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Assessing Boa Vista's "Família que Acolhe" program for early childhood

Uma avaliação do programa "Família que Acolhe" de Boa Vista

Eduardo Rodrigues Capocchi[1]* , David Moisés Felismino Silva[1] , Elizabeth Balbachevsky[1]

[1]*Universidade de São Paulo (USP), São Paulo, SP, Brasil*

Eduardo Rodrigues Capocchi, branco, Consultant and Ph.D. candidate at the School of Education (FE-USP), University of São Paulo, Brazil

David Moisés Felismino Silva, branco, Researcher - Center for Public Policy Research at the Institute of Advanced Studies (IEA), University of São Paulo (NUPPs/USP) and Ph.D. candidate at FFLCH-USP, University of São Paulo, Brazil

Prof. Elizabeth Balbachevsky, Dr, Priv. Doc., branca, Associate Professor - Department of Political Science, University of São Paulo (USP), Brazil and Director - Center for Public Policy Research at the Institute of Advanced Studies (IEA), University of São Paulo (NUPPs/USP)

Abstract

This study describes an impact assessment of Boa Vista's early childhood program *Família Que Acolhe* (FQA). A 2020 survey of 402 children, four to six years of age, was undertaken based on the Inter-American Development Bank (IDB)'s *Proyecto Regional de Indicadores de Desarrollo Infantil* (PRIDI) framework. The average treatment effects across eight indicators were estimated using multivariate matching. Treatment groups were assigned based on official participation levels of mothers in the Program's activities and confronted with control groups of similar but non-participating families. Results show increases in participation led to improved scores across several indicators. FQA children scored higher in vocabulary extension, language usage, motor skills and height-for-age indicators, more prolonged breastfeeding, and higher treatment rates for underlying medical conditions. Cognitive skills of FQA children of the cohort studied scored below their counterparts. Social-emotional skills did not track well with other indicators, with unreliable results.

Keywords: Família Que Acolhe. Boa Vista. Evaluation. Early childhood.

Resumo

Este estudo descreve uma avaliação de impacto do programa Família Que Acolhe (FQA), de Boa Vista. Uma pesquisa em 2020 com 402 crianças, de 4-6 anos, foi realizada usando a metodologia do *Proyecto Regional de Indicadores de Desarrollo Infantil* (PRIDI) do Banco Interamericano de Desenvolvimento (BID). Através de pareamento multivariado, foram estimados efeitos médios de tratamento nos tratados para oito indicadores. Grupos de tratamento foram baseados na participação nas atividades do programa e confrontados com controles de famílias semelhantes, não participantes. Crianças FQA obtiveram pontuações maiores em extensão de vocabulário, uso de linguagem, motricidade e medidas de altura para idade, sendo amamentadas por mais tempo e com cobertura maior de cuidados para condições médicas. As habilidades cognitivas das crianças FQA tiveram pontuações abaixo dos controles. As habilidades socioemocionais não se correlacionaram bem com outros indicadores, com resultados inconclusivos.

Palavras-chave: Família Que Acolhe. Boa Vista. Avaliação. Primeira infância.

Introduction

Context

Boa Vista is the capital of Roraima, a state located in the extreme north of Brazil, which borders Amazonas, Pará, Guyana, and Venezuela. The population of Roraima is the smallest among the states in Brazil, with 605.7 thousand inhabitants, with a low density of 2.33 people per km^2. Boa Vista's population exceeds than 430 thousand inhabitants (Instituto Brasileiro de Geografia e Estatística – IBGE, 2022). Boa Vista is the main urban center of Roraima and concentrates over 60% of the state's population. About 60 thousand residents of Boa Vista are Venezuelans who settled in the city since 2015, characterizing a population growth explosion with substantial impacts on public services. At the local children's hospital, from 2015 to 2019, assistance to Venezuelans increased by 1,640%, from 1,719 to 28,196; in municipal schools, 6,101 (or 13.8%) of the 44,025 students enrolled in 2020 were from Venezuelan families (Surita, 2019).

The Municipal Human Development Index (HDI-M) of Boa Vista is 0.752, considered high by the United Nations Development Program (UNDP); the longevity index is 0.725, higher than the national index (0.638). However, the percentage of inhabitants living below the poverty line is higher (37.95%) than in the state and in the country. The public sector supports the municipal economy, primarily via services demanded by the well-paid civil servants and the military. The municipal budget is the smallest among all state capitals in Brazil, around BRL 700 million (Fundação Getulio Vargas - Diretoria de Análise de Políticas Públicas, 2020).

Crime has been a significant concern in the last two decades. Although Boa Vista has always figured in the statistics as the state capital with the fewest firearm homicides, there was a 15.1% growth in cases per 100,000 inhabitants between 2004 and 2015. Regarding violent deaths of teenagers between ages 16 and 17, Boa Vista ranked 10th in the list of the Brazilian state capitals with the highest growths between 2003 and 2013, with a 142.5% increase. The peak of youth violence occurred in 2012, with a record of 56.6 homicides per 100,000 inhabitants (Waiselfisz, 2015, 2016). Violence between teenager gangs in Boa Vista led the municipal government, Prefeitura Municipal de Boa Vista, (PMBV), to develop policies for early childhood as a structural and preventive response against chronic social problems.

According to the 2010 IBGE Population Census (Instituto Brasileiro de Geografia e Estatística – IBGE, 2010), the city had 26,826 children aged between 0 and 4 years, representing about 10% of the population and forming the 6th largest stratum in the city's age pyramid. At least 64% of children aged 0 to 5 years did not have access to daycare or preschool. Since 2015, with the humanitarian crisis in Venezuela, the child population has also increased considerably.

Highlights of the FQA program

Through Law Number 1,545, of December 20, 2013 (Boa Vista, 2013), the *Família Que Acolhe* (FQA) program was created by the municipal government. The program initiated numerous integrated actions across health, education, and social protection fronts intending to promote the integral development of children from pre-birth to age 6.

A critical element of this integrated policy is the guidance and awareness content for mothers, fathers, and caregivers, through the *Universidade do Bebê*, with a set of lectures and workshops which provide training on how to care for young children to favor their development. Concurrently, a body of employees, prepared and trained to work with early childhood services, plays a critical role in implementing these policies. Around 5,000 employees from all sectors of PMBV have undergone training since 2013 (Boa Vista, 2020a).

In recent years, FQA experienced progressive decentralization. Specialized services for pregnant women, mothers, and children are also available in primary health units (UBS) and social assistance reference centers (CRAS). Furthermore, daycare centers and preschools began to reflect this new perspective. As a result, the Municipality became one of the first in Brazil to develop an early childhood education curriculum aligned with the National Common Curriculum Base (BNCC), including child development in its multiple dimensions.

Administrative areas such as urban planning, public infrastructure management, mobility, and housing have incorporated early childhood into their priorities, resulting in innovative policies. For example, the Municipality redesigned squares and parks to include toys and facilities to encourage socialization and cooperation among children, fostering playful interaction with parents and caregivers. Projects for public spaces began to consider accessibility and safety regarding infants. In addition, popular housing policies began to prioritize and accelerate the process of legalizing ownership for families with pregnant women and children aged 0 to 6 years.

Since 2014, PMBV has built a digital platform for registering and controlling activities, actions, and services related to each beneficiary of their integrated policies. Called *Cidade Social*, this platform allows municipal departments to access and share data on each family and each registered individual. Thus, educators can verify, for example, if a particular student has a history of health problems or if she is in a vulnerable condition. The system also generates alerts when, for example, a public service unit registers a teenage mother, allowing all other areas to direct specific actions for her benefit.

Although the integrated policy prioritizes pregnant women and low-income children with greater vulnerability, the decentralization and incorporation of an early childhood perspective by all sectors of the municipal administration has positively affected the entire population to some extent.

Família Que Acolhe directly served over 16,600 families between 2014 and 2019 and is the backbone of the PMBV's integrated policy for early childhood. All the essential services necessary for mother and child are guaranteed all at once, from appointment scheduling to follow-up appointments, exams, and medical procedures. The primary beneficiaries of the FQA are pregnant women, teenage mothers, and children from low-income and vulnerable families. Other groups covered by the program are pregnant women enlisted in the program *Bolsa Família* directly or through family ties, incarcerated pregnant women. Generally, the program targets pregnant women and children registered in the *Cadastro Único para Programas Sociais do Governo Federal* (*CadÚnico*)[1].

Ideally, participation in the FQA begins when the applicant, up to 21 weeks into her pregnancy, up to date with prenatal exams, voluntarily enrolls. Upon registration, she receives a calendar marking the dates and times of all her appointments, from medical consults and exams to meetings she is supposed to attend every fortnight at the parenting courses at *Universidade do Bebê*. Attendance at these meetings will enable her to receive other program benefits, such as baby clothing kits and supplementary powdered milk. Participation also entitles children to priority enrollment in full-time public daycare centers (*Casas Mãe)*, from ages 2 to 4.

At the *Universidade do Bebê* meetings, participants receive guidance on pregnancy topics and, after the baby is born, on the importance of bonding, care, and stimulation for the child's development. Parents and grandparents often participate together in these activities. Attendance controls occur through control cards for expecting mothers and, later, for joint activities between mother and child. Families are encouraged to talk to children from the womb, read children's stories, play, and sing, be caring in their relationships, and deal with discipline issues in a non-violent way. Invited experts and trained employees present these concepts in workshops.

The requirement of sustained attendance, a vital driver of the program's success, was only instituted as a criterion for access to benefits in early 2017. As an added incentive to participation, those who have 100% attendance in scheduled activities enjoy a professional photo-shoot session before giving birth, a much-coveted perk.

There are also individual follow-ups with psychologists to deal with acceptance of pregnancy, family conflicts, postpartum depression, miscarriages, etc. Teenage mothers receive additional

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[1] Bolsa Família is a conditional direct cash transfer Federal program that benefits families in poverty and extreme poverty. It was launched in 2004, and in 2021 it was replaced by Auxílio Brasil. The CadÚnico is an online database on Brazilian families in poverty and extreme poverty, used by the Federal Government, the States, and the municipalities to implement public policies to alleviate poverty conditions.

support. Expecting mothers are supported by the program's health workers in the only public maternity hospital in the state, from their arrival until their discharge, after giving birth. Soon after, visits by social workers ensue to the newborn and mother, especially for the most vulnerable families. Mothers, fathers, and caregivers receive guidance at home on bonding with the child. This support lasts until the child reaches three years of age or starts attending daycare at two.

As of 2014, public daycare centers have been directed to prioritize enrollment two-year-old's children attended by FQA. In 2017, educational managers and teachers developed a new preschool curriculum. The design of the new curriculum involved parents, experts, and representatives of civil society. The new curriculum, harmonized with early childhood policy principles and guidelines, was implemented in early 2019.

As of 2017, the seven municipal CRAS reference centers began to offer specialized care to families with children aged between 0 and 6 years, including home visits (linked to the federal *Criança Feliz* program) and regular meetings along the lines of *Universidade do Bebê*. The Municipality's health units (UBSs) adopted decentralized procedures emulated from the clinics installed at FQA headquarters, with pediatric offices, actively seeking pregnant women and mothers in the communities to maintain regular medical follow-ups. They also implemented parenting awareness activities.

The cumulative number of mothers enrolled in the FQA program from the end of 2013 to April 2020 exceeded 16,600. Key figures for the FQA program are available online at the Observatório de Boa Vista website (Boa Vista, 2020b). The year with the highest number of beneficiaries was 2016, with 3,126, followed by 2019, 2,877, and 2018, 2,859. In 2020, the program served more than 1,746 women, of which 777 were Venezuelans (44%).

As of 2017, the attendance of pregnant women and mothers in the activities of the *Universidade do Bebê* became a requirement for access to additional benefits, and participation rates began to rise sharply. There were 45,715 attendance records in 2019. Beneficiaries attend meetings every two weeks, from the 3rd to the 9th month of pregnancy and from birth until the child turns four.

An additional benefit is the home distribution of powdered milk to children from 1 year to 3 years of age, or until the child enrolls in daycare at age 2. This distribution started in 2015. Initially, it was an independent program, but in 2017 it became conditional on the participation of pregnant women and mothers in FQA activities.

Another benefit provided to beneficiaries with verified participation in programmed activities is the distribution of baby clothing kits on the 9th month of pregnancy. Between 2015 and 2019, the Municipality distributed an average of 2,600 kits per year. Each kit comprises a bathtub, a thermal bag, diapers, clothes and shoes, blanket and crib sheet, towels, and hygiene products. From 2017 onward, kit delivery was dependent on verified high attendance (Boa Vista, 2020a).

Boa Vista's early childhood policies are mentioned as an example of good practices in a case study funded by the Robert Wood Johnson Foundation. The survey carried out by the Training and Research Support Center in partnership with the University of Aberdeen covered various experiences of public policy change for families and children in Brazil. This study addresses the conditions that allowed the capital of Roraima to successfully implement the FQA program (Loewenson et al., 2019).

Objectives

As a first impact assessment, this work intends to establish a baseline for studying the evolution of Boa Vista's early childhood policies with a particular focus on the *Famíla Que Acolhe* program. Sponsors from PMBV highlight the motivation for this investigation to identify dimensions in which services can be adjusted and improved, reinforcing the diagnostic character of this research, assessing the effectiveness of policies in their implementation phase, and uncovering possible levers for improvement.

Boa Vista's policies for early childhood began to be designed and implemented before the advent of the *Marco Legal da Primeira Infância* (MLPI). MLPI was enacted in 2016, is a

comprehensive law establishing the general framework and guidelines for policies targeting early infancy in Brazil. Once passed, the law created awareness of the importance of public services for children aged 0 to 6 years (Brasil, 2016). Without the framework created by MLPI and its power of advocacy, the experience of Boa Vista has a bold, pioneering nature, which attracted the attention of many scholars interested in early childhood public policies.

Information for evaluating the impact of the policy comes from a total of 402 sets of interviews. Each set includes a child aged between 4 and 6 years old and their guardian. Thus, each case in the database refers to the assessed child and their mother (or another adult caregiver)—all children residing in Boa Vista between January 21st and March 16th, 2020. The survey didn't include families living outside the urban perimeter, those not fluent in Portuguese, or incarcerated mothers, even if these profiles correspond to the program's potential beneficiaries. This study describes the methodology deployed and summarizes baseline results for key indicators.

Methods

Preparation and choice of instruments
Proyecto Regional de Indicadores de Desarrollo Infantil (PRIDI) is an initiative of the Inter-American Development Bank (IDB) for developing a methodology suitable for evaluating the status and quality of child development in the light of projects the institution has supported. The methodology, developed from 2009 to 2013, focused on children aged 24 to 59 months, assessed under four domains: Cognitive skills, communication and language, socio-emotional skills, and motor skills. It was applied in Costa Rica, Nicaragua, Paraguay, and Peru, evaluating more than 7,700 children, considering characteristics of ethnic groups and marginalized populations.

Our team chose PRIDI as the reference framework for assessing the impact of the FQA program. Two reasons support this choice: First, when accessing the methodology, the team and senior officials from Boa Vista evaluated that the original requirements for scope, depth, and flexibility could answer the core questions posed by the policymakers. Furthermore, PRIDI's documentation is complete and readily available (Equipo Gerencial del PRIDI, 2011, 2014; IDB, 2019; Verdisco et al., 2014, 2016).

In assessing children, PRIDI employs the Engle Scale for Child Development, which has versions for children aged 24 to 42 months (Test A) and 42 to 59 months (Test B). Supplementing Tests A and B, PRIDI used the Peabody Picture Vocabulary Test (TVIP). Evaluators apply a questionnaire and tests directly to the child, in a domestic environment, under the supervision of caregivers. Finally, supervising adults answer a questionnaire which collects information about themselves and the child, to assess living conditions and core values regarding rearing a child.

The original PRIDI was designed to obtain samples representing the child population aged 2.5 to 5 years old in the four pilot countries. In the application in Boa Vista, the intention was not to represent the context in Brazil but to provide data for evaluating the impact of a local public policy. As a result, some modifications were necessary for sampling and the instruments' contents.

The main difference between the original PRIDI and the project carried out in Boa Vista in 2020 was the choice of ages of the participating children. While the original PRIDI assessed children aged between 2.5 and 5 years, the evaluation in Boa Vista looked at children aged between 4 and 6 years. The original PRIDI had a standard application in Spanish, with controlled translations into indigenous languages such as Quechua and Guarani, prevalent in the pilot countries. In Boa Vista in 2020, all instruments were in Portuguese. The questionnaires and Engels' Test B, once translated into Portuguese, were reviewed by a local team with a background in psychology to avoid the use of awkward wording or words with different local connotations.

The original PRIDI employed Spanish and indigenous language versions of the Peabody Auditory Vocabulary Test with 125 pictures and descriptive words, arranged in order of

increased difficulty. Although there is an adaptation to Portuguese (Capovilla et al., 1997) of the Peabody test, the choice was to use the TV Aud 33ob Auditory Vocabulary Test, proposed by Capovilla et al. (2011), with open access, ease of use (with 33 items) and adequate for the age group evaluated. Finally, for the specific context of Boa Vista, the questionnaire included items designed to inquire frequency of participation and mothers' qualitative impressions of the program.

The original PRIDI encoding and models were reproduced in the R statistics language used in analyses. The new R protocols were tested with the original PRIDI samples to assure replicability. The entire Program's impact assessment relied on controlled interviews with a parent or competent caregiver of children aged 4 to 6, followed by the application of PRIDI's test with the child, provided both the child and the adult involved gave formal consent. Extending field interviews to ages beyond PRIDI's 59-months limit was a design decision made early, with little or no substantial impact on results.

Supporting artifacts used in tests were procured and manufactured, following PRIDI's carefully laid out instructions, and made available to a team of 12 field crew. All members of the local team were recruited locally, with backgrounds in psychology, and attended an eight-day training and qualification process before fieldwork.

Sampling, treatment assignment, and data collection
The target group encompasses children born in 2014-2015 presumably exposed to FQA program services during most of their early childhood. This first generation of FQA children were 5-6 years old at the time of the fieldwork. The sampling design covered 52 neighborhoods in urban Boa Vista, including random home visits and children in the target age chosen from students from local public schools, always counting with the agreement and participation of a responsible adult. The analyses reflect the impacts of the first two years of the Program since it targets children born in 2014-2015, aged 5-6 years at the moment of the fieldwork.

The sampling plan focused on sampling children from the neighborhoods attended by FQA. However, to have a broader base of control covering higher socioeconomic levels, the research also included data from children not living in these neighborhoods. However, the additional interviews with families with higher socioeconomic profiles were cut short due to restrictions imposed by the Covid 19 epidemic, hitting Boa Vista in mid-March 2020.

The interviews collected information about the child, their family, routines, health, and their surroundings and qualitative impressions of the mothers regarding FQA for those participating in the program. Once trained, 11 of the original 12 psychologists carried out the fieldwork. They contacted the families, asked for formal authorization for conducting the research, applied the tests to the child, and interviewed the child's caregiver. Each member of the fieldwork team was tasked with recording the results collected in the field in templates, which were consolidated for analysis and quality control on a daily basis.

Families served by the FQA in 2014-2015 were included in the treatment group. Family attendance to FQA activities over various minimum threshold participation rates defined the treatment group. This information was available for mother-child pairings from FQA program records, which were shared by FQA management with the research team. The data set provided by the program's management also included dates of enrollment, approximate pregnancy stage upon registration, and home neighborhood data, which helped establish the treatment group, were anonymized to ensure respondent confidentiality.

The control group, children and families not participating in FQA, was used to estimate the impact of FQA on children and families attended by the Program. In the core statistical model for analysis, each child from the treatment group was paired to a child from the control group with similar socioeconomic and educational backgrounds.

Indicator choice
The main indicators are those used in this study to assess the magnitude of the effects of FQA on the participating children. Six key indicators, derived from PRIDI, cover the multiple facets of

child development: Motor skills, social-emotional development, language use, cognitive skills, vocabulary span, and height-for-age indicator. Additionally, other information was collected: the duration of the child's breastfeeding and the coverage of treatments for the children's medical conditions because these issues were targets of the Program.

Matching cases between treatment and non-treatment groups were done using three supporting indicators. The matching model considered the following indicators: children's sex, age and years of schooling, parents' educational level, socioeconomic status, the family environment's level of nurturing, and the level of maternal stress. Based on field questionnaire responses, all support indicators were obtained via Item Response Theory modeling. In line with original PRIDI indicators, indicators have scales with means of 50 and standard deviations of 5.

The socioeconomic status indicator (PRIDI's wealth index) makes it possible to match children according to the socioeconomic status of their households, based on infrastructure and possession of items and services. The indicator is built using graded Samejima models through Item Response Theory. Information used in this indicator considers the number of people per sleeping room in the house, the nature of the flooring, walls, and ceiling of the household, as recorded by the interviewer, the possession of goods such as landline and cell phones, separate refrigerator and freezer, computer and internet, radio, television, iron, stove, bicycle, motorcycle, and car. It also accesses the household's access to public water and sewage services, electricity from a grid, and if it counts with the service of a maid. An important and positive aspect coming from the analysis of mothers' participation in FQA's programmed activities, when clustered by Social Economic Status (SES) brackets, is that differences in socioeconomic level has little or no influence on the frequency of a mother's participation in the program.

PRIDI's nurturing environment index allows pairing children according to the quality of their interactions with their families. The indicator considers the variety and frequency of activities happening in the household which involve the child, the number of people who interact with the child, the number of children's books available at home, the observance of rules of conduct (recurrent bedtime, what to eat and not to eat, rules for family meals and attribution of simple tasks for the child to perform), the observance of hygiene rules in the child's routine at home (washing hands before meals and after using the bathroom, brushing the teeth after meals). As expected, the nurturing environment index increases with the family's socioeconomic level. This positive correlation can partly be explained by discretionary income that can be converted into inputs such as children's books or outings. However, the indicator also includes actions and habits that do not depend on material resources to leverage the home's nurturing environment.

The maternal stress indicator is not originally included in the PRIDI. It was derived from maternal mental health information collected in the questionnaire. This indicator involves sleep quality, fear, appetite, mood, and confidence in the future. Maternal stress levels decline as SES increases. However, more vulnerable mothers participating in the FQA reported less stress than their non-participating peers, albeit not significantly.

The ages of the children assessed in early 2020 were chosen to accommodate the enrollment of mothers in the FQA program from December 2013, the date of the formal creation of the program, and to allow for assessment through the PRIDI instruments.

Supporting indicators were constructed through Item Response Theory using graded 3-parameter models (Samejima, 1969) and main indicators through Rasch models (Rasch, 1960), implemented in *R* (R Core Team, 2020) using the *mirt* package (Chalmers, 2012; Chalmers et al., 2020). Expectation-Maximization (EM) was used to find maximum likelihoods. The items employed came from questionnaire responses with item encoding following the PRIDI guides closely. Covariate matching and balancing verification were implemented using *R* packages *Matching* (Sekhon, 2020) and *cobalt* (Greifer, 2020), respectively. The multivariate matching algorithm used the criterion of weighting by the inverse of the variances, with one-to-one matching, with repetitions, and default parameters, to estimate the average treatment effect on the treated (ATET).

With similar cases paired, the mean difference of the performance indicators was estimated and tabulated. Positive or negative differences in these means are understood as positive or negative effects (impacts) causally associated with the child's participation in the Program. Furthermore, even if an individual child, by definition, cannot be part of the control and treatment group, it is possible to compare groups of children with a similar profile but with different rates of participation in FQA. This approach allows to estimate the average effect of the Program on the child, accommodating confounding factors, characterizing FQA as the plausible cause of the effects (Lance et al., 2014).

Results

Population and sample characteristics
The FQA registration register allowed to produce a snapshot of the population served by the program, focusing on mothers enrolled in the first two years of the program's roll-out. This database consists of 4,661 pairs of mothers and children born in 2014 and 2015, the program's first years. The information collected in the database was essential to design the sampling plan, assess the quality of the sample produced by the fieldwork, confirm each pair's registration status, and, most importantly, estimate the level of participation.

Mothers' age at the time of birth of their child varied from a minimum of 12.5 years old to 45.7 years old, with an average age of 24.2 years. 18% of the registered mothers were minors when giving birth. On average, mothers enrolled at 4.9 months into their pregnancy, with 40% registering after the sixth month.

On average, mothers enrolled in 2014 or 2015 completed 26% of the scheduled activities. Only 13% of mothers participated in more than 50% of activities – and only 0.34% completed all activities. As described above, at the beginning of the Program, the mother's participation was not a condition for securing access to Program's additional benefits. Younger mothers had lower participation in activities, possibly due to competition with studies, absence of a more comprehensive support network, or sharing upbringing duties with older generations. The average participation in activities increased along the program's first two years, especially after April 2015. Likewise, enrollment was subject to tighter controls for signing up sooner during participants' pregnancies over time.

FQA, as it improved in subsequent years, changed content, rules, and filters to optimize effectiveness. For example, from January 2017 onward, a minimum participation criterion was established for the mother to have access to the program's fringe benefits.

Out of the 402 interviews conducted, 145 were with verified FQA participants. Of the 257 interviews conducted with non-FQA participants, 29 were fromh Venezuelan families fluent in Portuguese. All FQA participants interviewed were from Brazilian families. The ratio of enrolled to non-enrolled in the FQA turned out to be 1:1.8, close to the originally planned 1:2. This slight deviation, caused by the change from random sampling in households to sampling in municipal schools[2], did not affect the availability of control cases for the matching analyses.

Information on neighborhood declared by the mother when she registered in the FQA was used in planning the sample. However, when the field visits began, it became clear that more than 88% of the registration addresses (from 2014 and 2015) were out of date. This situation is explained by the mobility of vulnerable populations and the consequent inherent obsolescence of the registration data associated with them. This outcome led to lower daily productivity in interviewing and higher dependency on supporting logistics and field transportation.

In the end, when compared to the registration roster, the participants had a similar distribution of gestational ages. However, mothers in the sample had 13 percentage points higher in their attendance to FQA activities than the average attendance as registered in the rooster. This discrepancy could be partially explained by the fact that an unknown percentage of the

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[2] This change in fieldwork strategy was necessary because of the pressing news of the advent of COVID-19 in Asia and Europe. Considering the possibility of a lock-down in Boa Vista, the team decided for an alternative that could rush the end of the fieldwork.

mothers first enrolled in the program lived outside of Boa Vista, even when reporting an address in the city. This group was less represented in the sample than those living in Boa Vista. This situation is not a surprise. Being a pioneering program, FQA plausibly attracted pregnant women residing in neighboring municipalities. This hypothesis comes from anecdotal evidence provided by FQA management.

Some additional relevant information was collected in our sample: About 6% of the children interviewed (from 4 to 6 years old, average 5.0 years) were not enrolled in school. This proportion did not vary between the control and treatment groups. As a form of punishment, physical violence was reported more usually by caregivers not participating in the FQA. Almost 30% of FQA mothers work outside the home, versus 45% of non-participating mothers. Height stunting – an indicator of malnutrition – appears in about 3% of children, among FQA participants and those not registered.

Impact assessment based on indicators
The average variation in the main indicators used to assess the magnitude of the effects of FQA is described in Figure 1A-H. In this figure, the magnitude and confidence intervals of the gains/handicaps are graphically presented. "Effect" refers to the estimated Average Treatment Effect on the Treated (ATET). This magnitude shows how much the value of the indicator in question increases or decreases, on average, for very similar (matched) cases, whose only difference is exposure to the treatment, which, in this study, is defined by participation in the FQA above increasing participation thresholds. The mean values of the effects are reported with 95% confidence intervals.

Venezuelan children and families residing in Boa Vista in 2020 were also included in the control group, due to the large number of refugees living in the municipality. The first generation of FQA children did not have Venezuelans amongst them. Interviews were conducted in Portuguese and there were no comprehension difficulties on the part of the immigrants. Veneuelan children were removed from control groups for indicators for language use and vocabulary, to avoid inflation of treatment effects. They were maintened in the control groups for other indicators.

These analyzes address the mothers enrolled in the first two years of the *Família Que Acolhe*, in 2014-2015. In summary, participation in the FQA leads to gains in language use, vocabulary extension, and children's motor coordination. Participation in the FQA also increases breastfeeding duration, height for age, and the level of parental attention (treatment and follow-up) to any child's existing illnesses or conditions. Several of the gains positively affect children from lower socioeconomic levels, which fulfills the program's objectives. Negative results were found in cognitive development and, to a lesser extent, in socio-emotional development. These handicaps are reduced for mothers who are more involved with the program. Likewise, the average of gains in other indicators grows as registered mothers participate more in FQA activities. The overall average participation of mothers in activities was low (26%). It grew over time and with the improvements in FQA, including a tighter focus on registering mothers at the first months of pregnancy.

When indicators in their original scale are plausibly correlated with child's age, results are presented as gains in equivalent months of child development (if the effect is positive versus controls) or in months of child underdevelopment (if the effect is negative). Figure 2 illustrates this conversion, particularly the anomalous findings for the social-emotional indicator.

(A) Height-to-age Z

This indicator is known in the original PRIDI and in the literature as height-to-age z-ratio, or HAZ. The indicator measures where the height of a given child, of known age and sex, stands when compared to the average height of children of similar age and sex. It is based on tables from the World Health Organization (WHO, 2006). In practice, its scale has a mean of zero. It ranges from -3 to +3, approximately indicating standard deviations a child is below or above the mean for their age and sex. The indicator, when less than -2, signals stunting, a limitation in growth with probable origin in malnutrition.
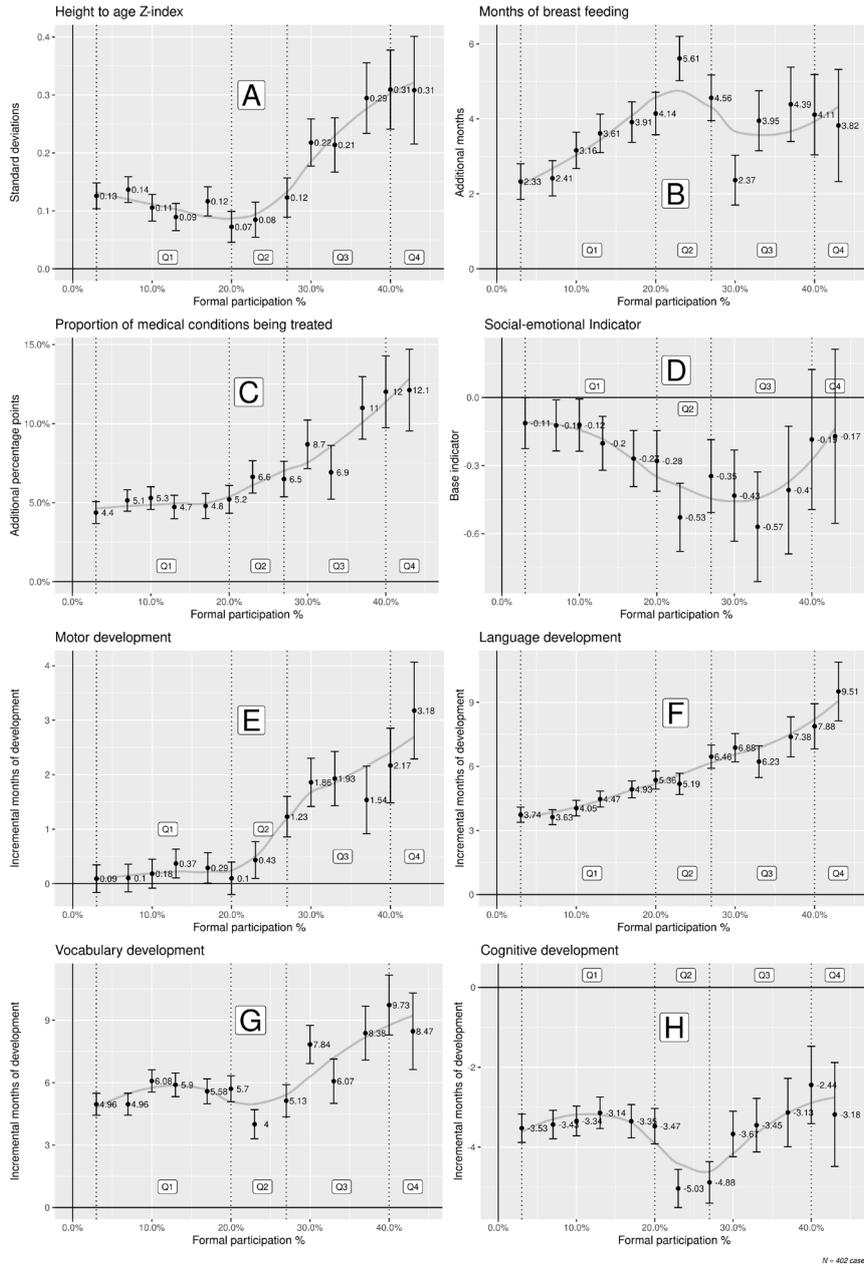
Figure 1. Resulting indicators (A to H) versus control group.
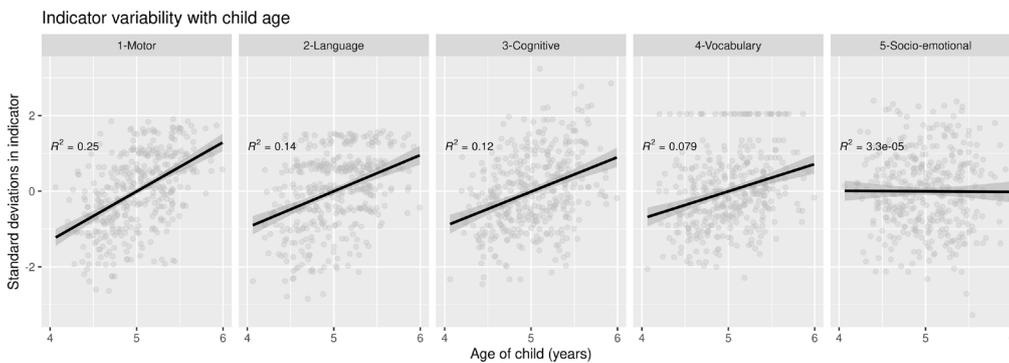Source: The authors.

Figure 2. Indicator variability with child age.
Source: The authors.

Measurements of the children's heights were made in the field using portable stadiometers. Two measurements were taken for each child, with the subject stepping on the measuring device twice. Records were made with millimeter resolution, and the mean value was used in the analyses. As this was the last stage of interaction with children, some were unwilling to be measured, or they accommodated only a single measurement due to tiredness or distraction.

Figure 1A shows all child participants in FQA having at least +0,07 standard deviations in the HAZ index gain versus their non-FQA counter-factual pairings. Yields are much higher for families with high participation, reaching almost +0.3 standard deviations, all significant at 95% confidence levels.

(B) Months of breastfeeding

This indicator measures the average duration of breastfeeding, in months, of the assessed children, as reported by their mother or caregiver. This is not an indicator reported by PRIDI but derives directly from the PRIDI questionnaires. It is measured and reported in months. The sample ranged from 0 to 69.6 months, with a mean and standard deviation of 16.8 and 17.0 months, respectively. This indicator was included in the analyses to resonate with FQA milk powder distribution and establish a framework for future monitoring. The *Leite da Família* program was implemented through FQA in 2015, with deliveries starting in August. Additionally, there is a set timetable for delivering powdered milk for children from 12 to 24 months of age. Monthly kits include three cans of 400 gramms of formula, which are to be returned once empty.

FQA children have positive gains when compared to the control group, as shown in Figure 1B. There is an increase of 2 to 4 months in the breastfeeding period. However, the gains-growth curve does not grow monotonically. There is a substantial drop in breastfeeding duration for the children of mothers with a participation rate in FQA above 30%. A plausible explanation for this drop may be the replacement of breastfeeding with supplementary formula coming from FQA. It is important to note that the correlation of this indicator with SES in the analyzed sample was not significant at 95% confidence. The duration of breastfeeding is practically independent of the socioeconomic level of the families studied.

(C) Degree of family's attention to the child's preexisting health conditions

This indicator measures the fraction of a child's conditions or diseases reported by mothers who received follow-up or treatment. It is an indicator that ranges from 0% to 100%. The closer to 100%, the larger the medical follow-up for the child's conditions. The conditions covered by the questionnaire were vision, hearing, skin or respiratory problems, headaches, fevers, diarrhea, and anemia. It was not up to the field evaluators to carry out diagnoses or confirm the existence of these conditions: They only recorded the mothers' information regarding the child's conditions and registered the treatments and follow-ups reported by the mother or caregiver.

Among non-FQA participants, on average, mothers reported to treat or follow-up 88.7% of the child's conditions, while FQA-enrolled participants, regardless of their level of participation, reported 92.4%. Thus, FQA children have positive gains when compared to the control group. The effect is smaller among children whose mothers had a low level of participation but grows steadily among mothers more committed to the Program. All treatment groups in the sample showed positive and significant gains (Figure 1C). Children of mothers with close to 40% participation have an average of +12 percentage points of additional coverage of conditions and diseases when compared to their non-participating peers. This indicator is weakly dependent on SES, being higher for children from families in the sample with higher SES.

(D) Social-emotional development

The indicator of socio-emotional development derives from 16 items responded by the child's mother or guardian. It is the only PRIDI's main indicator that assesses the child based on others' opinions and not directly interacting with the child. The indicator focuses primarily on measurements of the child's empathy, self-control, autonomy, and openness to new

experiences. It was measured on a scale with a mean of 50 and a standard deviation of 5, estimated by a Rasch model in R.

FQA children score less than non-FQA children on the socio-emotional indicator. For most children (those whose mothers are in the first to third quartile of participation), there is a small but significant negative effect of approximately -0.2 to -0.3 points on the indicator's scale (Figure 1D). The disadvantage only disappears with children whose mothers participate in more than 40% of the FQA activities, but this difference is not significant at 95% confidence levels.

The socio-emotional indicator showed an anomalous behavior, given its resulting weak correlation with the age of subjects and the socioeconomic level of the families. When comparing the answers for each of the items that make up this indicator, no differentiation patterns were found by socioeconomic status.

In the original PRIDI, with data for Latin American countries, this anomaly was not observed, although the effect of age and SES was not very clear. This anomalous behavior was verified even after expunging the questionnaires answered by guardians other than the mother. Given this anomaly, this indicator was not converted into months of development.

(E) Motor skills

The motor skills indicator comes from PRIDI Test B questions applied directly to children. It measures motor coordination. The questions comprehend exercises such as catching a softball thrown by the evaluator, building a bridge with wooden blocks, walking on a tape back and forth without losing balance, as well as drawing and copying exercises. The measurement uses a scale with a mean of 50 and a standard deviation of 5, estimated by a Rasch model.

Participation in the FQA has a positive effect on children in terms of motor development, constant for children whose mother's rate of participation in the Program is placed in the first quartile and increasing progressively from the second quartile of participation upward. The gains are only significant at 95% confidence for rates of participation over 20%. These gains translate into approximately +1.2 to +3.2 months of gain in development, reaching 2 to 3 months in developmental gains as the mother's attendance grew, as described in Figure 1E.

The scale of motor coordination proved to be insensitive to SES. FQA children's scores could be even higher if the results of the questions involving drawings were not considered. This result indicates a possible area for improvement of the program, either through early drawing workshops or higher attendance to formal (pre)schooling, which is the program's goal in the present design.

(F) Language skills

The language skills PRIDI indicator comes for a test applied directly to the child. It considers the child's ability to use verbs in the past, present, and future tenses, the correct differentiation of left and right, behind and in front, identifying actions represented in images, and correctly nominating geometric figures and colors. The scale of this indicator, again, has a mean of 50 and a standard deviation of 5, also constructed with a Rasch model.

Participation in the FQA has a strong positive effect on children's use of language. This positive effect regularly grows as the rate of mother's participation in the programmed activities increases. These gains, significant at 95% confidence, translate into approximately +3.7 to +9.5 months of gain in child development (Figure 1F). Compared to a control group that excludes Venezuelan children (due to their inherent potential handicap in Portuguese), results are slightly less impressive, on average dropping two months in the results described above.

Participation places FQA children, in terms of language use, at a level of 3 to 7 points on the SES scale above non-participants (or approximately one standard deviation of 5). The gains brought by the FQA are even more impressive considering the children of a very low SES stratum. Compared with this control group, FQA children have at least 0.8 additional scale points, exceeding 1.9 points for mothers with higher intensity of participation in the program (those situated in the fourth quartile).

(G) Vocabulary extension

This indicator is obtained by applying the TV-Aud 33bo vocabulary test, with 33 sets of 5 images each. The interviewer shows the set to the child, asking for them to identify images corresponding to spoken words. It uses a scale of mean 50 and standard deviation of 5, estimated by a Rasch model. It is an indicator that typically increases with the children age (they expand their vocabulary as they age), with the families' socioeconomic level and with exposure to schooling. Participation in the FQA positively affects children in terms of vocabulary extension. The effect is constant for children whose mothers have a rate of participation in the program below the median (4 to 5 months in gains) and increases progressively among children whose mothers have a rate of participation above the median, reaching a maximum of 8-10 months in gain, as described in Figure 1G.

In terms of vocabulary, FQA children with mothers highly engaged in the program have an important advantage. Compared with non-participants, their performance equals the one found among non-participant children of the same age but from families positioned 7 points above the SES scale. Thus, in this dimension, the Program effectively reduced the socioeconomic disadvantage.

In hindsight, using a different, more complete test for vocabulary could prove useful. The choice of a 33 words test was made, assuming this would reduce stress and improve overall performance during testing. However, this choice resulted in top-of-scale saturation in several test cases, indicating a longer, more discriminating instrument should be employed (such as TV-AUD-107 derivatives).

(H) Cognitive skills

FQA children show a lower rate of cognitive development than their non-participating peers. The indicator was sensitive to age and SES. The apparent handicap is not monotonically linked to participation but translates into -2.4 to -5 months of development compared to non-FQA children (Figure 1H).

The verified disadvantages of FQA children are linked to items involving sums, counting, and classifications in one or two dimensions. The cognitive indicator is highly sensitive to the SES and equivalent to -4.2 to -6.2 points on the socioeconomic scale. On average, FQA children have the equivalent cognitive development to children with approximately one standard deviation lower in the SES score.

SES leverages cognitive growth as the child ages. For families in the lowest SES range, participation in the FQA seems to place the children on par with the others, but this parity erodes as SES increases, albeit not significantly (at 95% confidence).

The cognitive development indicator is sensitive to years of schooling; a factor included in the matching model. The indicator's components in which FQA children showed a disadvantage are those associated with mathematical reasoning, typically developed in schools and not usually in family contexts.

It remains to be understood why FQA children – even those attending preschool – have this apparent deficit. A possible hypothesis is the concentration of these children, due to a systemic bias yet to be identified, in daycare centers or schools that were less successful in developing cognitive skills.

Another possible explanation comes from the average length, in years, of schooling of children in the sample, participating or not participating in FQA, by socioeconomic status. Children in the lowest SES, both FQA, and non-FQA, have an average of 1.2 years of exposure to school, with very similar average performance in the cognitive. As family SES increases, FQA children have lower average schooling than their counterparts, 13% to 25% less, for higher SES levels. The cognitive indicator follows this schooling deficit, penalizing FQA participants.

Other findings

For mothers participating in the FQA, the survey questionnaire included questions about perceptions of the program and suggestions for improvement. Note that the 123 responses

obtained come from questionnaires answered specifically by participating mothers and not by third parties, parents, relatives, or other guardians of the child. FQA's popularity is clear. 91% of participating mothers would recommend FQA to friends. 8% did not have an opinion, and only one mother would not recommend it (0.8%). Mothers consider content and lectures more relevant than material benefits, such as supplementary milk or baby clothing kits. The expansion of the service's network was the most frequent request by the participants, noting that interviewed mothers primarily reflect pioneering enrollments in a time in which FQA services were provided from a single central location.

Conclusions

The *Família Que Acolhe* program is a fundamental component of the early childhood policies in Boa Vista. This research evaluated the Program impact on the first two cohorts attended by the program. The evaluation presented here shows that the program had a notable impact on important dimensions of child development. The study aimed to assess causality between the level of mother's participation and effects. Data shows greater engagement and involvement of families in the program's activities lead to more substantial results.

In dimensions explicitly addressed by the program, the measured gains were clear. Children participating in the FQA have better language use, motor coordination, and vocabulary range than their non-participating counterparts. Regarding health dimensions, FQA children are breastfed for longer, are taller for their age, and have more extensive follow-up care for diseases and health conditions than their counterparts.

In two of the dimensions evaluated, cognitive and social-emotional, FQA children scored lower than their non-participating counterparts. The more problematic items are those typically associated with schooling, and in particular, mathematics. On average, FQA children had two months less formal schooling than their non-FQA counterparts. In fact, for the least vulnerable two-thirds of the participants, the average schooling is lower than that of non-participating counterparts. This disadvantage in exposure to schooling does not occur for the most vulnerable third of the participants, in line with the program's guidelines, oriented towards the most vulnerable families.

The cohort of FQA children surveyed is contemporaneous with the expansion of the municipal network for early childhood education and daycare facilities (Figure 3). Subsequent cohorts in the Program counted with a broader schooling network and improved opportunities for early schooling.
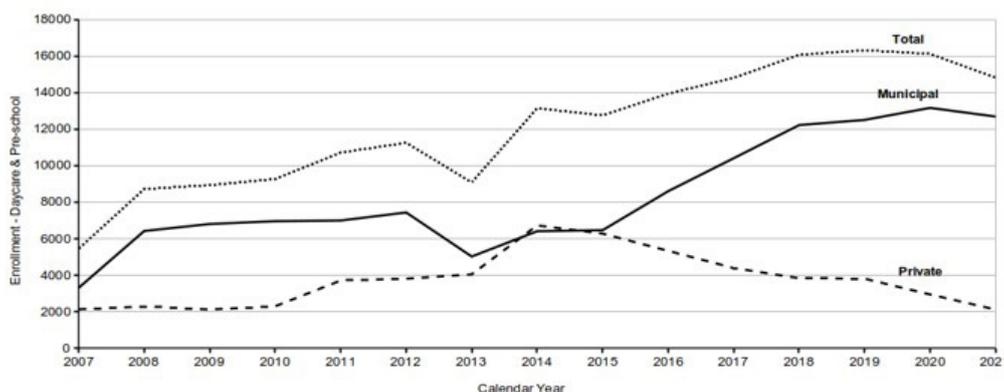

Figure 3. Early childhood school enrollment – Boa Vista.
Source: The authors, based on education census data (INEP, 2020).

As for the social-emotional disadvantage, it is important to note that it ceases to be significant as the frequency of mothers' participation in the Program increase. Possibly this disadvantage is rooted in the phenomenon of lower schooling for the less vulnerable groups of participants.

In general, the level of mothers' engagement with the Program did not depend on socioeconomic status: Average participation was the same for socioeconomic strata, confirming the program's ability to engage the most vulnerable. Nine out of ten participating mothers would recommend the program to a friend. For them, the lectures and informational content are more relevant than material benefits distributed by the Program. For families from the lowest SES stratum, participation in the program results in higher scores on four of the analyzed indicators when compared to non-participants.

The challenges initially encountered, and reflected in the data analyzed in this work, such as the relatively low participation and enrollment in the final months of pregnancy, have been addressed by the program over the years. Likewise, the contents presented in the lectures and practical activities were adapted to the needs of the participants, while the Program added new services. Some challenges remain salient among the participants, such as the frequent belief in physical punishment and the veiled subordination of children's interests to those of parents. Both are examples of attitudes and values that should be addressed by Boa Vista's programs and their service network.

Changes to the survey, for subsequent rounds of assessment, should include Spanish versions of the questionnaires to cater to Venezuelan families. Additionally, more extensive vocabulary testing instruments such as the TVAud 107 series (Capovilla et al., 2011) and more recent social-emotional measurement instruments could improve insights. From a sampling point of view, given the program's descentralization in recent years, an expansion into rural households might prove useful, if feasible from a safety and logistical perspective. Finally, a higher participation of high SES households in the control group – which were notably hard to approach on a random basis – could further improve the assessment of how developemental gaps can be narrowed for vulnerable FQA participants. As a baseline, this study's role is to serve as an evidence-based reference to track the progress of the integrated policies that qualify Boa Vista as "the Capital of Early Childhood".

Conflict of interest

None.

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