0.001</td>
</tr>
<tr>
<td>Protein (tercile 1)</td>
<td>-0.31</td>
<td>0.07</td>
<td>-0.45; -0.17</td>
<td>0.000</td>
</tr>
<tr>
<td>Protein (tercile 2)</td>
<td>-0.15</td>
<td>0.07</td>
<td>-0.28; -0.23</td>
<td>0.021</td>
</tr>
<tr>
<td>Carbohydrate (tercile 1)</td>
<td>-0.26</td>
<td>0.07</td>
<td>-0.39; -0.12</td>
<td>0.000</td>
</tr>
<tr>
<td>Carbohydrate (tercile 2)</td>
<td>-0.15</td>
<td>0.06</td>
<td>-0.28; -0.02</td>
<td>0.024</td>
</tr>
<tr>
<td>Zinc (tercile 1)</td>
<td>-0.21</td>
<td>0.07</td>
<td>-0.35; -0.08</td>
<td>0.002</td>
</tr>
<tr>
<td>Zinc (tercile 2)</td>
<td>-0.12</td>
<td>0.07</td>
<td>-0.25; 0.14</td>
<td>0.080</td>
</tr>
<tr>
<td>Iron (tercile 1)</td>
<td>-0.19</td>
<td>0.07</td>
<td>-0.33; -0.06</td>
<td>0.006</td>
</tr>
<tr>
<td>Iron (tercile 2)</td>
<td>-0.08</td>
<td>0.07</td>
<td>-0.21; 0.05</td>
<td>0.227</td>
</tr>
<tr>
<td>Retinol (tercile 1)</td>
<td>-0.22</td>
<td>0.07</td>
<td>-0.36; -0.08</td>
<td>0.002</td>
</tr>
<tr>
<td>Retinol (tercile 2)</td>
<td>-0.01</td>
<td>0.07</td>
<td>-0.14; 0.12</td>
<td>0.887</td>
</tr>
</tbody>
</table>

The authors had not the information about children height, making impossible, at that time, the detection of interventions effects on children growth. Thus, a single analysis of weight gain could not explain or even detect some of the possible interventions impacts.

Furthermore, the Brazilian Ministry of Health noted that the PBA families tend to use a higher percentage of their program resources on food than non-beneficiaries. Thus, the beneficiary families have a higher Marginal Propensity to Food Consumption (PMCA), i.e., they spend proportionally more with food for each US$ 1.00 added to the family income. This organ also registered an average over a period of one year variation of -0.21 deciles height-for-age for children six years old excluded from the study and -0.03 for recipients’ children. For children between one and two years old excluded and not excluded this value was -3.08 and -2.25 respectively, and for children of three years old the mean deciles were -1.26 from excluded children to -0.91 for recipients children. It is possible that the larger deficit is the possibility of recovery when conditions improve life, which makes it more credibility to our results.

Thus, whether contributing factors to impaired growth are eliminated, especially when the anthropometric deficits in children under 5 years old were elevated for height-for-age (17.9%) and weight-for-age (8.3%), as in the Northeast of Brazil - one of the poorest areas in the country and when the child dietary intake is improved, the preventive health actions is received, the health workers advice the mothers to improve the maternal behavior practice related to the children care of the program, as indicated by the Brazilian Ministry of Health report, the compensatory growth, even in older children, can happen.

The PBA impact on compensatory growth in children up to six years old identified in this study is reinforced by the mortality rate decrease reported by Rosella et al in PBA children under 5 years old in the same geographic region (Northeast of Brazil) where this study was conducted, using PBA secondary databases of 5565 brazilian municipalities from 2004 to 2009 period (it started one year after the ending of our follow-up).

The authors showed that where the PBA had consolidated coverage there was a decrease in the mortality rate by 17% (RR 0.83: 95% CI 0.79-0.88), which 53% were respectively attributed to incidence decrease of diarrhea (RR 0.47: 95% CI 0.37 to 0.61) and 65% to malnutrition (RR 0.35: 95% CI 0.24 to 0.50).

Program effectiveness assessments have shown a positive impact on growth in children younger than six years.
Table III
Bivariate multilevel linear analysis for height-for-age anthropometric indicator and covariates of children participating in the Brazilian Bolsa Alimentação program. Bahia, Northeast Brazil, 2002-2003

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>SE</th>
<th>CI(95%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 – Household</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone</td>
<td>-0.14</td>
<td>0.06</td>
<td>-0.25; -0.23</td>
<td>0.02</td>
</tr>
<tr>
<td>Programs participation</td>
<td>0.18</td>
<td>0.06</td>
<td>0.06; 0.29</td>
<td>0.00</td>
</tr>
<tr>
<td>Environmental index (tercile 1)</td>
<td>-0.37</td>
<td>0.06</td>
<td>-0.49; -0.24</td>
<td>0.00</td>
</tr>
<tr>
<td>Environmental index (tercile 2)</td>
<td>-0.11</td>
<td>0.07</td>
<td>-0.24; -0.02</td>
<td>0.09</td>
</tr>
<tr>
<td>Maternal education</td>
<td>-0.27</td>
<td>0.06</td>
<td>-0.39; -0.16</td>
<td>0.00</td>
</tr>
<tr>
<td>Electricity</td>
<td>-0.33</td>
<td>0.06</td>
<td>-0.45; -0.21</td>
<td>0.00</td>
</tr>
<tr>
<td>Floor</td>
<td>-0.37</td>
<td>0.09</td>
<td>-0.55; -0.18</td>
<td>0.00</td>
</tr>
<tr>
<td>Wall</td>
<td>-0.22</td>
<td>0.05</td>
<td>-0.33; -0.11</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Level 2 – Child</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (24 months)</td>
<td>-0.54</td>
<td>0.02</td>
<td>-0.09; -0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Siblings &lt;5y old</td>
<td>-0.22</td>
<td>0.05</td>
<td>-0.32; -0.11</td>
<td>0.00</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>-0.10</td>
<td>0.03</td>
<td>-0.16; -0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>Retinol (Tercile 1)</td>
<td>-0.21</td>
<td>0.06</td>
<td>-0.34; -0.09</td>
<td>0.00</td>
</tr>
<tr>
<td>Retinol (Tercile 2)</td>
<td>0.03</td>
<td>0.06</td>
<td>-0.09; 0.14</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Despite the extremely positive results observed in the Brazil’s CCT program (PBA) first implantation year, other factors continue to impede the adequate linear or weight growth in Brazilian children living in extreme poverty, such as more than 2 sibling <5 years old in the home, absence of electricity at home, low maternal schooling, the family necessity to participate in social programs, low food intake, specially micronutrients, as observed in this study. These observations reinforce the need to deal with the social and health inequalities combat to ensure the Brazilian children growth according to their genetic potential.

Finally, we should note the limitations imposed by the study design and follow-up losses. The follow-up losses were relatively low (14.6%) and did not influence significantly the group composition at the end of the study. These losses occurred in a random manner and possibly not introduced selection bias in the study greater proportion in a district that suffered a long period of drought that led to temporary migration of families in search of less adverse conditions.

And we emphasize that all variables were homogeneously distributed between recipient and no recipient children followed, with the exception of reported coughs (Table I).

However, it is worth noting the homogeneity observed in anthropometric variables distribution at the beginning and in the ending of the group set up, and between those lost in the program and those who remained until the end. This is important since this variable is directly related to the program impact.

We acknowledge the diversity of actions linked to the PBA; including immunizations, nutritional education and prenatal care among others; which makes it more difficult to identify the isolated effect of cash transfers on child’s physical growth. We also recognize that the operational old from poor countries. For example in ‘Pro-gresa-Oportunidades’ developed in Mexico, Leroy et al identified a linear gain of 1.5 cm (p<0.05) (corresponding to 0.41 Z score for height-for-age) and an absolute weight gain of 0.76 kg in one-year period (p<0.05) in children. In Mexican children from 24 to 68 months old, Rivera et al identified an overall association between the program participation and the growth improvement. Fernald et al reported positive impact on the growth of Mexican children in the Opportunity program children from 24 to 68 months old and an improvement was observed in children younger, but other investigators have found different results.

But we observed that the PBA had a positive impact on the growth of older children (6 months to 72 months old). This impact - age and sex independent - observed in this study can be expected, even in older children, in the first years of the program implementation, when children living conditions were more precarious and anthropometric deficits were more pronounced, such as the scenario where this study was developed. These results suggest that it may be more likely that the CCT program exerts more effect on the catch-up growth of younger children, but these effects can also be seen in older children. It is known for some time that eliminating the conditions that limit the adequate growth in school-aged children and even in adolescents is possible that the catch-up growth occurs in specific contexts, as the PBA context, whose effectiveness in the first year of the implantation, it revealed the possibility of breaking the association between poverty and health and nutritional status of children from the poorest urban and rural areas.

Positive effects on children catch-up growth of children was registered for a recent review of cash transfer programs in other Latin American countries, particularly in Nicaragua, Honduras and Colombia.

Finally, we should note the limitations imposed by the study design and follow-up losses. The follow-up losses were relatively low (14.6%) and did not influence significantly the group composition at the end of the study. These losses occurred in a random manner and possibly not introduced selection bias in the study greater proportion in a district that suffered a long period of drought that led to temporary migration of families in search of less adverse conditions.

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We acknowledge the diversity of actions linked to the PBA; including immunizations, nutritional education and prenatal care among others; which makes it more difficult to identify the isolated effect of cash transfers on child’s physical growth. We also recognize that the operational
combination of these actions, including health actions, does not always have an additive effect, but may have a multiplicative one\(^1\) that increases the potential of actions linked to the program. However, the study design allows us to control for the influence of various external factors that could influence the results, and we also included an internal control group.

An appropriated statistical technique was used; it is also expected to correct the regression to the mean, making the results more robust and reliable.

We recognize that the study design does not allow us to make inferences based on causality, however inferences can be made based on an assessment of the plausibility of the intervention\(^1\) which point to the effectiveness of the PBA in reducing anthropometric deficits in Brazilian children living in poverty.

Thus, it is possible to conclude by the study plausibility that reinforces the findings that recipients PBA children had better growth than those whose not recipients, indicating that the cash transfers programs reach vulnerable families and promote positive response on the children growth.

References