Impact of the Brazilian Family Health Strategy on Sexual and Reproductive Health Outcomes: An Analysis at Individual and Population Levels

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Abstract

We evaluate the Brazilian Family Health Strategy (FHS), the largest community-based health program in Brazil, estimating how it affects contraceptive use and health behaviors among adult and teenage women, as well as fertility rates and HIV diagnosis among teenage girls. We use publicly-available data to estimate program effects at individual and municipality levels. We employ propensity score matching combined with complex survey weights in individuals regressions and a differences-in-differences approach for municipalities. The results indicate the program has positive effects on the probability of using various types of contraceptive methods, mainly observed in condoms and pills and their combination. This result is found especially among women in households with a female teenager. Following this, we found negative and robust effects on adolescent maternity rate, with a monotonous decrease following exposure time to the program, especially among older teenage girls aged 15-19. In addition, we found that the decrease was higher in the poorest regions of Brazil, and also that the program is related with an increase in the diagnosis rates of HIV/AIDS.
Keywords: Family Health Strategy, Contraception, Teenage Fertility.
JEL classification: I12, I18, J13.

Resumo

Avaliamos a Estratégia de Saúde da Família (ESF), o maior programa comunitário de saúde no Brasil, estimando como essa afeta o uso de anticoncepcionais e comportamentos de saúde entre mulheres adultas e adolescentes, assim como taxas de fecundidade e diagnóstico de HIV entre mulheres adolescentes. Utilizamos um conjunto de dados públicos para estimar os efeitos do programa em nível individual e municipal. Empregamos combinação de escore de propensão combinada com pesos de amostragem complexa em regressões de indivíduos e uma abordagem de diferenças em diferenças para os municípios. Os resultados indicam que o programa tem efeitos positivos sobre a probabilidade de usar vários tipos de métodos contraceptivos, observados principalmente em preservativos e pílulas e sua combinação. Este resultado é encontrado especialmente entre as mulheres em domicílios com uma adolescente do sexo feminino. Em seguida, encontramos efeitos negativos e robustos sobre a taxa de maternidade na adolescência, com uma diminuição monótona após o tempo de exposição

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ao programa, especialmente entre adolescentes do sexo feminino de 15 a 19 anos. Além disso, constatamos que essa diminuição teve maior magnitude nas regiões mais pobres do Brasil, e também que o programa está relacionado com um aumento nas taxas de diagnóstico de HIV / AIDS.
Palavras-chave: Estratégia Saúde Da Familia, Contraceptivos, Fecundidade na Adolescência.
Classificação JEL: I12, I18, J13.

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1. Introduction

Despite the progress that has been achieved in expanding health coverage worldwide (Dye et al., 2013), adolescents are lagging behind regarding access to sexual and reproductive health services (Coll et al., 2019). Reproductive and sexual health is essential to the well-being of individuals and societies and is a driver for development (Rodríguez et al., 2014). Unplanned pregnancies, especially among poor adolescents, are associated with inadequate antenatal care, higher risk of medical complications, preterm birth, low birth weight, infant mortality, maternal mortality and morbidity, lower educational attainment, fewer work opportunities, and, ultimately, poverty (Glasier et al., 2006; United Nations, 2014; Rodríguez et al., 2014).

Similar to most of high- and middle-income countries, Brazil has experienced a fast decline in fertility rates since the 1970s, as a result of the demographic transition process (Maddison, 2001). In particular, the fertility rate among Brazilian adolescents has also decreased, especially since the mid-1990s. However, it is still higher than that of most countries in Latin America, as well as the global average (63 births per 1,000 women aged 15-19, against a global average of 44) (United Nations, 2014). Despite contraception being widely available throughout the country (de Leon et al., 2019), adolescents are affected by social norms and expectations in a particular manner. Furthermore, their lack of interest for general family planning services hamper the decrease of the adolescent fertility rate (Gonçalves et al., 2011). In the 1990s, after the establishment of the Brazilian National Health System, Brazil launched the Family Health Strategy (FHS) aiming to reach the most vulnerable populations and achieve a more equitable society (Datasus, 2019). Over the past years, the expansion of the FHS allowed people from harder-to-reach groups to access health services and improve several health outcomes (Mullachery et al., 2016).

This paper investigates the effects of the FHS expansion on contraceptive use among adult women and health behaviors of both adult and teenage women, exploring potential differences according to family structure (presence of adult women in the household and presence of teenage boys and girls). Determinants of risky sexual behaviors have been studied over the past decades (Wellings et al., 2001). Girls who live alone or with non-relatives usually have more risky sexual behaviours than girls who live with their parents or relatives (Curtis et al., 2018). Parents can affect adolescents' sexual behavior via their example, expectations and communication (Hutchinson et al., 2003; Kowal and Blinn-Pike, 2004). Parent-child sexual risk communication has been associated with more responsible sexual attitudes and behaviors among sexually active adolescents (Hutchinson et al., 2003).

We also explore the effects of FHS expansion on fertility rates and HIV diagnosis among females aged 10 to 19. Moreover, since previous works have found that the FHS seems to be most effective in the north and northeast regions of Brazil, and in municipalities with a lower coverage of public health infrastructure Rocha and Soares (2010), we focus on these regions on a secondary analysis.

Estimation regarding fertility and HIV rates are conducted with a panel of all Brazilian municipalities covering the period 1996 to 2016, with a specification that takes advantage of the staggered roll-out of the program to adopt a differences-in-differences strategy that explores time of exposure. Individual-level analyses are carried out with a cross-section survey of individuals, containing information on health characteristics and FHS visits, using Propensity Score methods.

Effects of the FHS on child health were already documented, especially regarding infant mortality, nutrition and early development (Bhalotra et al., 2019; Macinko et al., 2006, 2007; Rocha and Soares, 2010; Bastos et al., 2017). FHS can affect fertility rates directly, through provision of family planning services, and indirectly, as a response to the decline in infant mortality (Bhalotra et al., 2019). Its effects on sexual and reproductive health have been studies as well Bhalotra et al. (2019); however, to the best of our knowledge, information about how the FHS affects teenage fertility and about the pathways of its effects on adolescent maternity have not been evaluated until now.

At the individual level, we found that the decrease in fertility was accompanied by increase of contraceptive use for women in covered households. Higher effects of FHS on contraception were found for use of male condom (8.4 percentage points (pp)) and for the combo of male condom and contraceptive pill (13.3 pp). Its effects were even higher among households with a female adolescent, reaching an increase of 25.6 pp on the probability of using both condom and contraceptive pill. FHS coverage was also associated with an increase of 14.5 pp on the use of contraceptive condom, 34.5 pp on the use of combined pill and condom.

At the municipality level, we found complementary results, with a clearly decline on adolescent fertility rate along the implementation of the FHS. The decrease of the rate for 10-19 years old girls presents a steady drop reaching a decrease of 9.2% with 8 years of implementation. According to age group, effects reach a decrease around 15.6% and 9.4% among girls aged 10-14 and 15-19 years, respectively, after 8 years of program. In the poorest regions of the country (north and northeast), we find that the exposure to the program has a greater magnitude on female teenage fertility reaching a decline of 33% after 5 years and 64% after 10 of program implementation, among girls aged 10-19. We also found positive effect of the program on the HIV/AIDS diagnosis rate.

The paper proceeds as follows. Following this introduction, section 2 presents an overview of the Family Health Strategy, while section 3 provides a brief review of the relevant literature. Section 4 describes the data sets used, detailing our variables of analysis. In section 5, we outline the empirical strategies employed to address municipal- and individual-level data. Section 6 presents and discusses our estimation results, including robustness exercises. Final remarks are presented in section 7.

2. The Brazilian Family Health Strategy

The implementation of the Family Health Program, currently known as Family Health Strategy (FHS), began in 1994 in northeastern Brazil. The objective of the program is to promote access to free-of-charge health care to the general population, especially those at the margins. The FHS is a federal initiative under the Brazilian Ministry of Health that has reorganized basic care provision in the country, decentralizing primary care to the municipality-level. The program has had a strong focus on expansion and qualification of primary care, benefitting over 120 million people (Macinko and Harris, 2015; Bastos et al., 2017). It works mainly towards prevention and provision of basic health through the use of professional health care teams directly intervening within communities. The teams provide health counseling - including orientation of good habits of hygiene and food safety, but also proper antenatal and postnatal care and breastfeeding practices -, deliver preventive care (e.g. immunization campaigns) and act towards early diagnosis of diseases (Rocha and Soares, 2010).

The FHS is widely spread in Brazil: the population covered by the program has progressively increased from around 7% in 1998 to around 63% in 2015 (Macinko and Harris, 2015; Bastos et al., 2017). Implementation has been gradually spread across the country over time, providing an opportunity for a non-experimental impact evaluation that explores the staggered expansion. Nowadays, the FHS has already reached over 99% of Brazilian municipalities. Being such a large nationwide program, the amount of public investment involved in its implementation and execution is substantial, at the equivalent of was 5.32 billions US$ in 2010, and over 5.6 billions US$ in 2018, according to the Brazilian Ministry of Health, making it one of the biggest public policies in Brazil.

The program is carried out within communities by so-called Family Health teams. Each team consists of a group of several health professionals, including a minimum of one: (i) general practitioner; (ii) nurse; (iii) auxiliary or nursing technician; and (iv) at least four community health agents. The teams cover populations of at most 4,000 inhabitants each, being arranged with responsibilities for a given geographical area. The covered populations receive regular visits by the community health agents, in addition to having access to medical care at a basic health unit. This continuous care allows agents to serve a broad range of people, from pregnant women, who are referred to prenatal care; new mothers and their children, who are counseled towards best practices during postpartum and breastfeeding; to adolescents, adults and the elderly, healthy or sick, in an integral and continuous manner. Several works have done an excellent job of detailing the history and operation of the FHS, for further information see, e.g., Rocha and Soares (2010); Castro et al. (2019); Bhalotra et al. (2019)

3. Brief literature review

Health-focused interventions targeting communities formed by disadvantaged families are a key factor in promoting health improvements, giving access to information on disease prevention and early detection. To the extent that people respond to the exposition to information, this would directly influence their behavior (Becker, 2009), thus promoting better health in general. The provision of health education services and contraceptives is obviously relevant for the prevention of unplanned pregnancy, particularly during adolescence. When teenage pregnancy cannot be prevented, pregnant girls are left at high risk for the complications before, during and after childbirth (Chen et al., 2007). Long-term health consequences associated with teenage pregnancy are then an additional burden to the public health system (Irvine et al., 1997).

Studies show that the main factors leading to pregnancy during adolescence are a lack of basic information and attention. The presence of a mother figure seems to be particularly important, and greatly affects the adolescent (Hutchinson et al., 2003). The literature reports that there is a strong relationship between the attitudes of older women at a household and adolescent sexual behavior and contraceptive use, with some studies indicating that it is the adult woman in a family who passes on the use of contraceptives to teenage girls; this happens not only with mothers, but also older sisters, aunts and other female relatives (Curtis et al., 2018). Rodgers and Rowe (1993) showed that older sibling behavior directly affects younger siblings, including teenagers, who become sexually active earlier than their older siblings. Kowal and Blinn-Pike (2004) investigated the effects of the influence of parents and elders on adolescent sexual behavior and found that discussions between siblings about safe sex, in conjunction with discussions between parents, predicted better attitudes toward safe sexual practices for adolescents.

Simple dissemination of health education to families can be an important mechanism to overcome lack of information Duflo et al. (2015). Dupas (2011) conducted a large study in Kenya with a randomized, seven-year trial to explore the impacts of disseminating information about adolescent sexual behavior; they found that when parents received information about the risks of HIV infection, there was a decrease in the probability of teenage pregnancy. An opposing force is that presented by Hotz et al. (1997), who explain that a teenager who engages in sex only sporadically may not be willing to invest in contraceptive methods with high fixed costs and low marginal costs, while a more sexually active teenager might make such investments.

The evaluations of Family Health Strategy begun with the study of Macinko et al. (2006), who used a state-year panel spanning the period from 1990 to 2002 and found that an increase in FHS coverage was associated with a drop in the infant mortality rate. Macinko et al. (2007) analyzed data from microregions in Brazil from 1999 to 2004, with results suggesting that an increase in FHS coverage was associated with reductions in infant mortality from various causes (0.45% reduction in the infant mortality rate, 6% in post-neonatal mortality and 1% in mortality from diarrhea).

Rocha and Soares (2010) used a municipality-level panel to estimate the impacts of the FHS mortality rates from several causes and for various age groups, with additional analyses regarding schooling, labor supply and fertility. Their results show that FHS had a significant effect on the reduction in infant and adult mortality, with stronger effects among the poorest regions. They also found that the program had a significant impact on labor supply, enrollment rates and fertility reductions. However, they found no effect on fertility rates among adolescents. Guanais (2015) also used a panel of municipalities and a fixed-effects strategy, and estimated that the FHS, combined with the conditional cash transfer program *Bolsa Família*, led to reductions in post-neonatal mortality. More recently, Bhalotra et al. (2019) used a similar strategy to estimate the effects of the FHS, but explored a wide range of outcomes. They used a rich administrative data set in conjunction with a difference-in-differences methodology, with results suggesting that the program is associated with a large reduction in fetal, neonatal, and post-neonatal mortality, as well as with a decrease in maternal mortality. Additionally, the authors found that the program led to an increase in C-sections, hospital births and maternal hospitalization following complications at birth, as well as an increase in antenatal care consultation.

Our contribution to this literature is in addressing the question of how the Family Health Strategy in Brazil is associated with outcomes of reproductive and sexual health with a direct focus on adolescence. We attempt to estimate whether the FHS affects contraceptive use and health behaviors among adult women under different household structures - with or without teenage girls and boys -, and whether the program had an impact on fertility rates and HIV diagnosis among female adolescents aged 10 to 19.

4. Data

We take advantage of publicly-available administrative data to perform analyses at individual and municipal levels. First, we use data from a survey of Brazilian residents conducted in 2013 by the Brazilian Institute of Geography and Statistics (IBGE). This survey, called *Pesquisa Nacional da Saúde* (PNS), gathered information on the health, demographic and socioeconomic characteristics of all members of the households interviewed, selected via complex sampling to ensure population representativity.

Importantly, households reported whether they had received at least one visit from a FHS community health agent in the last 12 months, which we use to identify treatment status. Our outcomes of interest are related to contraceptive use and health behavior. Since questions related to sexual activity were only answered by legal adults (18 or more years old), we cannot estimate the association between the FHS and these outcomes among teenagers directly. For this reason, we analyze contraceptive use and health behaviors among adult women living in different household structures. We do this in order to investigate how the presence of female adolescents in the family influences the dissemination of the program regarding contraceptive methods. Additionally, we estimate how the FHS affects the probability of visiting a medical doctor among teenage women. Hence, we divided our sample into two strands: (i) a subsample of sexually active women aged 18-49 (furter split considering the presence of teenage boys and/or girls in the household); and (ii) a subsample of female adolescents aged 10-19 (further split by age groups 10-14 and 15-19 and by considering the presence or not of adult women in the household[1]).

Dependent variables on contraceptive use were carefully constructed by considering as non-adopters (women not using contraceptives) those who self-reportedly: (i) wanted to get pregnant; (ii) did not use contraceptives for religious reasons; (iii) did not know how to use contraceptive methods; or (iv) did not know where to find the information. We exclude from the sample women who:

[1]For this analysis, we considered that households with adult women were those where there lived at least one sexually active woman aged 20-49.

(i) were pregnant; (ii) were not sexually active; or (iii) did not have sex with men. We omitted the descriptive statistics because of space limitations, but they are available with the authors upon request.

Second, our municipality-level analysis relies on several administrative databases. We construct a panel including all municipalities in Brazil spanning the period from 1996 to 2016. Our panel includes: (i) Data on teenage fertility and number of HIV/AIDS diagnoses, available from the Live Birth Information System (SINASC) and the Notification of Injury Information System (SINAN), via the Ministry of Health's Integrated System of Information (DATASUS); (ii) year of program implementation for each municipality is obtained from the Ministry of Health's Department of Basic Attention[2]; (iii) control variables related to municipalities' infrastructure come from the education census, available from the Ministry of Education's National Institute for Educational Studies and Research (INEP), and include characteristics such as the proportion of public school teachers with a graduate degree and the proportion of public schools in rural areas. At the end, this municipality-year panel is composed of 5,509 municipalities with data from 1996 to 2016, for a total of 115,689 observations. Again, descriptive statistics were omitted for space considerations and are available with the authors upon request.

5. Empirical Strategy

Because of the different nature of our individual and municipal-level data, we adopt two distinct empirical approaches. First, for the individual-level data, we explore the impacts of the Family Health Strategy on two sets of outcomes (contraceptive use among adult women and health behaviors among teenage and adult women) using matching and weighting procedures. Under the hypothesis that the presence of adolescent girls in a household might affect the ability of health care programs to influence the behaviors of other women (Curtis et al., 2018), similarly to how it could affect the influence of adult women on the teenage girls (Wellings et al., 2001), we explore different household structures regarding the presence of adolescents and adults.

Since the PNS is a survey designed with complex sampling, matching procedures are not trivial. However, employing Propensity Score methods with complex surveys is becoming increasingly common (Zanutto, 2006; DuGoff et al., 2014; Austin et al., 2018; Ely et al., 2019). According to DuGoff et al. (2014), combining propensity score methods with appropriate survey weighting is necessary to achieve unbiased treatment effect estimates that can be generalized to achieve the original survey target population. After running Monte Carlo simulations, they suggested using a type of propensity score weighting in which the weights from the propensity score are multiplied by the survey weights. Austin et al. (2018), on the other hand, assessed the performance of different methods of matching under complex sampling and concluded that a Propensity Score Matching with complex survey weights employed during the first stage provides the less bias.

Given this discussion, we estimate the individual-level impacts of the FHS under three different models, for every dependent variable. The first model is a simple Probit regression using complex survey weights. The second model uses Propensity Score Weighting with weights from both the logistic regression and the complex survey (PSW). In order to estimate this model, we first run a logistic regression using the survey weights and then run a linear regression using the weights from the logistic regression multiplied by the survey weights, following the recommendations of DuGoff et al. (2014). Our last model uses Propensity Score Matching with complex survey weights (PSM), following Austin et al. (2018). To estimate the third model, we first run a nearest-neighbor algorithm with replacement to match treated and control individuals and then run a linear regression using the

[2]Due to data availability we ignore any coverage that was already in place in 1994 and 1995. Since coverage was minimum during this period, we believe this does not pose issue to our estimation strategy.

survey weights[3]. Throughout our results discussions, we focus on the estimates obtained from the third model.

The treatment variable is a dummy that indicates if the household received visits of FHS in the past 12 months. Control variables are related to individuals' skin color, age, years of study and households' people density by room, number of women, presence of piped water, indicator for rural areas and states.

Our individual-level empirical specification is the following:

First stage:

$$p(FHS_j) = \alpha + \beta.X_{ij} + \tau.Z_j + \mu_{ij} \tag{1}$$

Second stage on the matched sample:

$$Y_{ij} = \gamma + \lambda.FHS_j + \omega.X_{ij} + \sigma.Z_j + \epsilon_{ij} \tag{2}$$

In equation (1), the first stage, $p(FHS_j)$ is the probability of receiving the FHS, X_{ij} and Z_j denote a set of characteristics of individuals and households, respectively, μ_{ij} is the random error term, and α, β and τ are parameters. For the second stage, in equation (2), Y_{ij} denotes some health outcome for the matched individual (either contraceptive use or health behavior), FHS_j is the treatment status, and γ, λ, ω and σ are parameters. Standard errors are clustered at the household level.

Unfortunately, Propensity Score methods are known to have some limitations. This methodology attempts to mimic randomization by creating a sample of units who did not receive the treatment that is comparable on observables to the sample of units who did receive the treatment (Rosenbaum, 2014). The main limitation here is the possibility that some non-observable characteristics might influence treatment status, which would only be captured in the analysis to the extent of their correlation with the observed covariates. To address this, in addition to estimating our results with the three models mentioned above, we also estimate Rosenbaum bounds to test the sensibility of our results to hidden bias. Since our dependent variables are binaries we apply Rosenbaum bounds to McNemar's test to check differences in degree of departure from random assignment of treatment for variables between two related groups.

For the second part of this paper, we explore the staggered roll-out of the Family Health Strategy across municipalities in Brazil by adopting a differences-in-differences approach. Since our unit of observation in this case is a municipality in a given year of from 1996 onward, we identify status of treatment by observing year of implementation for each municipality. Treated municipalities are those who were exposed to the program with at least one Family Health team at some point up to the year they are observed in the data.

As such, the municipality-level empirical specification to capture the pre and post timing of adoption and different time of program exposure is the following:

$$Y_{mt} = \alpha + \sum_{j=-8}^{19} \beta_j.FHS_{mt-j} + \delta.X_{mt} + \mu_m + \gamma_{st} + t_m + \epsilon_{mt} \tag{3}$$

where Y_{mt} denotes some health outcome for municipality m in year t, FHS_{mt-j} is a dummy variable assuming value 1 if municipality m first received the program in year t-j, X_{mt} denotes a set of time-

[3]Following the recommendations of (Caliendo and Kopeinig, 2008; Lunt, 2013) to achieve balancedness of covariates, we match with replacement and apply a caliper of 5%. We also consider secondary-degree interactions and include all covariates as controls for the second stage regression.

varying controls, μ_m is a municipality fixed effect, γ^{st} are state-year fixed effects, t_m is a municipality-specific linear time trend, ϵ_{mt} is the random error term, and α, β^j, and δ are parameters. We omit the group with $j = -1$.

This specification allows us to examine heterogeneous effects of the program under different times of exposition by comparing the β_j for different levels of j. For simplicity, we also present these results graphically. Furthermore, we cluster standard errors at the municipality level, following the recommendations of Abadie et al. (2017). Additionally, the negative values of j function as a means to assess the plausibility of the differences-in-differences parallel trends hypothesis by analyzing pre-existing trends.

Such approach offers two additional concerns. First, FHS implementation did not historically follow a random assignment, in which case selection bias might threaten our strategy. With this concern in mind, Rocha and Soares (2010) attempted to find the determinants behind program implementation, and found that endogenous adoption did not seem to be problem. They found that political orientation and fixed initial characteristics were strongly correlated with the timing of adoption. This diminishes our concerns about the potential endogeneity of program adoption. The second concern is the possibility of confounding omitted factors correlated with both FHS and health outcomes. We deal with this to the best of existing approaches by including fixed effect over several dimensions, as well as municipality-specific time trends that control for any long-run linear trend differences over characteristics across regions.

6. Results

In this section we present the results of our estimations. First, we present the impacts of the Family Health Strategy on individuals. Second, we present the effects of the FHS at the municipality level. At the end, we present robustness checks of the results, analysis of sensitivity and confounding factors.

6.1. Impact on Individuals

Tables 1 and 2 present the results from the impact of Family Health Strategy on use of contraceptives methods and health behaviors for women aged 18 to 49 years old. Table 3 presents the effects of the FHS on health care for female teenagers over different age groups: 10-19, 15-19 and 10-14 years old. We present results following the three methods described earlier: Probit, Propensity score Weighting (PSW) and Propensity Score Matching (PSM). Different household structures are presented sequentially in columns and later in panels. All tables report the marginal coefficients of the regressions, and we have omitted the first stages and balancedness tests for limitations in space. In general, most covariates pass the balancedness test at a 5% significance level. We are also not reporting estimation results for three different samples: (i) all households, (ii) households with at least one teenager and (iii) households without any teenagers.

In tables 1 and 2, we present the estimates of the effects of the FHS for women living in: (i) households with male teenagers, (ii) households with female teenagers and (ii) household with only female teenagers. Following our preferred specification (PSM), the subsample of women with teenage men in the household seems to have the lowest impact on contraceptive use, compared to all other samples. In this case, we found a positive impact only on the probability of using the table as a contraceptive method, with a magnitude of 5.6 pp, but only significant at 10%. For health care, our results show a positive effect on the probability of having visited a doctor in the past 3 and 12 months, and the probability of having taken a blood exam.

In contrast, when we turn to the effects of the FHS on women living in households with the presence of female teenagers, we found a positive increase in almost all methods of contraception. These impacts are observed on the probability of using: any contraceptive methods, using permanent contraceptive methods, non-permanent contraceptive methods, male condom, contraceptive pill in combination with condoms, having a vasectomy and tubal ligation. Magnitudes are, respectively, equal to 3.1pp, 6.4pp, 4.1pp, 8.6pp, 18.2pp, 3.6pp, 7.4pp and 4.1pp. We also observe an increase in the conditional contraceptives use (probability of using pill conditional on using condom, and probability of using condom conditional on using pill) of 13.7pp and 8.3pp, respectively. Women in households where there are only teenage girls seem to be affected in a similar manner to those living with girls and girls+boys. However, magnitudes for this more restrictive sample are generally bigger, with effects on the probability of using permanent contraceptive, non-permanent contraceptive, condom and pill, conditional pill and conditional condom at magnitudes of 7.5pp, 4.6pp, 34.5pp, 13.2pp and 11.8pp, respectively. These results seem to indicate that women in households with the presence of teenage women might be more susceptible to have their sexual behaviors affected by health counseling.

As shown in table 1, FHS effects on the probability of visiting a medical doctor and taking a blood exam are also positive and seem to be strongly affected by the presence of teenage girls in the households, particularly for the subsample of *only* teenage girls. These results, when taken together, seem to indicate greater impacts of the FHS on health behaviors of adult women when there are teenage girls in the households, which could mean either a greater concern and susceptibility from the women or greater care from the health professionals.

Finally, table 3 presents our estimates of the impacts of the FHS on health care outcomes among female teenagers aged 10-19, sampled according to age group and household structure (presence or not of adult women in household). For the sample of all households, the estimates are similar for all age groups, with the FHS associated with an increased probability of visiting a doctor in the past 1 or 2 years. For teenagers aged 10-19 years old, the effect of the program is of 3.4 pp and 3.2 pp, respectively. In households with adult women, the effect of FHS on the health care of female teenagers appears with greater magnitude, reaching 8.3 pp for girls aged 15-19. We do not find statistically significant impacts among households without adult women.

6.2. Impact on Municipality

In this section we present the results of our municipality-level specification. Table 4 presents the long-run results of Family Health Strategy over teenage women fertility rate and HIV/AIDS diagnostic rate. We analyze outcomes separately by three age groups: 10-19, 15-19 and 10-14 years old. We also present these results graphically, plotting the coefficients β_j before and after program intervention following equation (3), as well as their respective confidence intervals (95%). The estimates are interpreted as percentages in relation to the omitted group mean.

The estimates considering adolescents' fertility rates are reported in table 4. Figures 2 to 4 show a clear decline following exposure time to the program. The effects seem to start in program year 3, with a decline of approximately 3.9% in fertility, reaching a decline of 17.2% in year 5, and further expanding to 28.2% after 8 years, relative to control group mean. Similarly, for teenage women with age range of 15-19 years old, we also find a negative impact. This impact starts with a decline of 4.3% in year 3, dropping to 6.0% in 4 years of implementation until the year 8, when it reaches 9.4% on the 15-19 fertility rate. Finally, for the fertility for teenage women rate aged 10-14, we find also a decline of 7.4%, starting on FHS year 3, dropping to around of 23% at program year 8, and to 52.6% in year 19 of FHS exposition.

Table 4 and figures 5 and 7 also provide the impact of the FHS on the diagnosis of HIV / AIDS. We only found an increase in the diagnosis of HIV / AIDS for adolescent girls aged 10 to 19 and 15 to 19 years. But especially for this result, the program can have adverse effects. The implementation of the program can have two mechanisms. First, it may be that FHS causes adolescents to use more contraceptive methods, which would probably cause the rate to drop. And second, the arrival of the program may cause an increase in the number of HIV diagnoses, not actual new infections.

Finally, in a secondary analysis, figures 9 to 14 present the results of the long-run effects of the FHS in the north and northeast region of Brazil. In general, those figure shows a clear pattern of decline on the teenage fertility rate in the program immediately in the first year of implementation. And this drop rises steadily until year 19 of program exposure in the municipality. The table with the FHS regressions in the north and northeast of Brazil was omitted by considerations of space. Overall, we also found a clear decline in the implementation of the FHS in the adolescent fertility rate. However, this occurs with a greater magnitude because they are regions of poverty and difficult access to health. These results are in line with empirical evidence that community-based health intervention and information dissemination lead to a reduction in the fertility of women. (Dupas, 2011; Duflo et al., 2015; Bhalotra et al., 2019).

6.3. Confounding Factors and Sensitivity Analysis

Here we discuss the results of robustness tests, both for the municipal level and the individual level regressions, available with the authors upon request. For the individual level regressions tables 1 to 3, we estimate Rosenbaum Bounds to check robustness of the results. This test assesses whether the results might be affected by omitted variables. In general, the results of this sensitivity analysis support the conclusion of a positive and significant effect of the FHS on the probabilities of contraceptive use and also for the health care of female teenagers. The results start to become sensitive to hidden bias when we use gammas higher than 1.6, with few exceptions in particular outcome like table method.

For municipality-level regressions we use dummies placebos. This dummies were constructed to investigate the effects of the FHS in municipalities before the program implementation. This can be seen both in tables 4 and figures 2 to 14. The placebo-like test is done using prior periods in which the treatment has not yet occurred, using the dummies to capture the exposure time prior to program intervention. In general, these estimates are not statistically significant and follow a pattern. With few exceptions, these coefficients suggest that our empirical analysis is not threatened by non-parallel trends, at least when assesses during pre-program periods.

7. Final Remarks

This paper provides the first investigation on how the Family Health Strategy, Brazil's federal initiative to expand access to primary care through a community-based home visiting approach, affects outcomes related to the sexual and reproductive health of adult and teenage women living in different household structures. We use a wide range of publicly available data to perform analyses at individual and municipality levels adopting strategies of propensity score and differences-in-differences, respectively.

Overall, our results at the individual level support the evidence that the Family Health Strategy visits increase the likelihood of using contraceptive methods among women over the age of 18, and this effect occurs differently when we look at the different household structures. We also found evidence that, when the household has the presence of female adolescents, the effect of the program on the use of contraception is performed in greater magnitude. This evidence support the idea that when the household has female teenagers the health professionals might be more concerned about disseminating contraceptive methods, as supported by, e.g., Hutchinson et al. (2003). The main mechanisms of the FHS towards contraceptive use seem to be the male condom, the contraceptive pill and the combination of both, which is the most effective against unwanted pregnancies and sexually transmitted diseases (Cates Jr and Steiner, 2002; Dupas, 2011).

The Family Health Strategy seems to affect young girls at several ages. This is observed not once, but twice using different methods and data sets. We explore contraceptive use and the heterogeneity effect of the program on health outcomes. We found that the program has a negative impact on teenage fertility rates throughout its implementation, which we interpret to be linked to an increased use of contraceptive methods, as evidenced by the individual-level results.

We believe our findings to be important inputs for the discussion in low- and middle-income countries, where inequality is particularly striking, education attainment is low and the fertility rates among teenagers is more prevalent. Programs such as the Family Health Strategy can be extremely important in disseminating information about the importance of contraceptive methods and thus promoting their use, especially for adolescents living in social vulnerability.

Table 1: Effects of FHS on the Probabilities on the Health Care and Contraception Methods use for Women on Different Family Structures

	Household with Teenagers Men[1]			Household with Teenagers Women[2]			Household only Teenage Women[3]		
Dependent variable:	Probit	PSW	PSM	Probit	PSW	PSM	Probit	PSW	PSM
Prob. of use Contraceptive Methods	0.001	-0.007	0.008	0.024**	0.015	0.031**	0.034***	0.026**	0.024*
	(0.013)	(0.012)	(0.015)	(0.012)	(0.011)	(0.014)	(0.013)	(0.012)	(0.016)
N	4,542	4,542	3,482	4,935	4,935	3,704	3,217	3,217	2,332
Prob. of use 2 Contraceptive Methods	0.002	0.006	-0.005	0.014	0.009	-0.007	0.030	0.025	0.021
	(0.014)	(0.014)	(0.015)	(0.017)	(0.016)	(0.017)	(0.022)	(0.022)	(0.022)
N	4,542	4,542	3,482	4,935	4,935	3,704	3,217	3,217	2,331
Prob. of use Common Contraceptive	0.040	0.029	0.030	0.057**	0.043	0.055	0.078***	0.078**	0.023
	(0.034)	(0.029)	(0.040)	(0.029)	(0.028)	(0.037)	(0.033)	(0.035)	(0.035)
N	1,643	1,643	1,230	1,960	1,960	1,352	1,364	1,364	898
Prob. of use Perm. Contraceptive	0.014	-0.003	0.040	0.060***	0.044***	0.064***	0.100***	0.095***	0.075**
	(0.024)	(0.020)	(0.032)	(0.023)	(0.022)	(0.027)	(0.032)	(0.033)	(0.037)
N	2,095	2,095	1,652	2,088	2,088	1,622	1,190	1,190	864
Prob. of use Non-Perm. Contraceptive	0.010	0.001	0.007	0.030*	0.020	0.041**	0.042***	0.034**	0.046**
	(0.018)	(0.016)	(0.022)	(0.017)	(0.016)	(0.020)	(0.017)	(0.018)	(0.022)
N	2,725	2,725	2,008	3,175	3,175	2,273	2,247	2,247	1544
Prob. to go Family planning meeting	0.013**	0.013***	0.007**	0.014**	0.013**	0.001	0.011*	0.010*	0.004
	(0.005)	(0.004)	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)	(0.005)	(0.004)
N	4,542	4,542	3,482	4,935	4,935	3,704	3,217	3,217	2,332
Prob. to visit Medical Doctor (3 months ago)	0.059***	0.062***	0.070**	0.038	0.039	0.037	0.032	0.033	0.059*
	(0.026)	(0.026)	(0.027)	(0.027)	(0.026)	(0.030)	(0.033)	(0.033)	(0.039)
N	4,542	4,542	3,482	4,935	4,935	3,704	3,217	3,217	2,332
Prob. to visit Medical Doctor (1 year ago)	0.052***	0.049***	0.049*	0.044**	0.045**	0.046*	0.044*	0.042*	0.067**
	(0.018)	(0.018)	(0.021)	(0.020)	(0.020)	(0.025)	(0.025)	(0.024)	(0.032)
N	4,542	4,542	3,482	4,935	4,935	3,704	3,217	3,217	2,332
Prob. to take Blood Exam	0.062***	0.078***	0.095***	0.054***	0.060***	0.084***	0.034	0.026	0.036
	(0.021)	(0.020)	(0.027)	(0.021)	(0.021)	(0.027)	(0.025)	(0.025)	(0.036)
N	4,542	4,542	3,482	4,935	4,935	3,703	3,217	3,217	2,332

Note: This table present the results of the effect of FHS on probabilities of use contraceptive methods to prevent the pregnancy for women with more than 18 years old, at individual level. This estimations are separate in 3 different samples. Control variables were omitted due to space considerations. Standard errors clustered at the household level are in parentheses. *, ** and *** represent statistical significance of 10%, 5% and 1%, respectively. [1] This sample includes only women in household with male children and adolescents aged 10 to 19 years. [2] This sample includes only women in household with female children and adolescents aged 10 to 19 years. [3] This sample includes only women in household with only female children and adolescents aged 10 to 19 years.

Table 2: Effects of FHS on the Probabilities of Contraceptives Methods use for Women on Different Family Structures

	Household with Teenage Men[1]			Household with Teenage Women[2]			Household only Teenage Women[3]		
Dependent variable:	Probit	PSW	PSM	Probit	PSW	PSM	Probit	PSW	PSM
Prob. of Male Condom	0.035	0.028	0.034	0.090***	0.082**	0.086**	0.121***	0.123***	0.149***
	(0.040)	(0.036)	(0.051)	(0.035)	(0.038)	(0.042)	(0.039)	(0.043)	(0.049)
N	1,376	1,376	1,022	1,619	1,619	1,152	1,129	1,129	776
Prob. of Contraceptive pill	0.010	-0.013	-0.033	0.061**	0.044*	0.045	0.072***	0.066**	0.038
	(0.030)	(0.027)	(0.031)	(0.027)	(0.026)	(0.030)	(0.026)	(0.030)	(0.025)
N	1,547	1,547	1,142	1,802	1,802	1,282	1,304	1,304	889
Prob. of use Table	0.125**	0.104**	0.056*	0.076	0.076	-	0.051	0.051	0.089
	(0.063)	(0.049)	(0.032)	(0.078)	(0.065)	-	(0.080)	(0.080)	(0.103)
N	403	403	277	465	465	-	318	318	161
Prob. of use Contraceptive Injection	0.077	0.046	0.124	0.033	-0.008	-0.042	0.091	0.001	0.036
	(0.072)	(0.069)	(0.094)	(0.069)	(0.065)	(0.075)	(0.081)	(0.001)	(0.099)
N	598	598	442	726	726	452	498	498	270
Prob. of Pill and Condom	0.015	0.007	0.019	0.235***	0.170***	0.182**	0.303***	0.234***	0.345***
	(0.072)	(0.066)	(0.085)	(0.064)	(0.069)	(0.085)	(0.067)	(0.083)	(0.074)
N	611	611	451	723	723	486	509	509	324
Prob. of Conditional Condom	-0.076	-0.060	-0.062	0.102**	0.059	0.137***	0.148***	0.121***	0.118*
	(0.051)	(0.050)	(0.060)	(0.051)	(0.048)	(0.053)	(0.058)	(0.055)	(0.065)
N	1,062	1,062	791	1,258	1,258	910	888	888	609
Prob. of Conditional Pill	0.020	0.019	-0.028	0.080**	0.051	0.083**	0.106***	0.082**	0.132***
	(0.035)	(0.041)	(0.044)	(0.037)	(0.037)	(0.040)	(0.041)	(0.043)	(0.038)
N	1,233	1,233	890	1,441	1,441	1011	1,063	1,063	758
Prob. of Vasectomy	-0.008	-0.040	-0.001	0.133*	0.070**	0.074***	0.208***	0.113***	0.024
	(0.059)	(0.033)	(0.034)	(0.072)	(0.032)	(0.043)	(0.086)	(0.038)	(0.496)
N	495	495	343	525	525	321	350	350	197
Prob. of Tubal Ligation	0.028	0.008	0.028	0.070***	0.045**	0.041*	0.116***	0.101***	0.040*
	(0.028)	(0.024)	(0.035)	(0.027)	(0.023)	(0.024)	(0.036)	(0.037)	(0.023)
N	1,914	1,914	1,516	1,924	1,924	1,466	1,081	1,081	793
Prob. of use Others Methods	-0.163**	-0.126*	-0.141	-0.002	-0.039	0.066	0.152*	0.146	0.060
	(0.073)	(0.076)	(0.089)	(0.076)	(0.070)	(0.090)	(0.086)	(0.164)	(0.103)
N	574	574	389	659	659	399	443	443	247

Note: This table present the results of the effect of FHS on probabilities of use contraceptive methods to prevent the pregnancy for women with more than 18 years old, at individual level. These estimates are separated into 3 different samples. Control variables were omitted due to space considerations. Standard errors clustered at the household level are in parentheses. *, ** and *** represent statistical significance of 10%, 5% and 1%, respectively. [1] This sample includes only women in household with male children and adolescents aged 10 to 19 years. [2] This sample includes only women in household with female children and adolescents aged 10 to 19 years. [3] This sample includes only women in household with only female children and adolescents aged 10 to 19 years.

Table 3: Effects of FHS for Teenagers Women on Health Care for Different Family Structures

	Teenage Women 10-19			Teenage Women 15-19			Teenage Women 10-14		
Dependent variable:	Probit	PSW	PSM	Probit	PSW	PSM	Probit	PSW	PSM
				All Households					
Prob. to visit Medical Doctor (1 year ago)	0.039***	0.030**	0.034**	0.047***	0.042***	0.052***	0.031*	0.017	0.054*
	(0.013)	(0.013)	(0.015)	(0.017)	(0.016)	(0.021)	(0.017)	(0.018)	(0.021)
N	18,411	18,411	14,092	9,473	9,473	7,084	8,938	8,938	7,043
Prob. to visit Medical Doctor (2 years ago)	0.028***	0.022**	0.032***	0.018*	0.017	0.027**	0.039***	0.027**	0.043
	(0.009)	(0.009)	(0.012)	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)	(0.017)
N	18,411	18,411	14,092	9,473	9,473	7,084	8,938	8,938	7,043
				Households with Adult Women[1]					
Prob. to visit Medical Doctor (1 year ago)	0.045***	0.035***	0.045***	0.061***	0.059***	0.083***	0.031*	0.015	0.009
	(0.014)	(0.014)	(0.016)	(0.013)	(0.018)	(0.022)	(0.018)	(0.018)	(0.021)
N	15,043	15,043	11,550	7,065	7,065	5,287	7,978	7,978	6,259
Prob. to visit Medical Doctor (2 years ago)	0.033***	0.026**	0.037***	0.033**	0.032***	0.041***	0.034***	0.024*	0.024
	(0.010)	(0.010)	(0.013)	(0.013)	(0.012)	(0.016)	(0.014)	(0.014)	6,017
N	15,043	15,043	11,099	7,065	7,064	5,287	7,978	7,978	6,259
				Households without Adult Women[2]					
Prob. to visit Medical Doctor (1 year ago)	0.021	0.018	0.005	0.013	-0.002	0.010	0.057	0.085	0.059
	(0.031)	(0.032)	(0.038)	(0.033)	(0.033)	(0.039)	(0.057)	(0.057)	(0.062)
N	3,368	3,368	2,510	2,408	2,408	1,779	960	960	717
Prob. to visit Medical Doctor (2 years ago)	0.009	-0.001	0.001	-0.018	-0.026	-0.013	0.079**	0.060*	0.047
	(0.016)	(0.017)	(0.019)	(0.017)	(0.017)	(0.021)	(0.032)	(0.032)	(0.030)
N	3,368	3,368	2,510	2,408	2,407	1,779	960	960	717

Note: This table present the results of the effect of FHS on probabilities go to the doctor for teenage women aged between 10 to 19 years old, at individual level. These estimates are separated into female adolescents in different types of families and different age groups. Control variables were omitted due to space considerations. Standard errors clustered at the household level are in parentheses. *, ** and *** represent statistical significance of 10%, 5% and 1%, respectively. [1] This sample includes female teenagers in household with at least 1 adult women aged 20 to 49 years old. [2] This sample includes female teenagers in household without adult women aged 20 to 49 years old.

Table 4: Long-run Effects of FHS on Fertility Rate and HIV/AIDS Diagnosis for Teenage Women

	Fertility Rate 10-19	Fertility Rate 15-19	Fertility Rate 10-14	HIV/AIDS Rate 10-19	HIV/AIDS Rate 15-19	HIV/AIDS Rate 10-14
Control mean	39.088	77.432	3.239	0.1059	0.0196	0.0019
FHS Year -8	1.0116	1.7289	0.1335	-0.0148	-0.0292	0.0003
	(0.471)	(0.533)	(0.525)	(0.139)	(0.114)	(0.969)
FHS Year -7	1.2137	2.3236	0.1286	-0.0109	-0.0202	-0.0010
	(0.320)	(0.334)	(0.490)	(0.193)	(0.195)	(0.885)
FHS Year -6	1.6563	3.4519	0.1444	-0.0080	-0.0133	-0.0020
	(0.194)	(0.181)	(0.373)	(0.234)	(0.282)	(0.726)
FHS Year -5	1.4671	3.0556	0.0932	-0.0077	-0.0137	-0.0012
	(0.160)	(0.144)	(0.479)	(0.183)	(0.213)	(0.800)
FHS Year -4	0.2854	0.6539	0.0625	-0.0080*	-0.0137*	-0.0022
	(0.673)	(0.624)	(0.539)	(0.070)	(0.097)	(0.562)
FHS Year -3	0.0780	0.2239	0.0198	-0.0036	-0.0064	-0.0007
	(0.882)	(0.830)	(0.793)	(0.294)	(0.328)	(0.805)
FHS Year -2	0.1075	0.2821	0.0373	-0.0042*	-0.0069	-0.0016
	(0.772)	(0.699)	(0.461)	(0.059)	(0.103)	(0.317)
FHS Year 0	-0.0549	-0.1950	-0.0082	0.0014	0.0025	0.0002
	(0.868)	(0.762)	(0.871)	(0.499)	(0.543)	(0.888)
FHS Year 1	-0.3175	-0.7851	-0.0906	0.0053*	0.0097*	0.0006
	(0.525)	(0.420)	(0.239)	(0.096)	(0.097)	(0.822)
FHS Year 2	-0.7360	-1.7268	-0.1424	0.0107**	0.0151*	0.0060
	(0.297)	(0.211)	(0.194)	(0.018)	(0.068)	(0.157)
FHS Year 3	-1.5753*	-3.4808*	-0.2442*	0.0116*	0.0200*	0.0026
	(0.090)	(0.056)	(0.095)	(0.055)	(0.087)	(0.638)
FHS Year 4	-2.3566**	-4.9841**	-0.3225*	0.0153**	0.0245*	0.0055
	(0.044)	(0.030)	(0.081)	(0.044)	(0.089)	(0.436)
FHS Year 5	-3.3765**	-6.9516**	-0.4330*	0.0197**	0.0320*	0.0067
	(0.020)	(0.015)	(0.057)	(0.033)	(0.071)	(0.435)
FHS Year 6	-4.1810**	-8.5255**	-0.5367*	0.0250**	0.0391*	0.0100
	(0.016)	(0.012)	(0.050)	(0.023)	(0.061)	(0.328)
FHS Year 7	-5.1603**	-10.3890***	-0.6433**	0.0272**	0.0442*	0.0094
	(0.011)	(0.009)	(0.046)	(0.034)	(0.071)	(0.430)
FHS Year 8	-5.7688**	-11.5498**	-0.7403**	0.0325**	0.0504*	0.0137
	(0.012)	(0.010)	(0.045)	(0.030)	(0.074)	(0.334)
FHS Year 9	-6.4737**	-12.7185**	-0.8228*	0.0380**	0.0621*	0.0130
	(0.013)	(0.012)	(0.050)	(0.024)	(0.055)	(0.415)
FHS Year 10	-7.1477**	-13.9454**	-0.9517**	0.0421**	0.0642*	0.0193
	(0.012)	(0.012)	(0.044)	(0.027)	(0.077)	(0.287)
FHS Year 11	-7.8605**	-15.1628**	-1.0568**	0.0480**	0.0744*	0.0209
	(0.012)	(0.012)	(0.043)	(0.024)	(0.068)	(0.299)
FHS Year 12	-8.2426**	-16.1624**	-1.0747*	0.0499**	0.0770*	0.0221
	(0.015)	(0.014)	(0.062)	(0.034)	(0.086)	(0.317)
FHS Year 13	-8.6888**	-17.0897**	-1.1560*	0.0572**	0.0911*	0.0225
	(0.018)	(0.017)	(0.066)	(0.027)	(0.064)	(0.345)
FHS Year 14	-8.8524**	-17.5370**	-1.2471*	0.0644**	0.1020*	0.0260
	(0.024)	(0.022)	(0.066)	(0.024)	(0.058)	(0.321)
FHS Year 15	-9.0166**	-17.9276**	-1.2629*	0.0697**	0.1112*	0.0274
	(0.032)	(0.029)	(0.086)	(0.024)	(0.057)	(0.337)
FHS Year 16	-9.3471**	-18.7156**	-1.3081*	0.0721**	0.1164*	0.0271
	(0.036)	(0.032)	(0.098)	(0.032)	(0.067)	(0.374)
FHS Year 17	-9.8467**	-19.6227**	-1.4892*	0.0781**	0.1257*	0.0301
	(0.036)	(0.032)	(0.081)	(0.033)	(0.069)	(0.359)
FHS Year 18	-10.0764**	-20.0866**	-1.5379*	0.0826**	0.1338*	0.0313
	(0.041)	(0.038)	(0.091)	(0.035)	(0.071)	(0.372)
FHS Year 19	-11.0393**	-22.0137**	-1.7093*	0.0913**	0.1505*	0.0321
	(0.029)	(0.027)	(0.087)	(0.036)	(0.067)	(0.410)
N	115,691	115,689	115,691	115,691	115,691	115,691

Note: This table present the results of effects of FHS on fertility rate of teenage women with 15-19 years old, at municipality-level. The interval is between 1996 to 2016. All specifications include cluster standard errors at at municipality-level. As well municipality, state, year fixed-effects and municipality-specific linear time trend. All regressions are weighted by population of interest. Control variables were omitted due to space considerations. Values in parentheses are the robust p-values of the coefficients. *, ** and *** represent statistical significance of 10%, 5% and 1%, respectively.

Figure 1: Long-run Exposition Effects of FHS on Fertility Rate and HIV/AIDS Diagnosis for Teenage Women

Figure 2: Fertility Rate 10-19

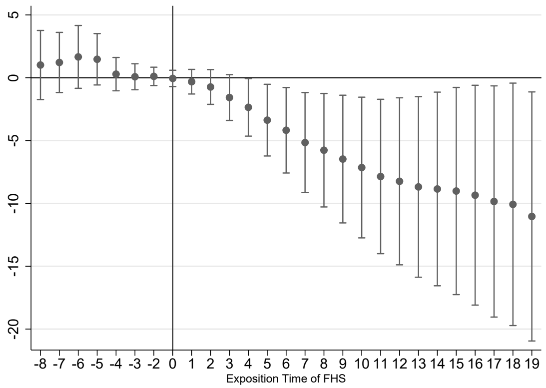


Figure 3: Fertility Rate 15-19

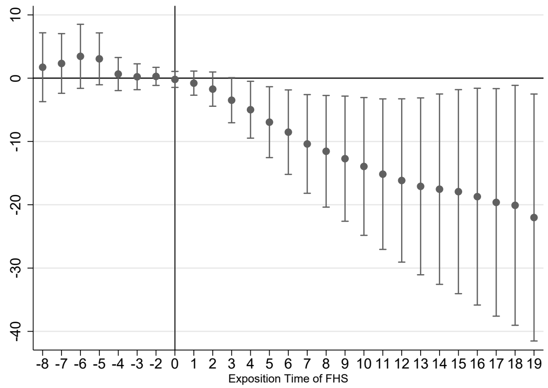


Figure 4: Fertility Rate 10-14

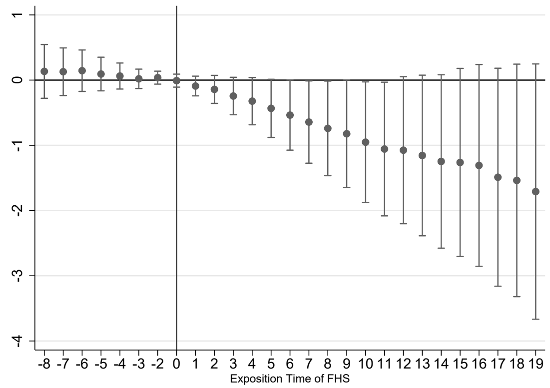


Figure 5: HIV/Aids Diagnostic Rate 10-19

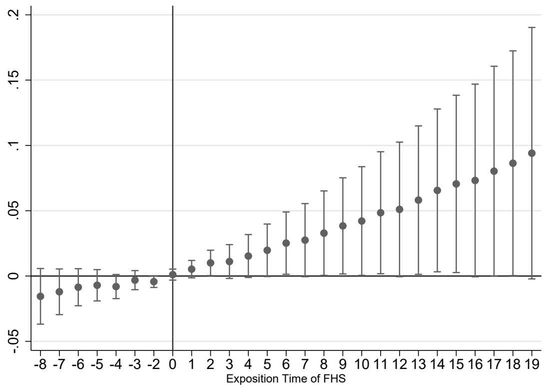


Figure 6: HIV/Aids Diagnostic Rate 15-19

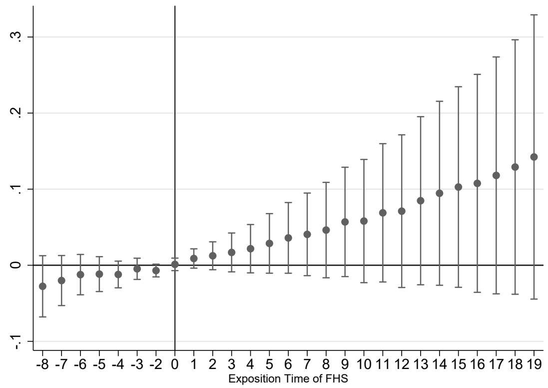


Figure 7: HIV/Aids Diagnostic Rate 10-14

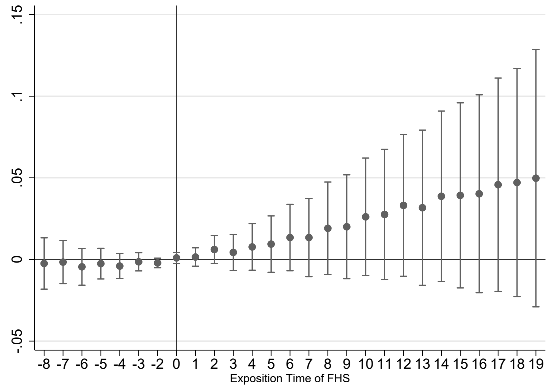


Figure 8: Long-run Effects of Exposition of FHS on Fertility Rate and HIV/AIDS Diagnosis for Teenage Women in Northeast and North of Brazil

Figure 9: Fertility Rate 10-19

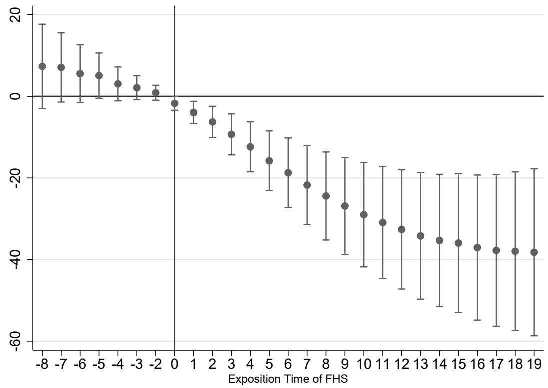


Figure 10: Fertility Rate 15-19

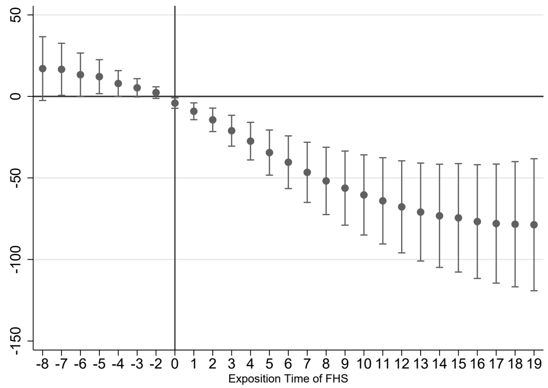


Figure 11: Fertility Rate 10-14

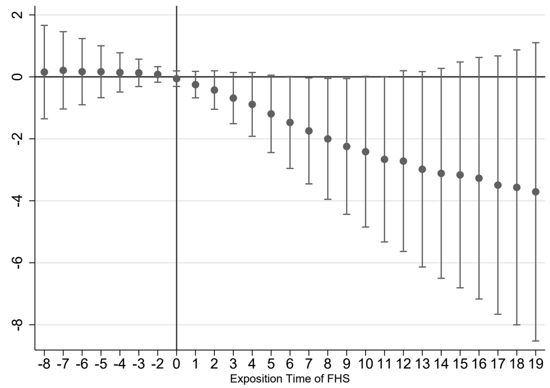


Figure 12: HIV/Aids Diagnostic Rate 10-19

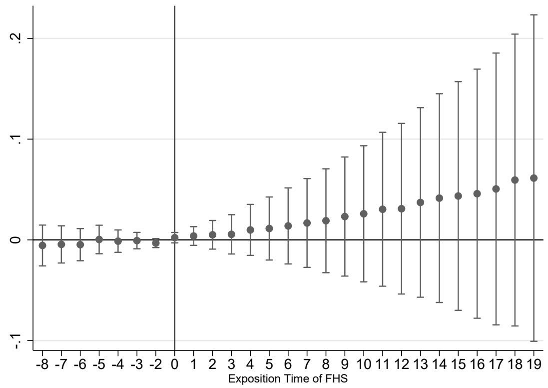


Figure 13: HIV/Aids Diagnostic Rate 15-19

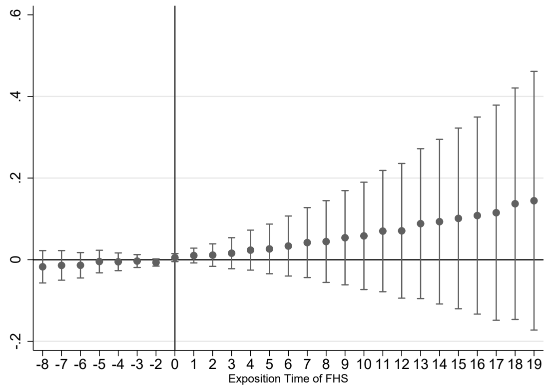
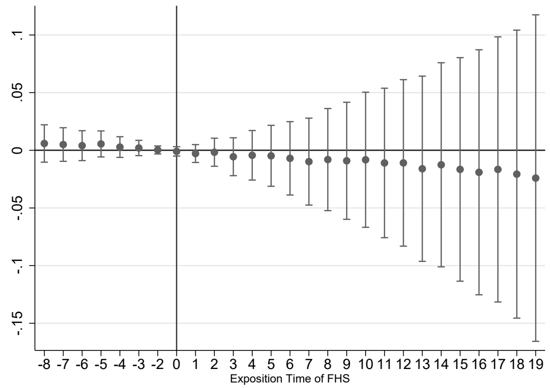


Figure 14: HUV/Aids Diagnostic Rate 10-14



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