Effects of extending primary healthcare hours on health facilities organization and healthcare usage

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Abstract

This paper evaluates the "Saúde na Hora" program, a policy initiative in Brazil aimed at increasing access to primary healthcare (PHC) by extending the operational hours of PHC facilities. Using a difference-in-differences research design and data from multiple sources, we provide causal evidence on the program's impact on healthcare service delivery and utilization. Our findings indicate that the program significantly increased the operational hours of PHC facilities, particularly during non-commercial hours and weekends and that this expansion was accompanied by a substantial increase in staffing levels, specifically the hours worked by general physicians and certified nurses. We document a 26% increase in patient visits, reflecting higher utilization of PHC services, and a 20% improvement in the productivity of healthcare professionals, as measured by visits per physician hour. We found no significant negative impacts on nearby non-participating clinics, indicating a net positive effect on the healthcare system. However, there is no evidence that the program reduced emergency visits to the closest urgent care center.

Keywords: primary healthcare utilization, working hours, difference-in-differences

JEL codes: I11, I12, I18, H51

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1 Introduction

Primary Health Care (PHC) is the building block of effective health systems, crucial for mitigating health disparities and preventing long-term disease burdens. It stands as an important public service, particularly significant in the context of global population trends that include an aging population and a surge in non-communicable diseases. Moreover, in the absence of PHC facilities patients often seek more costly alternatives such as hospital-based urgent care centers, even for events that could be solved in a PHC unit (Bhalotra et al., 2023). Hence, enhancing access to PHC not only promises improved health outcomes but also presents a strategic avenue for governments to reduce overall healthcare expenditures.

Access to PHC can be increased along two dimensions: the extensive and the intensive margins. Extensive margin improvements, which entail establishing PHC services where none previously existed, have shown substantial long-term public health benefits (Rao and Pilot, 2014; Rocha and Soares, 2010; Macinko et al., 2006). Conversely, changes in the intensive margin involve organizational changes to improve access or quality of care within existing PHC facilities. This dimension presents a more complex challenge, as it requires an understanding of the health production function at each facility, highlighting the necessity for empirical evidence to guide the efficient organization of PHC.

This paper contributes to the understanding of effective PHC organization by examining the impacts of a Brazilian initiative starting in 2019 aimed at extending PHC operational facility hours, the "Saúde na Hora" program. The program allocates additional funding to facilities meeting specific operational and staffing criteria, targeting regions with high demand for health services. It operates through an opt-in design, where the Ministry of Health accepts applications from municipal health units in a rolling-basis. The design of the program introduced changes in the provision of health services that can be used to identify the causal effects of the program. First, it created treatment and control groups, defined as facilities that adopted and did not adopt the program. Second, given the staggered adoption, we observe the outcomes over time, before and after program adoption.

While intuitively, longer hours might suggest increased health service provision, several factors could mitigate this effect. Resource constraints, for instance, might impede effective service delivery despite extended hours. Moreover, access barriers such as distance and cost, rather than operating hours, might pose significant challenges. Behavioral factors also play a role, since patients might remain unaware of extended hours or prefer to reach other available services such as emergency centers.

To assess the program's impact on PHC access, we examine changes in operational inputs

(e.g., facility and physician hours) and health service outputs (e.g., number of patient visits). Then, we test if the program was able to reduce the number of emergency visits in urgent care centers. We employ a difference-in-differences research design, integrating data from multiple sources to offer causal evidence of the program's effects. The program's voluntary, staggered adoption creates treatment and control groups and enables us to identify the program's impact. Since the assignment was based on the facilities voluntary adoption, units that received the treatment may differ in many pre-treatment dimensions from units that did not receive. To mitigate the concerns raised by this plausible selection into treatment, we allow for the conditional parallel trends assumption, using several pre-treatment covariates to re-weight the estimates using a doubly-robust estimator (Callaway and Sant'Anna, 2021). Moreover, we include the not-yet treated units in our main estimation to increase the reliability of the comparison between treated and untreated units.

Overall, our findings provide comprehensive evidence of the "Saúde na Hora" program's success in improving PHC access and utilization in Brazil. We find significant changes in the operational aspects of PHC facilities participating in the program. First, we observe a sizeable increase in total facility hours, particularly during non-commercial hours and weekends, suggesting an improvement in the availability of PHC services. The program also positively impacted staffing levels, with a substantial rise in the number of hours worked by general physicians and certified nurses, aligning with the program's requirements.

These operational improvements resulted in a significant increase in patient visits, demonstrating the effectiveness of extended hours in enhancing PHC utilization. We observed a 26% rise in visits, with a consistent divergence between treatment and control groups post-implementation. Moreover, the program enhanced healthcare professional productivity, with visits per physician hour increasing by approximately 20%. This suggests a more efficient allocation of healthcare resources, enabling better patient management without overburdening the staff. These results are robust across various specifications and samples.

The heterogeneous effects of the extended hours program show important variations in its impact based on the characteristics of PHC facilities and their geographic locations. Notably, while urban and rural areas both experienced significant benefits from the program, the effects were more volatile in urban settings, reflecting diverse local conditions and challenges. Besides, the effects of the program did not vary much across facilities that adopted it at different times, suggesting that earlier adopters did not benefit more from the program. These findings mitigate some concerns about selection into treatment.

Moreover, as expected, the impact varied according to the specific version of the program adopted, with more intensive versions yielding stronger effects due to higher requirements for operational hours and staffing. Our analysis of potential negative spillovers on nearby non-participating clinics showed no significant adverse effects, indicating that the program did not detract from healthcare provision in neighboring facilities.

Finally, one goal of the extended hours program was to reduce visits to Urgent Care Centers (UCCs). However, our difference-in-differences suggest no significant impacts in this regard, with UCC visits remaining unchanged before and after the program was implemented. This finding should be interpreted with caution, as it involves challenges such as identifying which UCCs were affected, measuring impacts without considering visit types or severity, and accounting for patient preferences for urgent care despite increased accessibility to PHC.

This extended hours program aligns with a broader global trend of increasing healthcare accessibility and efficiency through extended hours. In Quebec, Strumpf et al. (2017) found that team-based PHC delivery with extended hours decreased outpatient utilization and costs, reducing PHC visits per patient by 11% annually and specialist visits by 6%, though without affecting hospitalization rates. Furthermore, a systematic review by Hone et al. (2020) highlighted mixed effects on emergency department utilization, noting limited evidence for reductions in non-urgent and semi-urgent emergency department visits. These results are in line with our findings for the "Saúde na Hora Program".

On the other hand, others have found evidence that increasing PHC availability can significantly reduce the burden on emergency services and improve patient outcomes. For instance, Dolton and Pathania (2016) demonstrated that a seven-day General Practitioner (GP) opening in the UK led to a 9.9% reduction in Accident and Emergency attendances, particularly during weekends. Similarly, Pinchbeck (2019) observed that the Equitable Access to Primary Medical Care (EAPMC) initiative in the UK reduced unplanned emergency department visits by up to 4%, primarily by addressing less urgent health issues through more accessible primary care settings. These studies provide a valuable comparative framework for assessing the "Saúde na Hora" program's impact on healthcare accessibility and resource allocation.

In the context of Brazil, existing evidence suggests that expanding PHC access in the intensive margin has historically yielded positive health results. The expansion of the PHC system, as studied by Hone et al. (2020) Bastos et al. (2017), was associated with a lower risk of death and reduced racial health disparities. Additionally, the "Mais Médicos" program, which placed doctors in under served areas, resulted in reduced hospital admissions for ambulatory care sensitive conditions Fontes et al. (2018) although it did

not significantly impact infant health outcomes Carrillo and Feres (2017). Finally, a program aimed at increasing Emergency Care (UPA) found reductions in hospital outpatient procedures and admissions Bhalotra et al. (2023). These findings underscore the potential of targeted health interventions to enhance health systems efficiency and equity and therefore the importance of providing empirical evidence to evaluate them. This is specially the case for a sizeable program like "Saúde na Hora" which makes yearly payments of nearly 100 million dollars.

The paper proceeds as follows: Section 2 provides background information on the program, Section 3 details the data used and outlines the empirical strategy, Section 4 presents the results and Section 5 concludes.

2 Background

Brazil's PHC system, known for its comprehensive and equitable approach, provides free health services to the entire population (Bastos et al., 2017). Despite its strengths, the system faces challenges, especially in ensuring access to the whole population. In this regard, initiatives to improve provision have been adopted, specially to reach at the remote and rural areas (Carrillo and Feres, 2019). Nonetheless, access to PHC health services still faces challenges. For example, even in highly populated urban areas many working individuals find it difficult to visit PHC facilities during standard working hours. Within those that do not rely on private healthcare provision or out-of-pocket consultations[1] the limited hours might lead to a high number of non-scheduled or walk-in visits and an over-reliance on emergency services for non-urgent issues. Moreover, many urgent visits could be managed within PHC settings if access were improved during evenings and weekends.

In this scenario, the "*Saúde na Hora*" program[2] is a Brazilian initiative aimed at expanding access to primary health care (PHC) by extending the operating hours of PHC facilities. Launched by the Ministry of Health in 2019, the program was designed to address significant challenges in the Brazilian health system, particularly in urban and metropolitan areas where access to care can be limited due to traditional operating hours.

The specific objectives are to extend the operating hours of Family Health Units (USF) and Basic Health Units (UBS), allowing greater access for users to services, to expand the coverage of the Family Health Strategy, to increase access to actions and services considered essential in Primary Health Care (APS), to increase the number of users in actions and

[1] Approximately one fourth of the population has private insurance in Brazil according to the National Agency for Supplementary Health (ANS): `https://www.ans.gov.br/images/stories/Materiais_para_pesquisa/Perfil_setor/sala-de-situacao.html`

[2] "Health at the Right Time", in a literal translation.

services promoted in USF and UBS, and to reduce the volume of care for users with low-risk health conditions in emergency and hospital emergency units (Campos et al., 2023; BRASIL, 2019).

The enrollment to the "Saúde na Hora" program is a voluntary process where municipalities or the Federal District can apply to extend the operation hours of their Family Health Units (USF). The application process involves the municipal or district health manager submitting an electronic form through the e-Gestor AB platform ran by the Ministry of Health. Then, the Ministry of Health evaluates the applications based on the program's criteria and requirements. Approved applications are confirmed through a decree published in the Official Gazette of the Union (DOU).

The main requirement for participating facilities is that they should extend their weekly operating hours to at least 60 or 75 hours. The funding available for each facilities varies across these different versions of the program. Table 1 summarizes the different branches. In short, the extension of working hours includes longer daily hours or additional weekend hours, thereby providing more opportunities for patients to access care at more convenient times.

Table 1: Description of program types

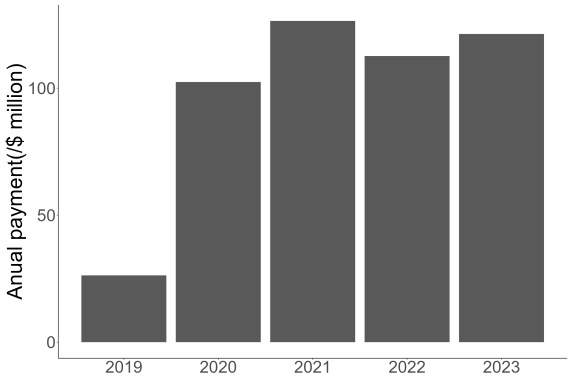
Version	**Human Resources**	**Funding (R$)**
60-hour limited	At least one health team (physician, registered nurse, vocational nurse, community health worker), providing services for a minimum of 60 hours per week	10,695 per month
60-hour standard	Minimum of three health teams, 120 hours of physicians and nurses	22,816 per month
60-hour standard plus dental	Equal to the 60-hour standard version, plus two dental teams or 80 hours for dentists	31,766 per month
75-hour	Minimum of six health teams and three dental health teams, 240 hours each for doctors and nurses, and 120 hours for dentists	59,866 per month

Payments for funding this extended hours program were significant, and the program be-

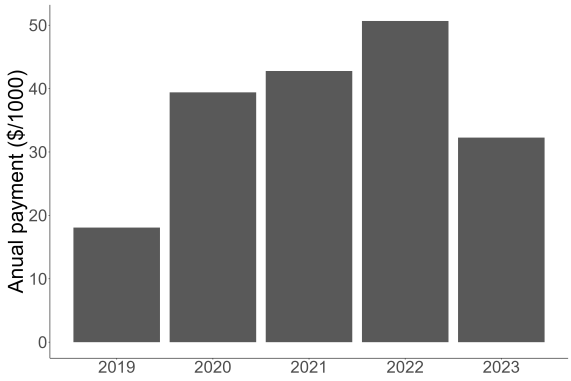
came the one of the biggest programs funded by the mixed payments system for primary care in Brazil (Rosa et al., 2023). Figure 1 shows the payments from 2019 to 2023, presenting the total, the payment for facility, and the payment by health team. Figure 1a shows that total payments per year are near 100 million dollars. Dividing the total payment by the number of facilities participating in the program, we observe in figure 1b that each facility got an extra funding close to 40-50 thousand dollars per year. Finally, each facility may encompasses a different number of Family Health Teams. Figure 1c shows that the payments per Health Team are close to 10 thousand dollars per year.

Figure 1c illustrates the size of the additional funding granted by the program. It paid nearly 10,000 USD per health team, representing a 20% increase compared to the amount granted through capitation and payment for performance, which is approximately 52,000 USD per team.[3]

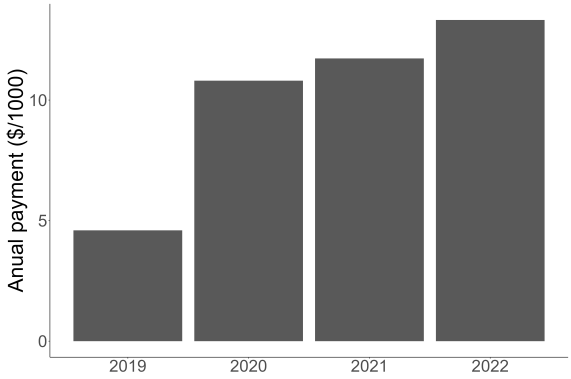
Figure 1: Payments for extended hours



(a) Total



(b) Per facility



(c) Per Health Team

[3]In Brazil, the most important funding source for primary care are the capitation and the performance-based payments Rosa et al. (2023), which are paid using the health team as the main parameter. In 2023, the Ministry of Health paid 3 billion USD from capitation and P4P for PHC. These resources were distributed across 50,000-57,000 health teams (family health), which translates into approximattely 52,000 USD per team.

In sum, the implementation of *"Saúde na Hora"* represents a significant policy effort to enhance the accessibility and efficiency of Brazil's PHC system. The program aims to impact health provision and inputs, such as the number of visits, staffing, and operating hours, which is a focal point of evaluation in this study. By analyzing these dimensions, we aim to improve our understanding on how the organization of the primary care health system might reduce disparities in access to care.

3 Data, research design, and descriptive statistics

This study utilizes data from various sources to evaluate the impact of the the extended hours program (*Saúde na Hora*) on PHC inputs and service delivery in Brazil, including records from the Brazilian Ministry of Health's DATASUS database, and characteristics of the municipalities available in the Brazilian Institute for Geography and Statistics (IBGE). We detail the key datasets and variables employed in our analysis below.

3.1 Data

Participation in the extended hours program

The enrollment to the "Saúde na Hora" program is a voluntary process where municipalities or the Federal District can apply to extend the working hours of PHC facilities The application process involves the municipal or district health manager submitting an electronic form to the Ministry of Health. Then, the Ministry of Health evaluates the applications based on the program's criteria and requirements. Approved applications are then confirmed through a decree published in the Official Gazette of the Union (DOU).

We have detailed data on the application process, including the exact PHC units the health managers applied to the program, exact dates when the health managers applied, the type of program the managers requested, and when the government released the authorizations for starting getting extra funding from the program. We do not know if the program was denied for any facility, since in our data we do not have information for health units that applied and were not accepted in the program. However, we have data on the facilities that did not comply with the requirements and where withdrawn from the program.

PHC Facilities, working hours, and human resources

We collected data on each Brazilian PHC facility from the Brazilian National Records of Health Facilities (CNES) from 2017 to 2022. The data includes the addresses of the facilities, their working hours (starting in 2018), the days the facilities are opened, and detailed

information about the human resources. From this data source, we generate the total number of hours the facility is opened over the week, and a variable indicating if the facility was opened on weekends. We also compute the number of physicians and certified nurses working in the facility, and the total number of hours associated to the these job contracts.

Patient visits in the PHC

The number of visits to Primary Health Care (PHC) facilities was gathered from the Brazilian Information System for Primary Care (SISAB). The data from SISAB was shared by the Ministry of Health via the Freedom of Information Act (LAI) and includes the number of visits to PHC facilities from 2017 to 2022 for each facility.[4] The data is monthly available, and we aggregated it by quarter to reduce noise and increase statistical power.

We have data on the number of visits categorized by different time periods and days of visits (before or after 5pm, week-days or weekends). However, the Ministry of Health shared truncated data, to prevent the identification of individual patients or specific professionals. Thus, if there were less than 6 visits, we only have an indication that there was a visit, but not the exact number. Additionally, the accuracy of this data is dependent on the quality of the information provided by the healthcare professionals. There may be discrepancies or inaccuracies, as professionals might not always accurately report the time of visits in the forms.

Urgent Care consultations

Another outcome variable that we are interested is the number of consultations in the urgent and emergent care facilities. For each hospital or urgent care center (UPA), we computed the total number of consultations. The data comes from the Ambulatorial Information System (SIA) from the Ministry of Health. We used specific health procedures codes to compute the consultations, which includes all consultations in these facilities related to emergency visits[5].

Also, as we explain later, we define the treatment status of urgent care facilities based on the distance from these facilities to the PHC facilities in the extended hours program. To generate this information, we geocoded urgent care facilities and PHC facilities, and calculated their distance to the PHC facilities that were treated.

[4] In order to qualify for financial support from federal government, PHC facilities must regularly report their operational data to the Ministry of Health. Failure to do so will result in the withholding of funds.

[5] We restrict the procedures in SIA to the group 03, subgroup 01, and organizational form 06. More information about what this restriction entails is present in `http://sigtap.datasus.gov.br/tabela-unificada/app/sec/inicio.jsp`. Accessed in July 2024.

Municipal characteristics

Given that the decision to participate in the program comes from the municipal health manager, we include municipal characteristics to deal with possible selection into treatment at the municipal level. Moreover, since the program focused on expanding working hours in metropolitan areas, we include the covariates that might capture this feature of the program. Thus, we use two municipal-level characteristics as covariates in our analysis: municipal GDP per capita and population. We also used the classification of rural or urban to analyze heterogeneous effects, since the intensive expansion of primary care can have different effects for each type of municipality.These variables are yearly provided by the Brazilian Institute for Geography and Statistics (IBGE).

3.2 Empirical strategy

In our analysis, we examine Primary Health Care (PHC) facilities that adopted the extended hours program. Application and take up of the program happened in a continuous basis, since each unit entered in the program at different time periods. Our dataset includes both units that participated in the program and those that did not. To assess the impact of the program, we employ the Callaway and Sant'Anna differences-in-differences (DiD) estimator (Callaway and Sant'Anna, 2021). This approach is particularly suitable for our study as it allows us to account for the staggered timing of program entry across different facilities. By comparing changes in outcomes between the treated and control groups before and after the program implementation, we aim to isolate the program's effect from other confounder factors.

In our setting, the treated units were those that applied to the program and stayed in the program across the periods we observed. The control group are those facilities that we do not observe in the program in any period or those who have not been treated yet. We defined that the treatment started when the facility applied to the program to avoid potential anticipation issues. We consider that once the health unit is treated it remains treated throughout the remaining dates of the panel.

The estimation of the difference-in-differences estimator proposed by Callaway and Sant'Anna (2021) follows a two step process. First, for each group of facilities that adopted the extended hours program in quarter g, we estimate a separated difference in differences, for each quarter t, using as comparison group municipalities that have not adopted the program yet or never adopted the program during the period we analyzed. Therefore, the control group is changing period by period to accommodate the units that become treated at each t. For identification of the causal parameters we rely on the conditional parallel trends assumption:

$$E[Y_t(0) - Y_{t-1}(0)|X, G = g] = E[Y_t(0) - Y_{t-1}(0)|X, D_s = 0, G \neq g]. \quad (1)$$

In equation 1 we impose that the parallel trends assumption holds, conditional on the covariates. That is, conditional on the covariates, had the treated units not been treated, they would have followed the same path as the untreated units.

Given the covariates' imbalance showed in table 2, estimating the differences in differences conditional on covariates is essential for our identification strategy. We assume that only municipalities and health units with similar characteristics would follow the same trend in outcomes in the absence of treatment. To account for non-random selection into the program adoption based on observables, we employed the doubly-robust difference-in-differences estimator proposed by Sant'Anna and Zhao (2020) and Callaway and Sant'Anna (2021). This approach helps to control for potential biases by ensuring that the comparison between treated and untreated facilities is based on similar observable characteristics[6]. Intuitively, we compare similar health units in similar municipalities. The identifying assumption is that these similar health facilities satisfy the parallel trends assumption.

The proposed estimator identifies the average treatment effect on the treated (ATT) for the groups defined by the units treated in a period g and for periods t after the beginning of the treatment. It also calculates placebos for periods before the start of the treatment. Then, it aggregates every $ATT(g,t)$ into other causal parameters of interest such as ATT, $ATT(g)$ or $ATT(t)$. The $ATT(g,t)$ are defined as:

$$ATT(g,t) = \mathbb{E}\left[\left(\frac{G_g}{\mathbb{E}[G_g]} - \frac{\frac{p_{g,t}(X)(1-D_t)(1-G_g)}{1-p_{g,t}}}{\mathbb{E}[\frac{p_{g.t}(X)(1-D_t)(1-G_g)}{1-p_{g,t}}]}\right)(Y_t - Y_{g-1} - m_{g,t}(X))\right] \quad (2)$$

where, g is the first time that the unit was treated, and G_g defines if the unit belongs to the cohort treated in g; D_t is a dummy that turns one if the the unit is treated in period t; $p_{g,t}(X)$ is the propensity score calculated for the cohorts treated in g using never-treated units and units that were not yet treated in t. The term inside the first pair of brackets is the inverse probability weighting estimand part. The last term is the outcome regression estimand part, where $m_{g,t}(X) = \mathbb{E}[Y_t - Y_{g-1}|X, D_t = 0, G_g = 0]$.

The estimation of equation 2 is done in a two-step manner. First, we estimate the propensity score ($p_{g,t}(X)$) and the outcome regression ($m_{g,t}(X)$) and, then, we plug in the fit-

[6] As discussed in Callaway and Sant'Anna (2021), we could also deal with covariate-specific trends using an outcome regression or an inverse probability weighting method. We chose the doubly-robust estimator because it incorporates both alternatives, being robust against model-misspecifications.

ted values into equation 2 and use a sample analogue of the estimated equation to find $\widehat{ATT(g,t)}$. We follow Callaway and Sant'Anna (2021) approach and use the computational package provided by the authors to estimate the equation.

In our preferred specification, we include covariates at the health facility level (number of appointments and health professionals' workload prior to the program) and at the municipal level (population and GDP per capita). To ensure asymptotically valid inference, we employ a bootstrap procedure that computes simultaneous confidence bands for the entire path of group-time average treatment effects. We account for autocorrelation at the health facility level, with standard errors bootstrapped clustered accordingly.

Concerns and threats to identification

The main concern to identification comes from the fact the municipalities and health facilities may select into treatment. Besides including covariates that are potentially related to the outcomes' evolution and, thus, allow for covariate-specific time trends, we also include not-yet-treated units in the estimation of equation 2 to partially mitigate these concerns.

Our identification strategy relies on the assumption that municipalities and health units select into treatment based on observable or fixed unobservable characteristics. If this is the selection process, then the conditional parallel trends assumption is not violated (Ghanem et al., 2022). However, one can be concerned that this is not the right selection process. Selection into treatment may occur because of time varying unobservables correlated with the treatment time. For example, this could occur if the quality of the municipal health manager is changing over time. To address this concern, we split our results by cohort of treatment, that is, we aggregate the $ATT(g,t)$ at the cohort-of-treatment level ($ATT(g)$). Although we cannot directly test the selection process, the idea is that the average treatment effects should be relatively stable over time if there is no selection on the time varying unobsorvables. We find that the effects are similar for different cohorts except for 2022, in which we may not have enough time to observe the total impact of the program yet.

Another concern relates to the possibility of negative spillovers to untreated health units in municipalities with treated health facilities. The program may have induced that municipal health managers allocate more health professionals in treated units, which could reduce the number of available health professionals in other untreated facilities. If that is the case, the program could cause a reduction in access to PHC in untreated units and we would overestimate the effects of the program on inputs and health services outcomes. We deal with this concern by estimating the effects of the program on untreated units located in treated municipalities. We do not observe negative spatial spillovers to these

health facilities.

Finally, one can be concerned about the estimator used. We show that our results hold regardless of the difference-in-differences estimator analyzed. Table A3 displays the effects of the program on visits for the two-way fixed effects, De Chaisemartin and d'Haultfoeuille (2020), Sun and Abraham (2021) and Borusyak et al. (2024) estimators.

3.2.1 Effects on urgent care centers' visits

Besides the direct effects on the organization of PHC facilities, we also estimate the indirect effects of the program on urgent care visits. To do so, we define that an urgent care center is treated if it is the closest urgent care center (UCC) to a treated health facility. The timing of treatment is first quarter in which the UCC received the treatment and the treatment is staggered. The UCCs that are not the closest center to any health facility are the control units (or never treated).

We follow the same identification and estimation approaches as above. The main difference is that we estimate the difference-in-differences at the UCC level, using the number of consultations that the UCC performed in 2017, municipal population and GDP per capita as covariates. The dependent variable is the number of consultations that happened in the urgent care centers.

3.3 Sample restriction

For our main sample, we performed minor restrictions in our data to have a balanced panel and remove units that left the program and could not be considered treated across the period of analysis. We started by excluding health facilities that had participated in the program but stopped complying with the requirements and were disqualified by the Ministry of Health.

Another restriction was to exclude from our sample the units that received resources from an emergency program during the Covid-19 pandemic. This program provided temporary funding from March to September 2020 for units that already operated 60 or more hours weekly. To mitigate concerns that health units may have participated in the program solely to address Covid-19-related issues, we removed from our sample the health units that received this specific branch of the program. While the impact of this branch could be interesting on its own, including it could raise concerns about our unconfoundedness assumption and complicate the interpretation of our results.

Finally, to mitigate concerns related to data reporting, we excluded units that reported zero visits in any quarter during the period of analysis (2018-2022). We applied simi-

lar sample restriction criteria for UCC analysis, excluding UCCs that were the nearest to PHCs receiving incentives from the emergency program or that left the analyzed policy.

As a robustness exercises, we provide additional estimates without the restrictions described above.

3.4 Descriptive statistics

The summary statistics presented in Table 2 provide a comprehensive overview of the characteristics of both treated and never-treated PHC facilities after applying our sampling restrictions. Examining these statistics reveals some notable differences between the two groups.

For example, the average number of visits in 2017 is higher for treated facilities (2950.42) compared to those that were never treated (956.38), indicating that treated facilities tend to serve more patients. Additionally, the average weekly working hours in 2018 is greater for treated facilities (52.2 hours) than for never treated ones (46.02 hours), and the proportion of facilities opening on weekends is also higher among the treated group (0.08) compared to the never treated group (0.01).

Further differences are evident in the physicians' weekly workload, with treated facilities reporting an average of 156.01 hours, while never treated facilities report 57.1 hours. Population size in 2016 and GDP per capita also differ significantly between the groups, with treated facilities serving larger populations (1644.56 per 1000) and being located in areas with higher GDP per capita (29.17) compared to never treated facilities (180.33 per 1000 population and 21.93 GDP per capita, respectively).

Additionally, the number of observations for each group is noteworthy. The treated group comprises 2,026 PHC facilities, while the never treated group includes a much larger number of 27,226 PHC facilities. These observed differences highlight the importance of using our research designing when estimating the causal parameter from the difference-in-differences estimator. By matching units and comparing changes over time between the treated and never treated groups, this method accounts for both observed differences, and ensures that the comparison between treated and control groups is as close as possible.

Table 2: Summary statistics - Treatment and never treated groups

	Never treated	**Treated**
Visits (2017)	956.38	2950.42
	(848.4)	(2972.7)
Working hours (weekly, 2018)	46.02	52.2
	(6.9)	(9.9)
Opening in weekends (2018)	0.01	0.08
	(0.1)	(0.3)
Physicians workload (weekly, 2018)	57.1	156.01
	(43.4)	(129.8)
Population (/1000, 2016)	180.33	1644.56
	(828.4)	(3236.6)
GDP per capita (/1000, 2016)	21.93	29.17
	(19.6)	(17.6)
PHC facilities	27,226	2,026
Urgente care centers	1360	423

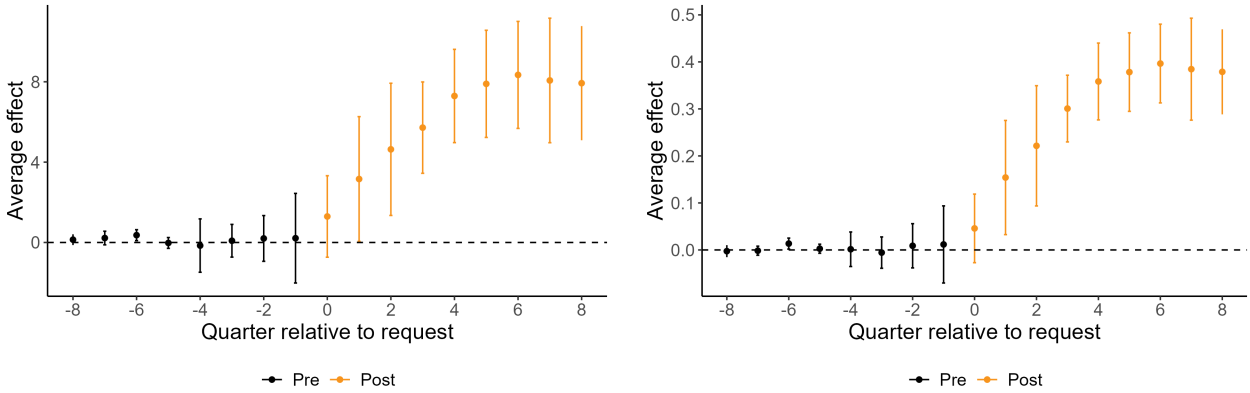
Note: The data presented in this table are sourced from the facilities register repository (CNES) and data from IBGE (population and GDP). The numbers in parentheses represent the standard deviations of the respective variables. Never treated and treated groups were defined restricting the sample for participants and non-participants of the program that informed at least one visit by quarter from 2018 to 2023.

4 Results

4.1 Effects on Health Inputs

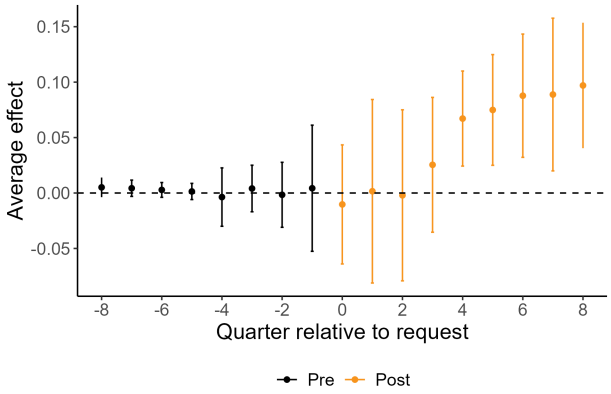
The extension of working hours induced by the *Saúde na Hora* program led to various organizational changes in PHC facilities, primarily in terms of operating hours, days of operation, and human resources. We present the results of the program's effects on these inputs below.

Figure 2: Effects of extended hours program on working hours of PHC facilities



(a) Total hours

(b) Opening after 5pm



(c) Opening on weekends

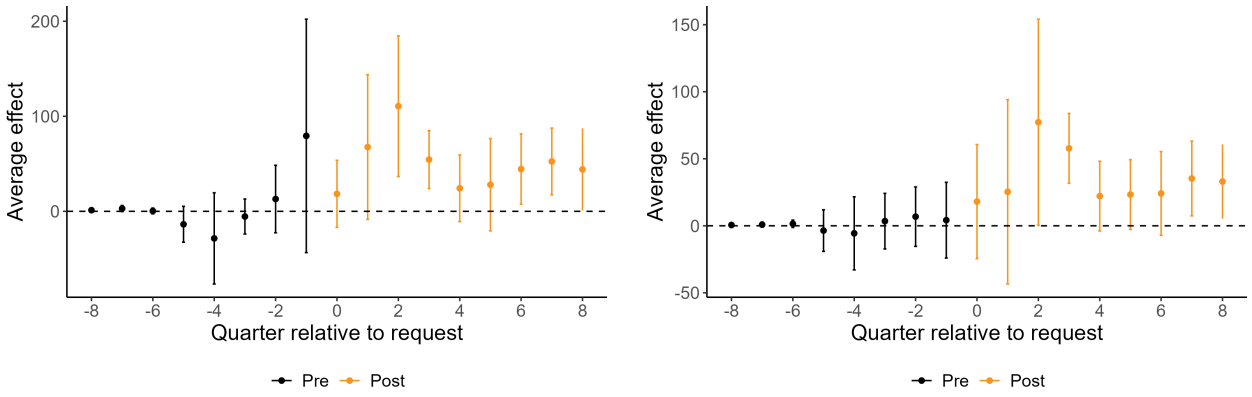
Note: Dynamic effects using the Callaway and Sant'Anna (2021) estimator on (a) total working hours, (b) binary indicating whether the facility opening after 5pm, and (c) opening on weekends. Treatment effects are shown for 8 quarters before (placebo) and 8 quarters after PHC facility treatment. Control variables include log of average attendances in 2017, physician working hours, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly attendance during this period. Only ever-treated considered as treated. Lines represents the confidence interval (95%).

One of the main changes was the increase in the number of hours PHC facilities work. Figure 2 displays the average treatment effect (ATT) estimates for the total number of hours, the non-commercial hours, and the likelihood of opening on the weekends. The results show a significant increase in all these dimensions, as expected by the design of the program. The average total opening hours increased gradually, achieving an increment of 8 hours after 4 quarters that the facility applied to enter in the program. This is a 15% increase compared to 52 hours they were opened on average in 2017, two years before the program. As required, PHC facilities started to provide primary care in the "non-commercial" hours (after 5pm) and on weekends. Figure 2b shows that the program increased by 40% the likelihood the PHC facility was opened after 5 p.m. Similarly,

Figure 2c indicates the program increased by 10 p.p. the likelihood of a PHC facility being opened on the weekends, which translates in doubling the proportion of PHC facilities opened on the weekends compared to the pre-treatment period (7% were opened, see Table 2).

The program also affected the number of health professionals. Participation on the program was conditional on specific requirements related to the minimum number of health teams, implying a minimum number of general physicians (GP) and certified nurses. Figure 3 presents the program ATT estimates for number of hours of GP and nurses, indicating a positive impact on supplied hours of these professionals. Figure 3a shows that the program, on average, increased by 49.9 the number of hours of GP. This is a 32% increase in the hours supplied by GPs, considering the total number of hours in PHC facilities in the program equals to 155 in 2017. We observe a similar pattern when analyzing nurse hours. Figure 3b shows the effects are positive, and the average ATT equals to 35.5 hours, or a 25% increase in the number of nurse hours compared to 2017.

Figure 3: Effects of extended hours program on human resources of PHC facilities



(a) GPs' total hours

(b) Nurses' total hours

Note: Dynamic effects using the Callaway and Sant'Anna (2021) estimator on (a) General Practitioners' total hours, and (b) nurses' total hours. Treatment effects are shown for 8 quarters before (placebo) and 8 quarters after PHC facility treatment. Control variables include log of average attendances in 2017, physician working hours, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly attendance during this period. Only ever-treated considered as treated. Lines represents the confidence interval (95%). Only ever-treated considered as treated. Lines represents the confidence interval (95%).

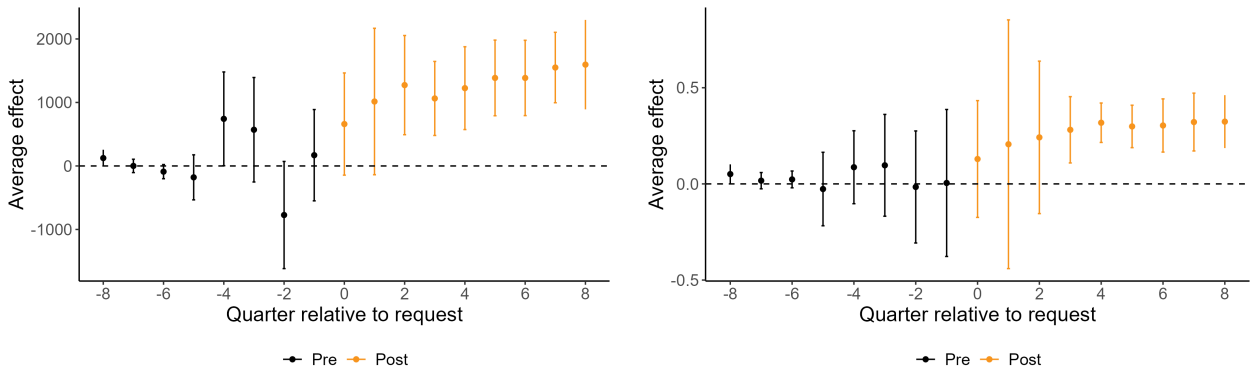
The analysis of the program's impact on primary healthcare facilities also reveals significant changes in operational hours and staffing levels. The program led to a notable increase in total facility hours, particularly during non-commercial hours and weekends, reflecting a strategic expansion in service availability. Similarly, there was a substantial rise in the number of hours supplied by general physicians and nurses, meeting the program's requirements for healthcare team composition. However, while these findings suggest a

positive influence on service provision, it is crucial to complement these insights with an examination of actual patient visits. The next section addresses this by assessing whether these operational enhancements translate into increased healthcare access and utilization, providing a more comprehensive evaluation of the program's effectiveness.

4.2 Effects of extended hours program on PHC Visits

The implementation of the extended hours program, *Saúde na Hora*, significantly increased the number of primary health care (PHC) visits. Our analysis shows that the program led to an approximate 35% increase in the number of visits. Figure 4 presents the DiD results on the number of visits by quarter for our preferred specification. It restricts the sample for facilities that deliver information for the Ministry of Health in all quarters, and it includes covariates in the facility level (the number of visits the number of hours of GPs in 2017) and in the municipality level (GPD and population). Figure 4a shows the absolute difference in the number of consultations and Figure 4b shows the difference in the log of the consultations, which might be interpreted as the percentage change of the treatment group relative to the control group. The results suggest similar pre-treatment trends (negative quarters) for treatment and control groups, supporting the paralell-trends assumption. After the program starts, there is a marked divergence between the treatment and control groups, with the treatment group showing a significant increase in the number of visits compared to the control group.

Figure 4: Effects on patient visits



(a) Visits (b) Visits (log.)

Note: Dynamic effects using the Callaway and Sant'Anna (2021) estimator on (a) total number of visits, and (b) log of visits. Treatment effects are shown for 8 quarters before (placebo) and 8 quarters after PHC facility treatment. Control variables include log of average attendances in 2017, physician working hours, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly attendance during this period. Only ever-treated considered as treated. Lines represents the confidence interval (95%).

We also analyze how visit frequencies vary across different service shifts. In Table A2,

we present the results, showing that visits increased in all the shifts. Because our data by shift is truncated, we used different imputation, and the results are similar. Assuming our preferred imputation (randomizing 1 to 6 visits for censored data), we found that 17.7% of the increase occurs after 5pm and on weekends, with the majority occurring before 5pm.

Our main findings are consistent across different specifications and sample choices. In the Appendix, we present the results using different specifications. Figure A1 shows the results for our preferred analytical sample varying the inclusion of covariates. As expected, the results without covariates are noisier and not as clean as our main results. However, estimates are very similar to our preferred specification, in which we add covariates at the facility and municipal level. In table A1, we vary the sample and variables similarly, displaying ATT rather than dynamic effects. The results are very similar to our main results. When we employ other estimators for DiD for favorite sample and specification, as shown in table A3, the results also indicate a positive and significant effect. Altogether, these robustness checks indicate that our model works as expected by matching similar units in treatment and control groups. Estimates using our preferred model (Callaway and Sant'Anna, 2021), do not show pre-trends and show positive effects on visits after the treatment starts.

4.3 Effects on the productivity of physicians

A program that extends operating hours for PHC clinics can potentially alter the productivity of physicians and other healthcare staff. Extending hours may reduce patient load during peak times, as patients can opt for the newly available hours. Theoretically, with a fixed daily demand, fewer opening hours can lead to congestion and overburdened healthcare staff, resulting in longer wait times and diminished care quality. Concentrated demand can cause fatigue and burnout among physicians and staff, negatively impacting their productivity and efficiency. Therefore, increasing operating hours can distribute patient demand more evenly throughout the day, mitigating these potential drawbacks for human resources.

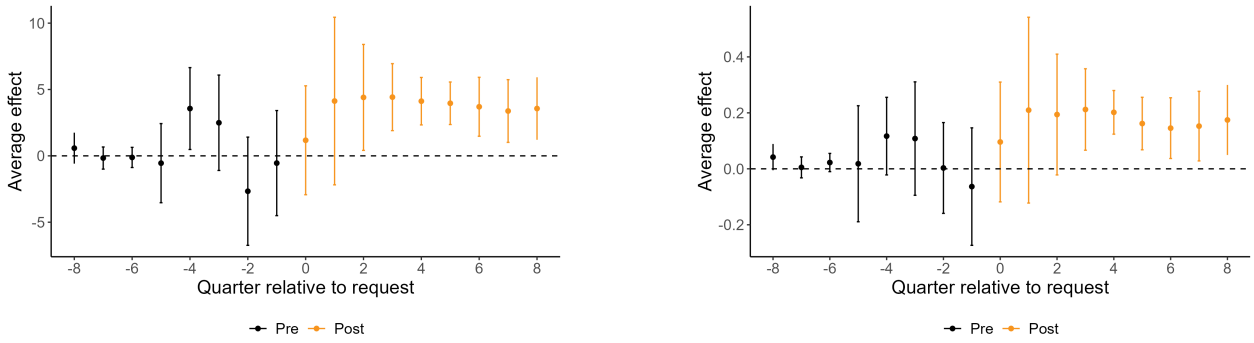
Another possibility is that resources might be underutilized, reducing overall productivity as staff may be idle during slower periods. By implementing part-time or shift-based staffing, PHC facilities can adjust the number of healthcare professionals according to patient demand, ensuring staff are effectively utilized throughout the extended hours. Managing a high volume of patients within these extended hours can be a strategic approach to resource allocation, potentially increasing productivity.

While there are reasons to believe that extending hours could increase productivity, there are also potential negative effects. Extending hours might result in periods of low patient

demand, especially during late nights, early mornings, or weekends. During these off-peak times, the presence of healthcare staff may not be justified by the number of patients, leading to underutilization of resources and lowering overall productivity.

Altogether, it is essential to analyze not only the effects on the number of physician hours or patient visits, but the combination on productivity, or the combination of both. We investigate the effects of the number of visits by physician hours, using the same approach as before. Results are shown in Figure 5 and they suggest that the program increased productivity of physicians. The number of visits per physician hours increased by 5 visits (Figure 5a), compared to the control group. The absolute number might be interpreted as an approximately 20% increase (Figure 5b).

Figure 5: Effects on productivity (number of visits per GP's hours)



(a) Visits/GP

(b) Visits/GP (log.)

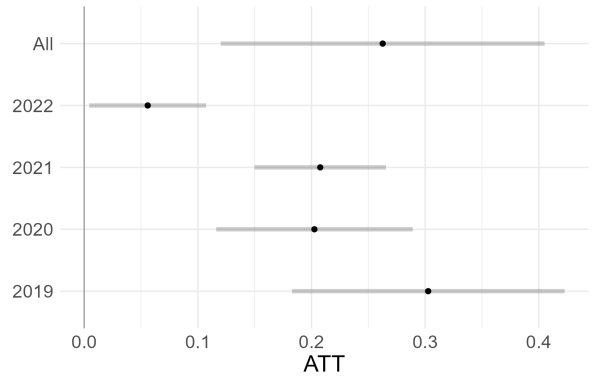
Note: Dynamic effects using the Callaway and Sant'Anna (2021) estimator on (a) total number of visits per hours of General Practitioners, and (b) log of visits per hours of General Practitioners. Treatment effects are shown for 8 quarters before (placebo) and 8 quarters after PHC facility treatment. Control variables include log of average attendances in 2017, physician working hours, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly attendance during this period. Only ever-treated considered as treated. Lines represents the confidence interval (95%).

4.4 Heterogeneous Effects

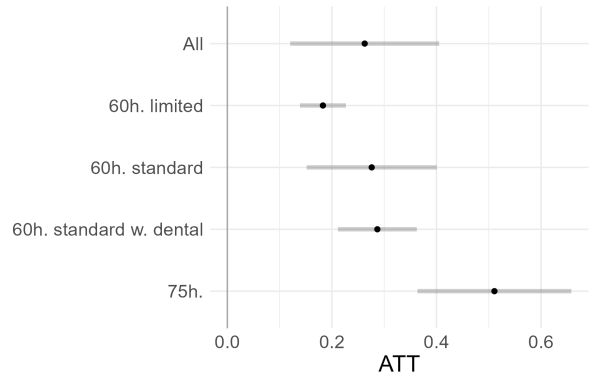
PHC facilities adopt the program through a continuous process. The effectiveness of the program might depend on the type of facilities. For example, units that adopted the program early may influence the results because they were better prepared to receive the program, while the effects on units that adopted it later might be small or null because they are not the best fit for the program. We investigate the heterogeneous effects by the year of adoption to examine this potential explanation. Figure 6a shows the results by the year of adoption, indicating that results are similar across units that adopted the program at different times. One exception is the units that adopted the program in 2022. However, given our data limitations, we can only observe these units for their first year in the pro-

gram. As we observe in Figure 6, positive results are partially driven by effects that occur later in the program.

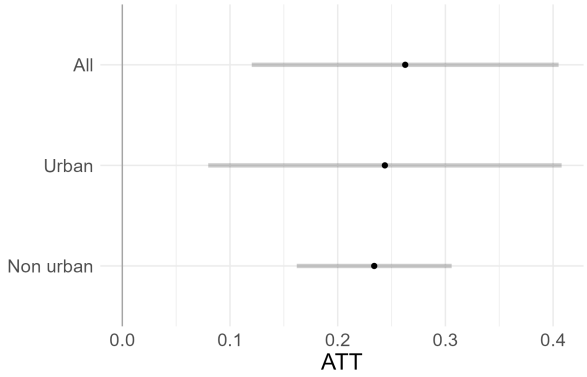
Figure 6: Heterogeneous effects by PHC facilities characteristics



(a) By year of adoption



(b) By program's version



(c) By location

Note: ATT using the Callaway and Sant'Anna (2021) estimator on log of visits. Each line represents the subsample by: (a) year of adaption of the program; (b) program's version adopted; and (c) urban/rural municipality. Control variables include log of average attendances in 2017, physician working hours, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly attendance during this period. Only ever-treated considered as treated. Lines represents the confidence interval (95%).

By the design of the extended hours program, we should also expect different results based on the version of the program adopted by PHC facilities. As we discussed in Section 2, units might adopt one of the four different versions of the program, each with different implications for the minimum requirements related to the time a facility is opened and the human resources available for provision of health services. Figure 6b shows the differential average ATT results by the version of the program. Each bar presents estimates for a different DiD, suggesting that effects vary across the different versions of the program. The simplified version, with loose requirements for human resources, generates lower effects than other versions. Additionally, the 75-hour version, with strong requirements, seems to have the largest effects. However, our estimates for the 75-hour version

are very imprecise, since we have only 18 units that we can use to compute the DiD and ATT effects.

While the extended hours program was designed for urban areas to enhance accessibility and convenience, extending hours in rural or remote areas might be important as well. It can significantly improve healthcare access for residents who face long travel distances and limited emergency services, potentially leading to better health outcomes and addressing healthcare disparities. Figure 6c examines the heterogeneous effects of the program by comparing urban and non-urban areas and it shows the program have similar results across the different location, and the ATT effects translates into a 25% increase in the number of visits. Also, the effects are noisier for urban areas than the rural areas, suggesting that effectivess across urban setting might vary widely.

4.5 Spatial spillovers

To fully understand the impact of the extended hours program, it is crucial to evaluate if there were negative equilibrium effects on non-participants in the same area. Extending hours in only some facilities, rather than all, can create several potential setbacks due to competition for limited resources, particularly human resources. When certain facilities extend their hours, they may need to hire additional staff or require existing staff to work longer hours. This can lead to a concentration of healthcare professionals in those facilities, creating a shortage in nearby clinics that do not have extended hours. As a result, other clinics might struggle to maintain adequate staffing levels, leading to longer waiting times, reduction in service quality, and potential burnout among remaining staff. Another potential equilibrium effect is related to patient flow. Patients from nearby areas might gravitate towards facilities with extended hours, especially during after-hours or weekends, leading to overcrowding and increased patient load in those facilities. Facilities that do not extend hours may experience a drop in patient volume, affecting their revenue and sustainability.

We analyze the potential negative equilibrium effects on nearby clinics by comparing PHC facilities that did not receive the program but are in the same municipality as those that did, with facilities in municipalities that did not receive the program. The results, shown in Table 3, suggest that negative equilibrium effects are not a concern. The number of visits to PHC facilities in municipalities with treated facilities did not decrease (the ATT is null). Additionally, we did not observe negative effects on the supply of physicians and certified nurses, indicating that treated facilities did not compete for healthcare staff but rather increased the in-service hours of existing human resources.

Table 3: Effects on treated and not-treated facilities

	(1) Non-treated	(2) Treated
ATT on visits (log.)	-0.022	0.263*
	(0.015)	(0.076)
ATT on total hours (h.)	0.392*	5.749*
	0.082	(0.182)
ATT on GP's total hours (h.)	-1.283	16.462*
	(0.678)	(1.437)
ATT on nurses's total hours (h.)	1.864*	16.418*
	(0.502)	(1.067)

Note: * confidence band (95%) does not cover 0. ATT using the Callaway and Sant'Anna (2021) estimator. Non-treated column (1): effects on the not-treated facilities in the municipalities that have at least one treated facility (control: facilities in the municipality that does not have any treated facility). Treated (2): treated facilities compared to not treated. Control variables include log of average attendances in 2017, physician working hours, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly attendance during this period.

4.6 Effects on emergency and urgent care centers

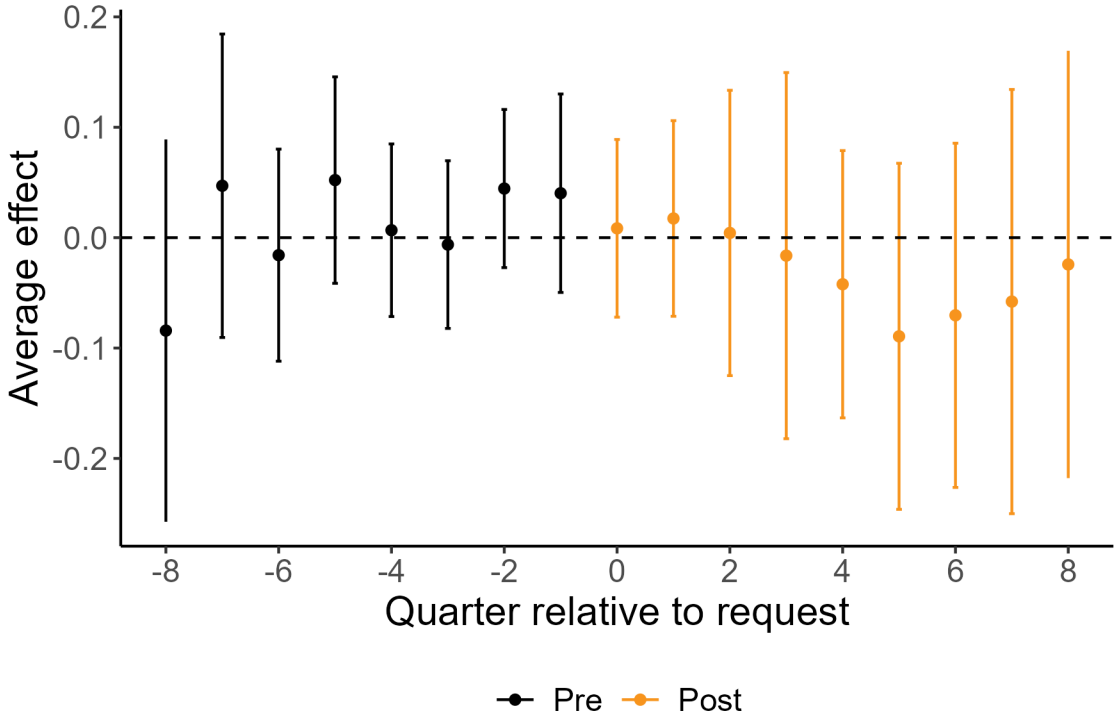
One of the primary objectives of the extended hours program for PHC was to reduce the number of patient visits to Urgent Care Centers (UCCs), typically located within hospitals. Given that these urgent care centers are more expensive than PHC facilities due to their higher fixed costs and the protocols that involve more extensive examinations and medications, it could be cost-effective to reduce the number of unnecessary visits in UCCs.

We investigate the effects of the extended hours on the number of urgent and emergency care consultations in UCCs. Figure 7 displays our results. We do not find evidence that the extended hours program significantly alter the number of visits to UCCs. The point estimates by quarter from our difference-in-differences (DD) analysis are close to zero, both before and after the implementation of the program. In summary, the extended hours program may not effectively reduce healthcare costs by decreasing the number of visits to UCCs, which are generally more expensive compared to PHCs.

It is important to consider several factors regarding the null effects observed in Figure 7 when examining the extension of PHC center hours on urgent care consultations. First, defining treatment for urgent care facilities poses a challenge. Identifying which urgent care centers were affected by our treatment definition (i.e., the nearest PHC with extended hours) and to what extent is difficult. Other limitation is the potential difficulty in mea-

suring the impact solely through total urgent care visits, which may not account for variations in visit types or severity. Furthermore, differences in how PHC centers implemented extended hours, along with patient preferences for urgent care despite increased PHC accessibility, could affect these outcomes.

Figure 7: Effects on urgent and emergency care consultations



Note: Dynamic effects using the Callaway and Sant'Anna (2021) estimator on (a) total number of urgent and emergency care consultations. Treatment effects are shown for 8 quarters before (placebo) and 8 quarters after PHC facility treatment. Control variables include log of average procedures in 2017, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly procedure during this period. Only ever-treated considered as treated. Lines represents the confidence interval (95%).

5 Conclusion

The "Saúde na Hora" program represents a significant policy intervention aimed at increasing the access to primary healthcare (PHC) in Brazil through the extension of operational hours in PHC facilities. Our study provides evidence on the effectiveness of this program in improving healthcare service delivery and utilization.

Our findings reveal that the program successfully increased the total operational hours of PHC facilities, particularly during non-commercial hours and weekends, thereby enhancing the availability of healthcare services. This extension of hours also led to a significant rise in the staffing levels of general physicians and certified nurses, in line with the program's requirements, thus ensuring that the increased operational hours were matched with adequate human resources.

The program resulted in a substantial increase in the number of patient visits, demonstrating that the extended hours translated into higher utilization of PHC services. We observed a 26% increase in the number of visits, indicating that the program effectively addressed unmet healthcare needs. Additionally, our analysis showed a notable improvement in the productivity of healthcare professionals, with the number of visits per physician hour increasing by approximately 20%, suggesting more efficient service delivery.

The heterogeneous effects of the program highlight important variations based on the characteristics of PHC facilities and their geographic locations. Urban and rural areas both experienced significant benefits, although the impacts were more variable in urban settings, reflecting diverse local conditions. Furthermore, the program's impact did not differ significantly across facilities that adopted it at different times, mitigating concerns about self-selection into the program.

Importantly, our analysis did not find any significant negative equilibrium effects on nearby non-participating clinics, suggesting that the extended hours program did not detract from healthcare provision in neighboring facilities. This indicates that the program's benefits were not achieved at the expense of other healthcare providers, thereby ensuring a net positive impact on the healthcare system.

We also examined the impact of the program on visits to the closest urgent care center. Our results suggest there was no reduction in the number of visits to the nearest urgent care center. However, these findings should be interpreted cautiously due to limitations in defining exposure to treatment and accurately measuring the effects on urgent care centers. We plan to address these limitations in future research.

In this paper, we showed the potential of a targeted policy intervention (program "Saúde na Hora") to improve access to and utilization of primary healthcare services. By ex-

tending operational hours and ensuring adequate staffing, the program has increased the availability and efficiency of healthcare delivery in Brazil. These findings provide important insights for policymakers seeking to optimize healthcare resource allocation and improve the overall performance of PHC systems.

Future research should continue to explore the long-term impacts of the program to further inform health policy and practice. In particular, it is essential to investigate the sustained effects of increased access to PHC services and how they influence broader health outcomes.

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A Appendix

Effects on visits - Robustness checks

Different specifications and analytical samples

Table A1: Effects on visits

	(1)	(2)	(3)	(4)	(5)
ATT	0.173*	0.417*	0.263*	0.353*	0.269*
	(0.013)	(0.180)	(0.076)	(0.109)	(0.079)
Controls: facility	No	Yes	Yes	Yes	Yes
Controls: municipality	No	No	Yes	Yes	Yes
Subset:	>0 visits per quarter	>0 visits per quarter	>0 visits per quarter	All	>5 visits per day

*Note: * confidence band (95%) does not cover 0. ATT using the Callaway and Sant'Anna (2021) estimator. Control variables at the facility level: log of average visits in 2017, physician working hours. Control variables at the municipality level: GDP per capita, and population in 2016. The sample period is 2018-2022. Subset for all facilities, one or more visits per quarter or 5 or more visits per day.*

Table A2: ATT on individual visits by time periods

Censored data = 1 visit	(1) Before 5pm	(2) After 5pm	(3) Weekends
ATT	1058.6*	54.9*	108.3
	(220.9)	(19)	(62.5)
Censored data = 6 visits			
ATT	967.6*	86.8*	167*
	(193.7)	(17.1)	(63.4)
Censored data = 1 to 6 visits			
ATT	1005.5*	75.6*	141*
	(173.4)	(19.6)	(53.4)

*Note: * confidence band (95%) does not cover 0. ATT using the Callaway and Sant'Anna (2021) estimator. The data on the number of consultations per shift has been censored by the Ministry of Health for cases with 6 or fewer visits to protect personal data. Consequently, each row in the table represents different scenarios. In the first scenario, these censored data points were considered as having one visit. In the second scenario, they were considered as six visits. In the third scenario, they were assigned a random value between 1 and 6. Control variables include log of average visits in 2017, physician working hours, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly visit during this period.*

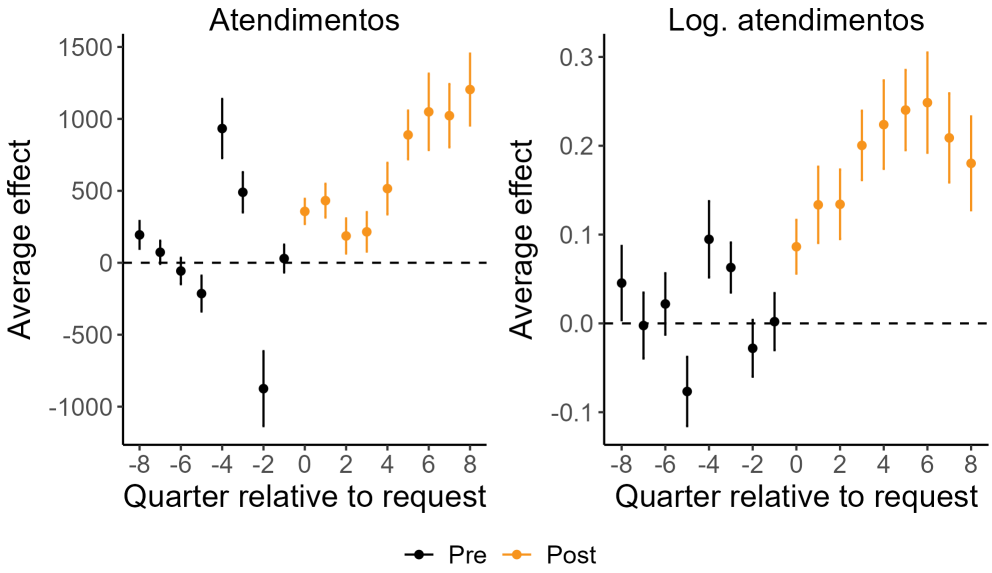
Different estimators

Table A3: Effects on visits: different estimators

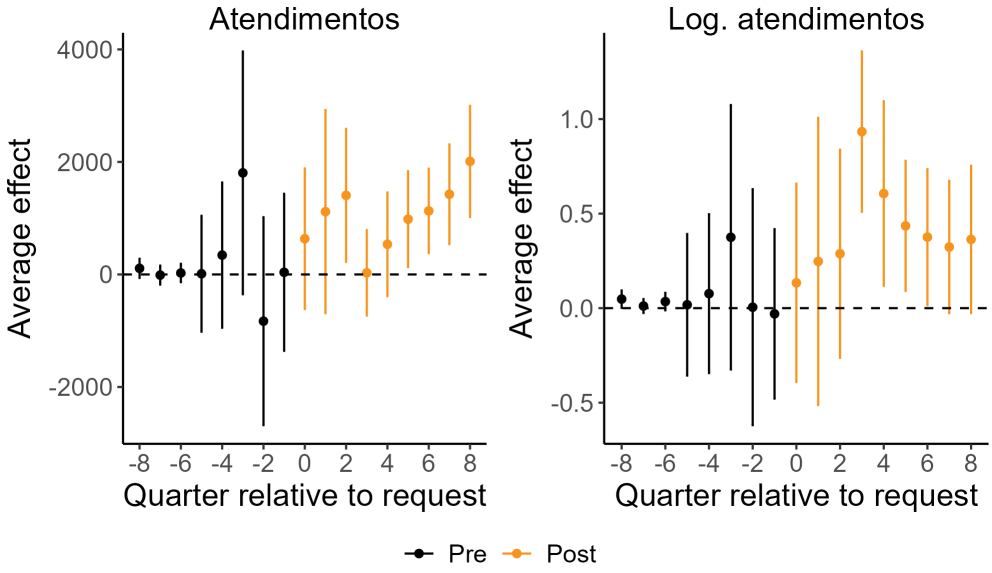
	(1)	(2)	(3)	(4)	(5)
ATT	0.272***	0.263[a]	0.174[a]	0.229***	0.265***
	(0.013)	(0.089)	(0.013)	(0.014)	(0.017)
Estimator:	TWFE	CS	dCH	SA	BJS

*Note: [a] confidence band (95%) does not cover 0. *** p-value bellow 0.01. ATT using: (1) Two Way Fix Effects (TWFE); (2) Callaway and Sant'Anna (2021) (CS); de Chaisemartin and D'Haultfoeuille (2024) (dCH); Sun and Abraham (2021) (SA); and Borusyak, Jaravel, and Spiess (2021) (BJS). Control variables include log of average attendances in 2017, physician working hours, municipal GDP per capita, and population in 2016. The sample period is 2018-2022 and includes only facilities with at least one quarterly attendance during this period.*

Figure A1: Effects on visits: different specifications



(a) No controls



(b) Facility covariates only