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Essays in Health Economics

Ensaios em Economia da Saúde

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"Health care is vital to all of us some of the time,

but public health is vital to all of us all the time."

C. Everett Koop

Abstract

The implementation of the Brazilian *Programa Saúde da Família* (PSF) in the 1990s was a milestone towards a primary care model based on community health workers, replacing a techno-health care model focused on hospital care. The program aims to provide basic health through professional health-care teams (composed by doctors, nurses and health agents) working at the community level. This thesis consists of three papers that seek to investigate the effects of PSF on health outcomes, using different empirical strategies of impact evaluation.

As a primary care initiative with an emphasis on improving child health, the first paper assesses whether PSF has a true and lasting impact on the lives of children preventing many of them to die from avoidable causes. We conducted a quasi-experimental study following municipalities that takes into account that PSF was implemented at different times in each municipality. The data covered all the 5570 Brazilian municipalities over a two-decades period (1998–2018). Our findings highlight that program implementation do have a remarkable effect on reducing infant preventable mortality, but the effect takes a couple of years to manifest itself. As the time of exposure to PSF increases, the predicted avoidable mortality rate (per 10,000 inhabitants) reduces from 3.1 to 2.5 after 5 years of exposure, then to 1.8 after 10 years, and reaches 0.4 after 20 years into the program. The results are robust to the possibility of pre-existing trends in mortality, suggesting that there is a causal negative relationship between PSF implementation and under-five avoidable mortality.

The second paper is based on the literature showing that what happens during pregnancy and youth significantly influences children's long-term health. The *Programa Saúde da Família* (PSF) has a wide range of initiatives to promote prenatal and childcare. Since the program was locally implemented in different periods of time, siblings may have been exposed to the program differently. Using Datasus and the Brazilian Household Survey, our empirical strategy aims to estimate the effect of the program's presence at early stages of life on children's health, partialling out family and regional features likely to be related to

the program availability and controlling for regional specific factors that varies over time. The findings provide evidence that children exposed to the PSF early (during prenatal, at birth or during their first year of life) have better health outcomes than children not exposed to the program during their same stages of life. The program's effects vary across stage of life and time of exposure analyzed. The effects are heterogeneous and focused on low-income, less-educated families and vary by skin color – leading us to ponder that PSF also plays a role in reducing health inequalities.

The third paper investigates whether PSF has an effect at the individual level, looking at a series of results that are closely related to primary care. Using microdata from the *Pesquisa Nacional de Saúde* (National Health Survey), this study estimates the effects of PSF on general health, preventive behavior and search for health. Our empirical strategy exploits a multivalued treatment effects approach by taking advantage of the information on household's registration in the PSF and frequency of the Family Health Teams. Our results show that the active presence of the program fosters preventive health behavior improving vaccination and preventive exams adherence, and intensifies search for public health care services, but does not have an overall effect on self-perceived health and measured indicators related to obesity and hypertension.

Keywords: primary care; health outcomes; impact evaluation

Resumo

A implementação do Programa de Saúde da Família (PSF) na década de 90 foi um marco em direção a um modelo de atenção básica baseado em agentes comunitários de saúde, substituindo um modelo de assistência em saúde focado na assistência hospitalar. O programa visa proporcionar saúde básica por meio de equipes profissionais de saúde (compostas por médicos, enfermeiros e agentes de saúde) que trabalham em nível comunitário. Esta tese é composta por três artigos que buscam investigar os efeitos do PSF nos desfechos em saúde, utilizando diferentes estratégias empíricas de avaliação de impacto.

Sendo uma iniciativa de atenção primária com ênfase na melhoria da saúde infantil, o primeiro artigo avalia se o PSF tem um impacto relevante e duradouro na vida das crianças, impedindo que muitas delas morram por causas evitáveis. Realizamos um estudo quase-experimental em municípios que leva em consideração que o PSF foi implementado em momentos diferentes em cada município. Os dados cobrem todos os 5570 municípios brasileiros em um período de duas décadas (1998–2018). Nossos resultados destacam que a implementação do programa tem um efeito notável na redução da mortalidade infantil evitável, mas o efeito leva alguns anos para se manifestar. À medida que o tempo de exposição ao PSF aumenta, a taxa de mortalidade evitável prevista (por 10.000 habitantes) reduz de 3,1 para 2,5 após 5 anos de exposição, depois para 1,8 após 10 anos e atinge 0,4 após 20 anos no programa. Os resultados são robustos à possibilidade de tendências preexistentes na mortalidade, sugerindo que existe uma relação causal negativa entre a implementação do PSF e a mortalidade evitável para menores de cinco anos.

O segundo artigo é baseado na literatura que mostra que o que acontece durante a gravidez e a infância influencia significativamente a saúde da criança a longo prazo. O Programa Saúde da Família possui uma ampla gama de iniciativas para promover o pré-natal e o cuidado infantil. Como o programa foi implementado localmente em diferentes períodos de tempo, em uma mesma família, irmãos podem ter sido expostos ao programa de maneira diferente. Usando o Datasus e a Pesquisa Nacional por Famílias, nossa estratégia

empírica visa estimar o efeito da presença do programa nas fases iniciais da vida na saúde das crianças, controlando por aspectos familiares e regionais que provavelmente estão relacionados à disponibilidade do programa e controlando por fatores específicos regionais que varia ao longo do tempo. Os resultados fornecem evidências de que as crianças expostas ao PSF precocemente (durante o pré-natal, o nascimento ou o primeiro ano de vida) têm melhores resultados de saúde do que as crianças não expostas ao programa durante os mesmos estágios da vida. Os efeitos do programa variam de acordo com o estágio da vida e o tempo de exposição analisado. Os efeitos são heterogêneos e focados em famílias de baixa renda e com baixa escolaridade e variam de acordo com a cor da pele – levando-nos a refletir que o PSF também desempenha um papel na redução das desigualdades de saúde.

O terceiro artigo investiga se o PSF tem efeito no nível individual, observando uma série de resultados que estão intimamente relacionados à atenção primária. Utilizando microdados da Pesquisa Nacional de Saúde, este estudo estima os efeitos do PSF na saúde geral, comportamento preventivo e busca por saúde. Nossa estratégia empírica explora uma abordagem de *Multivalued treatment effects*, aproveitando as informações sobre o registro da família no PSF e a frequência das equipes de saúde da família. Nossos resultados mostram que a presença ativa do programa promove o comportamento preventivo da saúde, melhorando a adesão à vacinação e aos exames preventivos, e intensifica a busca por serviços públicos de saúde, mas não tem um efeito geral na autopercepção da saúde e nos indicadores medidos relacionados à obesidade e hipertensão.

Palavras-chaves: Atenção básica; resultados de saúde; Avaliação de impacto

Contents

1 Can Primary care end Preventable deaths in Children? A quasi-experimental study from *Programa Saúde da Família*

Abstract

The under-five mortality rate, defined as the probability of a child dying before reaching five years of age, is known as a crucial indicator of child well-being and general health status of a population. Previous evidence have shown a negative association between primary care availability and infant mortality rates in developing countries. The creation of the Brazilian *Programa Saúde da Família* (PSF) in the 1990s was a milestone towards a primary care model based on community health workers, replacing a techno-health care model focused on hospital care. As a primary care initiative with an emphasis on improving child health, PSF is expected to have a true and lasting impact on the lives of children preventing many of them to die from avoidable causes. In this paper, we conducted a quasi-experimental study following municipalities that takes into account that PSF was implemented at different times in each municipality. The data covered all the 5570 Brazilian municipalities over a two-decades period (1998–2018). Our findings highlight that program implementation do have a remarkable effect on reducing infant preventable mortality, but the effect takes a couple of years to manifest itself. As the time of exposure to PSF increases, the predicted avoidable mortality rate (per 10,000 inhabitants) reduces from 3.1 to 2.5 after 5 years of exposure, then to 1.8 after 10 years, and reaches 0.4 after 20 years into the program. The results are robust to the possibility of pre-existing trends in mortality, suggesting that there is a causal negative relationship between PSF implementation and under-five avoidable mortality.

Keywords: primary care; preventable death; children's health.

1.1 Introduction

Mortality, especially at early ages, is a major metric of population health. Preventing child's premature death is a challenge for every health system that motivated worldwide governments to establish targets and commitments to accelerate progress. The Millennium Development Goals and the Sustainable Development Goals have put child mortality at the forefront in the development agenda. The former established a reduction of the under-five mortality rate by two-thirds (SUMMIT et al., 2000), the latter designed an action plan to mitigate preventable deaths of newborns and children under-five, in an attempt to decrease neonatal mortality to at least 12 for every 1,000 live births and under-five mortality to at least 25 per 1,000 live births by 2030 (UNDP, 2020). In the battle to end child mortality, the availability of adequate health care has a fundamental role, as more than half of child deaths worldwide could have been possibly prevented by the implementation of primary care-based policies (STARFIELD; SHI; MACINKO, 2005).

A couple of decades ago, Brazil had a staggering child mortality rate, but it has undergone improvements over the past 20 years (World Bank, 2020). In 1998, Brazil reported 39.6 deaths per 1,000 live births. As of 2018, the country had decreased the rate to 14.4 deaths per 1,000 live births. There are several reasons for the reduction of infant mortality in Brazil, but structural changes in the provision of health care have contributed to the decline aforementioned.

In the last decades, the fundamental principles that guide health care in Brazil (universality, equity and integrality), incorporated in the Brazilian Constitution of 1988 and in the legislation of the Unified Health System (SUS), have been promoting changes in the health provision model, especially in the primary health care. Beginning in the mid-1980s, limited primary care initiatives were developed in municipalities in combination with universities. Years later, this resulted in the creation of community-oriented policies – the Community Health Agents Program (PACS), then the Family Health Program/*Programa Saúde da Família* (PSF) – which became prototypes for a nationwide primary care policy (GIOVANELLA; PINTO, 2018).

After its creation in 1994, the PSF has progressively become the main strategy to facilitate access to first-contact care. Little more than ten years afterward, as the guiding axis of SUS, it became the **Family Health Strategy**, foreseen in the National Primary Care Policy/*Política Nacional de Atenção Básica* (PNAB), in 2006, later updated in 2011 and 2017. The PSF is a project of the Ministry of Health of Brazil and aims to provide basic health through the use of teams of health professionals, namely Family Health Team (FHT), which intervene directly at the family and community levels. Each team follows a preplanned number of families offering health counseling, information on health promotion, disease prevention and recovery-related guidance in the community.

The provision of primary care at the community level and the attribution of responsibility to family health professionals have changed the long-established paradigm and the way of providing health care in Brazil. A shift from the centralized health model around public hospitals in the central urban zones, to a decentralized model, where the first point of reference between the citizens and the public health system is transferred to local communities (ROCHA; SOARES, 2010).

Despite the relevance of the topic, few empirical studies assessing the effects of the program are available and most of them come from the public health literature. In a systematic review of articles from 2002 onwards, Arantes, Shimizu e Merchán-Hamann (2016) found that about 45% of the articles linked to the theme use qualitative methods, while 26% used quantitative methods and another 8% qualitative and quantitative approaches mixed. Among quantitative studies, most are focused on the first years of program implementation. In particular, Macinko, Guanais e Souza (2006) assesses the program's impact on child mortality using state data, and finds a significant impact on mortality. In line with this study, using municipal data, Rocha e Soares (2010) find that the first years of the program is associated with reductions in mortality, especially at younger ages, a result that is also noted by Aquino, Oliveira e Barreto (2009) and Bhalotra, Rocha e Soares (2019). Hospital admissions are also affected by the program: Macinko et al. (2010) has found an effect of PSF on reducing hospitalizations for chronic diseases that could be effectively managed and treated in the primary care. In a study of self-assessed

health, Macinko, Almeida e Sá (2007) investigate the effect of the program's presence on perceived subjective health and find evidence that the availability of the program in a given municipality is linked to a better perception of health by the population.

The aim of this study is to estimate the effects of the PSF on avoidable mortality in children – children deaths considered preventable through timely and effective care – classified as cause of death related to (A) Immunization; (B) Prenatal care; (C) Adequate care during childbirth; (D) Adequate attention to the newborn; (E) Diagnosis and appropriate treatment and (F) Actions of health promotion. Following all the 5570 Brazilian municipalities through two decades (1998-2018), our empirical approach uses a panel analysis that considers PSF was implemented at different times in each municipality and enables heterogeneous response according to the length of exposure to the program.

This paper is organized as follows. In section 1.2 we provide an overview of the *Programa Saúde da Família* and its specific features. Section 1.3 describes the datasets used to compose the characteristics of the municipalities. Section 1.4 elucidates the empirical strategy. Section 1.5 presents the findings on the effects of the program on avoidable mortality in children and performs the robustness analysis. Section 1.6 concludes the paper with a discussion of the results, limitations and next steps of research.

1.2 The Program

Three decades ago, the promulgation of the new Brazilian Constitution established Universal Health Coverage as a lemma: *"Health is the right of all and a duty of the State"*, that is, every Brazilian has access to prevention, promotion and health recovery actions guaranteed by law (CASTRO et al., 2019). In this process, the Unified Health System (SUS) was established based on the principles of universality, equity and integrality (PAIM; SILVA, 2010). In accordance with the principles of the SUS, the *Programa Saúde da Família* (PSF) emerges as a strategy for reorienting the health care model based on primary care setting.

The PSF started when the Ministry of Health formulated the Community Health Agents Program (PACS) in 1991 with the purpose of contributing to the reduction of infant and maternal mortality, mainly in the North and Northeast regions, through the extension of service coverage health care for less favored areas. From this first experience, the Ministry of Health perceives the importance of Agents in basic health services in the municipality and begins to focus on the family as a health intervention unit (ROSA; LABATE, 2005).

Although initially labeled as a program, the PSF differs from the usual conception of a program itself, since it is not a vertical intervention apart from other activities of health services. For the Ministry of Health, the PSF is a strategy that aims to serve the individual and the family in an integral and continuous way, developing actions to promote, protect and recover health. The way it was designed, PSF has as its general objective: *"to contribute to the reorientation of the care model based on primary care, in accordance with the principles of SUS, creating a new dynamic of performance in basic health units, with the definition of responsibilities between health services and the population"* (SAÚDE, 1997).

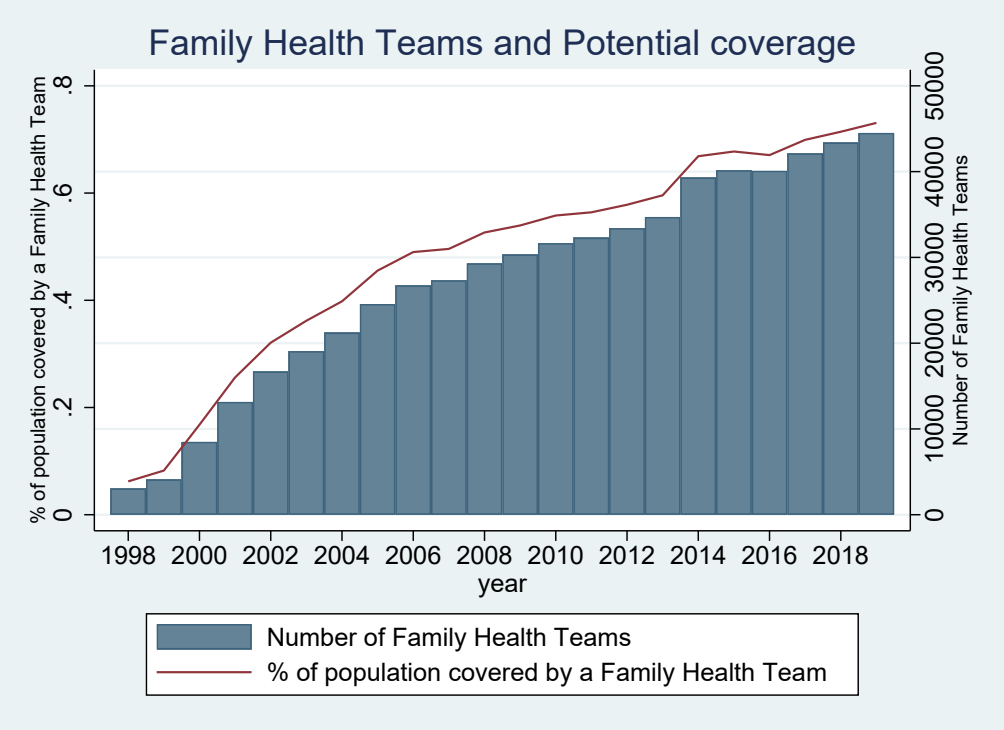
According to the Departamento de Atenção Básica (2000), to be eligible to obtain the federal resources[1] of PSF, the following elements are necessary:

- The presence of a Family Health Team (FHT) composed of general practitioner, general nurse, auxiliary or nursing technician and community health agents and oral health professionals.
- The total of community health agents (CHA) must be sufficient to cover the registered population, subject to a maximum of 750 people per CHA and 12 CHA per FHT.
- Each FHT must be responsible for a maximum of 4,000 people. It is advisable to assess the degree of vulnerability of families in the region, so that the greater the fragility, the lower the ratio of people served by the team.
- The registration of each health professional in only one FHT. Exception only to the doctor, who can act in up to two FHT and with a total workload of 40 hours per week.

Family Health Teams are in charge to register households through home visits, according to a pre-established geographic area. In this process, families will be known, as well as morbidity, housing conditions, sanitation and environmental conditions. This stage initiates a bond between the community and the health team, which is also informed of the services available and the Units that may serve as a health reference. After the first contact, continuous home visits are a key part of the FHT's duties in order to monitor the health situation of families and develop educational practices for health, focused on prevention and health promotion.

[1] The financing scheme of the PSF uses a framework of incentives, with two main components as explained by Andrade et al. (2018): "*First, each municipality receives a fixed amount from the federal government, based on the number of inhabitants, to finance primary care expenses. Until 2012, this fixed amount was the same for all municipalities. Starting in 2013, this amount varied from US$10 to US$12 per year per capita, depending on the socio-economic conditions of municipalities (better off municipalities receive less). Second, municipalities receive a variable amount conditioned on performance indicators, and on the development of some PHC programmes, such as the FHS. For instance, in 2012, the variable amount for each family health team was set monthly from approximately US$3500 to US$5400 depending on the type of the team.*"

Figure 1 displays the evolution of Family Health Teams and its potential coverage over time. As prescribed by the Ministry of Health, potential coverage assumes that each FHT follows 3,450 individuals[2] on average (Primary Care Department, 2004). In 1998, Brazil had 3,062 registered FHTs and 6.2% of the population was covered by the program. Two decades later, the country has 44,513 FHTs and 73.1% of the population is covered by the program.



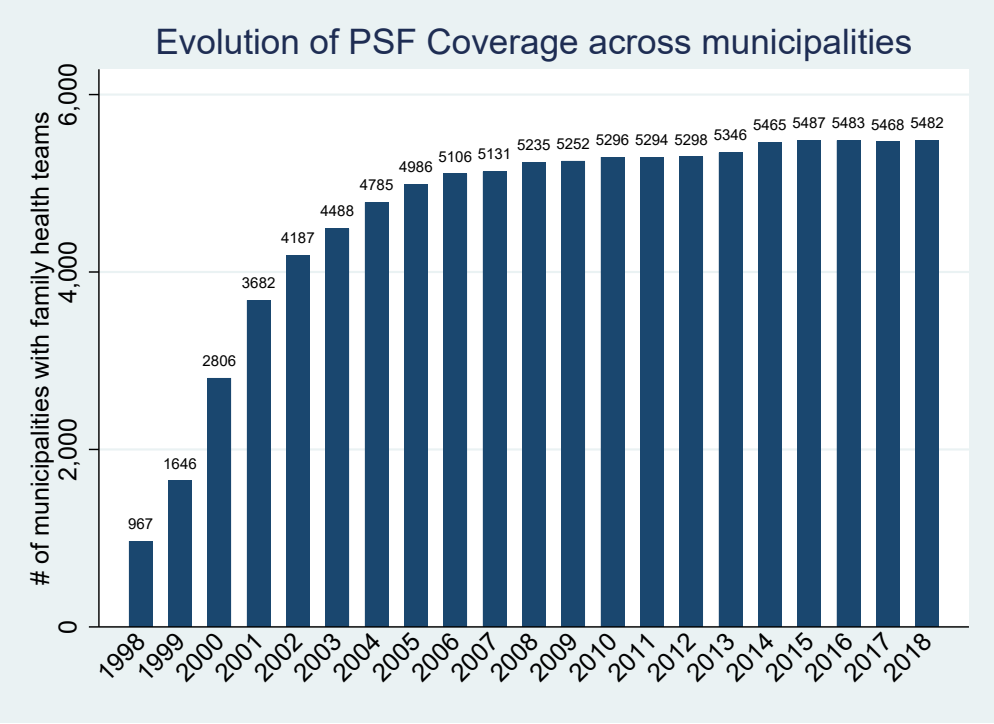
Source: Own elaboration with data from the Primary Care Department.

Figure 1

Besides the teams, PSF has public health units called Family Health Units that offers the infrastructure for the activity of the FHTs. A Family Health Unit aims to develop activities to promote, protect and recover health, at the primary level of care. It represents the first contact of the population with the municipality's health service, providing a bridge of communication for the different levels of the system, when the need for greater health complexity is identified. A Family Health Unit is usually situated inside a Basic Health Unit (BHU).

[2] PNAB 2017 changed this number of individuals that would be ideally served by a family health team to a range varying from 2000 to 3500 people. It was also determined that in municipalities with less than 2,000 inhabitants, one FHT is responsible for the entire population (BRASIL, 2017).

PSF is a federal initiative that is implemented at the municipal level. Implementation requires coordination between the federal, state and municipal levels[3]. Even though all three government spheres hold legal incumbencies to ensure the adequate operation of the program, the main issues regarding the adoption and the coverage of the PSF in a given area is a resolution reached by the municipality. This procedure can be divided into two stages: at first, the mayor decides whether the program will be introduced in the municipality; then, if implementation proceeds, the local administration establishes which localities within the municipality will be prioritized and the program's coverage by designating the number of FHTs to be formed. After a municipality opts for joining the program and chooses the regions that will receive its assistance, FHTs register households and carry out continuous visits to the families.



Source: Own elaboration with data from the Primary Care Department.

Figure 2

[3] Officially, the responsibilities for the three levels of government are listed as follows (Ministério da Saúde, 2006): i) Federal Government: elaboration of the basic health objectives of national policy; co-financing the primary health care system; to propose mechanisms for planning and evaluation of the primary health care system. ii) State Government: monitoring the implementation and execution of the program; regulation of inter-municipal relations; coordination of human resources; program co-financing; assistance in implementing the strategies of the primary health care system. iii) Municipal Government: definition and implementation of the PSF model; hiring workforce for FHTs; program co-financing; performance evaluation of the basic health care teams under their supervision.

Since its origins, the program has been constantly amplified, with a progressive participation of new municipalities. As illustrated in the Figure 2, there has been an expressive increase in the number of municipalities covered especially during the first half of the 2000s: starting with 967 municipalities in 1998 (the first year of official data related to PSF) and reaching 5482 municipalities in 2018.

The consolidation of the program marks a change in the provision of basic health care in the country, at some extent more distant from hospitals, and closer to communities and families. The health team's proximity to the user allows the person, family and neighborhood to be known. The idea is to facilitate a greater engagement with the treatments and actions proposed by the Family Health Team. The expected consequence is that more health problems are solved in primary care, avoiding the action of medium and high complexity in an Emergency Unit or hospital.

1.3 Data

The mortality data for the municipalities comes from the Mortality Information System (SIM), managed by the Department of Health Situation Analysis, along with the State and Municipal Health Secretariats. Each Health Secretariat collects the death certificates from the registry offices and transfers this information to the SIM. Death certificates are coded using the 10^{th} Review of the International Classification of Diseases (ICD-10). The cause of death is identified based on what was declared by the certifying doctor, according to the rules established by the World Health Organization.

The Brazilian List of Avoidable Deaths for children under-five (see Appendix) was prepared by a group of researchers coordinated by the Brazilian Ministry of Health that carried out a systematic review of preventable causes of death. The avoidable or reducible causes of death[4] were defined as "*those totally or partially preventable by health service effective actions, accessible in a determined place and time*" (MALTA et al., 2007). In the focus on preventable deaths, the group considered as causes of death those whose avoidability is dependent on technology offered by SUS[5]. The studies of Ortiz (2000) and Tobias e Jackson (2001) were used as a reference.

Mortality of children under five years old considered reducible or preventable was classified into six major groups:

A) Reducible by immunization actions: all causes of death for which there are effective vaccines.

B) Preventable by adequate care in pregnancy: conditions related to congenital syphilis, complications that affect the fetus or the newborn; disorders related to short-term pregnancy and low birth weight, Rh and ABO isoimmunization.

C) Reducible by adequate care for women during childbirth: conditions related to complications of the placenta, umbilical cord and membranes affecting the fetus,

[4] The concept internationally emerged from Rutstein et al. (1976) who introduced the notion of "*unnecessary untimely deaths*" as a way to assessing the quality of medical care.

[5] In this way, the List excludes causes of death avoidable by actions not foreseen or available by SUS. For example, according to Malta et al. (2007), it was decided not to include deaths from chickenpox, since the vaccine is not included in the National Immunization Program calendar.

disorders related to prolonged pregnancy and high birth weight, or asphyxia at birth.

D) Reducible by adequate care for the newborn: conditions related to perinatal and neonatal periods, including respiratory distress, neonatal hemorrhage and temperature regulation of the newborn.

E) Reducible by diagnostic actions and proper treatment: diseases for which treatments exist, even if this procedure is highly complex. It includes infectious and parasitic diseases, diseases of the endocrine glands, diseases of the nervous system, diseases of the circulatory and respiratory system.

F) Reducible by health promotion actions linked to health care: diseases that can be reduced by expanding basic sanitation, or controlled by educational practices, or associated with the control of vectors or actions aimed at reducing accidents.

The use of lists[6] of avoidable causes of death is an important instrument for evaluating the performance of health services. This is because preventable death is expected to be sensitive, to some degree, to the quality of health care provided by the health system (MALTA et al., 2010). The discussion paper of Castelli e Nizalova (2011) reviews how the concept of avoidable mortality progressed over time and discusses some of its criticisms.

Other sources of data were collected separately. DATASUS contains detailed information at the municipal level on the presence of the PSF during 1998-2018, as well as the number of public hospital beds[7] in each Brazilian municipality. Municipal GDP[8] data were collected from IBGE (Brazilian Institute of Geography and Statistics) and population estimates were obtained in DATASUS. Bolsa Família data regarding the amount monthly transferred to the Bolsa-Família Program to each municipality were gathered from MDS (Ministry of Social Development). Information on the Mais Médicos coverage, defined as the number of physicians allocated to the program by 10,000 inhabitants in each municipality, was obtained from a consultation via Information Access Law.

[6] Consistent with this literature, Alfradique et al. (2009) developed a specific List for Ambulatory care sensitive hospitalizations.

[7] The number of hospital beds from SUS is available in DATASUS since 2005. Hospital beds belonging to SUS from 1998 to 2004 were obtained through Information Access Law.

[8] The Municipal Gross Domestic Product (GDP) is available on annual basis between 1999 and 2017. The municipal GDP information for 1998 and 2018 was imputed using linear extrapolation.

1.4 Methodology

Our empirical strategy conducts a longitudinal study following municipalities that takes into account that *Programa Saúde da Família* was implemented at different times in a municipality. Our approach considers that the municipalities are heterogeneous, and the previous conditions of the municipalities are important to determine the adoption of the program, as well as the municipality's performance in combating avoidable mortality in children. Fixed institutional factors, health facilities, political issues and other time-invariant factors were controlled by adding municipality-fixed effects. Another relevant consideration is that at the time of implementation of the program, municipalities had their own trends in terms of infant mortality, to avoid this being understood as the effect of the program, municipality-specific time trends were included to consider differential trends in mortality particular to each municipality.

In addition, to prevent the effect of the program from being confused with other social policies that were implemented at the municipal level, we suitable control for other time-varying factors. Bolsa-Família, a nationwide program providing financial aid to poor families, was controlled by including its municipal coverage defined as the monthly amount per capita destined via Bolsa-Família to each municipality. More recently, Mais Médicos program, a federal initiative to provide doctors in under-served areas, was considered by adding the number of physicians allocated to Mais Médicos per 10,000 inhabitants. Hospital beds per capita is controlled as a measure of physical supply of health, to consider other health interventions occurred at the municipality. GDP per capita was included as an attempt to control for other local interventions and economic fluctuations specific to municipalities.

A fundamental point to be considered is that the program may have lagged effects on mortality, this is either because the program has a maturation stage for operational reasons (ROCHA; SOARES, 2010; BHALOTRA; ROCHA; SOARES, 2019) or because the health impacts take a while to be felt – Macinko, Guanais e Souza (2006) suggest that primary care based-interventions has a long-term relationship with infant mortality, considering that

maternal health is the first to be influenced, and the benefits extrapolate to the child over time. In order to understand this process, our first specification establishes a relationship between the avoidable mortality in children and the PSF coverage (contemporaneous and lagged measurements):

$$Avoidable\ Mortality_{\,m,\,t} = \alpha + \beta_j \cdot PSF\ coverage_{\,m,\,t-j} + \gamma \cdot X_{m,\,t} + \varphi_m + \mu_{m,\,t} + \tau_t + \varepsilon_{m,\,t} \tag{1.1}$$

where $Avoidable\ Mortality_{\,m,\,t}$ is the avoidable mortality rate in children under-five for municipality m in year t. $PSF\ coverage_{\,m,\,t-j}$ is the coverage of the program for municipality m in year $t-j$ and $j = 0, ..., 5$ denotes the lag-time. Two measures of coverage were considered: (i) the proportion of population potentially covered by the program in the municipality (which considers that each FHT covers 3,450 individuals); and (ii) number of deployed Family Health Teams by 1,000 inhabitants. The matrix $X_{\,m,\,t}$ contains a set of municipality level explanatory variables (Bolsa Família coverage, Mais Médicos coverage, GDP per capita and hospital beds per capita), φ_m is a municipality fixed-effect, $\mu_{m,\,t}$ is a municipality-specific year dummy, τ_t is a year fixed effect, $\varepsilon_{m,\,t}$ is a random error term, and α, β_j, and γ are parameters.

Extending this literature, our main specification is a difference-in-difference that enables heterogeneous response to the length of exposure to the program, also controlling for municipality-specific year dummies. Using all the Brazilian municipalities and two decades of data, this specification considers that PSF was implemented in different moments across municipalities, and municipalities were subjected to different lengths of exposure to the program. This way, our main specification is the following:

$$Avoidable\ Mortality_{m,\,t} = \alpha + \sum_{j=1}^{J} \beta_j \cdot PSF\ exposure^{\,j}_{\,m,\,t} + \gamma \cdot X_{m,\,t} + \varphi_m + \mu_{m,\,t} + \tau_t + \varepsilon_{m,\,t} \tag{1.2}$$

where $Avoidable\ Mortality_{m,\,t}$ denotes category-specific avoidable mortality rate in children under-five for municipality m in year t, $PSF\ exposure^{\,j}_{\,m,\,t}$ indicates a dummy variable taking value 1 if municipality m in year t has been in the program for j years. Regressions were weighted by population and standard errors were clustered at the municipality level.

1.5 Results

1.5.1 Descriptive statistics

Table 1 displays descriptive statistics of our main variables for each year between 1998 and 2018, stratified by municipalities covered and not covered by the program. As can be seen from the table, there is a declining pattern in mortality from preventable causes in children, both in municipalities covered and not covered by the program. The table also indicates that PSF was initially conceived in municipalities with lower GDP per capita and worse health conditions as measured by avoidable mortality rate in children and hospital beds per capita. Municipalities covered by the PSF receive higher Bolsa-Família and Mais Médicos coverages, which reinforces the importance of controlling for such programs in our estimations.

A declining trend in avoidable mortality is also seen in the set of causes of death considered to be amenable to health care in children as presented in Figure 3. Except for death reducible by immunization actions – which tends to attain a stable pattern varying from 0.013 to 0.0017 deaths per 10,000 inhabitants – a decreasing trend is found for all the categories analyzed. In particular, the mortality for causes reducible through adequate attention to the newborn has the highest rate in 1998 (0.91) but it was systematically reduced to 0.30 deaths per 10,000 inhabitants in 2018. To what extent PSF is responsible for the drop in avoidable mortality rate in children is an issue for the empirical investigation.

Table 1 – Descriptive statistics: Municipalities covered and not covered by the *Programa Saúde da Família*

	Avoidable Mortality		GDP per capita (R$)		Hospital beds per capita		Bolsa-Família coverage		Mais Médicos coverage	
Year	Not covered	Covered	Not covered	Covered	Not covered	Covered	Not covered	Covered	Not covered	Covered
1998	2.504	3.663	3297	3318	0.0023	0.0023	0.00	0.00	0.000	0.000
1999	2.456	3.229	3838	3566	0.0024	0.0022	0.00	0.00	0.000	0.000
2000	2.447	3.132	4301	4092	0.0023	0.0023	0.00	0.00	0.000	0.000
2001	2.311	2.743	4944	4402	0.0022	0.0023	0.00	0.00	0.000	0.000
2002	2.177	2.734	5717	5250	0.0019	0.0021	0.00	0.00	0.000	0.000
2003	2.240	2.602	6870	6454	0.0018	0.0021	0.00	0.00	0.000	0.000
2004	2.077	2.438	7975	7068	0.0017	0.0021	24.11	33.21	0.000	0.000
2005	1.866	2.377	9527	7254	0.0013	0.0018	30.93	48.76	0.000	0.000
2006	1.562	2.225	12068	7914	0.0013	0.0018	34.16	63.68	0.000	0.000
2007	1.421	2.055	13760	8931	0.0012	0.0017	38.21	74.31	0.000	0.000
2008	1.409	1.848	14403	10150	0.0011	0.0016	40.02	84.51	0.000	0.000
2009	1.241	1.781	16612	10697	0.0010	0.0016	43.14	95.70	0.000	0.000
2010	1.149	1.608	20048	12278	0.0009	0.0016	46.63	111.32	0.000	0.000
2011	1.041	1.582	22077	14127	0.0009	0.0015	52.95	131.56	0.000	0.000
2012	0.990	1.511	22766	15506	0.0008	0.0015	71.88	161.55	0.000	0.000
2013	0.864	1.474	25161	17116	0.0009	0.0014	77.78	188.14	0.047	0.051
2014	1.010	1.396	32899	18423	0.0007	0.0014	69.81	203.40	0.513	0.814
2015	1.145	1.321	35260	19425	0.0006	0.0014	61.33	204.62	0.441	0.967
2016	0.808	1.293	40390	20758	0.0005	0.0014	58.66	211.20	0.301	0.941
2017	0.797	1.289	40455	21759	0.0005	0.0013	55.47	195.07	0.397	0.841
2018	0.789	1.256	44544	22867	0.0005	0.0013	86.24	227.34	0.341	0.741

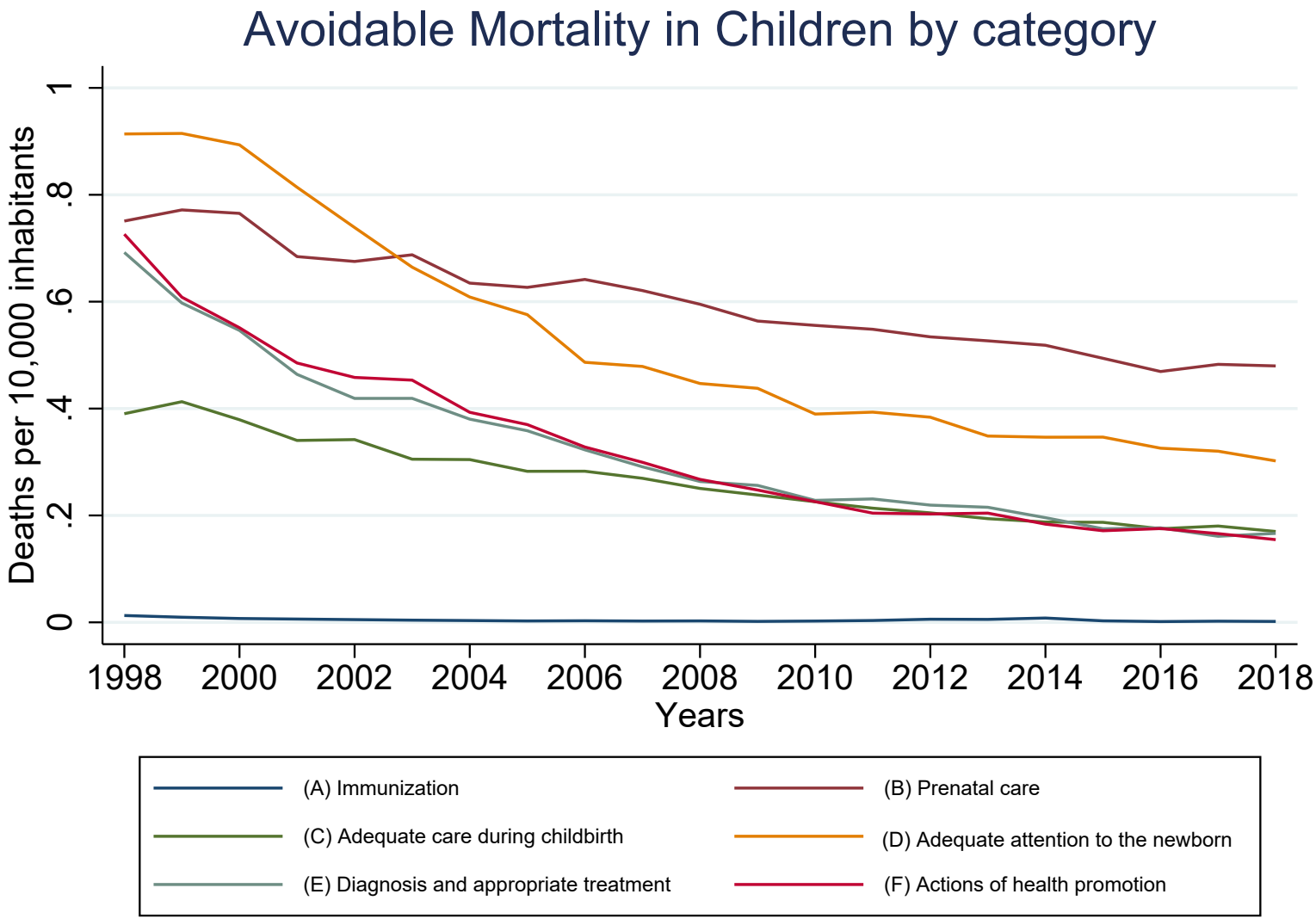

Avoidable Mortality in Children by category
Deaths per 10,000 inhabitants
0
.2
.4
.6
.8
1
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Years
(A) Immunization
(B) Prenatal care
(C) Adequate care during childbirth
(D) Adequate attention to the newborn
(E) Diagnosis and appropriate treatment
(F) Actions of health promotion

Figure 3

1.5.2 Main results

Table 2 provides a first assessment of the results of the PSF effects on the avoidable mortality in children, using two different measures of program coverage. In Panel A, PSF coverage is defined as a proportion of population potentially covered by the program in the municipality; and as the number of deployed family health teams by municipality's population in Panel B. Each column tests a different lagged PSF coverage in order to examine whether a previous expansion in program affects the avoidable mortality rates in the subsequent years.

The first estimated coefficients for model 1 and 2 suggest a positive correlation between program coverage and avoidable mortality, which could lead to the wrong conclusion that PSF is increasing mortality rates. Actually, the program implementation takes a couple of years to manifest itself an effect on avoidable mortality as shown in models 4 and 5. Ceteris paribus, an increase in program coverage by 10 percentage points (pp) is associated to a decrease of 0.016 on the avoidable mortality rate in children five years later. Meanwhile, an increase of one family health team per 1,000 inhabitants is linked to a reduction of 0.5 on the avoidable mortality rate five years later.

Table 3 presents our main estimations where heterogeneity in response is considered according to time of exposure to the PSF in each municipality. Our key explanatory variables are dummies indicating if the municipality was exposed 1, 2,. . . , 20 years to the program. The first column depicts the total avoidable mortality and the subsequent columns stratifies by category of avoidable cause: (A) Immunization; (B) Prenatal care; (C) Adequate care during childbirth; (D) Adequate attention to the newborn; (E) Diagnosis and appropriate treatment and (F) Actions of health promotion.

The estimated coefficients suggest that municipalities that have been exposed to the program for five years decrease the avoidable mortality rate in children by 0.56 per 10,000 more than otherwise similar municipalities not exposed to the program. Considering the 1998 average of avoidable mortality in children (3.48 per 10,000), this means a reduction of 16.1% in the avoidable mortality rate. For a municipality 20 years into the PSF, a decrease of 2.65 is verified which is equivalent to 76.1% of the 1998 average.

Table 2 – Children's Preventable death and *Programa Saúde da Família* coverage

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: PSF coverage defined as % of population potentially covered by the program in the municipality						
$PSF\ coverage_t$	0.0033***					
	(0.0006)					
$PSF\ coverage_{t-1}$		0.0018***				
		(0.0005)				
$PSF\ coverage_{t-2}$			0.0001			
			(0.0004)			
$PSF\ coverage_{t-3}$				-0.0004		
				(0.0004)		
$PSF\ coverage_{t-4}$					-0.0010***	
					(0.0004)	
$PSF\ coverage_{t-5}$						-0.0016***
						(0.0004)
Panel B: PSF coverage defined as the number of deployed Family Health Teams by 1,000 inhabitants						
$PSF\ coverage_t$	1.014***					
	(0.128)					
$PSF\ coverage_{t-1}$		0.545***				
		(0.138)				
$PSF\ coverage_{t-2}$			-0.055			
			(0.117)			
$PSF\ coverage_{t-3}$				-0.222**		
				(0.108)		
$PSF\ coverage_{t-4}$					-0.404***	
					(0.106)	
$PSF\ coverage_{t-5}$						-0.525***
						(0.108)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-specific Year FE	Yes	Yes	Yes	Yes	Yes	Yes
$N_{Panel\ A}$	116697	111127	105557	99987	94417	88842
$N_{Panel\ B}$	116707	111200	105693	100186	94626	89066

Robust standard errors clustered at the municipality level are in parentheses; regressions weighted by population. Outcome variable: Avoidable Mortality rate per 10,000 inhabitants. Independent variables: dummies indicating number of years into the program, municipality fixed-effects, year fixed-effects and municipality-specific trends. All regressions also included controls for: Bolsa Família coverage, Mais Médicos coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3 – Main results: Children's Preventable death and PSF exposure

	Total Avoidable	Categories of Avoidable cause					
		(A)	(B)	(C)	(D)	(E)	(F)
PSF year 1	-0.0567	0.0006	-0.0165	-0.0044	-0.0088	-0.0081	-0.0195
	(0.0457)	(0.0011)	(0.0158)	(0.0098)	(0.0184)	(0.0123)	(0.0127)
PSF year 2	-0.1362**	-0.0011	-0.0042	-0.0176	-0.0292	-0.0218	-0.0624***
	(0.0551)	(0.0012)	(0.0186)	(0.0109)	(0.0248)	(0.0138)	(0.0148)
PSF year 3	-0.2841***	-0.0013	-0.0381	-0.0408***	-0.0511	-0.0485***	-0.1042***
	(0.0715)	(0.0015)	(0.0241)	(0.0153)	(0.0345)	(0.0171)	(0.0184)
PSF year 4	-0.4329***	-0.0019	-0.0462	-0.0700***	-0.1187***	-0.0627***	-0.1334***
	(0.0931)	(0.0019)	(0.0287)	(0.0185)	(0.0456)	(0.0216)	(0.0219)
PSF year 5	-0.5598***	-0.0019	-0.0751**	-0.0817***	-0.1515***	-0.0830***	-0.1665***
	(0.1142)	(0.0022)	(0.0341)	(0.0217)	(0.0545)	(0.0270)	(0.0266)
PSF year 6	-0.7181***	-0.0026	-0.1124***	-0.1049***	-0.2020***	-0.0978***	-0.1985***
	(0.1439)	(0.0027)	(0.0428)	(0.0263)	(0.0673)	(0.0320)	(0.0319)
PSF year 7	-0.8749***	-0.0027	-0.1412***	-0.1336***	-0.2419***	-0.1167***	-0.2388***
	(0.1690)	(0.0032)	(0.0514)	(0.0304)	(0.0801)	(0.0370)	(0.0364)
PSF year 8	-1.0276***	-0.0044	-0.1665***	-0.1616***	-0.2813***	-0.1379***	-0.2760***
	(0.1996)	(0.0037)	(0.0617)	(0.0362)	(0.0933)	(0.0430)	(0.0422)
PSF year 9	-1.1424***	-0.0044	-0.1822**	-0.1844***	-0.3271***	-0.1499***	-0.2944***
	(0.2294)	(0.0043)	(0.0727)	(0.0405)	(0.1083)	(0.0485)	(0.0478)
PSF year 10	-1.2772***	-0.0049	-0.2060**	-0.2055***	-0.3684***	-0.1676***	-0.3250***
	(0.2573)	(0.0048)	(0.0821)	(0.0456)	(0.1230)	(0.0549)	(0.0542)
PSF year 11	-1.4702***	-0.0047	-0.2529***	-0.2363***	-0.4242***	-0.1836***	-0.3686***
	(0.2939)	(0.0055)	(0.0947)	(0.0511)	(0.1402)	(0.0611)	(0.0606)
PSF year 12	-1.5851***	-0.0055	-0.2757***	-0.2592***	-0.4639***	-0.1963***	-0.3845***
	(0.3253)	(0.0062)	(0.1064)	(0.0567)	(0.1573)	(0.0676)	(0.0679)
PSF year 13	-1.7314***	-0.0059	-0.3091**	-0.2888***	-0.5070***	-0.2019***	-0.4186***
	(0.3611)	(0.0068)	(0.1212)	(0.0631)	(0.1750)	(0.0747)	(0.0754)
PSF year 14	-1.8803***	-0.0057	-0.3480**	-0.3125***	-0.5554***	-0.2124***	-0.4462***
	(0.4036)	(0.0076)	(0.1371)	(0.0701)	(0.1954)	(0.0824)	(0.0829)
PSF year 15	-1.9988***	-0.0064	-0.3784**	-0.3383***	-0.5840***	-0.2186**	-0.4731***
	(0.4493)	(0.0085)	(0.1548)	(0.0771)	(0.2160)	(0.0908)	(0.0908)
PSF year 16	-2.1587***	-0.0075	-0.4161**	-0.3652***	-0.6315***	-0.2382**	-0.5002***
	(0.4950)	(0.0093)	(0.1689)	(0.0853)	(0.2401)	(0.0988)	(0.0998)
PSF year 17	-2.2953***	-0.0074	-0.4546**	-0.3966***	-0.6725**	-0.2497**	-0.5145***
	(0.5417)	(0.0102)	(0.1839)	(0.0936)	(0.2642)	(0.1074)	(0.1086)
PSF year 18	-2.4255***	-0.0084	-0.4907**	-0.4235***	-0.7113**	-0.2568**	-0.5348***
	(0.5908)	(0.0111)	(0.2028)	(0.1006)	(0.2895)	(0.1160)	(0.1178)
PSF year 19	-2.5675***	-0.0081	-0.5323**	-0.4562***	-0.7681**	-0.2728**	-0.5299***
	(0.6398)	(0.0120)	(0.2222)	(0.1083)	(0.3147)	(0.1247)	(0.1258)
PSF year 20	-2.6506***	-0.0091	-0.5755**	-0.4927***	-0.7898**	-0.2541*	-0.5294***
	(0.6938)	(0.0130)	(0.2434)	(0.1174)	(0.3421)	(0.1342)	(0.1354)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-specific Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	116707	116707	116707	116707	116707	116707	116707

Robust standard errors clustered at the municipality level are in parentheses; regressions weighted by population. Outcome variable: Mortality rate per 10,000 per category of avoidable cause. Independent variables: dummies indicating number of years into the program, municipality fixed-effects, year fixed-effects and municipality-specific trends. All regressions also included controls for: Bolsa Família coverage, Mais Médicos coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The findings for categories of avoidable cause (columns A to F) also point out a negative relationship between program exposure and avoidable mortality for all categories analyzed, except for avoidable deaths related to immunization. In particular, a reduction of 0.49 avoidable deaths related to adequate care during childbirth per 10,000 is estimated for a municipality 20 years into the program, which represents more than 100% of the 1998 average (0.39 per 10,000). Meanwhile, the estimated effects for adequate attention to the newborn and actions of health promotion for the same length of exposure corresponds to 86.8% and 72.6% of the avoidable mortality rate, respectively.

The predicted avoidable mortality according to the level of exposure to the program is illustrated in Figure 4. For a municipality not exposed to the program, our model estimates 3.07 avoidable deaths per 10,000 inhabitants. As the length of exposure to PSF increases, the predicted avoidable mortality rate reduces to 1.80 after 10 years and reaches 0.42 after 20 years into the program. A similar pattern is verified for most of the categories of preventable death as seen in Figure 5. The avoidable mortality related to adequate attention to the newborn, for example, starts at 0.82, drops to 0.46 after 10 years and goes to 0.03 after 20 years.

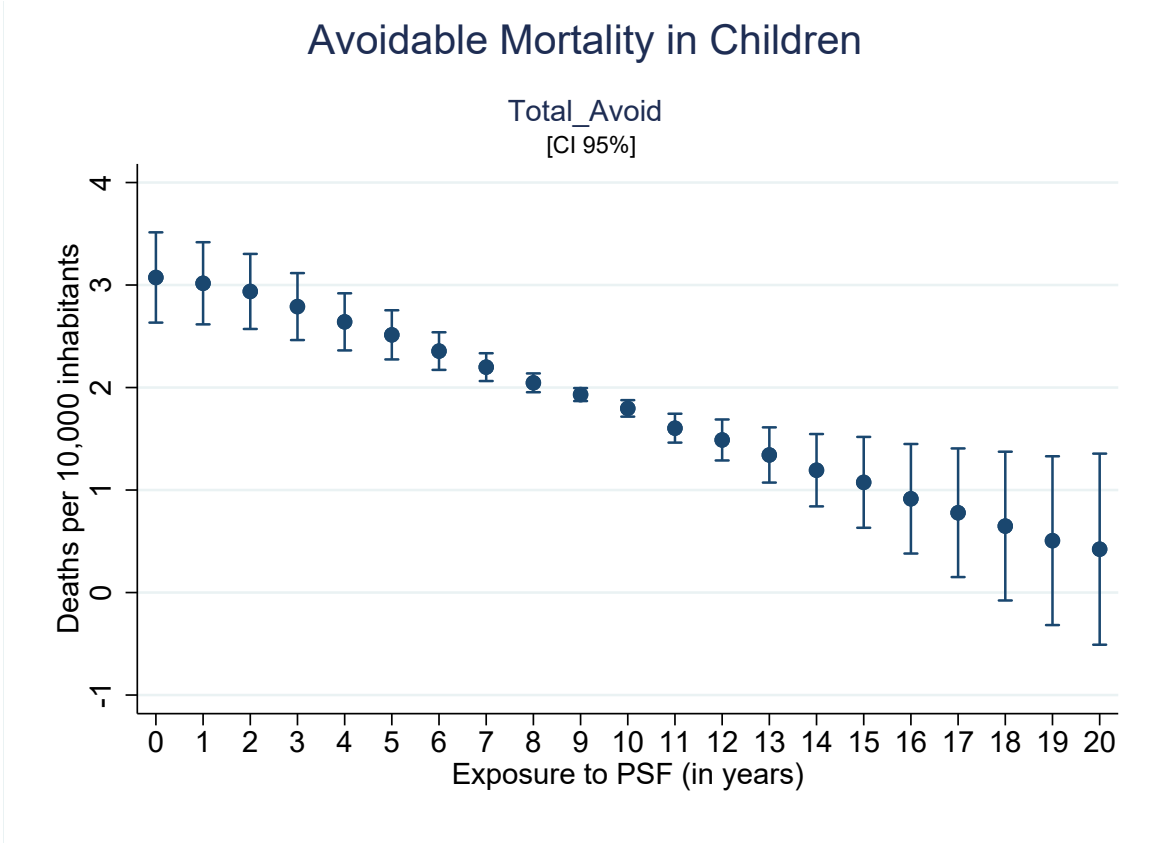


Figure 4 – Predicted Avoidable Mortality according to Exposure to PSF

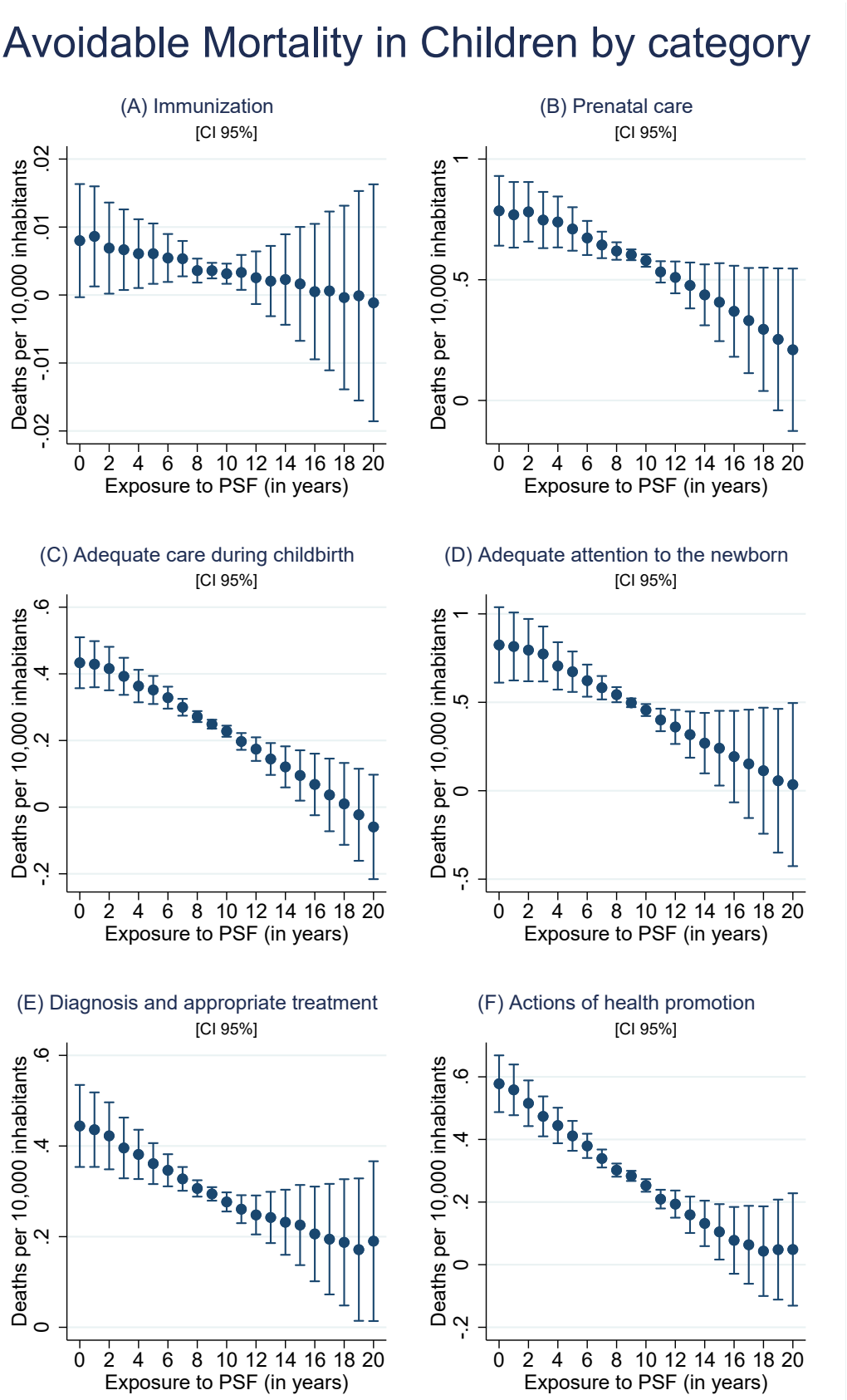


Figure 5 – Predicted Avoidable Mortality by category according to Exposure to PSF

1.5.3 Robustness check

One concern in employing our empirical strategy is the possibility of pre-existing trends in mortality are causing us to overestimate the effect of the PSF exposure. A robustness procedure was performed in order to address this concern, by introducing dummies for the number of years before the program implementation in each municipality. On the possibility that the previous results are driven by pre-existing trends in avoidable mortality, these pre-PSF dummies are expected to be statistically significant.

Results for the pre-existing trends test are provided in Table 4. Pre-existing trends does not seem to be a relevant issue here since the coefficients attributed to pre-PSF dummies are small and most revealed to be statistically insignificant. Actually, only 3 out of 140 pre-PSF coefficients exhibited to be statistically significant at a 10% level of significance.

Continuing our analysis from the pre-trends exercise, the marginal effects of PSF exposure on avoidable mortality are displayed in Figures 6 and 7. The illustrations confirm that the program effect does not start before its implementation and pre-existing trends are not likely to be a challenge to our identification strategy.

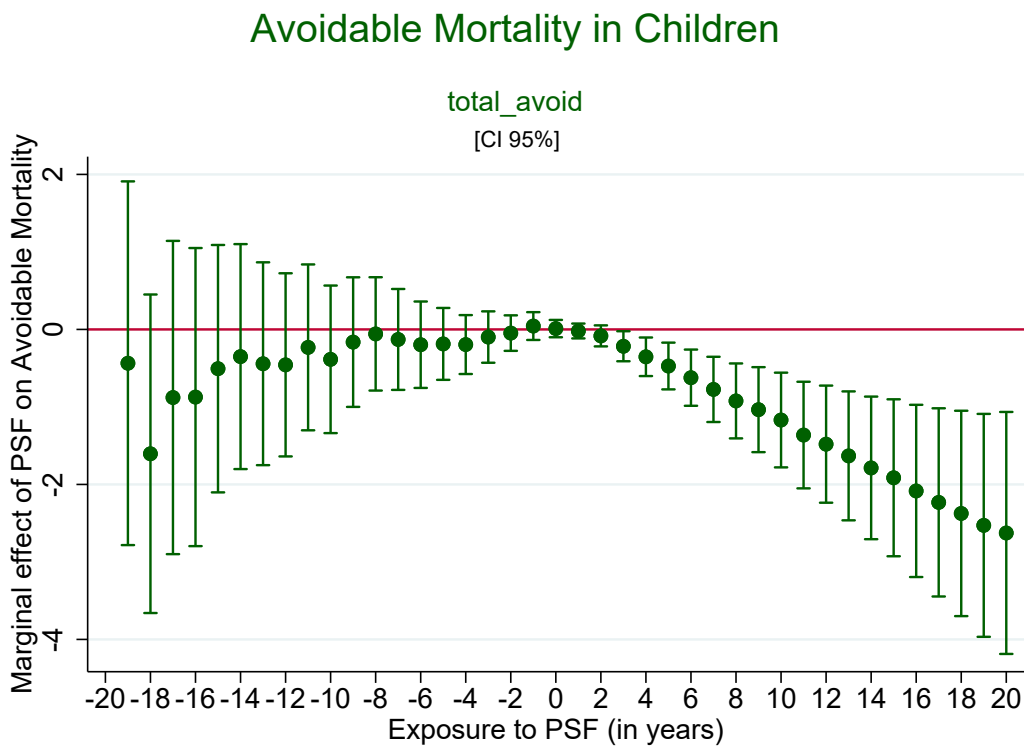


Figure 6 – Robustness check, pre-existing trends

Table 4 – Robustness check: Children's Preventable death and PSF exposure

	Total Avoidable	Categories of Avoidable cause					
	(1)	(A)	(B)	(C)	(D)	(E)	(F)
Before PSF year 20	-0.4363	-0.0272	-0.3383	0.2212	-0.0725	0.2065	-0.4259
	(1.1971)	(0.0194)	(0.5070)	(0.2786)	(0.4869)	(0.3308)	(0.3279)
Before PSF year 19	-1.6044	-0.0223	-0.7071	0.0832	-0.8188**	0.0954	-0.2347
	(1.0484)	(0.0178)	(0.4515)	(0.2342)	(0.3933)	(0.2613)	(0.2671)
Before PSF year 18	-0.8787	-0.0195	-0.8545*	0.1412	-0.2814	0.2502	-0.1146
	(1.0311)	(0.0165)	(0.4368)	(0.2320)	(0.3964)	(0.3233)	(0.2763)
Before PSF year 17	-0.8729	-0.0175	-0.5750	0.0993	-0.5561	0.2666	-0.0902
	(0.9812)	(0.0152)	(0.3888)	(0.1811)	(0.3411)	(0.3555)	(0.2473)
Before PSF year 16	-0.5066	-0.0163	-0.3904	0.1571	-0.1890	0.0400	-0.1080
	(0.8143)	(0.0139)	(0.3410)	(0.1749)	(0.3103)	(0.2061)	(0.2062)
Before PSF year 15	-0.3508	-0.0140	-0.4133	0.1045	-0.1050	0.1633	-0.0863
	(0.7405)	(0.0126)	(0.3191)	(0.1482)	(0.2854)	(0.1826)	(0.1922)
Before PSF year 14	-0.4428	-0.0002	-0.3233	0.0733	-0.1659	0.0759	-0.1027
	(0.6676)	(0.0148)	(0.2852)	(0.1339)	(0.2517)	(0.1652)	(0.1741)
Before PSF year 13	-0.4573	-0.0062	-0.2724	0.0918	-0.1792	0.0440	-0.1353
	(0.6027)	(0.0111)	(0.2535)	(0.1199)	(0.2281)	(0.1514)	(0.1562)
Before PSF year 12	-0.2317	-0.0088	-0.1964	0.1222	-0.1421	0.0809	-0.0875
	(0.5459)	(0.0097)	(0.2250)	(0.1064)	(0.2057)	(0.1333)	(0.1455)
Before PSF year 11	-0.3860	-0.0050	-0.2530	0.0466	-0.1161	0.0307	-0.0892
	(0.4858)	(0.0091)	(0.1999)	(0.0959)	(0.1828)	(0.1200)	(0.1271)
Before PSF year 10	-0.1637	-0.0030	-0.1360	0.0961	-0.1571	0.0472	-0.0109
	(0.4265)	(0.0081)	(0.1758)	(0.0875)	(0.1618)	(0.1072)	(0.1137)
Before PSF year 9	-0.0580	-0.0064	-0.1321	0.1186	-0.0416	0.0649	-0.0614
	(0.3730)	(0.0067)	(0.1533)	(0.0787)	(0.1427)	(0.0944)	(0.1003)
Before PSF year 8	-0.1296	-0.0055	-0.0974	0.0341	-0.0596	0.0877	-0.0889
	(0.3322)	(0.0058)	(0.1347)	(0.0701)	(0.1232)	(0.0906)	(0.0883)
Before PSF year 7	-0.1973	-0.0014	-0.1272	0.0478	-0.0478	0.0315	-0.1001
	(0.2844)	(0.0054)	(0.1131)	(0.0585)	(0.1085)	(0.0728)	(0.0786)
Before PSF year 6	-0.1869	-0.0018	-0.0651	0.0302	-0.0439	-0.0329	-0.0734
	(0.2367)	(0.0045)	(0.0945)	(0.0484)	(0.0926)	(0.0604)	(0.0643)
Before PSF year 5	-0.1955	-0.0015	-0.0690	0.0115	-0.0733	0.0010	-0.0641
	(0.1940)	(0.0036)	(0.0759)	(0.0389)	(0.0759)	(0.0493)	(0.0538)
Before PSF year 4	-0.0984	0.0006	-0.0642	0.0116	-0.0154	0.0205	-0.0516
	(0.1691)	(0.0030)	(0.0609)	(0.0316)	(0.0660)	(0.0456)	(0.0429)
Before PSF year 3	-0.0475	-0.0002	-0.0213	0.0139	-0.0199	0.0139	-0.0339
	(0.1168)	(0.0024)	(0.0458)	(0.0240)	(0.0470)	(0.0300)	(0.0331)
Before PSF year 2	0.0434	-0.0002	0.0437	0.0300	-0.0012	0.0216	-0.0505**
	(0.0916)	(0.0018)	(0.0404)	(0.0203)	(0.0348)	(0.0218)	(0.0254)
Before PSF year 1	0.0107	-0.0011	0.0195	0.0016	0.0038	0.0155	-0.0287
	(0.0570)	(0.0014)	(0.0211)	(0.0130)	(0.0256)	(0.0143)	(0.0180)

Continued on next page →

	Total Avoidable	Categories of Avoidable cause					
	(1)	(A)	(B)	(C)	(D)	(E)	(F)
PSF year 1	-0.0204	0.0005	0.0087	-0.0085	0.0018	-0.0038	-0.0192
	(0.0489)	(0.0012)	(0.0178)	(0.0117)	(0.0205)	(0.0141)	(0.0142)
PSF year 2	-0.0834	-0.0010	0.0269	-0.0261*	-0.0130	-0.0201	-0.0501**
	(0.0692)	(0.0015)	(0.0262)	(0.0158)	(0.0324)	(0.0178)	(0.0206)
PSF year 3	-0.2172**	-0.0014	-0.0022	-0.0535**	-0.0308	-0.0480*	-0.0812***
	(0.0988)	(0.0020)	(0.0371)	(0.0216)	(0.0490)	(0.0247)	(0.0282)
PSF year 4	-0.3532***	-0.0020	-0.0071	-0.0866***	-0.0944	-0.0640**	-0.0990***
	(0.1269)	(0.0025)	(0.0468)	(0.0271)	(0.0648)	(0.0301)	(0.0353)
PSF year 5	-0.4722***	-0.0022	-0.0363	-0.1023***	-0.1249	-0.0855**	-0.1210***
	(0.1539)	(0.0030)	(0.0537)	(0.0323)	(0.0794)	(0.0363)	(0.0430)
PSF year 6	-0.6227***	-0.0030	-0.0744	-0.1290***	-0.1735*	-0.1016**	-0.1413***
	(0.1849)	(0.0035)	(0.0615)	(0.0379)	(0.0965)	(0.0426)	(0.0507)
PSF year 7	-0.7739***	-0.0033	-0.1059	-0.1611***	-0.2121*	-0.1214**	-0.1701***
	(0.2147)	(0.0041)	(0.0699)	(0.0429)	(0.1146)	(0.0480)	(0.0579)
PSF year 8	-0.9226***	-0.0053	-0.1354*	-0.1922***	-0.2512*	-0.1432***	-0.1953***
	(0.2466)	(0.0047)	(0.0778)	(0.0489)	(0.1328)	(0.0540)	(0.0653)
PSF year 9	-1.0352***	-0.0057	-0.1570*	-0.2178***	-0.2972*	-0.1557***	-0.2018***
	(0.2798)	(0.0054)	(0.0857)	(0.0543)	(0.1527)	(0.0592)	(0.0729)
PSF year 10	-1.1690***	-0.0065	-0.1879**	-0.2415***	-0.3393*	-0.1738***	-0.2200***
	(0.3117)	(0.0061)	(0.0943)	(0.0601)	(0.1732)	(0.0649)	(0.0805)
PSF year 11	-1.3629***	-0.0067	-0.2436**	-0.2747***	-0.3968**	-0.1898***	-0.2514***
	(0.3509)	(0.0068)	(0.1034)	(0.0659)	(0.1959)	(0.0706)	(0.0882)
PSF year 12	-1.4806***	-0.0079	-0.2768**	-0.2999***	-0.4387**	-0.2024***	-0.2548***
	(0.3855)	(0.0076)	(0.1126)	(0.0714)	(0.2185)	(0.0762)	(0.0959)
PSF year 13	-1.6316***	-0.0089	-0.3221***	-0.3315***	-0.4849**	-0.2078**	-0.2764***
	(0.4245)	(0.0084)	(0.1226)	(0.0778)	(0.2425)	(0.0821)	(0.1038)
PSF year 14	-1.7869***	-0.0093	-0.3744***	-0.3570***	-0.5368**	-0.2180**	-0.2914***
	(0.4693)	(0.0092)	(0.1341)	(0.0844)	(0.2692)	(0.0881)	(0.1118)
PSF year 15	-1.9142***	-0.0105	-0.4199***	-0.3844***	-0.5699*	-0.2239**	-0.3055**
	(0.5166)	(0.0102)	(0.1467)	(0.0913)	(0.2962)	(0.0944)	(0.1202)
PSF year 16	-2.0840***	-0.0123	-0.4739***	-0.4129***	-0.6224*	-0.2429**	-0.3196**
	(0.5668)	(0.0111)	(0.1593)	(0.0985)	(0.3265)	(0.1009)	(0.1291)
PSF year 17	-2.2318***	-0.0128	-0.5303***	-0.4456***	-0.6689*	-0.2533**	-0.3208**
	(0.6195)	(0.0121)	(0.1728)	(0.1062)	(0.3573)	(0.1078)	(0.1381)
PSF year 18	-2.3743***	-0.0145	-0.5854***	-0.4734***	-0.7139*	-0.2591**	-0.3280**
	(0.6761)	(0.0132)	(0.1882)	(0.1138)	(0.3901)	(0.1151)	(0.1479)
PSF year 19	-2.5281***	-0.0151	-0.6457***	-0.5062***	-0.7774*	-0.2731**	-0.3107**
	(0.7337)	(0.0143)	(0.2051)	(0.1220)	(0.4233)	(0.1229)	(0.1577)
PSF year 20	-2.6261***	-0.0169	-0.7101***	-0.5431***	-0.8063*	-0.2524*	-0.2972*
	(0.7965)	(0.0155)	(0.2237)	(0.1310)	(0.4593)	(0.1308)	(0.1682)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-specific Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	116707	116707	116707	116707	116707	116707	116707

Robust standard errors clustered at the municipality level are in parentheses; regressions weighted by population. Outcome variable: Mortality rate per 10,000 per category of avoidable cause. Independent variables: dummies indicating number of years before and into the program, municipality fixed-effects, year fixed-effects and municipality-specific trends. All regressions also included controls for: Bolsa Família coverage, Mais Médicos coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

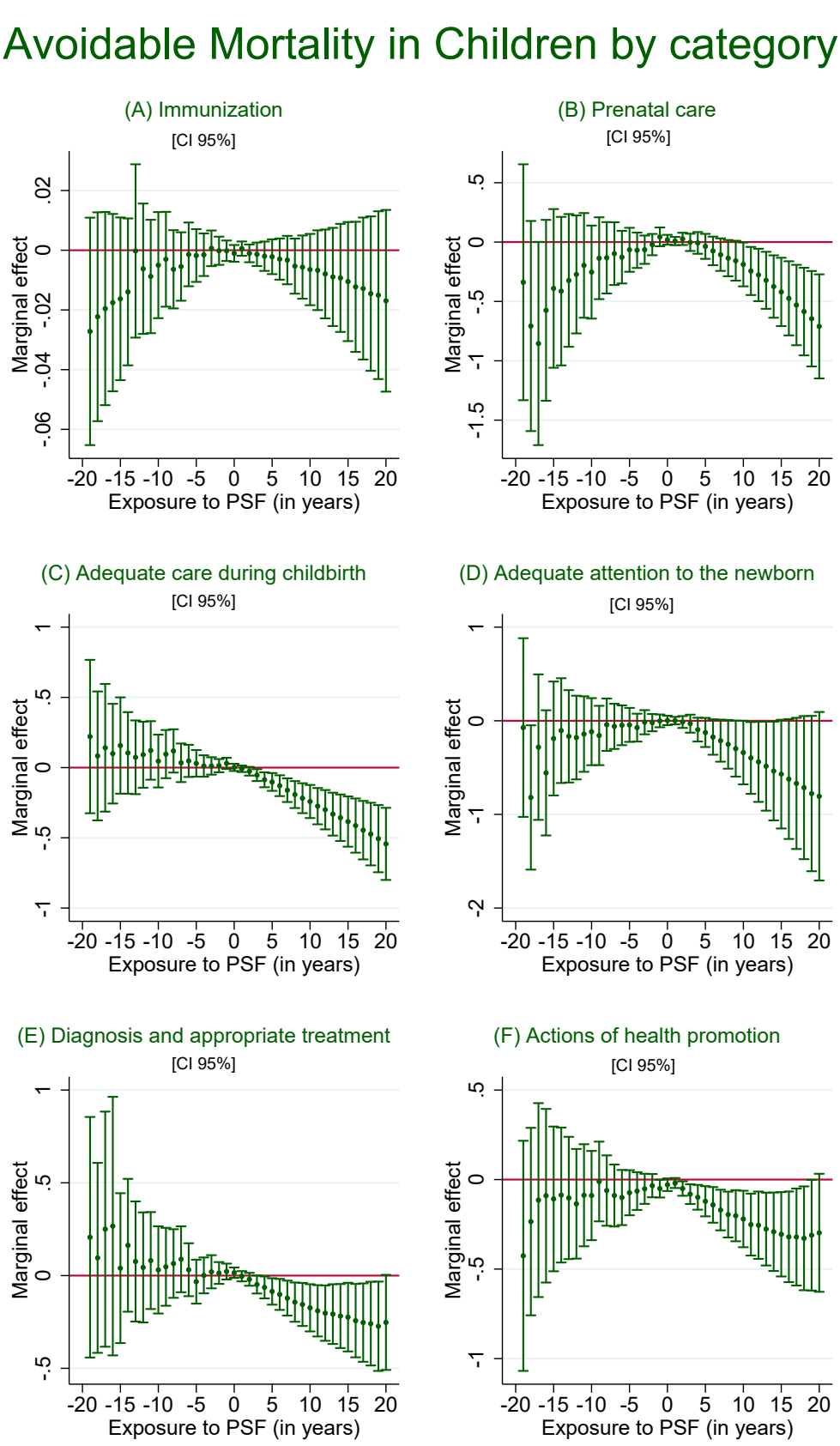


Figure 7 – Robustness check by category, pre-existing trends

1.6 Discussion

The results of this study revealed a negative long-term relationship between primary care availability and preventable mortality in children. Our findings suggest that primary care, represented by the *Programa Saúde da Família* (PSF), has an association with infant outcomes over time: the implementation of the program or the expansion of the program's coverage (as defined by the share of population covered or the proportion of Family Health Teams) in the municipality takes a couple of years to manifest itself an effect on mortality. As the time of exposure to PSF increases, a reduction of 0.56 per 10,000 is estimated after five years, then an effect of 1.28 after 10 years and a reduction of 2.65 is verified after 20 years – which represents 76.1% of all avoidable deaths in children. These results were achieved primarily through improvements related to adequate care during childbirth and adequate attention to the newborn, as shown in the estimations for categories of avoidable cause.

There are several reasons why primary care may improve the under-five mortality rate, most are linked to increasing the survival chances of newborns, children and mothers. Adequate prenatal care is shown to result in better pregnancy and birth outcomes, improving maternal health (CONWAY; KUTINOVA, 2006) and reducing infant mortality (HONG; RUIZ-BELTRAN, 2007) and morbidity (HERBST et al., 2003). One of the pathways by which health care during prenatal period can reduce infant mortality is dealing with a range of maternal health problems, for example, alcoholism, smoking, drug use, poor nutrition and sexually transmitted diseases. Primary care can mitigate another important source of infant avoidable mortality by offering support in critical times of labour, during birth and in the first days of life (WHO, 2014a). Any children receiving primary care visit should also benefit from activities related to disease prevention and adequate immunization, health promotion, diagnosis and treatment.

In order to have a clear understanding of the evolution of the program, we performed a longitudinal analysis following all 5570 municipalities through 1998-2018. The empirical strategy employed here enables heterogeneous response to the length of exposure to the program and controls for unobserved time-invariant municipality-level factors (like institutions, health facilities and political issues as long as these characteristics remain constant over time), municipality-specific time trends were used to capture differential trends in mortality specific to each municipality and year fixed effects were included to account for temporal shocks that might affect all municipalities.

Some limitations should be taken into consideration when interpreting these findings. First, despite the careful work of drawing up the list of preventable mortality carried out by professionals from the Brazilian Ministry of Health, death from any cause is the final event in a complex chain of processes and every classification list is made through technical judgments that may not cover all cases of death with due complexity (NOLTE; MCKEE, 2004). The concept of avoidability itself has already undergone adjustments in the literature (OLATUNDE; WINDSOR; CAMPBELL, 2016) and should be further updated as new medical advances emerge.

Second, PSF implementation might help to improve mortality statistics and cause-of-death recording – if this is the case, our estimates of the impact of PSF on mortality could be underestimated[9]. Third, even though the federal and state governments share the expenses and provide general guidelines, the execution of the program is done at the municipality level and the fact that municipalities are heterogeneous[10] allows different degrees of management and commitment to the program – Hone et al. (2017a) have found different effects of the program according to the municipal health governance and, as

[9] In an evaluation of interventions to improve cause of death data, Miki et al. (2018) lists key factors that determine the quality of death certification – primary care at some extent, might contribute to this issue – such as: i) adequate knowledge and awareness on the importance of death certification; ii) presence of physicians in all near and far afield areas within the country; iii) physician's experience in the certification deaths and iv) availability of diagnostic equipment.

[10] As noted by Hone et al. (2017a): "*Municipalities in Brazil vary in their population (ranging from approximately 800 to nearly twelve million individuals), size (from 3.6 to over 160,000 square kilometers), and wealth (roughly from R$3,500 to over R$700,000). Unsurprisingly, there is also considerable variation in municipalities' health governance, in terms of administrative capacity, leadership, and political will.*"

expected, municipalities with higher governance scores accomplished greater reductions on mortality linked to PSF. Fourth, evidence that more Family Health Teams is associated to lower avoidable mortality rates in children does not necessarily mean that more individuals are covered by the program or that program is making progress on health outcomes at the individual level (SHI et al., 2004). Individual level data are fundamental to answer this question.

To conclude, *Programa Saúde da Família* provided evidence to be crucial in preventing many avoidable deaths in children. As a community-based primary care initiative, program has much to inform public policies, but more research should be conducted to fully understand its effects and mechanisms at the individual level.

.1 Appendix: List of Avoidable Causes of Children Under 5

	Category of Avoidable cause	ICD-10 Codes
A	**Reducible by immunization actions**	
	Tuberculosis of the nervous system	A17
	Miliary tuberculosis	A19
	Neonatal Tetanus	A33
	Tetanus	A35
	Diphtheria	A36
	Whooping cough	A37
	Acute poliomyelitis	A80
	Measles	B05
	Rubella	B06
	Acute hepatitis B	B16
	Mumps	B26
	Haemophilus meningitis	G00.0
	Congenital rubella syndrome	P35.0
	Congenital viral hepatitis	P35.3
B	**Adequate care for women during pregnancy**	
	Congenital syphilis	A50
	Human Immunodeficiency Virus (HIV) diseases	B20-B24
	Some situations of fetus and newborn affected by complications of the placenta and membranes	P02.2-P02.3, P02.7-P02.9
	Fetus and newborn affected by maternal conditions, not necessarily related to the current pregnancy, and by harmful influences transmitted to the fetus by placenta or breast milk	P00, P04
	Fetus and newborn affected by maternal pregnancy complications	P01
	Delayed fetal growth and fetal malnutrition	P05
	Other disorders related to short-term pregnancy and low birth weight	P07

	Category of Avoidable cause	ICD-10 Codes
	Newborn's respiratory distress syndrome	P22.0
	Pulmonary hemorrhage originating in the perinatal period	P26
	Intracranial nontraumatic hemorrhage of newborn	P52
	Rh or ABO isoimmunization of newborn	P55.0-P55.1
	Other hemolytic diseases of the fetus and newborn due to immunization	P55.8-P55.9, P56-P57
	Necrotizing enterocolitis of newborn	P77
C	**Adequate care for women during childbirth**	
	Newborn affected by placenta previa and other forms of placental separation and hemorrhage	P02.0-P02.1
	Newborn affected by umbilical cord	P02.4-P02.6
	Newborn affected by other complications of labor and delivery	P03
	Disorders of newborn related to long gestation and high birth weight	P08
	Birth trauma	P10-P15
	Intrauterine hypoxia and Birth asphyxia	P20-P21
	Neonatal aspiration syndrome, except regurgitated milk and food	P24.0-P24.2, P24.8-P24.9
D	**Adequate care for the newborn**	
	Respiratory distress specific to perinatal period	P22.1, P22.8-P22.9, P23, P25, P27-P28
	Infections specific to the neonatal period, except congenital rubella syndrome and congenital viral hepatitis	P35.1-P35.2, P35.4-P35.9, P36-P39
	Neonatal hemorrhage, except non-traumatic intracranial	P50-P51, P53-P54
	Other neonatal jaundice	P58-P59
	Transitory endocrine and metabolic disorders specific to newborn	P70-P74
	Other Hemorrhagic and hematological disorders of newborn	P60-P61

	Category of Avoidable cause	ICD-10 Codes
	Disorders of the digestive system of the newborn, except for necrotizing enterocolitis	P75-P76, P78
	Conditions involving the integument and temperature regulation of newborn	P80-P83
	Other disorders originating in the perinatal period (except P95 and P96.9)	P90-P94, P96.0-P96.8
E	**For diagnostic actions and proper treatment**	
	Respiratory tuberculosis	A15
	Respiratory tuberculosis, not confirmed bacteriologically or histologically	A16
	Tuberculosis of other organs	A18
	Bacterial meningitis, not elsewhere classified (excpt Haemophilius) or due to other and unspecified causes	G00.1-G00.9, G03
	Acute upper respiratory infections	J00-J06
	Pneumonia	J12-J18
	Other acute lower respiratory infections	J20-J22
	Edema of larynx	J38.4
	Chronic lower respiratory diseases, exept emphysema and other chronic obstructive pulmonary diseases	J40-J42, J45-J47
	Respiratory conditions due to inhalation of chemicals, gases, fumes and vapors and Pneumonitis due to solids and liquids	J68-J69
	Other diseases caused by chlamydiae	A70-A74
	Other bacterial diseases	A30-A32, A38-A41, A46, A49
	Congenital hypothyroidism	E03.0-E03.1
	Diabetes mellitus	E10-E14
	Classical phenylketonuria	E70.0
	Congenital lactase deficiency	E73.0
	Epilepsy and Grand mal status epilepticus	G40-G41

	Category of Avoidable cause	ICD-10 Codes
	Down syndrome	Q90
	Urinary tract infection, site not specified	N39.0
	Acute rheumatic fever and chronic rheumatic heart diseases	I00-I09
F	**For health promotion actions linked to health care**	
	Intestinal infectious diseases	A00-A09
	Certain zoonotic bacterial diseases	A20-A28
	Arthropod-borne viral fevers and viral hemorrhagic fevers	A90-A99
	Rickettsioses	A75-A79
	Rabies	A82
	Protozoal diseases	B50-B64
	Helminthiases	B65-B83
	Other infectious diseases, other and unspecified infectious diseases	B99
	Nutritional anemias	D50-D53
	Malnutrition and other nutritional deficiencies	E40-E64
	Volume depletion	E86
	transport accidents	V01-V99
	Accidental poisoning by and exposure to other and unspecified drugs, medicaments and biological substances	X40-X44
	Accidental poisoning by exposure to other noxious substances	X45-X49
	Sudden infant death syndrome	R95
	Slipping, tripping, stumbling and falls	W00-W19
	Exposure to smoke, fire and flames	X00-X09
	Exposure to forces of nature	X30-X39
	Accidental non-transport drowning and submersion	W65-W74
	Other accidental risks to breathing	W75-W84
	Exposure to electric current, radiation and extreme ambient air temperature and pressure	W85-W99
	Assault	X85-Y09
	Events (facts) whose intention is undetermined	Y10-Y34

Category of Avoidable cause	ICD-10 Codes
Exposure to inanimate mechanical forces	W20-W49
Accidents occurring in patients during surgical and medical care	Y60-Y69
Surgical and other medical procedures as the cause of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure	Y83-Y84
Adverse effects of drugs, medications and biological substances used for therapeutic purposes	Y40-Y59

2 Born with PSF, grow healthy? Exploring variation in program availability among siblings

Abstract

Recent evidence shows that what happens during pregnancy and youth significantly influences children's long-term health. The *Programa Saúde da Família* (PSF) has a wide range of initiatives to promote prenatal and childcare. Since the program was locally implemented in different periods of time, siblings may have been exposed to the program differently. Using Datasus and the Brazilian Household Survey, our empirical strategy aims to estimate the effect of the program's presence at early stages of life on children's health, partialling out family and regional features likely to be related to the program availability and controlling for regional specific factors that varies over time. The findings provide evidence that children exposed to the PSF early (during prenatal, at birth or during their first year of life) have better health outcomes than children not exposed to the program during their same stages of life. The program's effects varies across stage of life and time of exposure analysed. The effects are heterogeneous and focused on low-income, less-educated families and vary by skin color – leading us to ponder that PSF also plays a role in reducing health inequalities.

Keywords: primary care; children's health; prenatal; siblings.

2.1 Introduction

Previous international studies provide evidence that early interventions during the prenatal period and the first months of postnatal life produce long-lasting effects (CURRIE, 2009; ALMOND; CURRIE, 2011). Programs that enhance adequate prenatal care is shown to decrease the probabilities of low birth weight and preterm birth (RICKETTS; MURRAY; SCHWALBERG, 2005; MALLINSON et al., 2020). Conversely, wrong actions or negative interventions during prenatal and childhood can lead to adverse outcomes throughout life. Poor maternal nutritional intake during pregnancy has negative effects on the child's neurological development and health in later life (BARKER, 1998). Children whose mothers smoked in pregnancy has higher risk of Attention deficit hyperactivity disorder (LINNET et al., 2006). Children who lived during economic crises and wars are more likely to experience disorders of the central nervous system, heart disease, and antisocial personality disorders (DOBLHAMMER, 2004).

The *Programa Saúde da Família* can be considered as an early intervention in the lives of many Brazilian children. Among the activities of the PSF, the following initiatives are highlighted to be directly related to children's health: (i) to monitor pregnant women and refer to prenatal and childcare services, (ii) to offer guidance on disease prevention and family planning, (iii) to promote vaccination of mothers and children (referring them to a health center in the circumstance they are behind schedule), (iv) to encourage breastfeeding, (v) to monitor children's weight and height, (vi) to draw attention to hygiene practices and (vii) to promote the use of oral rehydration solution to treat children afflicted by diarrhea (SAÚDE, 2002; SAÚDE, 2010).

The purpose of this study is to estimate the effects of the program's presence at early stages of life on children's health afterwards. We will use the fact that the *Programa Saúde da Família* has gradually expanded in Brazilian municipalities since its implementation. As a consequence, siblings of different ages, with the same variables related to the family, did not necessarily have similar access to primary care during their lives. Taking advantage of siblings estimations, our goal is to identify the PSF's effect by controlling for family

and regional unobserved features possibly related to the program availability. A similar strategy was first executed by Reis (2014), whose study looked into PSF effects on two specific moments of life: 6 months prior to birth and at birth, but the study was focused on the first years of program only.

By investigating the PSF's effects in different periods – especially on prenatal, at birth, and first year of life – our research is consistent with the literature which says that the timing of the intervention is critical and will determine subsequent results (WYNDER, 1998; HALFON; SHULMAN; HOCHSTEIN, 2001; DOYLE et al., 2009). In addition, one of the purposes of early childhood interventions is to reduce social inequalities (DOYLE et al., 2009), that is the reason why we have particular interest to check whether the program has heterogeneous effects through family income, education and skin color.

This paper is organized as follows. Section 2 provides an explanation of our two main datasets, Datasus and PNAD, and how we combined them to delimit our sample selection. Section 3 establishes our empirical strategies and exposes our siblings regressions. Section 4 reports all the results and descriptive statistics. The core estimations are presented in Subsection 4.2, and an heterogeneity analysis of the results is done in Subsection 4.3. Further analysis of the intensity of exposure to the program is implemented in Subsection 4.4. Section 5 discusses the results, limitations and further steps.

2.2 Data

Individual data with information that characterize the demographic, socioeconomic and health profiles were gathered from PNAD 2008 (Brazilian Household Survey/*Pesquisa Nacional por Amostra de Domicílios*), conducted by IBGE (Brazilian Institute of Geography and Statistics/*Instituto Brasileiro de Geografia e Estatistica*. In addition to the variables of family socioeconomic status, education and racial profile, PNAD 2008 is the latest national household survey with a health questionnaire, containing a wide range of variables related to health status of all individuals in the sample, such as self-assessed health, and recent disability variables related to illness which were measured by the number of restricted activity days, the number of days in bed and the number of days stayed in hospital.

PNAD uses a stratified three-stage cluster sample of households, where municipalities are the primary sampling units, the census enumeration areas are the secondary sampling units and households are sampled in the last stage. The lowest level of analysis for an individual's home that can be determined in the microdata is the Metropolitan Region[1], this is also the lowest geographic level for which PNAD microdata are country-wide representative (MORENO-SERRA, 2008). A Metropolitan Region comprehends a cluster of municipalities and PNAD identifies 9 of them: São Paulo, Rio de Janeiro, Belo Horizonte, Recife, Fortaleza, Belém, Salvador, Curitiba and Porto Alegre, which includes the capitals and the surrounding municipalities.

DATASUS contains detailed monthly information at the municipal level on the presence of the PSF, as well as the number of public hospital beds in each Brazilian municipality and each Metropolitan Region. Municipal GDP data were collected from IBGE and population estimates was obtained in Datasus. Bolsa Família data regarding the amount monthly transferred to the Bolsa-Família Program to each municipality were gathered from MDS (Ministry of Social Development/*Ministério do Desenvolvimento Social*). All data collected at the municipality level were properly transformed to the

[1] Reis (2014) combined Datasus and PNAD 2003 data at the municipality level, however it is unclear how the merge was done, since those datasets does not share the same municipality codes. The paper also uses data from 1996 to 2003, although there is no official data regarding PSF coverage between 1996 and 1998 at Datasus website.

Metropolitan Region level, respecting the composition of municipalities in each region.

Our sample selection comprehends children aged between 12 and 120 months in September 2008 and children who had always lived in the same municipality. The restriction of children living in the same geographic area is necessary to infer the availability of public primary care during their early stages of life. Also, since our strategy uses variation between siblings of different ages, families containing only one kid or twins were not considered.

2.3 Methodology

Our empirical strategy uses variations when adopting the program to estimate its impact on health years later. Children born in a municipality with the PSF may have grown up in a very different environment than kids who did not get the program accessible at birth. As the PSF was gradually adopted by the municipalities, there are many families for whom the program was implemented between the births of siblings, and therefore a provision of public health can make a difference in the future health of these covered children.

We will explore the variation in program availability between siblings in order to control for family and locality factors that are constant over time and have an impact on children's health. First, let's establish the Health Status of the child i in the family j in the Metropolitan Region m is represented by the following model[2]:

$$S_{ijm} = \beta_0 + \beta_1 PSF\ available_{ijm} + \beta_2 age_{ijm} + \beta_3 sex_{ijm} + \beta_4 order_{ijm} + F_{jm}\alpha + C_m\gamma + u_{ijm} \tag{2.1}$$

where $PSF\ available_{ijm}$ is a set of three dummy variables analyzed separately and equal to 1 if the program was present in the Metropolitan Region (i) during the child's prenatal, (ii) when the child was born and (iii) during the child's first year of life.

The variable age_{ijm} is age of child i in months, sex_{ijm} is a dummy equal to 1 if child i is a girl, $order_{ijm}$ represents child's birth order i. F_{jm} is a vector containing the characteristics of the family and household of the child i, and C_m contains variables at the Metropolitan Region level. Here we consider that C_m contemplates fixed effects that affect our regions and also some factors varying across time. Unobserved factors that influence the child's health are represented by u_{ijm}.

Suppose the child i has an older sibling, indexed by h, whose Health Status can also be represented by the previous equation. Therefore, the difference in the health status

[2] A simpler version of this specification can be found in Reis (2014).

of the child i in relation to his/her eldest sibling h is:

$$\Delta S_{ijm} = \beta_1 \Delta PSF\ available_{ijm} + \beta_2 \Delta age_{ijm} + \beta_3 \Delta sex_{ijm} + \beta_4 \Delta order_{ijm}$$
$$+\beta_5 \Delta Hospital\ beds_m + \beta_6 \Delta Bolsa\ Família\ coverage_m + \beta_7 \Delta GDP\ per\ capita_m + \Delta u_{ijm} \tag{2.2}$$

where $\Delta PSF\ available_{ijm}$ is equal to 1 if the program was present during the child's i prenatal but was not present during his older sibling's prenatal, equal to 0 if PSF was present for both siblings (or not present for both), equal to -1 if the program was not present during the child's i prenatal but was present during his older sibling's prenatal.

The variable Δage_{ijm} is the age difference between siblings, $\Delta order_{ijm}$ is birth order difference between i and h and Δsex_{ijm} can assume three values: 1 if the child i is a girl and h is a boy, 0 if both have the same sex, or -1 if i is a boy and h is a girl.

S_{ijm} contains a set of outcome variables related to children's health status generally answered by their parents: (1) perceived health, a dummy indicating perceived health status as poor or very poor, based on the question "*How is your health in general: very good, good, fair, poor or very poor?*"; (2) a dummy indicating whether the child was unable to perform his/her own activities due to illness two weeks prior to the survey, based on the question "*In the past two weeks, did he/she stop performing any of your usual activities for health reasons?*"; (3) a variable counting the number of days the child was unable to perform his/her own activities due to illness two weeks prior to the survey; (4) a dummy indicating whether the child was in bed due to illness two weeks prior to the survey, based on the question "*In the past two weeks, has he/she been bedridden?*"; (5) a variable counting the number of days the child was in bed due to illness two weeks prior to the survey; (6) a dummy indicating whether the child stayed in hospital anytime in the 12 months prior to the survey, based on the question "*In the past 12 months, has he/she been hospitalized?*"; (7) a variable counting the number of days the child stayed in hospital in the 12 months prior to the survey.

Since all the outcomes were defined as an unfavorable health, a positive value for ΔS_{ijm} indicates that the child i has a worse health status compared to his or her eldest

sibling h[3]. Therefore a negative value for β_1 means that PSF improves children's health.

The perceived health status, our first outcome variable, provides a unique measure of health based on the objective and subjective assessment that the individual has, not necessarily covered by clinical indicators. Each individual might have its own criteria to assess health as good or very good (KAPLAN; BARON-EPEL, 2003; SIMON et al., 2005), and the way to assess health can also vary for different cultures (DESESQUELLES; EGIDI; SALVATORE, 2009). Despite being a broad measure, studies have shown that perceived health status predicts mortality and morbidity (JYLHÄ, 2009; LATHAM; PEEK, 2013; LARSSON et al., 2002), which motivates to be used as an important complement to the clinical evaluation (OSIBOGUN et al., 2018) and as a quality indicator for primary care (ROHRER et al., 2007). In our case, since the children's health status is evaluated by the same person in each family (generally one of the parents), we tend to mitigate one source of bias associated to differences of criteria on health assessment.

Perceived health status should not be uncritically used as a replacement indicator when measures of health are missing (LOREM et al., 2020). That's the reason why we also investigate variables concerning the ability to perform usual activities, days in bed and days in hospital – which could provide more information on current health and observed prevalence of illness. In some broad sense, those measures are usually present in instruments linked to Health-related quality of life (HRQOL) indicators, such as the EQ-5D, a standardized instrument for measuring generic health status (WILLE et al., 2010; RAMOS-GOÑI et al., 2020).

Another important advantage associated with this strategy is that specific factors constant in the time of families, households and Metropolitan Regions are eliminated. To take into account of some factors that might vary over time, we suitable control for three possible confounding effects. First, hospital beds per capita is added as a measure of physical supply of health, in an attempt to control for other health interventions occurred at the Metropolitan Region. Second, Bolsa-Família is a nationwide program which provides

[3] In families with more than two kids aged between 12 and 120 months, variations between each child and the eldest brother or sister were calculated.

financial aid to poor families; its Coverage was defined by the monthly amount per capita destined via Bolsa-Família to each Metropolitan Region. Third, GDP per capita was included as an attempt to control for other local interventions and economic fluctuations specific to Metropolitan Regions over time.

2.4 Results

2.4.1 Descriptive statistics

Table 1 provides the descriptive statistics for children included in our estimations. For the purposes of our analysis, the statistics are separated according to PSF availability at birth: first column consists of children with PSF available when the child was born and second column children without the program when the child was born. The third columns is the full sample of children living in Metropolitan Regions.

Table 1 starts presenting the statistics about health outcomes. On average 0.82% of the children has perceived bad health, and this proportion is slightly higher (0.83%) for children with PSF available at birth. The proportion of children hospitalized or the proportion who were unable to perform their usual activities or were bedridden due to recent illness are also higher for the sample with PSF available when the child was born – this is also verified by the total days of illness, in bed and in hospital.

This could be partially explained by the socioeconomic conditions of the families living in localities covered by the program. Rocha e Soares (2010) assert that localities with worse initial socioeconomic status were more likely to join the program. In fact, 54.74% of the child's families with PSF at birth belong to the first quartile of income[4], compared to 48.17% in the sample without PSF at birth. Differences are also noted for education[5], the proportion of no completed degree is higher in the sample with PSF available when the child was born, even though the proportion of higher school is marginally higher in the first group.

Table 1 also reports information regarding child's characteristics. As expected, children without PSF available at birth are older, having 94.28 months on average, compared to 62.77 months on average of children with PSF at birth. This can be noticed

[4] Family income quartile was calculated based on the monthly family income divided by the number of family members. First quartile represents on average R$ 99.95 (US$ 77.48 PPP per capita), second quartile R$ 255.31 (US$ 197.91 PPP per capita), third quartile R$ 469.36 (US$ 369.84 PPP per capita), and fourth quartile R$ 1531.96 (US$ 1187.57 PPP per capita).

[5] Family education is a set of dummy variables based on the highest level of education achieved by the head of the family.

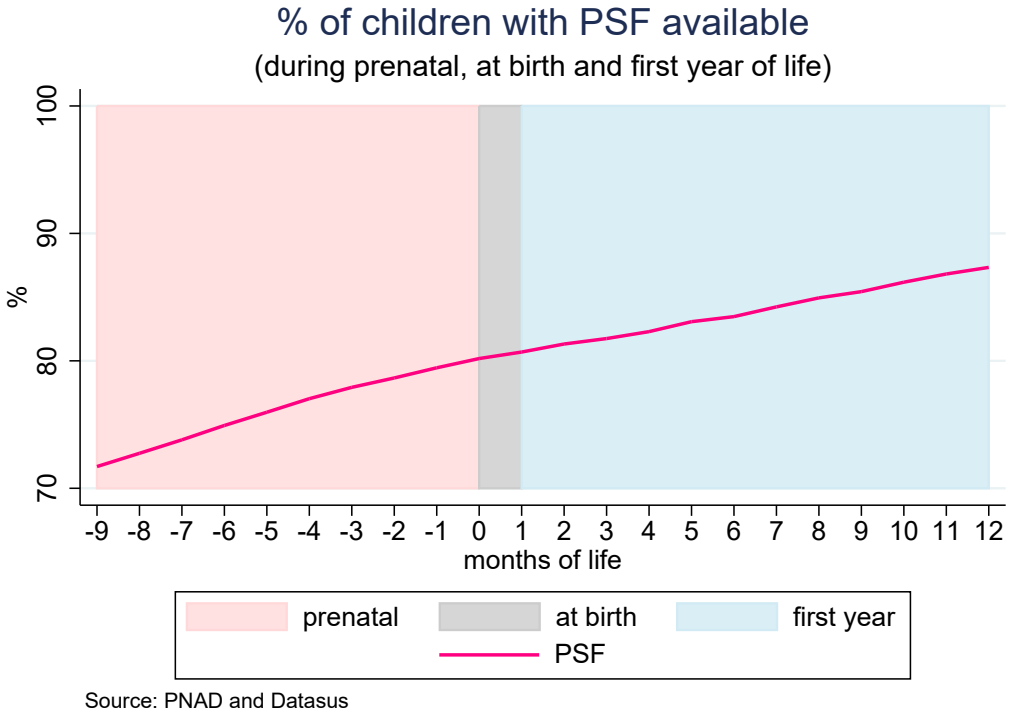
Table 1 – Descriptive statistics

	PSF available when the child was born (1)		PSF was not available when the child was born (2)		Total (3)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Perceived bad health (%)	0.83	9.08	0.75	8.63	0.82	8.99
Unable to perform due to illness (%)	7.26	25.94	6.32	24.35	7.07	25.64
Days of illness	0.29	1.37	0.20	1.07	0.27	1.32
Bed due to recent illness (%)	3.49	18.95	2.50	15.62	3.49	18.35
Days in bed	0.13	0.87	0.07	0.59	0.12	0.82
Hospitalized in the last year (%)	4.47	20.65	2.19	14.63	4.01	19.63
Days in hospital	0.08	0.61	0.05	0.42	0.07	0.58
Child's characteristics						
Age (months)	62.77	29.59	94.28	24.30	69.02	31.18
Female (%)	51.36	49.98	50.02	50.00	51.10	49.99
Black (%)	5.94	23.64	6.51	24.67	6.06	23.85
Pardo (%)	47.37	49.93	38.88	48.75	45.69	49.81
White (%)	45.76	49.82	54.41	49.80	47.48	49.94
Asian (%)	0.51	7.15	0.09	2.98	0.43	6.54
Indigenous (%)	0.41	6.37	0.10	3.21	0.35	5.88
Characteristics of child's family						
Family Income, 1st quartile (%)	55.74	49.67	48.17	49.97	54.25	49.82
Family Income, 2nd quartile (%)	25.00	43.30	27.97	44.89	25.58	43.63
Family Income, 3rd quartile (%)	11.10	31.40	14.57	35.28	11.78	32.24
Family Income, 4th quartile (%)	8.17	27.38	9.29	29.03	8.39	27.72
Family Education, No completed degree (%)	53.25	49.89	51.66	49.97	52.94	49.91
Family Education, Elementary school (%)	19.40	39.54	20.59	40.44	19.94	39.73
Family Education, High school (%)	21.53	41.11	22.56	41.80	21.74	41.25
Family Education, Higher school (%)	5.81	23.40	5.19	22.17	5.69	23.16
Variables of Metropolitan Regions						
Hospital beds per capita	0.0025	0.0027	0.0026	0.0024	0.0025	0.0026
GDP per capita	13051.61	10213.02	10859.86	8043.60	12639.79	9879.11
Bolsa Família coverage	9.81	15.36	1.66	5.51	8.20	14.34
Observations	4657		972		5629	
Weighted Share (%)	80.18		19.82		100	

by the expansion of the program over time.

Figure 1 illustrates the proportion of children with PSF available in each of the child's months of life. Due to the gradual adoption of the program, the proportion of children with PSF available at birth is higher than the same proportion during prenatal, and even higher after the first year of life. This average proportion starts at 72,7% during the first month of prenatal (months=-9), and achieves 87.3% when the child gets one year old (months=12).

Figure 1



2.4.2 Main results

The Siblings Regressions using equation (2) for seven current health outcomes are presented in Table 2. It is worth noting that the differences were computed using each variable of a given child in relation to his/her eldest sibling; this way, if PSF improves child's health the expected signal is negative. Estimates are reported in three panels (Panel A, B and C) to consider different effects of PSF on each early stage of life analyzed. Panel A uses variations of program availability during the child's prenatal, Panel B when the

child was born and Panel C during the child's first year of life.

All specifications control for differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. Since our strategy uses comparisons between siblings, our estimates also control for family and metropolitan regions-specific factors constant over time.

In Panel A, the change in PSF availability during prenatal is associated to a negative and significant effect on being hospitalized and decreases the total number of days in hospital. PSF reduces the prevalence of hospitalization by 2.1 percentage points (pp). The program also diminishes the number of days in hospital by 0.06 – which is a particularly relevant result since the average days in hospital for our sample is 0.07.

Panel B explores the variation in program availability at birth. PSF is associated to a reduction of 3.74 pp on the prevalence of the children being unable to perform their own activities and a reduction of 0.15 on the total days of illness. A negative and significant effect is also noticed on the prevalence of staying in bed due to recent illness: the effect is a reduction of 1.82 pp, more than half of the prevalence of staying in bed due to illness (3.49%) in our sample.

Panel C examines the children for whom PSF was and was not available during their first year of life. As found in Panel B, PSF is associated to a negative and significant effect on being unable to perform or bedridden, and with a reduction on the total days of illness.

2.4.3 Heterogeneity analysis

Since primary care improves access to health services for relatively deprived communities, assessing health inequalities should be an important part for the evaluation of the *Programa Saúde da Família*. Previous evidence reports that primary care is associated not only with improved health but also with reductions in disparities between more and less-disadvantaged population groups in self-rated health status (SHI et al., 2002). Hone et al. (2017b) have found that the expansion of the PSF in Brazil was associated with a

Table 2 – Main results: Children's health and *Programa Saúde da Família* [Siblings Regressions]

	Perceived health	Unable to perform due to illness		Bed due to recent illness		Hospitalized in the last year	
	Δ *Bad health*	Δ *Unable to perform*	Δ *Days of illness*	Δ *Bed due to illness*	Δ *Days in bed*	Δ *Stayed in hospital*	Δ *Days in hospital*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: PSF available in the metropolitan region during the child's prenatal							
Δ *PSF prenatal*	-0.0076	-0.0059	-0.0493	0.0059	0.0082	-0.0210*	-0.0648*
	(0.0087)	(0.0161)	(0.0865)	(0.0117)	(0.0549)	(0.0118)	(0.0350)
Panel B: PSF available in the metropolitan region when the child was born							
Δ *PSF birth*	-0.0100	-0.0374**	-0.1479*	-0.0182*	-0.0686	-0.0002	-0.0360
	(0.0069)	(0.0153)	(0.0761)	(0.0108)	(0.0536)	(0.0138)	(0.0367)
Panel C: PSF available in the metropolitan region during the child's first year of life							
Δ *PSF infant*	-0.0063	-0.0328**	-0.1263*	-0.0179*	-0.0642	0.0128	0.0055
	(0.0067)	(0.0155)	(0.0726)	(0.0100)	(0.0505)	(0.0114)	(0.0323)
N	5563	5563	5563	5563	5563	5563	5563

Standard errors were adjusted for spatial correlation by clustering at the level of the family. Controls: differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

decline in mortality from ambulatory-care-sensitive conditions and important reductions in health inequalities between racial groups.

The following subsections replicate our estimations interacting PSF availability with groups of income, educational level and skin color.

2.4.3.1 Family Income

Table 3 interacts PSF with family income quartiles, which were calculated based on the monthly family income divided by the number of family members.

In Panel A, the change in PSF availability during prenatal among the first quartile of income is associated to a reduction of 2.01 pp on reporting perceived bad health and a reduction of 0.10 on the total days hospitalized. The effect on being hospitalized is also noticed for the second quartile of income.

The presence of PSF when the child was born can make a difference on health outcomes, especially for the low-income families as showed in Panel B. Among the first quartile of income, the program is associated to a reduction of 3.91 pp on the prevalence of children being unable to perform their own activities and a reduction of 0.21 on the total days of illness. For this income-group, PSF is also associated to a decrease of 2.21 pp on the prevalence of staying in bed due to recent illness and a reduction of 0.11 on the total days in bed. Those effects are also partially seen among the third quartile of income.

Panel C investigates the effect of PSF during the child's first year of life for each income-group. The availability of public primary care plays an important role for the children whose families belong to the first quartile of income: PSF is associated to a reduction of 0.21 on the total days of illness, a decrease of 2.15 pp on being bedridden and a reduction of 0.11 on the total days in bed.

2.4.3.2 Family Education

Table 4 interacts PSF with family education, which was created based on the highest level of education achieved by the head of the family.

Table 3 – Heterogeneity by Family Income: Children's health and *Programa Saúde da Família* [Siblings Regressions]

	Perceived health	Unable to perform due to illness		Bed due to recent illness		Hospitalized in the last year	
	Δ *Bad health*	Δ *Unable to perform*	Δ *Days of illness*	Δ *Bed due to illness*	Δ *Days in bed*	Δ *Stayed in hospital*	Δ *Days in hospital*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: PSF available in the metropolitan region during the child's prenatal							
$1^{st}quartile \cdot \Delta\ PSF\ prenatal$	-0.0201**	-0.0101	-0.1215	-0.0008	-0.0282	-0.0243	-0.1033**
	(0.0100)	(0.0210)	(0.1200)	(0.0143)	(0.0624)	(0.0158)	(0.0485)
$2^{nd}quartile \cdot \Delta\ PSF\ prenatal$	-0.0039	-0.0068	0.0219	0.0090	-0.0017	-0.0341**	-0.0809***
	(0.0049)	(0.0225)	(0.0806)	(0.0191)	(0.0614)	(0.0162)	(0.0296)
$3^{rd}quartile \cdot \Delta\ PSF\ prenatal$	0.0048	-0.0193	-0.1131	-0.0187	-0.0439	0.0003	0.1452
	(0.0119)	(0.0257)	(0.0925)	(0.0230)	(0.0688)	(0.0277)	(0.2182)
$4^{th}quartile \cdot \Delta\ PSF\ prenatal$	-0.0067	0.0070	0.1783	0.0554	0.3605	-0.0334	-0.1421
	(0.0048)	(0.0528)	(0.2589)	(0.0377)	(0.2774)	(0.0335)	(0.1061)
Panel B: PSF available in the metropolitan region when the child was born							
$1^{st}quartile \cdot \Delta\ PSF\ birth$	-0.0142	-0.0391*	-0.2056**	-0.0221*	-0.1145**	0.0088	-0.0104
	(0.0107)	(0.0200)	(0.1024)	(0.0120)	(0.0520)	(0.0196)	(0.0437)
$2^{nd}quartile \cdot \Delta\ PSF\ birth$	-0.0065	-0.0325	-0.1070	-0.0068	-0.1080	-0.0226	-0.0617
	(0.0060)	(0.0227)	(0.0920)	(0.0189)	(0.0798)	(0.0198)	(0.0411)
$3^{rd}quartile \cdot \Delta\ PSF\ birth$	-0.0053	-0.0394	-0.2077**	-0.0420	-0.1186**	0.0129	-0.0377
	(0.0047)	(0.0301)	(0.0883)	(0.0261)	(0.0530)	(0.0306)	(0.0716)
$4^{th}quartile \cdot \Delta\ PSF\ birth$	-0.0030	-0.0597	0.0396	0.0044	0.4144	-0.0360	-0.1723
	(0.0038)	(0.0645)	(0.3516)	(0.0405)	(0.3618)	(0.0414)	(0.1391)
Panel C: PSF available in the metropolitan region during the child's first year of life							
$1^{st}quartile \cdot \Delta\ PSF\ infant$	-0.0119	-0.0347	-0.1829*	-0.0215*	-0.1058**	0.0253	0.0309
	(0.0111)	(0.0216)	(0.0999)	(0.0118)	(0.0496)	(0.0165)	(0.0387)
$2^{nd}quartile \cdot \Delta\ PSF\ infant$	-0.0056	-0.0360*	-0.1210	-0.0086	-0.1206	-0.0129	-0.0322
	(0.0059)	(0.0212)	(0.0904)	(0.0162)	(0.0781)	(0.0162)	(0.0347)
$3^{rd}quartile \cdot \Delta\ PSF\ infant$	-0.0039	-0.0189	-0.1125	-0.0364	-0.0990**	-0.0005	-0.0341
	(0.0039)	(0.0311)	(0.0995)	(0.0233)	(0.0453)	(0.0183)	(0.0598)
$4^{th}quartile \cdot \Delta\ PSF\ infant$	-0.0025	-0.0563	0.0540	0.0055	0.4167	0.0115	-0.0113
	(0.0036)	(0.0644)	(0.3505)	(0.0404)	(0.3608)	(0.0249)	(0.0370)
N	5159	5159	5159	5159	5159	5159	5159

Standard errors were adjusted for spatial correlation by clustering at the level of the family. Controls: differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4 – Heterogeneity by Family Education: Children's health and *Programa Saúde da Família* [Siblings Regressions]

	Perceived health	Unable to perform due to illness		Bed due to recent illness		Hospitalized in the last year	
	Δ *Bad health*	Δ *Unable to perform*	Δ *Days of illness*	Δ *Bed due to illness*	Δ *Days in bed*	Δ *Stayed in hospital*	Δ *Days in hospital*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: PSF available in the metropolitan region during the child's prenatal							
No completed degree ·Δ *PSF prenatal*	-0.0105	-0.0026	-0.0753	0.0008	-0.0213	-0.0283**	-0.0349
	(0.0116)	(0.0203)	(0.1175)	(0.0138)	(0.0583)	(0.0142)	(0.0540)
Elementary school·Δ *PSF prenatal*	-0.0085	-0.0139	-0.0138	0.0288	0.1003	-0.0312	-0.1600*
	(0.0126)	(0.0285)	(0.1259)	(0.0238)	(0.0983)	(0.0201)	(0.0831)
High school ·Δ *PSF prenatal*	-0.0013	-0.0144	-0.0302	-0.0046	-0.0029	-0.0021	-0.0507
	(0.0060)	(0.0236)	(0.0898)	(0.0189)	(0.0843)	(0.0246)	(0.0446)
Higher school ·Δ *PSF prenatal*	-0.0029	0.0192	-0.0538	-0.0030	-0.0535	0.0104	-0.0365
	(0.0060)	(0.0540)	(0.1722)	(0.0084)	(0.0462)	(0.0440)	(0.0504)
Panel B: PSF available in the metropolitan region when the child was born							
No completed degree ·Δ *PSF birth*	-0.0170	-0.0221	-0.1374	-0.0154	-0.0906*	-0.0092	-0.0447
	(0.0103)	(0.0192)	(0.1016)	(0.0122)	(0.0497)	(0.0181)	(0.0483)
Elementary school·Δ *PSF birth*	-0.0051	-0.0610**	-0.1597	-0.0131	-0.0762	-0.0153	-0.0648
	(0.0118)	(0.0267)	(0.1333)	(0.0199)	(0.1198)	(0.0233)	(0.0457)
High school ·Δ *PSF birth*	-0.0015	-0.0568**	-0.1528	-0.0292	-0.0198	0.0256	0.0023
	(0.0046)	(0.0267)	(0.1027)	(0.0197)	(0.1048)	(0.0294)	(0.0478)
Higher school ·Δ *PSF birth*	-0.0021	-0.0293	-0.2380	-0.0464	-0.1049**	0.0360	0.0047
	(0.0040)	(0.0760)	(0.1912)	(0.0364)	(0.0489)	(0.0544)	(0.0611)
Panel C: PSF available in the metropolitan region during the child's first year of life							
No completed degree ·Δ *PSF birth*	-0.0108	-0.0143	-0.1047	-0.0133	-0.0761*	0.0152	0.0213
	(0.0100)	(0.0200)	(0.0952)	(0.0115)	(0.0459)	(0.0136)	(0.0369)
Elementary school·Δ *PSF birth*	-0.0037	-0.0606**	-0.1695	-0.0066	-0.0762	-0.0096	-0.0376
	(0.0125)	(0.0264)	(0.1401)	(0.0184)	(0.1260)	(0.0151)	(0.0361)
High school ·Δ *PSF birth*	-0.0001	-0.0555**	-0.1429	-0.0265	-0.0148	0.0209	0.0072
	(0.0043)	(0.0259)	(0.0975)	(0.0187)	(0.0993)	(0.0264)	(0.0449)
Higher school ·Δ *PSF birth*	-0.0015	0.0090	-0.0751	-0.0403	-0.0924**	0.0359	0.0127
	(0.0037)	(0.0767)	(0.2233)	(0.0333)	(0.0463)	(0.0496)	(0.0559)
N	5242	5242	5242	5242	5242	5242	5242

Standard errors were adjusted for spatial correlation by clustering at the level of the family. Controls: differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The presence of PSF during the child's prenatal has an impact on health outcomes, especially for the low-educated families as showed in Panel A. Among the *no completed degree* group, the program is associated to a reduction of 2.83 pp on the prevalence of hospitalization. A reduction of 0.16 on the total days of illness is also noticed for the *elementary school* group.

In Panel B, the change in the program availability at birth is associated to a reduction of 0.09 on the total days in bed due to recent illness among the *no completed degree* group, and a similar decrease (0.10) is estimated for the *higher school* group. PSF is also associated to a decrease of 6.10 pp on the prevalence of children being unable to perform their own activities due to illness among the *no completed degree* group and a reduction of 5.68 pp on the prevalence of restricted activity days among the *elementary school* group.

A very similar pattern occurs in Panel C, where we evaluate PSF presence during the child's first year of life by family education. The program is associated to a reduction of 0.08 on the total days in bed due to recent illness among the *no completed degree* group, and another decrease (0.09) is estimated for the *higher school* group. PSF is also associated to a decrease of 6.06 pp and 5.55 pp on the prevalence of children being unable to perform their own activities due to illness among the *no completed degree* and *elementary school* groups, respectively.

2.4.3.3 Skin color

Table 5 interacts PSF availability with three skin colors. Official classifications are *branco* (white), *pardo* (brown/mixed), *preto* (black), *amarelo* (Asian), and indigenous – with black, *pardo* and white accounting for over 99% of our sample.

In Panel A, the change in PSF availability during prenatal is associated to a negative and significant effect on hospitalization among *pardo* and white children. PSF reduces the prevalence of being in hospital by 3.65 pp in the *pardo* sample. The program also diminishes the number of days in hospital by 0.09 in the white sample.

Table 5 – Heterogeneity by Skin color: Children's health and *Programa Saúde da Família* [Siblings Regressions]

	Perceived health	Unable to perform due to illness		Bed due to recent illness		Hospitalized in the last year	
	Δ *Bad health*	Δ *Unable to perform*	Δ *Days of illness*	Δ *Bed due to illness*	Δ *Days in bed*	Δ *Stayed in hospital*	Δ *Days in hospital*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: PSF available in the metropolitan region during the child's prenatal							
Black ·Δ *PSF prenatal*	0.0082	0.0158	0.0706	0.0045	-0.0543	0.0307	-0.0435
	(0.0099)	(0.0310)	(0.1322)	(0.0244)	(0.0689)	(0.0388)	(0.0755)
Pardo ·Δ *PSF prenatal*	-0.0084	0.0001	0.0209	0.0122	0.0196	-0.0365***	-0.0483
	(0.0109)	(0.0198)	(0.0937)	(0.0141)	(0.0587)	(0.0136)	(0.0652)
White ·Δ *PSF prenatal*	-0.0090	-0.0240	-0.1715	-0.0081	-0.0254	-0.0134	-0.0874**
	(0.0093)	(0.0203)	(0.1160)	(0.0149)	(0.0680)	(0.0175)	(0.0386)
Panel B: PSF available in the metropolitan region when the child was born							
Black ·Δ *PSF birth*	0.0005	-0.0308	-0.1212	-0.0220	-0.1174**	0.0145	-0.0586
	(0.0048)	(0.0244)	(0.0747)	(0.0160)	(0.0472)	(0.0301)	(0.0896)
Pardo ·Δ *PSF birth*	-0.0183*	-0.0292	-0.1103	0.0003	-0.0806	-0.0268	-0.0427
	(0.0098)	(0.0195)	(0.0890)	(0.0138)	(0.0607)	(0.0171)	(0.0457)
White ·Δ *PSF birth*	-0.0041	-0.0523**	-0.2106**	-0.0398***	-0.0738	0.0203	-0.0288
	(0.0071)	(0.0208)	(0.0985)	(0.0139)	(0.0730)	(0.0204)	(0.0420)
Panel C: PSF available in the metropolitan region during the child's first year of life							
Black ·Δ *PSF birth*	0.0016	-0.0171	-0.1099	-0.0204	-0.1147**	0.0145	-0.0490
	(0.0049)	(0.0221)	(0.0738)	(0.0157)	(0.0498)	(0.0301)	(0.0872)
Pardo ·Δ *PSF birth*	-0.0140	-0.0443**	-0.1341	-0.0047	-0.0885	-0.0082	0.0044
	(0.0092)	(0.0193)	(0.0870)	(0.0129)	(0.0583)	(0.0101)	(0.0369)
White ·Δ *PSF birth*	-0.0009	-0.0376*	-0.1701*	-0.0348***	-0.0579	0.0306*	0.0132
	(0.0075)	(0.0215)	(0.0931)	(0.0130)	(0.0707)	(0.0186)	(0.0357)
N	5242	5242	5242	5242	5242	5242	5242

Standard errors were adjusted for spatial correlation by clustering at the level of the family. Controls: differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel B explores the variation in program availability at birth by skin color. PSF is associated to a reduction of 0.12 on the total days in bed due to recent illness in the black sample, and a reduction of 1.83 pp on the perceived bad health in the *pardo* sample. A negative and significant effect is also noticed on the prevalence of being unable to perform due to recent illness, total restricted days, and prevalence of bedridden days in the white sample.

Panel C examines the children for whom PSF was and was not available during their first year of life by skin color. As found in Panel B, the program is associated to reductions on the bedridden days in the black and white samples. The program also seems to influence the restricted activity days in the *pardo* and white samples.

2.4.4 Exposure to PSF

The availability of PSF during the early stages of life proved to be important to improve the health outcomes analyzed. Now we are going to investigate whether the time of exposure to the program, measured by the proportion of life in which the child had the PSF available, also has effects on children's health. These results are shown in Table 7.

According to the results in Panel A, exposure to health care services provided by PSF during prenatal decreases the prevalence of having perceived bad health and being hospitalized. More specifically, an increase in program exposure from 0 to 100% during prenatal – which is the case for a child with PSF available during all months of prenatal, whose eldest sibling did not have the program at the same stage of life – is associated to a reduction of 0.07 on the total days in hospital, representing the totality of the average days in hospital. The same increase in program exposure is also associated to a reduction of 1 pp on having perceived bad health, a relevant effect since the average prevalence of perceived bad health is 0.82%.

In Panel B, exposure to the program during the child's first year of life decreases the total days in bed and the chances of being unable to perform due to illness. In other words, an increase in program exposure from 0 to 100% during first year of life is associated

Table 6 – Exposure to PSF: Children's health and share of life covered by *Programa Saúde da Família* [Siblings Regressions]

	Perceived health	Unable to perform due to illness		Bed due to recent illness		Hospitalized in the last year	
	Δ *Bad health*	Δ *Unable to perform*	Δ *Days of illness*	Δ *Bed due to illness*	Δ *Days in bed*	Δ *Stayed in hospital*	Δ *Days in hospital*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Exposure to the program during the child's prenatal							
Δ *Exposure during prenatal*	-0.0001*	-0.0002	-0.0013	-0.0001	-0.0004	-0.0001	-0.0007**
	(0.0001)	(0.0002)	(0.0009)	(0.0001)	(0.0006)	(0.0001)	(0.0003)
Panel B: Exposure to the program during the child's first year of life							
Δ *Exposure during* 1^{st} *year*	-0.0001	-0.0004**	-0.0016*	-0.0002	-0.0011*	0.0000	-0.0003
	(0.0001)	(0.0002)	(0.0009)	(0.0001)	(0.0007)	(0.0001)	(0.0005)
Panel C: Lifetime exposure to the program (from 1 year old to current age)							
Δ *Lifetime exposure to the program*	-0.0001	0.0002	-0.0015	-0.0005	-0.0042**	-0.0000	-0.0003
	(0.0003)	(0.0007)	(0.0029)	(0.0005)	(0.0021)	(0.0004)	(0.0011)
N	5563	5563	5563	5563	5563	5563	5563

Standard errors were adjusted for spatial correlation by clustering at the level of the family. Controls: differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

to a reduction of 4 pp on the prevalence of being unable to perform due to illness (which represents 57% of the average prevalence) and a reduction of 0.16 on the total restricted activity days (equivalent to 59% of the total average). The same increase in program exposure is also associated to a reduction of 0.11 on bedridden days, corresponding to 92% of the total days in bed.

Following this procedure, the final step is to investigate the lifetime exposure to the program, from 1 year old to current age. In Panel C, PSF has a significant effect on the days in bed, only. The fact that most of the coefficients are not significant here suggests that the stage of children's life for which primary care is available is decisive to determine their health outcomes later[6].

[6] We also executed an heterogeneity analysis for the estimations related to exposure to the program. Results are shown in Appendix.

2.5 Discussion

Primary care, as the first level of contact of individuals and families with the national health system, eliminates barriers to accessing health care services. By promoting maternal and child care as one of the guidelines, primary care helps to prevent illness and premature death. The *Programa Saúde da Família* implemented a national policy for primary care in Brazil, nevertheless there is little evidence assessing the true effects of the program on individual health status. In this paper, we explored the variation in program availability between siblings in order to control for family and locality factors that are constant over time and have an impact on children's health.

Our evidence points out that public health care services conducted at early stages of life improves children's health a few years later. More specifically, PSF presence in the prenatal period has a significant effect of a decrease in hospitalization, an effect especially concentrated in low-income and less educated families. These findings are consistent with the literature showing that lower rates of avoidable hospitalization are highly associated with the availability of primary care (LOENEN et al., 2014), also linked to the fact that primary care expand access to health services for relatively underprivileged population groups, reducing the adverse impact of social inequalities on health as a consequence (STARFIELD, 2012). Moreover, PSF availability and the time exposed to the program during the child's first months of life are associated to reductions on the prevalence of being bedridden or being unable to perform usual activities later, for which estimated effects are sufficiently large to mitigate a considerable proportion of restricted days caused by illness.

Despite these contributions and strengths, there are important limitations to this study that need to be mentioned. First, the combination of individual variables with the PSF presence was done at the metropolitan region-level, since this is lowest level of disaggregation that can be identified in the microdata[7]. Second, even though we controlled for hospital beds per capita in an attempt to control for improvements on health facilities,

[7] We have an ongoing project to access de-identified data at the municipality level, which depends on the approval of IBGE.

we cannot rule out that there might be other local interventions that affect health services that are not fully captured by this measure. Third, a more detailed information on households registered in PSF and the intensity of visits is desirable to enlighten the mechanisms determining the potential benefits experienced by the population attended[8].

There are several challenges in the consolidation of primary care in the Brazil, and surely the increase in its availability is a critical step, but this should come together with improvements in the management and financing of the program. More evidence of causation between primary care and effectiveness in improving health outcomes, as well as a decrease of inequalities in health would offer a compelling justification for continued investment in PSF.

[8] National Health Survey 2013 (*Pesquisa Nacional de Saúde*) has variables concerning the household's registration into PSF as well as the frequency of the Family Health Teams, but not any information about the previous PSF coverage, the municipality of birth or mobility characteristics, making it impossible to employ our empirical strategy for these data.

.1 Appendix: Exposure to PSF - Heterogeneity analysis

Table 7 – Exposure to PSF: Children's health, Family Income and share of life covered by *Programa Saúde da Família* [Siblings Regressions]

	Perceived health	Unable to perform due to illness		Bed due to recent illness		Hospitalized in the last year	
	Δ *Bad health*	Δ *Unable to perform*	Δ *Days of illness*	Δ *Bed due to illness*	Δ *Days in bed*	Δ *Stayed in hospital*	Δ *Days in hospital*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Exposure to the program during the child's prenatal							
$1^{st}quartile \cdot \Delta$ *Exposure during prenatal*	-0.0002**	-0.0003	-0.0021*	-0.0001	-0.0008	-0.0001	-0.0007
	(0.0001)	(0.0002)	(0.0012)	(0.0001)	(0.0006)	(0.0002)	(0.0005)
$2^{nd}quartile \cdot \Delta$ *Exposure during prenatal*	-0.0001	-0.0002	-0.0006	-0.0000	-0.0007	-0.0003	-0.0008**
	(0.0001)	(0.0002)	(0.0008)	(0.0002)	(0.0006)	(0.0002)	(0.0004)
$3^{rd}quartile \cdot \Delta$ *Exposure during prenatal*	-0.0000	-0.0003	-0.0019**	-0.0003	-0.0010	0.0001	0.0003
	(0.0001)	(0.0003)	(0.0009)	(0.0002)	(0.0006)	(0.0003)	(0.0008)
$4^{th}quartile \cdot \Delta$ *Exposure during prenatal*	-0.0001	-0.0004	0.0014	0.0003	0.0043	-0.0004	-0.0019
	(0.0001)	(0.0006)	(0.0034)	(0.0004)	(0.0036)	(0.0004)	(0.0014)
Panel B: Exposure to the program during the child's first year of life							
$1^{st}quartile \cdot \Delta$ *Exposure during* 1^{st} *year*	-0.0001	-0.0004	-0.0015	-0.0003	-0.0015**	0.0002	0.0003
	(0.0001)	(0.0002)	(0.0011)	(0.0002)	(0.0008)	(0.0002)	(0.0005)
$2^{nd}quartile \cdot \Delta$ *Exposure during* 1^{st} *year*	-0.0001	-0.0004	-0.0015	0.0001	-0.0015	-0.0002	-0.0005
	(0.0001)	(0.0003)	(0.0014)	(0.0002)	(0.0012)	(0.0003)	(0.0005)
$3^{rd}quartile \cdot \Delta$ *Exposure during* 1^{st} *year*	-0.0001	-0.0004	-0.0023**	-0.0005*	-0.0015**	-0.0001	-0.0007
	(0.0001)	(0.0003)	(0.0010)	(0.0003)	(0.0006)	(0.0002)	(0.0009)
$4^{th}quartile \cdot \Delta$ *Exposure during* 1^{st} *year*	-0.0000	-0.0006	-0.0027	-0.0002	0.0026	-0.0004	-0.0023
	(0.0000)	(0.0006)	(0.0035)	(0.0005)	(0.0029)	(0.0006)	(0.0020)
Panel C: Lifetime exposure to the program (from 1 year old to current age)							
$1^{st}quartile \cdot \Delta$ *Lifetime exposure to the program*	-0.0002	-0.0002	-0.0013	-0.0009	-0.0052	-0.0004	-0.0003
	(0.0005)	(0.0009)	(0.0045)	(0.0007)	(0.0032)	(0.0004)	(0.0011)
$2^{nd}quartile \cdot \Delta$ *Lifetime exposure to the program*	-0.0003	-0.0003	-0.0021	0.0008	-0.0037	-0.0008*	-0.0015*
	(0.0002)	(0.0008)	(0.0040)	(0.0012)	(0.0036)	(0.0005)	(0.0009)
$3^{rd}quartile \cdot \Delta$ *Lifetime exposure to the program*	-0.0001	0.0003	-0.0019	-0.0007*	-0.0029**	0.0021	0.0016
	(0.0001)	(0.0010)	(0.0017)	(0.0004)	(0.0011)	(0.0017)	(0.0043)
$4^{th}quartile \cdot \Delta$ *Lifetime exposure to the program*	-0.0001	-0.0002	-0.0143	-0.0008*	-0.0040***	0.0024	0.0012
	(0.0002)	(0.0028)	(0.0140)	(0.0004)	(0.0015)	(0.0035)	(0.0036)
N	5159	5159	5159	5159	5159	5159	5159

Standard errors were adjusted for spatial correlation by clustering at the level of the family. Controls: differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8 – Exposure to PSF: Children's health, Family Education and share of life covered by *Programa Saúde da Família* [Siblings Regressions]

	Perceived health	Unable to perform due to illness		Bed due to recent illness		Hospitalized in the last year	
	Δ *Bad health*	Δ *Unable to perform*	Δ *Days of illness*	Δ *Bed due to illness*	Δ *Days in bed*	Δ *Stayed in hospital*	Δ *Days in hospital*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Exposure to the program during the child's prenatal							
No completed degree ·Δ *Exposure during prenatal*	-0.0002**	-0.0001	-0.0015	-0.0001	-0.0006	-0.0003	-0.0007*
	(0.0001)	(0.0002)	(0.0012)	(0.0001)	(0.0006)	(0.0002)	(0.0004)
Elementary school ·Δ *Exposure during prenatal*	-0.0001	-0.0004	-0.0012	0.0001	-0.0000	-0.0002	-0.0011**
	(0.0001)	(0.0003)	(0.0012)	(0.0002)	(0.0010)	(0.0002)	(0.0005)
High school ·Δ *Exposure during prenata*	-0.0000	-0.0004	-0.0009	-0.0002	-0.0002	0.0002	-0.0003
	(0.0001)	(0.0002)	(0.0010)	(0.0002)	(0.0010)	(0.0003)	(0.0005)
Higher school ·Δ *Exposure during prenatal*	-0.0000	-0.0001	-0.0019	-0.0004	-0.0011**	0.0003	-0.0002
	(0.0001)	(0.0008)	(0.0021)	(0.0003)	(0.0006)	(0.0006)	(0.0007)
Panel B: Exposure to the program during the child's first year of life							
No completed degree ·Δ *Exposure during* 1^{st} *year*	-0.0001	-0.0002	-0.0010	-0.0001	-0.0012	-0.0001	-0.0003
	(0.0001)	(0.0003)	(0.0012)	(0.0002)	(0.0008)	(0.0002)	(0.0007)
Elementary school ·Δ *Exposure during* 1^{st} *year*	-0.0001	-0.0007**	-0.0021	-0.0001	-0.0015	-0.0001	-0.0005
	(0.0002)	(0.0003)	(0.0015)	(0.0002)	(0.0014)	(0.0002)	(0.0004)
High school ·Δ *Exposure during* 1^{st} *year*	-0.0000	-0.0005*	-0.0019*	-0.0003	-0.0006	0.0003	0.0001
	(0.0001)	(0.0003)	(0.0011)	(0.0002)	(0.0010)	(0.0004)	(0.0006)
Higher school ·Δ *Exposure during* 1^{st} *year*	-0.0000	-0.0005	-0.0039*	-0.0008	-0.0017**	0.0001	-0.0003
	(0.0001)	(0.0008)	(0.0023)	(0.0006)	(0.0008)	(0.0004)	(0.0006)
Panel C: Lifetime exposure to the program (from 1 year old to current age)							
No completed degree ·ΔΔ *Lifetime exposure to the program*	0.0001	0.0007	-0.0001	-0.0007	-0.0042	0.0002	0.0003
	(0.0002)	(0.0010)	(0.0040)	(0.0006)	(0.0028)	(0.0006)	(0.0015)
Elementary school ·Δ *Lifetime exposure to the program*	-0.0010	-0.0002	-0.0020	0.0005	-0.0042	-0.0006	-0.0013
	(0.0013)	(0.0008)	(0.0038)	(0.0011)	(0.0033)	(0.0004)	(0.0009)
High school ·Δ *Lifetime exposure to the program*	0.0000	-0.0010	-0.0065*	-0.0009*	-0.0038***	-0.0004	-0.0010
	(0.0001)	(0.0009)	(0.0037)	(0.0005)	(0.0014)	(0.0007)	(0.0011)
Higher school ·Δ *Lifetime exposure to the program*	0.0000	-0.0008	-0.0077	-0.0010	-0.0040**	-0.0015***	-0.0028**
	(0.0002)	(0.0009)	(0.0047)	(0.0008)	(0.0018)	(0.0004)	(0.0013)
N	5242	5242	5242	5242	5242	5242	5242

Standard errors were adjusted for spatial correlation by clustering at the level of the family. Controls: differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9 – Exposure to PSF: Children's health, Skin color and share of life covered by *Programa Saúde da Família* [Siblings Regressions]

	Perceived health	Unable to perform due to illness		Bed due to recent illness		Hospitalized in the last year	
	Δ *Bad health*	Δ *Unable to perform*	Δ *Days of illness*	Δ *Bed due to illness*	Δ *Days in bed*	Δ *Stayed in hospital*	Δ *Days in hospital*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Exposure to the program during the child's prenatal							
Black ·Δ *Exposure during prenatal*	0.0000	0.0000	-0.0003	0.0000	-0.0007	0.0002	-0.0006
	(0.0001)	(0.0003)	(0.0010)	(0.0003)	(0.0007)	(0.0003)	(0.0008)
Pardo ·Δ *Exposure during prenatal*	-0.0002*	-0.0001	-0.0008	0.0000	-0.0006	-0.0004**	-0.0007*
	(0.0001)	(0.0002)	(0.0009)	(0.0001)	(0.0005)	(0.0002)	(0.0003)
White ·Δ *Exposure during prenatal*	-0.0001	-0.0005**	-0.0023*	-0.0003*	-0.0005	0.0000	-0.0007
	(0.0001)	(0.0002)	(0.0012)	(0.0001)	(0.0008)	(0.0002)	(0.0005)
Panel B: Exposure to the program during the child's first year of life							
Black ·Δ *Exposure during* 1^{st} *year*	0.0000	-0.0003	-0.0016**	-0.0003	-0.0016**	0.0000	-0.0013
	(0.0001)	(0.0003)	(0.0008)	(0.0003)	(0.0006)	(0.0003)	(0.0012)
Pardo ·Δ *Exposure during* 1^{st} *year*	-0.0001	-0.0003	-0.0012	0.0000	-0.0012	-0.0001	0.0001
	(0.0001)	(0.0003)	(0.0012)	(0.0002)	(0.0010)	(0.0001)	(0.0006)
White ·Δ *Exposure during* 1^{st} *year*	-0.0000	-0.0005**	-0.0022**	-0.0004***	-0.0012*	0.0001	-0.0005
	(0.0001)	(0.0002)	(0.0010)	(0.0002)	(0.0007)	(0.0002)	(0.0005)
Panel C: Lifetime exposure to the program (from 1 year old to current age)							
Black ·Δ *Lifetime exposure to the program*	0.0000	-0.0001	-0.0029*	-0.0005*	-0.0032**	-0.0009**	-0.0065
	(0.0001)	(0.0003)	(0.0016)	(0.0003)	(0.0013)	(0.0003)	(0.0053)
Pardo ·Δ *Lifetime exposure to the program*	0.0001	0.0003	-0.0025	-0.0001	-0.0038	-0.0001	0.0016
	(0.0004)	(0.0013)	(0.0036)	(0.0009)	(0.0030)	(0.0006)	(0.0020)
White ·Δ *Lifetime exposure to the program*	-0.0004	0.0001	-0.0011	-0.0009*	-0.0051*	0.0001	-0.0006
	(0.0005)	(0.0008)	(0.0042)	(0.0005)	(0.0029)	(0.0006)	(0.0010)
N	5242	5242	5242	5242	5242	5242	5242

Standard errors were adjusted for spatial correlation by clustering at the level of the family. Controls: differences between younger and older sibling of age, gender, birth order, Bolsa Família coverage, GDP per capita and hospital beds per capita. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3 Brazilian *Programa Saúde da Família* on individual outcomes: Assessing general health, preventive behavior and search for health

Abstract

As a nationwide primary care policy, *Programa Saúde da Família* aims to provide basic health through professional health-care teams (composed by doctors, nurses and health agents) working at the community level. Despite the relevance and scope of the program, few studies addressing the impacts of the PSF are available; among the empirical studies, most are based on state and municipal data. Using microdata from the *Pesquisa Nacional de Saúde* (National Health Survey), this study estimates the effects of PSF on general health, preventive behavior and search for health. Our empirical strategy exploits a multi-valued treatment effects approach by taking advantage of the information on household's registration in the PSF and frequency of the Family Health Teams. Our results show that the active presence of the program fosters preventive health behavior improving vaccination and preventive exams adherence, and intensifies search for public health care services, but does not have an overall effect on self-perceived health and measured indicators related to obesity and hypertension.

Keywords: primary care; preventive behavior; individual health outcomes.

3.1 Introduction

"*He always explains something to me. Sometimes we want to have information and he communicates to us, because there is a lot in the health unit that we don't know. He visits my house and gives the first guidance so that my family go well-informed to the Basic Health Unit. He also raises awareness about high blood pressure, diabetes, to take the right medication, the importance of walking...*"[1] – says an interviewee about the home visits of the *Programa Saúde da Família* (PSF).

As a nationwide primary care policy, PSF places individuals at the centre of health care. With an officially declared goal fairly broad – namely, "*to improve the health conditions of the covered families*" (SAÚDE, 2001b) – the program aims to provide opportunities for health promotion and prevention, as well as an early detection of diseases. It also guides individuals through the health system, by referring to other levels of health care service when needed. The World Health Organization (WHO) especially encourages this sort of guidance since even when health services are available, individuals may not know how to access them due to personal or geographic barriers, some of them might arising from the health system itself (WHO, 2018). Access to health care and first-contact care are facilitated by establishing family health teams inside the communities and near people's homes.

Previous international evidence have noticed that nations with strong primary care has better population health, less socioeconomic inequalities in health and potentially unnecessary hospitalizations (KRINGOS et al., 2013). In addition, people suffering from chronic diseases has better prospects with a strong primary care structure (HANSEN et al., 2015). In Brazil, the most prominent evidence says that PSF affects child mortality (ROCHA; SOARES, 2010; MACINKO; GUANAIS; SOUZA, 2006) and hospitalizations (CAVALCANTE et al., 2018; RASELLA et al., 2014), but the program may also improve individual health by other unexplored means.

Using individual data from the *Pesquisa Nacional de Saúde*, the latest nationwide

[1] Non-literal translation of an interviewee's testimony about the program and its team's visits. Full declaration is provided by Lima, Silva e Bousso (2010).

health survey, this study estimates the effects of PSF on (i) general health: self-assessed health, anthropometric measurements and hypertension; (ii) preventive behavior: immunization, preventive exams and prenatal care; and (iii) search for health: based on variables related to where individuals often look for health care when they are sick or in need of care. In many outcomes assessed, PSF should act not solely by encouraging a healthy lifestyle, but by asking whether the individuals are up-to-date with vaccination and regular checkups, and referring them to a health facility capable of performing such exams and services. For people already suffering from illness, program also has a role to provide key information about their disease and treatment, as well as to offer support where it is needed.

At the time of our analysis, most of the municipalities already joined the program[2] however the number of family health teams and frequency of home visits varies considerably across localities. Since PSF is heterogeneous and program intensity can occur at different levels, our empirical strategy exploits a Multivalued Treatment Effects approach by taking advantage of the information on household's registration in the PSF and frequency of the Family Health Teams.

This study is organized as follows. In **section 3.2**, we present the data, outcomes and control variables, then in **section 3.3** we elucidate the empirical strategies and the Multivalued Treatment Effects framework. **Section 3.4** presents estimations for each strategy and **section 3.5** has a discussion of the results, drawbacks and future research possibilities.

[2] 5,346 out of 5,570 municipalities had Family Health Teams in 2013, but the deployed Family Health Teams varies from 0 to 1173 (or from 0 to 0.0012121 deployed teams per capita).

3.2 Data

Individual and household levels data were collected from the National Health Survey/*Pesquisa Nacional de Saúde* (PNS) 2013, fully released in 2017. PNS is the latest nationwide health survey, being produced by the Ministry of Health in partnership with Brazilian Institute of Geography and Statistics/*Instituto Brasileiro de Geografia e Estatistica* (IBGE). The sample size is 64,348 households and information on several dimensions of health were investigated, such as health indicators, as well as attention to their health, preventive behavior, access to and usage of health services. According to Szwarcwald et al. (2014):

> *"The questionnaire is subdivided into three parts. The first two are answered by a resident of the household and include questions about the characteristics of this household and the socioeconomic and health status of all residents. The individual questionnaire is answered by a resident of 18 years or older, selected with equiprobability among all adult residents of the household and focuses on morbidity and lifestyles."*

Indicators related to general health were built using four modules. Self-perceived health (Module N) and self-perceived oral health (Module U) performs an overall assessment of the individual health. Anthropometric measurements like weight, height and waist circumference are available (Module W), and were effectively measured (not only asked) by the survey. Weight and height were gathered to form Body Mass Index. Blood pressure (diastolic and systolic) is also provided (Module W) and used to infer hypertension. Finally, recent health indicators were built according to the information on whether the individual was unable to perform usual tasks or stayed in bed due to recent illness (Module J).

Information on where individuals often look for health care when they are sick or in need of health care was retrieved from Module J. We also selected information on where individuals sought first medical attention the last time they consulted a doctor and where they got the doctor appointment (Module X). Relative to oral health care, we gathered

the information on where was the last dental appointment and how did individuals get the dental appointment (Module U).

Issues regarding Children under two years old, Women's health, Prenatal and Elderly were collected from specific topics. For children under two, there are variables related to infant vaccination, medical appointment after maternity and infant health care (Module L). For Women's health, we have information on preventive exams, contraception and family planning (Module R). Specific issues about prenatal such as prenatal testing, maternal gestational weight gain and prenatal care were selected from Module S. For Elderly, flu vaccine and qualitative information about vaccination adherence were collected from Module K.

3.2.1 Controls

We divide our explanatory variables in three categories of controls:

(i) individual controls: sex (female or male), age (in years or in months for children under 2 years old), color (white, black, other), health insurance. Also some age-specific controls: employed, married and categories of education (primary, secondary and higher education) for adults ($age \geq 18$); illiterate, basic school and categories of education indicating if the household chief has primary, secondary and higher education for youth ($6 \leq age < 18$); for children under 2 years old, we also controlled for education of household chief by including indicators of primary, secondary and higher education.

(ii) past long-standing illness controls: we control for disabilities by including an indicator for a born or an acquired disability. Disabilities comprehends intellectual, physical, auditory or a visual disability. For adults, we also control for past and lasting chronic diseases which identifies if the individual was already diagnosed with a chronic disease a long time before the survey[3]. Chronic diseases encompass diabetes, heart and lung diseases, depression or any other chronic, long-term mental or physical illness.

[3] Indicators for disability and chronic disease were built to signalize a past and lasting illness. Since PSF could help to diagnose diseases, to avoid this source of endogeneity we consider chronic diseases diagnosed for at least 15 years before the survey, so before the program starts to take action in most of the municipalities.

(iii) household controls: categories of income quintile, categories of sewage disposal on household (sewage network, septic tank, cesspit, ditch, straight to river/lake/sea, or other), categories of water supply on household (general distribution, wells/springs, or other), piped water, electricity provision, television, cellular, and also some regional controls such as categories of regions (north, northeast, southeast, south or center-west), urban and capital city.

A detailed explanation for each control variable is provided in Appendix A.

3.3 Methodology

We conduct our empirical strategy following three steps. First, by using the information on household's registration in the PSF, we are able to see a general pattern of how health outcomes varies due to the registration or not in the program. Second, by using the information of frequency of visits on each household, we are able to check a specific pattern of how health outcomes respond across each frequency of visits. Third, by taking advantage of a multivalued treatment effects approach, we are able to estimate the average treatment effect, and each level of treatment provides a gradient of effects that ranges from zero visits to monthly visits.

Our identification hypothesis regards on the fact that individuals and households do not self-select into the PSF – at the individual and household levels, PSF runs as a compulsory program (MORENO-SERRA, 2008). Actually, after the municipality opts for adopting the program and chooses the areas that will be attended, FHTs manages to do the registration and visits in households. There is evidence that local administrations initially distributed its FHTs in the poorest and unhealthiest places using observable indicators to drive the choice of areas to be priorities (Ministério da Saúde e Fundação Oswaldo Cruz, 2005), leading us to argue that selection is on observables.

In details, the first step can be implemented through a PSF registration Regression:

$$H_i = \alpha + \beta PSF\_registration_i + X\gamma + \varepsilon_i \tag{3.1}$$

where H_i is the health outcome[4] of interest for individual i, $PSF\_registration_i$ is an indicator for whether the individual resides in a household registered on PSF. X contains a set of explanatory variables which conceivably affect both individual exposure to the program and the health outcome.

[4] The descriptive statistics of all variables are provided separately for each sub-sample in Appendix B.

The second step is implemented through a PSF frequency of visits Regression:

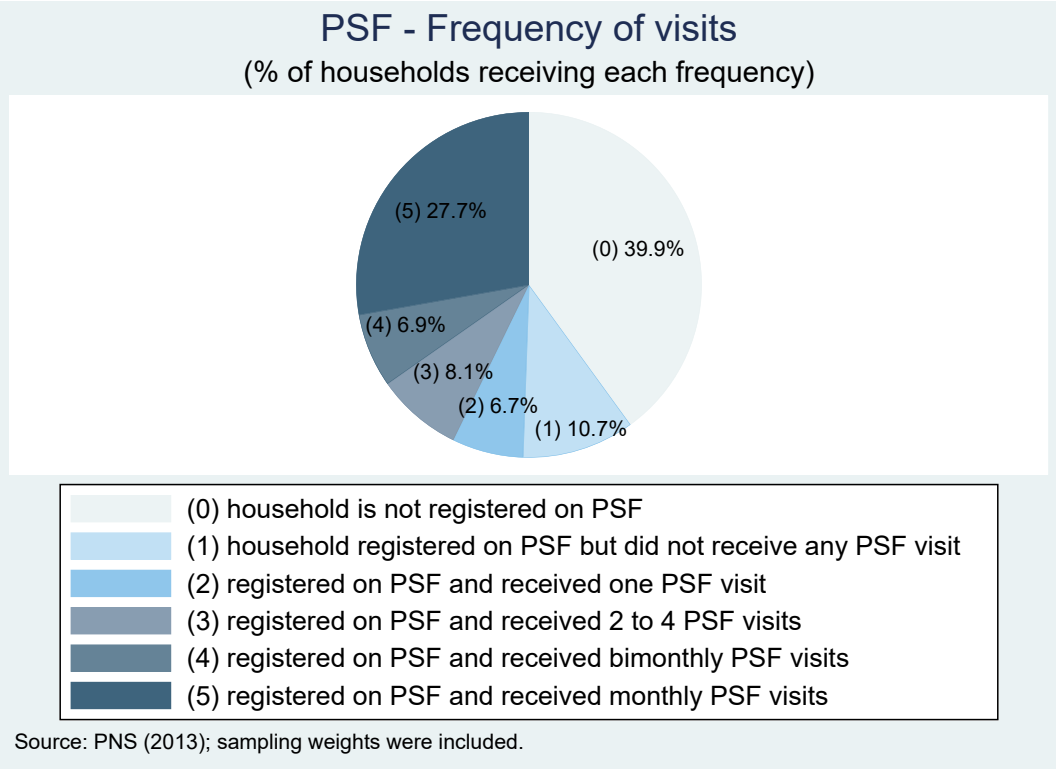
$$H_i = \alpha + \beta_1 PSF\_frequency\_1 + \beta_2 PSF\_frequency\_2 + \beta_3 PSF\_frequency\_3 + \beta_4 PSF\_frequency\_4 + \beta_5 PSF\_frequency\_5 + X\gamma + \varepsilon_i \quad (3.2)$$

where $PSF\_frequency$ dummies are built using the information on how often each household received a visit from a Family Health Team member in the 12 months prior to the survey. We believe this is a valuable information since it could be viewed as a measure of recent intensity of the program on each household. Our available knowledge of frequencies are organised according to the following indicators:

- PSF_frequency_0: household is not registered on PSF, which is the baseline category that has been left out of the regression.
- PSF_frequency_1: household is registered on PSF but did not receive any PSF visit[5].
- PSF_frequency_2: household is registered on PSF and received one PSF visit.
- PSF_frequency_3: household is registered on PSF and received 2 to 4 PSF visits.
- PSF_frequency_4: household is registered on PSF and received bimonthly PSF visits.
- PSF_frequency_5: household is registered on PSF and received monthly PSF visits.

The percentage of each frequency of visits is provided below. In our sample, 60.1% of the households are registered on PSF, but the frequency of visits ranges from no visits (10.7% of the households) to monthly visits (27.7%).

[5] If households registered in the program that do not receive visits are locally close to households that receive frequent visits, it can be argued that the coefficient associated with PSF_frequency_1 is partially capturing a spillover effect from other households which are registered in the program and receiving visits. For example, a household that has received guidance from the FHT to vaccinate their children can share this information with neighboring households that are registered on PSF but have not received any recent visit from the program.



The third step focuses on the intensity of the PSF through frequency of visits to estimate the average treatment effect of the program. If the treatment was homogeneous and dichotomous, each household could either be attended by the program or not, and we could follow the classical framework proposed by Rubin (1974) and Abadie e Imbens (2006). Unlike this case, PSF is heterogeneous and program intensity can occur at different levels according to the frequency of visits by a Family Health Team. We aim to know how effective each intensity of the program is relative to not being attended; once we estimate that, we can see a gradient of effects as the intensity increases. This obliges an extension of the classical framework which is presented for example in Wooldridge (2010) and Linden et al. (2016). There are also other developments on multivalued treatment effects with semiparametric estimators for quantile treatment in Cattaneo (2010), and nonparametric estimators based on propensity score weighting in Ao, Calonico e Lee (2019).

Following Wooldridge (2010), we adapt to the context of PSF and consider that the treatment intensity has 6 different frequencies, which we denote as g in the set $\{0, 1, 2, 3, 4, 5\}$. Here 0 indicates a household not registered on PSF and $1, 2, 3, 4, 5$ are each frequency of visits defined above. Hence, our treatment level is defined as w and takes a

value in $\{0, 1, 2, 3, 4, 5\}$. We label the *potential health outcome* that individual i $(1, ..., N)$ would acquire if received treatment intensity g as h_{ig}. The observed health response, h_i, can be written as:

$$h_i = 1[w_i = 0]h_{i0} + 1[w_i = 1]h_{i1} + 1[w_i = 2]h_{i2} + 1[w_i = 3]h_{i3} + 1[w_i = 4]h_{i4} + 1[w_i = 5]h_{i5} \tag{3.3}$$

We can also define $E[h_{ig}]$ as the population means of the potential health outcomes. As usual, we control for a set of explanatory variables in X. A sufficient hypothesis for identifying the means is the conditional mean independence assumption:

$$E[h_{ig}|w_i, X] = E(h_{ig}|X), g = 0, 1, 2, 3, 4, 5. \tag{3.4}$$

The idea underlying this assumption is that if we can observe enough information contained in X that determines treatment, then $(h_0, h_1, h_2, h_3, h_4, h_5)$ is mean independent of w, conditional on X, which is the same as assuming selection on observables.

Under this hypothesis it follows that:

$$E(h_i|w_i, X) = 1[w_i = 0]E(h_{i0}|X) + 1[w_i = 1]E(h_{i1}|X) + 1[w_i = 2]E(h_{i2}|X) + 1[w_i = 3]E(h_{i3}|X) + 1[w_i = 4]E(h_{i4}|X) + 1[w_i = 5]E(h_{i5}|X) \tag{3.5}$$

which demonstrates that the mean function $E(h_g|X)$ is identified since $E(h_g|X) = E(h|w = g, X)$.

Using a random sample, it is possible to estimate $E(h|w = g, X)$ for each g, by limiting our attention to units with $w_i = g$. Put it differently, regression adjustment in the multiple treatment case can be seen as an extension of the case when w_i is binary so that the average treatment effects are estimated pairwise.

Defining the conditional mean estimates $\{\hat{m}_g(X) : \ g = 0, 1, ..., 5\}$, the **Average Treatment Effect** (ATE) for treatment g relative to 0, say τ_{0g}, can be estimated as:

$$\hat{\tau}_{01} = N^{-1} \sum_{i=1}^{N} [\hat{m}_1(X) - \hat{m}_0(X)] \tag{3.6}$$

$$\hat{\tau}_{02} = N^{-1} \sum_{i=1}^{N} [\hat{m}_2(X) - \hat{m}_0(X)] \tag{3.7}$$

$$\hat{\tau}_{03} = N^{-1} \sum_{i=1}^{N} [\hat{m}_3(X) - \hat{m}_0(X)] \tag{3.8}$$

$$\hat{\tau}_{04} = N^{-1} \sum_{i=1}^{N} [\hat{m}_4(X) - \hat{m}_0(X)] \tag{3.9}$$

$$\hat{\tau}_{05} = N^{-1} \sum_{i=1}^{N} [\hat{m}_5(X) - \hat{m}_0(X)] \tag{3.10}$$

3.4 Results

3.4.1 Estimations for Children under 2 years old

3.4.1.1 Vaccination

A member of Family Health Team "*asks everything, 'how is your family'... Asks about my children, if they are up to date with the vaccine...*" (LIMA; SILVA; BOUSSO, 2010) – reports an interviewee about the home visits of the program. Indeed, our first estimations investigate vaccination for children under 2 years old. The results for PSF registration Regression are presented in Table 1.

Table 1 – Vaccination [PSF registration Regression]

		Tetravalent vaccine			
	Vaccination card	1^{st} Dose	2^{nd} Dose	3^{rd} Dose	Reinforcing Dose
	(1)	(2)	(3)	(4)	(5)
PSF_registration	0.0245	0.0030	0.0167	0.0281*	0.0515***
	(0.0185)	(0.0149)	(0.0242)	(0.0163)	(0.0168)
Constant	0.9188***	0.9686***	0.6331***	0.2184**	-0.2192***
	(0.0568)	(0.0365)	(0.0954)	(0.0894)	(0.0585)
Individual controls	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	4403	3811	3811	3811	3811

Vaccination card is a dummy variable equal to 1 if the child's family presented the vaccination card of the child; 0 otherwise. The remaining dependent variables identify whether the child had taken each dose of Tetravalente DTP-Hib vaccine. This information was filled by consulting the vaccination card. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Vaccination card is a variable that identifies whether a child has the official card carrying immunization records, which provides a history of all the vaccines a child received. PSF seems to have no effect on possessing a vaccination card, even though 86,1% already owe one[6].

[6] In our sample, 86.1% of the children under 2 years old have a vaccination card. Also, 96.5% have taken the first dose of the vaccine, this percentage is 84.7% for the second dose, then 73.2% for the third dose and drops to 28.1% for the reinforcing dose. These descriptive statistics are shown in Appendix B.

By consulting the vaccination card, the survey agent records which doses of the Tetravalente DTP-Hib vaccine has the child received. Tetravalente DTP-Hib vaccine prevents diphtheria, tetanus, pertussis, meningitis and other infections caused by *Haemophilus influenzae* type b. The Brazilian Ministry of Health recommends taking the first dose of vaccine at 2 months of age, the second dose at 4 months, the third dose at 6 months and a reinforcing dose at 15 months (Ministry of Health, 2019). Our estimates point out that PSF begins to have an effect on the final doses of the vaccine. Ceteris paribus, being registered on PSF is associated to a probability 2.81 percentage points (pp) higher of taking the third dose and 5.15 pp higher of taking the reinforcing dose.

The results for PSF frequency of visits Regression are presented in Table 2.

Table 2 – Vaccination [PSF frequency of visits Regression]

		Tetravalent vaccine			
	Vaccination card	1^{st} Dose	2^{nd} Dose	3^{rd} Dose	Reinforcing Dose
	(1)	(2)	(3)	(4)	(5)
PSF_frequency_1	0.0430*	-0.0221	0.0006	0.0124	-0.0436
	(0.0211)	(0.0257)	(0.0370)	(0.0326)	(0.0276)
PSF_frequency_2	-0.0512	0.0118	0.0001	-0.0104	0.0936***
	(0.0395)	(0.0154)	(0.0419)	(0.0247)	(0.0309)
PSF_frequency_3	0.0269	-0.0016	-0.0046	0.0132	0.0660
	(0.0250)	(0.0187)	(0.0277)	(0.0240)	(0.0408)
PSF_frequency_4	0.0207	0.0019	0.0574**	0.0628**	0.0349
	(0.0284)	(0.0177)	(0.0267)	(0.0263)	(0.0399)
PSF_frequency_5	0.0385*	0.0115	0.0225	0.0390*	0.0759***
	(0.0206)	(0.0134)	(0.0212)	(0.0216)	(0.0166)
Constant	0.9188***	0.9654***	0.6205***	0.2090**	-0.2243***
	(0.0554)	(0.0360)	(0.0946)	(0.0869)	(0.0609)
Individual controls	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	4403	3811	3811	3811	3811

Vaccination card is a Dummy variable equal to 1 if the child's family presented the vaccination card of the child; 0 otherwise. The remaining dependent variables identify whether the child had taken each dose of Tetravalente DTP-Hib vaccine. This information was filled by consulting the vaccination card. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

PSF has an effect on frequency 5 (household is registered on PSF and received monthly visits) and frequency 1 (household is registered on PSF but did not receive any visit), but it is statistically weak and does not extend to other frequencies. Then we confirm our results for tetravalente vaccine, PSF has an effect on the final doses especially as the frequency of visits increases. Receiving monthly visits is associated to a probability 3.9 pp higher of taking the third dose and 7.59 pp higher of taking the reinforcing dose.

The results for Multivalued treatment effects estimations are presented in Figure 1. The estimated potential-outcome mean of having a vaccination card is 84.8% for children not registered on PSF (frequency 0). The estimated ATE of going from frequency 0 to frequency 1 (household is registered on PSF but did not receive any visit) is 5.36 pp and the estimated ATE of going from frequency 0 to frequency 5 (household is registered on PSF and received monthly visits) is 4.91 pp.

Looking to the estimations of the first dose, we estimated that potential-outcome mean of taking the first dose is 96.3% for children not registered on PSF (frequency 0). The estimated ATEs of going from frequency 0 to any other frequencies are not statistically significant.

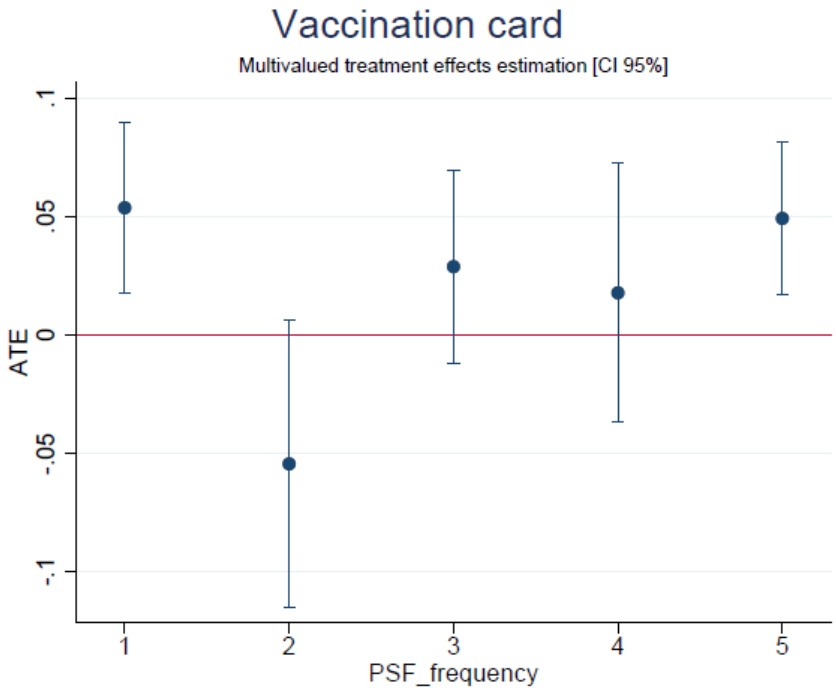
Again, PSF starts to have an effect on the second dose. The estimated potential-outcome mean of taking the second dose is 82.3% for children not registered on PSF (frequency 0). The estimated ATE of going from frequency 0 to frequency 4 (household is registered on PSF and received bimonthly PSF visits) is 6.39 pp and the estimated ATE of going from frequency 0 to frequency 5 (household is registered on PSF and received monthly visits) is 4.39 pp.

For the third dose, the estimated potential-outcome mean decreases to 69.2% among children not registered on PSF (frequency 0). The estimated ATE of going from frequency 0 to frequency 3 (household is registered on PSF and received 2 to 4 PSF visits) is 4.91 pp and the estimated ATE of going from frequency 0 to frequency 5 (household is registered on PSF and received monthly visits) is 6.06 pp.

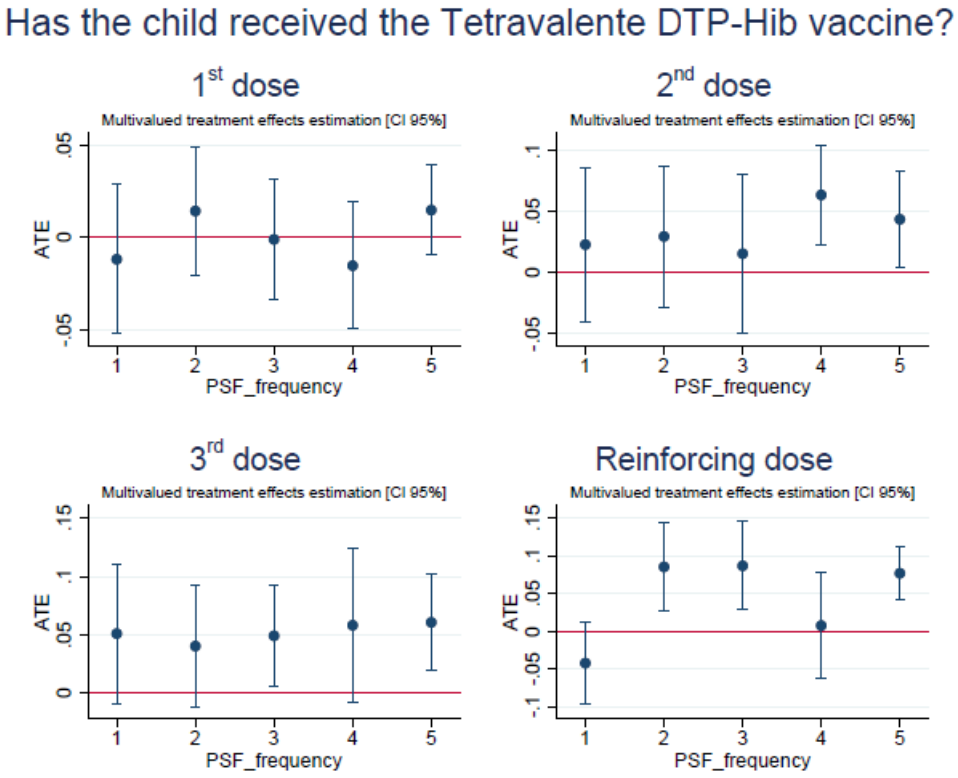
Finally, the estimated potential-outcome mean of taking the reinforcing dose is

23.8% for children not registered on PSF (frequency 0). The estimated ATE of going from frequency 0 to frequency 2 (household is registered on PSF and received one PSF visit) is 8.51 pp; from frequency 0 to frequency 3 (household is registered on PSF and received 2 to 4 PSF visits) is 8.66 pp and from frequency 0 to frequency 5 (household is registered on PSF and received monthly visits) is 7.66 pp.

Our results indicate that PSF has a role increasing the Tetravalente DTP-Hib vaccination adherence among children under 2 years old. The effects are stronger as the frequency of PSF visits increases, and especially high on the final doses of the vaccine that less children tended to adhere.



(a)



(b)

Figure 1 – The estimated potential-outcome mean of having a vaccination card is 84.8% for children not registered on PSF (frequency 0). The estimated potential-outcome mean is 96.3% of taking the first dose, 82.3% of taking the second dose, 69.2% of taking the third dose and 23.8% of taking the reinforcing dose for children not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.1.2 Medical appointment after maternity & Tracking growth

We now turn to health care for children under 2 years old. Our first outcome identifies where was the child's first medical appointment. We have particular interest on whether the child had his first medical appointment by a Family Health Team (FHT) in the household or in a *Unidade Básica de Saúde*/Basic Health Unit (BHU). It is worth mentioning that a BHU comprehends a Family Health Unit or a public health centre. Doing our estimations by FHT and BHU separately is a way to segregate the effect of the program on households and health units. The second outcome identifies whether the child tracks his growth and development in a BHU. Here there is no similar question for FHT.

Table 3 – Medical appointment after maternity & Tracking growth [PSF registration Regression]

	First Appointment after maternity		
	FHT	BHU	Tracking growth in BHU
	(1)	(2)	(3)
PSF_registration	0.0102***	0.0797**	0.0905***
	(0.0027)	(0.0290)	(0.0224)
Constant	-0.0419**	0.4495**	0.4487***
	(0.0198)	(0.1996)	(0.1536)
Individual controls	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
N	4249	4249	4457

First Appointment after maternity is a set of dummy variables that identifies whether the child had his/her first medical appointment by a Family Health Team (FHT) in the household or in a Basic Health Unit (BHU). Tracking growth in BHU is dummy variable taking on the value of 1 if the child tracks his/her growth and development in a BHU; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for PSF registration Regression are presented in Table 3. Our estimates reveal a significant effect of PSF both on having first medical appointment by a FHT or a BHU, even though the estimated effect on BHU is more than 7 times higher. Ceteris paribus, being registered on PSF is associated to a probability 1.02 pp higher of having first medical appointment by a FHT and 7.97 pp higher of having first medical appointment by a BHU. Similarly, being registered on PSF is associated to a probability 9.05 pp higher of having first medical appointment by a BHU.

The results for PSF frequency of visits Regression are presented in Table 4.

Table 4 – Medical appointment after maternity & Tracking growth [PSF frequency of visits Regression]

	First Appointment after maternity		
	FHT	BHU	Tracking growth in BHU
	(1)	(2)	(3)
PSF_frequency_1	0.0007	0.0910***	0.0662***
	(0.0014)	(0.0282)	(0.0194)
PSF_frequency_2	0.0071	0.0640*	0.0298
	(0.0072)	(0.0316)	(0.0336)
PSF_frequency_3	0.0049	0.1399**	0.1194**
	(0.0046)	(0.0642)	(0.0486)
PSF_frequency_4	0.0037	0.0427	0.0648**
	(0.0053)	(0.0318)	(0.0281)
PSF_frequency_5	0.0178***	0.0712*	0.1145***
	(0.0055)	(0.0363)	(0.0287)
Constant	-0.0397*	0.4810**	0.4526***
	(0.0204)	(0.2034)	(0.1541)
Individual controls	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
N	4249	4249	4457

First Appointment after maternity is a set of dummy variables that identifies whether the child had his/her first medical appointment by a Family Health Team (FHT) in the household or in a Basic Health Unit (BHU). Tracking growth in BHU is dummy variable taking on the value of 1 if the child tracks his/her growth and development in a BHU; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As indicated in estimates of FHT, our previous effect is confirmed on frequency 5. Receiving monthly visits is associated to a probability 1.78 pp higher of having first medical appointment by a FHT. We also have found that most of the PSF frequencies of visits pursue higher chances of having first medical appointment in a BHU, a probability 13.99 pp higher is found for frequency 3. In addition, this effect is extended to Tracking growth in BHU which estimated effects varies from 6.48 pp to 11.94 pp.

The results for Multivalued treatment effects estimations are presented in Figure 2. The estimated potential-outcome mean of having first medical appointment by a FHT is 0.09% and 43,58% in a BHU, among children not registered on PSF (frequency 0). For FHT, there is a significant effect of going from frequency 0 to frequency 5 and the estimated ATE is 1.65 pp. Meanwhile, frequencies 1, 3 and 5 have significant effects for BHU and the highest estimated ATE is 11.16 pp for frequency 3.

Results are even brighter for tracking growth in a BHU. The estimated potential-outcome mean is 52.39% for children not registered on PSF (frequency 0). Moreover, PSF seems to increase the probability of tracking growth in a BHU as the frequency of visits increases, and the estimated effect reaches 10.86 pp for frequency 5.

Our results show that BHU is seen to be a centre of reference for health care by households with children under two years old. We also have found that this effect is strengthened for households registered on PSF and especially those receiving more visits.

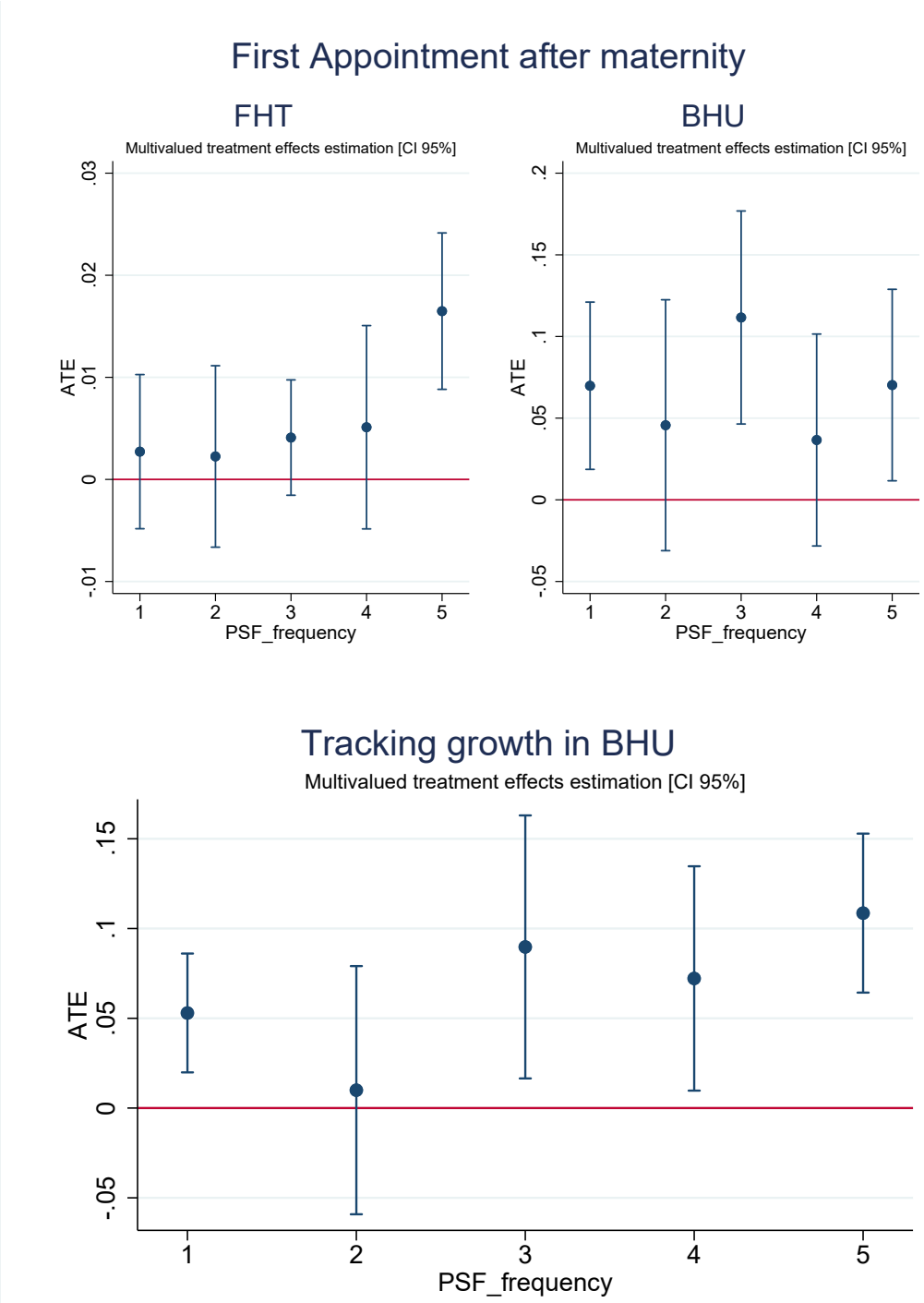


Figure 2 – The estimated potential-outcome mean of having first medical appointment by a FHT is 0.09% and 43,58% in a BHU, among children not registered on PSF (frequency 0). The estimated potential-outcome mean of tracking growth in a BHU is 52.39% for children not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.2 Estimations for Youth

For children aged between 6 and 17 years old, there is information about their recent health status of being unable to perform own activities due to recent illness or staying in bed due to recent illness two weeks previous to the survey. We investigated the prevalence of such occurrence and also the total number of restricted days – all this information is answered by their parents or an adult living in the household. The results for PSF registration Regression are presented in Table 5.

3.4.2.1 Health reflected on usual activities

Table 5 – Health reflected on usual activities [PSF registration Regression]

	Unable to perform due to illness		Bed due to recent illness	
	Dummy	# of days	Dummy	# of days
	(1)	(2)	(3)	(4)
PSF_registration	0.0081**	-0.0053	0.0024	-0.0042
	(0.0038)	(0.0241)	(0.0023)	(0.0143)
Constant	0.0975***	0.3915**	0.0535	0.1801
	(0.0310)	(0.1708)	(0.0322)	(0.1097)
Individual controls	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	37230	37230	37230	37230

Column 1 is a dummy variable taking on the value of 1 if the individual had been unable to perform their usual activities due to illness in the two weeks previous to the survey; 0 otherwise. Column 2 is a variable counting the number of days the individual was unable to perform his/her own activities due to illness two weeks previous to the survey. Column 3 is a dummy variable taking on the value of 1 if the individual had been in bed due to illness in the two weeks previous to the survey; 0 otherwise. Column 4 is a variable counting the number of days the individual was in bed due to illness two weeks previous to the survey. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A positive significant effect of PSF is found in the prevalence of being unable to perform only. Ceteris paribus, being registered on PSF is associated to a probability 0.81 pp higher of being unable to perform own activities. However this effect is significant for frequency 1 only, referring to households registered on PSF but receiving no visits as shown in Table 6. PSF is associated to a reduction of 0.07 restricted days and 0.03 bed days for households registered on PSF and receiving 2 to 4 visits.

Table 6 – Health reflected on usual activities [PSF frequency of visits Regression]

	Unable to perform due to illness		Bed due to recent illness	
	Dummy	# of days	Dummy	# of days
	(1)	(2)	(3)	(4)
PSF_frequency_1	0.0118*	-0.0003	-0.0020	-0.0193
	(0.0062)	(0.0401)	(0.0045)	(0.0178)
PSF_frequency_2	0.0184	0.0771	0.0081	0.0198
	(0.0114)	(0.0497)	(0.0060)	(0.0283)
PSF_frequency_3	0.0004	-0.0738***	-0.0020	-0.0335***
	(0.0036)	(0.0214)	(0.0024)	(0.0114)
PSF_frequency_4	0.0092	-0.0167	0.0043	0.0128
	(0.0069)	(0.0292)	(0.0045)	(0.0271)
PSF_frequency_5	0.0055	-0.0068	0.0038	0.0005
	(0.0041)	(0.0243)	(0.0024)	(0.0157)
Constant	0.0982***	0.3968**	0.0531	0.1780
	(0.0303)	(0.1663)	(0.0321)	(0.1081)
Individual controls	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	37230	37230	37230	37230

Column 1 is a dummy variable taking on the value of 1 if the individual had been unable to perform their usual activities due to illness in the two weeks previous to the survey; 0 otherwise. Column 2 is a variable counting the number of days the individual was unable to perform his/her own activities due to illness two weeks previous to the survey. Column 3 is a dummy variable taking on the value of 1 if the individual had been in bed due to illness in the two weeks previous to the survey; 0 otherwise. Column 4 is a variable counting the number of days the individual was in bed due to illness two weeks previous to the survey. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for Multivalued treatment effects estimations are presented in Figure 3. The estimated potential-outcome mean of being unable to perform recently is 4.6% and 0.21 restricted days, among children not registered on PSF (frequency 0). An increase in the frequency of visits is not associated with any improvement in prevalence of being unable to perform. However, there is a significant effect of going from frequency 0 to frequency 3 and the estimated ATE is -0.09 restricted days.

The estimated potential-outcome mean of staying in bed due to illness is 2% and 0.08 restricted days, among children not registered on PSF (frequency 0). Similar to our previous result, an increase in the frequency of visits does not significantly influence the

prevalence of staying in bed. Again, there is a significant effect of going from frequency 0 to frequency 3 and the estimated ATE is -0.03 restricted days.

Overall, PSF has an effect in improving health status through diminishing days of illness, but this effect is restricted to children living in households with frequency 3.

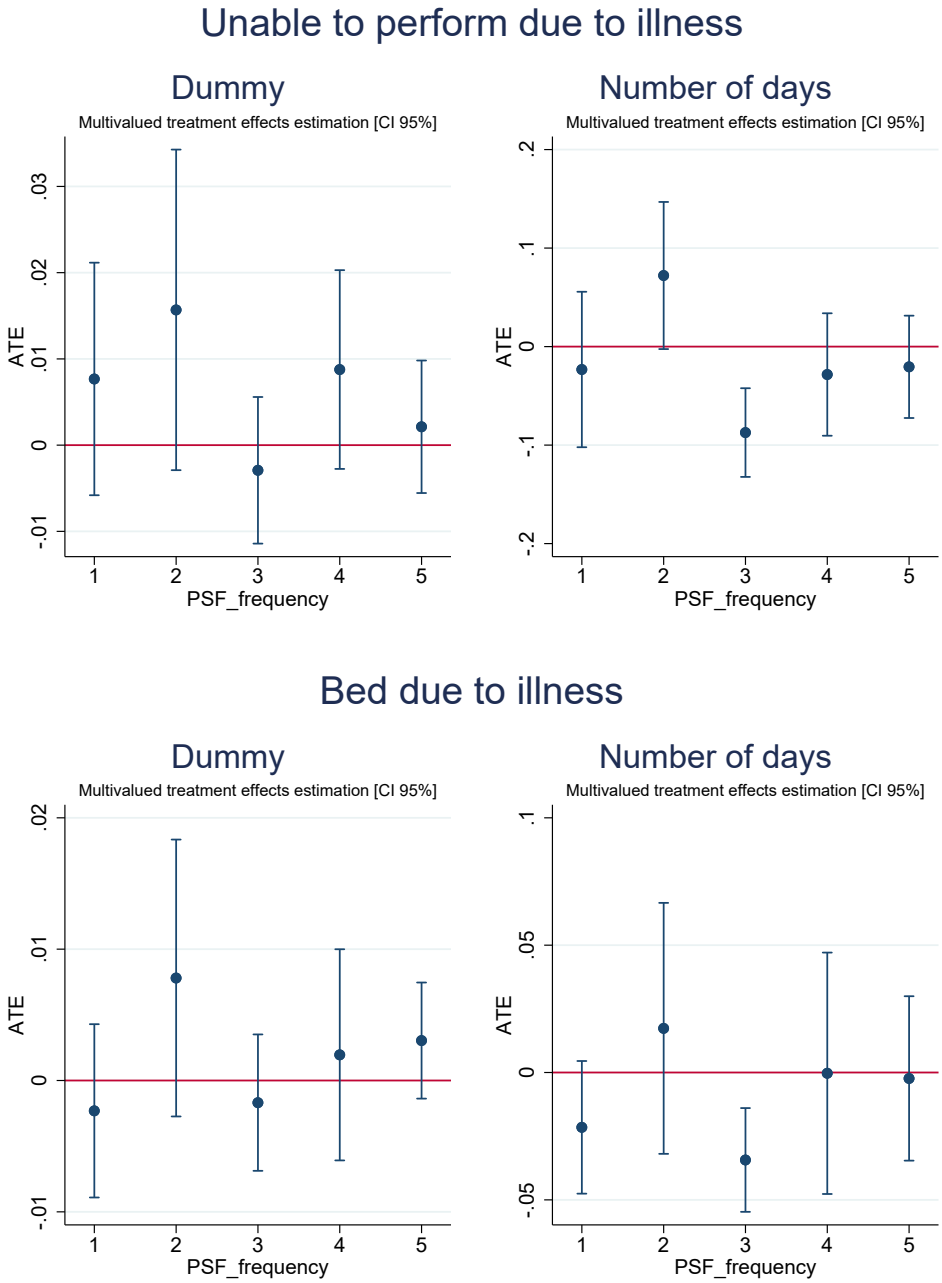


Figure 3 – The estimated potential-outcome mean of being unable to perform recently is 4.6% and 0.21 restricted days, among children not registered on PSF (frequency 0). The estimated potential-outcome mean of staying in bed due to illness recently is 2% and 0.08 restricted days, among children not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.2.2 Search for health care

In this subsection, we continue to investigate how the program works for children. Our outcome identifies where parents often look for health care when their children are sick or in need of health care. We have particular interest on whether the answer is Family Health Team (FHT) in the household or in a Basic Health Unit (BHU). The results for PSF registration Regression are presented in Table 7.

Table 7 – Search for health care [PSF registration Regression]

	Search for health care	
	FHT	BHU
	(1)	(2)
PSF_registration	0.0001	0.1228***
	(0.0001)	(0.0201)
Constant	0.0002	0.6279***
	(0.0009)	(0.0975)
Individual controls	Yes	Yes
Past long-standing illness controls	Yes	Yes
Household controls	Yes	Yes
N	29323	29323

Our dependent variables identify if the individual answered FHT or BHU to the question asking where do the individual often look for health care when sick or in need of care. Robust standard errors are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As expected, being registered on PSF is associated to go to a BHU (an estimated effect of 12.28 pp), but not to a FHT. This result supports our argument that individuals and households do not self-select into the PSF, since they do not go after a Family Health Team.

The estimates for PSF frequency of visits Regression are presented in Table 8. Again the coefficients associated to PSF are close to zero, regardless of the frequency of visits. Meanwhile, a crescent pattern is found for BHU as the frequency of visits increases. The estimated effect for BHU starts in 6.89 pp for frequency 2 and reaches 10.86 pp for frequency 5.

Table 8 – Search for health care [PSF frequency of visits Regression]

	Search for health care	
	FHT	BHU
	(1)	(2)
PSF_frequency_1	-0.0000	0.1095***
	(0.0001)	(0.0145)
PSF_frequency_2	-0.0001	0.0689***
	(0.0001)	(0.0199)
PSF_frequency_3	-0.0000	0.1105***
	(0.0001)	(0.0323)
PSF_frequency_4	0.0002	0.1047***
	(0.0003)	(0.0235)
PSF_frequency_5	0.0001	0.1528***
	(0.0002)	(0.0284)
Constant	0.0001	0.6209***
Individual controls	Yes	Yes
Past long-standing illness controls	Yes	Yes
Household controls	Yes	Yes
N	29323	29323

Our dependent variables identify if the individual answered FHT or BHU to the question asking where do the individual often look for health care when sick or in need of care. Robust standard errors are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for Multivalued treatment effects estimations are presented in Figure 4. The estimated potential-outcome mean of looking for health care in FHT is 0.01%, among children not registered on PSF (frequency 0). An increase in the frequency of visits is not associated with any significant change in the prevalence of looking for health care in FHT.

The estimated potential-outcome mean of looking for health care in BHU is 46.7%, among children not registered on PSF (frequency 0). As the frequency of visits increases, higher are the chances of looking for health care in BHU, which estimated effects varies from 6 pp to 14 pp.

Therefore, being registered on PSF or receiving program's visits are not associated to go after PSF services. This support our hypothesis that families does not self-select to receive medical assistance in their households. Instead, households receiving more intensity of the program has higher chances of looking for health care in BHU.

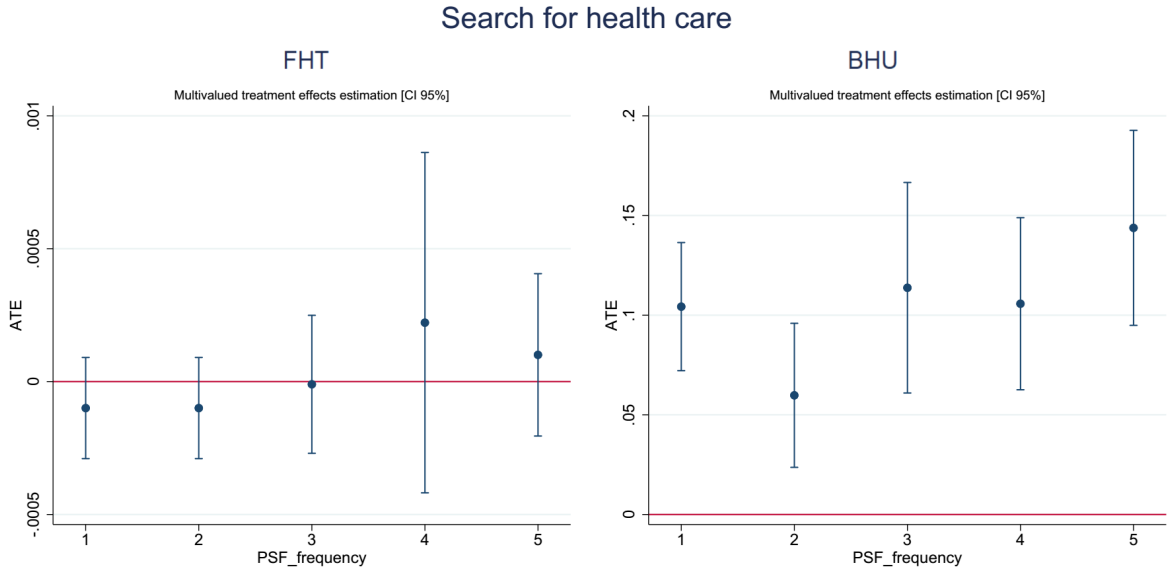


Figure 4 – The estimated potential-outcome mean of looking for health care in FHT is 0.01% and 46.7% in BHU, among children not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.3 Estimations for Adults

The sub-sample of adults has a wide range of variables regarding their health status, the restricted activity days and medical assistance. In the next subsections, we investigate how the *Programa Saúde da Família* affects those issues.

3.4.3.1 General Health & Measured indicators

Table 9 – General Health & Measured indicators [PSF registration Regression]

	Self-perceived health		Anthropometric measurements		Hypertension
	Good health	Good oral health	BMI over	WC over	High blood pressure
	(1)	(2)	(3)	(4)	(5)
PSF_registration	-0.0014	-0.0007	-0.0043	0.0024	-0.0045
	(0.0034)	(0.0024)	(0.0079)	(0.0057)	(0.0071)
Constant	0.9647***	0.9656***	0.0980	-0.2761***	-0.0145
	(0.0349)	(0.0280)	(0.0708)	(0.0571)	(0.0646)
Individual controls	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	52052	52052	52052	52052	52052

(1) Dummy variable taking on the value of 1 if the reported health status was either *very good*, *good* or *fair health* in the date of the interview; 0 otherwise. (2) Dummy variable taking on the value of 1 if the reported Oral health status was either *very good*, *good* or *fair health* in the date of the interview; 0 otherwise. (3) Dummy variable taking on the value of 1 if the individual has Body Mass Index above or equal 25 kg/m^2; 0 otherwise. (4) Dummy variable taking on the value of 1 if the individual has critical waist circumference ($\geq$ 102 cm for men or $\geq$ 88 cm for women). (5) Dummy variable taking on the value of 1 if the individual has high systolic (130 and over) or diastolic (80 and over); 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first two outcomes, Good health and Good oral health, concern the self-perceived health (1: very good, good, fair; 0: very bad, bad), which is a measure of self-rated health based on objective and subjective assessment[7]. The following two measured variables, BMI over and WC over, indicate whether the individual is overweight[8] or has critical waist circumference[9] according to his/her anthropometric measurements. The last

[7] Despite being a broad measure, previous evidence have found that self-perceived health predicts mortality and morbity (JYLHÄ, 2009; LATHAM; PEEK, 2013; LARSSON et al., 2002) and it is seen as a quality indicator for primary care (ROHRER et al., 2007).

[8] Overweight is a dummy variable defined as a Body Mass Index of 25 kg/m^2 or more.

[9] Critical waist circumference is a measure of excess adiposity in the central region of the body. Previous literature found out that Waist circumference is a better predictor of mortality than BMI (STAIANO et al., 2012). The waist circumference is incorporated into our analysis through the *WC over*, being

outcome is Hypertension, based on the systolic and diastolic blood pressure[10].

The results for PSF registration Regression are presented in Table 9. For adults, being registered on PSF is not associated to a better or worse health status measured by self-perceived health, obesity and hypertension.

Table 10 – General Health & Measured indicators [PSF frequency of visits Regression]

	Self-perceived health		Anthropometric measurements		Hypertension
	Good health	Good oral health	BMI over	WC over	High blood pressure
	(1)	(2)	(3)	(4)	(5)
PSF_frequency_1	-0.0074*	-0.0024	-0.0052	0.0145***	-0.0109
	(0.0036)	(0.0061)	(0.0109)	(0.0049)	(0.0128)
PSF_frequency_2	-0.0066	0.0072	-0.0004	-0.0028	-0.0035
	(0.0053)	(0.0048)	(0.0168)	(0.0109)	(0.0121)
PSF_frequency_3	-0.0013	-0.0046	-0.0212*	0.0007	-0.0077
	(0.0058)	(0.0046)	(0.0114)	(0.0114)	(0.0146)
PSF_frequency_4	0.0046	-0.0025	-0.0138	0.0018	-0.0095
	(0.0080)	(0.0064)	(0.0148)	(0.0102)	(0.0176)
PSF_frequency_5	0.0016	-0.0004	0.0037	-0.0015	0.0011
	(0.0049)	(0.0042)	(0.0056)	(0.0083)	(0.0063)
Constant	0.9635***	0.9662***	0.0992	-0.2757***	-0.0143
	(0.0349)	(0.0278)	(0.0703)	(0.0576)	(0.0642)
Individual controls	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	52052	52052	52052	52052	52052

(1) Dummy variable taking on the value of 1 if the reported health status was either *very good*, *good* or *fair health* in the date of the survey; 0 otherwise. (2) Dummy variable taking on the value of 1 if the reported Oral health status was either *very good*, *good* or *fair health* in the date of the survey; 0 otherwise. (3) Dummy variable taking on the value of 1 if the individual has Body Mass Index above or equal 25 kg/m^2; 0 otherwise. (4) Dummy variable taking on the value of 1 if the individual has critical waist circumference ($\geq$ 102 cm for men or $\geq$ 88 cm for women). (5) Dummy variable taking on the value of 1 if the individual has high systolic (130 and over) or diastolic (80 and over); 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for PSF frequency of visits Regression are presented in Table 10. The estimated effects of an increase in PSF visits are weak and mostly non-significant. A

equal to 1 if $\geq$ 102 cm for men or $\geq$ 88 cm for women, 0 otherwise. These thresholds were derived in the research of Lean, Han e Morrison (1995); men and women who exceed these respective thresholds are considered at risk for cardiometabolic diseases (WANG et al., 2005).

[10] A high systolic (130 and over) or diastolic (80 and over) is defined to be high blood pressure (WILLIAMS et al., 2018). Hypertension directly affects the risk of adverse cardiovascular events (FLINT et al., 2019), which justifies its adoption as an health outcome variable.

negative effect of 2.12 pp was found for being overweight, but this effect is restricted to frequency 3 (households registered on PSF and receiving 2 to 4 visits). Also, a positive effect for having Critical Waist Circumference and a negative effect for having Good health were noticed, but these effects are restricted to frequency 1 (households registered on PSF but not receiving any PSF visit).

The results for Multivalued treatment effects estimations are presented in Figure 5. The estimated potential-outcome mean of having Good health or Good Oral health is 94%, among individuals not registered on PSF (frequency 0). A negative impact of 0.7 pp is found for having Good health at frequencies 1 e 2, but this effect disappears as the frequency of visits increases. A positive effect is estimated for having Good Oral health but it is restricted to frequency 2.

The estimated potential-outcome mean of being overweight is 54% and 38% of having Critical Waist Circumference, among individuals not registered on PSF (frequency 0). A negative impact of 3 pp for BMI *over* and a positive effect of 1.5 pp are found at frequencies 3 and 1, respectively.

The estimated potential-outcome mean of having hypertension is 27%, among individuals not registered on PSF (frequency 0). Our results say that PSF does not seem to significantly influence this measurement.

To conclude, there is little evidence supporting any effect of the program on health status in adults. Worse health indicators for the population initially attended by the PSF might explain part of the negative effect found here, however our results interestingly show that this perverse effect tends to disappear as the intensity of visits increases.

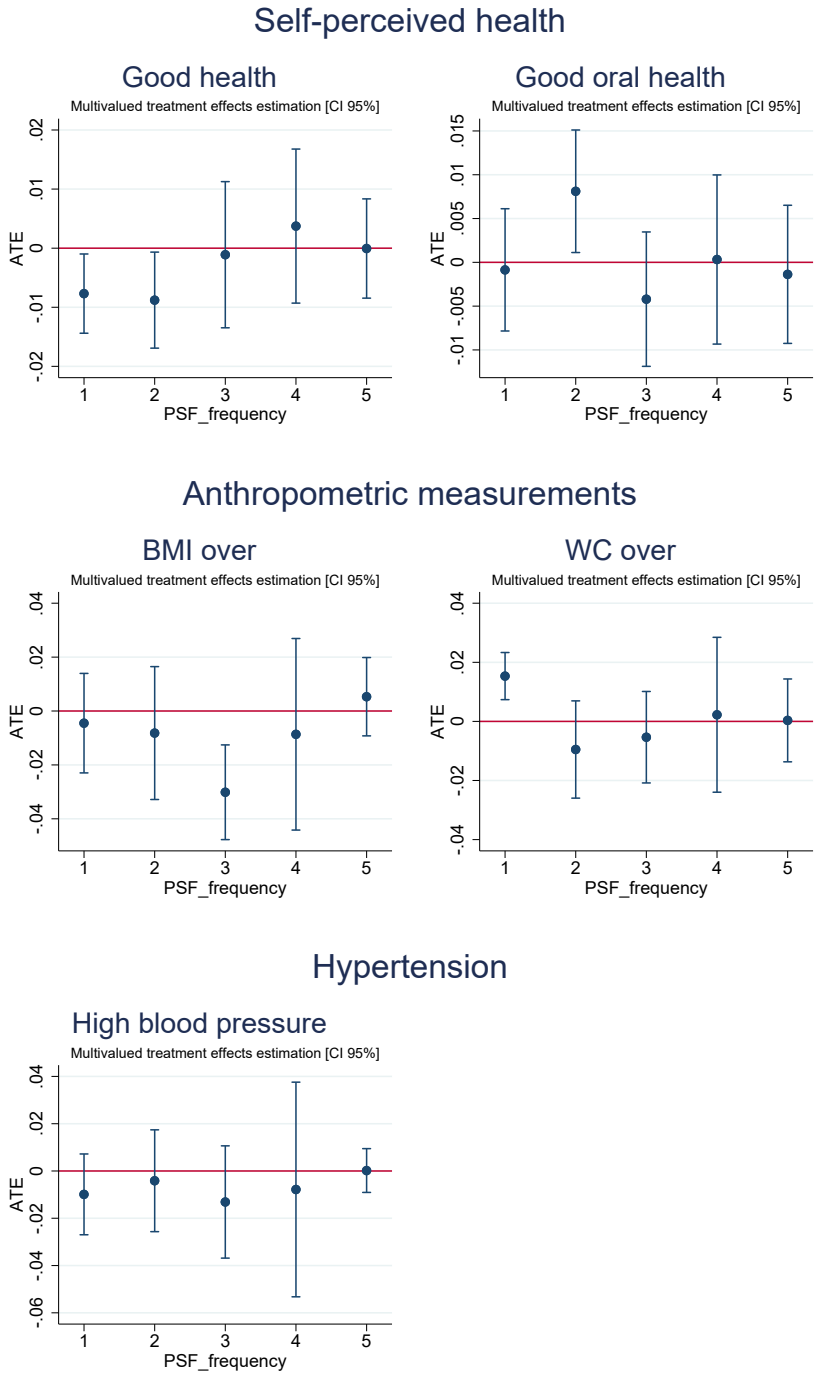


Figure 5 – The estimated potential-outcome mean of having Good health or Good Oral health is 94%, among individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of being overweight is 54% and 38% of having Critical Waist Circumference, among individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of having hypertension is 27%, among individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.3.2 Health reflected on usual activities

As we have done for children previously, there is information about recent health status of being unable to perform own activities due to recent illness or staying in bed due to recent illness two weeks previous to the survey for adults. The prevalence of such occurrence and also the total number of restricted days were investigated.

Table 11 – Health reflected on usual activities [PSF registration Regression]

	Unable to perform due to illness		Bed due to recent illness	
	Dummy	# of days	Dummy	# of days
	(1)	(2)	(3)	(4)
PSF_registration	0.0034	0.0493	0.0021	0.0028
	(0.0060)	(0.0447)	(0.0039)	(0.0325)
Constant	0.1185***	1.0101***	0.0409	0.3836
	(0.0329)	(0.3381)	(0.0259)	(0.3028)
Individual controls	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	52055	52055	52055	52055

Column 1 is a dummy variable equal to 1 if the individual had been unable to perform their usual activities due to illness in the two weeks previous to the survey; 0 otherwise. Column 2 is a variable counting the number of days the individual was unable to perform his/her own activities due to illness two weeks previous to the survey. Column 3 is a dummy variable taking on the value of 1 if the individual had been in bed due to illness in the two weeks previous to the survey; 0 otherwise. Column 4 is a variable counting the number of days the individual was in bed due to illness two weeks previous to the survey. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for PSF registration Regression are presented in Table 11. Being registered on PSF is not associated to be better/worse capable to perform usual activities or to stay in bed due to recent illness. Similar results are obtained when the intensity of visits is analysed (Table 12) – coefficients associated to all outcomes are non-significant regardless of the frequency of visits.

Figure 6 displays the results for Multivalued treatment effects estimations. The lack of significance is confirmed for all the coefficients and frequencies. For adults, PSF

does not seem to have an effect in improving health status through diminishing restricted activity days due to illness. Further research on the differences between the results found for adults and children is an important venue to be explored.

Table 12 – Health reflected on usual activities [PSF frequency of visits Regression]

	Unable to perform due to illness		Bed due to recent illness	
	Dummy	# of days	Dummy	# of days
	(1)	(2)	(3)	(4)
PSF_frequency_1	0.0038	0.0236	0.0036	-0.0081
	(0.0062)	(0.0593)	(0.0064)	(0.0355)
PSF_frequency_2	0.0016	-0.0032	-0.0026	0.0017
	(0.0087)	(0.0541)	(0.0039)	(0.0355)
PSF_frequency_3	0.0084	0.0635	0.0022	0.0038
	(0.0099)	(0.0824)	(0.0063)	(0.0585)
PSF_frequency_4	-0.0077	0.0009	-0.0018	-0.0287
	(0.0061)	(0.0561)	(0.0044)	(0.0384)
PSF_frequency_5	0.0051	0.0877	0.0039	0.0173
	(0.0089)	(0.0625)	(0.0050)	(0.0437)
Constant	0.1185***	1.0101***	0.0409	0.3836
	(0.0329)	(0.3381)	(0.0259)	(0.3028)
Individual controls	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
N	52055	52055	52055	52055

Column 1 is a dummy variable taking on the value of 1 if the individual had been unable to perform their usual activities due to illness in the two weeks previous to the survey; 0 otherwise. Column 2 is a variable counting the number of days the individual was unable to perform his/her own activities due to illness two weeks previous to the survey. Column 3 is a dummy variable taking on the value of 1 if the individual had been in bed due to illness in the two weeks previous to the survey; 0 otherwise. Column 4 is a variable counting the number of days the individual was in bed due to illness two weeks previous to the survey. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

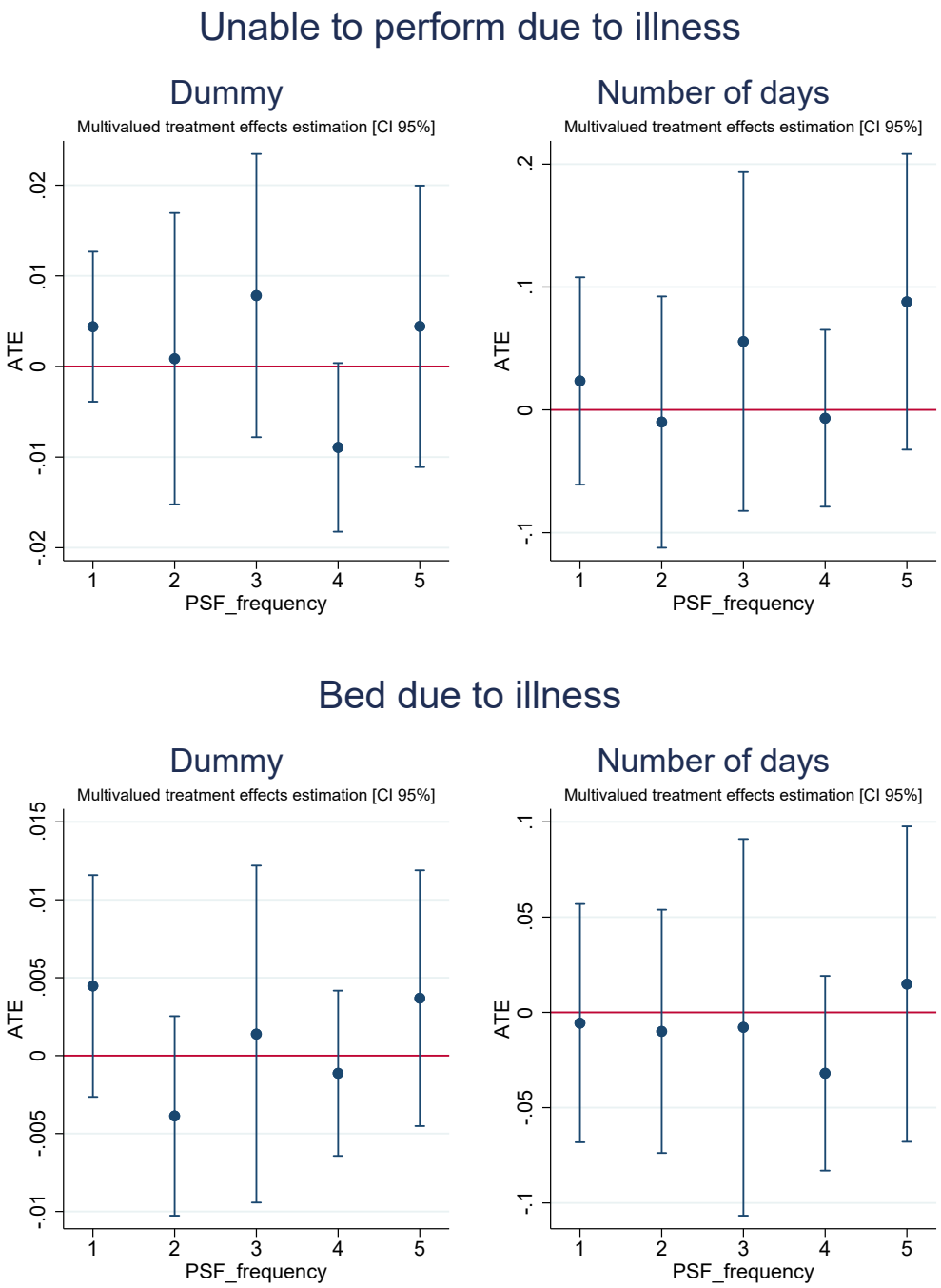


Figure 6 – The estimated potential-outcome mean of being unable to perform recently is 7.5% and 0.48 restricted days, among individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of staying in bed due to illness recently is 3% and 0.18 restricted days, among individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.3.3 Search for Health and Appointments

In this subsection, we investigate the health references of adults attended by the program. Our outcomes identify: (i) where do they often look for health care when sick or in need of care; (ii) where did they seek first medical attention the last time they consulted a doctor; (iii) where did they get the doctor appointment. As usual, we have particular interest on whether the answer is Family Health Team (FHT) in the household or in a Basic Health Unit (BHU).

Table 13 – Search for Health and Appointments [PSF registration Regression]

	Search for health care		Search for first Medical care		Getting appointment	
	FHT	BHU	FHT	BHU	FHT	BHU
	(1)	(2)	(3)	(4)	(5)	(6)
PSF_registration	0.0008**	0.1368***	0.0042	0.0960***	0.0175***	-0.0017
	(0.0003)	(0.0128)	(0.0025)	(0.0227)	(0.0036)	(0.0029)
Constant	0.0007	0.4345***	0.0309	0.1666*	-0.0191	-0.0014
	(0.0016)	(0.0777)	(0.0260)	(0.0884)	(0.0152)	(0.0166)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
N	39337	39337	38961	38961	36362	36362

(1) & (2) are a set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where do the individual often look for health care when sick or in need of care. (3) & (4) are a set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did they seek first medical attention the last time the individual consulted a doctor. (5) & (6) are a set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did the individual get the doctor appointment. Robust standard errors are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for PSF registration Regression are presented in Table 13. Being registered on PSF is positively associated to look for health care in BHU (an estimated effect of 13.68 pp), but hardly in FHT (0.08 pp). The registration on the program is also associated to an increase of 9.60 pp on the probability of seeking medical attention in BHU, and no significant effect noticed in FHT. Perhaps the most interesting result related to PSF is that being registered on the program is significantly associated to get a doctor appointment in FHT at home, an effect of 1.75 pp.

The estimates for PSF frequency of visits Regression are presented in Table 14. For Search for health care and Search for first Medical care in FHT, the coefficients associated to PSF are close to zero, with a small significant effect at frequency 5 only. Meanwhile, a crescent pattern is found for BHU as the frequency of visits increases. The estimated effect for BHU starts in 10.27 pp for frequency 1 and reaches 17.50 pp for frequency 5 in Search for health care. Moreover, receiving visits of the program is associated a higher chances of getting an appointment in FHT at home.

Table 14 – Search for Health and Appointments [PSF frequency of visits Regression]

	Search for health care		Search for first Medical care		Getting appointment	
	FHT	BHU	FHT	BHU	FHT	BHU
	(1)	(2)	(3)	(4)	(5)	(6)
PSF_frequency_1	0.0009	0.1027***	-0.0036	0.0729***	0.0057*	-0.0051
	(0.0007)	(0.0109)	(0.0045)	(0.0114)	(0.0030)	(0.0035)
PSF_frequency_2	0.0011	0.1102***	0.0041	0.0954***	0.0091*	-0.0039*
	(0.0009)	(0.0088)	(0.0042)	(0.0123)	(0.0046)	(0.0022)
PSF_frequency_3	0.0003	0.1181***	0.0004	0.0994***	0.0149***	-0.0014
	(0.0002)	(0.0230)	(0.0053)	(0.0318)	(0.0037)	(0.0045)
PSF_frequency_4	0.0000	0.1149***	0.0042	0.0800***	0.0083***	0.0039
	(0.0002)	(0.0238)	(0.0059)	(0.0288)	(0.0029)	(0.0048)
PSF_frequency_5	0.0011**	0.1750***	0.0100**	0.1120***	0.0304***	-0.0008
	(0.0004)	(0.0168)	(0.0043)	(0.0329)	(0.0070)	(0.0032)
Constant	0.0007	0.4360***	0.0306	0.1657*	-0.0190	-0.0018
	(0.0016)	(0.0767)	(0.0261)	(0.0880)	(0.0147)	(0.0167)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
N	39337	39337	38961	38961	36362	36362

(1) & (2) are a set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where do the individual often look for health care when sick or in need of care. (3) & (4) are a set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did they seek first medical attention the last time the individual consulted a doctor. (5) & (6) are a set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did the individual get the doctor appointment. Robust standard errors are in parentheses.

The results for Multivalued treatment effects estimations are presented in Figure 7. The estimated potential-outcome mean of looking for health care in BHU is 39%, among individuals not registered on PSF (frequency 0). As the frequency of visits increases, higher are the chances of looking for health care in BHU, which estimated effects varies from 10 pp to 17 pp. A similar pattern occurs to Search for first Medical care in BHU. The estimated potential-outcome mean of getting appointment in FHT is 0.4%, among

individuals not registered on PSF (frequency 0). PSF seems to increase the probability of getting appointment in FHT as the frequency of visits increases, and the estimated effect reaches 3 pp for frequency 5.

Overall, being registered on PSF or receiving program's visits is consistently associated to look for health care in BHU, and not in FHT. PSF seems to have an important role in facilitating medical appointments, which strengthens the bridge between primary care and public health.

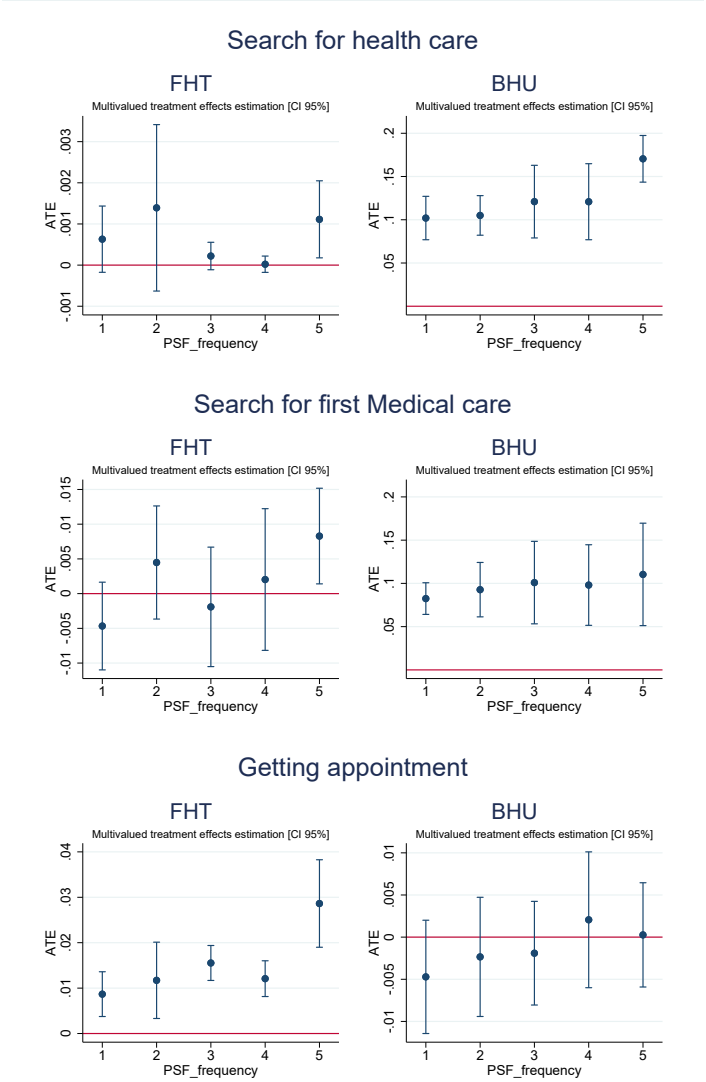


Figure 7 – The estimated potential-outcome mean of looking for health care in FHT is 0.01% and 39% in BHU, among individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of seeking first medical attention in FHT is 2% and 28% in BHU, among individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of getting appointment in FHT is 0.4% and 1.2% in BHU, among individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.3.4 Oral Health and Appointments

Oral Health Teams were incorporated in the *Programa Saúde da Família* as part of the Family Health Teams by the Ministry of Health (Portaria n. 1444 of December 2000) (SAÚDE, 2000) to expand access to oral health care[11]. These teams are in charge to broaden access to the activities related to oral health, preventing and mapping oral diseases through household visits at the community level (PUCCA et al., 2009).

Ministry of Health (Portaria n. 673 of 2003) started to fund oral health activities of PSF in a relative amount of one Oral Health Team for each Family Health Team (SAÚDE, 2003). Since its promulgation, each Oral Health Team has been ideally covering an average of 3,450 individuals.

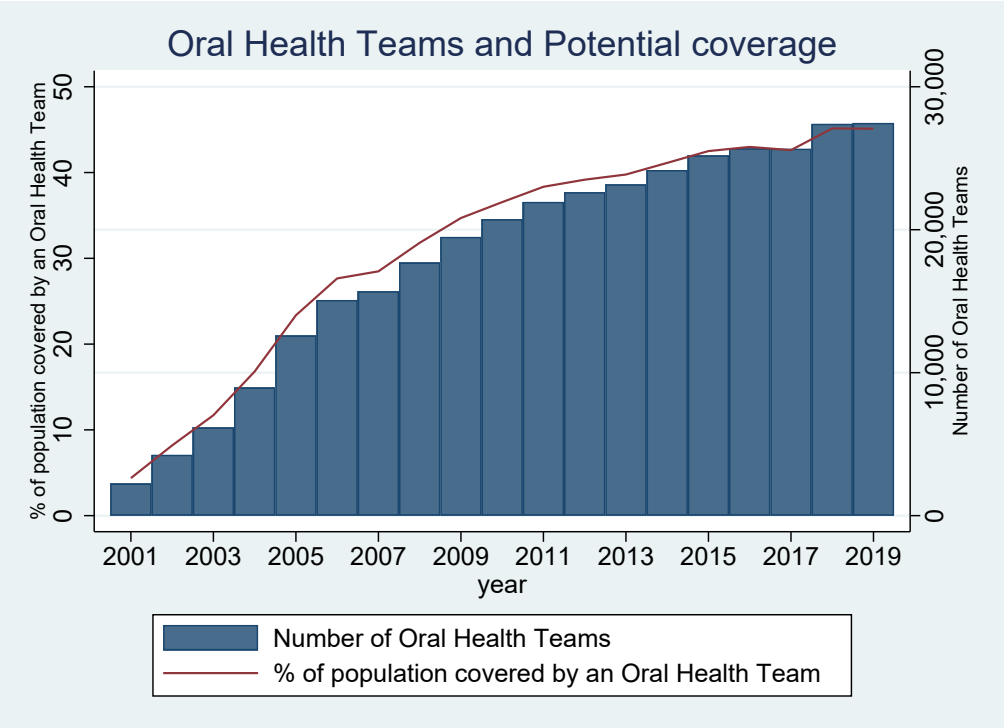


Figure 8

Figure 8 displays the evolution of Oral Health Teams and its potential coverage over time. In 19 years, an increase of 1122% is verified on the total of teams. Also, the proportion of population covered by an Oral Health Team starts at 4.38%, and increases 42.85 pp from 2001 to 2019.

[11] Specific guidelines were later announced by the Ministry of Health (Portaria n. 267 of March 2001), elucidating two types of Oral Health Teams (OHT): OHT 1, consisting of a Dentist and a Dental Assistant; and OHT 2, consisting of a Dentist, a Dental Assistant and a Dental Hygiene Technician (SAÚDE, 2001a).

The inclusion of oral health professionals in the program, as well as the significant increase in their teams justify the investigation of outcomes related to oral health. Two key variables were investigated for our individuals: (i) whether the last dental appointment was done in BHU and (ii) how did they get the dental appointment (via FHT or BHU).

Table 15 – Oral Health and Appointments [PSF registration Regression]

		Getting dental appointment	
	Dental appointment in BHU	FHT	BHU
	(1)	(2)	(3)
PSF_registration	0.0829***	0.0099***	0.0007
	(0.0090)	(0.0026)	(0.0020)
Constant	0.5302***	0.0483	0.0116
	(0.0685)	(0.0313)	(0.0162)
Individual controls	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
N	22511	22511	22511

(1) dummy variable taking on the value of 1 if the individual answered that his/her last dental appointment was done in a BHU; 0 otherwise. (2) & (3) are a set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did the individual get the dental appointment. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15 shows the results for PSF registration Regression. Being registered on PSF is associated to an increase of 8.29 pp on the probability of doing dental appointment in BHU. However, when individuals are asked where did they get the dental appointment, only FHT has a significant effect. This point become clearer when we check the results for PSF frequency of visits Regression presented in Table 16. Ceteris paribus, receiving monthly PSF visits is associated to an increase of 2.49 pp on the probability of getting dental appointment in FHT.

Table 16 – Oral Health and Appointments [PSF frequency of visits Regression]

		Getting dental appointment	
	Dental appointment in BHU	FHT	BHU
	(1)	(2)	(3)
PSF_frequency_1	0.0336**	-0.0035	-0.0001
	(0.0148)	(0.0024)	(0.0009)
PSF_frequency_2	0.0853**	-0.0017	-0.0015
	(0.0336)	(0.0032)	(0.0029)
PSF_frequency_3	0.0811***	0.0027	-0.0021
	(0.0177)	(0.0045)	(0.0021)
PSF_frequency_4	0.0931***	0.0075	0.0000
	(0.0189)	(0.0049)	(0.0017)
PSF_frequency_5	0.1081***	0.0249***	0.0031
	(0.0115)	(0.0064)	(0.0037)
Constant	0.5234***	0.0446	0.0111
	(0.0690)	(0.0305)	(0.0162)
Individual controls	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
N	22511	22511	22511

(1) dummy variable taking on the value of 1 if the individual answered that his/her last dental appointment was done in a BHU; 0 otherwise. (2) & (3) are a set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did the individual get the dental appointment. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The Multivalued treatment effects estimations in Figure 6 sums up these findings: as the frequency of visits increases, higher are the chances of having dental consultation in BHU (estimated effects varies from 4 pp to 10 pp) and getting dental appointment in FHT (significant effects ranges from 0.7 pp to 2 pp). This result reinforces the evidence that the PSF helps to establish a connection between households and the health services offered by health units.

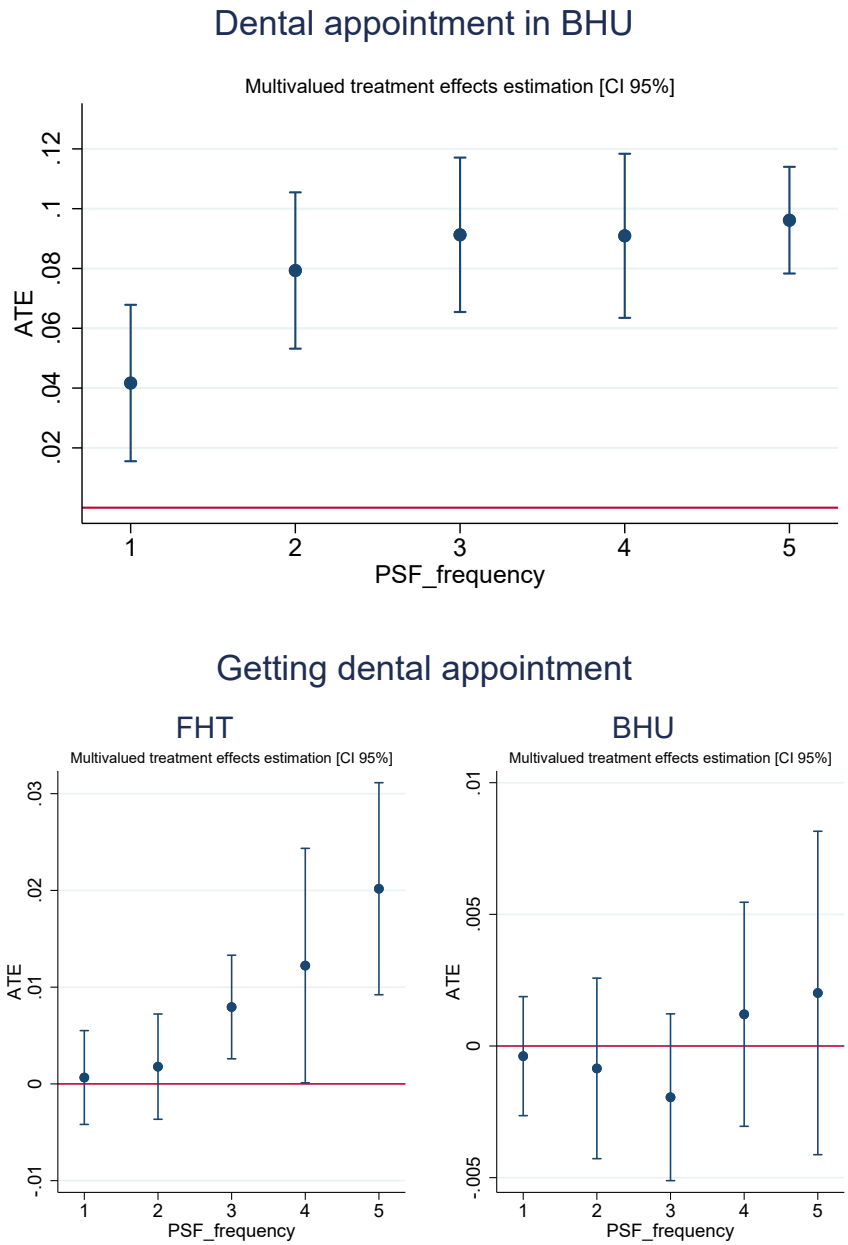


Figure 9 – The estimated potential-outcome mean of doing dental appointment in BHU is 15% for individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of getting dental appointment in FHT or in BHU is 0.4% for individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.4 Estimations for Women

In order to evaluate how the program affects Women's health, we retrieved information on preventive exams, contraception and family planning.

3.4.4.1 Preventive exams

Routine preventive health examinations are a major part of women's health, since specific tests can offer evidence for medical issues, assess risk for future medical problems and provide insight into habits that should be changed.

Programa Saúde da Família plays a role here not only by encouraging a healthy lifestyle, but by asking whether the women are up-to-date with regular checkups and by referring them to a BHU or another health facility capable of performing such examinations. Our outcomes related to preventive exams identify whether the woman had a (i) cervical exam or a (ii) mammography at least two years prior to the survey.

Table 17 – Preventive exams [PSF registration Regression]

	Cervical exam (1)	Mammography (2)
PSF_registration	0.0376**	-0.0131
	(0.0179)	(0.0080)
Constant	0.3423**	-0.4575***
	(0.1477)	(0.1001)
Individual controls	Yes	Yes
Past long-standing illness controls	Yes	Yes
Household controls	Yes	Yes
N	29436	29436

(1) Dummy variable taking on the value of 1 if the woman had a cervical exam at least two years prior to the survey; 0 otherwise. (2) Dummy variable taking on the value of 1 if the woman had a mammography at least two years prior to the survey; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death worldwide, which accounts for more than 600,000 deaths every year (BRAY et al., 2018). Screening with mammography is a usual way of detecting a change in a breast tissue at an early stage (NHS, 2019). Even though mammography does not necessarily mitigate breast cancer mortality (GØTZSCHE; JØRGENSEN, 2013), screening results

in some women getting a cancer diagnosis early, reducing morbidity of treatment and increasing the likelihood of survival (WHO, 2020).

Cervical cancer can be highly treatable, particularly if detected in its early stages. Individuals with stage I at diagnosis have around 90% 5-year survival rate, but the survival rates decrease to 50% and 10% for stages II and III, respectively (GARNER, 2003). Nevertheless, cervical cancer still represents 18.2% of all female malignancies in developing countries, which is substantially higher than the rate (10.4%) in developed countries (BRAY et al., 2018). Differences in screening policies and treatment of precancerous lesions might explain most of this verified disparity (SAFAEIAN; SOLOMON; CASTLE, 2007).

The results for PSF registration Regression are presented in Table 17. Being registered on PSF is positively associated to have a cervical exam recently, but not a mammography. Ceteris paribus, the registration on the program is associated to an increase of 3.76 pp on the probability of having a cervical exam.

Table 18 – Preventive exams [PSF frequency of visits Regression]

	Cervical exam (1)	Mammography (2)
PSF_frequency_1	0.0243	-0.0082
	(0.0208)	(0.0090)
PSF_frequency_2	0.0307	-0.0170
	(0.0212)	(0.0236)
PSF_frequency_3	0.0457**	-0.0164
	(0.0215)	(0.0106)
PSF_frequency_4	0.0430**	-0.0004
	(0.0191)	(0.0155)
PSF_frequency_5	0.0420*	-0.0166
	(0.0218)	(0.0134)
Constant	0.3397**	-0.4583***
	(0.1472)	(0.0992)
Individual controls	Yes	Yes
Past long-standing illness controls	Yes	Yes
Household controls	Yes	Yes
N	29436	29436

(1) Dummy variable taking on the value of 1 if the woman had a cervical exam at least two years prior to the survey; 0 otherwise. (2) Dummy variable taking on the value of 1 if the woman had a mammography at least two years prior to the survey; 0 otherwise. Robust standard errors are in parentheses.

The estimates for PSF frequency of visits Regression are presented in Table 18. The significant effect previously noticed for cervical exam, appears now for households receiving frequencies 3, 4 and 5, which estimated effects ranges from 4.20 pp to 4.57 pp. A very similar pattern is noticed for Multivalued treatment effects estimations presented in Figure 10.

In view of the effects estimated above, we can infer that the program is in some way encouraging women to have a cervical exam periodically. Yet, it remains to be understood why a similar result for mammography is not obtained, a future investigation of other exams may also shed light in what can be better highlighted in home visits to improve adherence to the preventive examinations.

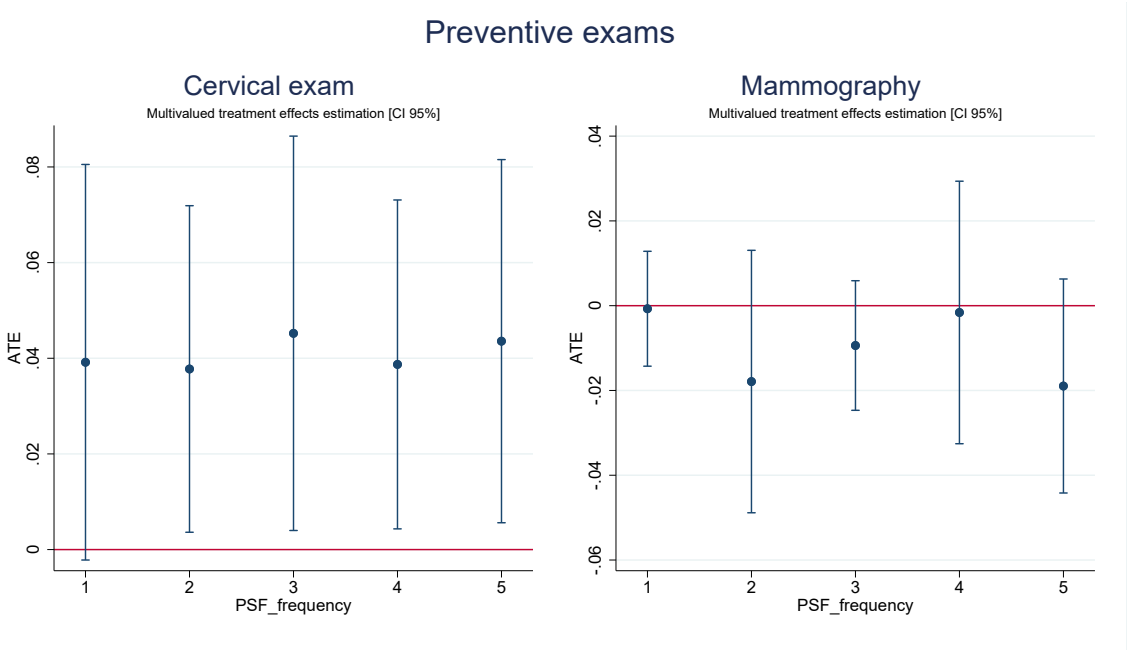


Figure 10 – The estimated potential-outcome mean of having a cervical exam recently is 60% and 32% for mammography, for individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.4.2 Contraception and Family planning

"Family planning enables people to make informed choices about their sexual and reproductive health", says the WHO (2014b). Indeed, the development of family planning activities and the provision of contraceptive information are crucial to ensure the autonomy and well-being of women, while promoting their health. Adequate information regarding contraception and productive health can prevent unintended pregnancies and this results in prevention of maternal morbidity and mortality (BHARGAVA, 2003; GANATRA; FAUNDES, 2016), and a reduction on the incidence of unsafe abortion (KHATRI; POUDEL; GHIMIRE, 2019). By doing well-informed decisions that affect other fields of life, family planning also play a role on gender equality (CATES, 2010)[12] – enhancing women to acquire more education and to have more job opportunities (MILLER, 2010).

PSF can help to fill this information gap by offering qualified assistance on family planning to households enrolled in the program. Moreover, one of the duties of a FHT is to encourage the participation of community group meetings, especially those related to diagnosis and disease prevention (SAÚDE, 1997).

Table 19 – Contraception and Family planning [PSF registration Regression]

	Contraception (1)	Family planning (2)
PSF_registration	0.0018	0.0197**
	(0.0184)	(0.0071)
Constant	1.1386***	0.0904
	(0.1374)	(0.0537)
Individual controls	Yes	Yes
Past long-standing illness controls	Yes	Yes
Household controls	Yes	Yes
N	16101	16101

(1) Dummy variable taking on the value of 1 if the woman or her partner uses contraceptive methods; 0 otherwise. (2) Dummy variable taking on the value of 1 if the woman participated in a family planning group recently; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[12] Cates (2010) argues that family planning might be decisive to achieving all eight Millennium Development Goals.

Our dependent variables are based on the following questions to the women of our sample: *(i) Do you or your partner use any contraceptive method to avoid pregnancy? (ii) Have you participated in a family planning group last year?* The results for PSF registration Regression are presented in Table 19. Being registered on PSF is positively associated to participate in a family planning group recently, but not to use a contraceptive method. Ceteris paribus, the registration on the program is associated to an increase of 1.97 pp on the probability of participation in family planning.

The estimates for PSF frequency of visits Regression are presented in Table 20. The significant effect previously noticed for family planning arises now for households receiving frequencies 2, 4 and 5, which estimated effects varies from 2.16 pp to 2.61 pp. These findings are corroborated by the Multivalued treatment effects estimations. Figure 8 depicts significant effects in family planning starting on frequency 2, meaning that the effect begins on households receiving at least one PSF visit.

Table 20 – Contraception and Family planning [PSF frequency of visits Regression]

	Contraception	Family planning
	(1)	(2)
PSF_frequency_1	0.0113	0.0055
	(0.0176)	(0.0053)
PSF_frequency_2	-0.0368	0.0219**
	(0.0321)	(0.0103)
PSF_frequency_3	0.0246	0.0183
	(0.0369)	(0.0110)
PSF_frequency_4	0.0021	0.0216**
	(0.0277)	(0.0095)
PSF_frequency_5	0.0018	0.0261*
	(0.0213)	(0.0132)
Constant	1.1422***	0.0867
	(0.1321)	(0.0532)
Individual controls	Yes	Yes
Past long-standing illness controls	Yes	Yes
Household controls	Yes	Yes
N	16101	16101

(1) Dummy variable taking on the value of 1 if the woman or her partner uses contraceptive methods; 0 otherwise. (2) Dummy variable taking on the value of 1 if the woman participated in a family planning group recently; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

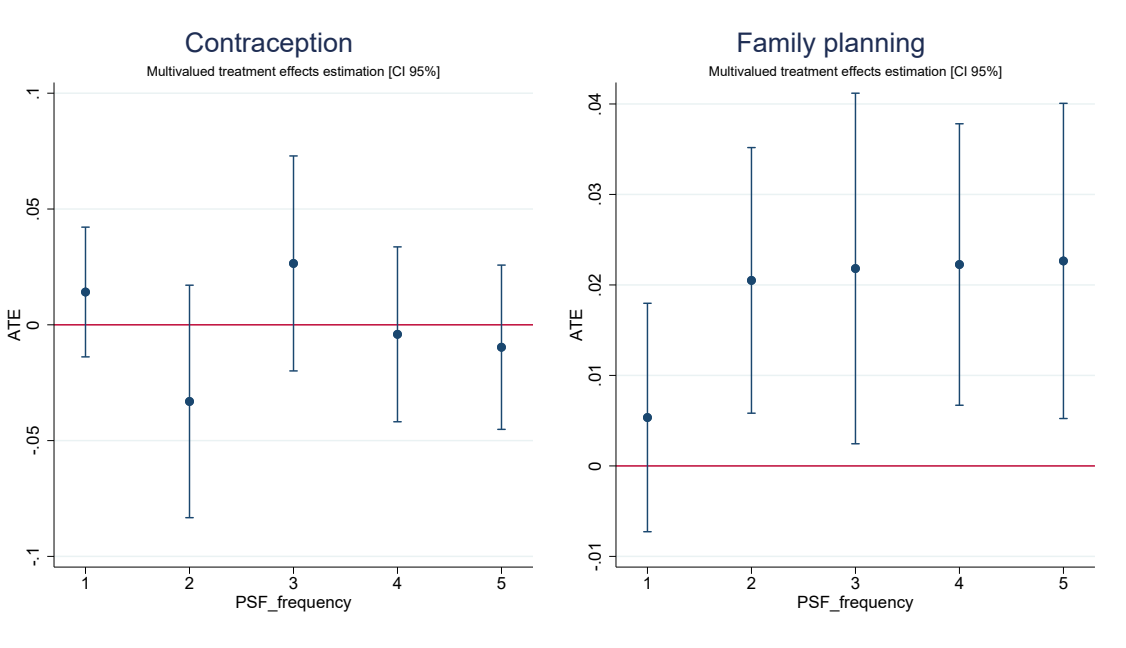


Figure 11 – The estimated potential-outcome mean of using a contraceptive method to avoid pregnancy is 60%, for individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of participating in a family planning group recently is 3%, for individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.5 Prenatal

Prenatal care, the health care women get while pregnant, influences maternal health, birth and long-term outcomes. Previous evidence have shown that access to timely and adequate prenatal care first affects maternal health, since it is associated with a higher likelihood of woman maintaining a healthy weight and avoiding her hospitalization after delivery (CONWAY; KUTINOVA, 2006). The following effects are that pregnancies with little or no prenatal care are at higher chance of suffering preterm delivery and infant low birth weight (KRUEGER; SCHOLL, 2000; HEAMAN et al., 2008; BEECKMAN et al., 2013). Low birth weight, in its turn, predicts subsequent health problems and long-term cognitive outcomes (VOSS et al., 2012).

Since one of the initiatives of *Programa Saúde da Família* is to watch carefully pregnant women and refer them to prenatal services, it is worthwhile to examine how successful the program has been in providing this guidance through prenatal care. The estimations for this subsection use a subsample of woman who recently had a child[13].

3.4.5.1 Prenatal testing

One of the primary aims of prenatal care is to offer regular check-ups in order to prevent and treat potential health problems throughout the course of the pregnancy. There are different prenatal tests, some examines women's health, and others gather information about the baby. Our outcomes of interest identify whether the woman (i) did a prenatal and (ii) have completed the examinations related to prenatal testing: ultrasound, blood test, urinalysis and syphilis test.

Obstetric ultrasounds are prescribed for pregnant women to assess gestational age, identify multiple pregnancies and detect fetal anomalies. WHO endorses one ultrasound scan earlier than 24 weeks of gestation (WHO, 2016). Blood tests during pregnancy investigate woman's blood type, Rh factor, anemia and infections such as toxoplasmosis and sexually transmitted infections (OWH, 2019). An urine test can check for urinary

[13] PNS 2013 has a specific module dedicated to Prenatal care. The questions in this module were answered by women who have given birth in the period from 07/28/2011 to 07/27/2013.

infection, diabetes and preeclampsia (PASTORE; SAVITZ; JR, 1999). A syphilis test is also recommended since untreated syphilis during pregnancy can cause stillbirth, neonatal death, bone deformities and neurological impairment (CALONGE et al., 2009).

Table 21 – Prenatal testing [PSF registration Regression]

		Prenatal Testing			
	Did prenatal (1)	Ultrasound (2)	Blood test (3)	Urinalysis (4)	Syphilis test (5)
PSF_registration	0.0084	-0.0049	-0.0085	-0.0194**	0.0647*
	(0.0079)	(0.0078)	(0.0232)	(0.0087)	(0.0325)
Constant	0.8668***	0.8618***	0.9679***	0.8721***	-0.0700
	(0.0971)	(0.0745)	(0.0520)	(0.0585)	(0.2413)
Individual controls	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	1689	1627	1627	1627	1583

(1) Dummy variable equal to 1 if the woman did prenatal; 0 otherwise. (2)-(5) Set of dummy variables that identifies if the woman have completed the examinations related to prenatal testing: ultrasound, blood test, urinalysis and syphilis test; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for PSF registration Regression are presented in Table 21. Being registered on PSF does not have a significant effect on doing prenatal. Being registered on PSF is also associated to an increase of 6.47pp to take a syphilis test, but a decrease of 1.94 pp to take an urine test.

The results for PSF frequency of visits Regression, presented in Table 22, shows that this decrease in the probability of urinalysis is verified for frequency 1 only – referring to households registered on PSF but receiving no visits. A positive effect of 2.96 pp was found for doing prenatal but this effect is restricted to frequency 4 (households registered on PSF and receiving bimonthly PSF visits).

Multivalued treatment effects estimations are presented in Figure 12. Again, except for Syphilis test, the effect seems to be local and valid for one of the frequencies only.

Of course, we cannot rule out that PSF does not have a role on promoting prenatal care; 97.5% women declared to have done a prenatal, 98.5% ultrasound, 97.2% Blood test, 98% Urinalysis – leaving little room for identifying PSF effects here.

Table 22 – Prenatal testing [PSF frequency of visits Regression]

		Prenatal Testing			
	Did prenatal	Ultrasound	Blood test	Urinalysis	Syphilis test
	(1)	(2)	(3)	(4)	(5)
PSF_frequency_1	0.0081	-0.0079	-0.0374	-0.0452***	0.0930*
	(0.0139)	(0.0080)	(0.0343)	(0.0143)	(0.0516)
PSF_frequency_2	-0.0049	-0.0176	-0.0324	-0.0462	0.1649***
	(0.0211)	(0.0183)	(0.0370)	(0.0334)	(0.0339)
PSF_frequency_3	0.0148	0.0041	0.0285	0.0072	0.0433
	(0.0092)	(0.0067)	(0.0200)	(0.0076)	(0.0664)
PSF_frequency_4	0.0296**	0.0071	-0.0109	-0.0375	0.0828
	(0.0111)	(0.0112)	(0.0380)	(0.0295)	(0.0702)
PSF_frequency_5	0.0055	-0.0055	-0.0015	-0.0046	0.0222
	(0.0097)	(0.0125)	(0.0223)	(0.0076)	(0.0385)
Constant	0.8615***	0.8619***	0.9732***	0.8774***	-0.0612
	(0.0942)	(0.0729)	(0.0512)	(0.0563)	(0.2430)
Individual controls	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	1689	1627	1627	1627	1583

(1) Dummy variable equal to 1 if the woman did prenatal; 0 otherwise. (2)-(5) Set of dummy variables that identifies if the woman have completed the examinations related to prenatal testing: ultrasound, blood test, urinalysis and syphilis test; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

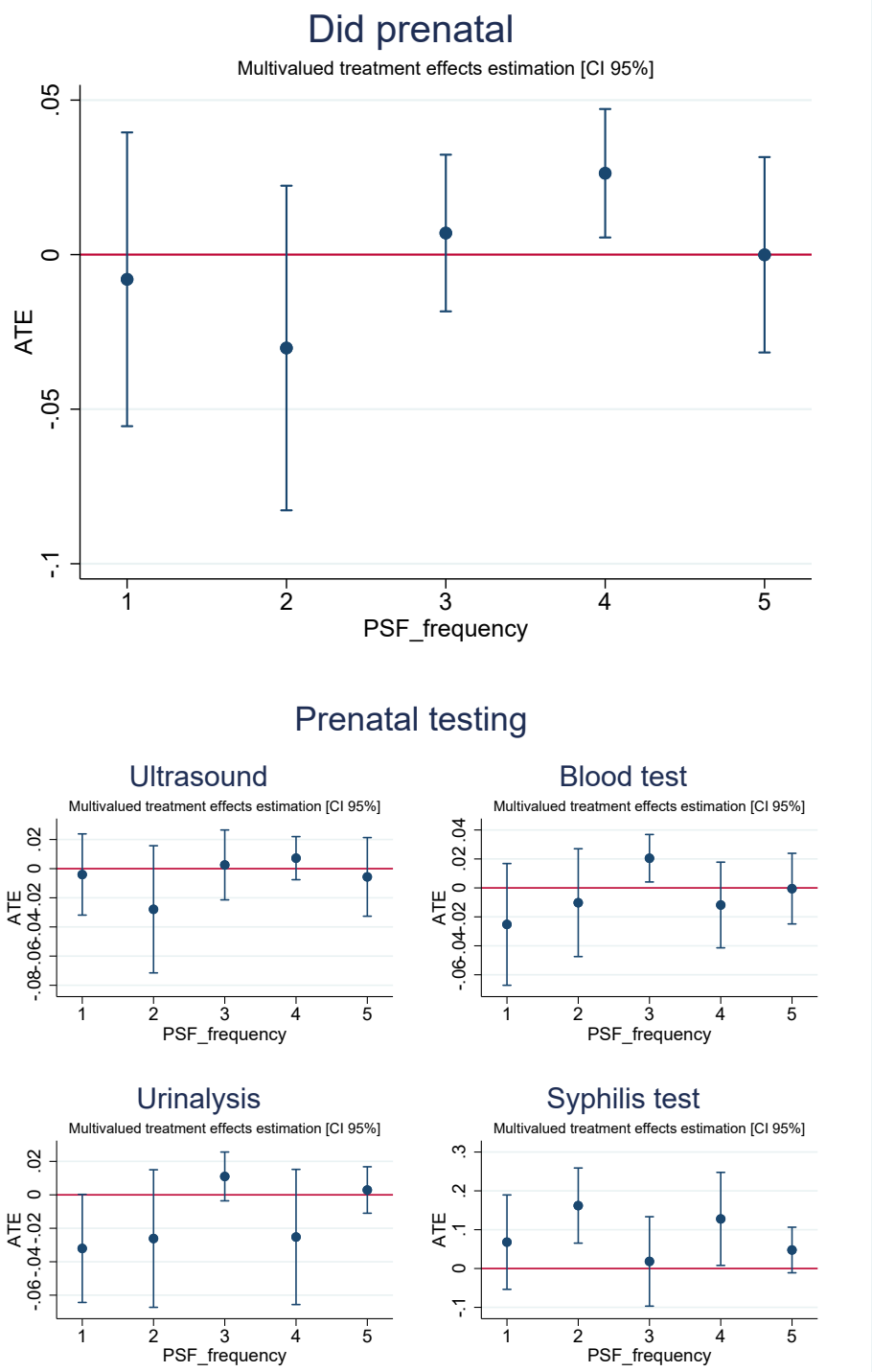


Figure 12 – The estimated potential-outcome mean of doing prenatal is 97%, for individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of doing ultrasound is 98%, 98% of doing blood test, 99% of doing Urinalysis and 62% – for individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.5.2 Maternal gestational weight gain

Previous work provided evidence that higher weight gains are linked to weight retention, both in the immediate postpartum phase and later in life (SIEGA-RIZ et al., 2009). Excess maternal gestational weight gain is also associated with large-for-gestational-age neonates, complications during labor and unsuccessful breastfeeding (VITERI et al., 2015). The consequences follow for the children, as excessive weight gains and a poor diet during pregnancy are associated with child obesity (HINKLE et al., 2012) and diabetes (DAMM, 2009), which contributes to an intergenerational cycle of metabolic risk.

Since prevention of excess gestational weight gain is one possible strategy to avoid maternal and child adverse effects in the short and long run, PSF has an important responsibility through helping monitor pregnant women and counseling them about the importance of adequate diet and lifestyle during pregnancy.

The new guidelines for gestational weight gain, produced by the Institute of Medicine (IOM), are formulated as a range for each category of pre-pregnancy BMI (IOM, 2010). The IOM recommendations are shown in Table 23.

Table 23 – IOM recommendations for total weight gain, by pre-pregnancy Body Mass Index

	Total weight gain	
	Range in kg	Range in lbs
Underweight ($< 18.5 kg/m^2$)	$12.5 - 18$	$28 - 40$
Normal weight ($18.5 - 24.9 kg/m^2$)	$11.5 - 16$	$25 - 35$
Overweight ($25 - 29.9 kg/m^2$)	$7 - 11.5$	$15 - 25$
Obese ($\geq 30.0 kg/m^2$)	$5 - 9$	$11 - 20$

For twin gestation, the committee provides the following guidelines: normal weight women should gain $17-25$ kg ($37-54$ pounds), overweight women, $14-23$ kg ($31-50$ pounds) and obese women, $11-19$ kg ($25-42$ pounds).

Using the subsample of women recently pregnant of our database, we gathered information of women's weight pre- and after-pregnancy, weight gain during pregnancy

and women's height to compose the BMI before and after pregnancy. This was done to check whether the gestational weight gain (also considering twin gestation) corresponds to the IOM recommended guidelines[14].

The results for PSF registration Regression are presented in Table 24. Interestingly, being registered on PSF is associated to a reduction of 8.97 pp on the probability of having maternal gestational weight gain above recommended.

Table 24 – Maternal gestational weight gain [PSF registration Regression]

	Below recommended	Within recommended	Above recommended
	(1)	(2)	(3)
PSF_registration	0.0134	0.0700	-0.0897**
	(0.0597)	(0.0514)	(0.0340)
Constant	0.4594	-0.1669	-0.0441
	(0.2948)	(0.1311)	(0.1814)
Individual controls	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
N	1455	1455	1455

Our dependent variables identify if the maternal gestational weight gain corresponds to the IOM recommended guidelines; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for PSF frequency of visits Regression, presented in Table 25, shows that this decrease in the probability of gaining too much weight during pregnancy is verified for frequency 3, 4 and 5 – corresponding to households registered on PSF and receiving more than one visit –, for which estimated effects varies from 10.16 pp to 14.81 pp.

A similar pattern is noticed for the Multivalued treatment effects estimations presented in Figure 13. To conclude, PSF seems to have an important effect on how much weight the women gain, presumably by providing information on the relevance of having a

[14] Our sample consists of 32 twins and 3 triplets. Triplets were not considered in this analysis since there are no formal guidelines regarding how much weight women should gain into a triple gestation.

healthy lifestyle during pregnancy.

Table 25 – Maternal gestational weight gain according to IOM guidelines [PSF frequency of visits Regression]

	Below recommended	Within recommended	Above recommended
	(1)	(2)	(3)
PSF_frequency_1	-0.0379	0.0962	-0.0549
	(0.0892)	(0.0788)	(0.0817)
PSF_frequency_2	-0.0049	0.0191	-0.0416
	(0.0595)	(0.0615)	(0.0561)
PSF_frequency_3	0.0153	0.0720	-0.1086*
	(0.1022)	(0.0709)	(0.0578)
PSF_frequency_4	-0.0202	0.1105	-0.1481***
	(0.0726)	(0.0894)	(0.0487)
PSF_frequency_5	0.0504	0.0673	-0.1016**
	(0.0561)	(0.0543)	(0.0382)
Constant	0.5247*	-0.2041	-0.0600
	(0.3073)	(0.1221)	(0.1705)
Individual controls	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
N	1455	1455	1455

Our dependent variables identify if the maternal gestational weight gain corresponds to the IOM recommended guidelines; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

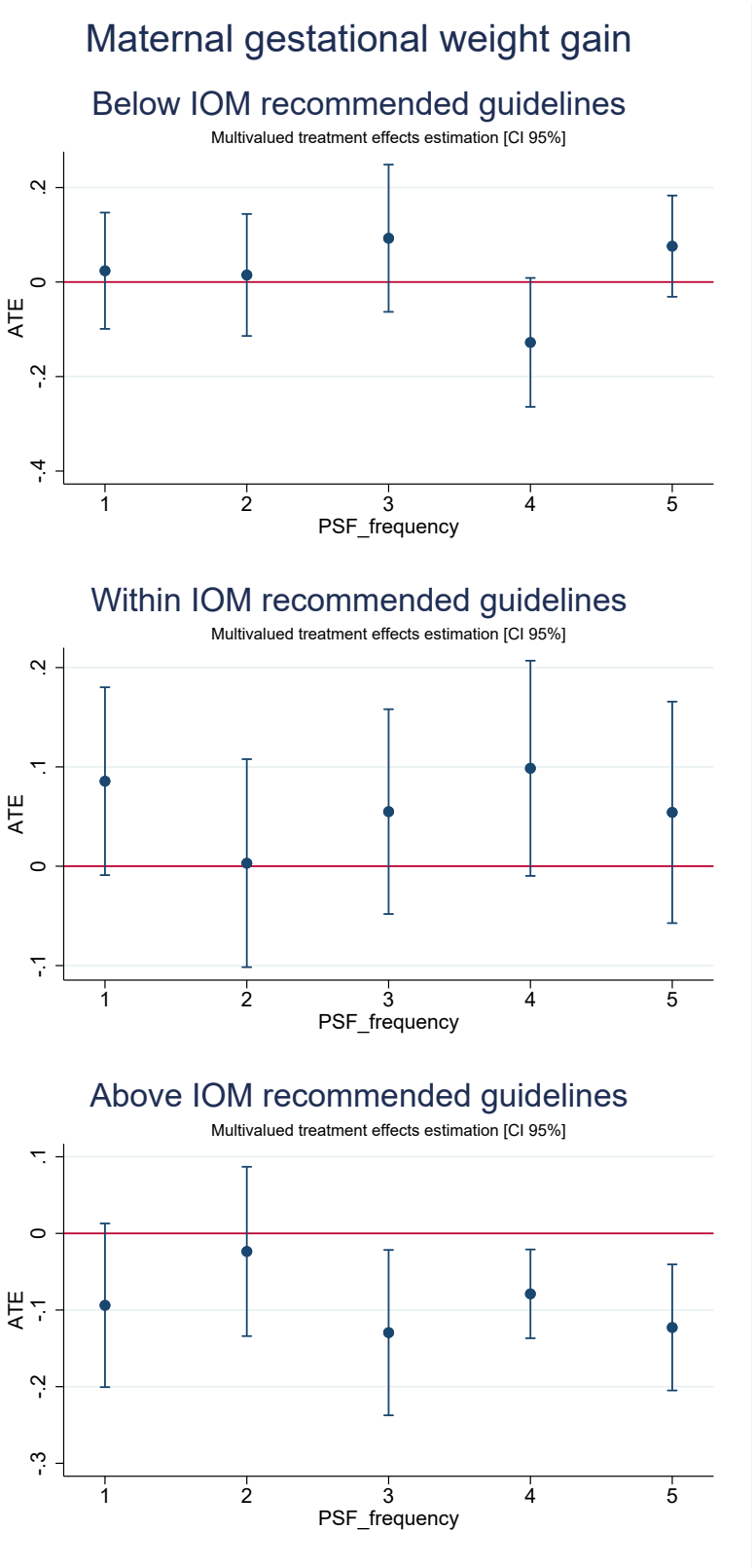


Figure 13 – The estimated potential-outcome mean of gaining weight below IOM guidelines is 34.9%, 19.5% within and 34.1% above recommended guidelines, for individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.5.3 Prenatal care

In this subsection, we examine prenatal care in order to understand where a woman, who recently had a child, have sought for health services during their pregnancy. As usual, we have particular interest on whether the individual goes to a Basic Health Unit or the health services were provided by another public health facility. Our first outcome identifies whether the prenatal care was in a BHU; the second oucome checks whether the ultrasound was in a public health center that belongs to the Brazilian National Health System (SUS) and the last outcome identifies whether the woman have given birth in a public health center that belongs to the SUS.

Table 26 – Prenatal care [PSF registration Regression]

	Did prenatal in BHU	Ultrasound in SUS	Birth in SUS
	(1)	(2)	(3)
PSF_registration	0.1125**	0.1011***	0.1348***
	(0.0407)	(0.0291)	(0.0449)
Constant	1.3013***	0.8013**	1.1184***
	(0.2275)	(0.3050)	(0.0974)
Individual controls	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
N	1627	1564	1635

(1) Dummy variable equal to 1 if the woman did the prenatal in a BHU; 0 otherwise. (2) Dummy variable equal to 1 if the woman have done ultrasound in a public health center from SUS; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results for PSF registration Regression are presented in Table 26. Our estimates reveal a significant effect of PSF for all three outcomes analysed. Ceteris paribus, being registered on PSF is associated to a probability 11.25 pp higher of doing prenatal care in a BHU and 10.11 pp higher of doing ultrasound in SUS. Similarly, being registered on PSF is associated to a probability 13.48 pp higher of giving birth in a public health center that belongs to the SUS.

This association is confirmed for the PSF frequency of visits Regression presented in Table 27. We have found that most of the PSF frequencies of visits pursue significant

and higher chances of doing prenatal care, ultrasound and giving birth in SUS.

Multivalued treatment effects estimations are presented in Figure 14. The estimated potential-outcome mean of doing prenatal care in a BHU is 53%, among children not registered on PSF (frequency 0). Being registered on PSF is associated to an additional likelihood of $8-15$ pp on doing prenatal in a BHU, depending on the frequency of PSF visit. For Ultrasound and Birth in SUS, the estimated effects ranges from $10-13$ pp and $8-19$ pp respectively.

Our estimates show that public health facilities are a reference for health care by woman during pregnancy. Not surprisingly, we have also found that this effect is strengthened for households registered on PSF.

Table 27 – Prenatal care [PSF frequency of visits Regression]

	Did prenatal in BHU	Ultrasound in SUS	Birth in SUS
	(1)	(2)	(3)
PSF_frequency_1	0.1140*	0.0725*	0.2124**
	(0.0636)	(0.0382)	(0.0772)
PSF_frequency_2	0.0348	0.1212*	0.0877**
	(0.0586)	(0.0627)	(0.0419)
PSF_frequency_3	0.2074**	0.1071*	0.1583***
	(0.0960)	(0.0625)	(0.0412)
PSF_frequency_4	0.0603	0.0794	0.1730***
	(0.0741)	(0.0763)	(0.0605)
PSF_frequency_5	0.1180**	0.1088**	0.1025**
	(0.0540)	(0.0449)	(0.0479)
Constant	1.3427***	0.8041***	1.0168***
	(0.2084)	(0.2888)	(0.1076)
Individual controls	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
N	1627	1564	1635

(1) Dummy variable equal to 1 if the woman did the prenatal in a BHU; 0 otherwise. (2) Dummy variable equal to 1 if the woman have done ultrasound in a public health center from SUS; 0 otherwise. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

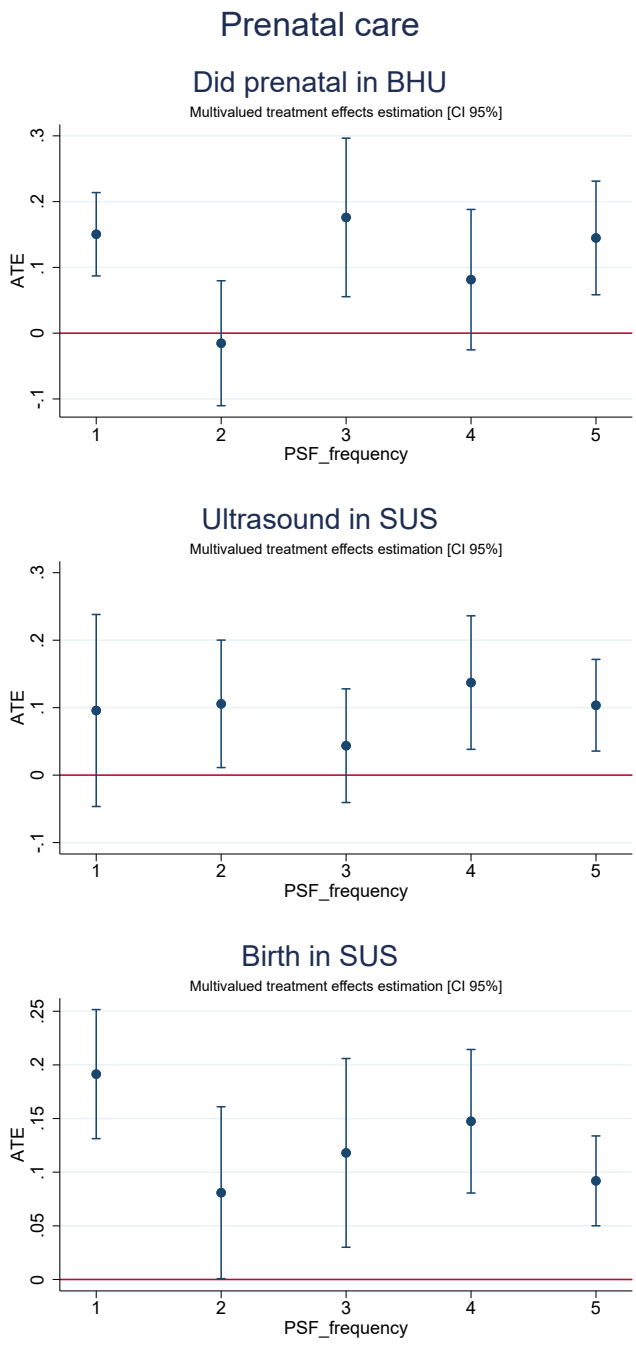


Figure 14 – The estimated potential-outcome mean of doing prenatal care in BHU is 53%, for individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of doing ultrasound in BHU is 48%, for individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of giving birth in SUS is 63%, for individuals not registered on PSF (frequency 0). ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.4.6 Estimations for Elderly

3.4.6.1 Flu vaccine

Seasonal influenza is a public health concern and its clinical complications are important causes of hospitalization and mortality, particularly in older adults. Paget et al. (2019) estimates a range of $294,000 - 518,000$ worldwide respiratory deaths are due to influenza every year (roughly 2% of all annual respiratory deaths), 67% of these were among elderly people. Vaccination is an effective way to prevent influenza and to decrease mortality, especially those in higher risk groups. While the scientific consensus on the benefits of flu vaccination is clear (OMEIRI et al., 2018), vaccine uptake is still low or not high enough in many communities.

In Brazil, SUS provides free-of-charge influenza vaccine to adults aged 60 years or more, and distributes it to each municipality, which delivers to its Basic Health Units. In our sample, our estimates show that prevalence of influenza vaccine uptake is 72.9% among elderly, close to the goal of 75% suggested by the World Health Organization (ASSEMBLY, 2003), but still lower than the target of 80% recommended by the Brazilian Minister of Health (BRASIL, 2007).

To identify reasons for noncompliance we should first address the concept of vaccine hesitancy, namely *"delay in acceptance or refusal of vaccines despite availability of vaccine services"* (WHO, 2015). False information about its efficacy, fear of side effects and fear of the spot are only a few reasons of a wide range factors explaining vaccine hesitancy. Dubé et al. (2016) translates it in 3 Cs:

> *"The three Cs model (confidence, complacency and convenience) outlines three key interrelated causes of vaccine hesitancy. Vaccine confidence is defined as trust in a) the effectiveness and safety of vaccines b) the system that delivers them, including the reliability and competence of the health services and health professionals and c) the motivations of the policymakers who decide which vaccines are needed when and where. Vaccine complacency exists where perceived risks of vaccine preventable diseases are low and vaccination is not*

deemed a necessary preventive action. Complacency about a vaccine or about vaccination in general is influenced by many factors including other life/health responsibilities that may be seen to be more important at that point in time. Vaccine convenience is measured by the extent to which physical availability, affordability and willingness to pay, geographical accessibility, ability to understand (language and health literacy) and appeal of immunization services affects uptake. The quality of the service (real and/or perceived) and the degree to which vaccination services are delivered at a time and place and in the cultural context that are convenient and comfortable also affects the decision to be vaccinated."

Given the complexity of the problem, *Programa Saúde da Família* has different possible lines of action in order to accomplish a higher influenza vaccination coverage. First, the program can fill the information gap on the vaccine's common benefits and doubts. Second, by referring families to a health facility, PSF clarifies them of the nearest location to get a flu vaccine. Third, by going to the households of the older people to effectively vaccinate them, the program helps to eliminate possible barriers to accessibility for people at higher risk.

Using the subsample of individuals aged 60 years or older[15], our outcomes identify: (1) whether the individual got the flu vaccine one year prior to the survey; if not, individual answers why[16]. (2) Lack of information: did not know was necessary to get the vaccine or did not know where to get one; (3) Fear: fear the spot or side effects; (4) Don't believe: has concerns about the vaccine's effectiveness; (5) Other reason.

The results for PSF registration Regression are presented in Table 28. Our estimates reveal a positive effect of PSF on seasonal flu vaccine uptake and initially no significant effects on the reasons for not getting the vaccine are obtained. Ceteris paribus, being

[15] PNS 2013 has a specific module (Module K) dedicated to risk factors of ill health among elderly people. The questions in this module were answered by individuals aged 60 years and older.

[16] Using another Brazilian data, recent evidence have pointed out common reasons why people skip vaccination: cultural beliefs regarding the lack of efficacy and potential side effects of the vaccine were two of the most cited reasons (SATO et al., 2020).

registered on PSF is associated to a probability 7.66 pp higher of getting a flu vaccine.

Table 28 – Flu vaccine [PSF registration Regression]

		What is your main reason for not getting a flu vaccine?			
	Flu vaccine	Lack of information	Fear	Don't believe	Other reason
	(1)	(2)	(3)	(4)	(5)
PSF_registration	0.0766***	0.0168	0.0075	0.0103	-0.0346
	(0.0098)	(0.0164)	(0.0333)	(0.0252)	(0.0327)
Constant	0.2625	0.2127**	-0.2571	-0.0378	1.0821***
	(0.1553)	(0.0965)	(0.2715)	(0.1290)	(0.2734)
Individual controls	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	9710	2557	2557	2557	2557

Our dependent variables identify the main reason for no getting a flu vaccine: (i) lack of information: did not know was necessary to get the vaccine or did not know where to get one; (ii) Fear: fear the spot or side effects; (iii) Don't believe: has concerns about the vaccine's effectiveness; (iv) Other reason. Answered by individuals aged 60 years and older. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for PSF frequency of visits Regression are presented in Table 29. The significant effect previously noticed for vaccine uptake arises now for all households receiving at least one yearly visit. Particularly, receiving monthly visits is associated to a probability 10.97 pp higher of getting the flu vaccine. A significant effect is also verified on the likelihood of answering Lack of information for households not receiving any PSF visit; mention should be made that this effect disappears as the frequency of visits increases.

The results for Multivalued treatment effects estimations are presented in Figure 17. The estimated potential-outcome mean of getting a flu vaccine is 68%, among individuals not registered on PSF (frequency 0). Receiving PSF visits is associated to an increase in this probability, which estimated ATEs vary from 8 pp to 10 pp. When we investigate what is the main reason for not getting a flu vaccine, less people tend to answer lack of information as the intensity of visits increases – which is an evidence that PSF helps to fulfill the information needs by providing vaccine supportive knowledge and addressing misinformation.

Table 29 – Flu vaccine [PSF frequency of visits Regression]

		What is your main reason for not getting a flu vaccine?			
	Flu vaccine	Lack of information	Fear	Don't believe	Other reason
	(1)	(2)	(3)	(4)	(5)
PSF_frequency_1	0.0229	0.0760***	-0.0357	0.0262	-0.0664
	(0.0238)	(0.0267)	(0.0463)	(0.0476)	(0.0771)
PSF_frequency_2	0.0655**	0.0522	0.0447	0.0135	-0.1104**
	(0.0297)	(0.0474)	(0.0493)	(0.0390)	(0.0458)
PSF_frequency_3	0.0861***	0.0122	-0.0148	0.0376	-0.0351
	(0.0310)	(0.0232)	(0.0481)	(0.0322)	(0.0469)
PSF_frequency_4	0.0696***	0.0077	0.0063	-0.0011	-0.0130
	(0.0192)	(0.0429)	(0.0857)	(0.0329)	(0.0787)
PSF_frequency_5	0.1097***	-0.0290	0.0329	-0.0084	0.0046
	(0.0140)	(0.0172)	(0.0404)	(0.0188)	(0.0332)
Constant	0.2854*	0.1868*	-0.2344	-0.0466	1.0942***
	(0.1618)	(0.1080)	(0.2818)	(0.1352)	(0.2860)
Individual controls	Yes	Yes	Yes	Yes	Yes
Past long-standing illness controls	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes
N	9710	2557	2557	2557	2557

Our dependent variables identify the main reason for no getting a flu vaccine: (i) lack of information: did not know was necessary to get the vaccine or did not know where to get one; (ii) Fear: fear the spot or side effects; (iii) Don't believe: has concerns about the vaccine's effectiveness; (iv) Other reason. Answered by individuals aged 60 years and older. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

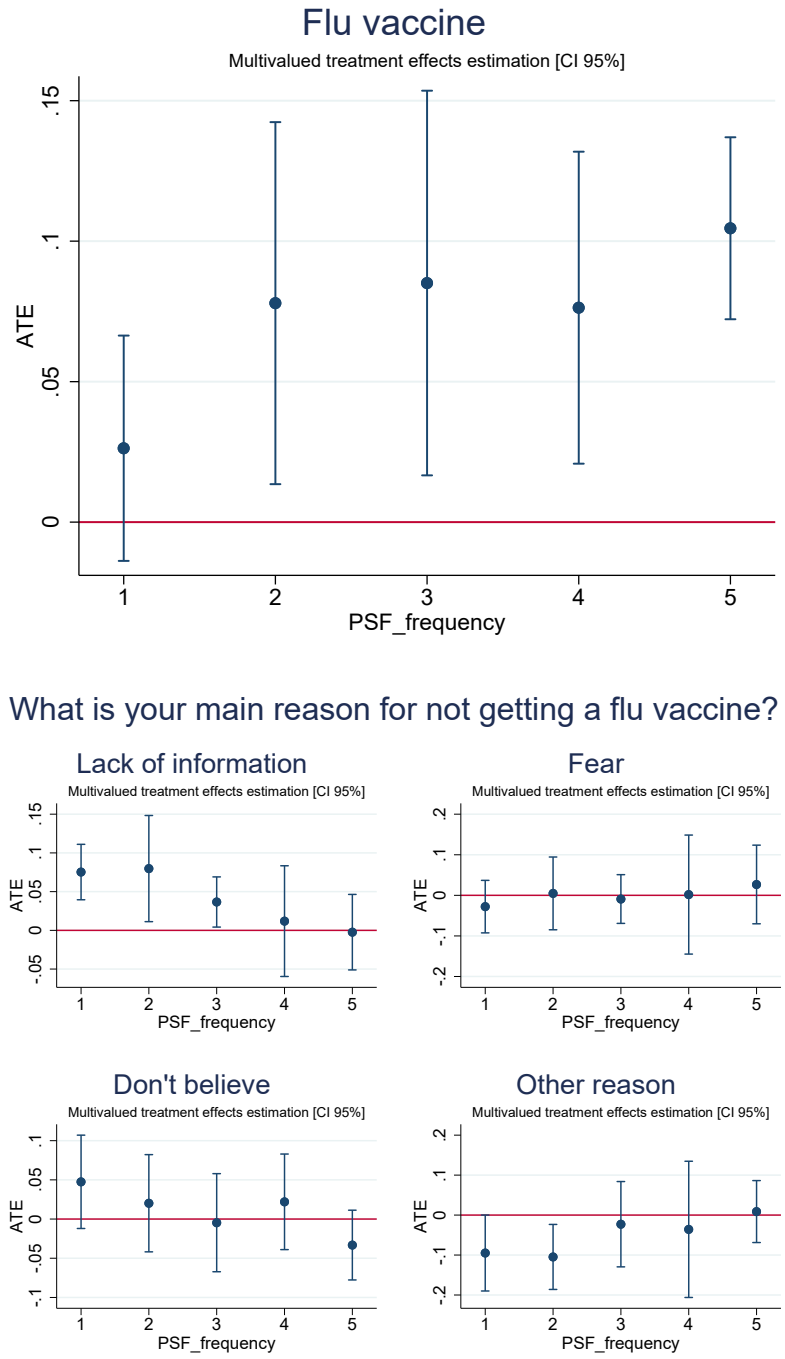


Figure 15 – The estimated potential-outcome mean of getting a flu vaccine is 68%, for individuals not registered on PSF (frequency 0). The estimated potential-outcome mean of answering Lack of information for frequency 0 is 5%, 34% of answering fear, 12% of answering Don't believe and 49% of answering other reason for individuals. ATE is the Average Treatment Effect for frequencies 1,2,3,4,5 relative to frequency 0.

3.5 Discussion

This study aims to insert in the literature that seeks to empirically evaluate the effects of the *Programa Saúde da Família* on individual outcomes. Using nationwide microdata, it was possible to access information on PSF registration as well as the frequency of a Family Health Team in each household. We adopted a Multivalued Treatment Effects approach as a way to accomplish the intensity of the program. For most of the variables assessed, being solely registered on PSF is not sufficient to experience better health outcomes – instead, the program starts to take action as the home visits increases. Our findings show that the active presence of the program fosters preventive health behavior improving vaccination and preventive exams adherence, and also intensifies search for public health care services, but does not have an overall effect on health indicators for adults.

PSF has an effect on several outcomes related to preventive behavior. A particular interesting result is found on vaccination adherence. Among children, the estimated effects on Tetravalente DTP-Hib are stronger as the frequency of PSF visits increases, and especially higher on the final doses of the vaccine that less children tended to adhere, in these cases PSF achieves an effect of 5 to 8 percentage points. Among elderly, individuals living in households with PSF visits has higher chances (8 to 10 pp) of having the flu vaccine up to date. Moreover, PSF seems to fulfill the role of informing about the importance of the vaccine: as the frequency of visits increases, less individuals tend to answer *Lack of information* as a reason for not getting the vaccine. In conclusion, PSF boosts preventive behavior, a result also noticed on preventive exams for women and Prenatal Testing for those recently pregnant.

The program effects on health outcomes vary across groups. Among pregnant women, the active presence of the program is associated to a lower probability (8 to 13 pp) of having maternal gestational weight gain above IOM recommended guidelines; and this is remarkably important since there is evidence that gaining too much weight during pregnancy is associated to bad outcomes in the short and long run. For youth, we also

found that PSF decreases the number of days individuals were unable to perform usual activities or stayed in bed due to recent illness – but this result is limited to households receiving frequency 3. For adults, PSF does not seem to be sufficient to statistically affect self-perceived health and measured indicators related to obesity and hypertension.

In several situations we find evidence that PSF is associated with more use of public health services. This result is noted in all groups analyzed, from children to adults. In children, PSF is associated with greater chances of having their first medical appointment after maternity at a BHU, as well as monitoring their growth at a BHU. For youth and adults, the more visits from the PSF you receive, the greater the likelihood of perceiving BHU as a health reference. The program also appears to play an important role in getting medical appointments, including oral health consultations, which strengthens the link between FHT visits and obtaining public health services. In pregnant women, the program is associated with greater chances of having prenatal exams at a BHU and giving birth in a public hospital.

It is worth emphasizing that our identification hypothesis regards on the fact that individuals and households do not self-select into the PSF – at the individual and household levels, PSF runs as a mandatory program. Indeed, we have found evidence that supports this assumption when individuals are asked (i) where they often look for health care when sick or in need of health care; (ii) where did they seek first medical attention the last time they consulted a doctor. In both cases, prevalence of people answering Family Health Team is very low, which supports our hypothesis that individuals don't go after FHT visits.

To our knowledge, this is the first study that investigates the consequences of the intensity of the PSF in a wide range of variables at the individual level. Our analysis is in line with the international literature that studies the effect of expanding primary care programs. As found in this study, previous work points out that people with access to primary care have higher immunization rates (TOWNSEND, 2019) and are more likely to be up to date on cancer screenings (STARFIELD; SHI; MACINKO, 2005). Another report reveals that the increase of just one primary care doctor per 10,000 population is

associated with a reduction of 14.4 deaths per 100,000 in the USA (SHI et al., 2005).

The main limitations of this study are due to the lack of detailed information about when the household was registered in the program and the history of visits throughout the individual's life. Unfortunately, our database does not identify the name or code of the municipality of residence, which does not allow combining with information from other sources at the municipal level. Mention may also be made of the absence of individual panel data, which would allow monitoring the effects of increasing program coverage at individual and household levels, isolating the fixed effects over time.

The intensity of the program plays a role in several health outcomes examined, especially those related to preventive behavior. From a public policy perspective, these results helps to shed more light on what is working well as primary health care initiative, and on which areas the program requires further development. Since PSF deepens search for public health care, further investigation should be conducted to understand the mechanism of this process. Taking into account that the PSF coverage has expanded rapidly and cuts in the budget of primary care are being considered very recently (RASELLA et al., 2019), the evaluation of the program's effects becomes even more urgent.

Table 30 – Variable definitions - **Health outcomes** (part 1)

Variable	Subsample	Definition
Vaccination Card	Children under 2 years old	Dummy variable equal to 1 if the child's family presented the vaccination card of the child; 0 otherwise.
Tetravalente DTP-Hib vaccine	Children under 2 years old	A set of dummy variables that identifies whether the child had taken each dose of Tetravalente DTP-Hib vaccine. This information was filled by consulting the vaccination card.
First Appointment after maternity	Children under 2 years old	Set of dummy variables that identifies whether the child had his/her first medical appointment by a Family Health Team (FHT) in the household or in a Basic Health Unit (BHU).
Tracking growth in BHU	Children under 2 years old	Dummy variable equal to 1 if the child tracks his/her growth and development in a BHU; 0 otherwise.
Unable to perform due to recent illness - Dummy	Youth and Adults	Dummy variable equal to 1 if the individual had been unable to perform their usual activities due to illness in the two weeks previous to the survey; 0 otherwise. Defined according to the individual response to the question "In the past two weeks, have you been unable to perform any of your usual activities (go to school, work, play etc.) due to health reasons?". This question is usually answered by the parents in the case of children.
Unable to perform due to recent illness - # of days	Youth and Adults	A variable counting the number of days the individual was unable to perform his/her own activities due to illness two weeks previous to the survey.
Bed due to recent illness - Dummy	Youth and Adults	Dummy variable equal to 1 if the individual had been in bed due to illness in the two weeks previous to the survey; 0 otherwise. Constructed based on the individual answers to the question "In the past two weeks, have you been in bed due to health reasons?". The question is usually answered by the parents in the case of children.
Bed due to recent illness - # of days	Youth and Adults	A variable counting the number of days the individual was in bed due to illness two weeks previous to the survey.
Good health	Adults	Dummy variable equal to 1 if the reported health status was either *very good*, *good* or *fair health* in the date of the survey; 0 otherwise. Constructed based on the individual answers to the question "How is your health in general: very good, good, fair, poor or very poor?".
Good oral health	Adults	Dummy variable equal to 1 if the reported Oral health status was either *very good*, *good* or *fair health* in the date of the survey; 0 otherwise. Constructed based on the individual answers to the question "How is your Oral health in general: very good, good, fair,poor or very poor?".

Table 31 – Variable definitions - **Health outcomes** (part 2)

Variable	Subsample	Definition
BMI over	Adults	Dummy variable equal to 1 if the individual has Body Mass Index above or equal 25 kg/m^2; 0 otherwise. Anthropometric measurements were effectively measured by the survey.
WC over	Adults	Dummy variable equal to 1 if the individual has critical waist circumference ($\geq$ 102 cm for men or $\geq$ 88 cm for women). Anthropometric measurements were effectively measured by the survey.
High Blood pressure	Adults	Dummy variable equal to 1 if the individual has high systolic (130 and over) or diastolic (80 and over); 0 otherwise.
Search for health care	Youth and Adults	Set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where do the individual often look for health care when sick or in need of care.
Search for first medical care	Adults	Set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did they seek first medical attention the last time the individual consulted a doctor.
Getting appointment	Adults	Set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did the individual get the doctor appointment.
Dental appointment in BHU	Adults	Dummy variable equal to 1 if the individual answered that his/her last dental appointment was done in a BHU; 0 otherwise.
Getting dental appointment	Adults	Set of dummy variables that identifies if the individual answered FHT or BHU to the question asking where did the individual get the dental appointment.
Cervical exam	Women	Dummy variable equal to 1 if the woman had a cervical exam at least two years prior to the survey; 0 otherwise.
Mammography	Women	Dummy variable equal to 1 if the woman had a mammography at least two years prior to the survey; 0 otherwise.

Table 32 – Variable definitions - **Health outcomes** (part 3)

Variable	Subsample	Definition
Contraception	Women	Dummy variable equal to 1 if the woman or her partner uses contraceptive methods; 0 otherwise. Constructed based on the woman's answers to the question: "Do you or your partner use any contraceptive method to avoid pregnancy?"
Family Planning	Women	Dummy variable equal to 1 if the woman participated in a family planning group recently; 0 otherwise. Constructed based on the woman's answers to the question: "Have you participated in a family planning group last year?"
Did prenatal	Prenatal	Dummy variable equal to 1 if the woman did prenatal; 0 otherwise. Answered by women who have given birth in the period from 07/28/2011 to 07/27/2013.
Prenatal Testing	Prenatal	Set of dummy variables that identifies if the woman have completed the examinations related to prenatal testing: ultrasound, blood test, urinalysis and syphilis test; 0 otherwise. Answered by women who have given birth in the period from 07/28/2011 to 07/27/2013.
Maternal gestational weight gain	Prenatal	Set of dummy variables that identifies if the maternal gestational weight gain corresponds to the IOM recommended guidelines; 0 otherwise. Answered by women who have given birth in the period from 07/28/2011 to 07/27/2013.
Did prenatal in BHU	Prenatal	Dummy variable equal to 1 if the woman did the prenatal in a BHU; 0 otherwise. Answered by women who have given birth in the period from 07/28/2011 to 07/27/2013.
Ultrasound in SUS	Prenatal	Dummy variable equal to 1 if the woman have done ultrasound in a public health center from SUS; 0 otherwise. Answered by women who have given birth in the period from 07/28/2011 to 07/27/2013.
Birth in SUS	Prenatal	Dummy variable equal to 1 if the woman have given birth in a public health center that belongs to the SUS; 0 otherwise. Answered by women who have given birth in the period from 07/28/2011 to 07/27/2013.
Flu vaccine	Elderly	Dummy variable equal to 1 if the individual got the flu vaccine one year prior to the survey; 0 otherwise. Answered by individuals aged 60 years and older.
Main reason for not getting a flu vaccine	Elderly	Set of dummy variables that identifies the main reason for no getting a flu vaccine: (i) lack of information: did not know was necessary to get the vaccine or did not know where to get one; (ii) Fear: fear the spot or side effects; (iii) Don't believe: has concerns about the vaccine's effectiveness; (iv) Other reason. Answered by individuals aged 60 years and older.

Table 33 – Variable definitions - **Controls** (part 1)

Variable	Subsample	Definition
Individual controls		
Female	All	Dummy variable equal to 1 if the individual is female; 0 otherwise.
Skin color	All	Set of dummy variables that identifies the individual's skin color: (i) Black, (ii) White or (iii) Other.
Health insurance	All	Dummy variable equal to 1 if the individual has a health insurance; 0 otherwise.
Education - head of the family	Children under 2 years old	Set of dummy variables that identifies the educational level of the head of the family: (i) Elementary school, (ii) High school or (iii) Higher school.
Education - Youth	Youth	Two dummy variables that identifies the educational level of the individual: (i) goes to school and (ii) can read and write.
Education - Adults	Adults	Set of dummies that identifies the educational level of the individual: (i) Elementary school, (ii) High school or (iii) Higher school.
Employed	Adults	Dummy variable equal to 1 if the individual is employed; 0 otherwise.
Age	All	Age in years. For children under 2 years old, age in months was considered.
Past long-standing illness controls		
Deficiency	All	Dummy variable equal to 1 if the individual has (i) intellectual, (ii) physical, (iii) hearing or (iv) visual disability; 0 otherwise.
Chronic past	Adults	Dummy variable equal to 1 if the individual has/had a chronic disease diagnosed at least fifteen years before the survey. Chronic diseases encompass (i) high blood pressure, (ii) diabetes, (iii) heart disease, (iv) cancer, (v) mental illness or (vi) any other chronic, physical, mental illness of long duration; 0 otherwise.

Note: The controls for Adults were also included for specific subsamples of Women, Prenatal and Elderly.

Table 34 – Variable definitions - **Controls** (part 2)

Variable	Subsample	Definition
Household controls		
Income quintile	All	Set of dummy variables that identifies if the individual lives in a household that belongs to the (i) bottom, (ii) second, (iii) third, (iv) fourth or (v) top quintile of the distribution of total household income per capita.
Urban	All	Dummy variable equal to 1 if the household is situated in a rural area; 0 otherwise.
Capital	All	Dummy variable equal to 1 if the household is situated in a capital city; 0 otherwise.
Piped water	All	Dummy variable equal to 1 if the individual lives in a house connected to piped water; 0 otherwise.
Sewage	All	Set of dummy variables that identifies if the individual lives in a household with either (i) proper sewage disposal, (ii) septic tank, (iii) rudimentary pit, (iv) ditch, (v) direct to river, lake or sea, (vi) another sewage destination or (vii) has no bathroom.
Water provision	All	Set of dummy variables that identifies if the individual lives in a household with either water provision via (i) general distribution network, (ii) well or spring water or (iii) other source of water.
Electricity provision	All	Dummy variable equal to 1 if the individual lives in a household connected to electricity; 0 otherwise.
TV	All	Dummy variable equal to 1 if the household has a television; 0 otherwise.
Cellular	All	Dummy variable equal to 1 if the household has a cellular phone; 0 otherwise.
Geographic region	All	Set of dummies that identifies the geographic region of the household: (i) North, (ii) Northeast, (iii) Southeast, (iv) South and (v) Midwest.
Number of residents	All	Number of residents in the individual's household.

Note: The controls for Adults were also included for specific subsamples of Women, Prenatal and Elderly.

.1 Appendix A - Variable Definitions

.1 Appendix B - Descriptive statistics

.1.1 Children under 2 years old

Table 35 – Vaccination

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Vaccination Card (%)	87.28	0.98	83.88	1.50	86.12	0.82
Tetravalente DTP-Hib vaccine						
1st Dose (%)	96.71	0.43	96.00	0.87	96.47	0.41
2nd Dose (%)	85.29	1.08	83.56	1.65	84.71	0.91
3rd Dose (%)	74.20	1.35	71.15	2.12	73.18	1.15
Reinforcing Dose (%)	29.82	1.49	24.52	1.98	28.06	1.20
Controls						
Female (%)	46.85	1.45	49.84	2.08	47.87	1.19
White (%)	44.78	1.45	53.42	2.07	47.72	1.20
Black (%)	6.01	0.73	7.02	1.08	6.36	0.60
Health insurance (%)	21.40	1.31	41.12	2.08	28.11	1.13
Education 1 - head of the family (%)	55.22	1.45	40.99	2.03	50.38	1.20
Education 2 - head of the family (%)	35.50	1.41	34.18	1.96	35.05	1.15
Education 3 - head of the family (%)	9.28	0.75	24.83	1.88	14.57	0.84
Defficiency (%)	0.58	0.17	0.41	0.15	0.52	0.12
Age in months	11.35	0.28	11.54	0.21	11.47	0.17
Income quintile 1 (%)	24.08	1.17	10.83	1.07	19.57	0.86
Income quintile 2 (%)	29.57	1.29	24.90	1.73	27.99	1.04
Income quintile 3 (%)	22.06	1.28	24.57	1.89	22.91	1.06
Income quintile 4 (%)	17.17	1.19	16.46	1.59	16.93	0.95
Income quintile 5 (%)	7.12	0.78	23.24	1.79	12.60	0.82
Urban (%)	79.65	1.07	90.60	0.95	83.38	0.79
Capital (%)	18.38	0.82	32.19	1.62	23.07	0.77
Piped water (%)	89.10	0.79	94.32	0.80	90.88	0.59
Water provision 1 (%)	78.83	1.08	86.26	1.16	81.36	0.82
Water provision 2 (%)	14.80	0.88	11.52	1.04	13.68	0.68
Sewage 1 (%)	45.06	1.48	64.35	1.89	51.62	1.19
Sewage 2 (%)	17.07	1.01	15.85	1.43	16.66	0.83
Sewage 3 (%)	27.53	1.24	13.57	1.23	22.78	0.93
Sewage 4 (%)	2.24	0.55	2.34	0.36	2.31	0.30
Sewage 5 (%)	2.03	0.34	1.23	0.43	1.76	0.27
Sewage 6 (%)	0.35	0.20	0.21	0.13	0.30	0.14
Sewage 7 (%)	5.60	0.60	2.54	0.48	4.56	0.43
North region (%)	10.43	0.62	10.97	0.81	10.61	0.49
Northeast region (%)	36.75	1.38	18.64	1.41	30.59	1.05
Southeast region (%)	31.11	1.53	46.92	2.13	36.49	1.26
South region (%)	14.26	0.99	14.00	1.47	14.17	0.82
Midwest region (%)	7.46	0.53	9.47	0.76	8.14	0.43
Electricity provision (%)	98.13	0.36	98.88	0.28	98.39	0.26
TV (%)	97.28	0.38	97.22	0.61	97.26	0.32
Cellular (%)	90.95	0.75	96.14	0.56	92.71	0.53
Number of residents	4.55	0.04	4.29	0.05	4.46	0.03
Weighted Share (%)	65.98		34.02		100	

Table 36 – Medical appointment after maternity & Tracking growth

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
First Appointment after maternity						
FHT (%)	1.32	0.28	0.05	0.03	0.88	0.19
BHU (%)	53.36	1.49	37.25	2.00	47.84	1.22
Tracking growth in BHU (%)	65.33	1.41	44.35	2.06	58.20	1.19
Controls						
Female (%)	46.85	1.45	49.84	2.08	47.87	1.19
White (%)	44.78	1.45	53.42	2.07	47.72	1.20
Black (%)	6.01	0.73	7.02	1.08	6.36	0.60
Health insurance (%)	21.40	1.31	41.12	2.08	28.11	1.13
Education 1 - head of the family (%)	55.22	1.45	40.99	2.03	50.38	1.20
Education 2 - head of the family (%)	35.50	1.41	34.18	1.96	35.05	1.15
Education 3 - head of the family (%)	9.28	0.75	24.83	1.88	14.57	0.84
Deficiency (%)	0.58	0.17	0.41	0.15	0.52	0.12
Age in months	11.35	0.28	11.54	0.21	11.47	0.17
Income quintile 1 (%)	24.08	1.17	10.83	1.07	19.57	0.86
Income quintile 2 (%)	29.57	1.29	24.90	1.73	27.99	1.04
Income quintile 3 (%)	22.06	1.28	24.57	1.89	22.91	1.06
Income quintile 4 (%)	17.17	1.19	16.46	1.59	16.93	0.95
Income quintile 5 (%)	7.12	0.78	23.24	1.79	12.60	0.82
Urban (%)	79.65	1.07	90.60	0.95	83.38	0.79
Capital (%)	18.38	0.82	32.19	1.62	23.07	0.77
Piped water (%)	89.10	0.79	94.32	0.80	90.88	0.59
Water provision 1 (%)	78.83	1.08	86.26	1.16	81.36	0.82
Water provision 2 (%)	14.80	0.88	11.52	1.04	13.68	0.68
Sewage 1 (%)	45.06	1.48	64.35	1.89	51.62	1.19
Sewage 2 (%)	17.07	1.01	15.85	1.43	16.66	0.83
Sewage 3 (%)	27.53	1.24	13.57	1.23	22.78	0.93
Sewage 4 (%)	2.24	0.55	2.34	0.36	2.31	0.30
Sewage 5 (%)	2.03	0.34	1.23	0.43	1.76	0.27
Sewage 6 (%)	0.35	0.20	0.21	0.13	0.30	0.14
Sewage 7 (%)	5.60	0.60	2.54	0.48	4.56	0.43
North region (%)	10.43	0.62	10.97	0.81	10.61	0.49
Northeast region (%)	36.75	1.38	18.64	1.41	30.59	1.05
Southeast region (%)	31.11	1.53	46.92	2.13	36.49	1.26
South region (%)	14.26	0.99	14.00	1.47	14.17	0.82
Midwest region (%)	7.46	0.53	9.47	0.76	8.14	0.43
Electricity provision (%)	98.13	0.36	98.88	0.28	98.39	0.26
TV (%)	97.28	0.38	97.22	0.61	97.26	0.32
Cellular (%)	90.95	0.75	96.14	0.56	92.71	0.53
Number of residents	4.55	0.04	4.29	0.05	4.46	0.03
Weighted Share (%)	65.98		34.02		100	

.1.2 Youth

Table 37 – Health reflected on usual activities

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Unable to perform due to illness						
Proportion (%)	5.04	0.22	4.39	0.29	4.83	0.18
# of days	0.188	0.011	0.196	0.019	0.191	0.010
Bed due to recent illness						
Proportion (%)	2.17	0.14	1.91	0.19	2.09	0.12
# of days	0.071	0.006	0.076	0.012	0.073	0.005
Controls						
Female (%)	49.60	0.52	48.17	0.73	49.13	0.42
White (%)	37.13	0.50	47.39	0.74	40.48	0.42
Black (%)	7.53	0.29	7.72	0.38	7.59	0.23
Health insurance (%)	15.89	0.39	32.94	0.71	21.46	0.36
Age	11.82	0.04	11.79	0.05	11.81	0.03
Education 1 - Youth (%)	7.94	0.27	6.46	0.36	7.45	0.21
Education 2 - Youth (%)	94.58	0.23	94.96	0.34	94.70	0.19
Deficiency (%)	1.83	0.14	1.81	0.22	1.82	0.12
Income quintile 1 (%)	26.24	0.43	14.63	0.47	22.44	0.33
Income quintile 2 (%)	28.44	0.46	22.92	0.60	26.64	0.37
Income quintile 3 (%)	21.97	0.44	22.28	0.63	22.07	0.36
Income quintile 4 (%)	16.29	0.40	19.91	0.60	17.47	0.33
Income quintile 5 (%)	7.05	0.27	20.27	0.62	11.37	0.28
Urban (%)	78.44	0.37	89.39	0.36	82.02	0.28
Capital (%)	15.61	0.25	31.66	0.57	20.85	0.25
Piped water (%)	88.62	0.29	94.45	0.27	90.52	0.22
Water provision 1 (%)	77.93	0.38	83.80	0.45	79.85	0.29
Water provision 2 (%)	16.31	0.33	13.98	0.41	15.55	0.26
Sewage 1 (%)	46.34	0.52	68.06	0.62	53.44	0.41
Sewage 2 (%)	17.50	0.34	13.70	0.43	16.26	0.27
Sewage 3 (%)	25.48	0.41	13.44	0.43	21.54	0.31
Sewage 4 (%)	2.22	0.13	1.13	0.12	1.86	0.09
Sewage 5 (%)	2.51	0.16	1.03	0.14	2.03	0.12
Sewage 6 (%)	0.31	0.06	0.36	0.07	0.33	0.04
Sewage 7 (%)	5.63	0.21	2.29	0.16	4.54	0.15
North region (%)	9.65	0.20	10.81	0.30	10.03	0.16
Northeast region (%)	36.68	0.48	18.33	0.48	30.68	0.37
Southeast region (%)	33.15	0.55	49.41	0.74	38.46	0.45
South region (%)	13.40	0.34	13.41	0.51	13.40	0.28
Midwest region (%)	7.12	0.18	8.04	0.25	7.42	0.14
Electricity provision (%)	98.51	0.10	99.02	0.12	98.68	0.08
TV (%)	97.59	0.15	98.10	0.18	97.76	0.12
Cellular (%)	92.68	0.24	95.74	0.24	93.68	0.18
Number of residents	4.72	0.02	4.43	0.02	4.63	0.01
Weighted Share (%)	67.32		32.68		100	

Table 38 – Search for health care

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Search for health care						
FHT (%)	0.016	0.009	0.006	0.002	0.013	0.006
BHU (%)	61.86	0.55	38.96	0.84	54.65	0.47
Controls						
Female (%)	49.60	0.52	48.17	0.73	49.13	0.42
White (%)	37.13	0.50	47.39	0.74	40.48	0.42
Black (%)	7.53	0.29	7.72	0.38	7.59	0.23
Health insurance (%)	15.89	0.39	32.94	0.71	21.46	0.36
Age	11.82	0.04	11.79	0.05	11.81	0.03
Education 1 - Youth (%)	7.94	0.27	6.46	0.36	7.45	0.21
Education 2 - Youth (%)	94.58	0.23	94.96	0.34	94.70	0.19
Deficiency (%)	1.83	0.14	1.81	0.22	1.82	0.12
Income quintile 1 (%)	26.24	0.43	14.63	0.47	22.44	0.33
Income quintile 2 (%)	28.44	0.46	22.92	0.60	26.64	0.37
Income quintile 3 (%)	21.97	0.44	22.28	0.63	22.07	0.36
Income quintile 4 (%)	16.29	0.40	19.91	0.60	17.47	0.33
Income quintile 5 (%)	7.05	0.27	20.27	0.62	11.37	0.28
Urban (%)	78.44	0.37	89.39	0.36	82.02	0.28
Capital (%)	15.61	0.25	31.66	0.57	20.85	0.25
Piped water (%)	88.62	0.29	94.45	0.27	90.52	0.22
Water provision 1 (%)	77.93	0.38	83.80	0.45	79.85	0.29
Water provision 2 (%)	16.31	0.33	13.98	0.41	15.55	0.26
Sewage 1 (%)	46.34	0.52	68.06	0.62	53.44	0.41
Sewage 2 (%)	17.50	0.34	13.70	0.43	16.26	0.27
Sewage 3 (%)	25.48	0.41	13.44	0.43	21.54	0.31
Sewage 4 (%)	2.22	0.13	1.13	0.12	1.86	0.09
Sewage 5 (%)	2.51	0.16	1.03	0.14	2.03	0.12
Sewage 6 (%)	0.31	0.06	0.36	0.07	0.33	0.04
Sewage 7 (%)	5.63	0.21	2.29	0.16	4.54	0.15
North region (%)	9.65	0.20	10.81	0.30	10.03	0.16
Northeast region (%)	36.68	0.48	18.33	0.48	30.68	0.37
Southeast region (%)	33.15	0.55	49.41	0.74	38.46	0.45
South region (%)	13.40	0.34	13.41	0.51	13.40	0.28
Midwest region (%)	7.12	0.18	8.04	0.25	7.42	0.14
Eletricity provision (%)	98.51	0.10	99.02	0.12	98.68	0.08
TV (%)	97.59	0.15	98.10	0.18	97.76	0.12
Cellular (%)	92.68	0.24	95.74	0.24	93.68	0.18
Number of residents	4.72	0.02	4.43	0.02	4.63	0.01
Weighted Share (%)	67.32		32.68		100	

.1.3 Adults

Table 39 – General Health & Measured indicators

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Self-perceived health						
Good health (%)	93.24	0.55	95.50	0.49	94.12	0.58
Good oral health (%)	93.32	0.52	95.33	0.47	94.10	0.57
Anthropometric measurements						
BMI over (%)	53.15	1.03	55.02	0.77	53.88	0.97
WC over (%)	38.65	1.35	38.72	1.97	38.68	1.53
Hypertension						
High Blood pressure (%)	26.8	0.8	26.3	1.2	26.6	0.9
Controls						
Female (%)	53.42	0.49	52.28	0.81	52.98	0.30
White (%)	42.58	5.27	54.73	5.99	47.29	5.84
Black (%)	9.41	1.24	8.89	1.81	9.21	1.39
Health insurance (%)	21.47	2.52	43.12	3.59	29.87	3.68
Age	43.20	0.31	43.43	0.63	43.29	0.40
Employed (%)	59.44	1.08	63.61	0.90	61.06	0.87
Education 1 - Elementary school (%)	56.26	2.03	38.48	1.60	49.36	2.62
Education 2 - High school (%)	32.73	1.82	34.89	0.92	33.57	1.44
Education 3 - Higher school (%)	11.02	0.55	26.63	1.46	17.07	1.35
Married (%)	43.89	1.76	45.65	2.08	44.57	1.88
Deficiency (%)	1.52	0.12	1.12	0.15	1.36	0.08
Chronic past (%)	22.27	1.05	21.24	1.15	21.87	0.95
Income quintile 1 (%)	22.56	2.25	15.23	1.11	19.72	1.98
Income quintile 2 (%)	20.10	1.92	12.06	1.54	16.98	2.04
Income quintile 3 (%)	20.70	0.85	16.94	0.47	19.24	0.60
Income quintile 4 (%)	22.50	2.23	22.81	0.58	22.62	1.56
Income quintile 5 (%)	14.14	1.87	32.95	2.33	21.44	2.69
Urban (%)	81.84	2.94	93.22	1.60	86.26	2.81
Capital (%)	17.30	2.42	35.67	3.90	24.43	2.66
Piped water (%)	92.36	1.95	96.57	1.32	93.99	1.80
Water provision 1 (%)	81.46	2.88	88.62	3.07	84.23	3.14
Water provision 2 (%)	14.20	2.24	10.11	2.68	12.61	2.48
Sewage 1 (%)	52.21	8.32	74.23	7.12	60.75	8.42
Sewage 2 (%)	17.36	3.91	12.42	3.44	15.44	3.71
Sewage 3 (%)	22.82	4.26	9.98	3.30	17.84	4.25
Sewage 4 (%)	1.65	0.38	0.85	0.23	1.34	0.32
Sewage 5 (%)	1.99	0.34	0.91	0.23	1.57	0.26
Sewage 6 (%)	0.26	0.07	0.16	0.07	0.22	0.06
Sewage 7 (%)	3.72	1.21	1.45	0.61	2.84	1.02
North region (%)	7.01	3.91	7.16	4.91	7.07	4.21
Northeast region (%)	32.32	11.84	17.71	9.61	26.65	11.17
Southeast region (%)	37.88	15.49	53.60	18.54	43.98	16.67
South region (%)	15.55	8.78	14.23	9.57	15.04	8.88
Midwest region (%)	7.24	4.48	7.29	4.85	7.26	4.39
Electricity provision (%)	99.10	0.38	99.53	0.28	99.27	0.34
TV (%)	97.56	0.35	98.02	0.39	97.74	0.36
Cellular (%)	91.30	0.70	94.26	0.56	92.45	0.64
Number of residents	3.68	0.06	3.35	0.06	3.55	0.06
Weighted Share (%)	61.20		38.80		100.00	

Table 40 – Health reflected on usual activities

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Unable to perform due to illness						
Proportion (%)	8.01	0.61	6.91	0.32	7.59	0.47
# of days	0.540	0.047	0.428	0.025	0.496	0.039
Bed due to recent illness						
Proportion (%)	3.62	0.32	2.93	0.18	3.35	0.23
# of days	0.194	0.024	0.168	0.013	0.184	0.015
Controls						
Female (%)	53.42	0.49	52.28	0.81	52.98	0.30
White (%)	42.58	5.27	54.73	5.99	47.29	5.84
Black (%)	9.41	1.24	8.89	1.81	9.21	1.39
Health insurance (%)	21.47	2.52	43.12	3.59	29.87	3.68
Age	43.20	0.31	43.43	0.63	43.29	0.40
Employed (%)	59.44	1.08	63.61	0.90	61.06	0.87
Education 1 - Elementary school (%)	56.26	2.03	38.48	1.60	49.36	2.62
Education 2 - High school (%)	32.73	1.82	34.89	0.92	33.57	1.44
Education 3 - Higher school (%)	11.02	0.55	26.63	1.46	17.07	1.35
Married (%)	43.89	1.76	45.65	2.08	44.57	1.88
Deficiency (%)	1.52	0.12	1.12	0.15	1.36	0.08
Chronic past (%)	22.27	1.05	21.24	1.15	21.87	0.95
Income quintile 1 (%)	22.56	2.25	15.23	1.11	19.72	1.98
Income quintile 2 (%)	20.10	1.92	12.06	1.54	16.98	2.04
Income quintile 3 (%)	20.70	0.85	16.94	0.47	19.24	0.60
Income quintile 4 (%)	22.50	2.23	22.81	0.58	22.62	1.56
Income quintile 5 (%)	14.14	1.87	32.95	2.33	21.44	2.69
Urban (%)	81.84	2.94	93.22	1.60	86.26	2.81
Capital (%)	17.30	2.42	35.67	3.90	24.43	2.66
Piped water (%)	92.36	1.95	96.57	1.32	93.99	1.80
Water provision 1 (%)	81.46	2.88	88.62	3.07	84.23	3.14
Water provision 2 (%)	14.20	2.24	10.11	2.68	12.61	2.48
Sewage 1 (%)	52.21	8.32	74.23	7.12	60.75	8.42
Sewage 2 (%)	17.36	3.91	12.42	3.44	15.44	3.71
Sewage 3 (%)	22.82	4.26	9.98	3.30	17.84	4.25
Sewage 4 (%)	1.65	0.38	0.85	0.23	1.34	0.32
Sewage 5 (%)	1.99	0.34	0.91	0.23	1.57	0.26
Sewage 6 (%)	0.26	0.07	0.16	0.07	0.22	0.06
Sewage 7 (%)	3.72	1.21	1.45	0.61	2.84	1.02
North region (%)	7.01	3.91	7.16	4.91	7.07	4.21
Northeast region (%)	32.32	11.84	17.71	9.61	26.65	11.17
Southeast region (%)	37.88	15.49	53.60	18.54	43.98	16.67
South region (%)	15.55	8.78	14.23	9.57	15.04	8.88
Midwest region (%)	7.24	4.48	7.29	4.85	7.26	4.39
Electricity provision (%)	99.10	0.38	99.53	0.28	99.27	0.34
TV (%)	97.56	0.35	98.02	0.39	97.74	0.36
Cellular (%)	91.30	0.70	94.26	0.56	92.45	0.64
Number of residents	3.68	0.06	3.35	0.06	3.55	0.06
Weighted Share (%)	61.23		38.77		100	

Table 41 – Search for Health and Appointments

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Search for health care						
FHT (%)	0.094	0.028	0.013	0.005	0.064	0.015
BHU (%)	57.78	1.83	29.72	1.54	47.30	2.66
Search for first medical care						
FHT (%)	3.50	0.41	2.37	0.46	3.06	0.44
BHU (%)	42.58	1.10	21.70	2.05	34.42	1.56
Getting appointment						
FHT (%)	2.79	0.56	0.41	0.07	1.86	0.44
BHU (%)	1.21	0.15	1.01	0.17	1.13	0.10
Controls						
Female (%)	53.42	0.49	52.28	0.81	52.98	0.30
White (%)	42.58	5.27	54.73	5.99	47.29	5.84
Black (%)	9.41	1.24	8.89	1.81	9.21	1.39
Health insurance (%)	21.47	2.52	43.12	3.59	29.87	3.68
Age	43.20	0.31	43.43	0.63	43.29	0.40
Employed (%)	59.44	1.08	63.61	0.90	61.06	0.87
Education 1 - Elementary school (%)	56.26	2.03	38.48	1.60	49.36	2.62
Education 2 - High school (%)	32.73	1.82	34.89	0.92	33.57	1.44
Education 3 - Higher school (%)	11.02	0.55	26.63	1.46	17.07	1.35
Married (%)	43.89	1.76	45.65	2.08	44.57	1.88
Deficiency (%)	1.52	0.12	1.12	0.15	1.36	0.08
Chronic past (%)	22.27	1.05	21.24	1.15	21.87	0.95
Income quintile 1 (%)	22.56	2.25	15.23	1.11	19.72	1.98
Income quintile 2 (%)	20.10	1.92	12.06	1.54	16.98	2.04
Income quintile 3 (%)	20.70	0.85	16.94	0.47	19.24	0.60
Income quintile 4 (%)	22.50	2.23	22.81	0.58	22.62	1.56
Income quintile 5 (%)	14.14	1.87	32.95	2.33	21.44	2.69
Urban (%)	81.84	2.94	93.22	1.60	86.26	2.81
Capital (%)	17.30	2.42	35.67	3.90	24.43	2.66
Piped water (%)	92.36	1.95	96.57	1.32	93.99	1.80
Water provision 1 (%)	81.46	2.88	88.62	3.07	84.23	3.14
Water provision 2 (%)	14.20	2.24	10.11	2.68	12.61	2.48
Sewage 1 (%)	52.21	8.32	74.23	7.12	60.75	8.42
Sewage 2 (%)	17.36	3.91	12.42	3.44	15.44	3.71
Sewage 3 (%)	22.82	4.26	9.98	3.30	17.84	4.25
Sewage 4 (%)	1.65	0.38	0.85	0.23	1.34	0.32
Sewage 5 (%)	1.99	0.34	0.91	0.23	1.57	0.26
Sewage 6 (%)	0.26	0.07	0.16	0.07	0.22	0.06
Sewage 7 (%)	3.72	1.21	1.45	0.61	2.84	1.02
North region (%)	7.01	3.91	7.16	4.91	7.07	4.21
Northeast region (%)	32.32	11.84	17.71	9.61	26.65	11.17
Southeast region (%)	37.88	15.49	53.60	18.54	43.98	16.67
South region (%)	15.55	8.78	14.23	9.57	15.04	8.88
Midwest region (%)	7.24	4.48	7.29	4.85	7.26	4.39
Electricity provision (%)	99.10	0.38	99.53	0.28	99.27	0.34
TV (%)	97.56	0.35	98.02	0.39	97.74	0.36
Cellular (%)	91.30	0.70	94.26	0.56	92.45	0.64
Number of residents	3.68	0.06	3.35	0.06	3.55	0.06
Weighted Share (%)	61.23		38.77		100	

Table 42 – Oral Health and Appointments

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Dental appointment in BHU (%)	28.65	1.58	9.86	0.95	20.62	1.78
Getting dental appointment						
FHT (%)	2.38	0.67	0.24	0.07	1.47	0.47
BHU (%)	0.69	0.16	0.40	0.08	0.56	0.09
Controls						
Female (%)	53.42	0.49	52.28	0.81	52.98	0.30
White (%)	42.58	5.27	54.73	5.99	47.29	5.84
Black (%)	9.41	1.24	8.89	1.81	9.21	1.39
Health insurance (%)	21.47	2.52	43.12	3.59	29.87	3.68
Age	43.20	0.31	43.43	0.63	43.29	0.40
Employed (%)	59.44	1.08	63.61	0.90	61.06	0.87
Education 1 - Elementary school (%)	56.26	2.03	38.48	1.60	49.36	2.62
Education 2 - High school (%)	32.73	1.82	34.89	0.92	33.57	1.44
Education 3 - Higher school (%)	11.02	0.55	26.63	1.46	17.07	1.35
Married (%)	43.89	1.76	45.65	2.08	44.57	1.88
Deficiency (%)	1.52	0.12	1.12	0.15	1.36	0.08
Chronic past (%)	22.27	1.05	21.24	1.15	21.87	0.95
Income quintile 1 (%)	22.56	2.25	15.23	1.11	19.72	1.98
Income quintile 2 (%)	20.10	1.92	12.06	1.54	16.98	2.04
Income quintile 3 (%)	20.70	0.85	16.94	0.47	19.24	0.60
Income quintile 4 (%)	22.50	2.23	22.81	0.58	22.62	1.56
Income quintile 5 (%)	14.14	1.87	32.95	2.33	21.44	2.69
Urban (%)	81.84	2.94	93.22	1.60	86.26	2.81
Capital (%)	17.30	2.42	35.67	3.90	24.43	2.66
Piped water (%)	92.36	1.95	96.57	1.32	93.99	1.80
Water provision 1 (%)	81.46	2.88	88.62	3.07	84.23	3.14
Water provision 2 (%)	14.20	2.24	10.11	2.68	12.61	2.48
Sewage 1 (%)	52.21	8.32	74.23	7.12	60.75	8.42
Sewage 2 (%)	17.36	3.91	12.42	3.44	15.44	3.71
Sewage 3 (%)	22.82	4.26	9.98	3.30	17.84	4.25
Sewage 4 (%)	1.65	0.38	0.85	0.23	1.34	0.32
Sewage 5 (%)	1.99	0.34	0.91	0.23	1.57	0.26
Sewage 6 (%)	0.26	0.07	0.16	0.07	0.22	0.06
Sewage 7 (%)	3.72	1.21	1.45	0.61	2.84	1.02
North region (%)	7.01	3.91	7.16	4.91	7.07	4.21
Northeast region (%)	32.32	11.84	17.71	9.61	26.65	11.17
Southeast region (%)	37.88	15.49	53.60	18.54	43.98	16.67
South region (%)	15.55	8.78	14.23	9.57	15.04	8.88
Midwest region (%)	7.24	4.48	7.29	4.85	7.26	4.39
Electricity provision (%)	99.10	0.38	99.53	0.28	99.27	0.34
TV (%)	97.56	0.35	98.02	0.39	97.74	0.36
Cellular (%)	91.30	0.70	94.26	0.56	92.45	0.64
Number of residents	3.68	0.06	3.35	0.06	3.55	0.06
Weighted Share (%)	61.22		38.78		100	

.1.4 Women

Table 43 – Preventive exams

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Cervical exam (%)	61.96	1.68	65.12	1.09	63.17	1.48
Mammography (%)	27.92	2.46	38.23	3.73	31.87	3.25
Controls						
White (%)	41.28	5.51	51.96	5.60	45.35	5.79
Black (%)	8.55	1.47	8.30	1.62	8.45	1.46
Health insurance (%)	21.43	2.73	44.04	4.18	30.04	4.02
Age	33.10	0.20	33.21	0.29	33.14	0.21
Employed (%)	58.52	1.89	64.13	1.87	60.66	1.89
Education 1 - Elementary school (%)	41.01	2.46	25.59	1.66	35.14	2.67
Education 2 - High school (%)	43.62	2.51	42.67	1.09	43.26	1.73
Education 3 - Higher school (%)	15.37	0.80	31.74	1.57	21.60	1.36
Married (%)	44.26	2.39	46.49	2.17	45.11	2.27
Deficiency (%)	0.94	0.17	0.79	0.19	0.88	0.11
Chronic past (%)	16.81	1.02	16.92	1.44	16.85	0.98
Income quintile 1 (%)	14.81	2.63	7.96	1.22	12.21	2.27
Income quintile 2 (%)	22.66	2.11	13.84	2.13	19.30	2.32
Income quintile 3 (%)	22.91	0.78	19.28	0.93	21.53	0.51
Income quintile 4 (%)	24.47	2.22	24.83	1.06	24.61	1.69
Income quintile 5 (%)	15.14	2.06	34.10	2.89	22.35	2.95
Urban (%)	82.94	2.63	92.99	1.56	86.76	2.47
Capital (%)	18.52	2.63	36.57	4.19	25.39	2.78
Piped water (%)	92.30	1.91	96.40	1.30	93.86	1.75
Water provision 1 (%)	82.08	2.77	87.85	3.24	84.28	3.04
Water provision 2 (%)	14.27	2.30	10.74	2.82	12.93	2.52
Sewage 1 (%)	50.97	8.03	72.22	7.25	59.05	8.20
Sewage 2 (%)	18.60	4.06	13.57	3.61	16.69	3.87
Sewage 3 (%)	22.59	4.01	10.71	3.32	18.07	4.00
Sewage 4 (%)	1.97	0.42	0.95	0.33	1.58	0.38
Sewage 5 (%)	1.84	0.21	1.22	0.38	1.60	0.17
Sewage 6 (%)	0.28	0.08	0.21	0.11	0.25	0.08
Sewage 7 (%)	3.76	1.28	1.13	0.41	2.76	1.00
North region (%)	7.89	4.29	8.24	5.36	8.02	4.60
Northeast region (%)	33.39	11.83	17.63	9.20	27.39	11.11
Southeast region (%)	35.51	14.87	51.29	18.43	41.51	16.32
South region (%)	15.56	8.70	15.15	9.83	15.41	8.93
Midwest region (%)	7.66	4.65	7.69	5.11	7.67	4.59
Electricity provision (%)	99.24	0.24	99.46	0.29	99.32	0.25
TV (%)	98.41	0.28	98.69	0.35	98.52	0.30
Cellular (%)	94.76	0.78	97.68	0.58	95.87	0.72
Number of residents	3.95	0.05	3.61	0.06	3.82	0.05
Weighted Share (%)	61.64		38.36		100	

Table 44 – Contraception and Family Planning

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Contraception (%)	58.58	2.52	63.31	2.05	60.38	2.22
Family Planning (%)	5.19	0.87	2.66	0.31	4.23	0.61
Controls						
White (%)	41.28	5.51	51.96	5.60	45.35	5.79
Black (%)	8.55	1.47	8.30	1.62	8.45	1.46
Health insurance (%)	21.43	2.73	44.04	4.18	30.04	4.02
Age	33.10	0.20	33.21	0.29	33.14	0.21
Employed (%)	58.52	1.89	64.13	1.87	60.66	1.89
Education 1 - Elementary school (%)	41.01	2.46	25.59	1.66	35.14	2.67
Education 2 - High school (%)	43.62	2.51	42.67	1.09	43.26	1.73
Education 3 - Higher school (%)	15.37	0.80	31.74	1.57	21.60	1.36
Married (%)	44.26	2.39	46.49	2.17	45.11	2.27
Deficiency (%)	0.94	0.17	0.79	0.19	0.88	0.11
Chronic past (%)	16.81	1.02	16.92	1.44	16.85	0.98
Income quintile 1 (%)	14.81	2.63	7.96	1.22	12.21	2.27
Income quintile 2 (%)	22.66	2.11	13.84	2.13	19.30	2.32
Income quintile 3 (%)	22.91	0.78	19.28	0.93	21.53	0.51
Income quintile 4 (%)	24.47	2.22	24.83	1.06	24.61	1.69
Income quintile 5 (%)	15.14	2.06	34.10	2.89	22.35	2.95
Urban (%)	82.94	2.63	92.99	1.56	86.76	2.47
Capital (%)	18.52	2.63	36.57	4.19	25.39	2.78
Piped water (%)	92.30	1.91	96.40	1.30	93.86	1.75
Water provision 1 (%)	82.08	2.77	87.85	3.24	84.28	3.04
Water provision 2 (%)	14.27	2.30	10.74	2.82	12.93	2.52
Sewage 1 (%)	50.97	8.03	72.22	7.25	59.05	8.20
Sewage 2 (%)	18.60	4.06	13.57	3.61	16.69	3.87
Sewage 3 (%)	22.59	4.01	10.71	3.32	18.07	4.00
Sewage 4 (%)	1.97	0.42	0.95	0.33	1.58	0.38
Sewage 5 (%)	1.84	0.21	1.22	0.38	1.60	0.17
Sewage 6 (%)	0.28	0.08	0.21	0.11	0.25	0.08
Sewage 7 (%)	3.76	1.28	1.13	0.41	2.76	1.00
North region (%)	7.89	4.29	8.24	5.36	8.02	4.60
Northeast region (%)	33.39	11.83	17.63	9.20	27.39	11.11
Southeast region (%)	35.51	14.87	51.29	18.43	41.51	16.32
South region (%)	15.56	8.70	15.15	9.83	15.41	8.93
Midwest region (%)	7.66	4.65	7.69	5.11	7.67	4.59
Electricity provision (%)	99.24	0.24	99.46	0.29	99.32	0.25
TV (%)	98.41	0.28	98.69	0.35	98.52	0.30
Cellular (%)	94.76	0.78	97.68	0.58	95.87	0.72
Number of residents	3.95	0.05	3.61	0.06	3.82	0.05
Weighted Share (%)	61.22		38.78		100	

.1.5 Prenatal

Table 45 – Prenatal testing

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Did prenatal (%)	97.82	0.55	96.71	0.95	97.45	0.55
Prenatal Testing						
Ultrasound (%)	98.26	0.54	98.90	0.39	98.47	0.40
Blood test (%)	96.90	0.77	97.85	1.53	97.21	0.53
Urinalysis (%)	97.54	0.47	99.01	0.49	98.02	0.32
Syphilis Test (%)	67.56	2.88	66.88	3.50	67.34	2.59
Controls						
White (%)	34.43	5.22	46.25	6.40	38.34	5.77
Black (%)	9.28	1.71	9.06	1.26	9.21	1.32
Health insurance (%)	20.61	4.46	40.71	8.80	27.26	6.29
Age	27.33	0.44	28.29	0.51	27.65	0.45
Employed (%)	37.44	2.72	47.38	4.77	40.73	3.35
Education 1 - Elementary school (%)	41.23	3.34	27.90	3.56	36.82	3.51
Education 2 - High school (%)	46.74	2.61	47.68	3.15	47.05	2.30
Education 3 - Higher school (%)	12.03	2.05	24.42	1.59	16.13	1.86
Married (%)	40.10	3.74	51.45	4.80	43.85	3.94
Deficiency (%)	0.97	0.38	0.39	0.42	0.78	0.38
Chronic past (%)	12.55	2.37	11.68	2.08	12.26	1.58
Income quintile 1 (%)	22.30	4.07	9.90	3.52	18.20	4.07
Income quintile 2 (%)	29.62	2.32	23.50	5.01	27.60	3.08
Income quintile 3 (%)	21.39	1.53	26.84	3.96	23.19	2.30
Income quintile 4 (%)	17.51	2.86	17.52	1.99	17.51	2.25
Income quintile 5 (%)	9.18	2.03	22.24	2.70	13.50	2.54
Urban (%)	80.09	3.64	89.91	2.37	83.34	3.48
Capital (%)	20.68	4.14	35.73	4.91	25.66	3.22
Piped water (%)	88.47	3.00	92.41	2.16	89.77	2.79
Water provision 1 (%)	78.26	3.14	87.08	3.72	81.18	3.51
Water provision 2 (%)	14.41	1.93	10.45	2.99	13.10	2.30
Sewage 1 (%)	44.16	6.87	66.54	7.29	51.56	7.83
Sewage 2 (%)	16.75	3.24	15.68	3.32	16.39	2.91
Sewage 3 (%)	28.07	3.82	11.10	3.82	22.46	3.97
Sewage 4 (%)	2.18	0.81	2.42	0.52	2.26	0.63
Sewage 5 (%)	1.89	0.53	1.70	0.85	1.83	0.41
Sewage 6 (%)	0.41	0.27	0.39	0.38	0.40	0.22
Sewage 7 (%)	6.54	2.32	2.17	0.92	5.10	1.90
North region (%)	10.04	5.45	9.03	5.61	9.71	5.34
Northeast region (%)	36.34	12.06	16.19	9.03	29.68	11.54
Southeast region (%)	31.34	13.59	50.14	20.09	37.56	16.05
South region (%)	15.32	8.93	14.63	10.24	15.09	9.04
Midwest region (%)	6.96	4.23	10.01	6.78	7.97	4.76
Electricity provision (%)	97.82	0.78	98.55	0.54	98.06	0.60
TV (%)	97.65	0.74	96.07	1.70	97.13	0.85
Cellular (%)	90.08	2.06	96.42	0.90	92.18	1.68
Number of residents	4.52	0.10	4.07	0.05	4.37	0.08
Weighted Share (%)	61.22		38.78		100	

Table 46 – Maternal gestational weight gain

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Maternal gestational weight gain						
Below IOM recommended guidelines (%)	42.28	3.38	37.02	3.21	40.47	2.01
Within IOM recommended guidelines (%)	22.18	2.56	18.58	3.15	20.94	1.55
Above IOM recommended guidelines (%)	23.3	1.5	32.6	2.6	26.5	1.7
Controls						
White (%)	34.43	5.22	46.25	6.40	38.34	5.77
Black (%)	9.28	1.71	9.06	1.26	9.21	1.32
Health insurance (%)	20.61	4.46	40.71	8.80	27.26	6.29
Age	27.33	0.44	28.29	0.51	27.65	0.45
Employed (%)	37.44	2.72	47.38	4.77	40.73	3.35
Education 1 - Elementary school (%)	41.23	3.34	27.90	3.56	36.82	3.51
Education 2 - High school (%)	46.74	2.61	47.68	3.15	47.05	2.30
Education 3 - Higher school (%)	12.03	2.05	24.42	1.59	16.13	1.86
Married (%)	40.10	3.74	51.45	4.80	43.85	3.94
Deficiency (%)	0.97	0.38	0.39	0.42	0.78	0.38
Chronic past (%)	12.55	2.37	11.68	2.08	12.26	1.58
Income quintile 1 (%)	22.30	4.07	9.90	3.52	18.20	4.07
Income quintile 2 (%)	29.62	2.32	23.50	5.01	27.60	3.08
Income quintile 3 (%)	21.39	1.53	26.84	3.96	23.19	2.30
Income quintile 4 (%)	17.51	2.86	17.52	1.99	17.51	2.25
Income quintile 5 (%)	9.18	2.03	22.24	2.70	13.50	2.54
Urban (%)	80.09	3.64	89.91	2.37	83.34	3.48
Capital (%)	20.68	4.14	35.73	4.91	25.66	3.22
Piped water (%)	88.47	3.00	92.41	2.16	89.77	2.79
Water provision 1 (%)	78.26	3.14	87.08	3.72	81.18	3.51
Water provision 2 (%)	14.41	1.93	10.45	2.99	13.10	2.30
Sewage 1 (%)	44.16	6.87	66.54	7.29	51.56	7.83
Sewage 2 (%)	16.75	3.24	15.68	3.32	16.39	2.91
Sewage 3 (%)	28.07	3.82	11.10	3.82	22.46	3.97
Sewage 4 (%)	2.18	0.81	2.42	0.52	2.26	0.63
Sewage 5 (%)	1.89	0.53	1.70	0.85	1.83	0.41
Sewage 6 (%)	0.41	0.27	0.39	0.38	0.40	0.22
Sewage 7 (%)	6.54	2.32	2.17	0.92	5.10	1.90
North region (%)	10.04	5.45	9.03	5.61	9.71	5.34
Northeast region (%)	36.34	12.06	16.19	9.03	29.68	11.54
Southeast region (%)	31.34	13.59	50.14	20.09	37.56	16.05
South region (%)	15.32	8.93	14.63	10.24	15.09	9.04
Midwest region (%)	6.96	4.23	10.01	6.78	7.97	4.76
Electricity provision (%)	97.82	0.78	98.55	0.54	98.06	0.60
TV (%)	97.65	0.74	96.07	1.70	97.13	0.85
Cellular (%)	90.08	2.06	96.42	0.90	92.18	1.68
Number of residents	4.52	0.10	4.07	0.05	4.37	0.08
Weighted Share (%)	61.22		38.78		100	

Table 47 – Prenatal care

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Did prenatal in BHU (%)	69.15	3.38	43.97	5.74	60.89	4.99
Ultrasound in SUS (%)	62.18	2.18	40.20	4.56	54.92	3.54
Birth in SUS (%)	79.4	2.6	53.2	8.3	70.7	5.4
Controls						
White (%)	34.43	5.22	46.25	6.40	38.34	5.77
Black (%)	9.28	1.71	9.06	1.26	9.21	1.32
Health insurance (%)	20.61	4.46	40.71	8.80	27.26	6.29
Age	27.33	0.44	28.29	0.51	27.65	0.45
Employed (%)	37.44	2.72	47.38	4.77	40.73	3.35
Education 1 - Elementary school (%)	41.23	3.34	27.90	3.56	36.82	3.51
Education 2 - High school (%)	46.74	2.61	47.68	3.15	47.05	2.30
Education 3 - Higher school (%)	12.03	2.05	24.42	1.59	16.13	1.86
Married (%)	40.10	3.74	51.45	4.80	43.85	3.94
Deficiency (%)	0.97	0.38	0.39	0.42	0.78	0.38
Chronic past (%)	12.55	2.37	11.68	2.08	12.26	1.58
Income quintile 1 (%)	22.30	4.07	9.90	3.52	18.20	4.07
Income quintile 2 (%)	29.62	2.32	23.50	5.01	27.60	3.08
Income quintile 3 (%)	21.39	1.53	26.84	3.96	23.19	2.30
Income quintile 4 (%)	17.51	2.86	17.52	1.99	17.51	2.25
Income quintile 5 (%)	9.18	2.03	22.24	2.70	13.50	2.54
Urban (%)	80.09	3.64	89.91	2.37	83.34	3.48
Capital (%)	20.68	4.14	35.73	4.91	25.66	3.22
Piped water (%)	88.47	3.00	92.41	2.16	89.77	2.79
Water provision 1 (%)	78.26	3.14	87.08	3.72	81.18	3.51
Water provision 2 (%)	14.41	1.93	10.45	2.99	13.10	2.30
Sewage 1 (%)	44.16	6.87	66.54	7.29	51.56	7.83
Sewage 2 (%)	16.75	3.24	15.68	3.32	16.39	2.91
Sewage 3 (%)	28.07	3.82	11.10	3.82	22.46	3.97
Sewage 4 (%)	2.18	0.81	2.42	0.52	2.26	0.63
Sewage 5 (%)	1.89	0.53	1.70	0.85	1.83	0.41
Sewage 6 (%)	0.41	0.27	0.39	0.38	0.40	0.22
Sewage 7 (%)	6.54	2.32	2.17	0.92	5.10	1.90
North region (%)	10.04	5.45	9.03	5.61	9.71	5.34
Northeast region (%)	36.34	12.06	16.19	9.03	29.68	11.54
Southeast region (%)	31.34	13.59	50.14	20.09	37.56	16.05
South region (%)	15.32	8.93	14.63	10.24	15.09	9.04
Midwest region (%)	6.96	4.23	10.01	6.78	7.97	4.76
Electricity provision (%)	97.82	0.78	98.55	0.54	98.06	0.60
TV (%)	97.65	0.74	96.07	1.70	97.13	0.85
Cellular (%)	90.08	2.06	96.42	0.90	92.18	1.68
Number of residents	4.52	0.10	4.07	0.05	4.37	0.08
Weighted Share (%)	61.22		38.78		100	

.1.6 Elderly

Table 48 – Flu vaccine

	Registered on PSF		Not registered on PSF		Total	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Health outcomes						
Flu vaccine (%)	74.62	1.49	70.02	1.14	72.85	1.21
Main reason for not getting a flu vaccine						
Lack of Information (%)	7.53	1.01	5.43	0.93	6.63	0.66
Fear (%)	36.59	1.38	30.41	2.64	33.95	1.81
Don't believe (%)	11.15	1.43	12.37	0.92	11.67	0.89
Other reason (%)	51.80	1.71	44.73	1.51	47.74	1.21
Controls						
Female (%)	55.67	1.16	57.50	1.07	56.38	0.66
White (%)	48.04	5.29	63.31	6.97	53.94	6.37
Black (%)	10.06	1.28	7.20	1.31	8.95	1.28
Health insurance (%)	21.35	2.19	49.03	3.43	32.04	3.68
Age	69.60	0.21	69.54	0.22	69.58	0.18
Employed (%)	21.69	1.14	23.82	0.77	22.52	0.79
Education 1 - Elementary school (%)	87.37	1.24	62.17	2.30	77.64	2.85
Education 2 - High school (%)	8.72	0.82	18.66	1.70	12.56	1.18
Education 3 - Higher school (%)	3.91	0.48	19.17	2.18	9.81	1.85
Married (%)	53.64	2.00	53.26	2.75	53.49	2.10
Deficiency (%)	1.33	0.31	0.94	0.27	1.18	0.22
Chronic past (%)	43.40	1.42	42.61	1.26	43.10	1.00
Income quintile 1 (%)	47.44	2.11	41.41	3.20	45.11	2.47
Income quintile 2 (%)	16.22	1.44	10.44	1.00	13.99	1.45
Income quintile 3 (%)	16.00	1.22	13.15	0.46	14.90	0.84
Income quintile 4 (%)	14.11	2.34	13.82	0.91	14.00	1.66
Income quintile 5 (%)	6.23	0.84	21.18	2.79	12.00	2.23
Urban (%)	81.04	3.47	93.29	1.96	85.77	3.36
Capital (%)	16.45	2.52	37.80	4.12	24.70	3.02
Piped water (%)	94.16	1.70	96.87	1.58	95.21	1.69
Water provision 1 (%)	82.01	3.07	89.95	3.11	85.08	3.35
Water provision 2 (%)	13.63	2.29	8.89	2.68	11.80	2.57
Sewage 1 (%)	53.96	8.97	77.74	7.27	63.15	9.10
Sewage 2 (%)	16.61	3.82	10.35	3.40	14.19	3.63
Sewage 3 (%)	23.91	4.88	8.98	3.51	18.14	4.95
Sewage 4 (%)	1.52	0.37	0.42	0.22	1.10	0.33
Sewage 5 (%)	1.27	0.23	0.70	0.11	1.05	0.13
Sewage 6 (%)	0.28	0.15	0.17	0.07	0.24	0.11
Sewage 7 (%)	2.45	0.84	1.65	0.89	2.14	0.83
North region (%)	5.18	2.98	5.29	3.96	5.23	3.26
Northeast region (%)	30.19	11.59	15.95	9.29	24.69	10.88
Southeast region (%)	41.39	15.96	58.29	18.87	47.92	17.08
South region (%)	16.75	9.50	14.10	10.23	15.73	9.55
Midwest region (%)	6.48	4.11	6.37	4.44	6.44	4.03
Electricity provision (%)	99.52	0.18	99.71	0.19	99.59	0.17
TV (%)	96.45	0.54	97.06	0.75	96.69	0.56
Cellular (%)	82.15	0.94	85.75	0.72	83.54	0.83
Number of residents	3.00	0.07	2.75	0.06	2.90	0.06
Weighted Share (%)	61.37		38.63		100	

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